APPENDIX F

Supplementary Transport Response prepared by Colston Budd Hunt and Kafes dated June 2013

WESTFIELD

SUPPLEMENTARY TRANSPORT REPORT (RESPONSE TO TRANSPORT MATTERS) – PROPOSED EXTENSIONS TO WESTFIELD PARRAMATTA SHOPPING CENTRE

JUNE 2013

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1. INTRODUCTION

1.1 Colston Budd Hunt and Kafes Pty Ltd has been retained by Westfield to prepare a supplementary transport report on the proposed extensions to Westfield Parramatta Shopping Centre. The supplementary transport report has been prepared in response to transport matters raised in submissions, particularly those raised by Transport for NSW (TfNSW) and Roads and Maritime Services (RMS). Other transport matters raised in submissions have been addressed in a preliminary response to submissions dated 9 May 2013. A copy of this response is provided in Appendix A.

1.2 The proposed extensions to Westfield Parramatta shopping centre are the subject of a Part 3A application and comprise 31,495m^2 GFA (24,504m^2 GLA) of additional retail area, additional 30,392m^2 GFA offices, provision of an additional 562 parking spaces, and modifications to the loading docks, parking layout and access driveways to accommodate the additional development. The site location is shown in Figure 1.

1.3 We prepared a traffic impact study and traffic management and accessibility plan (TMAP) in support of the Part 3A application (Traffic Impact Study and Traffic Management and Accessibility Plan following ROA for Part 3A Application for Extensions to Westfield Parramatta Shopping Centre – October 2012). Accompanying the TMAP was a PARAMICS modelling report prepared by Parsons Brinkerhoff.

1.4 The additional parking has been reduced by 11 from 573 to 562 spaces (comprising 462 retail (previously 473) and 100 commercial spaces), compared to

the original application. This reduction in parking is a result of the provision of a taxi pick up/set down area on Campbell Street, Level 4. The provision of the taxi pick up/set down area was requested by Parramatta City Council in its submission. Council suggested the taxi pick up/set down area on Campbell Street, Level 6. However the locating it on Level 4 will make it easier for taxis to enter/exit the car park and provides a convenient location for people to access it from the shopping centre.

1.5 Our response to the transport matters raised in the submissions by RMS and TfNSW are set out in Chapter 2.

2. RESPONSE TO TRANSPORT MATTERS

RMS Submission

2.1 Roads and Maritime Services (RMS) has provided a response to the traffic assessment and PARAMICS modelling as set out in its letter 16 April 2013 (copy provided in Appendix B). RMS has identified 12 points relating to the traffic modelling (provided in Attachment A to its letter) and requested that revised modelling be undertaken covering the following three scenarios:

- 2012 existing traffic conditions without the proposed development;
- with the proposed development and no network improvements (the year should be the expected year for completion of the development, not 2012; and;
- with the proposed development and with network improvement required to mitigate the impacts of the development in response to Conditions B4.3 and B4.4;

2.2 The first nine points set out in Attachment A relate to the PARAMICS modelling and have been addressed in the updated modelling report prepared by Parsons Brinkerhoff (copy provided in Appendix C).

2.3 Point 10 relates to a request for clarification on how the additional traffic generated by the proposed development was calculated. As set out in Section 3.44 of our previous report, traffic generation for the commercial component was based on a rate 0.3 trips per parking space. With 100 spaces the commercial component would generate 30 vehicles per hour (two way) in the morning and afternoon peak hours.

2.4 As set out on Sections 3.40 to 3.43 of our report, for the retail component a traffic generation of 170 and 450 vehicles per hour (two way) for the weekday morning and afternoon peak hours was used for the traffic assessment. This was based on applying the surveyed traffic generation rates of the existing shopping to the additional floor area and applying a 5% reduction in trip generation to the expanded centre (to take account that as shopping centres get larger the generation rate per 100m^2 gets lower).

2.5 In the afternoon peak hour the existing centre generates some 3,705 vehicles per hour (two way), a generation rate of 1 trip per 36.4m^2. Applying this rate to the expanded centre, and allowing for a 5% reduction, results in a generation of some 4,135 vehicles per hour (two way). This is an increase of 430 vehicles per hour (two way). 450 vehicles per hour (two way) was used in the traffic assessment.

2.6 Points 11 and 12 relate to the request for the additional modelling to include the matters raised in Points 1 to 10 and the three modelling scenarios identified in the RMS letter. Parsons Brinkerhoff has rerun the PARAMICS model to address the matters raised in Points 1 to 10 and for the three scenarios identified by the RMS.

2.7 As part of our response to the modelling issues raised we met with RMS and held discussions with Parramatta Council. It has been agreed with RMS and Council that:

- 2016 is the future year to assess the impacts of the proposed development (date that shopping centre extensions will open);
- the other major developments within Parramatta CBD that will be completed by 2016 that are to be taken into account as part of the cumulative assessment

are the Crown mixed use development located on the western corner of Hunter Street, Marsden Street and Macquarie Street; an additional 200 parking spaces within Council's Hunter Street car park; and the closure of Darcy Street at Church Street; and

- a 1% growth per year in through traffic on Pitt Street, O'Connell Street and Great Western Highway to account for background traffic growth and traffic from other minor developments that may be completed by 2016

2.8 The key findings of the revised modelling report undertaken by Parsons Brinkerhoff are set out below.

Base Calibration and Validation

2.9 The AM and PM peak models were calibrated and validated to RMS criteria. Feedback from RMS and Council officers indicated that the PM model presented was a reasonable representation of the typical conditions on a Thursday evening peak. RMS also conducted an independent audit and provided a number of comments on the base models. These comments have been addressed by Parsons Brinkerhoff and included in this report. Appendix H of the modelling report highlights where the report changes have been made to address these comments.

Model Scenarios

2.10 Two future scenarios have been analysed and compared to the 2012 and 2016 base scenarios. Scenario 1 was included to assess the impact of Westfield localized access improvements and its development traffic on the base traffic network. Scenario 2 contains the traffic generation of the development, road network upgrades identified by RMS/Council and the proposed internal car park

upgrades. The scenarios have been analysed to determine whether the impacts of the development traffic are mitigated by the proposed upgrades and car park improvements.

Road Network and Car Park Upgrades

2.11 Three intersection upgrades have been identified by Council and RMS (intersections of Great Western Highway with O'Connell Street, Marsden Street and Church Street/Parkes Street). The modelling indicates that these upgrades provide substantial benefits for traffic flow on the Great Western Highway, particularly during the AM peak.

2.12 A number of improvements to the Westfield car park entries and exits are planned to facilitate easier entry and exit. These include additional right turn lane at the eastern Campbell Street exit, widening of the western Campbell Street exit, reconfiguration of the Aird Street accesses (with improved management), lengthening of the second short lane to the Marsden Street exit and provision of a second boom gate on the Mardsen Street speed ramp entry.

2.13 The Paramics modelling has identified additional upgrades to mitigate the impacts of the proposed development including lengthening of the right turn bay from the Great Western Highway (westbound) into Marsden Street, extension of the two lane section Campbell Street (westbound) by extending the period of no parking, and modifications to the traffic signal phasing at the intersections of Marsden Street/Great Western Highway, Great Western Highway/Church Street and Church Street/Campbell Street.

Summary

2.14 The Paramics modelling has shown that:

- the identified Council/RMS upgrades and proposed upgrades mitigate the impacts of the proposed extensions. Traffic conditions in the AM and PM peaks would be similar or better than the existing situation; and

- the internal car park upgrades reduce the impact of the Westfield traffic on the road network.

TfNSW Submission

2.15 Transport for NSW (TfNSW), in its letter dated 21 March 2013, has requested a more detailed assessment of the impacts of the proposed development on public transport services within Parramatta CBD. This includes:

- an estimate of travel demand for the non-car mode;
- estimate of distribution of generated trips between origins and destinations;
- estimate of likely modal split for non-car modes (associated with proposed extensions);
- assessment of additional loads on existing public transport infrastructure in the AM and PM peak periods;
- set out planned improvements to public transport services within Parramatta CBD; and
- identify whether these loads can be accommodated by future public transport services within Parramatta CBD.

2.16 In addition to the above, in a further letter dated 27 March 2013, TfNSW has requested that additional information be provided on the construction impacts of the proposed development on bus services/pedestrian movements in the vicinity of the site and impacts of the expansion of the Aird Street (east) loading dock on bus services on Church Street.

2.17 We met with representatives of TfNSW and agreed an approach to address the matters raised in its letters. This involves surveys/observations of existing bus and train patronage within Parramatta CBD, estimate of non-car mode of travel from the additional development, identification of future improvements to public transport services and an assessment of the impact of the proposed development on non-car modes of travel.

2.18 With regard to the matters raised in the TfNSW letter dated 27 March we offer the following responses:

- construction impacts on bus services/pedestrians have been addressed in the draft construction management plan prepared by Westfield. This addresses construction of the additional retail area (Stage 1). The construction of the additional retail area would have minimal impact on bus movements along Church Street and Argyle Street with most construction activity located on Campbell Street. In the event that there was a requirement for construction access from Argyle Street, consultation would be undertaken between RMS, Council and the bus operators to minimise impacts to traffic, pedestrians and bus operations; and

- the expansion of the Aird Street (east) loading dock is relatively minor (one additional dock and no increase in truck size) and would have no impact on bus services on Church Street.

2.19 Our response to the matters raised in the TfNSW letter dated 21 March is set out through the following sections.

Estimate of Travel Demand for the Non-Car Mode

2.20 Estimates of the travel demand for the non-car mode have been made based on surveys of travel demand of the shopping centre (as set out in Section 2.46 of our report) and census data for the journey to work to the Parramatta CBD for the commercial component. These are set out below in Table 2.1

Table 2.1:	**Summary of Existing Travel Modes**	
Mode	Retail	Employees
Car Driver	27%	33%
Car Passenger	27%	5%
Train	13%	39%
Bus	15%	8%
Walked	16%	12%
Other (Taxi, Cycle)	2%	3%

2.21 For the retail component existing travel by non-car modes was estimated by applying the above mode splits to the surveyed traffic generation of the shopping centre in the AM and PM peak hour. In the AM peak hour the shopping centre had a traffic generation of 1,415 vehicles per hour (1,225 in/190 out). In the PM peak hour the shopping centre had a traffic generation of 3,705 vehicles per hour

(2,000 in/1,705 out). Thus the existing shopping centre is estimated to have the following travel by train and bus:

- AM peak hour – 680 people by train (590 in/90 out), 795 people by bus (680 in/105 out); and
- PM peak hour – 1,785 people by train (965 in/820 out), 2,055 people by bus (1,110 in/945 out).

Estimate of Distribution of Generated Trips

2.22 Census data indicates that the largest group of people who travel to Parramatta CBD come from within the Parramatta LGA. Beyond Parramatta the next highest set of origins/destinations are the adjoining areas of Auburn, Blacktown, Baulkham Hills and Holroyd.

Estimate of Likely Modal Split of Non-Car Modes

2.23 Estimates of the additional trips by non-car modes have been made based on the existing travel modes (retail and commercial), provision of parking and increase in population.

2.24 For the retail component the proportion of travel by non-car mode has been increased 5% to reflect the lower rate of parking (per 100m^2) for the expanded shopping centre. Thus the proportion of travel by train/bus for the retail component has increased from some 28% to some 30% (a 5% increase). The proposed extensions will increase the retail area of the shopping centre by some 18%. It has been assumed that the population of expanded shopping centre will also increase by 18%. The additional travel by bus and train in the AM/PM peak hours for the retail component is set out below:

- AM peak hour – +130 people by train (+110 in/+20 out), +150 people by bus (+130 in/+20 out); and
- PM peak hour – +335 people by train (+180 in/+155 out), +390 people by bus (+210 in/+180 out).

2.25 For the proposed office tower, on-site parking will be highly constrained (with provision of 100 parking spaces). An employee density of 1 person per 25m^2 GFA has been assumed for the 30,000m^2 GFA office tower, resulting in an employment population of some 1,200 people. Based on an average car occupancy of 1.1 people per car (compared to the Parramatta CBD average of 1.2 people per car), results in 1,090 people travelling to work by means other than car. Census data indicates that 63% of non-car travel to work within Parramatta CBD is by train and 11% by bus. Based on 50% of people travelling to work in the peak hours, the proposed office tower would generate the following trips by bus/train:

- AM peak hour – +345 people in by train, +60 people in by bus; and
- PM peak hour – +345 people out by train, +60 people out bus.

2.26 The above does not account for any absenteeism by office employees (such as holidays, working away from the office or sick leave). This can typically be some 10% of employees.

2.27 Combining both the retail and commercial components results in the following additional loadings:

- AM peak hour – +475 people by train (+455 in/+20 out), +495 people by bus (+475 in/+20 out); and

- PM peak hour – +680 people by train (+180 in/+500 out), +450 people by bus (+210 in/+240 out).

2.28 These additional trips will be distributed to existing buses and trains that service Parramatta CBD.

Assessment of Additional Loads on Public Transport Infrastructure

2.29 To assess the impact of additional loads on the public transport infrastructure, surveys were undertaken of the existing demand for bus and train services to/from Parramatta CBD in the AM and PM peak periods.

Trains

2.30 Parramatta station is serviced by trains operating on the Cumberland Line, Western Line/North Shore Line (Penrith and Richmond) and Blue Mountains Line. There are currently some 57 trains servicing Parramatta station in the morning peak period (35 city bound and 22 westbound services) and some 54 trains in the afternoon peak period (24 city bound and 30 westbound services). Observations found that city bound services in the AM peak period and westbound services in PM peak period operate at near capacity.

2.31 Surveys of the occupancy of a sample of trains during the AM (7.30am to 9.30am) and PM peak periods (two hours) were undertaken on Wednesday May 22 2013. All trains surveyed were eight car trains with an estimated capacity of 1,200 people per train. The surveys found the following:

- average occupancy for the city bound trains on the Western/North Shore Line was some 82% (range 64% to 100%). Based on six services an hour, there is spare capacity of some 1,300 people on these trains in the AM peak hour;

- average occupancy for the westbound trains on the Western/North Shore Line was 49% (range 17% to 96%). Based on four services an hour, there is spare capacity of some 2,450 people on these trains in the AM peak hour;

- average occupancy for Blacktown and Glenfield bound trains on the Cumberland Line was some 30% in both directions. Based on two services an hour, there is spare capacity of some 1,700 people on these trains in the AM peak hour;

- average occupancy for the westbound trains on the Western/North Shore Line was some 82% (range 27% to 100%). Based on six services an hour, there is spare capacity of some 1,300 people on these trains in the PM peak hour;

- average occupancy for the city bound trains on the Western/North Shore Line was some 59% (range 21% to 100%). Based on four services an hour, there is spare capacity of some 1,950 people on these trains in the PM peak hour; and

- average occupancy for Blacktown and Glenfield bound trains on the Cumberland Line was some 63% in both directions. Based on two services an hour, there is spare capacity of some 650 people on these trains in the PM peak hour.

2.32 The surveys found that while some trains are running at near capacity (particularly city bound in the morning and westbound in the afternoon), there is spare capacity on the trains in the AM and PM peak periods. Observations noted that the spare capacity is generally located within the end carriages.

2.33 The proposed development was found to generate an additional 475 trips by train in the AM peak hour (455 in/20 out) and 680 people in the PM peak hour (180 in/500 out). These trips would be split between the three lines entering/departing Parramatta with 60% to/from the west/northwest, 30% from the east and 10% from the south. Thus the increase in trips would range between 50 and 300 trips per hour in the peak direction. This level of increase could be accommodated by the existing spare capacity on each line (at least 1,300 people).

Buses

2.34 Parramatta bus interchange is located on both sides of the station (northern side is located on Darcy Street and southern side on Argyle Street). Over 45 bus routes operate out of the interchange ranging from local services connecting Parramatta CBD with the local area to regional services operating on the Liverpool to Parramatta and Northwest Transitways and Metrobus services. During the AM and PM peak periods service frequencies range from 10 to 30 minutes on local services to 5 to 15 minutes on Transitway services. The interchange operates as terminus for buses servicing Parramatta CBD.

2.35 Surveys of the occupancy of a sample of buses during the AM (7.30am to 9.30am) and PM peak periods (two hours) were undertaken on Wednesday May 22 2013. Capacity of buses varied from 60 to 70 for single unit buses to 115 buses for bendy buses. The surveys found the following:

- average occupancy for the inbound buses on the Western/North Shore Line was some 26% (range 3% to 95%) in the AM peak period. Based on an average of 100 services an hour and an average capacity of 65 people, there is spare capacity of some 4,800 people on these buses in the AM peak hour. Based on the location, existing demand and frequency of services, spare capacity is between 1,000 to 1,500 people by direction to/from Parramatta CBD;

- average occupancy for the outbound buses on the Western/North Shore Line was some 24% (range 7% to 93%) in the AM peak period. Based on an average of 100 services an hour and an average capacity of 65 people, there is spare capacity of some 4,940 people on these buses in the AM peak hour. Based on the location, existing demand and frequency of services, spare capacity is between 1,000 to 1,500 people by direction to/from Parramatta CBD;

- average occupancy for the inbound buses on the Western/North Shore Line was some 11% (range 3% to 79%) in the PM peak period. Based on an average of 100 services an hour and an average capacity of 65 people, there is spare capacity of some 5,785 people on these buses in the PM peak hour. Based on the location, existing demand and frequency of services, spare capacity is between 1,200 to 1,800 people by direction to/from Parramatta CBD; and

- average occupancy for the outbound buses on the Western/North Shore Line was some 40% (range 8% to 79%) in the PM peak period. Based on an average of 100 services an hour and an average capacity of 65 people, there is

spare capacity of some 3,900 people on these buses in the PM peak hour. Based on the location, existing demand and frequency of services, spare capacity is between 800 to 1,200 people by direction to/from Parramatta CBD.

2.36 The proposed development has been estimated to generate an additional 495 trips by bus in the AM peak hour (475 in/20 out) and 450 trips in the PM peak hour (210 in/240 out). These trips would be split between the various bus services entering/departing Parramatta. The increase in trips generated by the proposed development could be accommodated by the existing spare capacity (at least 3,900 people).

2.37 Thus in summary the review of existing bus and train services that operate out of Parramatta CBD has found the following:

- while a number of trains are operating close to capacity, overall during the AM and PM peak periods there is sufficient spare capacity to accommodate the additional demand generated by the proposed development; and

- there is sufficient spare capacity on buses operating out of the Parramatta CBD bus interchange in the AM and PM peak periods to accommodate the additional demand generated by the proposed development.

Planned Improvements to Public Transport Services within Parramatta CBD

2.38 There are a range of measures proposed to improve public transport services to Parramatta CBD by Parramatta Council and the NSW government. It is noted that NSW 2021. A plan to Make NSW Number One sets a target of commuter

trips by public transport to Parramatta CBD at 50%. The measures proposed to improve public transport services include:

- Redesigned Bus Network within Parramatta CBD

  - Parramatta shuttle bus is a free transport solution connecting tourists, residents and commuters to the commercial, retail and recreational landmarks of Parramatta;
  - NSW State Plan proposes to increase buses along major transport corridors (Liverpool to Parramatta and Northwest Transitways, Victoria Road and Parramatta Road);
  - Optimising bus priority along major transport corridors; and
  - New bus routes operating along an upgraded M4 Motorway (part of WestConnex).

- Improved Rail Links

  - South West Rail Link will improve access by train to Parramatta from southwestern Sydney (which is expected to grow by 300,000 people over the next 30 years);
  - Parramatta/Epping Rail Link will connect Parramatta with the Northern Line and provide rail access between Parramatta and Macquarie Park/Chatswood.

- WestConnex Motorway

  - A motorway connecting the M4 at Concord with Sydney Airport/Port Botany;

- Includes widening and extension of the existing M4 Motorway;
- Provision for new bus services operating along the Motorway;
- Extension of dedicated bus lanes and bus priority measures along Parramatta Road;
- New bus facilities may be created as part of the renewal on Parramatta Road to serve customers using local and cross regional services operating along Parramatta Road;
- Overall the WestConnex will provide for improved bus services between Parramatta CBD and areas to the east.

- Parramatta Light Rail

  - Council proposal for a light rail network in western Sydney;
  - Parramatta to be the hub of the light rail network connecting Parramatta with Macquarie Park, Castle Hill, Bankstown, Rhodes and Liverpool;
  - Will provide improved access to Parramatta CBD for local and regional trips;
  - Increase public transport capacity to/from Parramatta;
  - Will connect/integrate with existing major rail and bus routes.
  - Includes widening and extension of the existing M4 Motorway.

2.39 In summary the identified and potential public transport improvements will improve public transport capacity to/from Parramatta CBD, address a number of existing capacity constraints and assist the planning goals of increasing the proportion of trips to/from Parramatta CBD by non-car modes.

Summary

2.40 In summary the supplementary transport report responds to the transport matters raised in the submissions by RMS and TfNSW (other transport matters raised in submissions have been addressed in the preliminary response which is appended to this report).

2.41 The Paramics modelling has been revised by Parsons Brinkerhoff to address the matters raised by RMS (including the requested assessment scenarios). The revised modelling found that:

- The identified Council/RMS upgrades and proposed upgrades mitigate the impacts of the proposed extensions. Traffic conditions in the AM and PM peaks would be similar or better than the existing situation; and

- The internal car park upgrades reduce the impact of the Westfield traffic on the road network.

2.42 As requested by TfNSW a review of existing public transport services within in Parramatta CBD has been undertaken, along with an assessment of the impact of additional public transport trips from the proposed development and identification of planned improvements to public transport services. These found that:

- there is spare capacity on existing public transport services to accommodate the additional demand generated by the proposed development; and

- that planned improvements to public transport services (improved bus access, new bus and rail links, and potential light rail) will address a number of existing capacity constraints and assist the planning goals of increasing the proportion of trips to/from Parramatta CBD by non-car modes.

APPENDIX A

PRELIMINARY RESPONSE TO SUBMISSION

Colston Budd Hunt & Kafes Pty Ltd
as Trustee for C & B Unit Trust
ABN 27 623 918 759

Our Ref: TR/8659/jj

9 May 2013

Transport Planning
Town Planning
Retail Studies

Westfield
c/- Ingham Planning
19/303 Pacific Highway
LINDFIELD NSW 2070

Attention: Nick Juraowitch
Email: Nick@inghamplanning.com.au

Dear Sir,

RE: PART 3A APPLICATION FOR PROPOSED ADDITIONS TO PARRAMATTA SHOPPING CENTRE

1. As requested, we have reviewed the submissions to the above development. We prepared the TMAP that accompanied the Part 3A application (Traffic Impact Study and Traffic Management and Accessibility Plan following ROA for Part 3A Application for proposed extensions to Westfield Parramatta Shopping Centre, October 2012). Set out below is our response to the traffic and parking matters raised in these submissions.

Holroyd City Council Submission

2. Holroyd City Council (HCC) has raised traffic and parking matters as summarized below:

- whether the proposed parking provision is appropriate;
- impact of increased traffic within Holroyd (located south of the Great Western Highway);
- impact on public transport services from the proposed development.

3. With regard to traffic impacts on streets within HCC, we note that the proposed development will result in the centre generating a total of some 200 to 480 vehicles per hour (two way) in the weekday morning and afternoon peak periods respectively. This is a relatively minor increase of some 13% in for the existing traffic generation of the centre. When assigned to the surrounding road

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network, the increase in traffic on roads within the HCC (such as Pitt Street and Marsden Street, south of Great Western Highway) would be minor at some 10 to 45 vehicles per hour (two way). This represents increases of between 1% and 4% on existing peak hour traffic flows. Such minor increases would have no material impact of the operation of the road network within HCC. We note that the PARAMICS modelling found that with the additional traffic from the proposed development in place and the identified road improvements, traffic conditions in the AM and PM peaks would be similar or better than the existing situation.

4. With regard to parking provision this is addressed in Sections 3.17 to 3.25 of our report. The proposed development will provide an additional 573 car parking spaces (473 retail and 100 commercial) plus 254 bicycle spaces (90 retail and 164 commercial). The proposed car parking provision is less than the maximum permissible under Parramatta Council's planning controls and is consistent with Council's objectives of reducing traffic within Parramatta CBD. The reduced car parking provision also reflects the sites excellent access to public transport (located adjacent to the bus and rail interchange) and the ability for people to travel to the site by means other than private car.

5. With regard to public transport, a more detailed assessment of the impacts of the proposed development on public transport services within Parramatta CBD is being prepared to address matters raised by TfNSW.

Roads and Maritime Services Submission

6. Roads and Maritime Services (RMS) has provided a response to the traffic assessment and PARAMICS modelling as set out in its letter 16 April 2013. RMS has identified 12 points relating to the traffic modelling (provided in Attachment A to its letter) and requested that revised modelling be undertaken covering the following three scenarios:

- 2012 existing traffic conditions without the proposed development;
- With the proposed development and no network improvements (the year should be the expected year for completion of the development, not 2012; and
- With the proposed development and with network improvement required to mitigate the impacts of the development.

7. The first nine points set out in Attachment A relate to the PARAMICS modelling and have been addressed by the response by Parsons Brinkerhoff (attached to this letter).

8. Point 10 relates to a request for clarification on how the additional traffic generated by the proposed development was calculated. As set out in Section 3.44 of our report, traffic generation for the commercial component was based on a rate 0.3 trips per parking space. With 100 spaces the commercial component would generate 30 vehicles per hour (two way) in the morning and afternoon peak hours.

9. As set out on Sections 3.40 to 3.43 of our report for the retail component, a traffic generation of 170 and 450 vehicles per hour (two way) for the weekday morning and afternoon peak hours was used for the traffic assessment. This was based on applying the surveyed traffic generation rates of the existing shopping to the additional floor area and applying a 5% reduction in trip generation to the expanded centre (to take account that as shopping centres get larger the generation rate per 100m^2 gets lower).

10. In the afternoon peak hour the existing centre generates some 3,705 vehicles per hour (two way), a generation rate of 1 trip per 36.4m^2. Applying this rate to the expanded centre, and allowing for a 5% reduction, results in a generation of some 4,135 vehicles per hour (two way). This is an increase of 430 vehicles per hour (two way). 450 vehicles per hour (two way) was used in the traffic assessment.

11. Points 11 and 12 relate to the request for the additional modelling to include the matters raised in Points 1 to 10 and the three modelling scenarios identified in the RMS letter. Parsons Brinkerhoff is rerunning the PARAMICS model to address the matters raised in Points 1 to 10 and the three scenarios identified by the RMS. We have met with RMS and held discussions with Parramatta Council. It has been agreed that 2016 is the future year to assess the impacts of the proposed development (date that shopping centre extensions will open). The other major developments within Parramatta CBD that will be completed by 2016 that are to be taken into account as part of the cumulative assessment are Crown mixed use development located on the western corner of Hunter Street, Marsden Street and Macquarie Street; an additional 200 parking spaces with Council's Hunter Street car park; closures of Darcy Street. Also agreed a 1% growth per year in through traffic on Pitt Street, O'Connell Street and Great Western Highway to account for background traffic growth and traffic from other minor developments that may be completed by 2016.

12. The revised modelling and updated report is anticipated to be completed by June 3 2013.

Transport for NSW Submission

13. Transport for NSW (TfNSW), in its letter dated 21 March 2013, has requested a more detailed assessment of the impacts of the proposed development on public transport services within Parramatta CBD. This includes:

- an estimate of travel demand for the non-car mode;
- estimate of distribution of generated trips between origins and destinations;
- estimate of likely modal split for non-car modes;
- assessment of additional loads on existing public transport infrastructure in the AM and PM peak periods;
- set out planned improvements to public transport services within Parramatta CBD;
- identify whether these loads can be accommodated by future public transport services within Parramatta CBD.

14. In addition to the above, in a further letter dated 27 March 2013, TfNSW has requested that additional information be provided on the construction impacts of the proposed development on bus services/pedestrian movements in the vicinity of the site and impacts of the expansion of the Aird Street (east) loading dock on bus services on Church Street.

15. We met with representatives of TfNSW and agreed an approach to address the matters raised in its letters. This involves surveys/observations of existing bus and train patronage within Parramatta CBD, estimate of non-car mode of travel from the additional development, identification of future improvements to public transport services and an assessment of the impact of the proposed development on non-car modes of travel. A supplementary report is being prepared and is anticipated to be completed by 3 June 2013.

16. With regard to the matters raised in the TfNSW letter dated 27 March we offer the following comments:

- construction impacts on bus services/pedestrians have been addressed in the draft construction management plan prepared by Westfield. This addresses construction of the additional retail area (Stage 1). The construction of the additional retail area would have minimal impact on bus movements along Church Street and Argyle Street with most construction activity located on Campbell Street. In the event that there was a requirement for construction access from Argyle Street, consultation would be undertaken between RMS, Council and the bus operators to minimise impacts to traffic, pedestrians and bus operations; and

- The expansion of the Aird Street (east) loading dock in relatively minor (one additional dock and no increase in truck size) and would have no impact on bus services on Church Street.

Parramatta City Council Submission

17. Parramatta City Council (PCC) has raised traffic related issues as set out below:

- clarification that an additional boom gate will be provided at the entry from the Marsden Street speed ramp and that parking management information system display will be provided on the Aird Street entry points;
- the proposed traffic upgrades on Great Western Highway to be provided at no cost to Council prior to the completion of Stage 1;
- a request to view the PARAMICS model;
- preparation of traffic management plan for peak periods;
- advice on Westfield Parramatta's website for groups coming to the centre by coach or mini bus. The advice should include information on where to park, height restrictions and pick up/set down areas;
- provision of a taxi pick up/set down area within the car park with associated directional signage and provision of free phone to call taxis and web cam showing taxi waiting area that taxi operators can access;
- concerns that trucks are reversing into the Marsden Street dock creating a safety hazard.

10. With respect to point 1 we confirm that an additional boom gate will be provided at the entry from the Marsden Street speed ramp and that parking management information system display will be provided at the Aird Street entry points.

11. With respect to Point 2, the road upgrades identified along the Great Western Highway are required to accommodate existing plus development traffic. Hence Westfield is committed to making an appropriate contribution to these upgrades, consistent with the increase in traffic from the proposed development.

12. With respect to Point 3 Council has viewed the PARAMICS model (along with RMS). Video files of the PARAMICS model have been provided to Council.

13. With respect to Point 4, we understand that the centre currently has a management plan for peak periods. This involves the existing Park Assist management system to direct traffic to available parking, closing off sections of

the car park when fully occupied and opening of the boom gates at entry and exit when congestion occurs within the car park. These procedures will continue for the expanded centre.

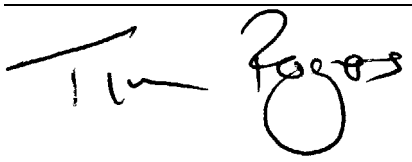
14. With respect to Point 5, Westfield do not encourage groups to travel to the centre by coach or mini bus as parking for these vehicles cannot be accommodated on site.

15. With respect to Point 6 Council has suggested provision of a taxi pick up/set down area on level 6 (east end near 5M speed ramp). The plans have been amended to provide this set down/pick up area.

16. With respect to Point 7 no changes are proposed to the existing Marsden Street loading dock as part of the Part 3 Application

17. We trust the above provides the information you require. Finally, if you should have any queries, please do not hesitate to contact us.

Yours faithfully,
COLSTON BUDD HUNT & KAFES



T. Rogers
Director

APPENDIX B

RMS SUBMISSION 16 APRIL 2013

Transport
Roads & Maritime
Services

16 April 2013

RMS Ref: SYD10/00689/02
Your Ref: MP10_0068

Director, Metropolitan & Regional Projects south
Department of Planning & Infrastructure
GPO Box 39
SYDNEY NSW 2001

Attention: Matthew Rosel

Dear Sir/Madam

EXHIBITION OF ENVIRONMENTAL ASSESSMENT FOR THE DEVELOPMENT OF WESTFIELD SHOPPING CENTRE, PARRAMATTA

Reference is made to Department's letter dated 18 January 2013, regarding the abovementioned Application which was referred to Roads and Maritime Services (RMS) for comments.

RMS has reviewed the submitted information and provides the following comments for Department's consideration:

1. RMS does support the proposed reduced parking for the development as the site is next to existing public transport interchange.

2. RMS identified a number of deficiencies in the traffic modelling that support the proposed development. These deficiencies are listed in the Attachment A.

   The applicant is to address all the issues raised in the attachment. Furthermore, the revised modelling should as a minimum have the following three scenarios:

   - 2012 Existing traffic without the proposed development;
   - With the proposed development and no network improvements (the year should be expected year for the completion of the development not 2012;
   - With the proposed development and with the network improvement required to mitigate the impacts of the developments

   The report should include concept plans for any identified improvement works. Future year modelling should include all known development in the vicinity and background traffic growth.

3. All works signage associated with the proposed development are to be at no cost to RMS.

Any inquiries in relation to this development application can be directed to Pahee Sellathurai on 8849 2219.

Yours faithfully

Owen Hodgson
Senior Land Use Planner
Transport Planning, Sydney Region

Attachment A

***Major non-conformance**: Both time step detail and mean driver reaction time have been modified outside of the RMS standards for urban congested networks. This has the effect of making simulated drivers more responsive and increasing the general capacity of the network.*

***Minor non-conformance**: The 40 km/hr school zone in the vicinity of Parramatta High School has not been coded in the morning peak period.*

***Minor non-conformance**: Next lane rules through intersections should be changed from default coding unless they reflect on site conditions.*

***Major non-conformance**: Signal phasing for the intersection of Church Street, Great Western Highway and Parkes Street has been coded incorrectly with gap-out phases coded in the incorrect order. It is recommended that gap-out logic be coded at this intersection to more accurately model the gapping-out of diamond phase as critical intersections.*

***Minor non-conformance**: Spot check of bus routes identified that many stop dwell times are based on passenger frequencies with very low passenger demands.*

***Minor non-conformance**: Very low reaction factors are used on O'Connell Street and no documentation of these changes is made in accompanying modelling report.*

***Minor non-conformance**: Travel time and queue length comparisons are not documented in the main body of the Traffic Modelling Report; the report should be updated to provide these comparisons and discuss any differences between observed and modelled conditions.*

***Minor non-conformance**: Release profiles should be replaced with plots of network vehicle load to provide an indication of model stability.*

***Minor non-conformance**: the validation section of the modelling report should be updated to address discrepancies in the observed and modelled travel time comparisons.*

***Major non-conformance**: traffic generation figures provided in the Traffic Impact Study are not internally consistent and do provide sufficient detail regarding the source and method by which this traffic generation has been calculated. Additional detail should be provided to identify the source for various rates used and how they have been used to arrive at the reported traffic generation.*

***Major non-conformance**: traffic modelling has not taken into account the cumulative impacts of the proposed development in combination with other developments in the Parramatta CBD that may also generate traffic at the time the Westfield expansion is complete. The model should be updated to include approved developments and some estimate of regional traffic growth to demonstrate that the road network will function acceptable when the expansion is complete.*

***Major non-conformance**: traffic modelling of the future development scenarios does not clearly demonstrate the impact of the proposed development or the benefit of identified improvement works, particularly in the critical evening peak period. Further testing should be undertaken to clearly demonstrate the impact of the proposed development and the identified mitigation measures.*

APPENDIX C

REVISED MODELLING REPORT (MAY 2013)

Traffic Modelling Report for Proposed Expansion of Westfield Parramatta Shopping Centre

May 2013

Westfield

PARSONS BRINCKERHOFF

Parsons Brinckerhoff Australia Pty Limited
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Certified to ISO 9001, ISO 14001, AS/NZS 4801
A+ GRI Rating: Sustainability Report 2010

Revision	Details	Date	Amended By
	Draft	10/09/12	TvD
A	Draft	14/09/12	TvD
B	Draft	28/05/13	MA

Author: Meysam Ahmadpour, Tom van Drempt.....

Signed: .....

Reviewer: Graeme Inglis.....

Signed: .....

Approved by: Graeme Inglis.....

Signed: .....

Date: 28 May 2013.....

Distribution: Westfield, Colston Budd Hunt & Kafes.....

Please note that when viewed electronically this document may contain pages that have been intentionally left blank. These blank pages may occur because in consideration of the environment and for your convenience, this document has been set up so that it can be printed correctly in double-sided format.

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Executive summary

Westfield has made an application under Part 3A of the EP&A Act for a Concept Plan and Project Application for proposed extensions to the Westfield Parramatta Shopping Centre. Westfield commissioned Colston Budd Hunt and Kafes (CBKH) Pty Ltd to prepare a traffic impact study and Traffic Management and Accessibility Plan (TMAP) for the expansion. Parsons Brinckerhoff has been commissioned to develop a Paramics traffic microsimulation model to address Roads and Maritime Services (RMS) and Parramatta City Council questions about the impact of the expansion on traffic conditions and internal car park operation.

Base model calibration and validation

The AM and PM peak models were calibrated and validated to RMS criteria. Feedback from RMS and Council officers indicated that the PM model presented was a reasonable representation of the typical traffic conditions on a Thursday evening peak.

RMS also conducted an independent audit and provided a number of comments on the base models. These comments were addressed by Parsons Brinckerhoff and included in this report.

Proposed development

The expansion of the shopping centre is expected to increase the demand for parking and traffic generation. An additional 473 parking spaces are being provided for retail shoppers and staff, and 100 spaces are being provided for users of the commercial building.

Traffic generation

Traffic generation above that of the current centre has been estimated by CBHK at 200 vph in the morning peak and 480 vph in the afternoon peak, with increased activity at loading docks.

Assessment year

Based on discussion with RMS and Council, the year 2016 advised as the development impact assessment year. The year 2016 coincides with the development site opening year. Based on discussion with RMS and CBHK the following assumption were made to estimate the year 2016 background traffic changes:

1. additional 200 spaces within the Council Hunter Street car park: pro-rata the traffic generation by the ratio of current spaces (550) to future spaces (750)

2. Crown development (134 to 140 Hunter Street, Parramatta) as per the CBHK traffic report supplied

3. background growth: add 1% additional traffic per annum (linear) to the external to external zones (i.e. no change to other Parramatta traffic apart from the above).

The above demand assumptions add approximately 450 trips per hour onto the network in each of the AM peak and PM peak traffic.

Model scenarios

Two scenarios have been analysed and compared to the 2012 and 2016 base scenario. Scenario 1 was included to assess the impact of Westfield localised access improvements and its developments traffic on the base traffic network.

Scenario 2 contains the traffic generation for the development, road network upgrades identified by RMS and Council and the proposed internal car park upgrades.

The scenarios have been analysed to determine whether the impacts for the development traffic are mitigated by the proposed upgrades and car park improvements.

Identified Council and RMS intersection upgrades on the Great Western Highway

Three intersection upgrades have been identified by Council and RMS in the area, including:

- Great Western Highway and O'Connell Street
- Great Western Highway and Marsden Street
- Church Street, Great Western Highway and Parkes Street.

The modelling indicates that these upgrades would provide substantial benefits for traffic flow on the Great Western Highway, with the greatest benefits during the AM peak. A minor modification to the identified upgrade on Church Street is also suggested, involving the change in lane allocation on Church Street around Lansdowne Street. The model indicates that this modification would have benefits in the PM peak without affecting the demonstrated benefits in the AM peak. This modification is not needed to mitigate the impacts of the development.

Proposed upgrades to mitigate the impacts of the development

Improvements to the Westfield Parramatta car park entries and exits are planned to facilitate easier entry and exit, including:

- additional right-turn lane from the eastern Campbell Street access driveway and ramp
- widened western Campbell Street exit driveway and ramp to provide two continuous exit lanes from the Level 6 car park exit controls to Campbell Street
- reconfigure the western Aird Street entry driveway (located between O'Connell Street and Marsden Street) by closing the entry to Level 3 of the car park, but retaining the 'speed ramp' to Level 4M
- a new entry driveway at the eastern end of Aird Street (located between O'Connell Street and Marsden Street), providing access to Level 2 of the Aird Street car park
- use car park management and information systems to optimise the split of traffic entering the Aird Street entry ramps between the existing speed ramp to Level 4M and the new access to Level 2
- lengthen the second (short) lane at the Marsden Street exit driveway and ramp to increase capacity
- add a second boom gate on the Marsden Street rooftop entry ramp.

The Paramics modelling has identified additional upgrades to mitigate the impacts of the proposed development, including:

- extend the length of the right-turn bay from Great Western Highway (westbound) into Marsden Street by approximately 170 m, almost to Church Street by adjusting existing linemarking
- extend the two-lane linemarked section of Campbell Street in the westbound direction to approximately 70 m west of Church Street and change the current No Parking times from '8.30 am–6.00 pm Mon–Fri, 8.00 am–9.00 pm Sat' to: '8.30 am–6.00 pm Sun–Wed, 8.30 am–9.00 pm Thursday to Saturday'
- modifications to traffic signal phasing at Marsden Street and Great Western Highway; Great Western Highway and Church Street; and Church Street and Campbell Street.

The Paramics modelling has shown that:

1. The identified Council/RMS upgrades and proposed upgrades mitigate the impacts of the proposed extensions. Traffic conditions in the AM and PM peaks would be similar or better than the existing situation.
2. The internal car park upgrades reduce the impact of the Westfield car park on the road network.

1. Introduction

Westfield has made an application under Part 3A of the EP&A Act for a Concept Plan and Project Application for proposed extensions to the Westfield Parramatta Shopping Centre. Westfield commissioned Colston Budd Hunt and Kafes (CBKH) Pty Ltd to prepare a traffic impact study and Traffic Management and Accessibility Plan (TMAP) for the expansion. Parsons Brinckerhoff has been commissioned to develop Paramics traffic microsimulation model to assist CBHK assess the impacts of the proposed extension on traffic conditions and car park access.

1.1 Background

Westfield is proposing extensions to the Westfield Parramatta Shopping Centre, including an additional 31,495 m^2 GFA (equivalent to 24,504 m^2 GLA) of retail area, 30,392 m^2 GFA offices, provision of an additional 573 parking spaces, and modifications to the loading docks, parking layout and access driveways to accommodate the additional development.

The Department of Planning and Infrastructure (DPI) issued Director General's Requirements (DGRs) for the assessment of the application in October 2010. In response[1] to these DGRs, the Roads and Traffic Authority (now Roads and Maritime Services (RMS)) suggested the use of Parramatta City Council's PARAMICS model of the Parramatta CBD to assess the traffic impacts of the proposed extensions and the consideration of a number of changes to the road network adjacent to the centre.

A meeting on 25 May 2012 with RMS, Council, CBHK and Parsons Brinckerhoff was held to discuss the study methodology. At this meeting, it was agreed that:

1. The road network upgrade options suggested in Paragraph 3 of the RTA's letter of 2 September 2010 are no longer required to be assessed.

2. The improvements identified by Council at the intersections of Great Western Highway with Church Street, O'Connell Street and Marsden Street should be considered (copies of plans showing these improvements were provided by Council).

3. Weekday morning and Thursday afternoon peak periods traffic conditions to be assessed. An assessment of the Saturday midday peak period is not required.

4. A PARAMICS model is to be used to assess the traffic impacts of the proposed development.

5. Intersections identified in Paragraph 2 of the RMS letter of 2 September 2010 are still appropriate.

Subsequent consultation with RMS agreed that a new model would be developed for the area relevant to the Westfield Parramatta Shopping Centre. This option was preferred as the model could be tailored to suit the needs of the assessment with an appropriate area and recent calibration.

[1] *Roads and Traffic Authority letter dated 2 September 2010*

A traffic modelling report was produced by Parsons Brinckerhoff outlining the results of the modelling (as described above). The Report*, Traffic Modelling Report for the Proposed Expansion of Westfield Parramatta Shopping Centre, September 2012*, outlined the model development, calibration and validation process. It also outlined the results of the option testing, describing the traffic impacts and proposed mitigation measures.

1.2 RMS review

The Parsons Brinckerhoff modelling report and Paramics Models were subsequently reviewed by RMS. The review (summarised in RMS letter of 16 April 2013, attached in Appendix H) made a number of comments on relation to the Paramics modelling and requested that further model runs be undertaken.

This report has been updated to address the comments made in the RMS letter.

A response to each of the comments raised is also provided in Appendix H, highlighting where in the report changes have been made to address the comments.

1.3 Purpose of report

CBHK submitted a traffic impact study and TMAP[2] in August 2012 in support of the application. This report advised that this traffic modelling report would follow.

The purpose of this report is to:

- outline the process undertaken to develop the models
- present the calibration and validation results, and summarise the assessment of the existing traffic conditions
- present the results of the modelling of the proposed development
- address the comments made by RMS regarding traffic modelling dated 16 April 2013.

1.4 Study area

RMS requested that the 14 intersections shown in blue on Figure 1.1 be modelled for the purposes of assessing the impacts of the proposed extension. From this list, the model boundary also shown in Figure 1.1 was developed. It covers a section of Parramatta bounded by Macquarie Street to the North, Church Street to the East, the Great Western Highway to the South and Pitt Street to the West. Six additional intersections were included, along with all of the entrances to the Westfield Parramatta car park and loading docks.

[2] *Colston Budd Hunt & Kafes Pty Ltd, 'Traffic Impact Study and Traffic Management and Accessibility Plan for Part 3A Application for Proposed Extensions to Westfield Parramatta Shopping Centre', (August 2012)*

1.5 Report structure

The report is structured as follows:

- **Section 2:** outlines the model development process and presents information on the data sources
- **Section 3:** describes the model calibration and validation process and outlines the assessment of the performance of the existing road network
- **Section 4:** describes the development and future traffic assumptions
- **Section 5:** outlines the result of the traffic modelling exercise
- **Section 6:** provides a summary of the study and conclusions.

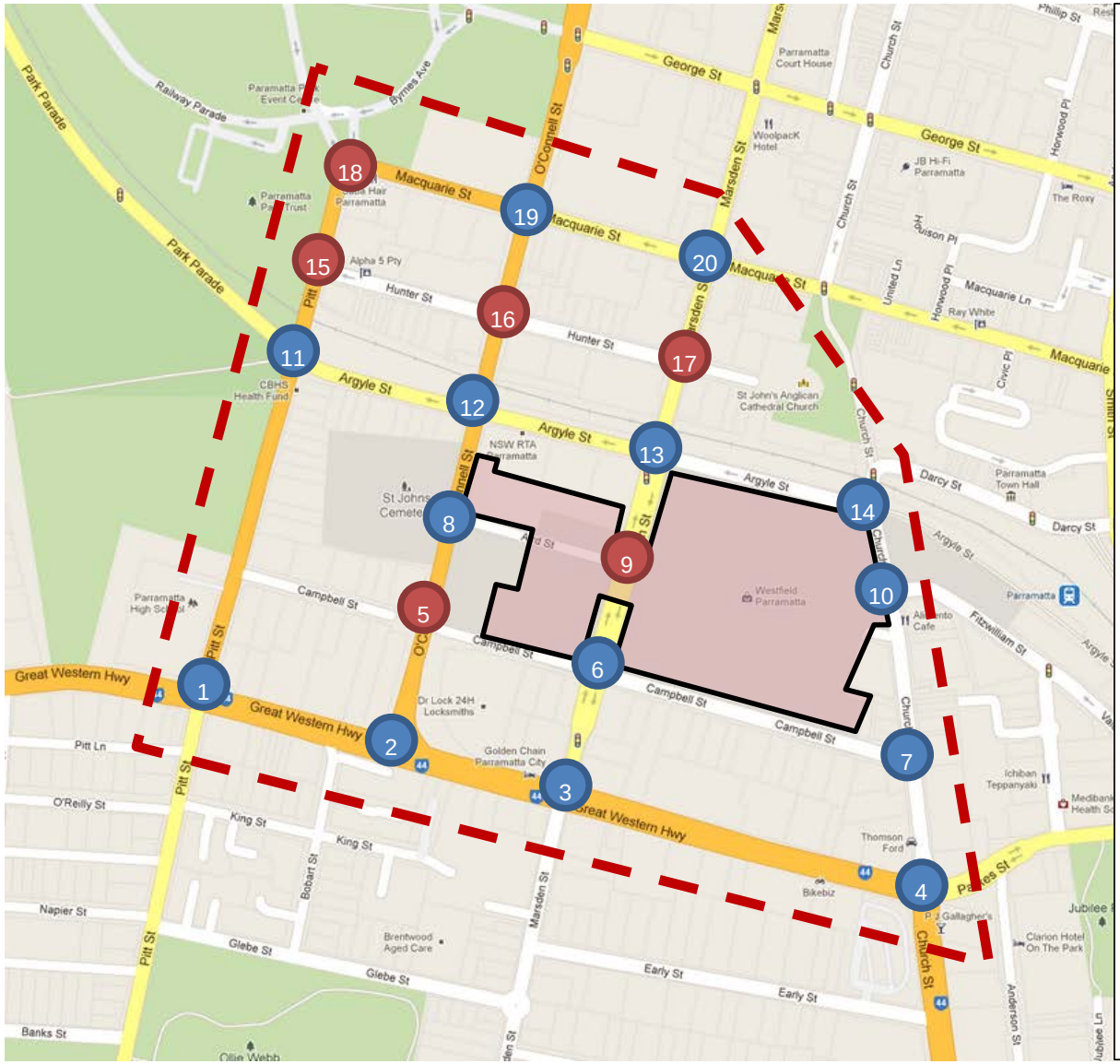


Figure 1.1 Modeling study area

2. Traffic model development

The traffic modelling has been undertaken to meet the requirements of RMS. The model has been developed using the Paramics microsimulation software, due to its ability to simulate the impact or queuing on the performance of adjacent intersections and to consider the impact of detailed changes within the car park. The calibrated model will be used as the platform with which to assess the impact of the proposed increase in traffic generated by the proposed increase in car park spaces and modifications to entrance, exit and ramp configurations.

2.1 Traffic modelling software

Paramics microsimulation software (Version 6.8.2) was used as the modelling tool of choice to deliver the required tasks for this project. Azalient plugin software (Version 6.8.1.G05) was used in the development of the base models. The following plugins have been utilised:

- Network Evaluation
- Validator
- Level of Service.

2.2 RMS traffic modelling guidelines

The base models have been developed in accordance with Roads and Maritime Services (RMS) Paramics Microsimulation Modelling Manual Version 1.0 (formerly known as RTA Paramics Microsimulation Modelling Manual Version 1.0).

2.3 Base models

Paramics models for the following times periods for 2012 were developed for the following weekday morning and afternoon peaks:

- **AM peak** 7.00 am to 9.00 am
- **PM peak** 4.30 pm to 6.30 pm.

Each model was also built with a 30 minute warm up period to ensure a good representation of traffic conditions at the beginning of the modelling period. In addition, a 30 minute cool down period was included to replicate the ‘clear out’ after the peak period.

2.4 Data sources

Traffic and transport data from several sources was used as the basis for the development of the model. The model was calibrated to traffic turn movements at intersections and observed and surveyed queue lengths. The model was validated to vehicle travel time surveys.

2.4.1 Site inspections

Parsons Brinckerhoff undertook site inspections on 7 June 2012 during the AM and PM peak periods. The AM site visit was undertaken between 7.00 am and 10.00 am and the PM site visit was undertaken between 4.00 pm and 7.00 pm. Council officers indicated that the days on which the site observations were made appeared to be typical of traffic conditions in Parramatta.

During the site visits, observations were made of vehicle queuing, intersection performance and car park operation. Photo and video footage was also collected and analysed later to provide information for the model development.

2.4.2 Traffic data

Intersection turn counts

Parsons Brinckerhoff was provided with turn count data from CBHK. Intersection turn counts were undertaken on 6, 7, 14 and 21 June 2012 at all the intersections listed on Figure 1.1 except for intersections 15, 16 and 17 on Hunter Street. Traffic volumes at the Hunter Street intersections were estimated from the surrounding intersection counts on Macquarie Street and Argyle Street and previous counts collected by CBHK. In addition, the Westfield car park entry/exits on Campbell Street, Aird Street and Marsden Street were also surveyed.

Traffic counts were undertaken between 7.00 am and 9.30 am for the morning peak and between 2.30 pm and 6.30 pm for the evening peak. Count data was collected in 15 minute intervals.

The balanced traffic volumes used in the model are shown in Appendix A.

Queue lengths

In order to ensure the traffic models represent the queuing conditions in the traffic network, Parsons Brinckerhoff made observations of queue length during morning and afternoon site visits on the 7 of June 2012. In addition, traffic queue information was provided by CBHK for the intersections along the Great Western Highway in the AM peak. These observations along with the captured video footages were later used to calibrate the traffic models for the queuing conditions. A summary of the queue length observations is provided in Appendix B.

Travel times

Parsons Brinckerhoff undertook floating car travel time surveys of selected routes through the model area on 7 June 2012, coinciding with the observations of queue length and network operation. Times were taken on the following sections of road:

- Great Western Highway between Church Street and Pitt Street westbound and eastbound
- Argyle street between Church Street and Pitt street westbound
- Church Street between Great Western Highway and Argyle Street northbound and southbound
- Marsden Street between Macquarie Street and Great Western Highway northbound and southbound.

This data was used in the validation process. More details are provided in Appendix D.

2.4.3 Public transport

All bus stops and bus routes in the area have been included in the model. Bus service frequency was obtained from the published timetables. Bus layovers and buses preparing for their next route have also been included. The number of buses operating 'out of service' was inferred based on the traffic counts and the identified timetables services.

2.4.4 Pedestrians

Pedestrian counts were taken at the zebra crossings across Church Street, north of Campbell Street and across Aird Street, west of Marsden Street. This delay was incorporated into the model by coding additional movement delay for vehicles waiting for pedestrians.

2.4.5 Posted speed limits

Site observations were made in regards to the posted speed limits in the study area. The posted speed limits were incorporated in the traffic models for the road sections in the study area. This includes school zone speed limit on Great Western Highway between Pitt Street and O'Connell Street and on Pitt Street between Great Western Highway and Argyle Street. Note that during the morning peak (when the schools zone is operational) speeds on these links are already very low due to high levels of congestion.

2.4.6 Traffic signal data

There are several signalised intersections within the study area. IDM data was obtained from the RMS for all intersection within the model. The IDM data was used to program the signal timings. The data was collected for the times corresponding to the traffic counts on 6 and 7 June 2012 for all intersections apart from the intersections of Marsden Street and Hunter Street, and O'Connell Street and Hunter Street, for whom IDM data was obtained for 5 July 2012 (during the school holiday period).

2.4.7 RMS microsimulation standard files

Parsons Brinckerhoff used the standard Paramics input files developed by the RMS for: configuration, behaviour, categories, acceleration profiles and vehicles. Any changes to the above files have been noted and are discussed in section 3.1.

2.5 Model network and zoning system

2.5.1 Road, intersection and car park layout

The model network was coded based on aerial photos, SCATS signal layout plans provided by RMS, car park plans from Westfield and site observations. The times of permitted on-street parking were observed during the site inspections. The modelled network is shown in Figure 2.1.

Traffic generating areas and the roads cut at the edge of the model were represented as traffic-generating zones. Zones are defined as locations where vehicular trips originate and terminate i.e. trip ends. The zone layout used is also indicated in Figure 2.1. In total, 43 zones have been coded in the model.

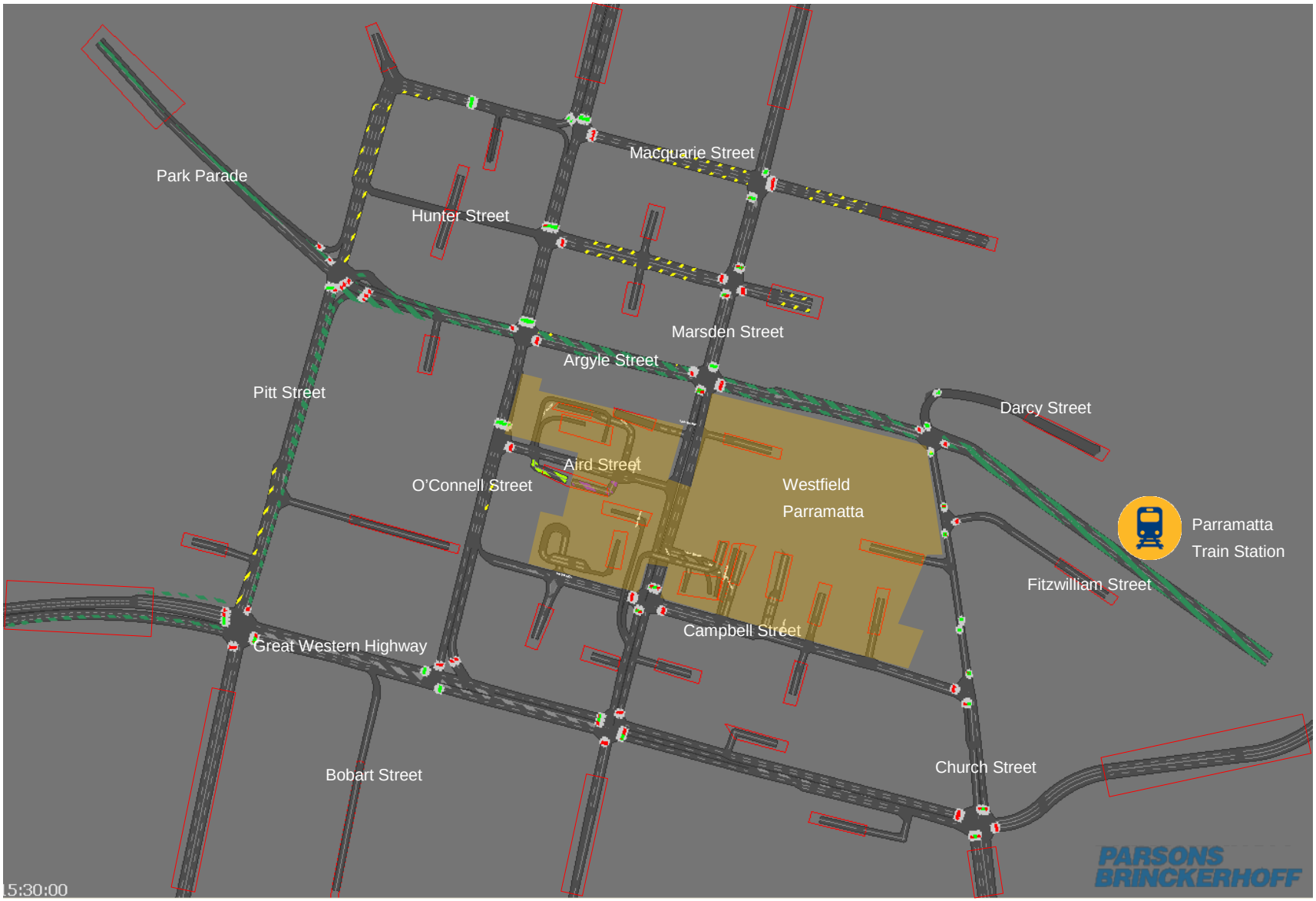


Figure 2.1 Modelled road network

2.6 Assignment method

In developing the traffic models, 'All or Nothing' (AoN) traffic models with perturbation was applied. The all or nothing assignment method causes all vehicles to choose the same route between each origin and destination based on the perceived lowest cost (in this case travel time). The application of perturbation adds a random element to the cost calculation for individual drivers and provides more realistic representation of the actual drivers' behaviour in the traffic network.

2.7 Base model trip matrix development

The vehicle trip matrices for each of the two models (AM and PM) have all been calculated from intersection turning counts. Trip balancing has been undertaken to ensure that mid-block vehicle gains and losses are within reasonable estimates.

2.7.1 Hourly trip matrix development

To develop an accurate representation of existing traffic conditions, demand matrices for each hourly period have been developed to increase the detail of the modelling and replicate localised time dependent traffic movements. Overall, it was found that traffic volumes were relatively constant over the model period.

In addition, separate light and heavy vehicle matrices have been developed through the assumption of an overall 1% heavy vehicle percentage (advised by CBHK based on survey data), not including bus numbers which were coded based on the published timetable. Heavy vehicle travel was assumed to be focussed on the loading docks of Westfield Parramatta.

2.7.2 Matrix estimation

In the absence of detailed origin and destination information, matrix estimation has been undertaken based on the intersection turning movement counts. The distribution of traffic to/from the Westfield car park entrances was weighted towards vehicles using the closest entrance to the place at which they entered the model network. This was also further checked against the provided Westfield access counts and intersection counts.

2.7.3 Demand profile

Demand profiles were developed for each of the models. These profiles specify the timing of proportional release of vehicles into the models. The profiles were developed from the 15 minute interval turning movement counts, and global profiles were applied to the model.

Figure 2.2 and 2.3 show the applied profiles for AM and PM peak traffic models. They indicate a relatively flat demand profile, possibly indicating a network which is operating close to its capacity throughout the peak.

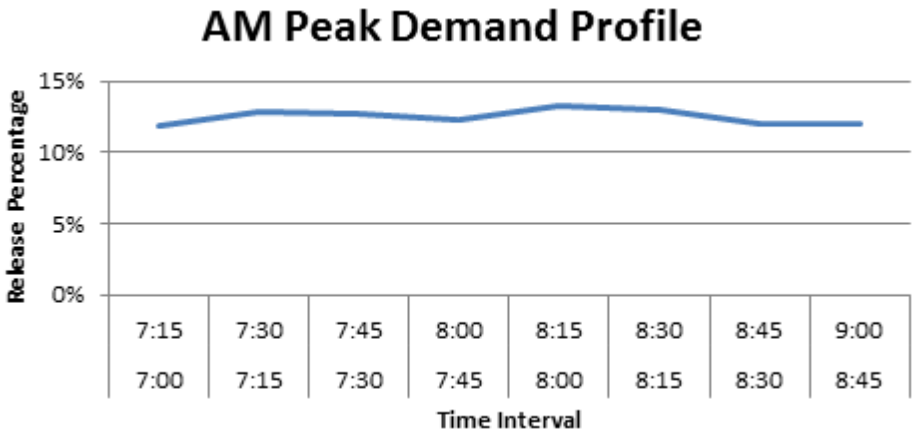


Figure 2.2 AM peak demand profile

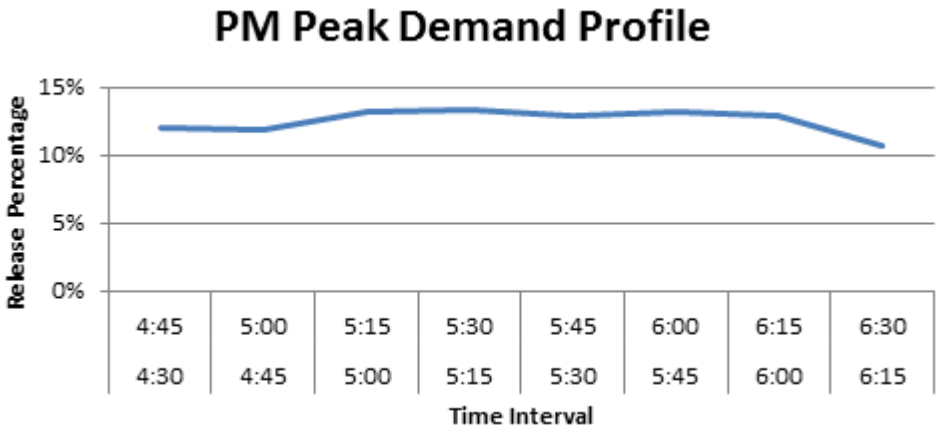


Figure 2.3 PM peak demand profile

The balanced AM and PM peak traffic volumes used in the model are included in Appendix A.

3. Model calibration and validation to existing conditions

The weekday AM and PM models were calibrated and validated to ensure that they could adequately reflect the existing road network operation. This was done to ensure that they are a reasonable basis for the estimating the future impacts of the proposed extension.

- calibration involves comparing observed traffic conditions with those in the model to provide confidence that the model is representative of observed traffic conditions
- validation involves using an independent data set, not used in the setup of the model, to check whether the model is robust.

Parsons Brinckerhoff has followed the RMS microsimulation modelling guidelines in developing, calibrating and validating the traffic models. In this case, traffic volumes and queue length surveys/observations were used to calibrate the model and travel time samples have been used to validate the model.

Parson Brinckerhoff has also obtained the traffic modelling results based the recommended 5 seed values of 560, 28, 7771, 86524, and 2849.

3.1 Base model updates following RMS review

A number of minor updates were made to the base models as recommended in the RMS model review (summarised in RMS letter of 16 April 2013). The calibration and validation process has been rerun and the results updated accordingly. See Appendix H for more details.

3.2 Model calibration

To calibrate the model observed turn counts and queue observations were compared with those in the model. This information was used to adjust the model until a reasonable level of calibration was achieved.

Throughout the traffic modelling, a time step value of 5 was adopted and speed memory and mean reaction times were adjusted to reflect the adjusted time step (as recommended in the RMS Guidelines, Page 58). The mean driver reaction were adjusted in order to control any shockwave phenomenon associated with traffic flow and ensure drivers late reaction is not causing over reaction. These parameters were adjusted as part of the model calibration process to reflect the observed traffic conditions. While a time step value of 2 is the recommended default value, the RMS guidelines state that this value can be changed and may provide some benefit in larger models.

In order to calibrate the traffic models for the observed queue conditions and lane choice behaviour, the following parameters were adjusted in certain locations from the default values. This was done to replicate the observed traffic movement and queue conditions:

- signposting
- lane choice

- Link Headway factor
- Link Reaction factors
- approach visibility
- force merge and force across.

In calibrating the travel models to turn counts, it is critical to ensure that the correct traffic demand has been coded in the traffic networks, and logical vehicle routing is used. In doing so the routing patterns between individual zones were carefully studied and examined and compared against the observed traffic counts. Changes were made to link category cost factors and link cost factors in order to achieve desired turn count calibration.

The traffic models were calibrated against the calibration criteria specified in RMS' modelling guidelines as shown below:

- GEH statistics for turning movements with no fewer than 85% less than 5
- difference in link flow within 100 for 85% of flows <700 vph
- difference in link flow within 15% of the total value for 85% of link with flows in the range of 700–2,700 vph
- R^2 statistic within the range of 0.9 to 1.0
- slope factor within the range of 0.9 to 1.1.

GEH compares the differences between observed flows and modelled flows on a link by using the following formula:

$$GEH = \sqrt{\left(V_O - V_A\right)^2 / \left(0.5 \times \left(V_O + V_A\right)\right)}$$

Where:

V_O = Observed traffic flow (vehicles/hour)

V_A = Assigned (or modelled) hourly traffic flow (vehicles/hour).

R squared and Slope factors are statistical measures of how well a regression line approximates real data points .They are descriptive measure between zero and one, indicating how good one term is at predicting another.

The summary of the calibration results is shown in Table 3.1. A detailed list of GEH values and turn counts can be found in Appendix C.

Table 3.1 Calibration achievement criteria

Assessment criteria	Target	Achieved	
		AM	PM
GEH Statistic less than 5 of all individual modelled flow	85%	98%	97%
Difference in link flow within 100 for flows <700 vph	85%	99%	99%
Difference in link flow within 15% for flows 700–2,700 vph	85%	100%	100%
R^2 statistic	0.9–1	0.99	0.99
Slope factor	0.9–1.1	1.00	1.01

The results indicate a good level of calibration, with most of the model statistics close to the ideal value of 1.00/100%.

3.3 Queue calibration

In order to calibrate traffic models against the observed queue length, comprehensive queue length observations were made by Parsons Brinckerhoff during AM and PM peak site visits. During the site visits, Parsons Brinckerhoff captured video footage at all the major intersections. This footage was used as a means to calibrate against observed queue lengths so that the observed queuing closely matches the queuing observed in the modelling. During the model calibration stage Parsons Brinckerhoff, consulted with Parramatta City Council officers to confirm that the queuing observed on the day of the survey were representative of prevailing queuing conditions.

In addition, RMS confirmed that queuing observed in the AM and PM peak models were representative of prevailing queuing conditions (See 3.5.1).

The summary of the queue length observations are shown in Appendix B.

3.4 Model stability

In order to ensure that traffic models are stable i.e. that the results do not vary greatly for different seed values, 15 minutes release profile were compared and plotted against the five seed values used. The stability graphs are shown in Appendix C. These graphs indicate very stable network results over 15 minute intervals, with little change between model runs.

3.5 Model validation

To validate the Paramics models, observed travel times along the Great Western Highway, Marsden Street, Church Street and Argyle Street were compared with modelled travel times.

When the travel time surveys were undertaken, very large discrepancies were observed between travel time runs (collected over a two hour period), which demonstrates the congested and unstable nature of travel conditions within the study area. Due to the high level of congestion it was difficult to achieve multiple runs along each route during both peak periods. The modelled travel times are an average of all vehicles which travel on those links

throughout the peak period so are much more robust figures than the average of the travel time surveys.

In terms of travel time validation the RMS criteria suggests – *Greater than 85% of all travel time routes to have modelled travel times within 15%*. Table 3.2 below shows which routes met the RMS criteria. More detailed summary graphs of the validation results are shown in Appendix D.

While the criteria is not met on all sections, given the congested nature of the network, and because only a small number of journey time runs could be achieved, the level of match is suitable for model validation purposes when considered alongside the traffic volume and queue length calibration results.

Table 3.2 Travel time criteria

Intersection	AM peak (7.00 am to 9.00 am)		PM peak (4.30 pm to 6.30 pm)	
	EB/NB	WB/SB	EB/NB	WB/SB
Great Wester Highway	No	Yes	Yes	No
Church Street	Yes	n/a	Yes	n/a
Marsden Street	Yes	Yes	Yes	Yes
Argyle Street	n/a	Yes	n/a	No

3.5.1 Presentation of model to RMS and Council

The calibrated and validated PM model was presented to RMS and Council officers at the Regional Traffic Committee on 15 August 2012 (because the PM peak represents the busier of the two peaks assessed). After seeing the demonstration of the PM model, RMS and Council officers were in agreement that the PM model was generally representative of a typical Thursday afternoon peak. Queues of approximately the right length were noted at the critical sections of the traffic network (as outlined in Appendix B).

Council officers noted that the right-turn from the Great Western Highway into Marsden Street operates slower at times, with a weaving movement as drivers attempt to enter the Westfield car park ramp. Parsons Brinckerhoff noted that when our on-site observations were made, the movement was operating slower. However, this was due to one of the two ramp lanes inside the Westfield car park being closed, slowing vehicle entry. This was the result of a breakdown in the entry boom gate and is not representative of the regular situation. The model is presented based on the internal ramp lanes being open. Parsons Brinckerhoff noted that Parsons Brinckerhoff has carried out sensitivity tests to ensure that the traffic networks represent the observed queuing conditions with limited ramp access.

During the meeting the results of the Travel time validation for the PM peak were presented and discussed with the RMS.

3.6 Existing conditions level of service

Once the base model was developed and calibrated, intersection performance was measured against standard criteria. This information will be used as a baseline with which to compare the model forecasts with the additional traffic and car park modifications associated with the proposed extension.

3.6.1 Level of service definitions

Intersection performance is measured by the delay experienced by vehicles. This delay is then associated with a Level of Service (LoS) according to RMS guidelines ranging from A (indicating good intersection performance) to F (indicating conditions with long delays and queues). A full list of levels of service is shown in Table 3.3.

Table 3.3 Level of Service Criteria for Intersections

Level of Service	Average delay (seconds per vehicle)	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; requires other control mode
F	Greater than 71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control mode

Source: RTA Guide to Traffic Generating Developments

3.6.2 AM and PM peak results

The modelling results for the AM peak hour (8.00 am to 9.00 am) and PM peak hour (4.30 pm to 5.30 pm) are summarised for the intersections listed in Table 3.4. Reported results include Level of Service and average vehicle delay. More detailed LoS and average delay results by intersection approach are provided in Appendix E.

Table 3.4 Intersection level of service results

Intersection	AM peak (8.00 am to 9.00 am)		PM peak (5.30 pm to 6.30 pm)	
	LoS	Average delay (seconds per vehicle)	LoS	Average delay (seconds per vehicle)
1. Pitt Street - Great Western Highway	F	>200	F	>200
2. O'Connell Street - Great Western Highway	F	>200	F	>200
3. Marsden Street - Great Western Highway	F	>200	F	>200
4. Church Street - Great Western Highway	F	109	F	187
6. Marsden Street - Campbell Street	A	13	E	62
7. Church Street - Campbell Street	B	26	D	45
8. O'Connell Street - Aird Street	A	7	C	34
10. Church Street - Fitzwilliam Street	B	21	D	44
11. Argyle Street - Pitt Street - Park Parade	C	39	C	32
12. O'Connell Street - Argyle Street	B	22	D*	44
13. Marsden Street - Argyle Street	B	21	C	35
14. Church Street - Darcy Street - Argyle Street	C	29	C	37
19. O'Connell Street - Macquarie Street	B	24	F	158
20. Marsden Street - Macquarie Street	A	11	D	49

Note: where queues extend back through up-stream intersections, cumulative delays have been reported (i.e. all affected intersections added together). Cumulative delays at O'Connell Street and Argyle Street attributable to queue-back from Great Western Highway have not been included.

Great Western Highway congestion

The traffic models indicate traffic congestion on the Great Western Highway in both the morning and afternoon peaks. During the morning peak, a large volume of traffic enters/leaves Parramatta CBD via the Great Western Highway at the south-eastern corner of the study area. The majority of this traffic is travelling is travelling east-west, while some peels off at Marsden Street or joins from O'Connell Street to enter/leave Parramatta CBD. During the PM peak, the reverse flow occurs but with higher overall volumes. East-west traffic from Parkes Street and Church Street remain. A significant volume of traffic travels south along O'Connell Street to turn west onto Great Western Highway.

During the PM peak, traffic congestion occurs along the Great Western Highway. This congestion flows back up into the Parramatta CBD area along streets such as O'Connell Street and Marsden Street. On O'Connell Street, delays getting on to the Great Western Highway contribute to slow-moving traffic and spill-back queues through the model to north of Macquarie Street, affecting the operation of the intersections such as Argyle Street and Macquarie Street. The operation of the intersection of O'Connell Street and Macquarie Street and in particular the southbound movement on O'Connell Street is affected by the slow moving queue from Great Western Highway. While the southbound movement gets a red-signal, traffic from Macquarie Street fills-up the space left as the downstream queue on O'Connell Street moves south. This reduces the space available for O'Connell Street traffic to move into when it gets a green signal again.

4. Proposed Westfield Parramatta extension

The Westfield Shopping Centre in Parramatta is seeking approval for extensions to include additional retail and car parking space, as well as a new commercial tower. The centre at the moment includes 135,000 m^2 GLA comprising retail, commercial and cinemas with parking for some 4,450 cars in multi-deck car parks. Access is provided from Campbell Street, Aird Street and Marsden Street.

4.1 Proposed extensions

The proposed extensions have been summarised from the CBHK traffic report[3], and include:

- 31,495 m^2 GFA (24,504 m^2 GLA) of additional retail area
- an additional 30,392 m^2 GFA offices
- provision of an additional 573 parking spaces
- modifications to the loading docks, parking layout and access driveways to accommodate the additional development.

Parking

The proposed extension includes the addition of new parking levels on some of the car parking areas. An additional 573 car spaces allocated as 100 to the new commercial tower and 473 allocated to the expanded retail area. In addition to the above, 20 motorcycle spaces would be provided, along with 110 bicycle spaces for the commercial tower (with shower and change facilities) and 90 bicycle spaces for the retail areas.

As part of the proposed extensions, the on-site car parking will be expanded and modified. Three new levels of parking will be added and a new extended roof top car park will provide access across Marsden Street and Aird Street to connect all parking areas within the shopping centre. Some existing parking will be lost to accommodate the additional retail space. These spaces will be replaced in the proposed new parking areas.

Access

Access to the shopping centre will be retained from the existing streets of Campbell Street, Marsden Street and Aird Street. However, modifications to the entrances and exits are planned to improve flow in and out of the car parking areas. The five proposed changes to parking access are listed in this section and shown on Figure 4.1. Changes to loading docks are also shown on this figure.

[3] *Colston Budd Hunt & Kafes Pty Ltd, 'Traffic Impact Study and Traffic Management and Accessibility Plan for Part 3A Application for Proposed Extensions to Westfield Parramatta Shopping Centre', (August 2012)*

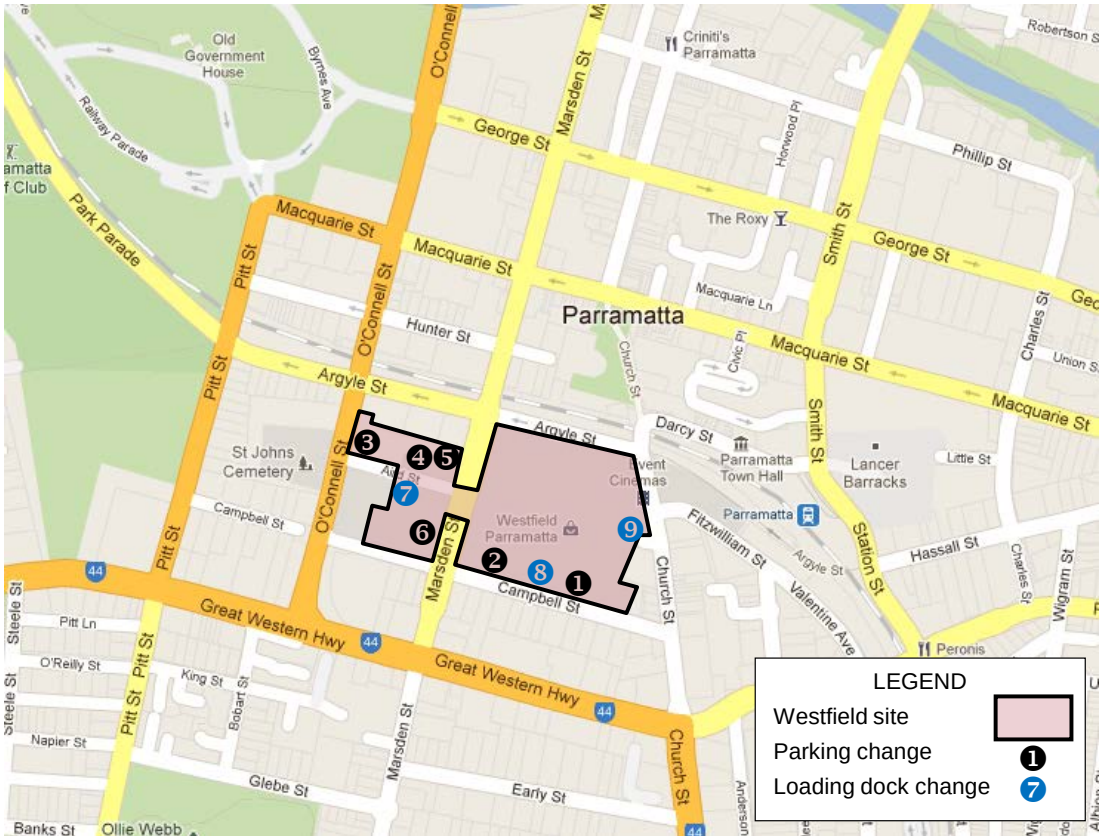


Figure 4.1 Changes to parking access and loading docks

1. The existing eastern Campbell Street access driveway and ramp (located between Marsden Street and Church Street) will be reconfigured to provide one entry lane and two exit lanes. The two exit lanes will provide for simultaneous left and right turn movements out of the shopping centre onto Campbell Street.

2. The existing western Campbell Street exit driveway and ramp (located between O'Connell Street and Marsden Street) will be reconfigured to provide two continuous exit lanes from the Level 6 car park exit controls. The exit ramp will be widened to accommodate the two continuous lanes.

3. The existing western Aird Street entry driveway (located between O'Connell Street and Marsden Street), providing access to the Aird Street car park, will be reconfigured to close off entry to Level 3 of the car park. This access driveway will be retained solely for the speed ramp to Level 4M.

4. A new entry driveway will be provided at the eastern end of Aird Street (located between O'Connell Street and Marsden Street), providing access to Level 2 of the Aird Street car park. This new driveway will be located west of the existing car park exit driveway and will provide two entry lanes.

   As part of car park upgrades 3 and 4, the parking management system and information displays would be upgraded to advise motorists of the amount of parking available in each ramp, taking advantage of the increased entry capacity on the eastern ramp to change the percentage of traffic that uses these ramps to 50%/50%.

5. The existing Marsden Street exit driveway and ramp (located between Aird Street and Argyle Street) will be reconfigured to lengthen the southern exit lane by some 10 m. The proposed lengthening of the lane will increase capacity at the existing exit controls from the car park.

6. The existing Marsden Street entry speed ramp to create a second boom gate to double the capacity and improve northbound flow on Marsden Street as shown in Figure 4.2.

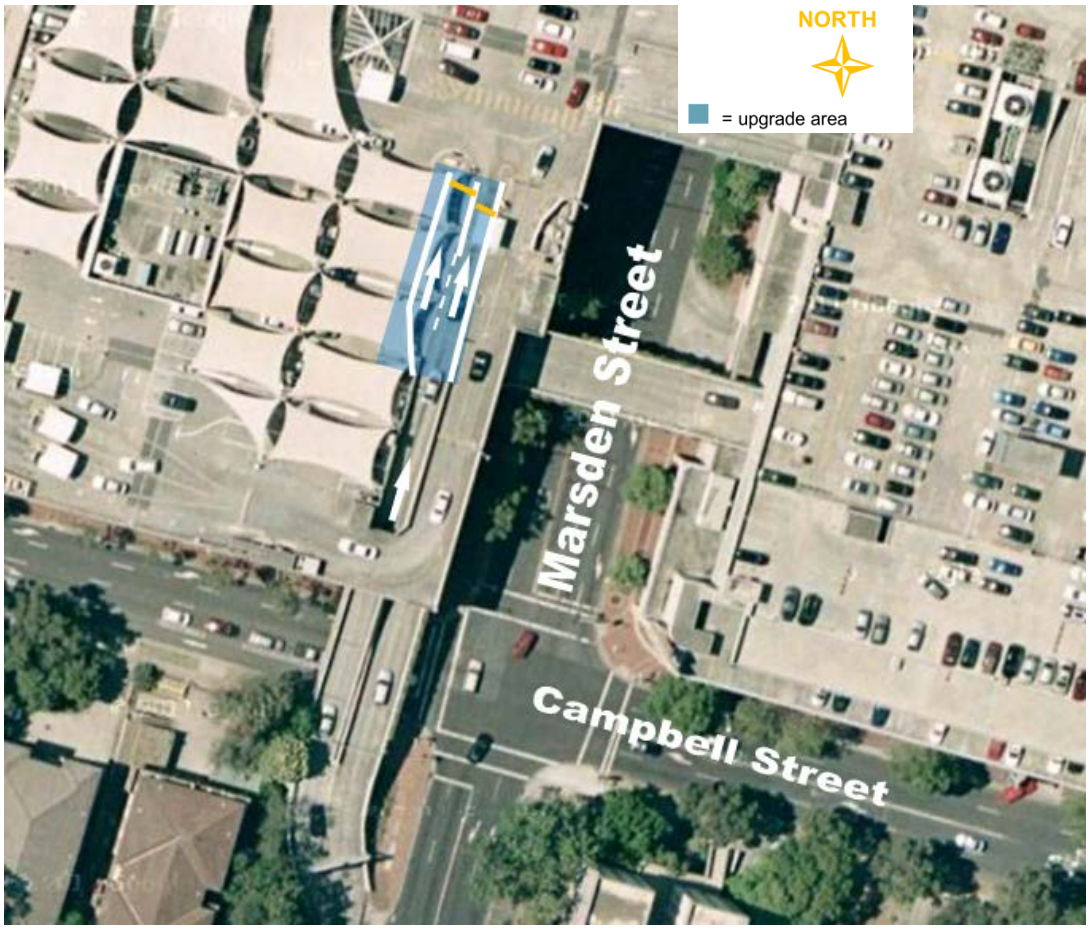


Figure 4.2 Proposed additional boom gate and lane on Marsden Street entry ramp

Loading docks

The increase in floor space will also increase loading dock movement. Modifications to the Aird Street (east and west) and Campbell Street loading docks are planned.

7. The Aird Street (west) loading dock will be extended to service the new supermarket and provide improved manoeuvring area for service vehicles. Access to the dock will be maintained in its current location.

8. The Campbell Street loading dock will be expanded to serve new shops. It would be sized to allow access for a variety of truck sizes, with space for internal manoeuvring allowing all movements to/from Campbell Street to be performed in a forward direction.

9. The Aird Street (east) loading dock, with access from Church Street, will be expanded to serve the new commercial tower development. This dock upgrade will be undertaken when the commercial tower is constructed.

4.2 Traffic generation

Traffic generation numbers for the morning and afternoon peak periods were provided by CBHK. Details are provided in the traffic impact study[4].

The total traffic generation of the proposed extension is approximately 200 and 480 vehicles per hour (two-way) during morning and afternoon peak hours. The additional traffic has been distributed between the entry and exits by CBHK. The additional traffic at each of the access points is summarised in Table 4.1.

Table 4.1 Summary of existing and development traffic movements in and out of Shopping Centre

Access	Weekday morning (vehicles/hour)			Weekday afternoon (vehicles/hour)		
	In	Out	Total	In	Out	Total
Campbell Street (east)	340 (+45)	25 (+5)	365 (+50)	265 (+35)	160 (+20)	425 (+55)
Campbell Street (central)	175 (+20)	50 (+10)	225 (+30)	215 (+30)	340 (+45)	555 (+75)
Campbell Street (west)	n/a	35 (+5)	35 (+5)	n/a	550 (+70)	550 (+70)
Marsden Street (north)	n/a	10	10	n/a	230 (+30)	230 (+30)
Marsden Street (central)	100 (+15)	25 (+5)	125 (+20)	290 (+30)	185 (+20)	415 (+50)
Marsden Street (south)	300 (+45)	n/a	300 (+45)	725 (+95)	n/a	725 (+95)
Aird Street (east)	n/a	45 (+5)	45 (+5)	n/a	240 (+35)	240 (+35)
Aird Street (west)	310 (+45)	n/a	310 (+45)	505 (+60)	n/a	505 (+70)
Total	**1,225 (+170)**	**190 (+30)**	**1,415 (+200)**	**2,000 (+260)**	**1,705 (+220)**	**3,705 (+480)**

Source: Colston Budd Hunt & Kafes, August 2012

[4] *Colston Budd Hunt & Kafes Pty Ltd, 'Traffic Impact Study and Traffic Management and Accessibility Plan for Part 3A Application for Proposed Extensions to Westfield Parramatta Shopping Centre', (August 2012)*

Other assumptions advised by CBHK are:

- An extra 20 loading dock trips have been included in the AM two hour peak and 13 trips in the PM 2 hour peak.
- The modifications to Campbell Street eastern car park exit are likely to change the amount of right-turning traffic exiting the Campbell Street western car park. It has been assumed that 25% of right-turning traffic will use the Campbell Street eastern exit.
- The change in ramp access from Aird Street from the existing ramps to levels 3 and 4M to ramps to 2 and 4M will not change the amount of traffic that uses each ramp (the split of traffic between them).

5. Model results with extension and identified road upgrades

Further to the RMS review letter of the 16 April 2013, CBHK and RMS agreed that an opening year of 2016 should be considered in the modelling.

The following scenarios have therefore been considered:

- 2012 Existing: traffic without the proposed development
- 2016 Base Case: traffic network without the proposed development
- 2016 Scenario 1: with the proposed development and no network improvements (future year nominated as 2016 by Westfield Design)
- 2016 Scenario 2: with the proposed development and with the network improvements required to mitigate the impacts of the development.

In order to estimate the background traffic growth in the study area, the year 2016 background trip matrices were developed for the following assumptions:

- Additional 200 spaces within the Council Hunter Street car park: pro-rata the traffic generation by the ratio of current spaces (550) to future spaces (750).
- Crown development (134 to 140 Hunter Street, Parramatta) as per the CBHK traffic report supplied (factor up the relevant zone to include the increased trip numbers).
- Background growth: add 1% additional traffic per annum (linear) to the external to external zones (i.e. no change to other Parramatta traffic apart from the above).
- Closure of the Darcy Street at Argyle Street intersection.

The above demand assumptions add approximately 450 trips per hour onto the network in each of the AM peak and PM peak traffic.

The two scenarios have been modelled to test the impacts of the proposed extension and the proposed road upgrades. Scenario 1 considers localised Parramatta Westfield access upgrades where scenario 2 has been used to test the road network upgrades identified by Council/RMS along the Great Western Highway and additional upgrades to mitigate the impacts of the development traffic.

5.1 Road network upgrades

Three road network upgrades have been identified by Council/RMS along the Great Western Highway. Council/RMS have indicated no funding or timing for these upgrades and have suggested that these works could be included as conditions of consent if there is a nexus between the proposed extensions and the need for the works. The upgrades include:

- Great Western Highway and O'Connell Street: relocated vacant lane in eastbound direction from position alongside median to kerbside to link to changes at Marsden Street.

- Great Western Highway and Marsden Street: remove westbound vacant lane alongside median, shift eastbound through and right turn lane across one lane and create new left-turn lane into Marsden Street, reconstruct median accordingly.

- Church Street, Great Western Highway and Parkes Street: widen Church Street northbound (from Lansdowne Street to the Great Western Highway) to create a second right-turn lane into Parkes Street.

Copies of plans showing these improvements were provided by Council and RMS. They are included in Appendix F.

5.1.1 Additional upgrades

In addition to these identified Council/RMS upgrades, other upgrades have been included in Scenario 2 to mitigate the impacts of the proposed extensions, they include:

1. The queue for the right-turn from the Great Western Highway westbound into Marden Street northbound currently at peak times is longer than the storage length of the two right-turn bays. This temporarily blocks one of the two westbound through lanes, reducing throughput, especially in the PM peak.

   Council's identified upgrade to the eastbound direction of the Great Western Highway at this intersection allows more green-time to be dedicated to the right-turn phase, reducing the right-turn queue length so that it is contained within the right-turn bays. This improves westbound flow.

   The addition of the traffic generated by the proposed parking increase extends the queue of the right-turn so that it again exceeds the length of the right-turn bay and temporarily blocks the westbound through lanes. It is proposed that the length of the right-turn bay be extended by 170 m, almost to Church Street to avoid the right-turn blocking the through lanes. This has benefit for traffic flow on Parkes Street and Church Street. An indicative sketch is shown in Figure 5.1. This upgrade could be readily completed by re-linemarking this section of Great Western Highway.

2. The additional traffic turning into the Campbell Street car park entrances, combined with the increased volume of traffic leaving the Campbell Street car park increases congestion on Campbell Street during the PM peak, mainly in the westbound direction.

   It is proposed that the two-lane linemarked section of Campbell Street in the westbound direction be extended to approximately 70 m west of Church Street (the maximum permitted without the need for road widening). This would allow vehicles to bypass other vehicles turning right into the car park entries, shortening the queue and reducing the risk that Church Street will be affected by congestion in Campbell Street.

   This change would require additional linemarking and a modification to the parking restrictions on the southern side of Campbell Street. Current restrictions are 'No Parking 8.30 am–6.00 pm Mon–Fri, 8.00 am–9.00 pm Sat'. It is proposed that this be modified to: 8.30 am–6.00 pm Sun–Wed, 8.30 am–9.00 pm Thursday to Saturday. A layout sketch is shown in Figure 5.2.

Both upgrades can be completed by changes in linemarking and signing. They do not require physical changes to the road carriageway. Both upgrades have benefits for all traffic, reducing delays for vehicles driving into Parramatta CBD, as well as those on the Great Western Highway, Church Street and Parkes Street.

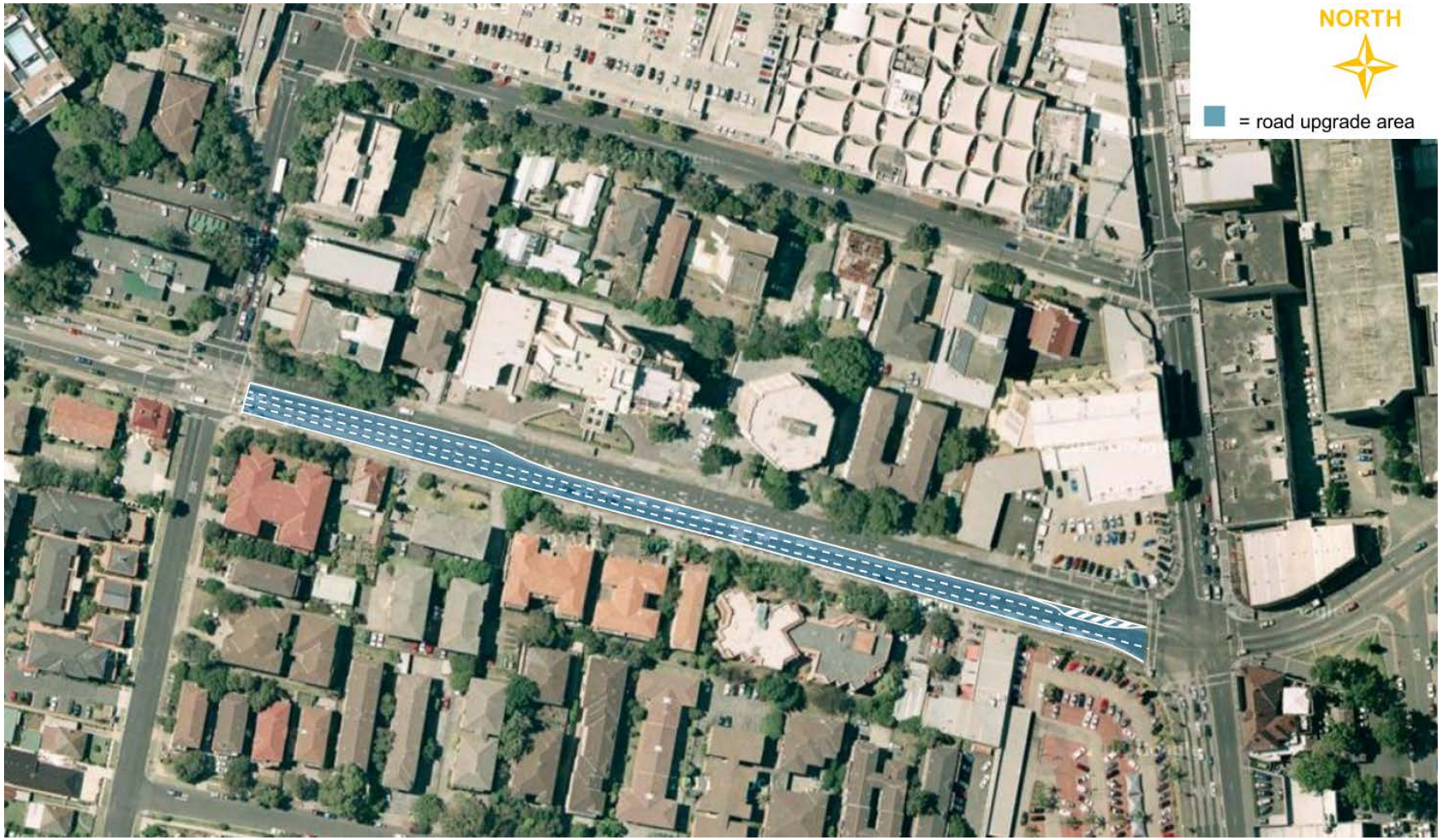


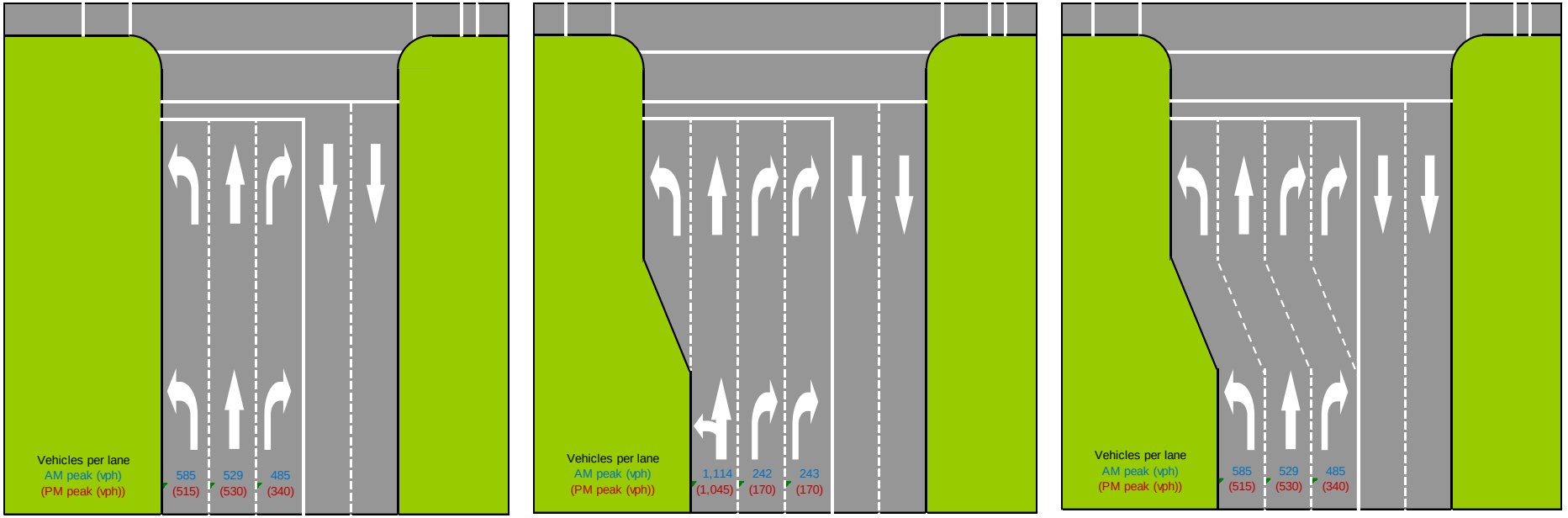
Figure 5.1 Proposed extension of Great Western Highway right turn bay at Marsden Street

Figure 5.2 Proposed extension of two lane section and No Parking times on Campbell Street

Suggested change to RMS plan for Church Street at Great Western Highway

The lane arrangement for Church Street in RMS' identified modifications changes the upstream distribution of traffic between lanes before it arrives at the area of modification. Parsons Brinckerhoff has modified the lane allocation of the continuous lanes in Scenario 2. This is not

required to mitigate the impacts of the proposed development, but appears to have operational benefits, particularly in the PM peak. Concept sketches showing the approximate 2012 traffic volume in each lane are illustrated in Figure 5.3.



Existing situation | As per supplied RMS plan | PB suggestion

Figure 5.3 Suggestion for modification of Church Street upgrade

5.1.2 Traffic signal modifications

Traffic signal phasing was adjusted for all scenarios to improve traffic flow and to take advantage of the proposed intersection upgrades. Changes were made by reducing green times by a few seconds on some phase(s) and adding them onto other phases. The changes made were within the RMS prescribed maximum and minimum values. The overall cycle time was kept constant.

Changes were made to the traffic signal timings at the following intersections for Scenario 2 (with the proposed development and upgrades):

- Intersection 3 - Marsden Street and Great Western Highway:
  - AM peak: reallocation of green time to increase the time for the Great Western Highway right-turn movements and Marsden Street northbound movement
  - PM peak: reallocation of green time to increase the time given to Great Western Highway westbound movements and Marsden Street northbound movement.
- Intersection 4 - Great Western Highway and Church Street:
  - AM peak only: reallocation of green time to increase the time given to north-south Church Street through phase and Parkes Street.
- Intersection 6 - Church Street and Campbell Street: AM peak only:
  - AM peak only: relocation of green time to increase time for Church Street.

The changes for Scenario 2 are detailed in Appendix G.

5.2 Model result summary

Model results have been extracted from the different scenario models for the following measures of performance:

- Traffic released and traffic blocked during two hour period: Ideally, all traffic attempting to move through the network will be able to get onto the network within a reasonable time. In congested networks, extended traffic queues can block vehicles from getting onto the network. Generally, the more vehicles blocked, the greater the level of congestion.
- Release percentage: the percentage of vehicles successfully getting onto the network.
- Vehicle kilometres of travel (VKT): the addition of the distance travelled by all vehicles in the model during the analysis period. Assuming a similar amount of traffic between scenarios, higher VKT indicates that traffic is diverting from their usual routes to bypass congestion.
- Vehicle hours of travel (VHT): the addition of the time spent by vehicles travelling between their origin and destination through the model during the analysis period. Assuming a similar amount of traffic between scenarios, higher VHT indicates higher levels of congestion.

- Average network speed: is the average speed of vehicles during the analysis period as they travel through the network. Higher speeds indicate less congestion.

The results for each scenario, including the 2012 and 2016 base models are provided in section 5.2.1 and 5.2.2. A discussion of the observed traffic conditions in each scenario is provided in section 5.3. The results are provided for the same analysis period used in section 3.4, i.e. the AM peak hour of 8.00 am to 9.00 am and the PM peak hour of 4.30 pm to 5.30 pm.

5.2.1 Model network performance statistics

The model network performance statistics for the AM and PM peak models for each of the four scenarios are shown in Table 5.2. They indicate the following:

- The AM peak experiences less congestion than the PM peak in both the base case models.
- Scenario 1 indicates heavy congestion and low network speed (grid lock) conditions. It also indicates high percentage of unreleased vehicles.
- The three intersection upgrades identified in scenario 2 provide a substantial benefit to the network, reducing congestion and increasing average speeds.
- With the upgrades identified in scenario 2, traffic from the proposed extensions in place and the additional upgrades the road network would operate at similar or better levels than the base case situation.

Table 5.1 Network statistics

	2012 Base	2016 Base	Scenario 1	Scenario 2
AM peak model				
Traffic demand during two hour period	16,600	17,500	18,000	18,000
Traffic blocked during two hour period	0	0	2,900	0
Release percentage	100%	100%	84%	100%
VKT	32,700	33,600	34,000	34,300
VHT	1,700	2,000	4,700	1,400
Average network speed (km/h)	20	17	8	25
PM peak model				
Traffic demand during two hour period	20,100	21,000	21,900	21,900
Traffic blocked during two hour period	400	800	1,300	900
Release percentage	98%	96%	94%	96%
VKT	36,200	37,400	38,800	38,800
VHT	2,400	3,100	3,400	2,900
Average network speed (km/h)	15	13	12	14

5.2.2 Delay and level of service

The level of service and delay results for each scenario are summarised for the intersections listed in Table 5.3. Reported results include Level of Service and average vehicle delay. More detailed LoS and average delay results by intersection approach are provided in Appendix E for the Base and Scenarios 1 and 2.

Overall, the LoS and average delay results follow the same patterns as the network statistics outlined in section 5.2.1.

- A comparison of the 2012 base scenario and Scenario 1 indicates that there are substantial benefits from the identified upgrades from Council and RMS along the Great Western Highway. Benefits are greatest during the morning peak.

- A comparison of the results for Scenarios 1 and 2.shows that with traffic from the proposed extensions in place, the identified RMS/Council upgrades and the additional upgrades, the road network would operate at similar or better levels than the existing situation during the AM and PM peak periods.

Table 5.2 Intersection level of service results – AM peak model

Intersection	2012 Base		2016 Base		Scenario 1		Scenario 2	
	LoS	Average delay	LoS	Average delay	LoS	Average delay	LoS	Average delay
1. Pitt Street - Great Western Highway	F	>200	F	>200	F	>200	F	79
2. O'Connell Street - Great Western Highway	F	>200	F	>200	F	>200	C	37
3. Marsden Street - Great Western Highway	F	>200	F	>200	F	>200	F	83
4. Church Street - Great Western Highway	F	109	F	101	F	170	E	59
6. Marsden Street - Campbell Street	A	13	A	14	B	22	B	15
7. Church Street - Campbell Street	B	26	B	27	B	26	B	24
8. O'Connell Street - Aird Street	A	7	A	9	F	145	A	7
10. Church Street - Fitzwilliam Street	B	21	B	21	D	49	B	27
11. Argyle Street - Pitt Street - Park Parade	C	39	C	38	F	145	E	65
12. O'Connell Street - Argyle Street	B	22	B	23	F	78	B	26
13. Marsden Street - Argyle Street	B	21	B	21	E	66	B	19
14. Church Street - Darcy Street - Argyle Street	C	29	B	24	C	42	C	32
19. O'Connell Street - Macquarie Street	B	24	B	24	F	288	B	24
20. Marsden Street - Macquarie Street	A	11	A	12	F	104	A	11

Table 5.3 Intersection level of service results – PM peak model

Intersection	2012 Base		2016 Base		Scenario 1		Scenario 2	
	LoS	Average delay	LoS	Average delay	LoS	Average delay	LoS	Average delay
1. Pitt Street - Great Western Highway	F	>200	F	>200	F	>200	F	>200
2. O'Connell Street - Great Western Highway	F	>200	F	>200	F	>200	F	>200
3. Marsden Street - Great Western Highway	F	>200	F	>200	F	>200	F	>200
4. Church Street - Great Western Highway	F	187	F	>200	F	>200	F	199
6. Marsden Street - Campbell Street	E	62	D	56	D	55	E	66
7. Church Street - Campbell Street	D	45	C	31	C	30	D	43
8. O'Connell Street - Aird Street	C	34	C	37	C	30	B	25
10. Church Street - Fitzwilliam Street	D	44	D	44	C	41	C	40
11. Argyle Street - Pitt Street - Park Parade	C	32	C	34	D	46	C	42
12. O'Connell Street - Argyle Street	D*	44	C	39	C	37	C	34
13. Marsden Street - Argyle Street	C	35	C	29	C	30	C	35
14. Church Street - Darcy Street - Argyle Street	C	37	C	30	C	31	C	31
19. O'Connell Street - Macquarie Street	F	158	F	183	F	182	F	168
20. Marsden Street - Macquarie Street	D	49	E	60	F	76	E	70

5.3 Model observation summary

The following observations are made from the model scenarios.

- Scenario 1: Addition of background traffic along with Parramatta Westfield development leads to considerable congestion on existing traffic networks. The extent of the traffic congestion dramatically increases in both AM and PM peak models compared to the 2016 base models.
- Scenario 2: With development traffic in place and the inclusion of the identified RMS/Council upgrades and proposed Westfield upgrades, the road network would operate at 2016 base condition or better. Furthermore, the additional upgrades to RMS and Councils improvements were found to have the following effects:
  - The change in ramp split between the two entry ramps on Aird Street, effectively eliminates the queue-back from the car park onto Aird Street and eliminates the flow-on effects up O'Connell Street, Hunter Street, Macquarie Street and Marsden Street.

- The addition of an extra boom gate on the Marsden Street entry ramp improves vehicle flow into the car park in the critical block of Marsden Street between the Great Western Highway and Campbell Street. Improving this flow reduces delays due to weaving on Marsden Street in the northbound direction). This in turn allows more vehicles through the right-turn and left-turn from the Great Western Highway, reducing queue lengths and improving through vehicle flow.

- The extension of the westbound right-turn bay reduces the impact of the right-turn queue into Marsden Street on westbound through traffic. This has benefits for traffic on both Parkes Street and Church Street.

- While not critical to the proposed development, the slight change in the RMS plan for the upgrade in Church Street improves vehicle flow in the PM peak, while having little impact during the AM peak.

- The restriction of parking on the southern side of Campbell Street allows space for vehicles to pass vehicles waiting to turn into the Westfield car park. This prevents congestion on Campbell Street flowing back onto Church Street and affecting the intersection of Great Western Highway, Church Street and Parkes Street.

6. Summary

A Paramics microsimulation model has been developed to test the impacts of the proposed extension of the Westfield Parramatta shopping centre.

Base model calibration and validation

The AM and PM peak models were calibrated and validated to RMS criteria. Feedback from RMS and Council officers indicated that the PM model presented was a reasonable representation of the typical traffic conditions on a Thursday evening peak.

RMS also provided independent model audit where a number of comments and clarifications were sought. Parsons Brinckerhoff addressed the comments in this modelling report.

Proposed development

The expansion of the shopping centre is expected to increase the demand for parking and traffic generation. An additional 473 parking spaces are being provided for retail shoppers and staff, and 100 spaces are being provided for users of the commercial building. Allowance has been made for 20 motorbikes and 200 bicycles.

Traffic generation

Traffic generation above that of the current centre has been estimated by CBHK as 200 vph in the morning peak and 480 vph in the afternoon peak. An allowance has been made for increased activity at loading docks.

Assessment year

Based on discussion with RMS and Council, the year 2016 advised as the development impact assessment year. The year 2016 coincides with the development site opening year. Based on discussion with RMS and CBHK the following assumption were made to estimate the year 2016 background traffic changes:

- Additional 200 spaces within the Council Hunter Street car park: pro-rata the traffic generation by the ratio of current spaces (550) to future spaces (750).
- Crown development (134 to 140 Hunter Street, Parramatta) as per the CBHK traffic report supplied.
- Background growth: add 1% additional traffic per annum (linear) to the external to external zones (i.e. no change to other Parramatta traffic apart from the above).

Traffic scenarios

Two scenarios have been analysed and compared to the 2012 and 2016 base scenario. Scenario 1 was included to Parramatta Westfield localised car park access improvements. This scenario assumed no major upgrade to external road network.

Scenario 2 was included to allow the benefits attributable to the upgrades identified by RMS and Council. Scenario 2 also contains the traffic generation for the development and the proposed improvements (including internal car park upgrades).

The scenarios have been analysed to determine whether the impacts for the development traffic are mitigated by the proposed upgrades and car park improvements.

Council and RMS identified intersection upgrades on the Great Western Highway

Three intersection upgrades have been identified by Council and RMS in the area, including:

- Great Western Highway and O'Connell Street
- Great Western Highway and Marsden Street
- Church Street, Great Western Highway and Parkes Street.

The model indicates that these upgrades should have substantial benefits for traffic flow on the Great Western Highway, particularly during the AM peak.

A slight modification to the identified upgrade on Church Street is proposed, involving the change in lane allocation on Church Street around Lansdowne Street. The model indicates that this modification would have benefits in the PM peak without affecting the demonstrated benefits in the AM peak.

Proposed upgrades to mitigate the impacts of the proposed extensions

Improvements to the Westfield Parramatta car park entries and exits are planned to facilitate easier entry and exit, including:

- Additional right-turn lane from the eastern Campbell Street access driveway and ramp.
- Widened western Campbell Street exit driveway and ramp to provide two continuous exit lanes from the Level 6 car park exit controls to Campbell Street.
- Reconfigure the western Aird Street entry driveway (located between O'Connell Street and Marsden Street) by closing the entry to Level 3 of the car park, but retaining the 'speed ramp' to Level 4M.
- A new entry driveway at the eastern end of Aird Street (located between O'Connell Street and Marsden Street), providing access to Level 2 of the Aird Street car park.
- Car park management and information systems to optimise the split of traffic entering the Aird Street entry ramps between the Level 4M and new Level 2 ramps.
- Lengthen the second (short) lane at the Marsden Street exit driveway and ramp to increase capacity.
- Add a second boom gate on the Marsden Street rooftop entry ramp.

The Paramics modelling has identified additional upgrades to maintain traffic network performance:

- Extend the length of the westbound right-turn bay from Great Western Highway into Marsden Street by approximately 170 metres, almost to Church Street using linemarking.
- Extend the two-lane linemarked section of Campbell Street in the westbound direction to approximately 70 m west of Church Street and change the current No Parking times from '8.30 am–6.00 pm Mon–Fri, 8.00 am–9.00 pm Sat' to: '8.30 am–9.00 pm'.
- Modifications to traffic signal phasing at Marsden Street and Great Western Highway; Great Western Highway and Church Street; and Church Street and Campbell Street.

The Paramics modelling has shown that:

1. The identified Council/RMS upgrades and proposed upgrades mitigate the impacts of the proposed extensions. Traffic conditions in the AM and PM peaks would be similar or better than the existing situation

2. The internal car park upgrades reduce the impact of the Westfield car park on the road network.

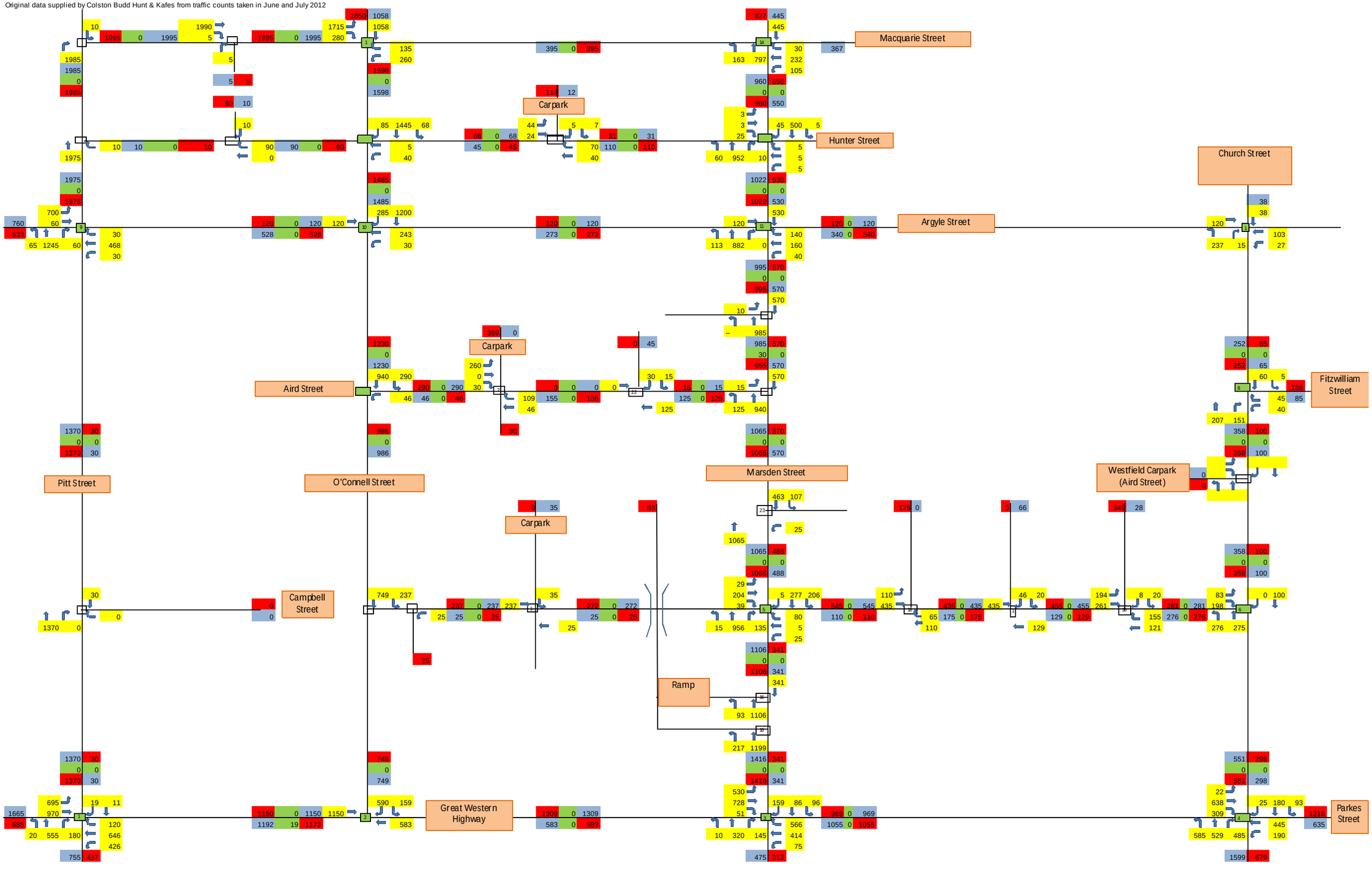
Appendix A

2012 AM and PM peak traffic volumes

Parramatta Westfield Paramics Model

2012 balanced 1 hour AM Peak traffic volumes (vehicles per hour)

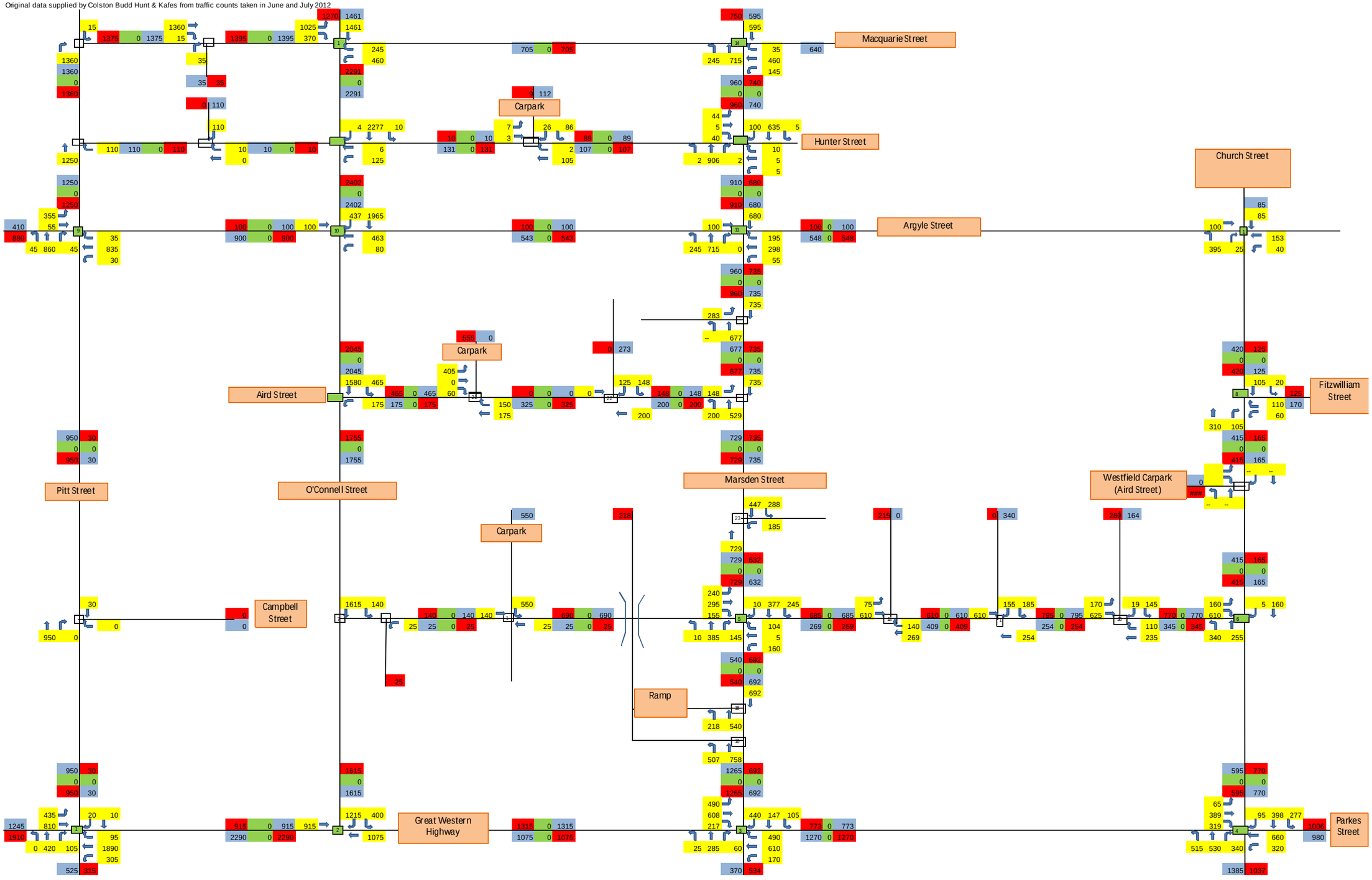
Original data supplied by Colston Budd Hunt & Kafes from traffic counts taken in June and July 2012



Parramatta Westfield Paramics Model

2012 balanced 1 hour PM Peak traffic volumes (vehicles per hour)

Original data supplied by Colston Budd Hunt & Kafes from traffic counts taken in June and July 2012



Appendix B

Queue length observations

Queue length observations

Table B.1 Critical queue observations

Intersection/road section	Weekday AM peak	Weekday PM peak
1. Great Western Highway and Pitt Street	▪ Pitt Street northbound between Great Western Highway and Argyle Street shows extended and long queuing condition which extend up to Great Western Highway intersection with Pitt Street.	▪ Great Western Highway westbound exhibits long and extended queues. The queue frequently extends back to the Great Western Highway intersection with O'Connell Street. ▪ Pitt Street northbound shows long queue.
2. Great Western Highway and O'Connell Street	▪ No major issues.	▪ Great Western Highway westbound exhibits long and extended queues. The queue frequently extends back to the Great Western Highway intersection with Marsden Street. The queue is mainly due to the extended queue at westbound trough movement at Great Western Highway and Pitt Street. ▪ O'Connell Street southbound indicates long and extended queue. The queue frequently extended back up to Argyle Street and Macquarie Street.
3. Great Western Highway and Marsden Street	▪ Great Western Highway eastbound between Pitt Street and Marsden Street shows long and extended queues which adversely impacts the operation of the Great Western Highway intersection with O'Connell Street and Pitt Street. The slow movement on Great Western Highway eastbound causes the left turn southbound movement on O'Connell Street to experience long delays and queuing problems. ▪ At this interaction the following movements show long and extended queues: ‣ Great Western Highway eastbound which impacts other Great Western Highway intersections with Pitt Street and O'Connell Street ‣ Great Western Highway westbound right turn which frequently spills out of the provided turn bay and impacts the through traffic movement.	▪ Marsden Street northbound exhibits long and extended queues ▪ Great Western Highway westbound exhibits long and extended queues. The queue frequently extends back to the Great Western Highway intersection with Church Street. The queue is mainly due to the following movements: ‣ right turn onto Marsden Street, northbound ‣ westbound trough movement which is caused by the extended queue from the downstream intersection of Great Western Highway and O'Connell Street. ▪ Marsden Street southbound exhibits long and extended queues. The queue frequently extends to Marsden Street intersection with Campbell Street. ▪ Great Western Highway eastbound right turn shows occasional queue spill-back form the right turn bay onto the through movement.
4. Church Street and Great Western Highway	▪ The northbound section on Church Street shows a long and extended queue at its intersection with Great Western Highway.	▪ Church Street northbound exhibited long and extended queues. ▪ Great Western Highway westbound exhibited long and extended queues. ▪ Church Street southbound exhibited long and extended queues. The queue frequently extended to the Church Street intersection with Campbell Street.

Intersection/road section	Weekday AM peak	Weekday PM peak
6. Marsden Street and Campbell Street	▪ No major issues.	▪ Marsden Street southbound, Campbell Street eastbound and Campbell Street westbound exhibit long and extended queues due to the congestion on Marsden Street southbound at Great Western Highway intersection.
7. Campbell Street and Church Street	▪ No major issues.	▪ Church Street southbound and Campbell Street eastbound right turn exhibits slow traffic movement. This is mainly due to the slow movement and traffic congestion on Church Street southbound between Campbell Street and Great Western Highway.
8. Aird Street and O'Connell Street	▪ No major issues.	▪ O'Connell Street southbound left turn shows occasional queue and slow movements. The queue is mainly due to congestion on Aird Street eastbound at Westfield's entry and its queue blocking back.
16. Hunter Street and O'Connell Street	▪ No major issues.	▪ This section exhibits long and extended queues. The westbound queue frequently spills back onto Marsden Street southbound.
19. Macquarie Street and O'Connell Street	▪ No major issues	▪ This section shows extended and long queues in the westbound direction with queues back to Marsden Street.
Marsden Street northbound between Great Western Highway and Campbell Street	▪ No major issues	▪ This section of Marsden Street shows slow and congested traffic which leads to extended queue spill onto Great Western Highway. The congestion is mainly due to the followings: ‣ slow traffic movement on Westfield's parking ramps ‣ weaving on Marden Street northbound between Great Western Highway and Campbell Street. ‣ northbound queue on Marsden Street between Great Western Highway and Campbell Street.
O'Connell Street between Macquarie Street and Great Western Highway	▪ No major issues	▪ This section shows long and extended queue which adversely impacts the performance of the O'Connell Street intersections with Macquarie Street, Hunter Street, Argyle Street, and Aird Street. The queue is mainly due to the low approach level of service on O'Connell Street southbound at its intersection with Great western Highway.

Appendix C

2012 model calibration statistics and stability results

AM calibration results

Index	ID	Intersection	Approach		2012 Counts/ AM1HR			2012 Modelled AM2HR	2012 Modelled AM1HR	GEH
					LV	HV	Total	Total	Total	
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway	North	R			19	12	6	3.7
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		T			11	12	6	1.7
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		L			0	0	0	1.4
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway	East	R			120	274	139	1.6
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		T			646	1109	561	3.5
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		L			426	862	436	0.5
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway	South	R			180	342	173	0.5
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		T			555	1014	513	1.8
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		L			20	51	26	1.2
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway	West	R			0	0	0	1.4
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		T			970	1712	865	3.5
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		L			695	1539	778	3.1
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway	North	R			590	1095	554	1.5
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		T			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		L			159	318	161	0.1
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway	East	R			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		T			583	1146	579	0.2
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		L			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway	South	R			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		T			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		L			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway	West	R			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		T			1,150	2019	1,021	3.9
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		L			--	--	--	--
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway	North	R			159	272	138	1.8
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		T			86	226	114	2.8
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		L			96	206	104	0.8
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway	East	R			566	1150	581	0.6
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		T			414	833	421	0.3
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		L			75	175	88	1.5
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway	South	R			145	300	152	0.5
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		T			320	673	340	1.1
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		L			10	43	22	2.9
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway	West	R			51	128	65	1.8
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		T			728	1283	649	3.0
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		L			530	915	463	3.0
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway	North	R			25	23	12	3.1
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		T			180	401	203	1.6
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		L			93	185	94	0.1
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway	East	R			--	--	--	--
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		T			445	876	443	0.1
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		L			190	348	176	1.0
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway	South	R			485	967	489	0.2
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		T			529	905	457	3.2
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		L			585	1298	656	2.9
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway	West	R			309	580	293	0.9
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		T			638	1146	579	2.4
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		L			22	60	30	1.6
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street	North	R			5	11	6	0.2
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		T			277	594	300	1.4
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		L			206	429	217	0.7
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street	East	R			80	130	66	1.7
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		T			5	2	1	2.3
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		L			25	54	27	0.4
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street	South	R			135	190	96	3.6
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		T			956	1905	963	0.2
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		L			15	42	21	1.5
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street	West	R			39	44	22	3.0
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		T			204	424	214	0.7
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		L			29	52	26	0.5
6	I-6	Church Street / -- / Church Street / Cambpell Street	North	R			0	2	1	1.4
6	I-6	Church Street / -- / Church Street / Cambpell Street		T			100	192	97	0.3
6	I-6	Church Street / -- / Church Street / Cambpell Street		L			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street	East	R			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street		T			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street		L			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street	South	R			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street		T			275	414	209	4.2
6	I-6	Church Street / -- / Church Street / Cambpell Street		L			276	537	271	0.3
6	I-6	Church Street / -- / Church Street / Cambpell Street	West	R			198	440	222	1.7
6	I-6	Church Street / -- / Church Street / Cambpell Street		T			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street		L			83	152	77	0.7

AM calibration results - continued

7	I-7	O'Connell Street / Cambpell Street / -- / --	North	R			--	--		--	
7	I-7	O'Connell Street / Cambpell Street / -- / --		T1			749	1415		715	1.2
				T2			--	--		--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		L	0	0	237	456		231	0.4
7	I-7	O'Connell Street / Cambpell Street / -- / --	East	R	0	0	--	--		--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		T	0	0	--	--		--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		L	0	0	--	--		--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --	South	R	0	0	--	--		--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		T	0	0	--	--		--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		L	0	0	--	--		--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --	West	R	0	0	--	--		--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		T	0	0	--	--		--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		L	0	0	--	--		--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --	North	R	0	0	--	--		--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		T	0	0	60	126		64	0.5
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		L	0	0	5	4		2	1.6
8	I-8	Church Street / Fitzwilliam Street / Church Street / --	East	R	0	0	45	149		75	3.9
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		T	0	0	--	--		--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		L	0	0	40	74		37	0.4
8	I-8	Church Street / Fitzwilliam Street / Church Street / --	South	R	0	0	151	277		140	0.9
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		T	0	0	207	281		142	4.9
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		L	0	0	--	--		--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --	West	R	0	0	--	--		--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		T	0	0	--	--		--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		L	0	0	--	--		--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade	North	R	0	0	--	--		--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T	0	0	--	--		--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		L	0	0	--	--		--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade	East	R1	0	0	30	50		25	0.9
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		R2	0	0	--				
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T1	0	0	468	863		436	1.5
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T2	0	0	--				
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		L	0	0	30	24		12	3.9
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		U	0	0	--	48		24	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade	South	R	0	0	60	72		36	3.4
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T	0	0	1,245	2493		1,260	0.4
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		L	0	0	65	272		138	7.2
9	I-9	-- / Argyle Street / Pitt Street / Park Parade	West	R	0	0	--	--		--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T	0	0	60	120		61	0.1
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		L	0	0	700	1401		708	0.3
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street	North	R	0	0	285	623		315	1.7
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		T	0	0	1,200	2367		1,197	0.1
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		L	0	0	5	--		--	2.3
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street	East	R	0	0	--	--		--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		T	0	0	243	296		150	6.7
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		L	0	0	30	22		11	4.2
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street	South	R	0	0	--	--		--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		T	0	0	--	--		--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		L	0	0	--	--		--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street	West	R	0	0	--	--		--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		T	0	0	120	240		121	0.1
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		L	0	0	0	--		--	1.4
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street	North	R	0	0	--	--		--	--
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		T	0	0	530	1209		611	3.4
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		L	0	0	--	--		--	--
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street	East	R	0	0	140	270		136	0.3
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		T	0	0	160	228		115	3.8
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		L	0	0	40	24		12	5.5
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street	South	R	0	0	0	0		0	1.4
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		T	0	0	882	1852		936	1.8
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		L	0	0	113	92		47	7.4
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street	West	R	0	0	--	--		--	--
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		T	0	0	120	240		121	0.1
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		L	0	0	--	--		--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street	North	R	0	0	--	--		--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		T	0	0	38	96		49	1.6
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		L	0	0	--	--		--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street	East	R	0	0	--	--		--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		T	0	0	103	124		63	4.4
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		L	0	0	27	32		16	2.3
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street	South	R	0	0	15	31		16	0.2
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		T	0	0	--	--		--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		L	0	0	237	400		202	2.3
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street	West	R	0	0	--	--		--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		T	0	0	120	240		121	0.1
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		L	0	0	--	--		--	--

AM calibration results - continued

13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street	North	R	0	0	--	--	--	--	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		T	0	0	1,058	2216	1,120	1.9	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		L	0	0	--	--	--	--	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street	East	R	0	0	135	369	187	4.1	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		T	0	0	--	--	--	--	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		L	0	0	260	432	218	2.7	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street	South	R	0	0	--	--	--	--	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		T	0	0	--	--	--	--	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		L	0	0	--	--	--	--	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street	West	R	0	0	280	564	285	0.3	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		T	0	0	--	--	--	--	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		L	0	0	1,715	3442	1,740	0.6	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street	North	R	0	0	--	--	--	--	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		T	0	0	445	1044	528	3.8	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		L	0	0	--	--	--	--	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street	East	R	0	0	30	54	27	0.5	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		T	0	0	232	452	228	0.2	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		L	0	0	105	277	140	3.2	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street	South	R	0	0	--	--	--	--	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		T	0	0	797	1683	851	1.9	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		L	0	0	163	353	178	1.2	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street	West	R	0	0	--	--	--	--	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		T	0	0	--	--	--	--	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		L	0	0	--	--	--	--	
15	P-15	Pitt Street / Campbell Street / -- / --	North	R	0	0	--	--	--	--	
15	P-15	Pitt Street / Campbell Street / -- / --		T	0	0	30	24	12	3.9	
15	P-15	Pitt Street / Campbell Street / -- / --		L	0	0	--	--	--	--	
15	P-15	Pitt Street / Campbell Street / -- / --	East	R	0	0	0	0	0	1.4	
15	P-15	Pitt Street / Campbell Street / -- / --		T	0	0	--	--	--	--	
15	P-15	Pitt Street / Campbell Street / -- / --		L	0	0	--	--	--	--	
15	P-15	Pitt Street / Campbell Street / -- / --	South	R	0	0	0	0	0	1.4	
15	P-15	Pitt Street / Campbell Street / -- / --		T	0	0	1,370	2834	1,433	1.7	
15	P-15	Pitt Street / Campbell Street / -- / --		L	0	0	--	--	--	--	
15	P-15	Pitt Street / Campbell Street / -- / --	West	R	0	0	--	--	--	--	
15	P-15	Pitt Street / Campbell Street / -- / --		T	0	0	--	--	--	--	
15	P-15	Pitt Street / Campbell Street / -- / --		L	0	0	--	--	--	--	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --	North	R	0	0	--	--	--	--	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		T	0	0	341	695	351	0.6	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		L	0	0	--	--	--	--	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --	East	R	0	0	--	--	--	--	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		T	0	0	--	--	--	--	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		L	0	0	--	--	--	--	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --	South	R	0	0	--	--	--	--	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		T	0	0	1,106	2144	1,084	0.7	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		L	0	0	93	236	119	2.6	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --	West	R	0	0	--	--	--	--	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		T	0	0	--	--	--	--	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		L	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --	North	R	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		T	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		L	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --	East	R	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		T	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		L	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --	South	R	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		T	0	0	1,106	2144	1,084	0.7	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		L	0	0	217	340	172	3.2	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --	West	R	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		T	0	0	--	--	--	--	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		L	0	0	--	--	--	--	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street	North	R	0	0	0	0	0	1.4	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		T	0	0	--	--	--	--	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		L	0	0	0	0	0	1.4	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street	East	R	0	0	65	157	79	1.7	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		T	0	0	110	187	95	1.5	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		L	0	0	--	--	--	--	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street	South	R	0	0	--	--	--	--	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		T	0	0	--	--	--	--	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		L	0	0	--	--	--	--	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street	West	R	0	0	--	--	--	--	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		T	0	0	435	855	432	0.1	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		L	0	0	110	207	105	0.5	

AM calibration results - continued

19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --	North	R	0	0	46	97	--	49	0.4
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		T	0	0	--	--	--	--	
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		L	0	0	20	40	--	20	0.0
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --	East	R	0	0	--	--	--	--	
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		T	0	0	129	248	--	125	0.3
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		L	0	0	--	--	--	--	
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --	South	R	0	0	--	--	--	--	
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		T	0	0	--	--	--	--	
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		L	0	0	--	--	--	--	
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --	West	R	0	0	--	--	--	--	
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		T	0	0	435	854	--	432	0.2
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		L	0	0	--	--	--	--	
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street	North	R	0	0	8	13	--	7	0.5
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		T	0	0	--	--	--	--	
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		L	0	0	20	34	--	17	0.7
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street	East	R	0	0	155	308	--	156	0.1
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		T	0	0	121	233	--	118	0.3
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		L	0	0	--	--	--	--	
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street	South	R	0	0	--	--	--	--	
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		T	0	0	--	--	--	--	
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		L	0	0	--	--	--	--	
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street	West	R	0	0	--	--	--	--	
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		T	0	0	261	547	--	277	0.9
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		L	0	0	194	339	--	171	1.7
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street	North	R	0	0	--	--	--	--	
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		T	0	0	--	--	--	--	
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		L	0	0	--	--	--	--	
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street	East	R	0	0	109	223	--	113	0.4
								114			
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		T	0	0	46	63	--	32	2.3
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		L	0	0	--	--	--	--	
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street	South	R	0	0	--	--	--	--	
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		T	0	0	--	--	--	--	
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		L	0	0	--	--	--	--	
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street	West	R	0	0	30	77	--	39	1.5
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		T	0	0	0	4	--	2	2.0
								270			
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		L	0	0	260	494	--	250	0.6
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --	North	R	0	0	30	61	--	31	0.2
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		T	0	0	--	--	--	--	
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		L	0	0	15	32	--	16	0.3
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --	East	R	0	0	--	--	--	--	
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		T	0	0	125	220	--	111	1.3
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		L	0	0	--	--	--	--	
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --	South	R	0	0	--	--	--	--	
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		T	0	0	--	--	--	--	
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		L	0	0	--	--	--	--	
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --	West	R	0	0	--	--	--	--	
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		T	0	0	0	0	--	0	1.4
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		L	0	0	--	--	--	--	
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --	North	R	0	0	--	--	--	--	
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		T	0	0	463	999	--	505	1.9
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		L	0	0	107	219	--	111	0.4
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --	East	R	0	0	--	--	--	--	
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		T	0	0	--	--	--	--	
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		L	0	0	25	68	--	34	1.7
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --	South	R	0	0	--	--	--	--	
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		T	0	0	1,065	2099	--	1,061	0.1
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		L	0	0	--	--	--	--	
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --	West	R	0	0	--	--	--	--	
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		T	0	0	--	--	--	--	
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		L	0	0	--	--	--	--	
24	P-24	O'Connell Street / Aird Street / -- / --	North	R	0	0	--	--	--	--	
24	P-24	O'Connell Street / Aird Street / -- / --		T	0	0	940	1823	--	922	0.6
24	P-24	O'Connell Street / Aird Street / -- / --		L	0	0	290	563	--	285	0.3
24	P-24	O'Connell Street / Aird Street / -- / --	East	R	0	0	--	--	--	--	
24	P-24	O'Connell Street / Aird Street / -- / --		T	0	0	--	--	--	--	
24	P-24	O'Connell Street / Aird Street / -- / --		L	0	0	46	63	--	32	2.3
24	P-24	O'Connell Street / Aird Street / -- / --	South	R	0	0	--	--	--	--	
24	P-24	O'Connell Street / Aird Street / -- / --		T	0	0	--	--	--	--	
24	P-24	O'Connell Street / Aird Street / -- / --		L	0	0	--	--	--	--	
24	P-24	O'Connell Street / Aird Street / -- / --	West	R	0	0	--	--	--	--	
24	P-24	O'Connell Street / Aird Street / -- / --		T	0	0	--	--	--	--	
24	P-24	O'Connell Street / Aird Street / -- / --		L	0	0	--	--	--	--	

AM calibration results - continued

25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street	North	R	0	0	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		T	0	0	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		L	0	0	35	63	32	0.5
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street	East	R	0	0	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		T	0	0	25	52	26	0.3
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		L	0	0	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street	South	R	0	0	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		T	0	0	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		L	0	0	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street	West	R	0	0	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		T	0	0	237	456	231	0.4
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		L	0	0	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street	North	R	0	0	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		T	0	0	570	1202	608	1.6
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		L	0	0	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street	East	R	0	0	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		T	0	0	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		L	0	0	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street	South	R	0	0	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		T	0	0	940	1885	953	0.4
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		L	0	0	125	227	115	0.9
26	P-26	Marsden Street / -- / Marsden Street / Aird Street	West	R	0	0	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		T	0	0	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		L	0	0	15	33	17	0.4
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit	North	R	0	0	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		T	0	0	570	1202	608	1.6
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		L	0	0	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit	East	R	0	0	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		T	0	0	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		L	0	0	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit	South	R	0	0	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		T	0	0	985	1919	970	0.5
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		L	0	0	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit	West	R	0	0	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		T	0	0	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		L	0	0	10	30	15	1.5
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street	North	R	0	0	45	96	49	0.5
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		T	0	0	500	1201	607	4.6
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		L	0	0	5	10	5	0.0
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street	East	R	0	0	5	22	11	2.2
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		T	0	0	5	0	0	2.3
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		L	0	0	5	4	2	1.6
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street	South	R	0	0	10	18	9	0.3
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		T	0	0	952	1978	1,000	1.5
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		L	0	0	60	109	55	0.6
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street	West	R	0	0	25	2	1	6.7
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		T	0	0	3	3	2	1.0
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		L	0	0	3	20	10	2.8
29	P-29	O'Connell Street / Hunter Street / -- / --	North	R	0	0	85	181	91	0.7
29	P-29	O'Connell Street / Hunter Street / -- / --		T	0	0	1,445	2901	1,467	0.6
29	P-29	O'Connell Street / Hunter Street / -- / --		L	0	0	68	112	57	1.4
29	P-29	O'Connell Street / Hunter Street / -- / --	East	R	0	0	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		T	0	0	5	0	0	2.3
29	P-29	O'Connell Street / Hunter Street / -- / --		L	0	0	40	96	49	1.3
29	P-29	O'Connell Street / Hunter Street / -- / --	South	R	0	0	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		T	0	0	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		L	0	0	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --	West	R	0	0	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		T	0	0	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		L	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --	North	R	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		T	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		L	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --	East	R	0	0	10	32	16	1.7
30	P-30	-- / Hunter Street / Pitt Street / --		T	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		L	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --	South	R	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		T	0	0	1,975	3941	1,992	0.4
30	P-30	-- / Hunter Street / Pitt Street / --		L	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --	West	R	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		T	0	0	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		L	0	0	--	--	--	--

PM calibration results

Index	ID	Intersection	Approach		2012 Counts/ PM1HR			2012 Modelled PM2HR	2012 Modelled PM1HR	GEH
					LV	HV	Total	Total	Total	
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway	North	R			20	24	13	1.8
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		T			10	24	13	0.8
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		L			0	0	0	1.4
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway	East	R			95	141	74	2.3
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		T			1,890	3454	1,815	1.8
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		L			305	507	266	2.3
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway	South	R			105	291	153	4.2
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		T			420	763	401	0.9
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		L			0	0	0	1.4
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway	West	R			0	0	0	1.4
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		T			810	1369	719	3.3
1	I-1	Pitt Street / Great Western Highway / Pitt Street / Great Western Highway		L			435	1015	533	4.5
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway	North	R			1,215	2343	1,231	0.5
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		T			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		L			400	840	441	2.0
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway	East	R			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		T			1,075	1798	945	4.1
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		L			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway	South	R			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		T			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		L			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway	West	R			--	--	--	--
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		T			915	1631	857	2.0
2	I-2	O'Connell Street / Great Western Highway / -- / Great Western Highway		L			--	--	--	--
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway	North	R			440	726	381	2.9
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		T			147	272	143	0.3
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		L			105	192	101	0.4
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway	East	R			490	982	516	1.2
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		T			610	982	516	4.0
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		L			170	369	194	1.8
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway	South	R			60	149	78	2.2
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		T			285	490	257	1.7
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		L			25	86	45	3.4
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway	West	R			217	439	231	0.9
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		T			608	1211	636	1.1
3	I-3	Marsden Street / Great Western Highway / Marsden Street / Great Western Highway		L			490	844	443	2.2
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway	North	R			95	130	68	3.0
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		T			398	614	323	4.0
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		L			277	485	255	1.4
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway	East	R			--	--	--	--
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		T			660	1340	704	1.7
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		L			320	575	302	1.0
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway	South	R			340	717	377	1.9
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		T			530	1041	547	0.7
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		L			515	1051	552	1.6
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway	West	R			319	666	350	1.7
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		T			389	868	456	3.3
4	I-4	Church Street / Great Western Highway / Church Street / Great Western Highway		L			65	149	78	1.6
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street	North	R			10	19	10	0.0
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		T			377	648	340	1.9
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		L			245	395	208	2.5
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street	East	R			104	147	77	2.8
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		T			5	3	2	1.9
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		L			160	266	140	1.7
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street	South	R			145	253	133	1.0
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		T			385	697	366	1.0
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		L			10	23	12	0.6
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street	West	R			155	295	155	0.0
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		T			295	518	272	1.4
5	I-5	Marsden Street / Cambpell Street / Marsden Street / Cambpell Street		L			240	395	208	2.2
6	I-6	Church Street / -- / Church Street / Cambpell Street	North	R			5	30	16	3.3
6	I-6	Church Street / -- / Church Street / Cambpell Street		T			160	266	140	1.7
6	I-6	Church Street / -- / Church Street / Cambpell Street		L			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street	East	R			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street		T			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street		L			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street	South	R			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street		T			255	620	326	4.1
6	I-6	Church Street / -- / Church Street / Cambpell Street		L			340	574	302	2.1
6	I-6	Church Street / -- / Church Street / Cambpell Street	West	R			610	988	519	3.8
6	I-6	Church Street / -- / Church Street / Cambpell Street		T			--	--	--	--
6	I-6	Church Street / -- / Church Street / Cambpell Street		L			160	226	119	3.5

PM calibration results - continued

7	I-7	O'Connell Street / Cambpell Street / -- / --	North	R			--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		T1			1,615	3204	1,683	1.7
				T2			--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		L	0	0	140	278	146	0.5
7	I-7	O'Connell Street / Cambpell Street / -- / --	East	R	0	0	--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		T	0	0	--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		L	0	0	--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --	South	R	0	0	--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		T	0	0	--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		L	0	0	--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --	West	R	0	0	--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		T	0	0	--	--	--	--
7	I-7	O'Connell Street / Cambpell Street / -- / --		L	0	0	--	--	--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --	North	R	0	0	--	--	--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		T	0	0	105	224	118	1.2
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		L	0	0	20	12	6	3.8
8	I-8	Church Street / Fitzwilliam Street / Church Street / --	East	R	0	0	110	278	146	3.2
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		T	0	0	--	--	--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		L	0	0	60	80	42	2.5
8	I-8	Church Street / Fitzwilliam Street / Church Street / --	South	R	0	0	105	227	119	1.3
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		T	0	0	310	618	325	0.8
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		L	0	0	--	--	--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --	West	R	0	0	--	--	--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		T	0	0	--	--	--	--
8	I-8	Church Street / Fitzwilliam Street / Church Street / --		L	0	0	--	--	--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade	North	R	0	0	--	--	--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T	0	0	--	--	--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		L	0	0	--	--	--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade	East	R1	0	0	35	48	25	1.8
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		R2	0	0	--			
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T1	0	0	835	1436	754	2.9
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T2	0	0	--			
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		L	0	0	16	48	25	2.1
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		U	0	0	--	48	25	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade	South	R	0	0	45	36	19	4.6
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T	0	0	860	1698	892	1.1
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		L	0	0	45	137	72	3.5
9	I-9	-- / Argyle Street / Pitt Street / Park Parade	West	R	0	0	--	--	--	--
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		T	0	0	55	60	32	3.6
9	I-9	-- / Argyle Street / Pitt Street / Park Parade		L	0	0	355	761	400	2.3
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street	North	R	0	0	437	816	429	0.4
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		T	0	0	1,965	3979	2,090	2.8
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		L	0	0	1	0	0	0.0
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street	East	R	0	0	--	--	--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		T	0	0	463	729	383	3.9
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		L	0	0	80	125	66	1.7
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street	South	R	0	0	--	--	--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		T	0	0	--	--	--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		L	0	0	--	--	--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street	West	R	0	0	--	--	--	--
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		T	0	0	100	144	76	2.6
10	I-10	O'Connell Street / Argyle Street / -- / Argyle Street		L	0	0	0	0	0	1.4
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street	North	R	0	0	--	--	--	--
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		T	0	0	680	1319	693	0.5
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		L	0	0	--	--	--	--
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street	East	R	0	0	195	543	285	5.8
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		T	0	0	298	427	224	4.6
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		L	0	0	55	61	32	3.5
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street	South	R	0	0	0	0	0	1.4
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		T	0	0	715	1267	666	1.9
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		L	0	0	245	438	230	1.0
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street	West	R	0	0	--	--	--	--
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		T	0	0	100	142	75	2.7
11	I-11	Marsden Street / Argyle Street / Marsden Street / Argyle Street		L	0	0	--	--	--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street	North	R	0	0	--	--	--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		T	0	0	85	204	107	2.3
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		L	0	0	--	--	--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street	East	R	0	0	--	--	--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		T	0	0	153	156	82	6.6
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		L	0	0	40	32	17	4.4
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street	South	R	0	0	25	32	17	1.8
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		T	0	0	--	--	--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		L	0	0	395	870	457	3.0
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street	West	R	0	0	--	--	--	--
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		T	0	0	100	141	74	2.8
12	I-12	Church Street / Darcy Street / Church Street / Argyle Street		L	0	0	--	--	--	--

PM calibration results - continued

13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street	North	R	0	0	--	--	--	--	--
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		T	0	0	1,461	2906	1,527	1.7	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		L	0	0	--	--	--	--	--
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street	East	R	0	0	245	462	243	0.1	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		T	0	0	--	--	--	--	--
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		L	0	0	460	896	471	0.5	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street	South	R	0	0	--	--	--	--	--
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		T	0	0	--	--	--	--	--
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		L	0	0	--	--	--	--	--
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street	West	R	0	0	370	824	433	3.1	
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		T	0	0	--	--	--	--	--
13	I-13	O'Connell Street / Macquarie Street / -- / Macquarie Street		L	0	0	1,025	2021	1,062	1.1	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street	North	R	0	0	--	--	--	--	--
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		T	0	0	595	1212	637	1.7	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		L	0	0	--	--	--	--	--
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street	East	R	0	0	35	80	42	1.1	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		T	0	0	460	916	481	1.0	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		L	0	0	145	251	132	1.1	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street	South	R	0	0	--	--	--	--	--
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		T	0	0	715	1434	753	1.4	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		L	0	0	245	473	248	0.2	
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street	West	R	0	0	--	--	--	--	--
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		T	0	0	--	--	--	--	--
14	I-14	Marsden Street / Macquarie Street / Marsden Street / Macquarie Street		L	0	0	--	--	--	--	--
15	P-15	Pitt Street / Campbell Street / -- / --	North	R	0	0	--	--	--	--	--
15	P-15	Pitt Street / Campbell Street / -- / --		T	0	0	30	48	25	0.9	
15	P-15	Pitt Street / Campbell Street / -- / --		L	0	0	--	--	--	--	--
15	P-15	Pitt Street / Campbell Street / -- / --	East	R	0	0	0	0	0	1.4	
15	P-15	Pitt Street / Campbell Street / -- / --		T	0	0	--	--	--	--	--
15	P-15	Pitt Street / Campbell Street / -- / --		L	0	0	--	--	--	--	--
15	P-15	Pitt Street / Campbell Street / -- / --	South	R	0	0	0	0	0	1.4	
15	P-15	Pitt Street / Campbell Street / -- / --		T	0	0	950	1870	982	1.0	
15	P-15	Pitt Street / Campbell Street / -- / --		L	0	0	--	--	--	--	--
15	P-15	Pitt Street / Campbell Street / -- / --	West	R	0	0	--	--	--	--	--
15	P-15	Pitt Street / Campbell Street / -- / --		T	0	0	--	--	--	--	--
15	P-15	Pitt Street / Campbell Street / -- / --		L	0	0	--	--	--	--	--
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --	North	R	0	0	--	--	--	--	--
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		T	0	0	692	1211	636	2.2	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		L	0	0	--	--	--	--	--
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --	East	R	0	0	--	--	--	--	--
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		T	0	0	--	--	--	--	--
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		L	0	0	--	--	--	--	--
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --	South	R	0	0	--	--	--	--	--
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		T	0	0	540	981	515	1.1	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		L	0	0	218	510	268	3.2	
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --	West	R	0	0	--	--	--	--	--
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		T	0	0	--	--	--	--	--
16	P-16	Marsden Street - Ramp to Aird Street / -- / -- / --		L	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --	North	R	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		T	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		L	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --	East	R	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		T	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		L	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --	South	R	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		T	0	0	540	981	515	1.1	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		L	0	0	507	803	422	4.0	
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --	West	R	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		T	0	0	--	--	--	--	--
17	P-17	Marsden Street - Ramp to Campbell Street / -- / -- / --		L	0	0	--	--	--	--	--
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street	North	R	0	0	0	0	0	1.4	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		T	0	0	--	--	--	--	--
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		L	0	0	0	0	0	1.4	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street	East	R	0	0	140	297	156	1.3	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		T	0	0	269	422	222	3.0	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		L	0	0	--	--	--	--	--
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street	South	R	0	0	--	--	--	--	--
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		T	0	0	--	--	--	--	--
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		L	0	0	--	--	--	--	--
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street	West	R	0	0	--	--	--	--	--
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		T	0	0	610	993	522	3.7	
18	P-18	Campbell Street - Valet Parking / Campbell Street / -- / Campbell Street		L	0	0	75	178	94	2.0	

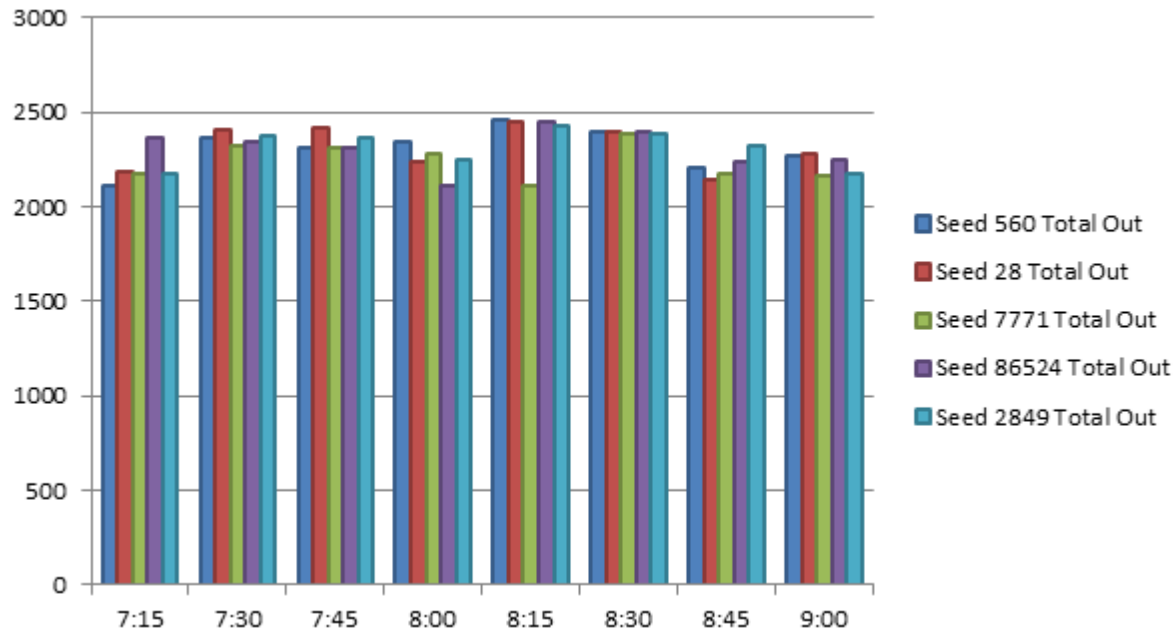
PM calibration results - continued

19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --	North	R	0	0	155	281	148	0.6
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		T	0	0	--	--	--	--
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		L	0	0	185	327	172	1.0
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --	East	R	0	0	--	--	--	--
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		T	0	0	254	453	238	1.0
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		L	0	0	--	--	--	--
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --	South	R	0	0	--	--	--	--
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		T	0	0	--	--	--	--
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		L	0	0	--	--	--	--
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --	West	R	0	0	--	--	--	--
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		T	0	0	610	993	522	3.7
19	P-19	Campbell Street - Exit - East of Marsden Street / -- / -- / --		L	0	0	--	--	--	--
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street	North	R	0	0	19	38	20	0.2
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		T	0	0	--	--	--	--
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		L	0	0	145	266	140	0.4
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street	East	R	0	0	110	191	100	0.9
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		T	0	0	235	418	220	1.0
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		L	0	0	--	--	--	--
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street	South	R	0	0	--	--	--	--
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		T	0	0	--	--	--	--
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		L	0	0	--	--	--	--
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street	West	R	0	0	--	--	--	--
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		T	0	0	625	960	504	5.1
20	P-20	Campbell Street -West of Church Street / Campbell Street / -- / Campbell Street		L	0	0	170	369	194	1.8
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street	North	R	0	0	--	--	--	--
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		T	0	0	--	--	--	--
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		L	0	0	--	--	--	--
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street	East	R	0	0	150	350	184	2.6
								185		
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		T	0	0	175	243	128	3.8
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		L	0	0	--	--	--	--
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street	South	R	0	0	--	--	--	--
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		T	0	0	--	--	--	--
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		L	0	0	--	--	--	--
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street	West	R	0	0	--	--	--	--
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		T	0	0	0	4	2	2.1
								379		
21	P-21	Aird Street -East of O'Connell Street / Aird Street / -- / Aird Street		L	0	0	405	712	374	1.6
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --	North	R	0	0	125	241	127	0.1
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		T	0	0	--	--	--	--
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		L	0	0	148	263	138	0.8
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --	East	R	0	0	--	--	--	--
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		T	0	0	200	348	183	1.2
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		L	0	0	--	--	--	--
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --	South	R	0	0	--	--	--	--
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		T	0	0	--	--	--	--
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		L	0	0	--	--	--	--
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --	West	R	0	0	--	--	--	--
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		T	0	0	0	--	--	1.4
22	P-22	Aird Street -Exit - West of Marsden Street / -- / -- / --		L	0	0	--	--	--	--
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --	North	R	0	0	--	--	--	--
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		T	0	0	447	826	434	0.6
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		L	0	0	288	549	288	0.0
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --	East	R	0	0	--	--	--	--
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		T	0	0	--	--	--	--
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		L	0	0	185	266	140	3.6
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --	South	R	0	0	--	--	--	--
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		T	0	0	729	1250	657	2.7
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		L	0	0	--	--	--	--
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --	West	R	0	0	--	--	--	--
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		T	0	0	--	--	--	--
23	P-23	Marsden Street / Marsden Street - North of Campbell Street / -- / --		L	0	0	--	--	--	--
24	P-24	O'Connell Street / Aird Street / -- / --	North	R	0	0	--	--	--	--
24	P-24	O'Connell Street / Aird Street / -- / --		T	0	0	1,580	3245	1,705	3.1
24	P-24	O'Connell Street / Aird Street / -- / --		L	0	0	465	847	445	0.9
24	P-24	O'Connell Street / Aird Street / -- / --	East	R	0	0	--	--	--	--
24	P-24	O'Connell Street / Aird Street / -- / --		T	0	0	--	--	--	--
24	P-24	O'Connell Street / Aird Street / -- / --		L	0	0	175	243	128	3.8
24	P-24	O'Connell Street / Aird Street / -- / --	South	R	0	0	--	--	--	--
24	P-24	O'Connell Street / Aird Street / -- / --		T	0	0	--	--	--	--
24	P-24	O'Connell Street / Aird Street / -- / --		L	0	0	--	--	--	--
24	P-24	O'Connell Street / Aird Street / -- / --	West	R	0	0	--	--	--	--
24	P-24	O'Connell Street / Aird Street / -- / --		T	0	0	--	--	--	--
24	P-24	O'Connell Street / Aird Street / -- / --		L	0	0	--	--	--	--

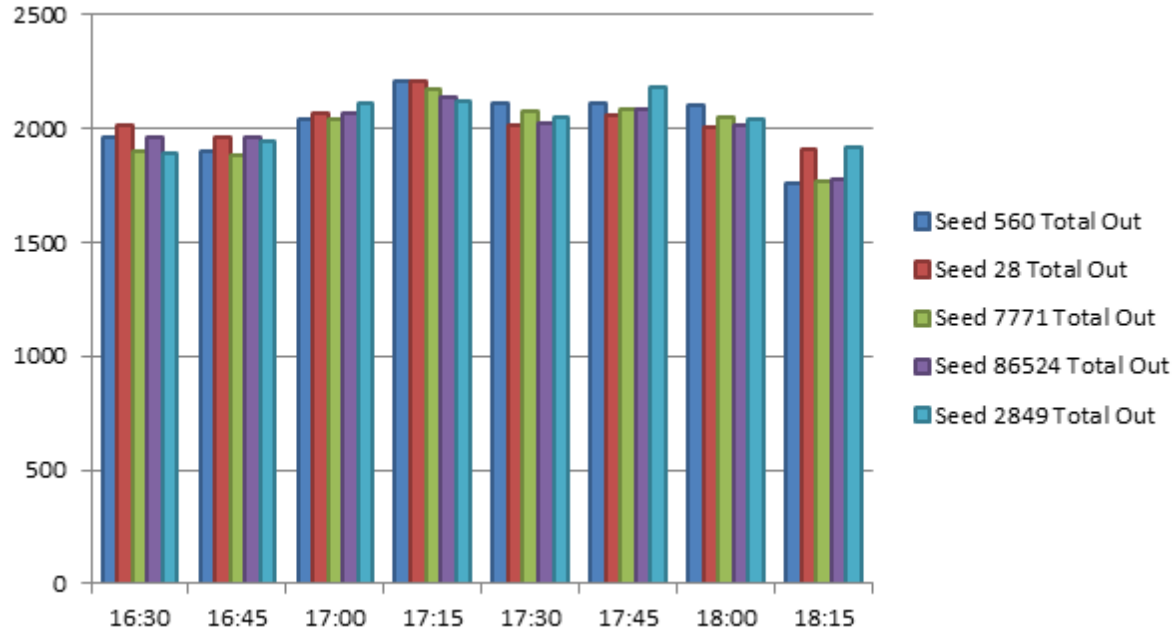
PM calibration results - continued

25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street	North	R	0	0	--	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		T	0	0	--	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		L	0	0	550	933	490	2.6
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street	East	R	0	0	--	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		T	0	0	25	44	23	0.4
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		L	0	0	--	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street	South	R	0	0	--	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		T	0	0	--	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		L	0	0	--	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street	West	R	0	0	--	--	--	--	--
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		T	0	0	140	278	146	0.5
25	P-25	Car Park Exit - West of Marsden Street / Cambpell Street / -- / Cambpell Street		L	0	0	--	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street	North	R	0	0	--	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		T	0	0	735	1362	716	0.7
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		L	0	0	--	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street	East	R	0	0	--	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		T	0	0	--	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		L	0	0	--	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street	South	R	0	0	--	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		T	0	0	529	892	469	2.7
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		L	0	0	200	356	187	0.9
26	P-26	Marsden Street / -- / Marsden Street / Aird Street	West	R	0	0	--	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		T	0	0	--	--	--	--	--
26	P-26	Marsden Street / -- / Marsden Street / Aird Street		L	0	0	148	268	141	0.6
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit	North	R	0	0	--	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		T	0	0	735	1355	712	0.9
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		L	0	0	--	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit	East	R	0	0	--	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		T	0	0	--	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		L	0	0	--	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit	South	R	0	0	--	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		T	0	0	677	1160	609	2.7
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		L	0	0	--	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit	West	R	0	0	--	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		T	0	0	--	--	--	--	--
27	P-27	Marsden Street / -- / Marsden Street / Car Park Exit		L	0	0	283	536	282	0.1
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street	North	R	0	0	100	288	151	4.6
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		T	0	0	635	1191	626	0.4
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		L	0	0	5	7	4	0.6
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street	East	R	0	0	10	21	11	0.3
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		T	0	0	5	0	0	2.3
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		L	0	0	5	2	1	2.3
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street	South	R	0	0	2	6	3	0.7
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		T	0	0	906	1803	947	1.4
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		L	0	0	2	0	0	0.8
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street	West	R	0	0	40	141	74	4.5
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		T	0	0	5	9	5	0.1
28	P-28	Marsden Street / Hunter Street / Marsden Street / Hunter Street		L	0	0	44	86	45	0.2
29	P-29	O'Connell Street / Hunter Street / -- / --	North	R	0	0	4	2	1	1.9
29	P-29	O'Connell Street / Hunter Street / -- / --		T	0	0	2,277	4565	2,398	2.5
29	P-29	O'Connell Street / Hunter Street / -- / --		L	0	0	10	23	12	0.6
29	P-29	O'Connell Street / Hunter Street / -- / --	East	R	0	0	--	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		T	0	0	6	11	6	0.1
29	P-29	O'Connell Street / Hunter Street / -- / --		L	0	0	125	265	139	1.2
29	P-29	O'Connell Street / Hunter Street / -- / --	South	R	0	0	--	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		T	0	0	--	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		L	0	0	--	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --	West	R	0	0	--	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		T	0	0	--	--	--	--	--
29	P-29	O'Connell Street / Hunter Street / -- / --		L	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --	North	R	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		T	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		L	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --	East	R	0	0	110	223	117	0.7
30	P-30	-- / Hunter Street / Pitt Street / --		T	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		L	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --	South	R	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		T	0	0	1,250	2491	1,309	1.6
30	P-30	-- / Hunter Street / Pitt Street / --		L	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --	West	R	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		T	0	0	--	--	--	--	--
30	P-30	-- / Hunter Street / Pitt Street / --		L	0	0	--	--	--	--	--

AM stability



PM stability



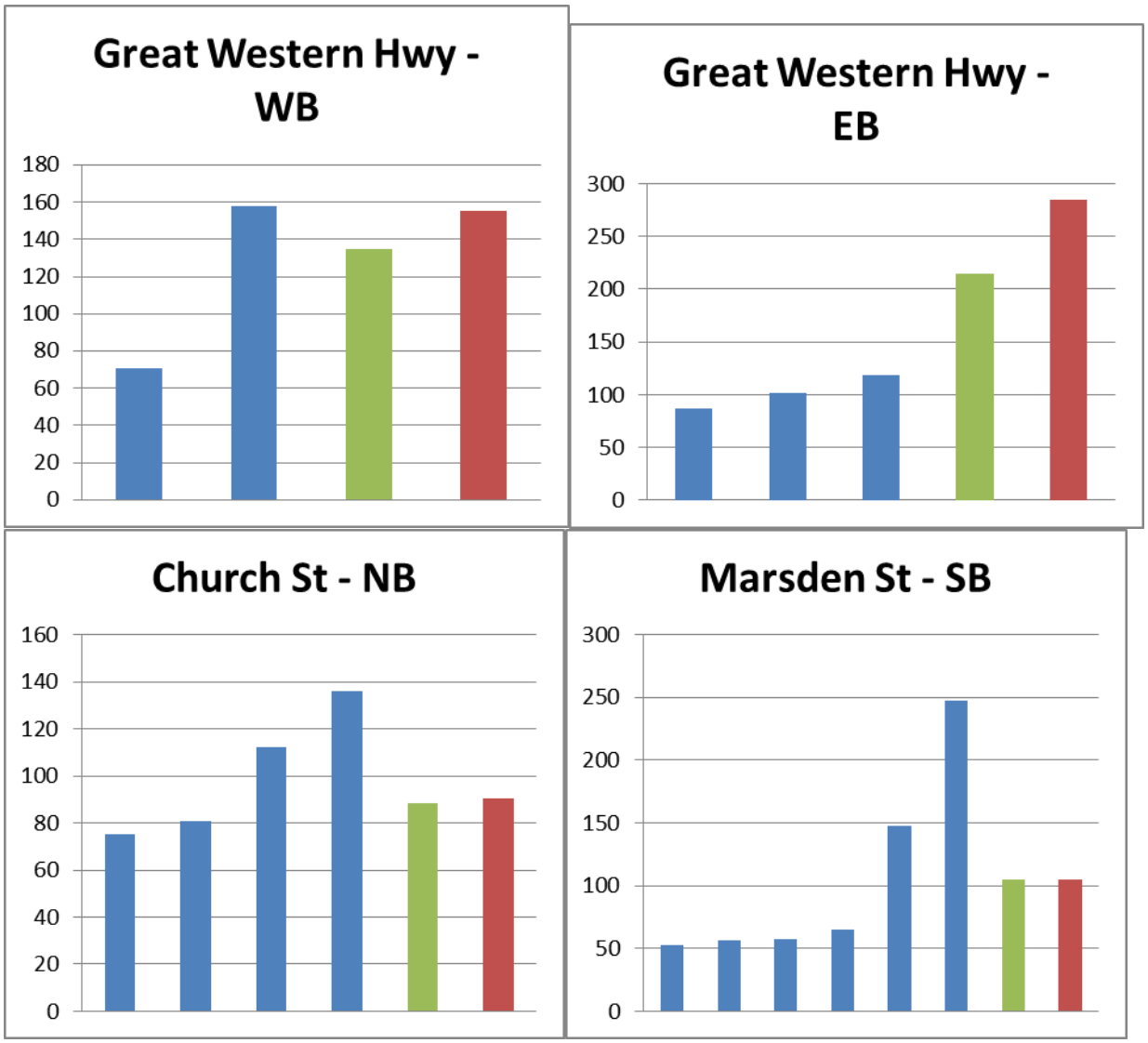
Appendix D

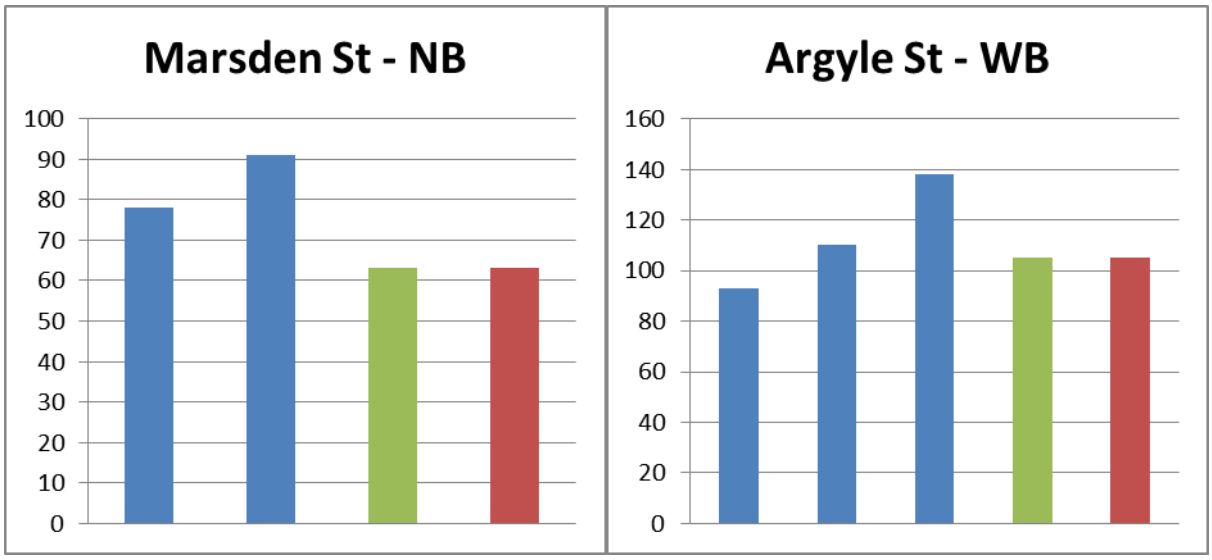
2012 model trip time validation

AM trip times

Legend:

Observed (seconds) | 1st hour modelled (seconds) | 2nd hour modelled (seconds)

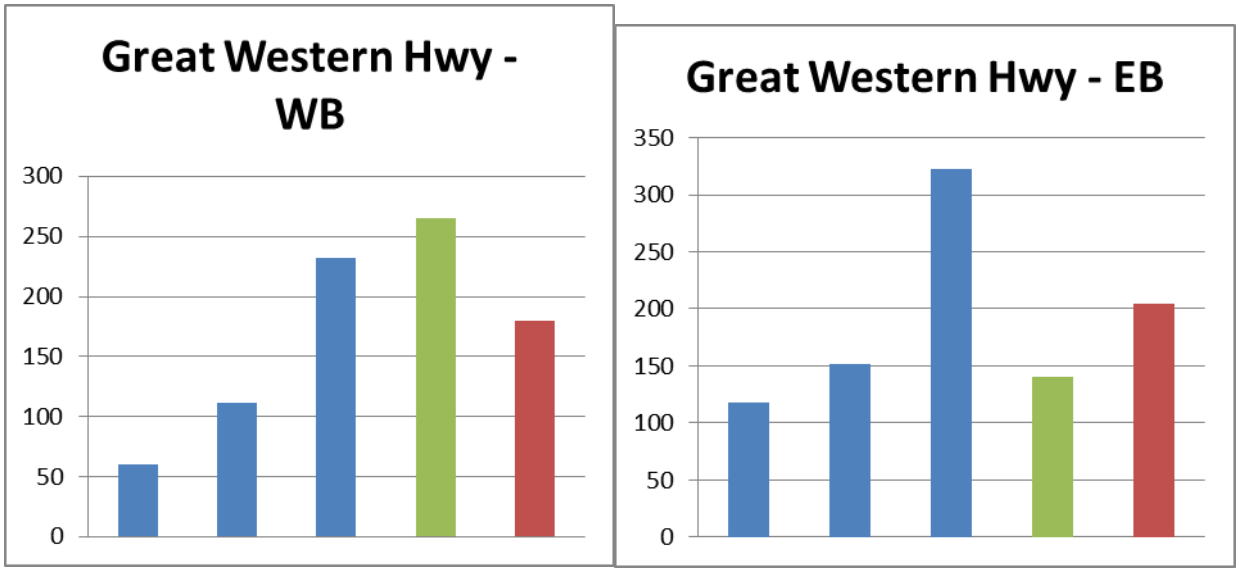


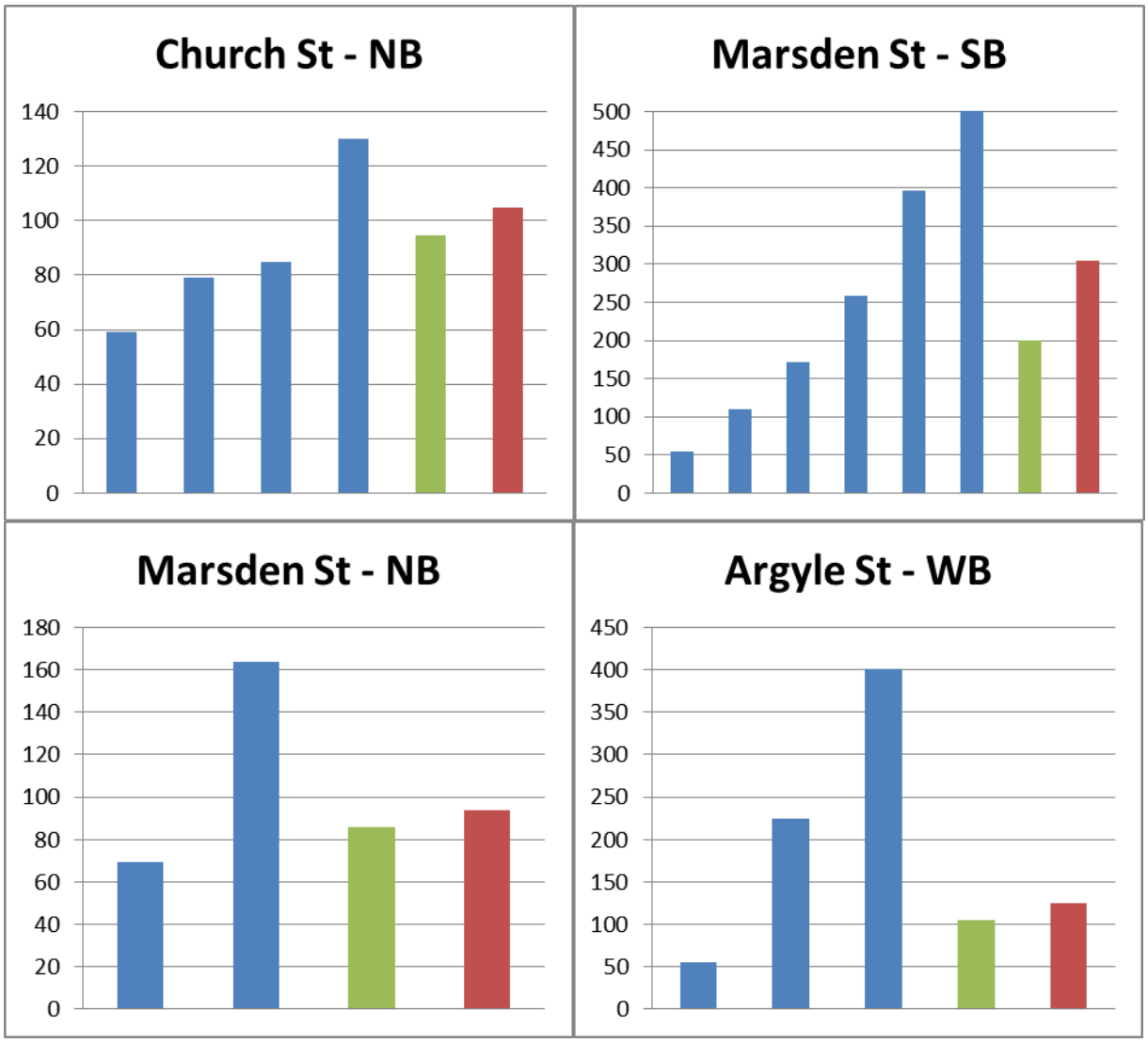


PM trip times

Legend:

Observed (seconds) 1st hour modelled (seconds) 2nd hour modelled (seconds)




Church St - NB
140
120
100
80
60
40
20
0
Marsden St - SB
500
450
400
350
300
250
200
150
100
50
0
Marsden St - NB
180
160
140
120
100
80
60
40
20
0
Argyle St - WB
450
400
350
300
250
200
150
100
50
0

Appendix E

AM and PM model levels of service

Table D.1 AM peak level of service results- by approach

Intersection	Approach	2012 Base			2016 Base			Scenario 1			Scenario 2		
		LoS	Delay	Flows	LoS	Delay	Flows	LoS	Delay	Flows	LoS	Delay	Flows
Pitt Street–Great Western Highway	North	F	87	12	F	87	12	F	83	12	F	84	12
	East	B	19	1052	B	18	1083	A	14	808	B	28	1146
	South	F	254	725	F	225	717	F	441	595	F	167	759
	West	F	293	1649	F	341	1619	F	570	1302	F	74	1840
O'Connell Street–Great Western Highway	North	F	109	730	F	147	730	F	430	482	D	53	861
	East	B	22	493	B	23	520	B	22	506	A	11	537
	West	F	416	1042	F	465	1041	F	728	876	C	37	1196
Marsden Street–Great Western Highway	North	E	61	348	F	73	363	E	59	272	F	82	369
	East	F	92	1028	F	128	1066	E	70	788	D	44	1002
	South	F	214	527	F	199	522	F	343	489	F	133	565
	West	F	493	1051	F	541	1048	F	801	885	F	91	1209
Church Street–Great Western Highway	North	F	94	318	F	90	302	E	66	172	E	69	235
	East	F	74	601	F	113	621	F	99	679	F	95	655
	South	F	163	1552	F	159	1567	F	323	1085	D	56	1679
	West	D	47	951	D	48	948	C	42	790	C	42	1110
Marsden Street–Campbell Street	North	A	5	501	A	7	526	A	5	346	A	6	538
	East	E	63	42	F	71	45	C	39	36	A	0	0
	South	A	10	1108	A	10	1134	B	26	807	B	16	1126
	West	C	34	269	C	38	269	C	34	157	C	34	231
Church Street–Campbell Street	North	A	11	101	A	12	75	A	12	49	A	11	49
	East	B	24	212	B	24	212	B	26	290	B	18	340
	South	C	35	282	C	35	277	C	34	199	C	32	357
	West	B	24	263	B	24	269	B	18	148	B	23	227
Church Street–Fitzwilliam Street	North	A	7	71	A	14	41	B	20	20	B	22	16
	East	D	43	102	D	43	105	F	117	111	D	51	107
	South	B	16	288	B	15	287	C	29	350	B	21	422

Intersection	Approach	2012 Base			2016 Base			Scenario 1			Scenario 2		
		LoS	Delay	Flows	LoS	Delay	Flows	LoS	Delay	Flows	LoS	Delay	Flows
Argyle Street–Pitt Street – Park Parade	East	E	63	44	E	61	44	E	63	44	E	63	44
	South	D	45	1406	C	40	1374	F	178	1015	F	77	1495
	West	C	30	1052	C	32	1050	F	99	888	D	45	1205
O'Connell Street–Argyle Street	North	B	25	1515	C	34	1529	F	97	971	C	29	1687
	East	A	10	196	A	10	206	B	16	199	A	11	252
	West	B	17	120	B	20	119	B	18	118	B	20	121
Marsden Street–Argyle Street	North	A	11	620	A	12	641	B	15	442	A	12	665
	East	C	39	247	C	39	249	F	110	365	C	39	377
	South	B	19	978	B	19	1021	F	80	694	A	14	1026
	West	D	44	108	D	46	107	D	45	106	D	46	109
Church Street–Darcy Street–Argyle Street	North	B	27	60	ERR	--	--	ERR	--	--	ERR	--	--
	East	C	39	73	C	39	122	C	39	74	C	38	78
	South	C	38	219	B	28	188	D	56	295	C	39	347
	West	A	8	119	B	25	466	A	13	137	A	8	121
O'Connell Street–Macquarie Street	North	B	15	1114	B	21	938	F	646	529	B	16	1331
	East	C	31	379	C	31	890	F	257	368	B	25	413
	West	B	28	2020	B	23	1555	F	159	1379	C	29	2164
Marsden Street–Macquarie Street	North	A	9	530	B	16	503	F	222	528	A	10	593
	East	C	32	380	B	22	580	F	131	287	C	32	385
	South	A	5	1014	B	15	1018	A	14	785	A	5	1132
O'Connell Street–Aird Street	North	A	6	1221	B	18	816	F	95	841	A	6	1361
	East	D	49	32	D	48	29	F	915	54	D	45	31

Table D.2 PM peak level of service results- by approach

Intersection	Approach	2012 Base			2016 Base			Scenario 1			Scenario 2		
		LoS	Delay	Flows	LoS	Delay	Flows	LoS	Delay	Flows	LoS	Delay	Flows
Pitt Street–Great Western Highway	North	F	73	24	F	75	24	F	77	24	F	73	24
	East	F	782	2025	F	784	1936	F	803	1991	F	571	2076
	South	F	73	527	F	84	544	F	127	586	F	115	572
	West	D	45	1159	D	47	1179	F	79	1242	C	34	1229
O'Connell Street–Great Western Highway	North	F	155	1567	F	178	1518	F	154	1599	F	126	1662
	East	F	750	899	F	752	874	F	770	847	F	538	895
	West	C	41	816	E	66	842	D	54	891	A	14	891
Marsden Street–Great Western Highway	North	F	238	620	F	227	619	F	230	625	F	301	598
	East	F	346	1144	F	352	1137	F	369	1106	F	252	1243
	South	F	320	382	F	307	386	F	411	391	F	446	371
	West	E	64	948	F	88	954	F	75	1015	D	43	1023
Church Street–Great Western Highway	North	F	91	599	F	77	532	F	74	544	F	78	565
	East	F	358	939	F	393	942	F	409	936	F	375	1003
	South	F	171	1365	F	272	1372	F	508	1313	F	161	1503
	West	F	86	789	F	140	834	F	107	837	F	136	833
Marsden Street–Campbell Street	North	F	110	404	F	101	421	F	103	406	F	165	426
	East	F	128	58	F	150	54	F	185	50	A	0	0
	South	C	37	502	C	35	515	B	27	520	B	26	553
	West	D	44	607	C	35	602	C	36	613	C	34	648
Church Street–Campbell Street	North	D	54	127	C	38	59	C	34	62	C	30	57
	East	B	27	311	B	26	298	B	28	304	C	42	291
	South	C	39	288	C	40	278	C	40	291	E	61	383
	West	E	66	303	B	27	300	B	23	304	B	27	326
Church Street–Fitzwilliam Street	North	A	5	93	B	16	16	B	16	16	B	16	16
	East	F	83	181	F	76	186	E	66	193	E	64	192
	South	C	35	414	C	31	407	C	31	413	C	30	402

Intersection	Approach	2012 Base			2016 Base			Scenario 1			Scenario 2		
		LoS	Delay	Flows	LoS	Delay	Flows	LoS	Delay	Flows	LoS	Delay	Flows
Argyle Street–Pitt Street –Park Parade	East	F	80	53	F	72	53	E	65	54	E	70	54
	South	C	41	941	C	42	947	E	61	991	D	54	989
	West	A	11	768	A	11	775	A	11	823	A	11	830
O'Connell Street–Argyle Street	North	C	39	2264	C	39	2249	C	36	2356	C	33	2505
	East	F	72	446	D	44	430	C	39	457	C	40	456
	West	C	42	72	C	40	72	C	41	72	C	40	72
Marsden Street–Argyle Street	North	B	21	642	B	19	661	B	23	670	C	41	682
	East	D	45	520	C	34	486	C	34	501	C	35	487
	South	C	37	581	C	33	632	C	30	631	B	28	718
	West	E	69	59	E	68	59	E	68	60	E	67	60
Church Street–Darcy Street–Argyle Street	North	D	52	110	ERR	--	--	ERR	--	--	ERR	--	--
	East	C	32	94	C	32	94	C	32	94	C	32	94
	South	C	38	452	C	32	446	C	34	459	C	33	446
	West	B	15	70	B	17	73	B	16	73	B	17	72
O'Connell Street–Macquarie Street	North	F	275	1345	F	315	1238	F	305	1288	F	284	1366
	East	F	177	626	F	201	614	F	182	652	F	160	694
	West	B	22	1245	D	46	1281	E	63	1339	D	53	1345
Marsden Street–Macquarie Street	North	C	41	585	C	42	624	F	103	633	F	112	628
	East	F	112	558	F	153	529	F	152	539	F	125	608
	South	B	16	949	B	21	988	B	19	1021	A	13	1065
O'Connell Street–Aird Street	North	C	29	1966	C	31	1899	B	26	2023	B	23	2116
	East	F	107	121	F	123	130	F	74	142	D	51	139

Appendix F

Proposed Great Western Highway intersection upgrades

TRAFFIC MANAGEMENT NOTES:

1. ALL PAVEMENT MARKING AND SIGNPOSTING TO BE IN ACCORDANCE WITH "INTERIM GUIDE TO SIGNS AND MARKINGS" (ROAD AND TRAFFIC AUTHORITY) AND A.S.1742 AND R.T.A. SPECIFICATION R141 AND R143.

2. ALL RETROREFLECTIVE RAISED PAVEMENT MARKERS TO BE IN ACCORDANCE WITH RTA SPECIFICATION R142.

3. ALL MOUNTABLE KERB FACES ARE TO BE PAINTED WITH APPROVED REFLECTIVE WHITE PAINT IN ACCORDANCE WITH R.T.A. SPECIFICATION R141.

4. STREET SIGNS TO BE PLACED AS DIRECTED BY SUPERVISING ENGINEER.

5. ENSURE ALL SIGNPOSTS ARE PLACED CLEAR OF EXISTING OR PROPOSED DRIVEWAYS AND CLEAR OF TREES AND OTHER STREET FURNITURE.

6. TRAFFIC CONTROL MEASURES ARE TO BE CARRIED OUT PRIOR, DURING AND AFTER CONSTRUCTION IN ACCORDANCE WITH A.S.1742.3

7. ALL PAVEMENT MARKING AND SIGNPOSTING IS TO BE APPROVED BY PARRAMATTA CITY COUNCIL TRAFFIC ENGINEER.

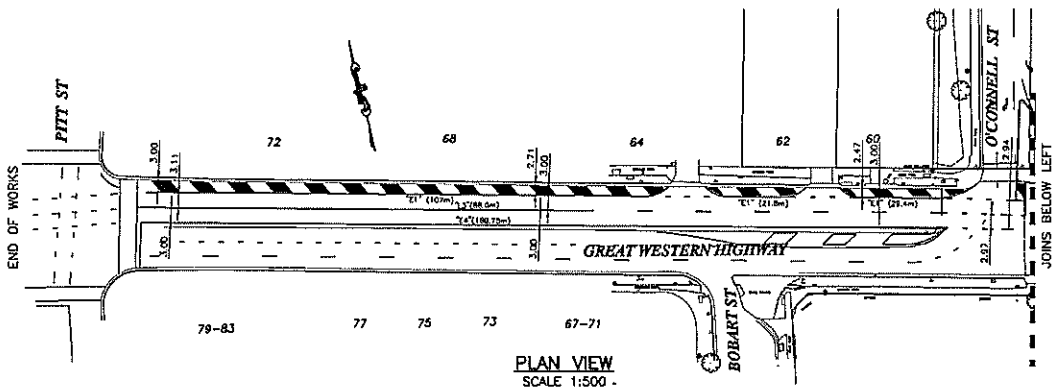
8. ALL SIGN POSTS IN CONCRETE TO BE HELD IN POSITION WITH V-LOCKS.

9. ALL PAINTWORK TO BE COMPLETED ON DAY OF CONSTRUCTION.

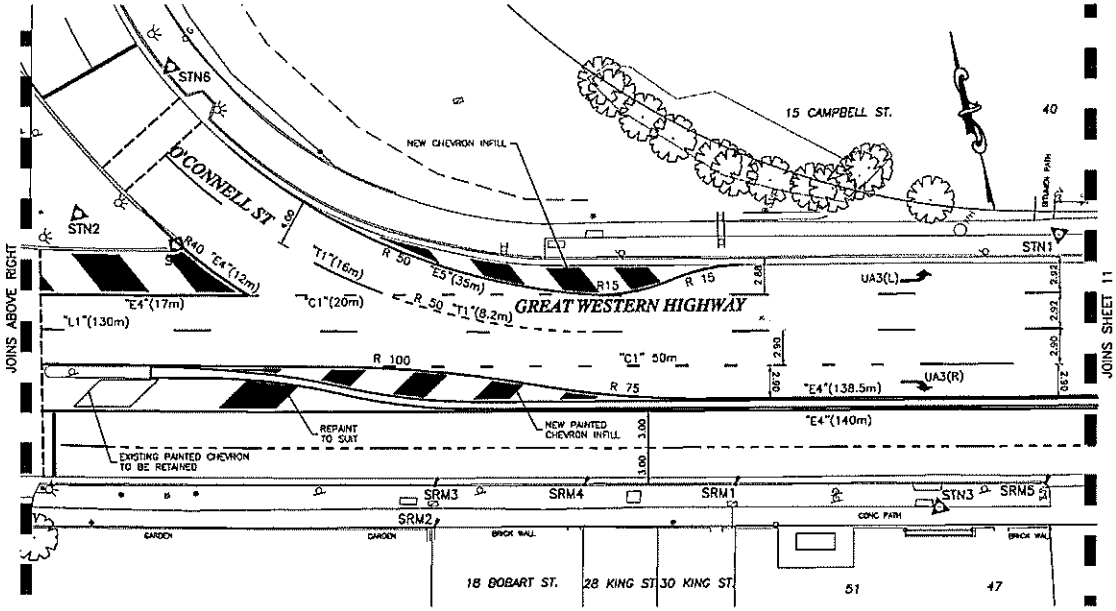
10. ALL LINEMARKING TO BE APPROVED WHITE THERMOPLASTIC PAINT.

11. ALL REDUNDANT SIGNS AND LINEMARKING WITHIN LIMIT OF WORKS TO BE REMOVED AS REQUIRED. RECOVERED POSTS TO BE REUSED.

12. ALL "TB", "TT" HOLDING LINES TO BE 300mm WIDE UNLESS NOTED OTHERWISE.



PLAN VIEW
SCALE 1:500 -



PLAN VIEW
SCALE 1:200

NOTE:
ALL EXISTING LINEMARKING INCLUDING CHEVRON TO BE REMOVED

SCALE OF METRES 1:500 | SCALE OF METRES 1:200

DIAL 1100 BEFORE YOU DIG

UNLESS DETAILED ON THIS DRAWING ALL WORK SHALL CONFORM TO AUS-SPEC

PLAN FEATURES		PUBLIC UTILITIES	
EXISTING/MISCELLANEOUS	PROPOSED	ABOVEGROUND	U/GROUND
KERB AND GUTTER:	KERB AND GUTTER:	TELSTRA:	
EDGE OF BITUMEN:	EDGE OF BITUMEN:	ELECTRICITY:	
ROAD C/CROWN:	ROAD C/CROWN:	GAS & MISC.:	
EARTH BATTERS:	EARTH BATTERS:	SEWER:	
PIPE DRAINS:	PIPE DRAINS:	WATER:	
DRAINAGE PITS:	DRAINAGE PITS:	POLES:	
TREES & SHRUBS:	SUB-SOIL DRAIN:	OVERHEAD:	
SPOT LEVELS:	SET-OUT LINE:	SURVEY:	

No.	AMENDMENTS DETAIL	CHECKED	DATE

DESIGN CHECKED AND APPROVED ___/___/___
APPROVED FOR CONSTRUCTION
Service Manager Capital Projects ___/___/___
ACCEPTED
Client ___/___/___
DESIGNED ___/___/___
DRAWN ___/___/___
DRAWING REVIEW ___/___/___

DATUM: A.H.D.
CO-ORDS: M.G.A.
RATIO: AS SHOWN
ACAD REF: 16499
STATUS: **DRAFT**

PARRAMATTA CITY COUNCIL

GREAT WESTERN HIGHWAY, PARRAMATTA
AT MARSDEN ST.
KERB & GUTTER, MEDIAN ISLAND RECONSTRUCTION AND ASSOCIATED WORKS

TRAFFIC MANAGEMENT - 1

PLAN NUMBER 16499
Sheet No : 10 of 15
Revision :

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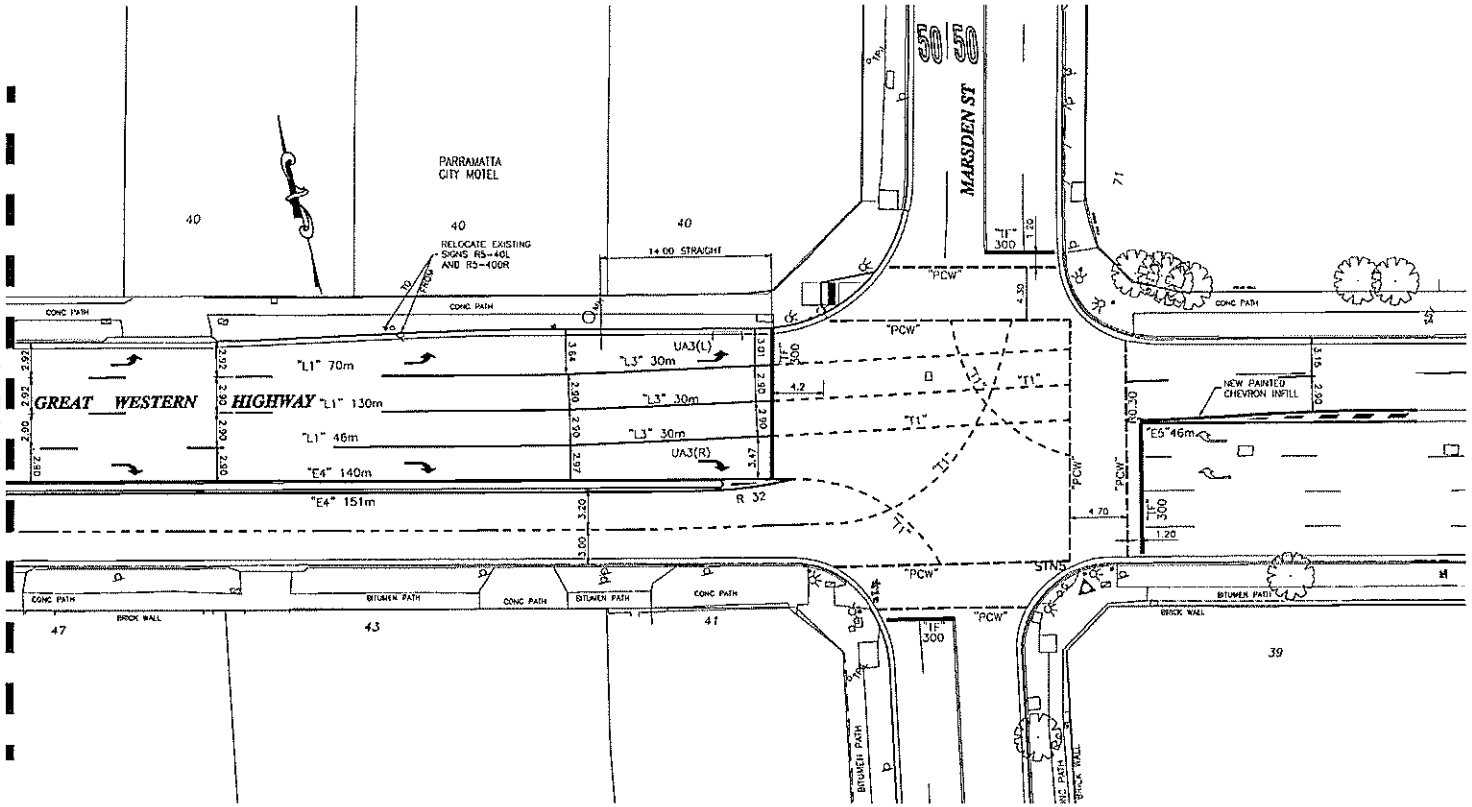

PLAN VIEW
SCALE 1:200

NOTE:
ALL EXISTING LINEMARKING INCLUDING CHEVRON TO BE REMOVED

DEFLECTION PATH 70KMH

TRAFFIC SIGNS SCHEDULE - RELOCATION

GRAPHIC SYMBOL	NAME / TYPE	No EXISTING	REMARKS
	R5-40L	1	AS INDICATED ON PLAN
	R5-400R	1	AS INDICATED ON PLAN

SCALE OF METRES 1:200

DIAL 1100 BEFORE YOU DIG

UNLESS DETAILED ON THIS DRAWING ALL WORK SHALL CONFORM TO AUS-SPEC

PLAN FEATURES — EXISTING/MISCELLANEOUS / PROPOSED
KERB AND GUTTER
EDGE OF BITUMEN
ROAD C/CROWN
EARTH BATTERS
PIPE DRAINS
DRAINAGE PITS
TREES & SHRUBS
SPOT LEVELS

PUBLIC UTILITIES — ABOVE/GROUND / U/GROUND
TELSTRA
ELECTRICITY
GAS & MISC.
SEWER
WATER
POLES
OVERHEAD
SURVEY

No.	AMENDMENTS DETAIL	CHECKED	DATE

DESIGN CHECKED AND APPROVED
APPROVED FOR CONSTRUCTION
Service Manager Capital Projects
ACCEPTED
Client
DESIGNED
DRAWN
DRAWING REVIEW

DATUM: A.H.D.
CO-ORDS: M.G.A.
RATIO: 1:200
ACAD REF: 16499
STATUS: DRAFT

PARRAMATTA CITY COUNCIL

GREAT WESTERN HIGHWAY, PARRAMATTA
AT MARSDEN ST.
KERB & GUTTER, MEDIAN ISLAND RECONSTRUCTION AND ASSOCIATED WORKS
TRAFFIC MANAGEMENT - 2

PLAN NUMBER 16499
Sheet No.: 11 of 15
Revision:

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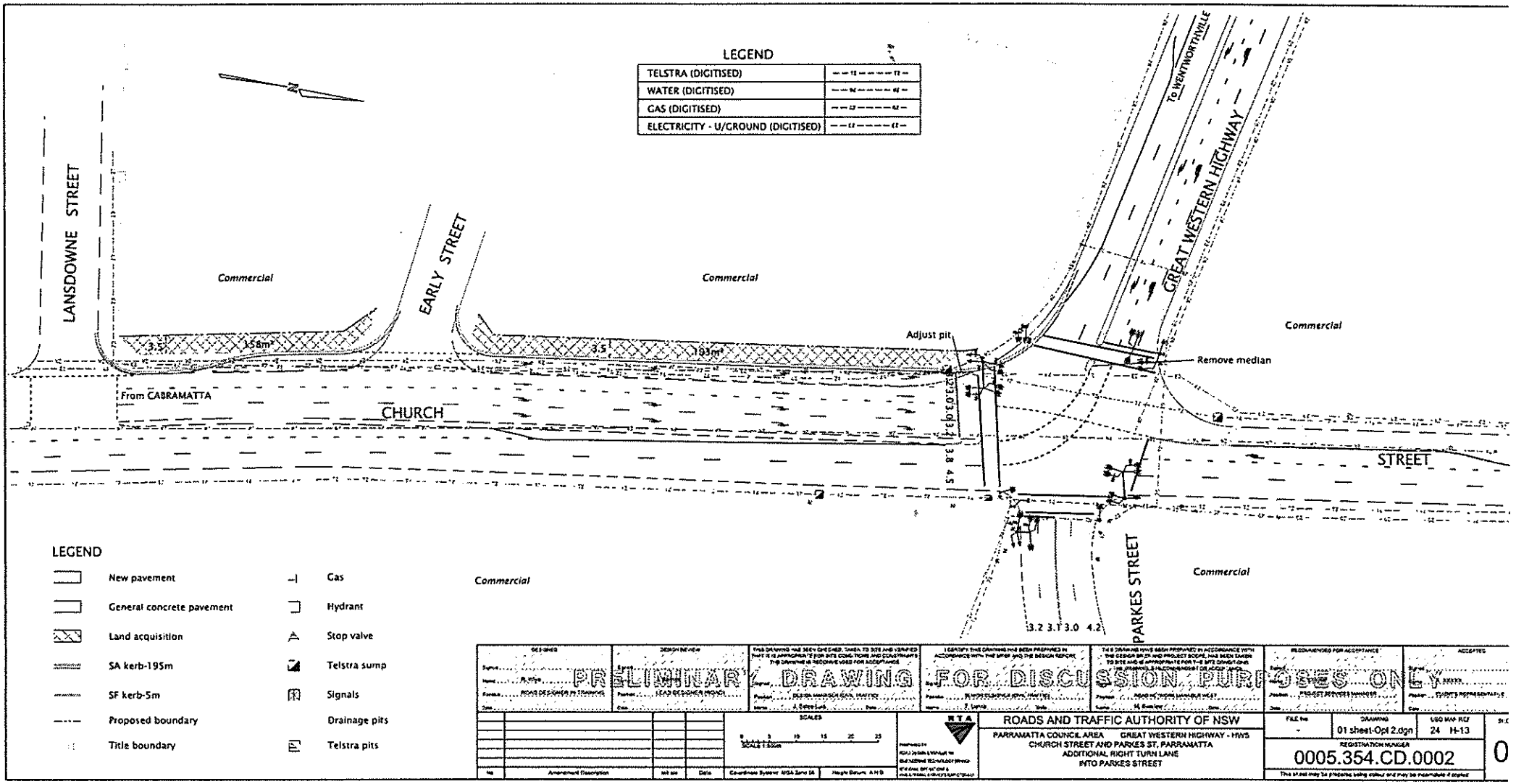
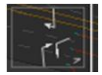
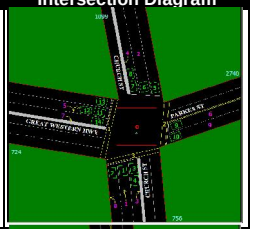
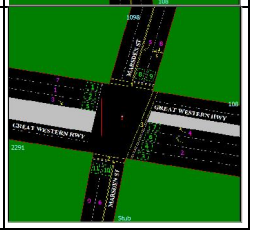

LEGEND
TELSTRA (DIGITISED)
WATER (DIGITISED)
GAS (DIGITISED)
ELECTRICITY - U/GROUND (DIGITISED)
LANSDOWNE STREET
EARLY STREET
CHURCH STREET
GREAT WESTERN HIGHWAY
To WENTWORTHVILLE
PARKES STREET
Commercial
Commercial
Commercial
Commercial
Adjust pit
Remove median
From CABRAMATTA
158m²
93m²
3.5
3.5
3.2 3.1 3.0 4.2
LEGEND
New pavement
General concrete pavement
Land acquisition
SA kerb-195m
SF kerb-5m
Proposed boundary
Title boundary
Gas
Hydrant
Stop valve
Telstra sump
Signals
Drainage pits
Telstra pits
PRELIMINARY DRAWING FOR DISCUSSION PURPOSES ONLY
ROADS AND TRAFFIC AUTHORITY OF NSW
PARRAMATTA COUNCIL AREA GREAT WESTERN HIGHWAY - HW5
CHURCH STREET AND PARKES ST, PARRAMATTA
ADDITIONAL RIGHT TURN LANE
INTO PARKES STREET
01 sheet-Opt 2.dgn
24 H-13
0005.354.CD.0002

Appendix G

Traffic signal modifications

Proposed traffic signal changes for Scenario 3: 2012 base plus Westfield extension traffic, car park upgrades, planned intersection upgrades and proposed intersection upgrades

AM Peak

Intersection	Overall Changes	Phase Changes	Phases to be adjusted			Intersection Diagram
Great Western Highway - Church Street	- Overall 14 Second increase for the northbound ahead/left turn movement - Overall 7 seconds increase for southbound ahead/left turn movement - Overall 7 seconds decrease for northbound right turn and westbound left turn - Overall 14 seconds decrease for southbound right turn	Phase A = +7 s Phase B = +7 s Phase F = -14 s	 A	 B	 F	
Church Street - Campbell Street	-Overall 8 increase on Church Street movements -Overall 8 Seconds decrease on Campbell Street movements	Phase A = +8 s Phase B = -7 s	 A	 B		
Marsden Street - Great Western Highway	- Overall 10 seconds decrease on Great Western Highway eastbound ahead/left turn movement - Overall 10 seconds decrease on Great Western Highway westbound ahead/left turn movement - Overall 5 seconds increase for ahead/right turn movements on Marsden Street northbound - Overall 5 seconds increase for westbound and eastbound right turn movement -Overall 5 seconds increase on southbound left turn movement on Marsden Street -Overall 10 seconds increase on northbound left urn on Marsden Street	Phase A = -10 s Phase E = +5 s Phase F = +5 s	 A	 E	 F	

PM Peak

Intersection	Overall Changes	Phase Changes	Phases to be adjusted			Intersection Diagram
Marsden Street - Great Western Highway	- Overall 9 seconds decrease on Great Western Highway eastbound ahead/left turn movement - Overall 7 seconds decrease on Great Western Highway westbound ahead/left turn movement - Overall 9 seconds increase for southbound left turn - Overall 9 seconds increase for westbound right turn - Overall 7 seconds increase for eastbound right turn movement - Overall 7 seconds increase for northbound left turn movement	Phase A = -9 s Phase C = +2 s Phase F = +7 s	 A	 C	 F	

Appendix H

RMS model review and Parsons Brinckerhoff response

Transport
Roads & Maritime
Services

16 April 2013

RMS Ref: SYD10/00689/02
Your Ref: MP10_0068

Director, Metropolitan & Regional Projects south
Department of Planning & Infrastructure
GPO Box 39
SYDNEY NSW 2001

Attention: Matthew Rosel

Dear Sir/Madam

EXHIBITION OF ENVIRONMENTAL ASSESSMENT FOR THE DEVELOPMENT OF WESTFIELD SHOPPING CENTRE, PARRAMATTA

Reference is made to Department's letter dated 18 January 2013, regarding the abovementioned Application which was referred to Roads and Maritime Services (RMS) for comments.

RMS has reviewed the submitted information and provides the following comments for Department's consideration:

1. RMS does support the proposed reduced parking for the development as the site is next to existing public transport interchange.

2. RMS identified a number of deficiencies in the traffic modelling that support the proposed development. These deficiencies are listed in the Attachment A.

   The applicant is to address all the issues raised in the attachment. Furthermore, the revised modelling should as a minimum have the following three scenarios:

   - 2012 Existing traffic without the proposed development;
   - With the proposed development and no network improvements (the year should be expected year for the completion of the development not 2012;
   - With the proposed development and with the network improvement required to mitigate the impacts of the developments

   The report should include concept plans for any identified improvement works. Future year modelling should include all known development in the vicinity and background traffic growth.

3. All works signage associated with the proposed development are to be at no cost to RMS.

Any inquiries in relation to this development application can be directed to Pahee Sellathurai on 8849 2219.

Yours faithfully

Owen Hodgson
Senior Land Use Planner
Transport Planning, Sydney Region

Attachment A

***Major non-conformance**: Both time step detail and mean driver reaction time have been modified outside of the RMS standards for urban congested networks. This has the effect of making simulated drivers more responsive and increasing the general capacity of the network.*

***Minor non-conformance**: The 40 km/hr school zone in the vicinity of Parramatta High School has not been coded in the morning peak period.*

***Minor non-conformance**: Next lane rules through intersections should be changed from default coding unless they reflect on site conditions.*

***Major non-conformance**: Signal phasing for the intersection of Church Street, Great Western Highway and Parkes Street has been coded incorrectly with gap-out phases coded in the incorrect order. It is recommended that gap-out logic be coded at this intersection to more accurately model the gapping-out of diamond phase as critical intersections.*

***Minor non-conformance**: Spot check of bus routes identified that many stop dwell times are based on passenger frequencies with very low passenger demands.*

***Minor non-conformance**: Very low reaction factors are used on O'Connell Street and no documentation of these changes is made in accompanying modelling report.*

***Minor non-conformance**: Travel time and queue length comparisons are not documented in the main body of the Traffic Modelling Report; the report should be updated to provide these comparisons and discuss any differences between observed and modelled conditions.*

***Minor non-conformance**: Release profiles should be replaced with plots of network vehicle load to provide an indication of model stability.*

***Minor non-conformance**: the validation section of the modelling report should be updated to address discrepancies in the observed and modelled travel time comparisons.*

***Major non-conformance**: traffic generation figures provided in the Traffic Impact Study are not internally consistent and do provide sufficient detail regarding the source and method by which this traffic generation has been calculated. Additional detail should be provided to identify the source for various rates used and how they have been used to arrive at the reported traffic generation.*

***Major non-conformance**: traffic modelling has not taken into account the cumulative impacts of the proposed development in combination with other developments in the Parramatta CBD that may also generate traffic at the time the Westfield expansion is complete. The model should be updated to include approved developments and some estimate of regional traffic growth to demonstrate that the road network will function acceptable when the expansion is complete.*

***Major non-conformance**: traffic modelling of the future development scenarios does not clearly demonstrate the impact of the proposed development or the benefit of identified improvement works, particularly in the critical evening peak period. Further testing should be undertaken to clearly demonstrate the impact of the proposed development and the identified mitigation measures.*

Parsons Brinckerhoff Australia Pty Limited

ABN 80 078 004 798

Level 27 Ernst & Young Centre
680 George Street, Sydney NSW 2000
GPO Box 5394
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Memo

Date 24 May 2013

To Tim Rogers

From Graeme Inglis

Ref 2108370A-MO_3519

Subject Responce to RMS

1. Response to RMS comments

Further to the RMS letter we have responded to the issues raised by RMS in their letter of 16 April 2013 (Appendix A). Parsons Brinckerhoff discussed the issues findings with GHD who undertook the model audit on behalf of RMS. This memo outlines our responses to the issued raised and outlines the changed made to the modelling. The main modelling report has been updated to reflect the changes made.

1. ***Major non-conformance:*** *Both time step detail and mean driver reaction time have been modified outside of the RMS standards for urban congested networks. This has the effect of making simulated drivers more responsive and increasing the general capacity of the network.*

   Parsons Brinckerhoff response - While the RMS guidelines recommend a time step parameter of 2, the same guidelines also state that there are some benefits of increasing the number of time steps, particularly on larger models. '*Generally a time step parameter of 2 should be used as the default. However, there may be some benefits in increasing the time step value in larger models*', (Page 58, Section B.3). Therefore the time step parameter does not fall under the "*Should NOT be changed*" category but the '*May be altered to suit each model'* (Also See Page 99).

   A time step value of 5 has been adopted and speed memory and mean reaction times have been adjusted to reflect the adjusted time step (as recommended in the RMS Guidelines, Page 58). These were adjusted as part of the model calibration process to reflect the observed traffic conditions. The RMS guidelines also show that the mean reaction time '*May be altered to suit each model'* (Page 99).

   In addition the Quadstone Paramics Manual, states that the mean driver's reaction time must be adjusted to ensure driver reaction time is inside the time span stored by the leading vehicle. The mean driver reaction has been also adjusted in order to control any shockwave phenomenon associated with traffic flow and ensure drivers late reaction is not causing over reaction.

   Additionally, according to the Paramics Knowledge Base '*The default value of 1 second has been validated in studies throughout the initial Paramics development, however it is recognized that there are very different traffic flow conditions worldwide and it is recommended that the default value be used as an initial value and then altered as part of the calibration process if required'.*

A time step value of 5 has been used in all modelling scenarios in order to provide a like for like comparison between models.

Additional text has been added to the model development report (Section 3.2) to explain why the time step detail was changed in this instance.

2. ***Minor non-conformance:*** *The 40 km/hr school zone in the vicinity of Parramatta High School has not been coded in the morning peak period.*

   Parsons Brinckerhoff response - Due to high levels of congestion within the model, vehicle speeds are generally under 40 km/hr at this location during the AM peak, so no material difference is expected within the model. However the speed limits have been adjusted in the Base models and all subsequent runs. (See Section 2.4.5 for more detail).

3. ***Minor non-conformance:*** *Next lanes through intersections should be changed from default coding unless they reflect on site conditions.*

   Parsons Brinckerhoff response - All next lane rules have been carefully adjusted to reflect observed conditions. Some next lanes have been altered following discussions with GHD.

4. ***Major non-conformance:*** *Signals Phasing for the intersection of Church Street, Great Western Highway and Parkes Street has been coded incorrectly with gap-out phases coded in the correct order.*

   Parsons Brinckerhoff response – The phasing at this intersection has been changed so that the gap out stage occurs after the diamond stage.

5. ***Minor non-conformance:*** *Spot Check of bus routes identified that many stop dwell times are based on passenger frequencies with very low passenger demand.*

   Parsons Brinckerhoff response - No bus patronage surveys were undertaken as part of the survey programme so estimated figures were adopted (patronage surveys are generally not undertaken for this type of modelling unless specifically modelling detailed bus operations). Increasing passenger demand is unlikely to materially change the model calibration of traffic impact results. Also, because the buses have been modelled the same in all scenarios the traffic impacts resulting from the development will not be affected by the bus operations.

6. ***Minor non-conformance:*** *Very low reactions factors are used on O'Connell Street and no documentation of these changes is made in accompanying model report.*

   Parsons Brinckerhoff response - Local reaction time adjustments are applied to reflect observed environment conditions. This has now been flagged in Section 3.2 of the modelling report.

   Note that the Base models were updated to reflect the comments raised by GHD and the re-run. The model calibration and validation results have been updated accordingly. The changes made to the models have a negligible impact effect on the model calibration and validation results.

7. ***Minor non-conformance:*** *Travel time and queue comparisons are not documented in the main body of the Traffic Modelling Report; the report should be updated to provide these comparisons and discuss any differences between observed and modelled conditions.*

   Parsons Brinckerhoff response - Further discussion and analysis in relation to queue length calibration and travel time validation has been added to the modelling report. (See sections 3.3 and 3.5.).

8. ***Minor non-conformance:*** *Release profiles should be replaced with plots of network vehicle loads to provide an indication of model stability.*

   Parsons Brinckerhoff response – Release out profiles are an alternative way of assessing model stability. If the model was unstable and congestion extended back into the zones, then the release out values would vary between model runs.

9. ***Minor non-conformance:*** *The validation Section of the modelling report should be updated to address discrepancies in observed and modelled travel time comparisons.*

   Parsons Brinckerhoff response - Further discussion and analysis in relation to travel time validation has been added to the modelling report. (See section 3.5).

10. **Major non-conformance:** traffic generation figures provided in the Traffic Impact Study are not internally consistent and do provide sufficient detail regarding the source and method by which this traffic generation has been calculated.

    Parsons Brinckerhoff response – CBHK provided Parsons Brinckerhoff with trip generation rates for the modelling. CBHK to respond.

11. **Major non-conformance:** Traffic modelling has not taken into account the cumulative impacts of the proposed development in combination with other developments in the CBD.

    Parsons Brinckerhoff response – The modelling has been updated to assess the cumulative impacts of other developments and background growth within Parramatta.

12. **Major non-conformance:** traffic modelling of the future development scenarios does not clearly demonstrate the impact of the proposed development of the benefit of identified improvement works, particularly in the critical evening peak. Further testing should be undertaken to clearly demonstrate the impact of the proposed development and identifier mitigation measures.

    Parsons Brinckerhoff response – The modelling has been updated to assess the cumulative impacts of other developments and background growth within Parramatta.

Yours sincerely

Graeme Inglis

Parsons Brinckerhoff