Appendix A
Transport Assessment

BAYSWATER JOINT VENTURE PTY LTD

MELTHAM STATION PRECINCT STRUCTURE PLAN

TRANSPORT ASSESSMENT REPORT

November 2016

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1. EXECUTIVE SUMMARY

1.1. Riley Consulting has been commissioned by Bayswater Joint Venture Pty Ltd to prepare a structure plan traffic report for the Meltham station precinct structure plan. The key findings of the traffic review are:

1.2. This structure plan traffic report is based on 100% development of all land and reflects a worst-case scenario. It is unlikely that 100% of development will be achieved due to height limits, lot amalgamation and recently constructed lower density dwellings. The impacts of 100% of development are unlikely to be realised until well beyond 2050.

1.3. The structure plan area is focussed around Meltham railway station on the Perth-Midland line. The station presently is considered to be under-utilised and unsustainable. Medium to high density dwellings within 400 metres of the station will provide an increase to the local population and a greater passenger base.

1.4. The Meltham Station Precinct Structure Plan proposes an increase in density to provide 2,595 dwelling units. Based on recognised traffic generation trip rates, the structure plan could increase local traffic demands by 11,995 vehicle movements per day. During peak periods this equate to about 1,000 additional vehicle movements.

1.5. No reductions to the density dwelling trip rate have been applied to reflect a higher peak hour use of public transport. The traffic assessment provides a very robust review of the surrounding road network impact.

1.6. In general, the surrounding road network is shown to be able to accommodate the forecast traffic increases. The intersection of Grand Promenade / Bowden Street is recommended to be upgraded to provide a single lane roundabout to assist side road movements. All other intersections are indicated to operate within capacity.

Recommended Road Upgrades

1.7. As a result of the forecast traffic increase produced by the structure plan it is recommended that the intersection of Grand Promenade / Bowden Street be a single lane roundabout.

1.8. Local road and pedestrian crossing upgrades are also identified in section 15. These recommended upgrades should be considered regardless of any local development proposals.

2. CHECKLIST

Item	Included	Comments
Introduction/Background		
Regional context	✔	
Proposed land uses	✔	
Table of land uses and quantities	✔	
Major attractors / generators	✔	
Specific issues	✔	
Existing situation		
Existing land uses within structure plan	✔	
Existing land uses within 800 metres of structure plan area	✔	
Existing road network within structure plan area	✔	
Existing pedestrian/cycle networks within structure plan area	✔	
Existing public transport services within structure plan area	✔	
Existing road network within 2 (or 5) km of structure plan area	✔	
Traffic flows on roads within structure plan area (peak hours)	✔	Daily flows Peak used for analysis
Traffic flows on roads within 2 (or 5) km (peak hours)	✔	
Existing pedestrian/cycle networks within 800m	✔	
Existing public transport services within 800m	✔	
Proposed internal transport networks		
Changes/additions to existing road network	✔	
proposed new road network	✔	Not applicable
Road reservation widths	✔	Existing road network
Road cross-sections & speed limits	✔	
Intersection controls	✔	
Pedestrian/cycle networks and crossing facilities	✔	
Public transport routes	✔	
Changes to external transport networks		
Road network	✔	
Intersection controls	✔	
Pedestrian/cycle networks and crossing facilities	✔	
Public transport services	✔	
Integration with surrounding area		
Trip attractors/generators within 800 metres	✔	
Proposed changes to land uses within 800 metres	✔	
Travel desire lines to attractors/generators	✔	
Adequacy of external transport networks	✔	
Deficiencies in external transport networks	✔	
Remedial measures to address deficiencies	✔	
Analysis of internal transport networks		
Assessment year(s) and time period(s)	✔	
Structure plan generated traffic	✔	
Extraneous (through) traffic	✔	
Design traffic flows (total traffic)	✔	
Road cross-sections	✔	
Intersection controls	✔	
Access strategy	✔	
Pedestrian/cycle networks	✔	
Safe routes to schools	✔	
Pedestrian permeability & deficiency	✔	
Access to public transport	✔	
Analysis of external transport network		
Extent of analysis	✔	800 metres
Base flows for assessment year(s)	✔	
Total traffic flows	✔	
Road cross-sections	✔	Existing road network
Intersection layouts & controls	✔	
Pedestrian/cycle networks	✔	Exiting network
Conclusions		

3. INTRODUCTION AND BACKGROUND

3.1. Riley Consulting (WA) Pty Ltd has been engaged by Bayswater Joint venture Pty Ltd to prepare a structure plan transport report for the Meltham station precinct. Bayswater Joint Venture Pty Ltd has an interest in four sites within the structure plan area that represent a small proportion of the total land area covered.

3.2. As no studies have been undertaken to support the intent of the rezoning of Meltham, a structure plan is proposed before Bayswater Joint Venture Pty Ltd's land can be redeveloped.

3.3. The structure plan area is focussed around Meltham railway station and is shown overlaid to Google maps in Figure 1. Figure 2 shows an aerial image of the study area.

3.4. Discussions with the Public Transport Authority and the City of Bayswater have been held to assist the preparation of this structure plan transport report. Main Roads has not been consulted directly as there are no roads under their control within the structure plan area.

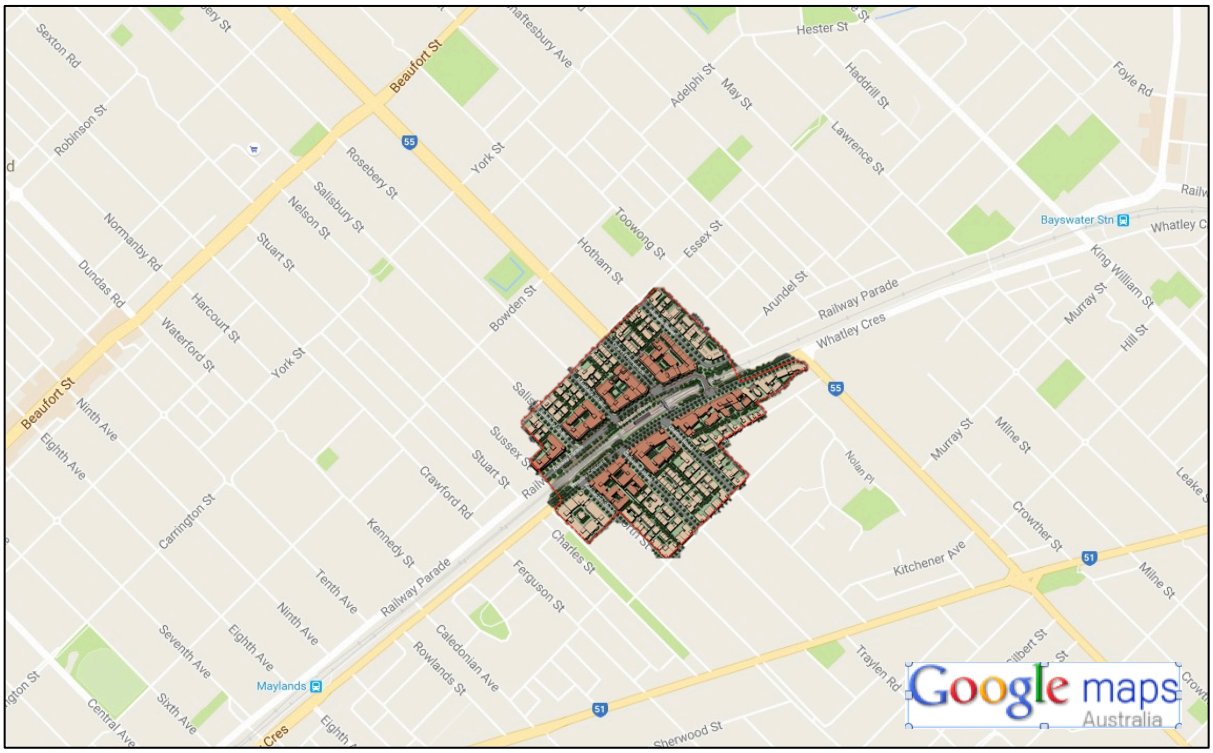


Figure 1 Site Location

Figure 2 **Structure Plan Aerial Image** (Google Earth)

4. THE EXISTING TRANSPORT NETWORK

4.1. The locality is an historical suburb of Perth centred on Meltham railway station. The housing stock is relatively old and low density.

4.2. The majority of roads affected by the proposed structure plan are residential streets. A review of the local road network is set out below. All major roads operate with a 60kph speed limit and residential streets are subject to a limit of 50kph. Local traffic data is shown in Table 1.

Whatley Crescent

4.3. Whatley Crescent is classified as a district distributor A road in the Main Roads *Functional Road Hierarchy*. It is constructed with a 13.3 metre wide carriageway with a 1.4 metres painted median.

4.4. Traffic data on the Main Roads website shows that to the north of Grafton Road Whatley Crescent passes 10,942 vehicles per day (vpd) of which 5% are Heavy Goods Vehicles. East of Garratt Road the volume is 17,773vpd.

Railway Parade

4.5. Railway Parade is classified as a district distributor A road in the Main Roads *Functional Road Hierarchy*. It is constructed with an 11 metre wide carriageway within a 20 metre road reservation. It runs parallel to the railway line and connects to Whatley Crescent to the east of Meltham Station. To the west it connects to Central Avenue and East Perth.

4.6. Traffic data on the Main Roads website shows 13,000vpd south of Grand Promenade (3% HGV).

4.7. The intersection of Railway Parade and Whatley Crescent restricts traffic to turn left only from Railway Parade. The intersection operates under priority control with priority to movements on Whatley Crescent. There is no formal right turning lane marked on Whatley Crescent, but the pavement width allows through traffic to pass turning vehicles. Left turning vehicles does not unduly obstruct vehicles heading east on Whatley Crescent. At peak times the queues on Railway Parade approaching Whatley Crescent can extend through the traffic signals at Grand Promenade.

Grand Promenade

4.8. Grand Promenade is classified as a district distributor A road in the Main Roads *Functional Road Hierarchy*. It is constructed with a 13.3 metre wide carriageway with a 1.4 metre painted median.

4.9. Traffic data on the Main Roads website shows 17,547vpd west of Railway Parade (4% HGV).

4.10. The intersections of Grand Promenade / Railway Parade and Grand Promenade / Beaufort Street are controlled by traffic signals.

Beaufort Street

4.11. Beaufort Street is classified as a district distributor A road in the Main Roads *Functional Road Hierarchy*. It is constructed with a varying carriageway width providing two lanes in each direction, a central median and turning lanes. Peak period bus lanes have been implemented through the Inglewood section.

4.12. Local shopping facilities are provided in Inglewood including a Coles supermarket. It is understood Aldi will also open a store in the vicinity of Eleventh Avenue.

4.13. Recent MRWA traffic data indicates 30,800vpd south of Grand Promenade.

4.14. Beaufort Street is approximately 600 metres from the structure plan area.

Garratt Road

4.15. Garratt Road is classified as a district distributor A road in the Main Roads *Functional Road Hierarchy*. It is constructed with a 13.5 metre wide carriageway with a 1.4 metre painted median between Whatley Crescent and Guildford Road.

4.16. It provides an important district link between Whatley Crescent and Guildford Road and to Perth Airport (Garratt Road bridge over the Swan River). MRWA traffic data shows 13,250vpd south of Whatley Crescent. Access to residential dwellings and recreation facilities is provided from Garratt Road.

4.17. Traffic signals control the intersections of Garratt Road / Whatley Crescent and Garratt Road / Guildford Road.

4.18. Guildford Road is approximately 400 metres from the structure plan area.

Guildford Road

4.19. Guildford Road is classified as a primary distributor in the Main Roads *Functional Road Hierarchy*. It is constructed with a 13.0 metre wide carriageway with two lanes in each direction. No medians are provided.

4.20. Recent MRWA traffic data indicates 38,8000vpd east of Garratt Road.

Local Road Network

Grafton Road

4.21. Grafton Road is classified as a local access in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 6.5 - 7.2 metres wide. Access to residential lots is provided along the length of the street.

4.22. Grafton Road provides a local link between Whatley Crescent and Guildford Road. Traffic counts undertaken for the structure plan indicate an average of 730vpd south of Whatley Crescent.

Grosvenor Road

4.23. Grosvenor Road is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of about 7.0 metres. Access to residential lots is provided along the length of the street.

4.24. Grosvenor Road provides a local link between Whatley Crescent and Guildford Road. Traffic counts undertaken for the structure plan indicate an average of 176vpd south of Whatley Crescent.

Kenilworth Street

4.25. Kenilworth Street is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 6.5 - 7.2 metres wide. Access to residential lots is provided along the length of the street.

4.26. It provides a local link between Whatley Crescent and Guildford Road. Traffic counts undertaken for the structure plan indicate an average of 206vpd south of Whatley Crescent.

Belgrave Street / Charles Street

4.27. Belgrave Street and Charles Street are classified as a local access streets in the Main Roads *Functional Road Hierarchy*. They are constructed with standard carriageways of 6.5 - 7.2 metres wide. The two roads form a boulevard style street to a local strip park, but both operate with two-way traffic flows. Access to residential lots is provided along the length of the streets.

4.28. The streets provide a local link between Whatley Crescent and Guildford Road. No traffic data is available and the Saturn model has been used to provide an expectation of current movements based on residential access.

Coombe Street / Cox Street

4.29. Coombe Street and Cox Street are classified as local access streets in the Main Roads *Functional Road Hierarchy*. They are constructed with a standard carriageway of 6.5 - 7.2 metres wide. Access to residential lots is provided along the length of the streets.

4.30. The two roads are contiguous and provide a local east-west link between MooreStreet and Charles Street. The streets would provide for local access only. No traffic data is available and the Saturn model has been used to provide an expectation of current movements based on residential access. The derived flow is 390vpd.

Hayward Street

4.31. Hayward Street is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 6.5 - 7.2 metres wide. Access to residential lots is provided along the length of the streets.

4.32. Hayward Street does not connect through to Garratt Road and all traffic must access from Grafton Road or Moore Street.

Kitchener Avenue

4.33. Kitchener Avenue is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 6.5 - 7.2 metres wide. Access to residential lots is provided along the length of the streets. Kitchener Street provides the only local access to Garratt Road. No traffic data is available, but the Saturn model indicates about 620vpd.

Bowden Street

4.34. Bowden Street is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 7.0 metres. Access to residential lots is provided along the length of the street.

4.35. It provides a local link between Toowong Street and Stuart Street. No traffic data is available and the Saturn model has been used to provide an expectation of current movements based on residential access. The derived flow is 530vpd west of Grand Promenade and 280vpd east of Grand Promenade.

Crawford Road

4.36. Crawford Road is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 7.0 metres. Access to residential lots is provided along the length of the street.

4.37. It provides a local link between Railway Parade and Beaufort Street, where full movement is permitted. No traffic data is available and the Saturn model has been used to provide an expectation of current movements based on residential access. The derived flow is 520vpd. Crawford Road is not within the structure an area.

Stuart Street

4.38. Stuart Street is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 7.0metres. Access to residential lots is provided along the length of the street.

4.39. It provides a local link between Railway Parade and Beaufort Street, where left out only is permitted. No traffic data is available and the Saturn model has been used to provide an expectation of current movements based on residential access. The derived flow is 350vpd.

Sussex Street

4.40. Sussex Street is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 6.5 - 7.2 metres wide. Access to residential lots is provided along the length of the street.

4.41. It provides a local link between Railway Parade and York Street. Access to Beaufort Street is achieved via Nelson Street, where full movement to Beaufort Street is permitted. Traffic counts undertaken for the structure plan indicate an average of 345vpd north of Railway Parade.

4.42. The northern side of Sussex Street is occupied by industrial type land uses.

Salisbury Street

4.43. Salisbury Street is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 7.0 metres. Access to residential lots is provided along the length of the street.

4.44. It provides a local link between Railway Parade and Beaufort Street, where left in / left out only is permitted. Traffic counts undertaken for the structure plan indicate an average of 438vpd north of Railway Parade.

Rosebery Street

4.45. Rosebery Street is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 7.0 metres. Access to residential lots is provided along the length of the street.

4.46. It provides a local link between Railway Parade and Beaufort Street, where full movement is permitted. Traffic counts undertaken for the structure plan indicate an average of 283vpd north of Railway Parade.

Hotham Street

4.47. Hotham Street is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 7.0 metres. Access to residential lots is provided along the length of the street.

4.48. It provides a local link between Railway Parade, east of Meltham Station to York Street. Access to Beaufort Street north of Grand Promenade can be achieved via Drummond Street where full movement is permitted. Traffic counts undertaken for the structure plan indicate an average of 188vpd north of Railway Parade.

Essex Street

4.49. Essex Street is classified as a local access street in the Main Roads *Functional Road Hierarchy*. It is constructed with a standard carriageway of 7.0 metres. Access to residential lots is provided along the length of the street. It provides a local connection between Hotham Street and Grand Promenade.

4.50. Its intersection with Grand Promenade is restricted to left-in / left-out movements due to a crest on Grand Promenade to the south of Essex Street. No traffic data is available and the Saturn modelling indicates a demand of about 200vpd.

Table 1 Traffic Data

Location	Volume	Capacity[1]
Whatley Crescent N Garratt Road	16,339	25,200
Whatley Crescent N Grafton Road	10,703	25,200
Whatley Crescent E Central Avenue	12,334	25,200
Railway Parade E Central Avenue	10,199	22,900
Railway Parade S Grand Promenade	13,354	22,900
Grand Promenade N Beaufort Street	16,087	40,000
Grand Promenade W Railway Parade	17,521	40,000
Beaufort Street S Grand Promenade	30,803	25,200[3]
Beaufort Street N Central Avenue	22,776	25,200[3]
Garratt Road S Whatley Crescent	13,252	25,200[3]
Garratt Road bridge	19,513	40,000
Guildford Road E Garratt Road	38,800	40,000
Guildford Road E First Avenue	31,997	40,000
Grafton Road	730	3,000vpd[2]
Grosvenor Road	176	3,000vpd[2]
Kenilworth Street	206	3,000vpd[2]
Belgrave / Charles Streets	480	3,000vpd[2]
Coombe Street	340	3,000vpd[2]
Kitchener Avenue	280	3,000vpd
Bowden Street	520	3,000vpd[2]
Stuart Street	350	3,000vpd[2]
Sussex Street	345	3,000vpd[2]
Salisbury Street	438	3,000vpd[2]
Rosebery Street	283	3,000vpd[2]
Hotham Street	188	3,000vpd[2]
Essex Street	200	3,000vpd

[1] shown in Appendix A for Level of Service F
[2] Liveable Neighbourhoods maximum desirable flow
[3] Assumes single lane boulevard due to bus lanes in peak direction.

Road Network Changes

4.51. There are no known major road network changes outside of the structure plan area that would be considered to have a significant impact to local traffic movements.

4.52. It is understood that Main Roads Western Australia has a road reservation requirement on Guildford Road for future upgrading. It is expected that bus lanes will be provided to Guildford Road with intersections upgraded accordingly. The proposals are not ion the Main Road four-year programme.

Bus Routes

4.53. There are no bus services within the area of the proposed structure plan. Bus services are available on Beaufort Street, 945 metres from Railway Parade. Bus services are also available on Guildford Road, 635 metres from Whatley Crescent.

4.54. Bus services on Beaufort Street are considered to be high frequency and provide services into Perth CBD. Beaufort Street is just under 600 metres from the northern boundary of the structure plan area. The majority of the structure plan area would therefore be considered to be outside of the 400 metre walkable catchment for buses on Beaufort Street. However these bus routes are within 800 metres.

4.55. Figure 3 shows the Transperth network map for the structure plan area.

Railways

4.56. The structure plan is centred on Meltham railway station. The station provides regular train services to Perth CBD (and then Fremantle) and Midland. Trains operate on a 15 minute frequency during the day. During the commuter peak period between 8am and 9am, there are 3 services to Perth and 4 services to Midland. The peak trains do not qualify as a high frequency service.

4.57. Discussions with the PTA indicate that the Forrestfield rail line extension to Perth Airport will pass through Meltham station and will be complete by 2020. At this time a more frequent service is expected with approximately 1 service every 5 minutes during peak periods. As part of the works stations on the Midland line may be upgraded to accommodate 6 car trains (4 car at present).

4.58. PTA further advised that passenger boarding at Meltham station in March 2016 was 524 persons per day and PTA has a target of a minimum patronage of 1,000 persons per day (ideally 2,000 persons per day).

4.59. It can be seen that the proposed increase to the local population density can optimise the use of Meltham station.

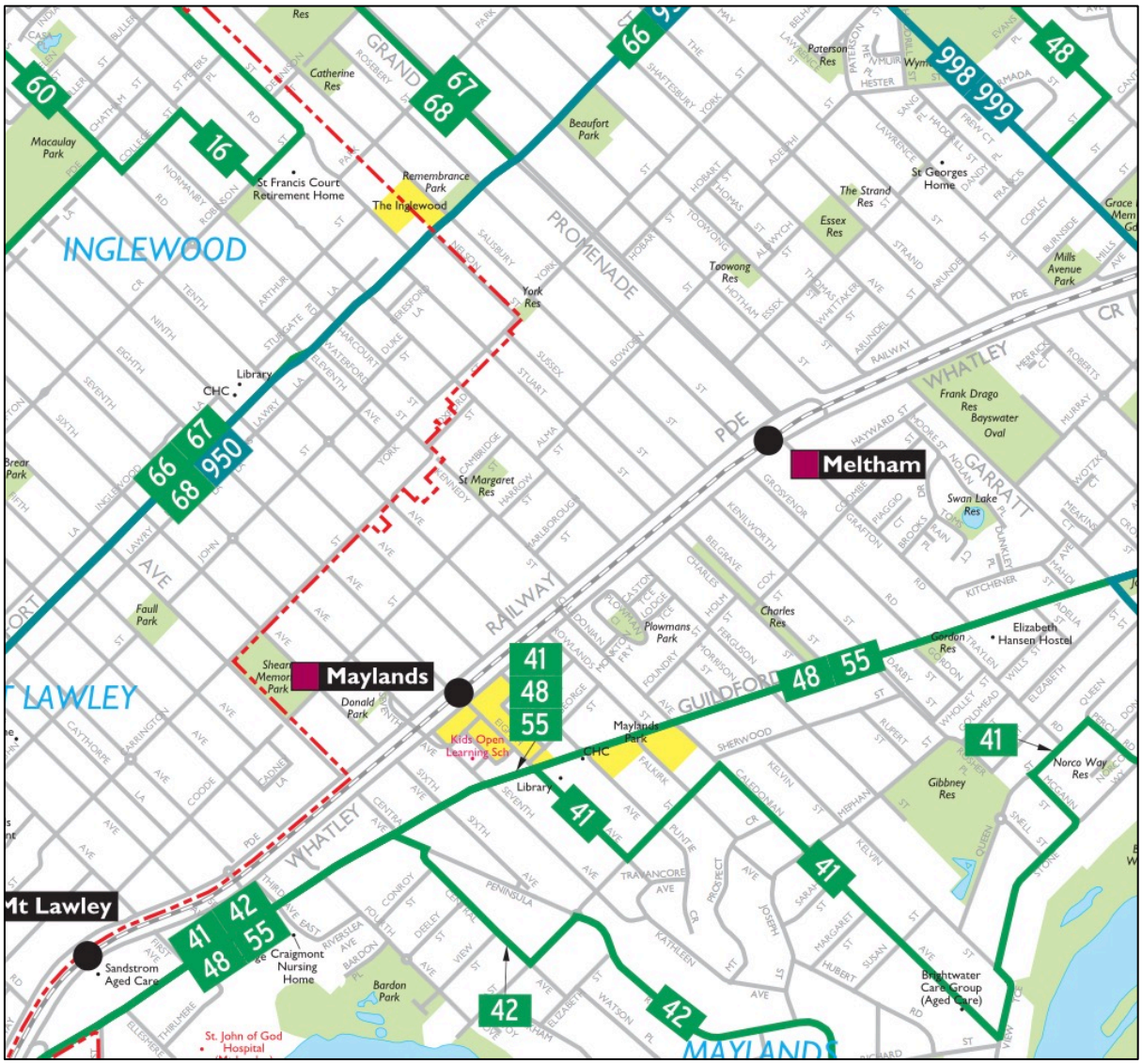


Figure 3 Local Bus Services

4.60. Figure 4 shows the 400 metre and 800 metre walkable catchment to Meltham Railway Station. The catchment is the walking distance to the centre of the platform using both pedestrian access points.

Figure 4 Meltham Railway Station Walkable Catchment

Meltham Station Car Parking

4.61. There are 9 public parking bays provided adjacent to Railway Parade to the north of the station.

4.62. There are 38 PTA bays adjacent to Railway Parade (Grand Promenade to Rosebery Street) and 44 PTA bays adjacent to Railway Parade close to Salisbury Street. A further 22 PTA bays are provided adjacent to Whatley Crescent. In total 104 parking bays are provided by the PTA at Meltham railway station (on PTA land)

4.63. Pedestrian access to the station is taken at two locations.

4.64. To the Midland end of the station a bridge over the tracks is provided close to Grand Promenade. Pedestrian access is provided to Railway Parade but is circuitous to the pedestrian crossing facilities provided at the traffic signals at the Grand Promenade intersection. Further the median provided at the traffic signals is narrow and provides no safe stopping location for pedestrians. This median requires widening.

4.65. The railway station pedestrian access bridge links Railway Parade to Whatley Crescent, where a narrow path is provided to the rail replacement bus service stop. The path is in the order of 1.4 metres wide and is not to an appropriate standard. Further a narrow median of approximately 0.5m is provided to Whatley Crescent that does not provide a safe stopping point for pedestrians. It is recommended that a pedestrian median be provided to Whatley Crescent.

4.66. To the Perth city side of the station pedestrian access is provided by an at-grade crossing of the rail tracks. A pedestrian median is provided to Whatley Crescent of an appropriate standard to access to station. It is noted that the station access is crossed by the Principle Shared Path (PSP) which could present a pedestrian / cycle conflict issue. However good visibility is provided in both directions. It is recommended that warning signage for both pedestrian and cyclists be provided.

Figure 5 Meltham Station Access Works

4.67. Pedestrian access to Railway Parade is circuitous and obstructed by cycle lockers. It is considered that pedestrian access at this location has been poorly designed. A median is provided to Railway Parade, but is poorly aligned and of an unacceptable width. It is recommended that these matter be addressed. Figure 5 indicates the recommended works.

Cycling

4.68. Figure 6 shows the local cycling network accessed by the structure plan area. The City of Bayswater engaged Cardno to prepare a bike plan report in July 2014.

4.69. A principle shared path (PSP) is provided to the south side of the Perth-Midland railway line and provides a high quality connection between Midland town centre and Perth CBD. The path continues along the railway line to Fremantle.

4.70. The Perth Bicycle network route NE26 is signed along Bowden Street to the north side of the structure plan area.

4.71. The local cycling network is very accessible and provides good quality linkages. External to the structure plan area, major roads do not provide on-street cycle facilities and cyclist are encouraged to use local roads.

4.72. The Cardno Bike Plan report identified several deficiencies in the local cycle network and recommended improving the railway crossing connectivity around Meltham station. It also recommended an improved connection between Railway Parade and Hotham Street and on-street cycle lanes to Grand Promenade.

Figure 6 Existing Local Cycle Network

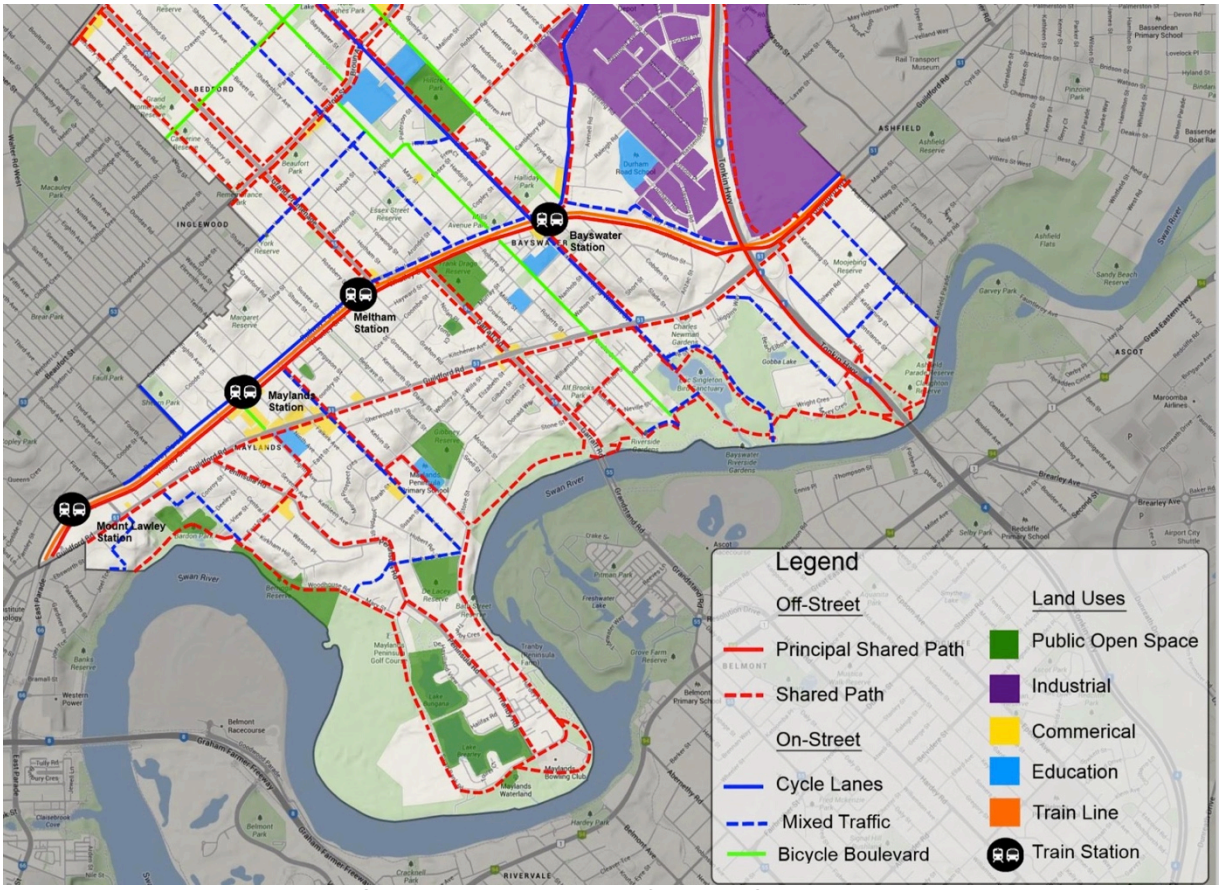


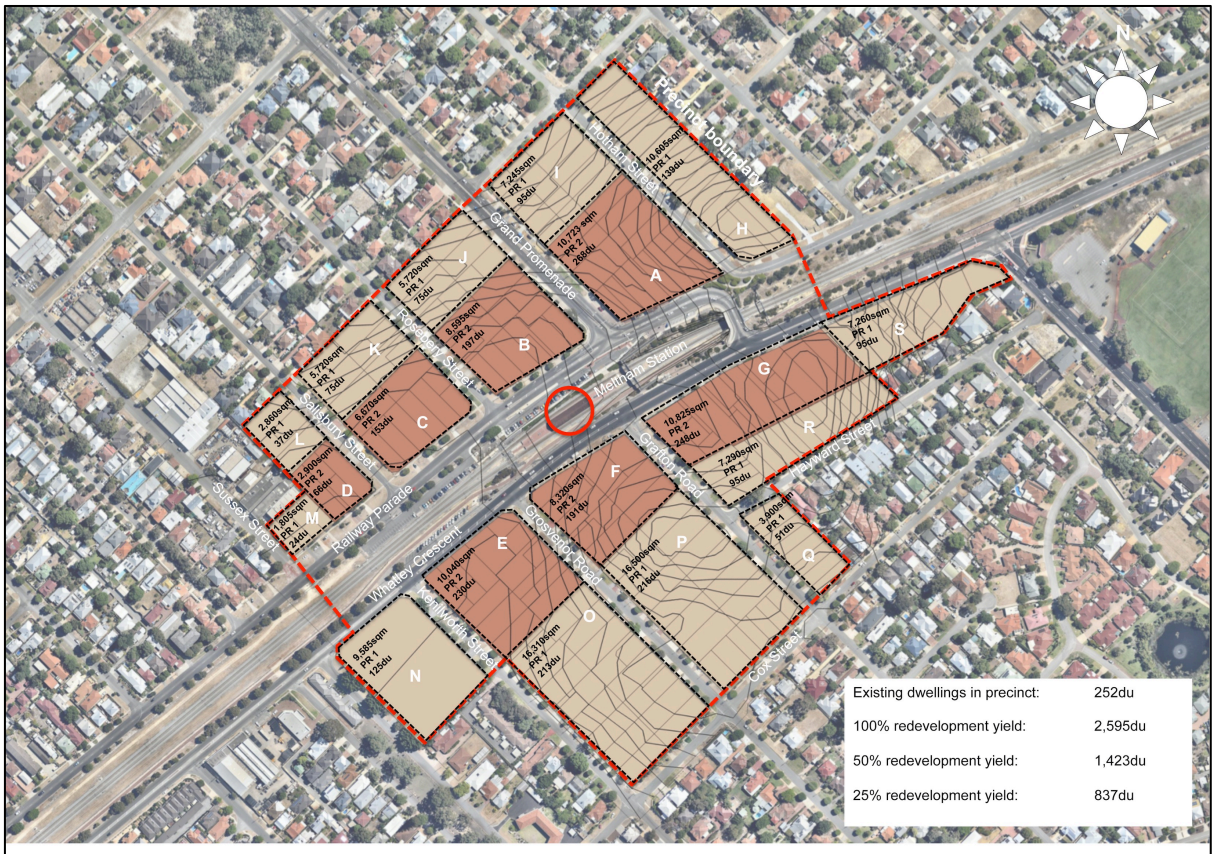
Figure 7 Long Term Cycle Network Identified by Cardno

5. STRUCTURE PLAN PROPOSAL

5.1. The proposed structure plan is focussed around Meltham railway station, located 5.5km to the north east of Perth CBD. The railway station provides an excellent transport hub suited to higher density development. Figure 8 shows the indicative structure plan.

5.2. The structure plan shown in Figure 7 identifies that within the subject area there are presently about 252 residential units. The structure plan shows a range of development scenarios ranging from 25% to 100%. Based on 100% of the area being developed, there could be 2,595 dwellings.

5.3. The structure plan does not identify land uses other than residential. However, it is proposed to limit shop/retail floor space to 3,000m^2 in the mixed-use core precinct. Commercial land uses would comprise of local shops and cafes and would not be expected to be major traffic attractors in their own right. The proposed medium to high-density development will provide the customer base for these future businesses.



Indicative maximum yield plan

Figure 8 Indicative Structure Plan

6. STRUCTURE PLAN GENERATED TRAFFIC

6.1. Traffic generated by the structure plan can be expected to make similar movements to the existing residential land uses. Assessment of the existing traffic demand is made based on a trip rate of 8 trips per house per day. Units are assessed based on 5 trips per dwelling per day. The trip rates accord with the rates identified by the RTA *Guide to Traffic Generating Developments*.

6.2. Many structure plans covering areas well serviced by public transport have used trip rates of between 3 and 4 trips per dwelling per day. Studies of inner city dwellings in West Perth indicate a trip rate of around 2.4 trips per dwelling per day. It can be seen therefore that a far lower trip rate could be justified.

6.3. A lower trip rate has not been used for the Meltham structure plan as public transport access is only by train and the current train services would not be classified as high frequency during the morning peak hour (3 peak hour services). Advice from PTA indicates that train frequencies of services provided at Meltham could improve

6.4. The existing structure plan area has about 252 dwellings and the expected traffic generation is in the order of 1,100 trips per day.

6.5. The structure plan will see a potential of 2,595 dwelling units replacing existing houses. Figure 9 shows the dwelling yield by area used for the structure plan.

SUB-PRECINCT	AREA	PLOT RATIO	FLOORSPACE	AVE DU AREA	DWELLINGS	OCCUPANCY	POPULATION
CORE							
A	10,723	2	21,446	80	268	1.8	482.54
B	8,595	2	17,190	87.3	197	1.8	354.43
C	6,670	2	13,340	87.3	153	1.8	275.05
D	2,900	2	5,800	87.3	66	1.8	119.59
E	10,040	2	20,080	87.3	230	1.8	414.02
F	8,320	2	16,640	87.3	191	1.8	343.09
G	10,825	2	21,650	87.3	248	1.8	446.39
Sub Total	**58,073**		**116,146**		**1,353**		**2,435**
FRAME							
H	10,605	1	10,605	76.4	139	1.8	249.86
I	7,245	1	7,245	76.4	95	1.8	170.69
J	5,720	1	5,720	76.4	75	1.8	134.76
K	5,720	1	5,720	76.4	75	1.8	134.76
L	2,860	1	2,860	76.4	37	1.8	67.38
M	1,805	1	1,805	76.4	24	1.8	42.53
N	9,585	1	9,585	76.4	125	1.8	225.82
O	16,310	1	16,310	76.4	213	1.8	384.27
P	16,500	1	16,500	76.4	216	1.8	388.74
Q	3,900	1	3,900	76.4	51	1.8	91.88
R	7,290	1	7,290	76.4	95	1.8	171.75
S	7,260	1	7,260	76.4	95	1.8	171.05
Sub-total	**94,800**		**94,800**		**1,241**		**2,234**
Total	**152,873**		**210,946**		**2,594**		**4,669**

Figure 9 Structure Plan Dwelling Yields – Maximum Development Potential

6.6. The dwelling yields have been used with the stated trip generation rates to determine that the structure plan area can be expected to generate up to 12,995 trips per day.

6.7. It is calculated that existing dwellings in the structure plan area would generate about 1,100 trips per day. The structure plan may therefore increase local traffic by 11,895 vehicle movements per day.

6.8. During the peak hours between 8% and 10% of the daily demand would normally be expected. Thus peak hours will experience an increase of about 1,000 vehicle movements. This traffic forecast has been used to determine the future traffic impacts. It is noted that a lower level of traffic may be generated, but the higher trip rate used will provide robustness to the existing road network.

6.9. The level of traffic generated by the full development potential of the structure plan area is equivalent to the capacity of a single traffic lane.

7. DESIGN TRAFFIC FLOWS

7.1. Traffic modelling using Saturn has been undertaken to distribute the existing residential traffic to the local road network. The full development of the structure plan area yielding 2,595 residential units has also been run to identify the expected changes to local traffic demands.

7.2. It is important to remember that the structure plan considers 100% development of all land in the structure plan area. In reality 100% development may not be achieved due to height limits and the need to amalgamate lots, which may significantly reduce the overall development yield.

7.3. Figure 9 shows the modelled area and the distribution of structure plan traffic over the road network. Figure 10 is provided for indicative purposes only. Appendix B provides a link volume plot from the Saturn model.

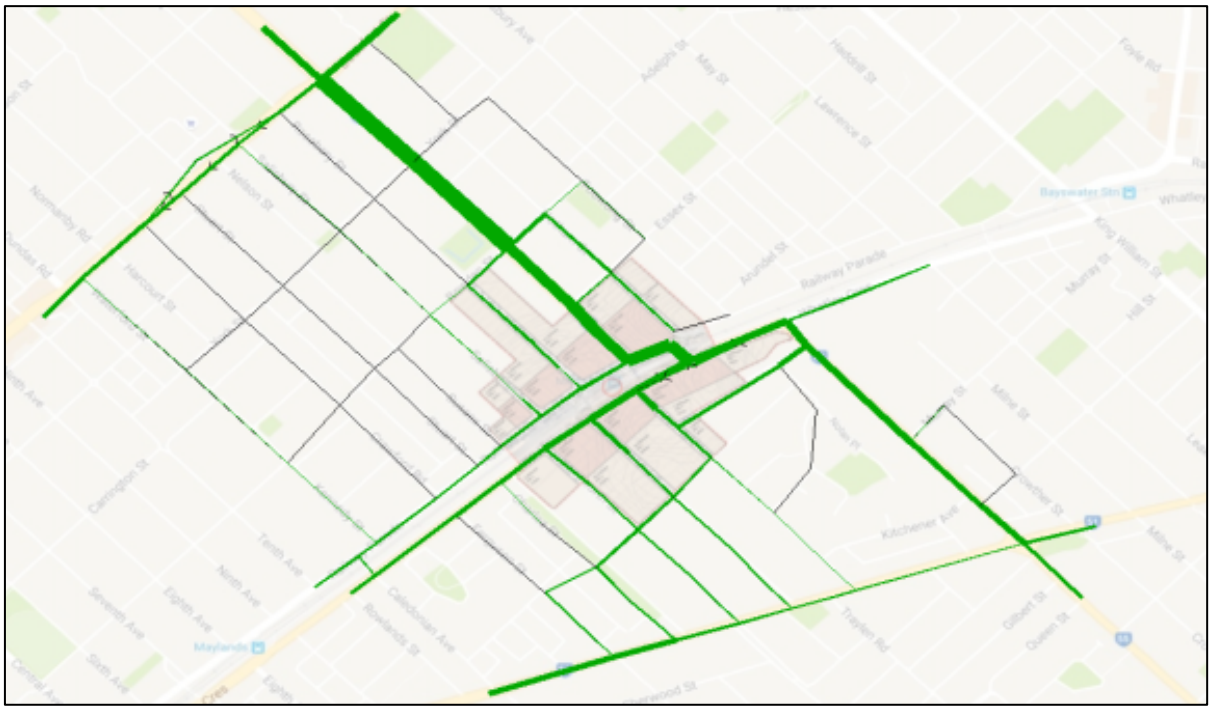


Figure 10 Modelled Area and Indicative Development Traffic Demands[1]

7.4. Table 2 compares the existing traffic flows to the expected increases as a result of 100% development of the structure plan. The affected local streets are street sections outside of the structure plan area.

[1] Note the base map shows the old structure plan

Table 2 Forecast Traffic Increases to the Local Road Network

Location	Volume	Increase	Capacity	% [1]	Forecast
District Road Network					
Whatley Crescent N Garratt Road	16,339	550	25,200	2.2%	16,889
Whatley Crescent N Grafton Road	10,703	2,820	25,200	**11.2%**	13,523
Whatley Crescent E Central Avenue	12,334	890	25,200	3.5%	13,224
Railway Parade E Central Avenue	10,199	540	22,900	2.4%	10,739
Railway Parade S Grand Promenade	13,354	1,030	22,900	4.5%	14,384
Railway Parade Bridge	13,174	3,230	22,900	**14.1%**	16,404
Grand Promenade N Beaufort Street	16,087	1760	40,000	4.4%	17,847
Grand Promenade W Railway Parade	17,521	4,670	40,000	**11.7%**	22,191
Beaufort Street N Grand Promenade	26,423	1,880	40,000	4.7%	28,303
Beaufort Street S Grand Promenade	30,803	1060	40,000	2.7%	31,863
Beaufort Street N Central Avenue	22,776	1,340	25,200	5.3%	24,116
Garratt Road S Whatley Crescent	13,252	2,040	25,200	8.1%	15,292
Garratt Road bridge	19,513	920	40,000	2.3%	20,433
Guildford Road E Garratt Road	38,800	850	40,000	2.1%	39,650
Guildford Road E First Avenue	31,997	1,800	40,000	4.5%	33,797
Local Road network					
Grafton Road	730	1,720	3,000[2]	57.3%	2,450
Grosvenor Road	176	1060	3,000[2]	35.3%	1,236
Kenilworth Street	206	620	3,000[2]	20.7%	826
Belgrave / Charles Streets	480	630	3,000[2]	21.0%	1,110
Coombe Street	340	990	3,000[2]	33.0%	1,330
Kitchener Avenue	280	630	3,000[2]	21.0%	910
Bowden Street west	520	750	3,000[2]	25.0%	1,270
Bowden Street east	280	960	3,000[2]	32.0%	1,240
Crawford Road	520	40	3,000[2]	1.3%	560
Stuart Street	350	40	3,000[2]	1.3%	390
Sussex Street	345	110	3,000[2]	3.7%	455
Salisbury Street	438	280	3,000[2]	9.3%	718
Rosebery Street	283	630	3,000[2]	21.0%	913
Hotham Street	188	830	3,000[2]	27.7%	1,018
Essex Street	200	510	3,000[2]	17.0%	710

[1] shown in Appendix A
[2] *Liveable Neighbourhoods* maximum desirable flow

8. ROADS AND INTERSECTIONS

8.1. The WAPC *Transport Assessment Guidelines for Developments* identifies that "*Where a traffic increase as a result of a proposed development is less than 10% of current road capacity, it would not normally have a material impact".*

8.2. Using this guideline, the forecast traffic movements generated by the proposed full development of the structure plan can be assessed. Table 2 identifies the affected road network, the current daily demand, the forecast increase, the capacity and the increase as a percentage of capacity. All roads with an increase of less than 10% are not materially affected, unless the forecast demand exceeds the capacity or desirable maximum flow.

District Road Network Impacts

8.3. Reference to Table 2 shows that Whatley Crescent north of Grafton Road; Grand Promenade and Railway Parade bridge are affected in terms of an increase greater than 10% of capacity. All other district level roads are unaffected by the proposed structure plan traffic demands.

8.4. The increase to Whatley Crescent north of Grafton Road is to be expected, as this will be a central point within the structure plan. The forecast increase of 11% will result in a forecast demand of 13,532vpd. The forecast traffic demands will not affect the current Level of Service.

8.5. The increase to Grand Promenade of about 4,670vpd will result in a long-term demand of 22,191vpd. The forecast equates to 55% of the road capacity and would not be likely to have a significant impact. Reference to Appendix A indicates that Level of Service B can be expected.

8.6. The increase to Railway Parade rail bridge at 14.5% will result in a forecast demand of 16,484vpd. Appendix A indicates that Level of Service E will occur. There is little opportunity to widen the rail bridge and this section of road will be likely to experience increased delays during peak periods. This will be the most significant impact of the proposed structure plan development. It should be noted that a far lesser impact is more likely as 100% of development may not mature until 2050

8.7. By 2050 mode shift may reduce the overall traffic generation within the structure plan.

Local Road Network Impacts

8.8. The local road network is assessed in terms of the desirable traffic volumes identified by *Liveable Neighbourhoods* for residential streets.

8.9. *Liveable Neighbourhoods* identifies that local access streets, or residential streets, should retain daily traffic flows below 3,000vpd. This daily volume ensures residential amenity is retained. Table 2 considers the affected access streets and shows the forecast traffic demands based on current residential uses compared to future residential uses.

8.10. Table 2 shows that the forecast increases to the local road network and it can be seen that most streets experience an increase greater than 10% of capacity. However, Table 2 shows that with full development of the structure plan area no local street is expected to operate with daily flows greater then 3,000 vehicles. Indeed most streets are significantly under the amenity threshold of 3,000vpd.

8.11. It is concluded that the local road network can accommodate the proposed structure plan without significant detrimental impact to residential amenity.

Intersection Impacts

8.12. The WAPC guidelines further state that "*For ease of assessment, an increase of 100 vehicles per hour for any lane can be considered as equating to around 10% of capacity. Therefore any section of road where traffic would increase flows by more than 100 vehicles per hour for any lane should be included in the analysis"*.

8.13. The Saturn model has been used to identify any road section that may experience an increase of more than 100 vehicle movements in any hour. Appendix C shows the affected links for both peak periods. Using the output shown in Appendix C, affected intersection can be identified and assessed.

Affected Intersections

8.14. Appendix C shows that the following links may be subject to an increase of over 100 vehicles to any direction of flow during the peak periods. The following intersections within 800 metres of the structure plan may be negatively impacted:

- Grand Promenade / Bowden Street
- Grand Promenade / Railway Parade
- Railway Parade / Whatley Crescent
- Whatley Crescent / Garratt Road
- Whatley Crescent / Grafton Road
- Whatley Crescent / Kenilworth Street

8.15. The existing peak hour traffic demands have been combined with the forecast traffic flows of the full development of the structure plan to identify the expected future turning movements at affected intersections. These forecasts have been used in Sidra to assess the future operation of the affected intersections. The Sidra outputs are attached at Appendix D. Affected intersections are discussed below. The year of assessment is indicatively 2026. No local area traffic growth has been applied, as redevelopment within the structure plan area will be the cause of traffic growth.

Grand Promenade / Bowden Street

8.16. The intersection of Grand Promenade and Bowden Street is presently operating as a four-way with priority control. The intersection would not conform to current intersection planning guidelines. As a four-way intersection, the forecast increases to Bowden Street will not be able to access Grand Promenade and will rat-run through the local neighbourhood to access the district road network. Such an outcome is highly undesirable and upgrading to the intersection is required.

8.17. As previously indicated, Grand Promenade does not require two traffic lanes northbound from Railway Parade as only a single lane can enter Grand Promenade at any one time. On this basis a single lane roundabout has been modelled with the structure plan traffic demands. The Sidra analysis indicates that an overall Level of Service A can be expected, with Level of Service B affecting the worst movement.

8.18. Long term planning for Grand Promenade / Bowden Street indicates a single lane roundabout will provide acceptable Levels of Service. A roundabout will also slow traffic allowing the section of Grand Promenade between Bowden Street and Railway Parade and provide for main street activity.

8.19. Table 3 indicates the future operation of the intersection. The Sidra output is attached in Appendix D.

Table 3 Grand Promenade / Bowden Street Future Operation 2026

Approach	V/C	LoS	V/C	LoS
	AM Peak		PM Peak	
Grand Promenade south	0.342	A	0.854	A
Bowden Street east	0.220	A	0.141	A
Grand Promenade North	0.70	A	0.449	A
Bowden Street west	0.168	A	0.512	B

Grand Promenade / Railway Parade

8.20. The intersection of Grand Promenade / Railway Parade is presently controlled by traffic signals. Analysis of the forecast structure plan traffic indicates that an overall Level of Service B can be expected, with Level of Service D for the worst movements (Level of Service D is deemed to be an acceptable Level of Service).

8.21. The Sidra analysis indicates that acceptable operation of the intersection can be expected and no major upgrade is required.

8.22. Table 4 indicates the future operation of the intersection. The Sidra output is attached in Appendix D.

Table 4 Grand Promenade / Railway Parade Future Operation 2026

Approach	V/C	LoS	V/C	LoS
	AM Peak		PM Peak	
Railway Parade East	0.855	C	0.837	B
Grand Promenade	0.850	B	0.825	B
Railway Parade west	0.823	B	0.813	B

Railway Parade / Whatley Crescent

8.23. The intersection of Railway Parade and Whatley Crescent is priority controlled and traffic may only turn left from Railway Parade. Sidra analysis of the existing intersection layout has been undertaken with the forecast structure plan traffic increases. It is noted that vegetation on PTA land obstructs visibility for traffic egressing Railway Parade, which in turn reduces capacity at this intersection.

8.24. Sidra analysis indicates that Railway Parade will continue to operate with acceptable Levels of Service. However, the right turn from Whatley Crescent is shown to operate at capacity. It can be expected that traffic may seek alternative routes to this intersection. As a result impacts outside of the structure plan area may occur.

8.25. No upgrade is suggested for this intersection as traffic signals would be unlikely to be approved by Main Roads due to the proximity to Garratt Road and a roundabout will permit the right turn out from Railway Parade. This in turn will exacerbate local traffic movements and may redistribute district level traffic.

8.26. Table 5 indicates the future operation of the intersection. The Sidra output is attached in Appendix D.

Table 5 Railway Parade / Whatley Crescent Future Operation

Approach	V/C	LoS	V/C	LoS
	AM Peak		PM Peak	
Whatley Crescent East	0.451	A	0.1.007	D
Railway Parade	0.882	B	0.819	B
Whatley Crescent west	0.206	A	0.260	A

8.27. It can be seen from Table 5 that the intersection of Whatley Crescent and Railway Parade would appear to operate in an acceptable manner, contrary to the current operation that has queuing extending back to Grand Promenade during the late afternoon peak. The Sidra model assumes good conditions and it has been identified that visibility for traffic on Railway parade is obstructed by vegetation on PTA land. The vegetation should be removed and better traffic flow should prevail.

Whatley Crescent / Garratt Road

8.28. The intersection of Whatley Crescent and Garratt Road is controlled by traffic signals. Analysis using Sidra of the impacts of the increased traffic demand of the structure plan indicates an overall Level of Service E can be expected. Some movements experience long delays and queues, but overall the intersection continues to operate within capacity.

8.29. No upgrade would be considered required for the intersection of Whatley Crescent and Garratt Road.

8.30. Table 6 indicates the future operation of the intersection. The Sidra output is attached in Appendix D.

Table 6 Whatley Crescent / Garratt Road Future Operation

Approach	V/C	LoS	V/C	LoS
	AM Peak		PM Peak	
Garratt Road	0.892	D	0.895	C
Whatley Crescent east	0.959	E	0.889	C
Whatley Crescent west	0.971	E	0.896	B

Whatley Crescent / Grafton Road

8.31. Whatley Crescent and the residential access streets (Grafton Road to Kenilworth Street) are all priority controlled. As a result of the structure plan, residential density will increase and traffic increases to affected side roads can be expected. Based on the forecast traffic increases to Grafton Road the forecast traffic increases can be seen to be manageable. However, the

outcome is based on no significant reductions to residential trip rates to account for Meltham station.

8.32. Table 7 indicates the future operation of the intersection. The Sidra output is attached in Appendix D.

Table 7 Whatley Crescent / Grafton Road Future Operation

Approach	V/C	LoS	V/C	LoS
	AM Peak		PM Peak	
Garratt Road	0.849	D	0.116	B
Whatley Crescent east	0.292	A	0.253	A
Whatley Crescent west	0.331	A	0.350	A

8.33. The analysis indicates that operating under priority control, the local access street intersections to Whatley Crescent can be expected to operate within capacity. However, it is likely that long delays will occur and some re-distribution over the local road network could occur. Sidra has been used to test the impact of a single lane roundabout and the analysis indicates that with the forecast traffic demands, Level of Service A can be expected on all approaches. Should issues occur with access to Whatley Crescent, then a single lane roundabout can be provided.

9. ACCESS TO FRONTAGE PROPERTIES

9.1. The majority of residential lots within the structure plan area have direct access to the local road network. Re-development to medium to high density will see access points combined as a result of small car parks being provided. Access points will need to conform to the requirements set out in AS2890.1.

9.2. Where possible, access for redeveloped lots should be taken to lower order streets. This will typically apply to lots fronting Grand Promenade, Railway Parade and Whatley Crescent. However, this may be impossible to achieve if land is in different ownerships.

9.3. External to the structure plan area the forecast traffic increases do not result in any street operating in a manner contrary to its classification within the functional road hierarchy. District level streets already pass greater flows than desirable under the *Liveable Neighbourhoods* frontage access policy. The structure plan will not change current conditions.

10. PEDESTRIAN AND CYCLE NETWORKS

10.1. The structure plan covers an existing residential area focussed around Meltham railway station. An assessment of the pedestrian and cycle network is provided in Table 8

10.2. All roads within the structure plan areas should be provided with a footpath to both sides and it would be expected that where a site has no footpath, a footpath would be provided as part of the development.

Safe Routes to Schools

10.3. Bayswater primary school is located approximately 500 metres north of Garratt Road. The primary school currently services the local community and the structure plan area.

10.4. Footpaths exist adjacent to Garratt Road that can be used to access the school. However, given the distance, it is unlikely that parents will walk their children to school.

10.5. Notwithstanding the low walking demand, a pedestrian refuge should be provided to Garratt Road in the vicinity of Murray Street to provide a safe pedestrian crossing point. All other streets likely to be used are local residential streets and are appropriate for walking.

Access to Public Transport

10.6. The purpose of the structure plan is to provide medium to high density dwellings within the walkable catchment of Meltham railway station. Figure 4 shows the 400 metre and 800 metre walkable catchments.

10.7. Good public transport is currently provided in the Meltham station precinct.

10.8. Buses can be accessed on Guildford Road and Beaufort Street, which are both within an acceptable walking distance.

Table 8 Pedestrian and Cycle Network

Location	Footpath	Cycle path	Comment
Whatley Crescent N Garratt Road	Yes	Yes	Footpath to southern side only PSP adjacent to rail line
Whatley Crescent N Grafton Road	Yes	Yes	Footpath to southern side only PSP adjacent to rail line
Whatley Crescent E Central Avenue	Yes	Yes	Footpath to southern side only PSP adjacent to rail line
Railway Parade E Central Avenue	Yes	No	Footpath to north side only. PSP to opposite side of railway
Railway Parade S Grand Promenade	Yes	No	As above
Grand Promenade N Beaufort Street	Yes	No	Footpath to both sides Possible future on-street cycle lanes
Grand Promenade W Railway Parade	Yes	No	Footpath to both sides Possible future on-street cycle lanes
Beaufort Street S Grand Promenade	Yes	No	Footpath to both sides. Cycling in bus lanes feasible.
Beaufort Street N Central Avenue	Yes	No	Footpath to both sides. Cycling in bus lanes feasible.
Garratt Road S Whatley Crescent	Yes	No	Footpaths adjacent to Houses both sides.
Guildford Road E Garratt Road	Yes	No	Footpaths both sides. Unsafe cycling environment on-road
Guildford Road E First Avenue	Yes	No	Footpaths both sides. Unsafe cycling environment on-road
Local Road Network			
Grafton Road	No	No	Cycling on-road considered acceptable
Grosvenor Road	Yes	No	Footpath to one side. Cycling on-road considered acceptable
Kenilworth Street	Yes	No	Footpath to one side. Cycling on-road considered acceptable
Belgrave / Charles Streets	No	No	Cycling on-road considered acceptable
Coombe Street / Cox Street	Yes	No	Footpath to one side. Cycling on-road considered acceptable
Haywood Street	No	No	Cycling on-road considered acceptable
Bowden Street	Yes	No	Footpath to one side. Cycling on-road considered acceptable
Crawford Road	Yes	No	Footpath to both sides. Cycling on-road considered acceptable
Stuart Street	Yes	No	Footpath to both sides. Cycling on-road considered acceptable
Sussex Street	Yes	No	Footpath to one side. Cycling on-road considered acceptable
Salisbury Street	Yes	No	Footpath to one side. Cycling on-road considered acceptable
Rosebery Street	Yes	No	Footpath to one side. Cycling on-road considered acceptable

Hotham Street	Yes	No	Footpath to one side. Cycling on-road considered acceptable

11. ANTICIPATED DEVELOPMENT

11.1. This structure plan report has been prepared on behalf of Bayswater Joint Venture Pty Ltd, who are set to develop Lots fronting Grand Promenade and Hotham Street.

11.2. The intentions of other landowners are unknown.

11.3. Bayswater Joint Venture Pty Ltd has interests in some land parcels north of Railway Parade between Grand Promenade and Hotham Street that will be subject to redevelopment in the near future.

11.4. The small area north of Railway Parade could yield up to 244 dwellings and based on the trip rates used for the structure plan, could generate up to 1,220 vehicle movements per day. The level of development is approximately 10% of the overall yield of the structure plan.

11.5. If this small parcel opposite Meltham station was developed, it could generate about 120 vehicle movements in each of the peak periods (assumes 10%). Based on a typical residential split of 80/20 the maximum traffic increase to any lane would be 98 vehicles. On this basis the anticipated development would be deemed to have no material impact under WAPC guidelines. No formal traffic assessment of the impact of these land parcels would be required.

Parking

11.6. Parking for individual developments will need to comply with the R-Codes and the City of Bayswater's Town Planning Scheme.

11.7. As part of the structure plan it would be feasible to apply a blanket car parking requirement for commercial uses within the development precinct. It is recommended that the existing minimum parking rate of the Scheme standards be used but with reduction factor that are allowed for the Bayswater and Maylands town centres.

11.8. On-street parking should be maximised for any small commercial land uses proposed as customers are unlikely to use visitor parking provided within the basement of a multi level development.

11.9. It is suggested that on-street parking bays can be provided to Grand Promenade between Railway Parade and Bowden Street. The existing carriageway provides two lanes in each direction. Approaching the traffic signals two lanes will be required to provide the necessary stacking capacity during peak periods. On street parking can be managed by time restrictions to

maintain signal capacity. Heading north, only a single traffic lane is required and on-street parking can be provided throughout the day.

12. RECOMMENDED UPGRADING WORKS

12.1. As a result of the investigations undertaken for the Meltham railway station precinct structure plan, the following road network improvements would be recommended regardless of any development:

- Vegetation to the south side of Railway Parade rail bridge is removed to increase visibility for traffic entering Whatley Crescent (City of Bayswater / PTA).
- The pedestrian median at the Railway Parade / Grand Promenade traffic signal intersection be widened to an appropriate standard to facilitate safe pedestrian crossing movement (MRWA)
- A pedestrian median is provided to Whatley Crescent adjacent to the foot bridge access to the railway station. (PTA / City of Bayswater).
- Warning sign be located at the station access and PSP to alert pedestrians and cyclist of conflict points. (City of Bayswater).
- Pedestrian access to Railway Parade should be reviewed by PTA to remove obstructions.
- The median to Railway Parade at Rosebery Street should be widened to provide a safe crossing point, particularly for parents with prams. (City of Bayswater).

12.2. The traffic investigations for the structure plan identify the following road network improvements:

- Long term planning for a single lane roundabout at the Grand Promenade / Bowden Street intersection.

APPENDIX A

Levels of Service by Road Type

LOS	Single Carriageway[1]	2-Lane Boulevard[2]	Dual Carriageway (4-Lanes)[3]	Dual Carriageway (4-lane Clearway)[3]
A	2,400vpd	2,600vpd	24,000vpd	27,000vpd
B	4,800vpd	5,300vpd	28,000vpd	31,500vpd
C	7,900vpd	8,700vpd	32,000vpd	36,000vpd
D	13,500vpd	15,000vpd	36,000vpd	40,500vpd
E	22,900vpd	25,200vpd[4]	40,000vpd	45,000vpd
F	>22,900vpd	>25,200vpd[4]	>40,000vpd	>45,000vpd

[1] Based on Table 3.9 Austroads - Guide to Traffic Engineering Practice Part 2
[2] Based on single carriageway +10% (supported by Table 3.1 Austroads - Guide to Traffic Engineering Practice Part 3) – Boulevard or division by medians.
[3] Based on RRR Table 3.5 - mid-block service flow rates (SF.) for urban arterial roads with interrupted flow. Using 60/40 peak split.
[4] Note James Street Guildford passes 28,000vpd.

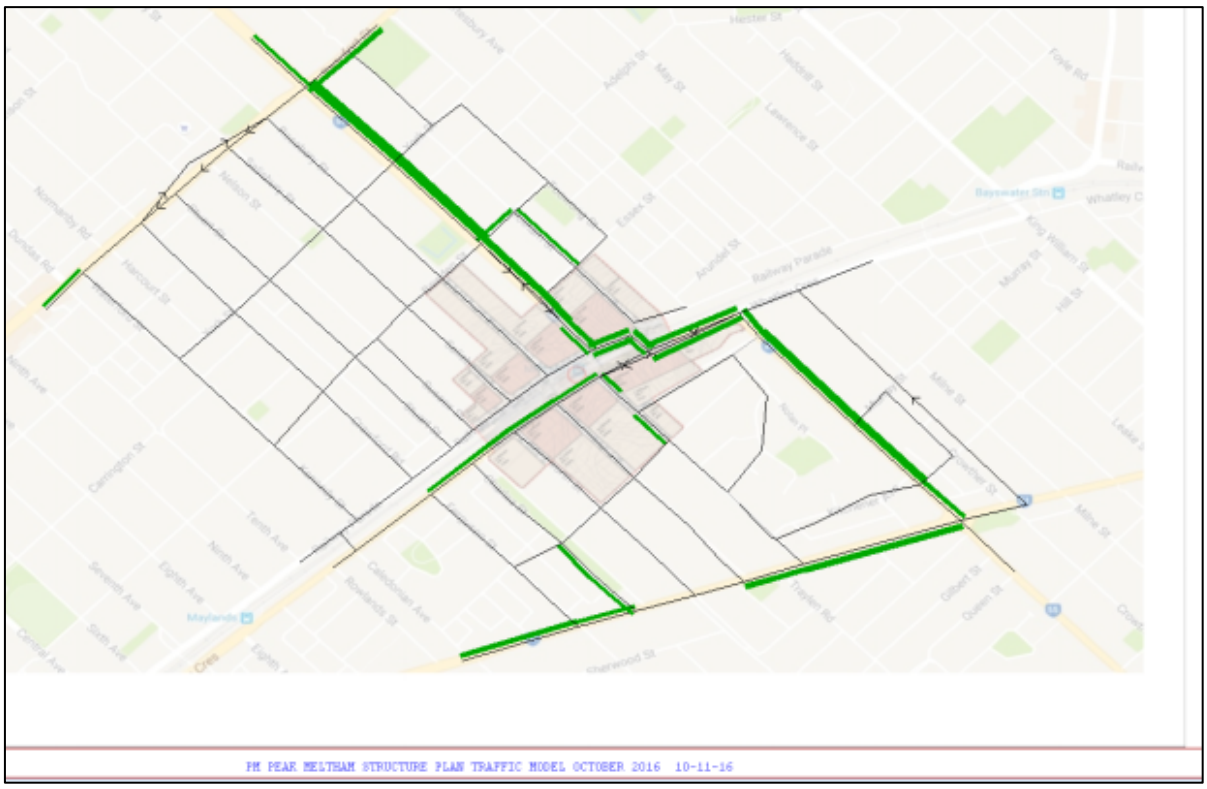
For the purposes of planning, the capacity of a road can be taken as the value between Level of Service E and F. However, a Level of Service D is the lowest preferred operational Level of Service.

APPENDIX B STRUCTURE PLAN TRAFFIC DEMANDS

Daily volumes x 10

APPENDIX C Peak Hour Impacts

AM Peak – Links passing >100 vehicles per hour



PM Peak – Links passing >100 vehicles per hour

APPENDIX D SIDRA ASSESSMENT

Grand Promenade / Bowden Street

MOVEMENT SUMMARY

Site: 105 [Gand Prom 3 AM]

Grand Promenade / Bowden St
AM Peak Structure Plan
Single lane roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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: RoadName											
1	L2	11	0.0	0.342	4.6	LOS A	2.5	17.5	0.40	0.50	53.3
2	T1	365	0.0	0.342	4.8	LOS A	2.5	17.5	0.40	0.50	54.6
3	R2	69	0.0	0.342	9.4	LOS A	2.5	17.5	0.40	0.50	54.5
Approach		445	0.0	0.342	5.5	LOS A	2.5	17.5	0.40	0.50	54.5
East: RoadName											
4	L2	17	0.0	0.220	10.8	LOS A	1.5	10.8	0.89	0.88	48.5
5	T1	28	0.0	0.220	11.1	LOS A	1.5	10.8	0.89	0.88	49.6
6	R2	74	0.0	0.220	15.7	LOS B	1.5	10.8	0.89	0.88	49.6
Approach		119	0.0	0.220	13.9	LOS A	1.5	10.8	0.89	0.88	49.4
North: RoadName											
7	L2	3	0.0	0.700	5.3	LOS A	7.6	53.3	0.62	0.54	52.6
8	T1	906	0.0	0.700	5.6	LOS A	7.6	53.3	0.62	0.54	53.8
9	R2	25	0.0	0.700	10.2	LOS A	7.6	53.3	0.62	0.54	53.8
Approach		935	0.0	0.700	5.7	LOS A	7.6	53.3	0.62	0.54	53.8
West: RoadName											
10	L2	74	0.0	0.168	6.6	LOS A	1.0	6.8	0.61	0.66	52.9
11	T1	74	0.0	0.168	6.8	LOS A	1.0	6.8	0.61	0.66	54.2
12	R2	6	0.0	0.168	11.5	LOS A	1.0	6.8	0.61	0.66	54.2
Approach		154	0.0	0.168	6.9	LOS A	1.0	6.8	0.61	0.66	53.6
All Vehicles		1653	0.0	0.700	6.4	LOS A	7.6	53.3	0.58	0.57	53.6

MOVEMENT SUMMARY

Site: 105 [Gand Prom 3 PM]

Grand Promenade / Bowden St
PM Peak Structure Plan
Single lane roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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: RoadName											
1	L2	11	0.0	0.854	5.8	LOS A	14.6	102.3	0.86	0.57	51.5
2	T1	1098	0.0	0.854	6.0	LOS A	14.6	102.3	0.86	0.57	52.7
3	R2	69	0.0	0.854	10.6	LOS A	14.6	102.3	0.86	0.57	52.7
Approach		1178	0.0	0.854	6.3	LOS A	14.6	102.3	0.86	0.57	52.7
East: RoadName											
4	L2	17	0.0	0.141	7.0	LOS A	0.8	5.9	0.66	0.73	50.9
5	T1	28	0.0	0.141	7.3	LOS A	0.8	5.9	0.66	0.73	52.1
6	R2	74	0.0	0.141	11.9	LOS A	0.8	5.9	0.66	0.73	52.0
Approach		119	0.0	0.141	10.1	LOS A	0.8	5.9	0.66	0.73	51.9
North: RoadName											
7	L2	3	0.0	0.449	4.8	LOS A	3.5	24.6	0.46	0.50	53.3
8	T1	551	0.0	0.449	5.1	LOS A	3.5	24.6	0.46	0.50	54.5
9	R2	25	0.0	0.449	9.7	LOS A	3.5	24.6	0.46	0.50	54.5
Approach		579	0.0	0.449	5.3	LOS A	3.5	24.6	0.46	0.50	54.5
West: RoadName											
10	L2	74	0.0	0.512	26.7	LOS B	4.7	32.7	1.00	1.10	41.3
11	T1	74	0.0	0.512	27.0	LOS B	4.7	32.7	1.00	1.10	42.0
12	R2	6	0.0	0.512	31.6	LOS C	4.7	32.7	1.00	1.10	42.0
Approach		154	0.0	0.512	27.0	LOS B	4.7	32.7	1.00	1.10	41.7
All Vehicles		2029	0.0	0.854	7.8	LOS A	14.6	102.3	0.75	0.60	52.1

Grand Promenade / Railway Parade

MOVEMENT SUMMARY

Site: 104 [Gran Prom 2 AM]

Grand Promenade / Railway Parade
AM Peak Structure Plan
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Railway Parade											
5	T1	195	0.0	0.182	8.7	LOS A	3.4	23.5	0.54	0.45	52.5
6	R2	504	0.0	0.855	37.8	LOS C	19.4	135.6	1.00	0.97	36.3
Approach		699	0.0	0.855	29.7	LOS C	19.4	135.6	0.87	0.83	39.7
North: Grand Promenade											
7	L2	655	0.0	0.509	11.2	LOS A	10.8	75.3	0.52	0.75	49.5
9	R2	456	0.0	0.850	38.6	LOS C	17.5	122.3	1.00	0.98	36.1
Approach		1111	0.0	0.850	22.5	LOS B	17.5	122.3	0.72	0.84	43.0
West: Railway Parade											
10	L2	197	0.0	0.204	15.4	LOS B	3.6	25.5	0.58	0.72	46.8
11	T1	232	0.0	0.823	37.4	LOS C	8.8	61.7	1.00	0.97	37.2
Approach		428	0.0	0.823	27.3	LOS B	8.8	61.7	0.80	0.86	41.1
All Vehicles		2238	0.0	0.855	25.7	LOS B	19.4	135.6	0.78	0.84	41.6

MOVEMENT SUMMARY

Site: 104 [Gran Prom 2 AM]

Grand Promenade / Railway Parade
PM Peak Structure Plan
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Railway Parade											
5	T1	214	0.0	0.171	4.8	LOS A	2.6	17.9	0.44	0.37	55.6
6	R2	628	0.0	0.837	29.4	LOS C	19.9	139.5	0.97	0.96	39.6
Approach		842	0.0	0.837	23.2	LOS B	19.9	139.5	0.83	0.81	42.7
North: Grand Promenade											
7	L2	408	0.0	0.326	10.1	LOS A	5.1	35.6	0.46	0.71	50.3
9	R2	258	0.0	0.825	37.6	LOS C	8.6	59.9	1.00	0.97	36.5
Approach		666	0.0	0.825	20.8	LOS B	8.6	59.9	0.67	0.81	43.9
West: Railway Parade											
10	L2	588	0.0	0.784	25.9	LOS B	16.9	118.3	0.94	0.91	41.3
11	T1	214	0.0	0.813	32.7	LOS C	7.0	49.3	1.00	0.96	39.1
Approach		802	0.0	0.813	27.7	LOS B	16.9	118.3	0.95	0.93	40.7
All Vehicles		2311	0.0	0.837	24.1	LOS B	19.9	139.5	0.83	0.85	42.3

Railway Parade / Whatley Crescent

MOVEMENT SUMMARY

▽ Site: 102 [Railway AM]

Railway Parade / Whatley Crescent
AM Peak
Meltham Strcucture Plan
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Whatley Crescent East											
5	T1	613	0.0	0.311	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
6	R2	312	0.0	0.451	11.6	LOS A	2.6	18.3	0.67	0.96	49.1
Approach		924	0.0	0.451	3.9	NA	2.6	18.3	0.23	0.32	55.8
North: Railway Parade											
7	L2	886	0.0	0.882	15.9	LOS B	20.4	143.0	0.88	1.32	46.5
Approach		886	0.0	0.882	15.9	LOS B	20.4	143.0	0.88	1.32	46.5
West: Whatley Crescent west											
10	L2	387	0.0	0.206	5.6	LOS A	0.0	0.0	0.00	0.58	53.6
11	T1	286	0.0	0.145	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		674	0.0	0.206	3.2	NA	0.0	0.0	0.00	0.33	56.1
All Vehicles		2484	0.0	0.882	8.0	NA	20.4	143.0	0.40	0.68	52.2

MOVEMENT SUMMARY

▽ Site: 102 [Railway PM]

Railway Parade / Whatley Crescent
PM Peak
Meltham Strcucture Plan
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Whatley Crescent East											
5	T1	374	0.0	0.190	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	664	0.0	1.007	55.5	LOS D	31.4	220.0	1.00	2.73	30.8
Approach		1038	0.0	1.007	35.5	NA	31.4	220.0	0.64	1.75	37.4
North: Railway Parade											
7	L2	622	0.0	0.819	16.3	LOS B	10.1	70.8	0.81	1.37	46.3
Approach		622	0.0	0.819	16.3	LOS B	10.1	70.8	0.81	1.37	46.3
West: Whatley Crescent west											
10	L2	178	0.0	0.095	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
11	T1	513	0.0	0.260	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		691	0.0	0.260	1.5	NA	0.0	0.0	0.00	0.15	58.2
All Vehicles		2351	0.0	1.007	20.4	NA	31.4	220.0	0.50	1.18	44.3

Whatley Crescent / Garratt Road

MOVEMENT SUMMARY

Site: 103 [Garratt AM]

Whatley Crescent / Garratt Road
AM Structure PLan

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Garratt Road											
1	L2	235	0.0	0.232	24.6	LOS B	8.8	61.7	0.56	0.73	41.9
3	R2	112	0.0	0.892	93.4	LOS F	9.2	64.2	1.00	0.95	23.5
Approach		346	0.0	0.892	46.8	LOS D	9.2	64.2	0.70	0.80	33.5
East: Whatley Crescent											
4	L2	203	0.0	0.285	39.8	LOS C	10.2	71.2	0.74	0.77	35.7
5	T1	718	0.0	0.959	76.8	LOS F	64.4	450.8	1.00	1.11	26.6
Approach		921	0.0	0.959	68.6	LOS E	64.4	450.8	0.94	1.04	28.2
West: Whatley Crecent											
11	T1	362	0.0	0.215	2.1	LOS A	4.6	32.2	0.19	0.17	58.0
12	R2	789	0.0	0.971	84.2	LOS F	73.5	514.4	1.00	1.03	24.9
Approach		1152	0.0	0.971	58.4	LOS E	73.5	514.4	0.75	0.76	30.4
All Vehicles		2419	0.0	0.971	60.6	LOS E	73.5	514.4	0.81	0.87	29.9

MOVEMENT SUMMARY

Site: 103 [Garratt PM]

Whatley Crescent / Garratt Road
PM Structure PLan

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Garratt Road											
1	L2	528	0.0	0.479	15.7	LOS B	11.8	82.5	0.62	0.77	46.7
3	R2	315	0.0	0.895	52.0	LOS D	14.8	103.4	1.00	1.02	32.0
Approach		843	0.0	0.895	29.3	LOS C	14.8	103.4	0.76	0.86	39.8
East: Whatley Crescent											
4	L2	22	0.0	0.178	30.4	LOS C	2.8	19.4	0.81	0.66	41.2
5	T1	528	0.0	0.889	39.8	LOS C	21.2	148.2	0.98	1.02	36.3
Approach		551	0.0	0.889	39.4	LOS C	21.2	148.2	0.97	1.01	36.4
West: Whatley Crecent											
11	T1	589	0.0	0.452	6.9	LOS A	11.0	76.8	0.52	0.46	53.9
12	R2	546	0.0	0.896	46.3	LOS D	25.6	179.0	1.00	1.01	33.6
Approach		1136	0.0	0.896	25.9	LOS B	25.6	179.0	0.75	0.73	41.8
All Vehicles		2529	0.0	0.896	29.9	LOS C	25.6	179.0	0.80	0.83	39.9

Whatley Crescent / Grafton Road

MOVEMENT SUMMARY

Site: 101 [Grafton AM]

Whatley Crescent / Grafton Street
AM Peak
Structure Plan
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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: Grafton Road											
1	L2	25	0.0	0.029	8.1	LOS A	0.1	0.7	0.52	0.69	51.7
3	R2	155	0.0	0.849	60.2	LOS E	5.3	37.3	0.97	1.36	29.7
Approach		180	0.0	0.849	52.9	LOS D	5.3	37.3	0.91	1.27	31.6
East: Whatley Crescent											
4	L2	6	0.0	0.292	5.6	LOS A	0.0	0.0	0.00	0.01	58.3
5	T1	613	0.0	0.292	0.0	LOS A	0.0	0.0	0.00	0.01	59.9
Approach		619	0.0	0.292	0.1	NA	0.0	0.0	0.00	0.01	59.9
West: Whatley Crescent											
11	T1	653	0.0	0.331	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	16	0.0	0.017	8.1	LOS A	0.1	0.5	0.55	0.66	51.7
Approach		668	0.0	0.331	0.2	NA	0.1	0.5	0.01	0.02	59.7
All Vehicles		1467	0.0	0.849	6.6	NA	5.3	37.3	0.12	0.16	53.9

MOVEMENT SUMMARY

Site: 101 [Grafton PM]

Whatley Crescent / Grafton Street
PM Peak
Structure Plan
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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: Grafton Road											
1	L2	16	0.0	0.014	6.8	LOS A	0.1	0.4	0.40	0.59	52.4
3	R2	25	0.0	0.116	21.5	LOS B	0.4	2.6	0.84	0.93	43.3
Approach		41	0.0	0.116	15.9	LOS B	0.4	2.6	0.67	0.80	46.4
East: Whatley Crescent											
4	L2	155	0.0	0.253	5.6	LOS A	0.0	0.0	0.00	0.17	56.9
5	T1	374	0.0	0.253	0.0	LOS A	0.0	0.0	0.00	0.17	58.4
Approach		528	0.0	0.253	1.6	NA	0.0	0.0	0.00	0.17	57.9
West: Whatley Crescent											
11	T1	691	0.0	0.350	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	25	0.0	0.024	7.6	LOS A	0.1	0.7	0.51	0.65	52.1
Approach		716	0.0	0.350	0.3	NA	0.1	0.7	0.02	0.02	59.6
All Vehicles		1285	0.0	0.350	1.4	NA	0.4	2.6	0.03	0.11	58.4