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ST LEONARDS SOUTH

A REPORT ON TRAFFIC IMPACTS

OF LARGE-SCALE DEVELOPMENTS

ON PACIFIC HIGHWAY

Prepared for

Lane Cove Council

By

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Report Document Control

Title	ST LEONARDS SOUTH - A REPORT ON TRAFFIC IMPACTS OF DEVELOPMENTS ALONG PACIFIC HIGHWAY
Date	21 September 2017
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Client	Lane Cove Council
Job No.	16020
Quality Control Reviewer	I. Mileusnic
Keywords	Modelling/Aimsun//St Leonards/
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1 EXECUTIVE SUMMARY

1.1 Objective

- The purpose of this study is to provide a review and independent assessment of cumulative traffic impacts current proposal and other approved proposals within Lane Cove Council's portion of St Leonards. These proposals are located in:
  - St Leonards South (residential)
    1. St Leonards South Master Plan precinct (bounded by Pacific Highway, Greenwich Road, River Road and Rail line)
    2. Loftex development (1-25 Marshall Ave).
  - St Leonards East (commercial/mixed use)
    1. New Hope development (496-520 Pacific Highway)
    2. Winten development (71-79 Lithgow St and 82-90 Christie St)
    3. Mirvac development (472-494 Pacific Highway)

1.2 Findings

- Overall, this Study finds that traffic increases are very moderate for each of the development sites, especially where proposed developments are "replacing existing substantial buildings". "Levels of service remained essentially the same for all models" compared to a pre-development base (see Section 4).

1.3 Recommendations

- Modelling indicates that "relatively minor improvements" would be required to maintain satisfactory network function as a result of all development. Furthermore, these improvements (illustrated in Figure 4 on Page 9) would "be required regardless of the approved and proposed developments subject of this report".
- For the St Leonards South (residential) area, the recommended infrastructure improvements are:
  - Removal of the roundabout at the intersection of Marshall Ave/Berry Road and replace with a Give Way intersection, and
  - Provide a new road connection between Berry Road and Park Road.
- However it is recommended that the measure involving the proposed removal of the roundabout be further investigated in detail at the Development Application stage.
- For the St Leonards East (commercial/mixed use) area, no infrastructure improvements are recommended.

2 INTRODUCTION

2.1 Study Objective

- The purpose of this study is to provide a review and independent assessment of traffic impacts of current and approved proposals in the Lane Cove portion of St Leonards South and East precincts.
- Specifically, the report aims to address the cumulative impacts of current development in conjunction with other, approved, developments in the same area, namely
  - St Leonards South Master Plan development (Rezoning stage - Gateway Determination)
    - Proposed number of dwellings – 2,400 (assuming full development from Canberra Avenue up to Park Road)
  - Winten development (Rezoning stage - being finalised by State government)
    - 71 – 79 Lithgow St and 82 – 90 Christie St - 450 residential units & 7,760 m² commercial/retail area
  - Loftex development (DA stage - approved)
    - 15 - 25 Marshall Ave – 66 apartments & 105 m² commercial/retail area at the ground floor
    - 1-13 Marshall Ave - 269 apartments & 290 m² commercial/ retail space located on Level 1 (123 m²) and 3 (167 m²) of the high rise building
  - Mirvac development (DA stage - approved)
    - 472-494 Pacific Hwy – 539 apartments & 8,263 m² of specialty retail and restaurant/cafe tenancies
  - New Hope & VIMG development (DA stage - awaiting final determination)
    - 496-504 Pacific Highway - 495 apartments & 5,628 m² of commercial floor space

2.2 History of assessments and modelling approach

- Previously, a microsimulation model was developed by GTA Consultants to examine new large scale developments and the impacts the additional traffic may have on the surrounding road network (**GTA model**). The GTA model utilised Paramics microsimulation software package.
- The GTA model was approved by RMS as "fit for purpose", although it had some issues, namely fixed traffic signal phasing and limited representation of pedestrian movements. The GTA model was calibrated and validated against a set of data, containing intersection traffic counts and results of travel time and queue length surveys.
- The GTA model was further developed by Transport Modellers Alliance (TMA). TMA explored various development scenarios for St Leonards South on behalf of Lane Cove Council.
- Initially, TMA used the GTA model as a base model and added various developments to create the **TMA Base Model 2021** with
  - approved developments under LEP 2009
  - general network traffic growth and

        - developments as per the St Leonards South Master Plan bounded by rail line/Marshall Ave/River Rd/Berry Rd
    - The TMA Base Model 2021 is essentially the GTA Model with additional future traffic.
    - This TMA Base Model 2021 was then used to test impacts of a number of the recently proposed (some of them now approved) developments along Pacific Hwy (**Site A** = 84-90 Christie St/ 75-79 Lithgow St and **Sites B & C** = 472-520 Pacific Highway).
    - The final model, described in TMA report dated 11 September 2015, may be called, for easier reference, **TMA Base Model 2021+ABC** (refer to **Appendix A** for a copy of the TMA report).
- Due to a number of reasons, one of them being issues that RMS had with trip generation rates and modelling results for TMA Model 2021+ABC, Council has decided to engage an independent modelling firm (TEF Consulting) to revisit TMA Model 2021+ABC.
    - Refer to **Appendix A** for a copy of the RMS letter with regard to the TMA report of 11 September 2015.
- Given the issues with GTA Model and TMA models based on GTA model previously, TEF approach was to replicate GTA Model in Aimsun environment and then to add on traffic volumes to develop 2021 TEF Base and TEF 2021+ABC models in Aimsun instead of Paramics.
- The Aimsun version of the GTA model, **TEF Base** 2013 model, was built using the trip (OD) matrices from the GTA model, with the road geometry, traffic signal programming and public transport (PT) coded from the beginning.
    - TEF Base 2013 was then calibrated and validated using the same data that was used for calibration and validation of the GTA Model.
        - It was agreed between RMS and Council that no new (2016) traffic surveys were to be undertaken and it was acceptable for the TEF Base model to be an Aimsun replica of the Paramic based GTA Model, that is calibrated on 2013 survey data.
    - TEF Base model was subsequently approved as fit-for-purpose by RMS.
    - Details of the TEF Base model are described in the calibration report, a copy of which is attached in **Appendix B**.
    - The decision to move to Aimsun environment has provided an opportunity to improve network representation (actuated traffic signals instead of fixed signals and more detailed pedestrian and PT modelling) and to establish a better base for the model use and expansion in the future.

3 MODELLING SPECIFICATIONS

3.1 Model Study Area

- Refer to **Figure 1**

Figure 1: Study area.

3.2 Software

- Aimsun v.8.07
  - Microsimulation model

3.3 TEF Base Model 2013

- Refer to the TEF Calibration report in Appendix B for a detailed description of the TEF Base (2013) model

3.3.1 Zoning System

- The Base model adopted the zoning system used in GTA Model (same system was also used in TMA models)
  - Refer to **Figure 4**
- 36 zones in total

Figure 2: Model zoning system – Base model 2013.

3.3.2 Demand (OD) Matrix

- The demand matrix was imported from the Paramics model developed by GTA Consultants

3.4 TEF Base Model 2021

3.4.1 Zoning System

- TEF Base model 2021 adopted the zoning system used in TMA Base Model 2021
  - Refer to **Figure 3**
- 56 zones in total
  - Additional zones were introduced to account for LEP 2009 growth, St Leonards South Master Plan and new developments A, B & C (refer to Section 1.2 of the present report) and also Loftex (Marshall Ave, **Site L**) sites.

3.4.2 Demand (OD) Matrix

- TEF Base model 2021 adopted the trip matrices used in TMA Base Model 2021 with the following trip generators/attractors and changes.
  - **LEP Growth** – imported from TMA model,
    - except Site L, where the following changes were made
      - Trip generation was adjusted to account for the actual approved number of residential units (335) as opposed the number used in the DA report (271 units) prepared by Traffix (report Reference: 11.066r03v03)

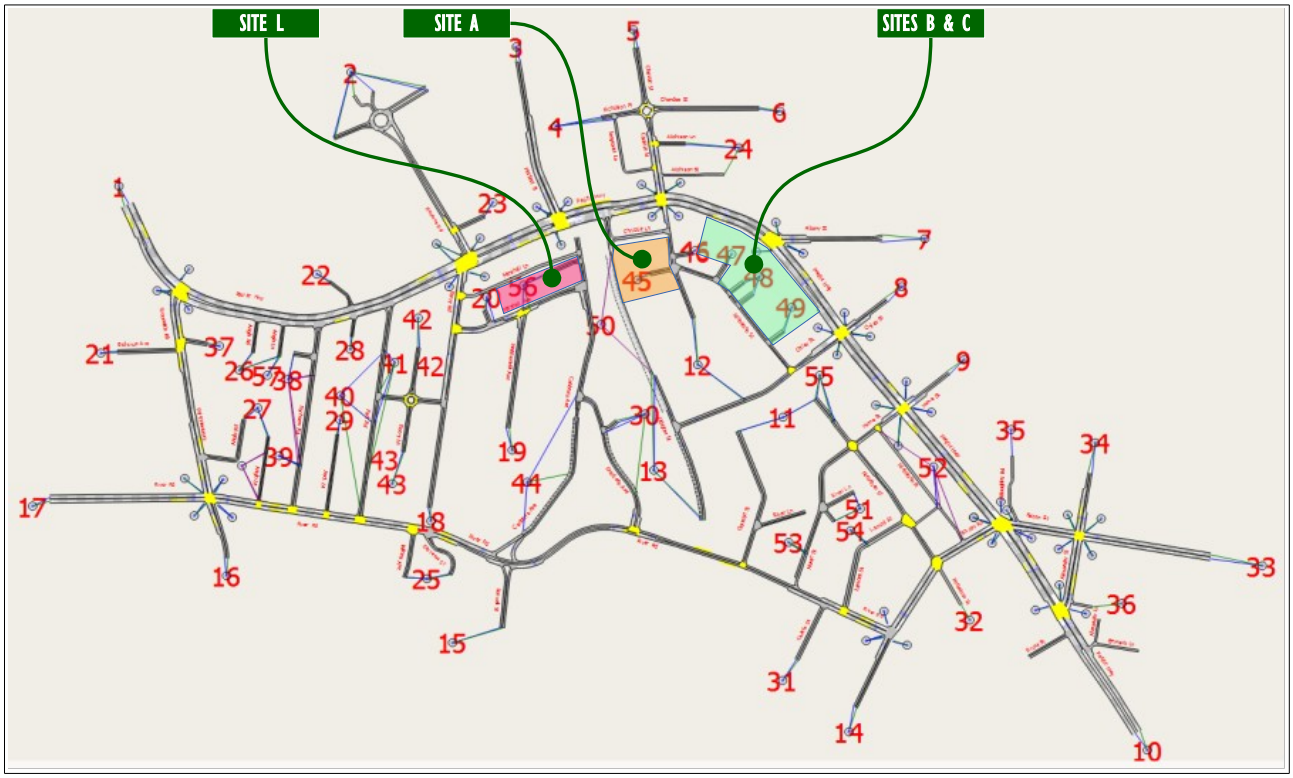


Figure 3: Model zoning system – Base model 2021.

- Peak hour trip rates were adopted from the Traffix report.
  - These rates are the same as in the RMS request as detailed in a letter dated 04 January 2016, that is 0.14 trips per dwelling (AM peak) and 0.07 trips per dwelling (PM peak)
- Trip distribution was based on the 2011 Journey to Work data (TZ 1832)
  - Percentage of origin and destination suburbs for driver travel mode were extracted for each suburb and the aggregated by general direction.
  - For the OD centroids (Aimsun name for "nodes" in Paramics), distribution was then carried out having regard to the actual traffic flow by connection.
    - Refer to **Appendix C** for calculation spreadsheets.

- **Growth on RMS network** – imported from TMA model
- **St Leonards South Master Plan**
  - Trip generation – corrected as follows
    - Number of dwellings was changed from 2,200 (TMA) to 2,400 (as per the latest Council's advice)
      - Note that the addition of 650 dwellings described in TMA report is no longer pursued.
    - Peak hour trip rates were adopted from the RMS request as detailed in a letter dated 04 January 2016, that is 0.14 trips per dwelling (AM peak) and 0.07 trips per dwelling (PM peak)
      - Increased from TMA rates of 0.07 (AM) and 0.06 (PM) trips per dwelling.

- Trip distribution was based on the 2011 Journey to Work data (TZ 1832)
  - Same as for Site L
    - Refer to **Appendix C** for calculation spreadsheets.

3.5 TEF Model 2021 +ABC

3.5.1 Demand (OD) Matrix

- Trip generation
  - Site A
    - Winten development
    - 71 – 79 Lithgow St and 82 – 90 Christie St - 450 residential units & 7,760 m² commercial/retail area
      - Trip generation was adopted from the DA report prepared by Colston Budd Hunt and Kafes Pty Ltd (report reference: 9351/3 dated December 2014)
  - Site B
    - Mirvac development
    - 472-494 Pacific Hwy – 539 apartments & 8,263 m² of specialty retail and restaurant/cafe tenancies
      - Trip generation was adopted from the DA report prepared by Calibre Consulting (report reference: 15-002041 dated 07/08/2015), with the following changes
        - The number of residential units was changed from 535 units (report) to 539 (approved)
        - The floor area for commercial/retail/supermarket tenancies was changed from 6,494 m² (report) to 8,263 m² (approved)
        - Peak hour trip generation rates for residential units were adopted from the RMS request as detailed in a letter dated 04 January 2016, that is 0.14 trips per dwelling (AM peak) and 0.07 trips per dwelling (PM peak)
          - Increased from Calibre Consulting rates of 0.07 (AM) and 0.06 (PM) trips per unit.
  - Site C
    - New Hope & VIMG development
    - 496-520 Pacific Hwy, St Leonards – 495 apartments and 5,628 m² of commercial floor space.
      - Trip generation was adopted from the DA report prepared by Colston Budd Hunt and Kafes Pty Ltd (CBHK) (report reference: 9923/3 dated December 2015)
        - Peak hour trip generation rates for residential units were adopted from the RMS request as detailed in a letter dated 04 January 2016, that is 0.14 trips per dwelling (AM peak) and

0.07 trips per dwelling (PM peak)

- Decreased from CBHK rates of 0.15 (AM) and 0.19 (PM) trips per unit.

- Trip distribution for all sites A, B, C and L was based on the 2011 Journey to Work data (TZ 1832)
  - Same as for Site L and St Leonards South Master Plan
    - Refer to **Appendix C** for calculation spreadsheets.

3.6 Model runs

- For each development scenario, the respective models had 5 microsimulation replications (runs) carried out for the morning peak and 5 for the afternoon peak.
- Sets of seed numbers were the same for all model scenarios.
  - Seed numbers were set as per the RMS Traffic Modelling Guidelines.
- Analysis of the results was performed on averages calculated for 5 replications in each instance.

4 MODELLING RESULTS

4.1 TEF Base Model 2021

- This model comprises a calibrated 2013 network with new OD matrices to create a 2021 base traffic situation.
    - The OD matrices were imported from TMA models accepted by RMS previously, with the changes as described in **Section 2.4.2** of the present report.
        - Changes of trip generation introduced by TEF were based on trip rates requested by RMS.
        - These changes resulted in higher traffic generation in some areas compared with the previous TMA models.
        - TEF model, therefore, considers the same or worse conditions compared with those estimated by TMA previously.
- The initial runs of the model indicated substantial deterioration of the operation of certain intersections and road links.
    - Capacity constraints resulted in some microsimulation runs coming to a halt due to interlocking blockages in the system. Because of this situation, average delays and other parameters for network operation assessment could not be extracted.
- A range of measures have been introduced to achieve satisfactory performance of the majority of the links and intersection on the network, before proceeding with loading of additional traffic from the new large-scale developments.
        - These measures are detailed in **Figure 4** overleaf.
        - One particular measure involved replacement of the existing roundabout at the intersection of Marshall Ave and Berry Rd with a priority control intersection.
            - This measure was necessary to unlock the gridlock occurring during the microsimulation process. Queuing extending to the south from the intersection of Pacific Hwy and Berry Rd consistently blocked the roundabout, thus not letting vehicles from Marshall Ave to exit. Conversion of this intersection into a Give Way control resolved this issue.
            - It is noted that this appears to be an issue with the simulation of the roundabout operation (due to limitations of modelling software) rather than the actual capacity issues. Following a discussion of this matter with an RMS modeller, it was agreed to adopt this change of intersection control for modelling purposes as this change was minor in terms of the overall model and did not impact on modelling results for critical road links and intersections.
            - However, it is recommended that the above issue be further investigated separately, as it falls outside of the scope of the current report. The temporary solution introduced by TEF for the modelling purposes only served the purpose of unlocking the model to enable unhindered assessment of the larger network and main roads specifically.
        - The base cycle time was increased compared with the Base 2013 model (135 to 150 seconds).
        - Other measures were generally of minor nature and did not involve infrastructure modifications.

- After the proposed measures, the network operated in a stable manner with acceptable operational parameters. This scenario was regarded as a suitable base case for assessment of the proposed large scale developments.
- **Table 3.1** shows results of modelling. Detailed results are contained in **Appendix D**, together with definitions of Level of Service parameter used in **Table 3.1.**

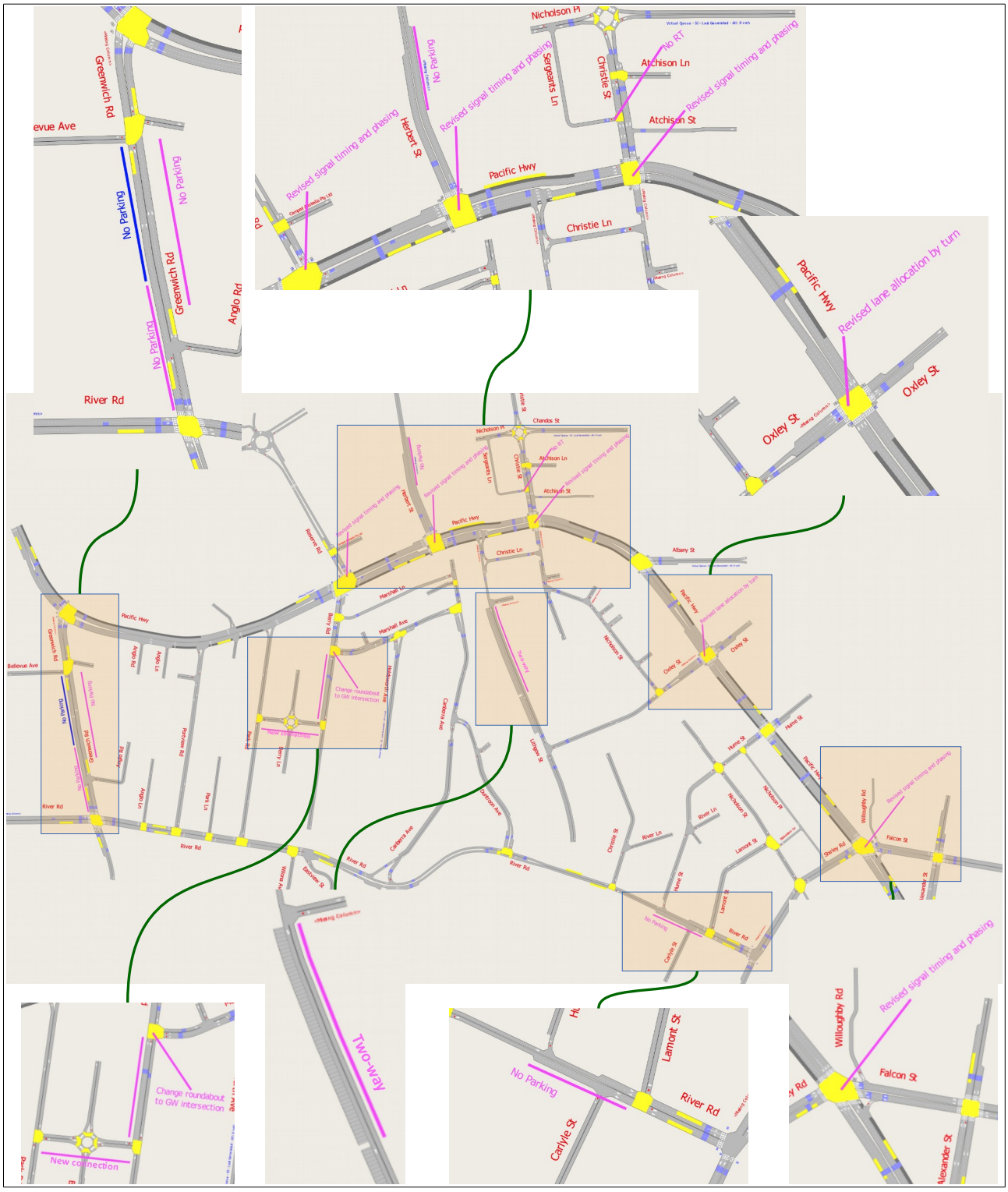


Figure 4: Proposed network improvements for Base Model 2021.

- The results contained in **Table 3.1** generally indicate better delays and levels of

service at key intersection compared with those reported by TMA (refer to Appendix A) from the Paramics model. In our opinion, this is likely to be due to the use of adaptive, rather than fixed, traffic signals and thus better propagation of traffic between the intersections, as well as due to some network improvements described earlier.

- Following Council's request, the impacts of Site L were analysed prior to the assessment of sites A, B and C. The results included in Table 3.1 are for the full Base Model 2021, inclusive of Site L. **Table 3.1a** contains modelling results prior to introduction of Site L for comparison. As may have been expected, the differences in delays and queuing are minor and generally fluctuate up and down compared with the full Base Model 2021.

Table 3.1. Intersection operation - Base Model 2021.

Morning peak

Base Model 2021	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1513	16.4	9.4				1210	19.3	9.8	381	27.9	9.0	18.9	B
Pacific Hwy / Shirley Rd/Falcon St	1623	44.5	23.6	553	41.5	6.4	919	23.4	7.0	980	26.5	11.0	35.0	C
Pacific Hwy / Hume St	1585	15.6	10.2	257	61.4	9.2	1362	22.0	12.6	196	122.9	6.8	27.8	B
Pacific Hwy / Oxley St	1644	6.3	5.4	183	53.2	3.6	1496	5.2	4.4	180	54.9	5.4	10.8	A
Pacific Hwy / Albany St	2057	16.8	14.0				1342	13.6	4.4	620	80.4	13.2	25.5	B
Pacific Hwy / Christie St	585	51.9	9.8	2640	17.5	15.2	137	0.9	0.0	1750	16.8	11.2	20.7	B
Pacific Hwy / Herbert St	709	64.8	18.8	2364	21.2	11.6				2177	15.4	4.2	24.7	B
Pacific Hwy / Reserve Rd/Berry Rd	169	44.2	6.6	1981	29.7	15.6	526	59.9	9.6	1891	13.1	7.6	26.8	B
Pacific Hwy / Greenwich Rd				1723	10.2	7.8	584	54.5	10.0	1868	17.7	11.0	19.7	B
Shirley Rd / River Rd	587	36.4	13.4	1221	17.6	8.8	192	30.0	4.4				24.3	B
River Rd / Greenwich Rd	482	53.3	7.0	1601	54.9	33.4	312	86.1	8.8	641	50.0	8.8	56.8	E

Afternoon peak

Base Model 2021	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1170	11.2	6.4				1404	19.0	10.8	288	23.1	6.8	16.3	B
Pacific Hwy / Shirley Rd/Falcon St	1274	41.3	20.4	723	36.3	6.6	1119	27.9	10.0	930	22.4	10.2	32.4	C
Pacific Hwy / Hume St	1255	14.4	8.6	195	60.5	8.8	1157	18.4	11.4	159	82.8	5.8	23.2	B
Pacific Hwy / Oxley St	1256	5.6	3.8	319	104.9	6.8	1238	5.2	5.0	160	59.5	5.2	19.0	B
Pacific Hwy / Albany St	1531	9.0	8.4				1276	12.1	4.4	560	62.4	12.6	19.0	B
Pacific Hwy / Christie St	360	42.8	8.0	1977	9.7	9.0	68	0.9	0.0	1676	13.6	10.8	14.1	A
Pacific Hwy / Herbert St	858	60.5	21.0	1563	20.2	8.2				2059	16.3	5.0	26.1	B
Pacific Hwy / Reserve Rd/Berry Rd	258	41.6	7.8	1402	22.2	10.4	204	53.7	5.8	1948	9.8	6.4	18.9	B
Pacific Hwy / Greenwich Rd				1411	6.5	4.2	268	63.4	8.6	1717	16.7	10.2	16.1	B
Shirley Rd / River Rd	856	28.2	14.8	818	17.2	7.8	384	36.4	7.8				25.4	B
River Rd / Greenwich Rd	422	63.6	7.2	942	20.5	14.6	239	80.0	7.6	1175	27.0	8.4	34.9	C

Table 3.1a. Intersection operation - Base Model 2021 without Site L.

Morning peak

Base Model 2021 – L	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1501	16.2	9.4				1220	16.4	9.2	378	29.0	9.0	17.9	B
Pacific Hwy / Shirley Rd/Falcon St	1616	44.8	25.0	556	40.7	6.4	942	25.0	7.2	969	25.0	10.8	35.0	C
Pacific Hwy / Hume St	1586	16.1	10.6	250	56.5	8.6	1392	22.0	12.2	196	106.1	6.8	26.6	B
Pacific Hwy / Oxley St	1646	6.6	5.0	183	53.7	3.8	1524	6.1	5.2	180	54.6	5.4	11.2	A
Pacific Hwy / Albany St	2034	16.9	12.0				1296	12.9	5.0	624	78.3	13.6	25.3	B
Pacific Hwy / Christie St	583	51.9	9.6	2625	16.9	15.8	126	0.9	0.0	1714	16.7	12.0	20.4	B
Pacific Hwy / Herbert St	706	57.1	17.4	2358	20.7	12.0				2209	16.0	4.6	23.6	B
Pacific Hwy / Reserve Rd/Berry Rd	185	42.0	6.4	1972	30.5	16.0	509	55.0	9.2	1909	13.1	7.2	26.4	B
Pacific Hwy / Greenwich Rd				1716	10.1	7.4	557	55.3	9.8	1863	16.5	10.2	19.1	B
Shirley Rd / River Rd	555	36.4	13.6	1220	17.4	8.2	193	27.7	4.4				23.8	B
River Rd / Greenwich Rd	486	53.1	7.6	1598	53.5	32.0	311	88.6	9.0	615	52.4	9.0	56.8	E

Afternoon peak

Base Model 2021 – L	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1137	11.7	6.4				1346	18.3	10.6	279	22.4	6.6	16.0	B
Pacific Hwy / Shirley Rd/Falcon St	1268	41.4	20.8	705	37.8	6.4	1081	27.2	9.4	923	20.4	10.0	32.0	C
Pacific Hwy / Hume St	1247	13.7	7.8	193	66.0	8.2	1119	17.9	10.8	159	86.3	6.0	23.4	B
Pacific Hwy / Oxley St	1244	5.9	4.0	314	94.4	6.8	1197	5.0	5.0	160	59.5	5.2	18.0	B
Pacific Hwy / Albany St	1524	9.0	8.2				1243	12.5	4.6	564	61.2	13.0	19.1	B
Pacific Hwy / Christie St	358	42.6	8.4	1959	9.8	8.8	66	1.3	0.2	1642	14.1	10.6	14.4	A
Pacific Hwy / Herbert St	850	54.7	18.6	1550	20.1	8.2				2013	16.0	5.4	24.9	B
Pacific Hwy / Reserve Rd/Berry Rd	257	42.9	8.4	1395	22.8	10.4	196	48.0	5.8	1916	9.5	6.2	18.7	B
Pacific Hwy / Greenwich Rd				1389	6.8	4.4	279	62.6	8.6	1688	16.4	10.4	16.3	B
Shirley Rd / River Rd	864	29.6	15.2	798	17.1	7.6	384	39.5	7.8				26.6	B
River Rd / Greenwich Rd	438	64.2	7.4	938	20.4	15.4	239	76.4	7.8	1130	27.8	8.4	35.3	C

4.2 Model 2021+A

- This model comprises TEF Base Model 2021 plus additional traffic generated by Site A.
    - It is noted that the approved development on Site A replaces the existing commercial buildings with a total floor area of approximately 6,500 m² and its trip generation.
        - Trip generation for the respective OD centroid was reduced accordingly prior to overlaying additional trips from the proposed development.
    - Council's Development Control Plan for the 'Winten' site development envisages to close the existing Christie Lane to vehicular traffic. A 'new Christie Lane' would then be relocated to the south of the development site and be a 2 lane road. Council would also partially close the adjoining portion of Lithgow St to allow the development of its Over Rail Plaza. This was illustrated in the draft Voluntary Planning Agreement (reproduced in Figure 5 below). Aimsun model was amended to reflect this proposal (also shown in Figure 5).

Figure 5: Proposed network improvements for Base Model 2021+A.

4.3 Model 2021+AB

- This model comprises TEF Model 2021+A plus additional traffic generated by Site B.
    - It is noted that the approved development on Site B replaces the existing commercial & retail land uses with a total floor area of approximately 11,800 m² and their trip generation.
        - Trip generation for the respective OD centroid was reduced accordingly prior to overlaying additional trips from the proposed development.

4.4 Model 2021+ABC

- This model comprises TEF Model 2021+AB plus additional traffic generated by Site C.

- It is noted that the approved development on Site C replaces the existing commercial building with a total floor area of approximately 12,380 m² and its trip generation.
    - Trip generation for the respective OD centroid was reduced accordingly prior to overlaying additional trips from the proposed development.

4.5 Comparison of delays and queues

- **Tables 3.2** and **3.3** show the results of modelling for morning and afternoon peak hours respectively, for all of the above models for comparison. Detailed results are contained in **Appendix D**.
- The results of modelling for all development options, with consideration of subsequent cumulative impacts of each large development analysed in this study, are generally consistent with findings of the traffic impact assessment reports submitted for the respective development applications.
    - Primarily due to the fact that the proposed developments replace existing substantial buildings, traffic increases as a result were very moderate for each of the developments L, A, B and C and in some cases a reduction of trip generation resulted from the land use change.
        - Accordingly, although total traffic delays for the whole network generally increased with each additional development, some intersections even experienced slight improvements (due to traffic redistribution), whilst increased delays at other intersections were minor to moderate. Levels of Service remained essentially the same for all models.

4.6 Comparison of travel times

- **Figures 5** to **8** show the modelled travel times along the main routes for morning and afternoon peak hours, for all of the above models for comparison.

Table 3.2. Intersection operation – comparison of models – morning peak hour.

Base Model 2021	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1513	16.4	9.4				1210	19.3	9.8	381	27.9	9.0	18.9	B
Pacific Hwy / Shirley Rd/Falcon St	1623	44.5	23.6	553	41.5	6.4	919	23.4	7.0	980	26.5	11.0	35.0	C
Pacific Hwy / Hume St	1585	15.6	10.2	257	61.4	9.2	1362	22.0	12.6	196	122.9	6.8	27.8	B
Pacific Hwy / Oxley St	1644	6.3	5.4	183	53.2	3.6	1496	5.2	4.4	180	54.9	5.4	10.8	A
Pacific Hwy / Albany St	2057	16.8	14.0				1342	13.6	4.4	620	80.4	13.2	25.5	B
Pacific Hwy / Christie St	585	51.9	9.8	2640	17.5	15.2	137	0.9	0.0	1750	16.8	11.2	20.7	B
Pacific Hwy / Herbert St	709	64.8	18.8	2364	21.2	11.6				2177	15.4	4.2	24.7	B
Pacific Hwy / Reserve Rd/Berry Rd	169	44.2	6.6	1981	29.7	15.6	526	59.9	9.6	1891	13.1	7.6	26.8	B
Pacific Hwy / Greenwich Rd				1723	10.2	7.8	584	54.5	10.0	1868	17.7	11.0	19.7	B
Shirley Rd / River Rd	587	36.4	13.4	1221	17.6	8.8	192	30.0	4.4				24.3	B
River Rd / Greenwich Rd	482	53.3	7.0	1601	54.9	33.4	312	86.1	8.8	641	50.0	8.8	56.8	E

Base Model 2021 + A	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1520	17.2	9.2				1229	17.8	9.6	391	29.3	9.4	18.9	B
Pacific Hwy / Shirley Rd/Falcon St	1663	49.4	24.0	557	42.2	6.4	968	25.9	7.8	976	27.5	10.8	37.8	C
Pacific Hwy / Hume St	1633	17.0	10.6	254	61.0	9.4	1404	21.2	12.6	196	129.9	6.4	28.3	B
Pacific Hwy / Oxley St	1663	6.0	4.4	284	54.3	4.8	1542	5.5	4.8	172	55.8	5.8	11.9	A
Pacific Hwy / Albany St	2062	15.8	11.6				1485	15.6	5.8	621	81.2	13.6	25.5	B
Pacific Hwy / Christie St	601	52.2	10.2	2685	18.2	15.2	175	0.8	0.0	1891	17.8	14.2	21.3	B
Pacific Hwy / Herbert St	709	75.2	22.2	2423	22.0	12.4				2227	15.4	5.2	26.3	B
Pacific Hwy / Reserve Rd/Berry Rd	163	41.0	6.2	2122	31.4	17.0	460	53.6	9.0	1965	12.9	7.6	26.2	B
Pacific Hwy / Greenwich Rd				1727	12.1	7.8	714	56.5	10.0	1896	18.9	10.4	22.4	B
Shirley Rd / River Rd	590	35.1	13.2	1211	18.0	8.8	190	25.4	3.8				23.8	B
River Rd / Greenwich Rd	469	55.1	7.2	1598	49.5	33.2	305	76.1	8.6	651	49.4	8.2	53.0	D

Base Model 2021 + AB	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1561	17.8	9.8				1221	16.4	8.4	369	27.9	9.6	18.4	B
Pacific Hwy / Shirley Rd/Falcon St	1721	47.9	26.6	588	40.0	6.6	938	25.4	8.2	987	28.6	11.4	37.3	C
Pacific Hwy / Hume St	1696	20.7	12.8	263	64.8	9.2	1410	21.4	12.6	180	108.0	6.8	28.7	C
Pacific Hwy / Oxley St	1673	7.2	5.4	370	54.0	6.2	1555	5.9	5.6	153	57.0	5.6	13.3	A
Pacific Hwy / Albany St	2068	15.4	11.2				1513	16.3	6.0	596	69.8	13.0	23.5	B
Pacific Hwy / Christie St	660	58.4	10.2	2731	19.0	15.4	188	0.7	0.0	1902	17.3	12.6	22.6	B
Pacific Hwy / Herbert St	726	78.3	25.2	2459	23.9	12.6				2278	16.0	6.0	27.9	B
Pacific Hwy / Reserve Rd/Berry Rd	167	46.3	6.4	2150	33.0	16.2	460	64.8	8.6	1999	14.2	8.4	28.7	C
Pacific Hwy / Greenwich Rd				1753	11.1	7.2	695	56.0	10.0	1915	18.1	11.0	21.3	B
Shirley Rd / River Rd	567	35.9	13.0	1229	18.6	9.0	196	28.0	5.0				24.5	B
River Rd / Greenwich Rd	460	55.6	7.2	1612	53.9	33.6	307	81.1	9.0	656	49.9	8.0	56.1	D

Base Model 2021 + ABC	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1588	18.8	11.0				1248	21.6	9.0	392	30.1	10.2	21.2	B
Pacific Hwy / Shirley Rd/Falcon St	1710	51.7	25.6	601	39.7	6.4	958	24.3	7.4	945	29.1	11.0	38.7	C
Pacific Hwy / Hume St	1698	21.4	13.4	243	66.1	9.6	1372	21.5	12.4	187	119.4	6.6	29.8	C
Pacific Hwy / Oxley St	1654	7.6	7.2	377	56.3	6.4	1512	5.4	5.8	101	54.0	3.2	13.0	A
Pacific Hwy / Albany St	2047	15.1	10.6				1515	16.2	6.0	581	68.8	13.2	23.0	B
Pacific Hwy / Christie St	654	56.8	10.2	2737	19.9	15.6	152	0.6	0.2	1875	17.3	13.4	22.9	B
Pacific Hwy / Herbert St	702	69.6	21.2	2476	25.7	12.6				2282	16.2	5.6	27.4	B
Pacific Hwy / Reserve Rd/Berry Rd	166	48.1	6.8	2176	34.2	16.8	474	63.6	9.0	2004	13.8	8.8	29.1	C
Pacific Hwy / Greenwich Rd				1805	10.7	7.6	675	55.9	10.0	1939	19.1	11.0	21.3	B
Shirley Rd / River Rd	569	36.2	12.0	1244	17.6	8.6	199	31.3	4.2				24.2	B
River Rd / Greenwich Rd	452	56.0	7.4	1587	48.2	31.8	307	78.9	9.0	648	49.1	8.2	52.8	D

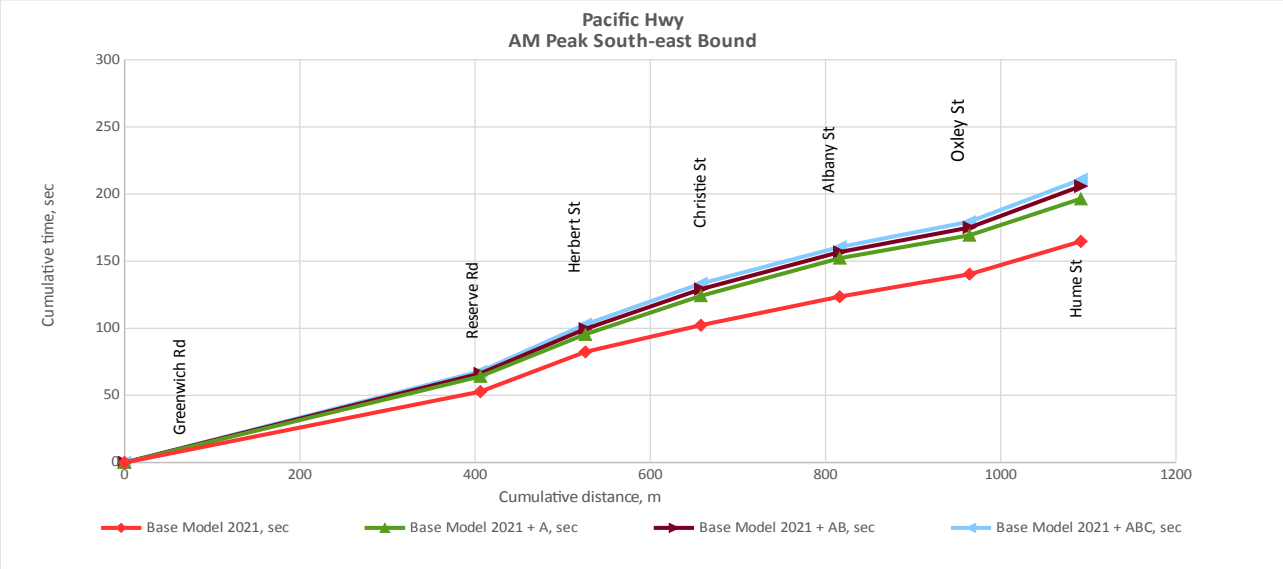
Table 3.3. Intersection operation – comparison of models – afternoon peak hour.

Base Model 2021	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1170	11.2	6.4				1404	19.0	10.8	288	23.1	6.8	16.3	B
Pacific Hwy / Shirley Rd/Falcon St	1274	41.3	20.4	723	36.3	6.6	1119	27.9	10.0	930	22.4	10.2	32.4	C
Pacific Hwy / Hume St	1255	14.4	8.6	195	60.5	8.8	1157	18.4	11.4	159	82.8	5.8	23.2	B
Pacific Hwy / Oxley St	1256	5.6	3.8	319	104.9	6.8	1238	5.2	5.0	160	59.5	5.2	19.0	B
Pacific Hwy / Albany St	1531	9.0	8.4				1276	12.1	4.4	560	62.4	12.6	19.0	B
Pacific Hwy / Christie St	360	42.8	8.0	1977	9.7	9.0	68	0.9	0.0	1676	13.6	10.8	14.1	A
Pacific Hwy / Herbert St	858	60.5	21.0	1563	20.2	8.2				2059	16.3	5.0	26.1	B
Pacific Hwy / Reserve Rd/Berry Rd	258	41.6	7.8	1402	22.2	10.4	204	53.7	5.8	1948	9.8	6.4	18.9	B
Pacific Hwy / Greenwich Rd				1411	6.5	4.2	268	63.4	8.6	1717	16.7	10.2	16.1	B
Shirley Rd / River Rd	856	28.2	14.8	818	17.2	7.8	384	36.4	7.8				25.4	B
River Rd / Greenwich Rd	422	63.6	7.2	942	20.5	14.6	239	80.0	7.6	1175	27.0	8.4	34.9	C

Base Model 2021 + A	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1118	11.6	5.2				1430	18.1	11.2	287	23.2	6.4	16.1	B
Pacific Hwy / Shirley Rd/Falcon St	1243	39.5	19.8	689	38.2	6.4	1170	27.9	10.6	959	18.9	9.6	31.1	C
Pacific Hwy / Hume St	1215	12.5	8.2	210	73.2	8.4	1226	18.9	11.2	159	76.6	5.6	23.4	B
Pacific Hwy / Oxley St	1250	6.2	3.8	213	62.3	4.4	1313	5.4	5.0	200	57.9	6.0	13.3	A
Pacific Hwy / Albany St	1524	9.8	8.6				1333	11.9	4.8	545	60.5	12.8	18.7	B
Pacific Hwy / Christie St	389	43.4	9.0	1968	10.0	9.4	120	0.8	0.0	1727	13.9	11.4	14.4	A
Pacific Hwy / Herbert St	856	60.0	21.6	1564	17.8	7.4				1948	17.1	5.8	25.8	B
Pacific Hwy / Reserve Rd/Berry Rd	258	38.7	7.2	1488	23.3	10.6	120	50.7	3.6	1854	8.1	5.2	17.7	B
Pacific Hwy / Greenwich Rd				1393	7.7	5.0	361	61.5	9.2	1745	17.7	10.6	18.2	B
Shirley Rd / River Rd	876	29.6	15.0	811	17.3	7.6	392	44.0	8.6				27.5	B
River Rd / Greenwich Rd	441	63.5	7.2	974	21.1	14.8	237	77.5	7.8	1108	27.2	8.0	35.2	C

Base Model 2021 + AB	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1111	11.7	6.8				1414	18.8	11.0	291	23.6	6.6	16.5	B
Pacific Hwy / Shirley Rd/Falcon St	1248	39.6	19.0	715	37.3	6.2	1126	28.5	9.6	1011	23.8	10.4	32.3	C
Pacific Hwy / Hume St	1244	12.8	7.2	190	62.4	8.8	1251	19.8	11.8	145	73.7	5.0	22.4	B
Pacific Hwy / Oxley St	1246	5.9	3.8	231	68.9	4.6	1342	6.1	5.8	176	60.7	5.4	14.1	A
Pacific Hwy / Albany St	1531	10.0	8.4				1324	12.4	4.8	552	61.6	13.0	19.3	B
Pacific Hwy / Christie St	455	45.4	9.4	2042	10.6	10.2	157	0.6	0.0	1724	12.8	10.0	14.7	B
Pacific Hwy / Herbert St	880	61.8	22.0	1607	18.0	7.8				1972	17.3	5.8	26.4	B
Pacific Hwy / Reserve Rd/Berry Rd	255	40.4	7.4	1538	22.9	10.8	114	53.5	3.2	1872	8.4	6.2	17.8	B
Pacific Hwy / Greenwich Rd				1445	7.5	5.0	367	59.6	9.6	1690	18.1	10.8	18.1	B
Shirley Rd / River Rd	874	27.9	14.8	805	17.2	7.4	394	40.2	8.2				26.1	B
River Rd / Greenwich Rd	406	64.4	7.4	944	20.3	13.8	239	77.4	7.2	1138	26.8	8.0	34.6	C

Base Model 2021 + ABC	SB			EB			NB			WB			AVD	LOS
	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
Pacific Hwy / Alexander St	1091	12.4	6.6				1430	20.5	11.0	290	22.3	7.4	17.6	B
Pacific Hwy / Shirley Rd/Falcon St	1254	41.8	21.0	690	38.2	6.8	1114	28.9	9.0	1017	23.3	11.2	33.0	C
Pacific Hwy / Hume St	1208	13.0	7.6	226	77.4	9.6	1261	20.3	11.6	152	81.4	5.0	25.0	B
Pacific Hwy / Oxley St	1233	6.0	3.4	203	61.1	4.2	1340	6.0	5.2	172	60.9	5.6	13.0	A
Pacific Hwy / Albany St	1500	9.0	8.0				1315	12.0	4.6	536	61.6	12.6	18.6	B
Pacific Hwy / Christie St	453	47.1	9.4	2029	10.4	9.6	187	0.7	0.0	1711	12.6	10.4	14.7	B
Pacific Hwy / Herbert St	859	65.1	21.4	1617	18.0	7.4				1933	17.1	5.2	26.8	B
Pacific Hwy / Reserve Rd/Berry Rd	246	40.8	7.6	1554	22.6	10.8	121	52.5	3.4	1849	7.9	5.4	17.6	B
Pacific Hwy / Greenwich Rd				1476	7.6	5.6	359	61.2	9.2	1711	17.9	10.4	18.0	B
Shirley Rd / River Rd	869	28.5	15.4	809	17.9	7.6	387	40.3	8.0				26.5	B
River Rd / Greenwich Rd	420	65.9	7.2	971	21.0	14.8	240	73.6	7.6	1095	26.9	8.0	34.9	C



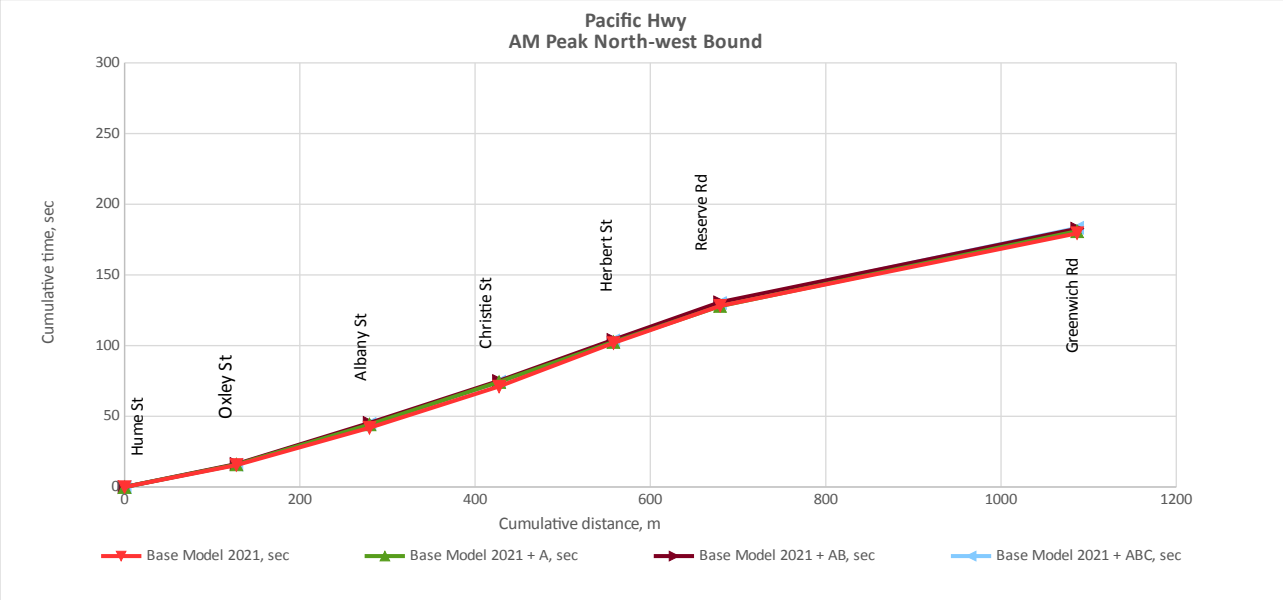
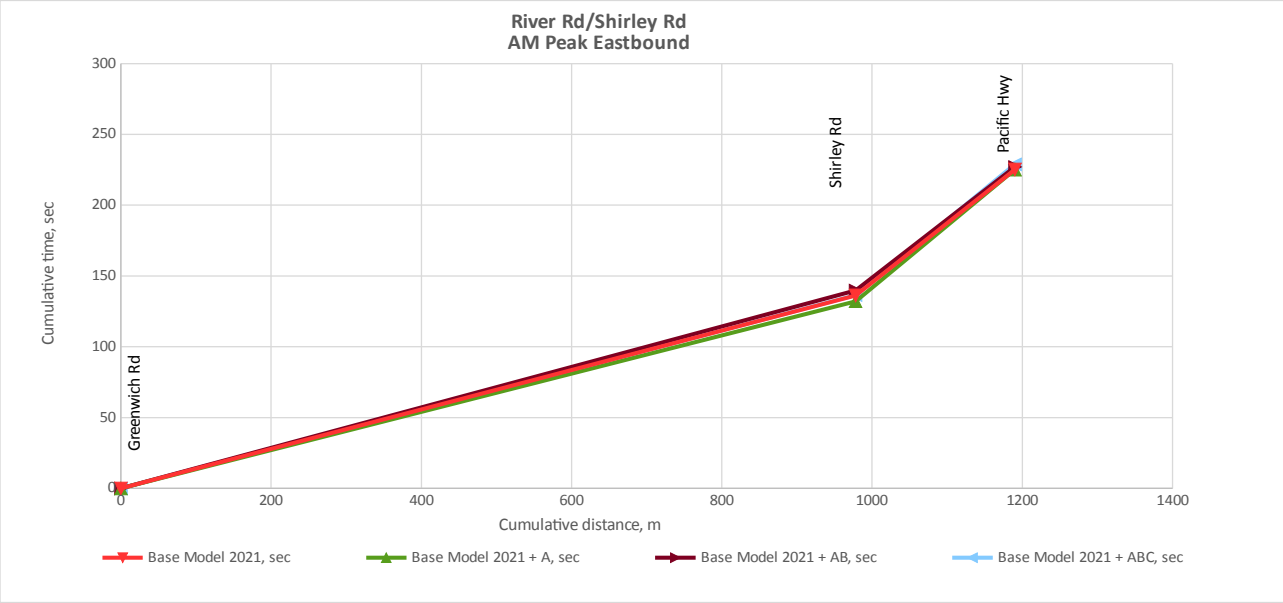


Figure 6: Travel times – comparison of models – morning peak hour – Pacific Highway.

- Modelled travel times shown in **Figure 5** indicate their consistent growth for every additional development in the morning peak hour.
  - Travel time increases are spread along the Pacific Highway in the peak direction of travel.
  - In the off-peak direction, the main travel time increase occurred at the Herbert St intersection for the 2021+ABC model. Other models do not indicate any travel time increases compared with the Base Model 2021.



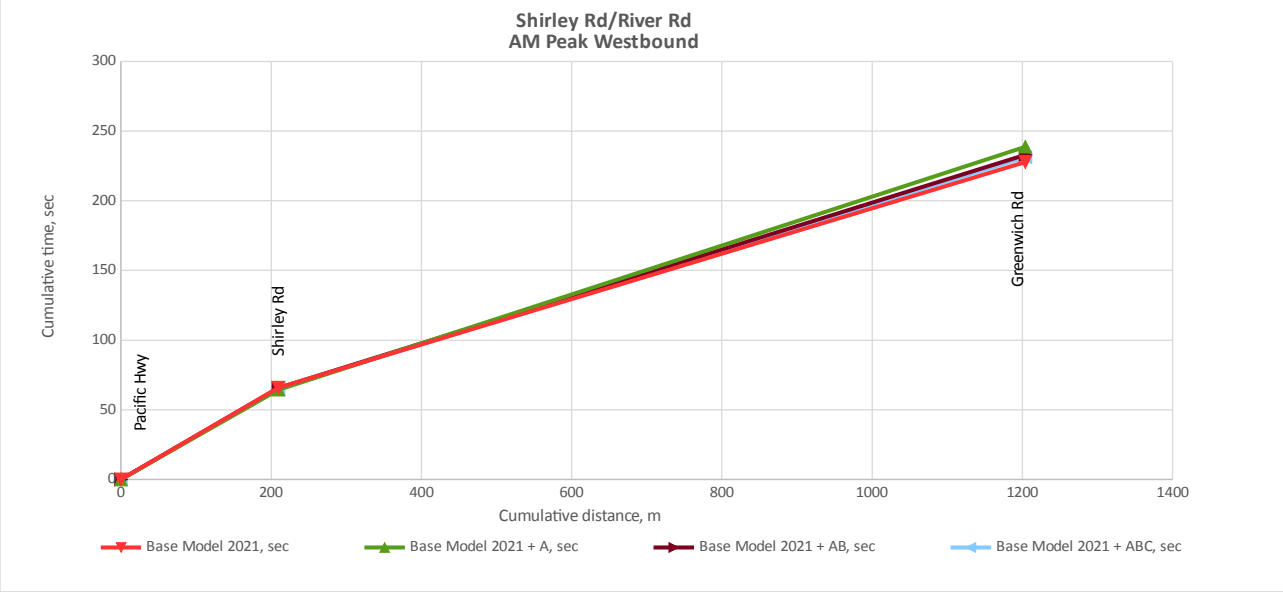


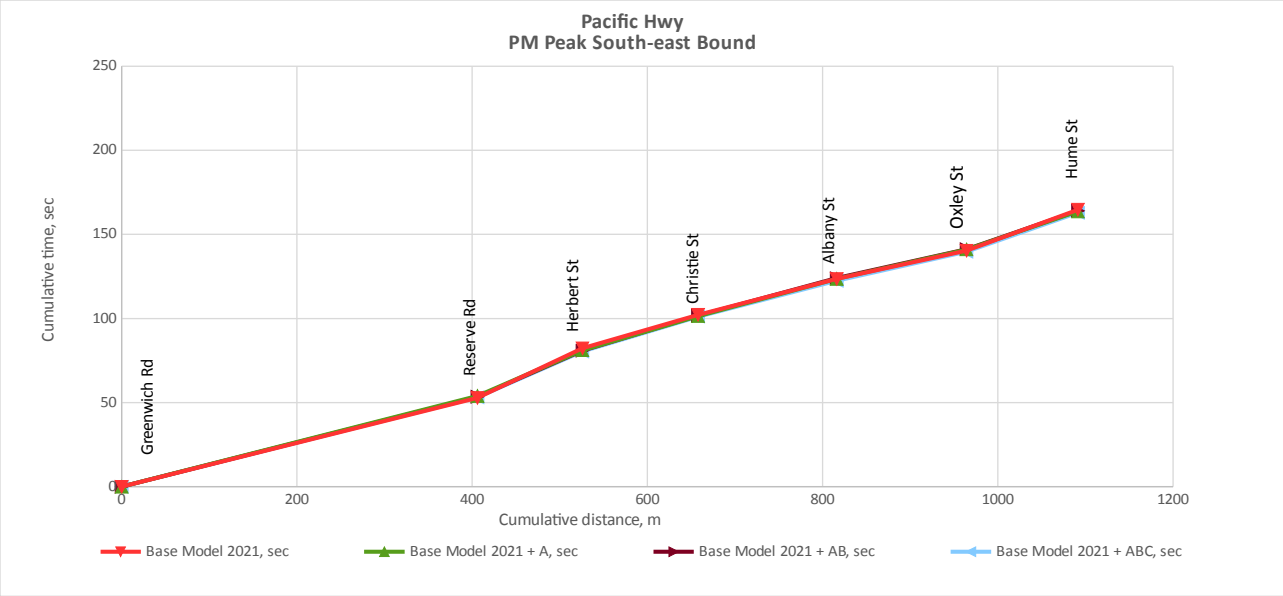
Figure 7: Travel times – comparison of models – morning peak hour – Shirley Rd / River Rd.

- With the exception of increased travel time on River Road eastbound for 2021+AB scenario, travel times on Shirley Road and River Road remain essentially the same for all scenarios in the morning, as evidenced by the information presented in **Figure 6**.
- For the afternoon peak period, all graphs (**Figures 7** and **8** overleaf) show no difference in travel time for all scenarios on both main routes.

4.7 Previous RMS concerns

- The current models address the concerns raised by RMS with regard to the TMA modelling report (refer to Appendix A) as follows.

- Trip generation rates for all residential developments, including all proposed developments in St Leonards South Master Plan area, were adopted as requested by RMS (that is 0.14 trips per dwelling (AM peak) and 0.07 trips per dwelling (PM peak).



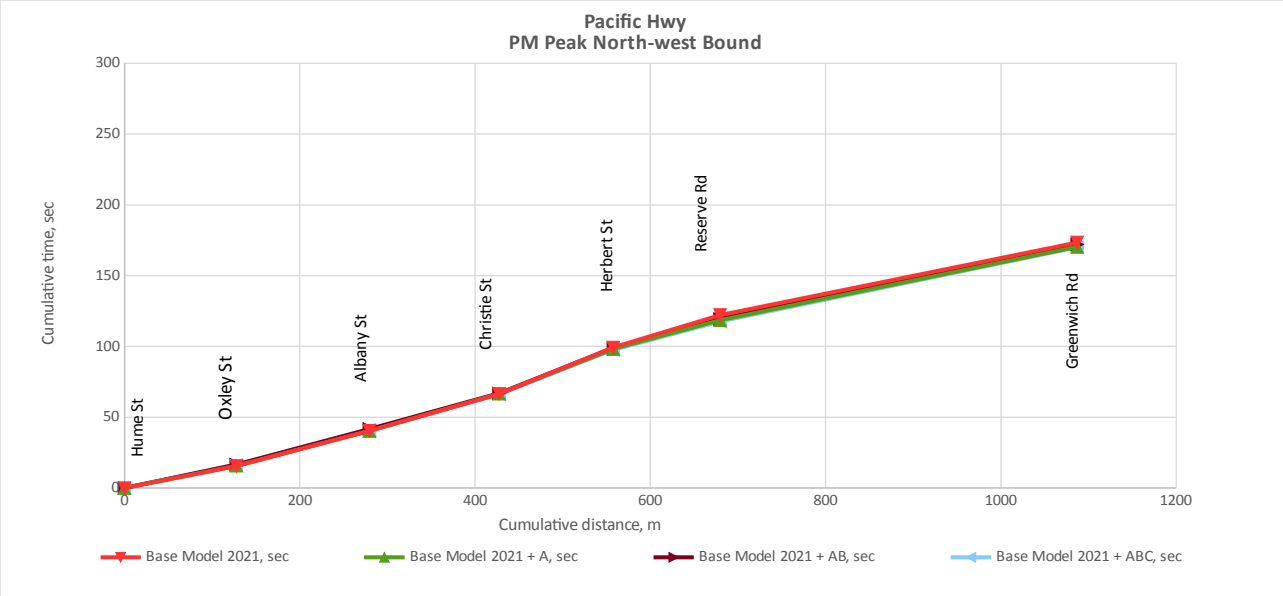
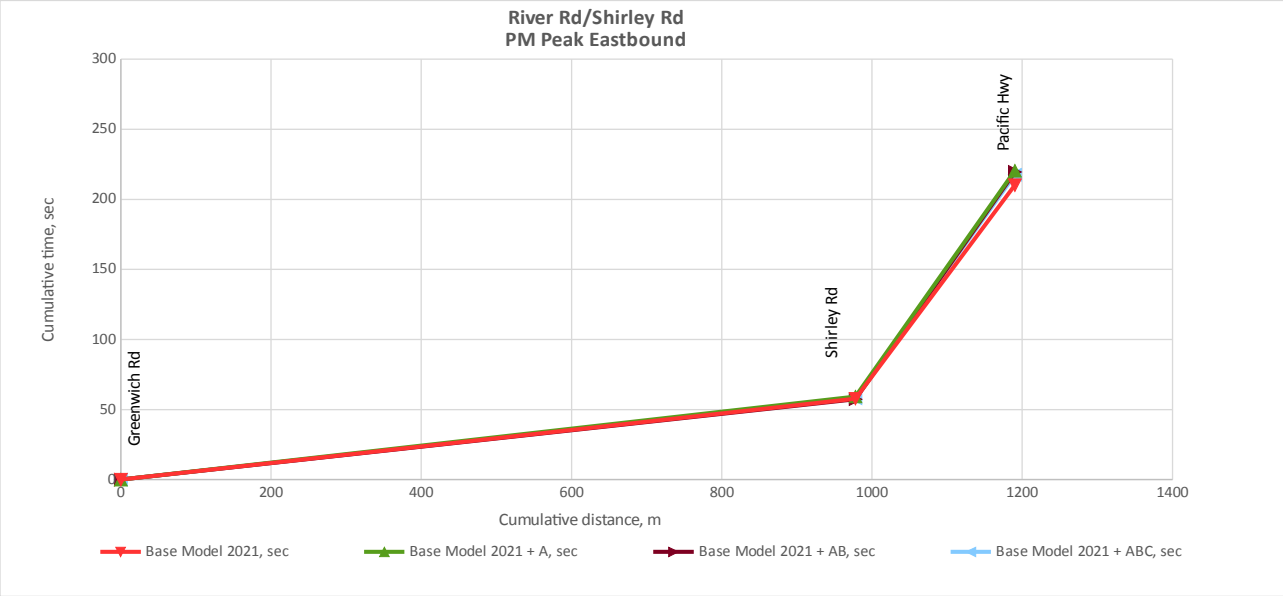


Figure 8: Travel times – comparison of models – afternoon peak hour – Pacific Highway.



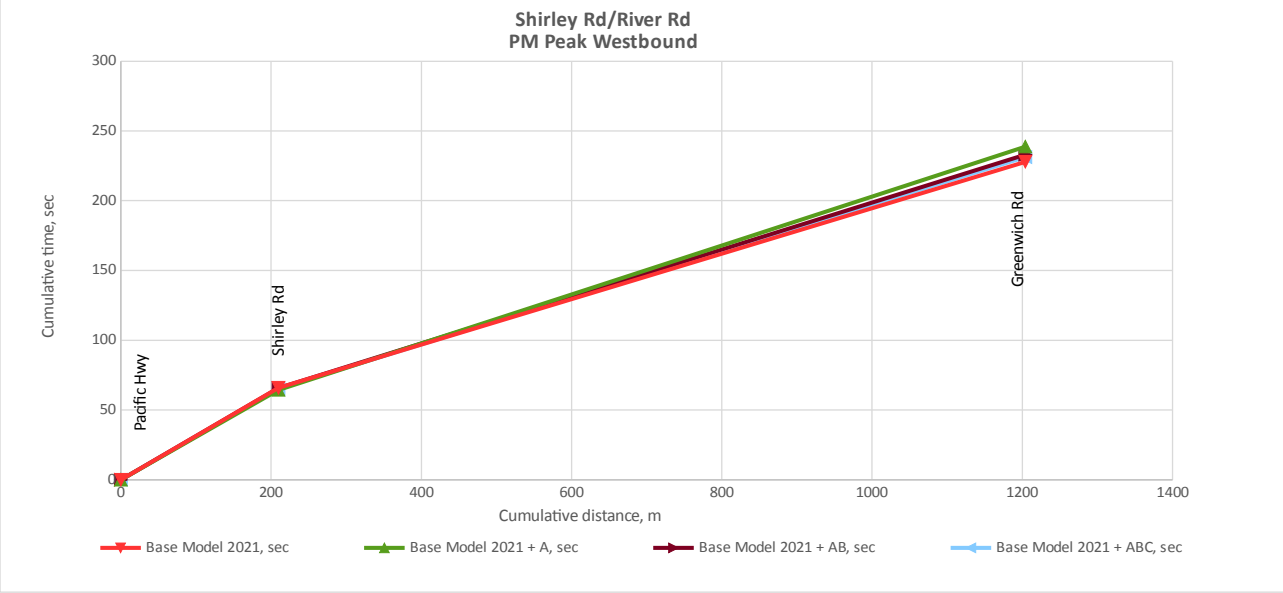


Figure 9: Travel times – comparison of models – afternoon peak hour – Shirley Rd / River Rd.

- The modelling results have been disaggregated to show the performance by movements on each approach (refer to Appendix D).
- For the TMA report, RMS requested an explanation for decreased traffic volumes at some intersections, as a result of the proposed additional developments. The TEF models show similar results. This is due to the fact, that the proposed developments replace existing substantial buildings. Also, commercial areas are proposed to be replaced by residential units, which are lower traffic generators. As a result, traffic increases were very moderate for each of the developments L, A, B and C and in some cases a reduction of trip generation resulted from the land use change.
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- All models for each hourly peak period were simulated using 5 replications (runs) with different seeds. Seed numbers were adopted from the RMS modelling guidelines and were the same for each model for consistency.
- Some of the issues related specifically to the results of TMA modelling and are not relevant for the TEF models.

5 CONCLUSIONS AND RECOMMENDATIONS

- The measures that are necessary in order to achieve satisfactory performance of the network are detailed in **Figure 4** of this report.
- The results of modelling for all development options, with consideration of subsequent cumulative impacts of each large development analysed in this study, are generally consistent with findings of the traffic impact assessment reports submitted for the respective development applications.
    - Primarily due to the fact that the proposed developments replace existing substantial buildings, traffic increases as a result are very moderate for each of the developments on sites L (Marshall Ave), A (Winten), B (Mirvac) and C (New Hope & VIMG).
        - Accordingly, although total traffic delays for the whole network generally increased with each additional development, some intersections even experienced slight improvements (due to traffic redistribution), whilst increased delays at other intersections were minor to moderate. Levels of Service remained essentially the same for all models.
    - Modelled travel times increased consistently with an addition of each development only in the south-eastbound direction on Pacific Highway and in the eastbound direction on River Road during the morning peak. In all other instances there was virtually no change of modelled travel times.
- In general terms. the modelling results indicate that a number of relatively minor improvements would be required as a result of general growth of network traffic, LEP 2009 developments and the proposed St Leonards South Master Plan development. These improvements will be required regardless of the other approved and proposed developments subject of this report (Loftex, Winten, Mirvac and New Hope/VIMG).
    - It is recommended that improvements required for satisfactory operation of the road network under general traffic growth/LEP 2009/St Leonards South Master Plan be further investigated in detail at the later Development Application stage for St Leonards South.
- For the St Leonards South (residential) precinct, the only infrastructure improvements recommended are:
    - Removal of roundabout at Marshall Ave/Berry Rd intersection and replacement with a Give Way intersection, and
    - Provision of a new road connection between Berry and Park Roads.
- For the St Leonards East (commercial/mixed use) precinct, the Winten, Mirvac and New Hope/VIMG developments will not generate sufficient additional traffic to require infrastructure improvements.

Appendix A

TMA report of 11 September 2015.

RMS letter dated 04 January 2016

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Traffic Modelling Report

Project: St Leonards South	**Date:** 11 September 2015
Note: Development sites A and BC	**Ref:** TN002
Author: Tim Clark	

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1 Introduction

This technical note reports on the updated traffic model that now includes two components:-

- The "base model" – containing:-
  - o LEP growth, including 1-25 Marshall Avenue* and other developments in accordance with LEP 2009 (as endorsed by the RMS on 11 April 2014)
  - o St Leonards South Master Plan's 2,200 dwellings (endorsed by the RMS on 2 October 2014) bounded by rail line/ Marshall Av/ River Rd/ Berry Rd (and see below)
  - o growth on the RMS network.

  * Note: The base model incorporates traffic generation for the proposed development at 1-13A Marshall Avenue for 271 dwellings & 320m^2 retail/ commercial, and 15-25 Marshall Avenue, totalling approximately 350 dwellings for Nos.1-25, as allowed under LEP 2009.

- The "future model" containing development sites A and BC in addition to the base model:-
  - o Site A = 84-90 Christie St/ 75-79 Lithgow St and Sites BC = 472-504 Pacific Highway
  - o St Leonards South extension from Berry Rd to Park Rd - 650 dwellings (Council 13/7/15).

The note then compares the performance of this future model against that of the base model.

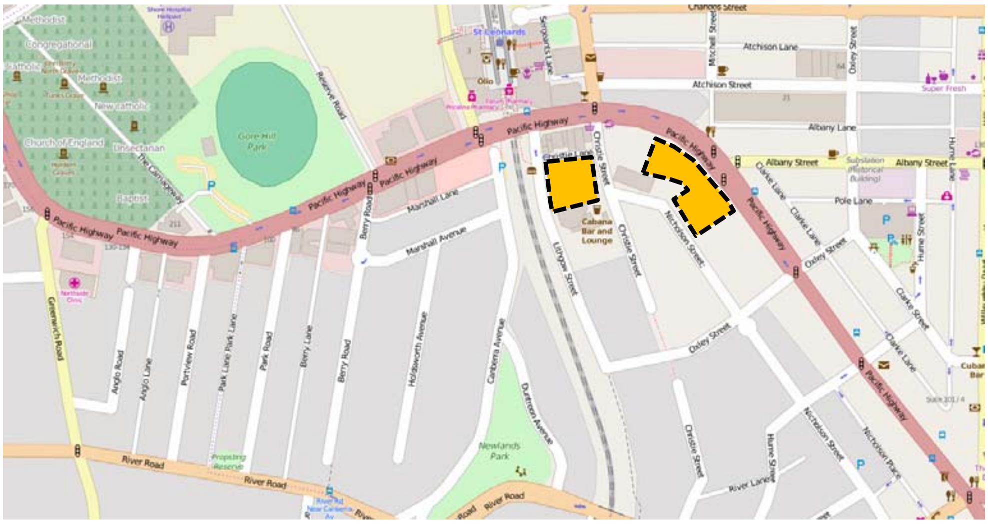

FIGURE 1 SITE A AND BC LOCATION

Source: Open street map

The following changes were implemented in the future model:

- Berry Lane was removed from consideration for traffic movement
- A new connection between Park Rd and Berry Rd 100m south of Marshall Ave was implemented
- Lithgow Street's proposed opening to River Rd was not proceeded with.

2 Traffic Generation

2.1 SITE A

The traffic generation for Site A was taken from the Colston Budd Hunt & Kafes PTY LTD report *Transport Aspects of Planning Proposal for Proposed Mixed Use Developments, Christie Street & Lithgow Street St Leonards*, issued December 2014 on behalf of Winten Property Group.

In this report it is established that Site A will generate 210 and 350 vehicles per hour two way in the AM and PM peaks respectively.

2.2 SITE B&C

Site B and Site C were previously treated as separate sites and have since been amalgamated into one site consisting of 472 - 486, 500 and 504 Pacific Highway.

The traffic generation for Site B&C was taken from the Brown report *Traffic, Parking and Accessibility Report*, issued May 2014 on behalf of Leighton Properties and Charter Hall.

In this report it was established that Site B&C will generate 236 and 177 vehicles per hour two way in the AM and PM peaks respectively.

2.3 BERRY ST PARK RD DWELLIINGS

650 dwelling were added to the model for the St Leonards South Master Plan extension (decided on 13 July 2015) from Berry St to Park Rd, with 50% of the dwellings being accessed from Berry Rd and the other 50% being accessed from Park Rd.

As the dwellings will be high density residential at a distance of around 500m from the train station, the lowest trip generation rate will be used.

The RMS *Guide to Traffic Generating Developments Updated traffic surveys* indicates that a trip generation rate of 0.07 trips per dwelling in the AM and 0.06 trips per dwelling in the PM can be used resulting in 46 trips in the AM peak and 39 trips the PM peak being generated.

TABLE 1 TRAFFIC GENERATION SUMMARY

		AM	PM
Site A	88 Christie Street	210	350
Site B	472 - 486 and 504 - 520 Pacific Hwy		
Site C	500 Pacific Hwy	236	177
	Berry St Park Rd dwellings	46	39
Total		**492**	**566**

3 Traffic Distribution

The traffic was broken up into three categories commercial (office), retail and residential, with the traffic generation volumes being broken up into these three categories and then assigned to the network.

Previously established traffic patterns were used for commercial and residential distributions which were extracted from immediately surrounding sites, while a new retail distribution pattern was established.

The retail distribution pattern was established by assessing the size of the retail development and identifying all surrounding retail land uses. This established a catchment that was broken up into areas relating to the model zones and trips were assigned to the individual zones depending of the proportion of residential dwelling in a particular zone as it related to the entire catchment.

4 Results

4.1 NETWORK PERFORMANCE

TABLE 2NETWORK STATISTICS

	Model	Description	Mean Speed (kph)	VKT	VHT	Unreleased
AM	D02N02_AM_21	Background Growth Only	22.6	18273.0	809.9	7
	D13N20_AM_21	Future	20.3	18629.9	920.4	50
		% diff	**-10.4%**	**2.0%**	**13.7%**	
PM	D02N02_PM_21	Background Growth Only	21.6	18124.4	839.7	22
	D13N20_PM_21	Future	21.4	19147.8	896.1	22
		% diff	**-0.9%**	**5.6%**	**6.7%**	

Table 2 shows that the introduction of the developments has had some impact on the network statistics with the average speed reducing and the Vehicle Kilometres Travelled (VKT) and the Vehicle Hours Travelled (VHT) increasing.

Some of the increase in VKT and VHT will be a result of the increase in demand and not necessarily a deterioration of network performance, such as in the PM. The AM however has had a smaller increase in trips and had a more adverse effect. The reason for this will be further explored in the proceeding sections.

4.2 TRAVEL TIMES

Figure 2 and **figure 3** show the impact that the increased demand has had on the Pacific highway.

The Future Base (FB) AM model has seen a 30 second increase in travel times between Greenwich Rd and Berry Rd and the FB PM has seen a 45 second increase in travel times between Rocklands Ave and Shirley Rd. These small increases in travel time are consistent with an increase in volume on the Pacific Hwy travelling towards the development sites.

As the rest of the curves are identical as such the increases are not consistently seen along the length of the curve this suggests that the increase in volume is placing pressure only as specific intersections.

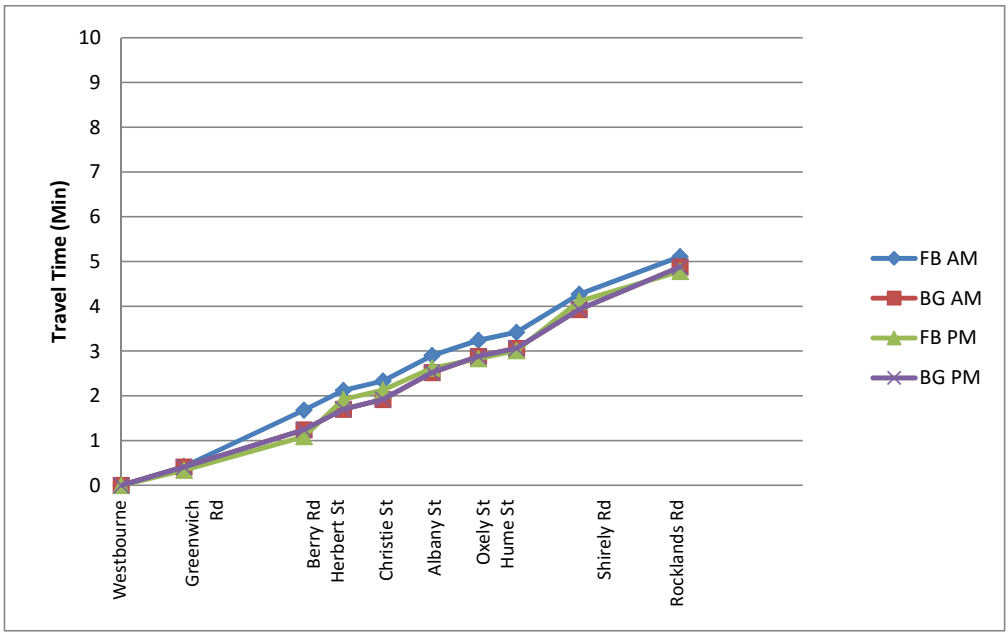

FIGURE 2 PACIFIC HWY EASTBOUND

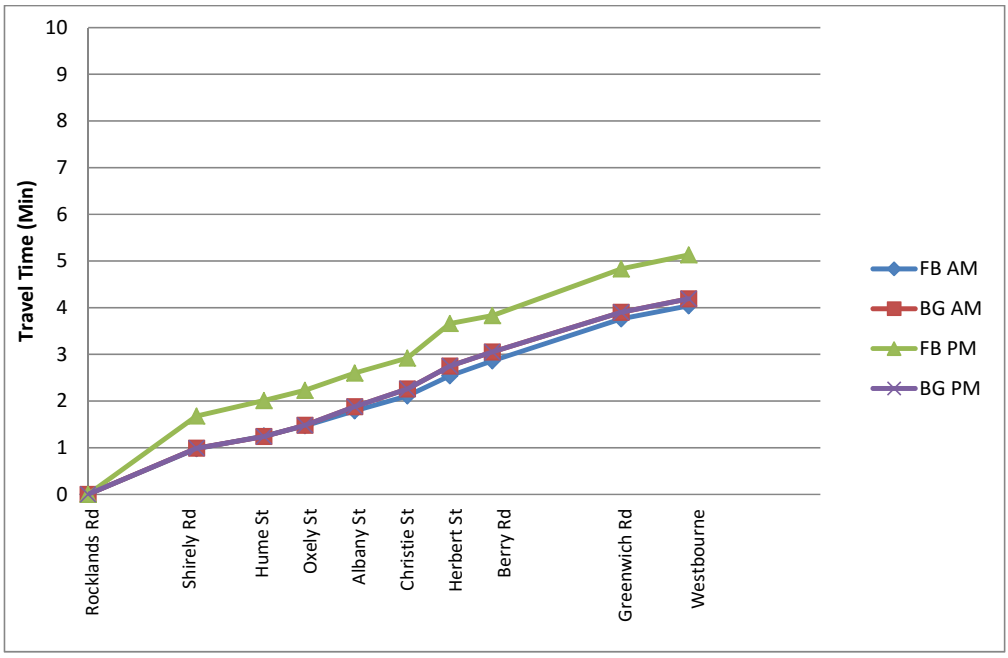

FIGURE 3 PACIFIC HWY WESTBOUND

4.3 LEVEL OF SERVICE

TABLE 3 AM LEVEL OF SERVICE

Intersection	Approach	Delay (s)	Vehicles	Level of Service	Delay (s)	Vehicles	Level of Service
		Background Growth Only			Future		
Pacific Hwy/Reserve Rd/Berry Rd	Reserve Rd	72.5	82	F	61.2	105	E
	Pacific Hwy [E]	97.2	1689	F	132.9	1661	F
	Berry Rd	60.6	125	E	53.3	113	D
	Pacific Hwy [W]	122.0	1965	F	133.4	1849	F
	Intersection	**108.1**	**3861**	**F**	**128.7**	**3728**	**F**
Pacific Hwy/Herbert St	Herbert St	54.1	618	D	124.9	686	F
	Pacific Hwy [E]	75.5	2112	F	57.7	1994	E
	Pacific Hwy [W]	44.5	1940	D	31.5	1801	C
	Intersection	**59.8**	**4670**	**E**	**57.5**	**4481**	**E**
Pacific Hwy/Christie St	Christie St [N]	71.9	499	F	104.3	532	F
	Pacific Hwy [E]	23.3	1995	B	13.9	1875	A
	Pacific Hwy [W]	20.8	2249	B	16.4	2181	B
	Intersection	**27.2**	**4743**	**B**	**25.6**	**4588**	**B**
Pacific Hwy/Albany St	Pacific Hwy [N]	29.2	1759	C	31.5	1710	C
	Albany St	110.3	610	F	68.0	608	E
	Pacific Hwy [S]	34.0	1593	C	22.3	1417	B
	Intersection	**43.6**	**3962**	**D**	**34.0**	**3735**	**C**
Pacific Hwy/Oxley St	Pacific Hwy [N]	12.2	1387	A	18.6	1317	B
	Oxley St [E]	54.4	114	D	37.8	120	C
	Pacific Hwy [S]	14.1	1373	B	20.2	1251	B
	Oxley St [W]	67.3	430	E	64.9	256	E
	Intersection	**21.6**	**3304**	**B**	**24.1**	**2944**	**B**
Pacific Hwy/Hume St	Pacific Hwy [N]	12.0	1446	A	12.9	1341	A
	Hume St [E]	56.7	188	D	52.4	137	D
	Pacific Hwy [S]	19.4	1257	B	19.2	1184	B
	Hume St [W]	55.6	142	D	56.3	146	D
	Intersection	**19.9**	**3033**	**B**	**19.7**	**2808**	**B**
Pacific Hwy/Falcon St/Shirley Rd	Pacific Hwy [N]	51.4	1413	D	48.6	1282	D
	Falcon St	114.8	879	F	135.7	813	F
	Pacific Hwy [S]	29.6	876	C	29.2	805	C
	Shirley Rd	119.4	457	F	106.2	512	F
	Intersection	**70.1**	**3625**	**F**	**73.4**	**3412**	**F**
Pacific Hwy/Alexander St	Pacific Hwy [N]	23.3	1253	B	20.1	1185	B
	Alexander St	43.7	356	D	44.8	326	D
	Pacific Hwy [S]	32.2	1124	C	33.7	1035	C
	Intersection	**29.6**	**2733**	**C**	**28.8**	**2546**	**B**
River Rd/Shirley Rd	Shirley Rd [N]	60.0	455	E	59.6	401	E
	Shirley Rd [S]	49.0	202	D	49.9	215	D
	River Rd	52.5	894	D	50.8	929	D
	Intersection	**54.3**	**1551**	**D**	**52.9**	**1545**	**D**

TABLE 4 PM LEVEL OF SERVICE

Intersection	Approach	Background Growth Only			Future		
		Delay (s)	Vehicles	Level of Service	Delay (s)	Vehicles	Level of Service
Pacific Hwy/Reserve Rd/Berry Rd	Reserve Rd	61.9	82	E	55.1	214	D
	Pacific Hwy [E]	92.2	1689	F	83.3	1803	F
	Berry Rd	65.6	125	E	67.7	116	E
	Pacific Hwy [W]	105.7	1965	F	114.6	1442	F
	Intersection	**97.6**	**3861**	**F**	**93.7**	**3575**	**F**
Pacific Hwy/Herbert St	Herbert St	50.9	618	D	50.3	850	D
	Pacific Hwy [E]	61.5	2112	E	59.4	1933	E
	Pacific Hwy [W]	27.2	1940	B	48.3	1515	D
	Intersection	**45.8**	**4670**	**D**	**53.7**	**4298**	**D**
Pacific Hwy/Christie St	Christie St [N]	168.5	499	F	52.4	391	D
	Pacific Hwy [E]	25.6	1995	B	17.3	1918	B
	Pacific Hwy [W]	16.3	2249	B	15.4	1943	B
	Intersection	**36.2**	**4743**	**C**	**19.7**	**4252**	**B**
Pacific Hwy/Albany St	Pacific Hwy [N]	23.4	1759	B	27.6	1480	B
	Albany St	74.8	610	F	66.4	611	E
	Pacific Hwy [S]	28.4	1593	B	24.6	1548	B
	Intersection	**33.4**	**3962**	**C**	**32.8**	**3639**	**C**
Pacific Hwy/Oxley St	Pacific Hwy [N]	13.4	1387	A	13.9	1178	A
	Oxley St [E]	45.7	114	D	40.0	132	C
	Pacific Hwy [S]	11.9	1373	A	15.5	1367	B
	Oxley St [W]	91.6	430	F	94.1	500	F
	Intersection	**24.1**	**3304**	**B**	**28.3**	**3177**	**B**
Pacific Hwy/Hume St	Pacific Hwy [N]	13.5	1446	A	14.8	1319	B
	Hume St [E]	46.5	188	D	51.3	163	D
	Pacific Hwy [S]	19.2	1257	B	19.7	1294	B
	Hume St [W]	54.6	142	D	51.7	173	D
	Intersection	**19.8**	**3033**	**B**	**21.1**	**2949**	**B**
Pacific Hwy/Falcon St/Shirley Rd	Pacific Hwy [N]	63.2	1413	E	63.6	1258	E
	Falcon St	85.8	879	F	93.0	954	F
	Pacific Hwy [S]	65.7	876	E	66.2	1072	E
	Shirley Rd	99.2	457	F	99.5	642	F
	Intersection	**73.8**	**3625**	**F**	**77.3**	**3926**	**F**
Pacific Hwy/Alexander St	Pacific Hwy [N]	15.2	1253	B	15.7	1080	B
	Alexander St	69.2	356	E	89.0	261	F
	Pacific Hwy [S]	47.6	1124	D	41.5	1305	C
	Intersection	**35.6**	**2733**	**C**	**35.7**	**2646**	**C**
River Rd/Shirley Rd	Shirley Rd [N]	27.1	455	B	27.4	775	B
	Shirley Rd [S]	38.8	202	C	50.8	398	D
	River Rd	34.4	894	C	32.6	644	C
	Intersection	**32.9**	**1551**	**C**	**34.3**	**1817**	**C**

The AM Level of service graph further reinforces what was discovered in the travel time results being that there has been an adverse effect to the Pacific Hwy at Berry St, delay has also gone up at Herbert St and Christie St.

The volumes at the Christie St intersection have dropped as a result of the increase in delay and as a result the volumes southbound along the Pacific Hwy are also lower indicating that the Berry St intersection is operating at capacity.

There are no real increases in delay in the PM with most of the intersection Level of Service remanning similar with some of the intersection actually being improved upon as a result of signal optimisation along the Pacific Hwy.

4.4 QUEUE DIAGRAMS

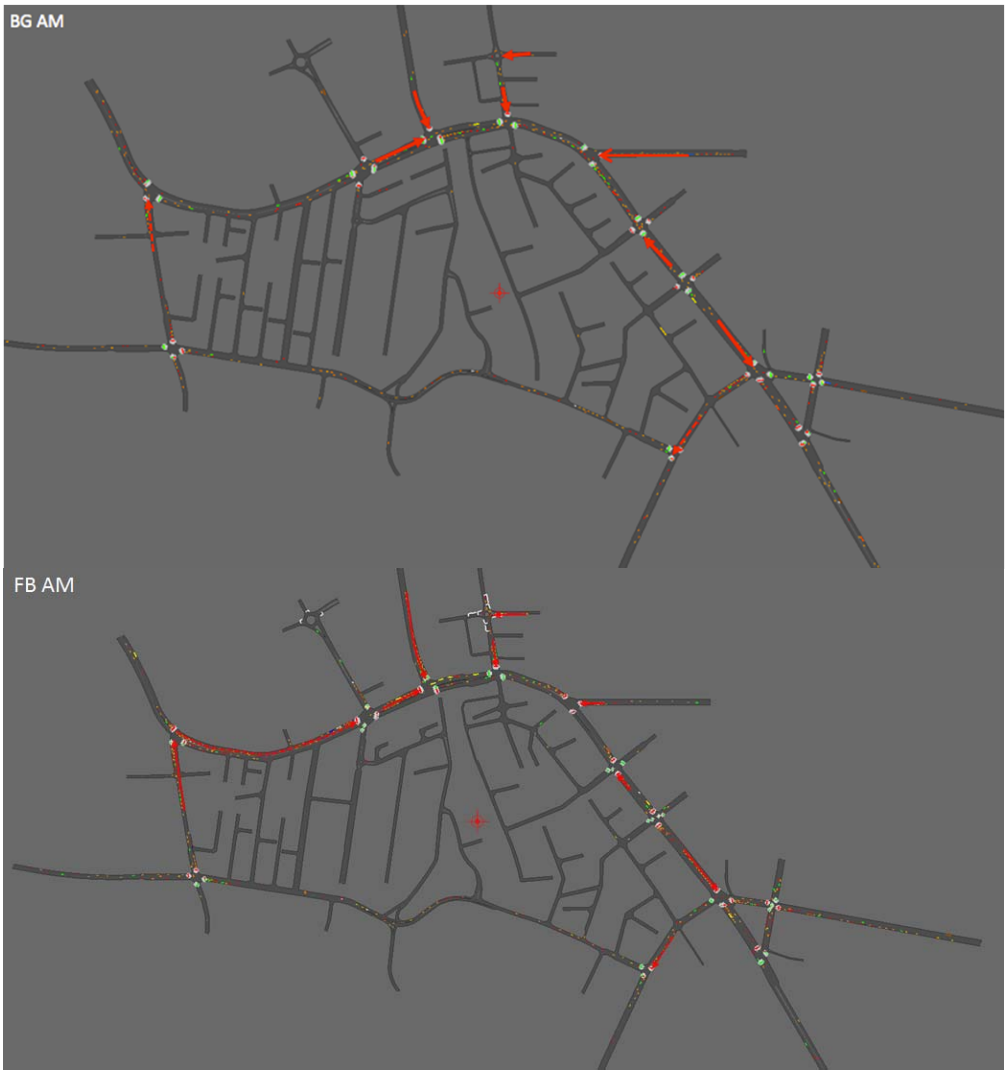

FIGURE 4 AM QUEUE DIAGRAMS

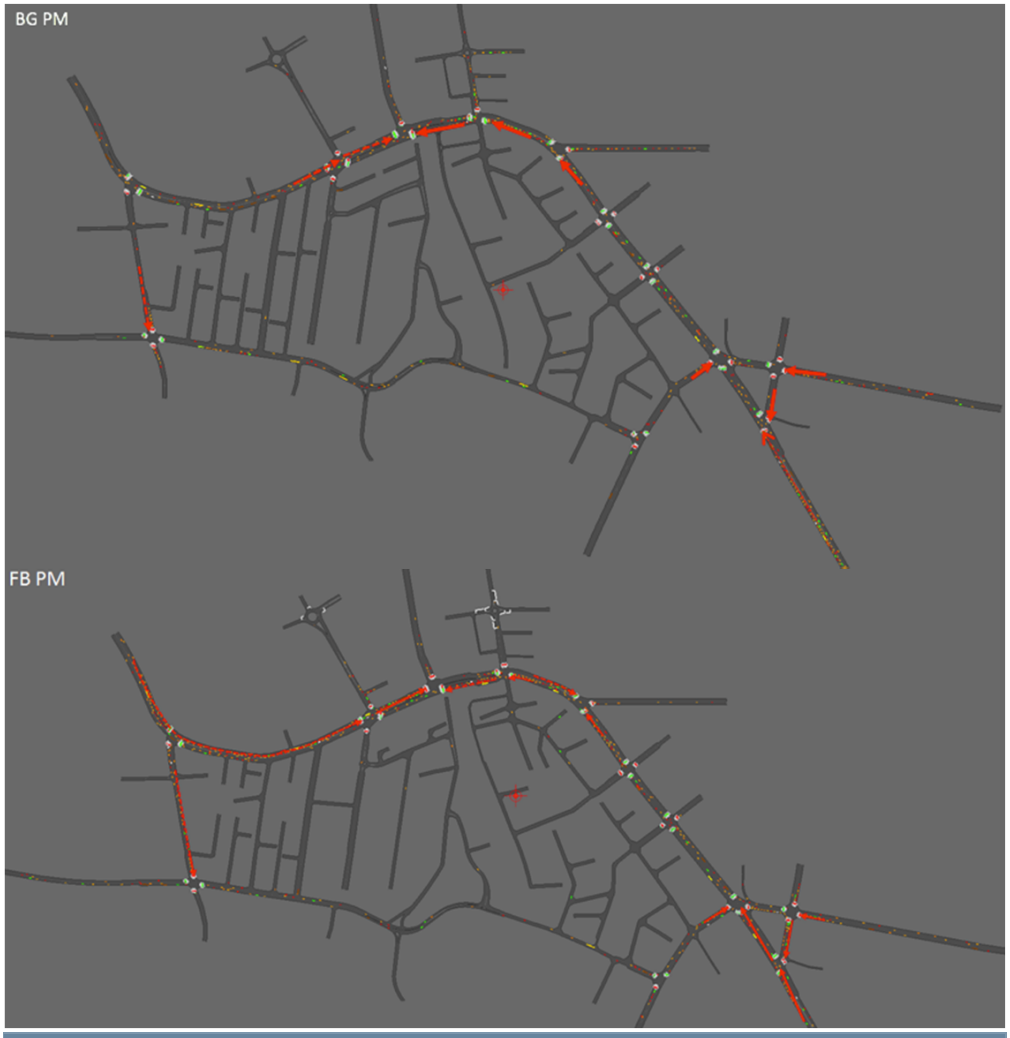

FIGURE 5 PM QUEUE DIAGRAMS

Figure 4 confirms that the increase in delay the AM had at the Berry Pacific Berry intersection is also accompanied by and increase in queueing.

Figure 5 shows that previously the PM had a small rolling queue extending back from the Berry St intersection and even though the intersection performance hasn't deteriorated this rolling queue has grown indicating that the queue is dissipating quickly. A similar story can be told for the Pacific Falcon St intersection as there has been an increase in queueing without a substantial increase in delay.

5 Conclusion

In summary the PM model does not experience any major network deterioration as a result of the introduction of the Site A and Site BC developments. There is the potential for an increase in queues; however the models showed that the queues dissipate quickly and as such there has been no deterioration in intersection performance.

The improvement of some approaches at the PM intersections can be accounted for as a result of optimisation (in line with what is possible within SCATS) of signals along the Pacific Hwy.

The results do however there indicate the potential for some network deterioration in the AM centred around the Pacific Berry St intersection (also potentially the PM if demands increase further). Previous modelling has indicated that it is the interaction between the Berry, Herbert and Christie Street intersections that causes the delay at Berry Street and that this is a bottleneck on the network.

The performance of the Berry St intersection is more sensitive in the AM due to the more directed nature of AM flows. The increase in delay on the western approach is around 11 seconds and is manageable, as a result the network is able to cope with the increase in demand associated with the new developments but any further increase in development will need to be tested.

NSW GOVERNMENT | Transport for NSW

Stephanie Bashford
Manager, Strategic Planning
Lane Cove Council
PO Box 20
Lane Cove NSW 1595

Dear Ms Bashford,

St Leonards Traffic Modelling Report and Planning Proposal for 88 Christie St, St Leonards

Thank you for meeting with officers from Transport for NSW (TfNSW) and Roads and Maritime Services (Roads and Maritime) on 20 November 2015 regarding the planning proposal at 88 Christie Street, St Leonards. Please consider this as a joint response from both agencies.

Given the number of proposed developments in St Leonards within the Lane Cove local government area, TfNSW and Roads and Maritime have a strong interest in understanding the cumulative impact of these developments on the operation of the road network, and in particular, the performance of the Pacific Highway.

TfNSW and Roads and Maritime have reviewed Council's Traffic Modelling Report dated 11 September 2015 by TMA, which was received on 26 November 2015. A number of issues have been identified which requires further clarification and analysis. These issues include the use of appropriate traffic generation rates for St Leonards, details of assumptions used in the modelling process, and further explanation of modelling outputs which were not documented in the report. Detailed technical comments on the TMA Traffic Modelling Report are provided in Attachment A.

TfNSW and Roads and Maritime also have minor comments on the Concept Design Report and the Transport Aspects of Planning Proposal report, both dated December 2014. These comments are provided in Attachment B.

As suggested by TfNSW and Roads and Maritime at the meeting, an overarching transport and traffic report should be produced for the purpose of public exhibition, which integrates the developer's transport report with Council's Traffic Modelling Report. This overarching report should seek to provide a comprehensive overview of the transport and traffic impacts of the planning proposal, the likely cumulative impact of proposed developments in St Leonards, and identify actions or issues that are to be addressed.

Given the number of issues identified in the TMA Traffic Modelling Report, TfNSW and Roads and Maritime request for further modelling work to be undertaken, and the report be revised to address the issues identified. The revised report should be submitted to TfNSW and Roads and Maritime for further review and comment prior to its finalisation for public exhibition.

TfNSW and Roads and Maritime are keen to work with Council in ensuring that the modelling report provides an appropriate level of assessment of road network operational impacts. A technical meeting with Council and TMA to discuss the traffic modelling results and address the issues identified would be productive in that regard.

Should you have any questions regarding this matter, please contact James Li, Senior Transport Planner at TfNSW, on 02 8202 2179 / james.li@transport.nsw.gov.au or Andrew Popoff, Senior Land Use Planner at Roads and Maritime, on 02 8849 2180 / andrew.popoff@rms.nsw.gov.au

Yours sincerely,

Simon Hunter
Executive Director, Transport Strategy
Freight, Strategy and Planning

CD15/19127

ATTACHMENT A
Comments on the TMA Traffic Modelling Report (11 September 2015)

Development generated traffic impact may or may not be significant to Pacific Highway traffic performance but the report does not provide a complete view on the impact of the proposed developments.

There is insufficient information documented in the report from the modelling exercise to enable full assessment as some essential matters are not clearly addressed. The following matters identified require clarification and needs to be addressed in further modelling work and documented in the report.

1. Concerns are raised with regard to the use of 0.07 trips per dwelling (AM Peak) and 0.06 trips per dwelling (PM Peak) for High Density Residential as these are the "lowest" surveyed rates provided within the "Guide to Traffic Generating Developments – Updated Traffic Surveys (TDT2013/04a) which have come from differing areas in the Sydney Metro area. The more appropriate trip generation rates which should be used would be the High Density Residential rates taken from the St Leonards site within (TDT2013/04a) which is 0.14 trips per dwelling (AM Peak) and 0.07 trips per dwelling (PM Peak). The modelling should be amended accordingly based on these more appropriate generation rates.

2. The modelling results provided within Tables 3 and 4 (intersection performance results) needs to be disaggregated, showing the performance by movements on each approach in the report (as an appendix to the report). This is necessary to enable closer investigation of future intersection impacts. This should be provided in the revised report.

3. Some of the provided modelling results require an explanation. For example, intersection traffic volumes at the various Pacific Highway intersections appear to have decreased, as a result of the proposed additional developments. In particular, results given in Tables 3 and 4 appear to be unexpected and no explanation has been given.

   The following are some key modelling issues that need further explanation by Council and TMA.

   a) Are the given traffic numbers extracted from a single model run? Or, are they averages from several different "seed" runs?

   b) Why has Pacific Highway traffic at many intersections decreased in the AM peak?

   c) Why has the Pacific Highway PM Peak traffic at the Reserve Road / Berry Road and Albany Street intersections changed significantly between "Background Growth Only" and "Future Base" scenarios? For example, Background Growth Only has Pacific Highway (west approach flows) higher than Pacific Highway (east approach flows), but these approach flows then have Pacific Highway (east approach flows) higher than Pacific Highway (west approach flows) in the Future scenario at the Reserve Road / Berry Road intersection. A similar pattern is also identified for Pacific Highway approach flows at the Albany Street intersection).

   d) Why has the Pacific Highway/Reserve Road/Berry Road intersection performance in the AM Peak decreased significantly in the Future scenario when, at the same time, the intersection volume is lower. Is this resulting from an adjacent critical intersection?

e) Where is the development traffic coming / going within this model? How was trip modal choice determined? In the AM Peak, there is only about 55 veh/hr more on Shirley Road approaching the Pacific Highway/Falcon Street /Shirley Road intersection, and only a marginal traffic increase at some other intersections, and even small (-12 veh/hr) decrease along Berry Road at Pacific Highway intersection. In the PM Peak, there are about 185 vehicles more at Shirley Road approaching Pacific Highway, and 70 vehicles more at Oxley Street.

f) Why has Christie Street PM Peak traffic decreased by 108 vehicles and at the same time the Herbert Street traffic increases by 232 vehicles. Are those traffic variations related to the proposed developments?

4. How have the intersection traffic signal settings been determined, for the "Background Growth Only" and "Future Base" models? Model input assumptions need to be documented, with information on signal phasing, timing and offsets.

5. Why in Network wide traffic performance (Table 2), has only unreleased vehicles been reported whereas total traffic is not reported?

In summary, to ensure the completeness of the traffic modelling report for the purpose of the public exhibition, the analysis and modelling to be undertaken and documented should include:

A. Estimated development generated/attracted traffic from all proposed developments based on the trip generation rates surveyed for St Leonards.

B. Estimated traffic directional distribution – showing where development generated traffic is going to and where development attracted traffic is coming from.

C. Identify key intersections affected by development traffic, and estimate traffic turning movements – separately for background traffic and development traffic.

D. State what future year traffic signals settings at signalised intersections that were adopted in the model.

E. Provide details on intersection performance (by approach and movement) with and without development traffic.

Furthermore, based on the revised modelling results, Council and/or the developer will need to identify the intersection improvements measures (if any) that may be required to support this current planning proposal and other proposed developments in the area.

This is necessary to inform any development contributions or planning agreements for any additional infrastructure that may be required to support these developments. It will also assist in determining whether or not such improvements are feasible. This identification and scoping process should begin prior to the planning proposal being placed on public exhibition such that these requirements which may be attributable to the planning proposal could be determined and agreed to before the LEP amendment is made.

ATTACHMENT B
Comments on Planning Proposal for 88 Christie Street, St Leonards

Concept Design Report – Development access via Christie Street to the Pacific Highway

It is noted that section 6.2 of the Concept Design Report, proposes to open Christie Street between Nicholson Street and the Pacific Highway to two way traffic, which is currently limited to one way traffic heading southbound only.

TfNSW and Roads and Maritime note the developer's representation at the meeting that this was an editorial error and that current traffic arrangement are to remain unchanged for this section of Christie Street. As such, the Concept Design Report should be amended prior to public exhibition.

Roads and Maritime reaffirms that it will not support any proposal to open Christie Street to two way access to/from the Pacific Highway.

Transport Aspects of Planning Proposal report

The report by Colston Budd Hunt and Kafes dated December 2014 provides a high level overview on the traffic generation expected with the two potential development yields on the site.

Council should note that TfNSW and Roads and Maritime would require a detailed Traffic Impact Assessment (TIA) supported by traffic modelling analysis for any future development applications at the site, based on the scale of the proposed development at that time. The TIA will need to address road network impacts from development traffic generated and access issues. The developer should consult with TfNSW and Roads and Maritime to obtain input into the preparation of the TIA prior to development application lodgement with Council.

Appendix B

TEF Calibration report for the Base Model 2013

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ST LEONARDS SOUTH AIMSUN MODEL

CALIBRATION / VALIDATION REPORT

Prepared for

Lane Cove Council

By

O. Sannikov

TEF Consulting

Report Document Control

Title	ST LEONARDS SOUTH AIMSUN MODEL – AM PEAK CALIBRATION AND VALIDATION REPORT
Date	08 August 2016
Author(s)	O. Sannikov, V. Pantyukhin, A. Tan
Client	Lane Cove Council
Job No.	16020
Quality Control Reviewer	I. Mileusnic
Keywords	Modelling/Aimsun//St Leonards/
Disclaimer	**This report is believed to be true and correct at the time of writing. It is based on the information and data provided by the client and other relevant organisations during preparation. TEF Consulting does not accept any contractual, tortuous or other form of liability for any consequences arising from its use. People using the information in the report should apply and rely on their own skill and judgement to a particular issue they are considering.**

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Appendix

Details of GEH analysis.
GTA travel time survey data.

1 INTRODUCTION

1.1 Study Objective

- The purpose of this study is to provide a calibrated and validated Aimsun model for the St Leonards south road network for future use.
- Previously, a microsimulation model was developed by GTA Consultants to examine new large scale developments and the impacts the additional traffic may have on the surrounding road network (GTA model). The GTA model utilised Paramics microsimulation software package.
- The new Aimsun model has been developed for the same purpose. It uses the data from the previous base model and report developed by GTA Consultants for the same area.
- This report discusses the calibration and validation procedure for the model and why it is fit for use as a base road network model.

1.2 Purpose of this Report

- The report covers the following topics
  - Model development
  - Transport data
  - Calibration and validation methodology
  - Results

2 MODELLING SPECIFICATION

2.1 Previous Paramics Model

- A Paramics model was developed by GTA Consultants for Lane Cove Council (GTA model) and subsequently approved by RMS as fit for purpose.
- The GTA model represented the existing road geometry, intersection control and demands within the study area.
- The GTA model has been used as a base for the current Aimsun model with permission from Lane Cove Council

2.2 Software

- Aimsun v.8.07
  - Microsimulation model

2.3 Model Study Area

- Refer to **Figure 1**

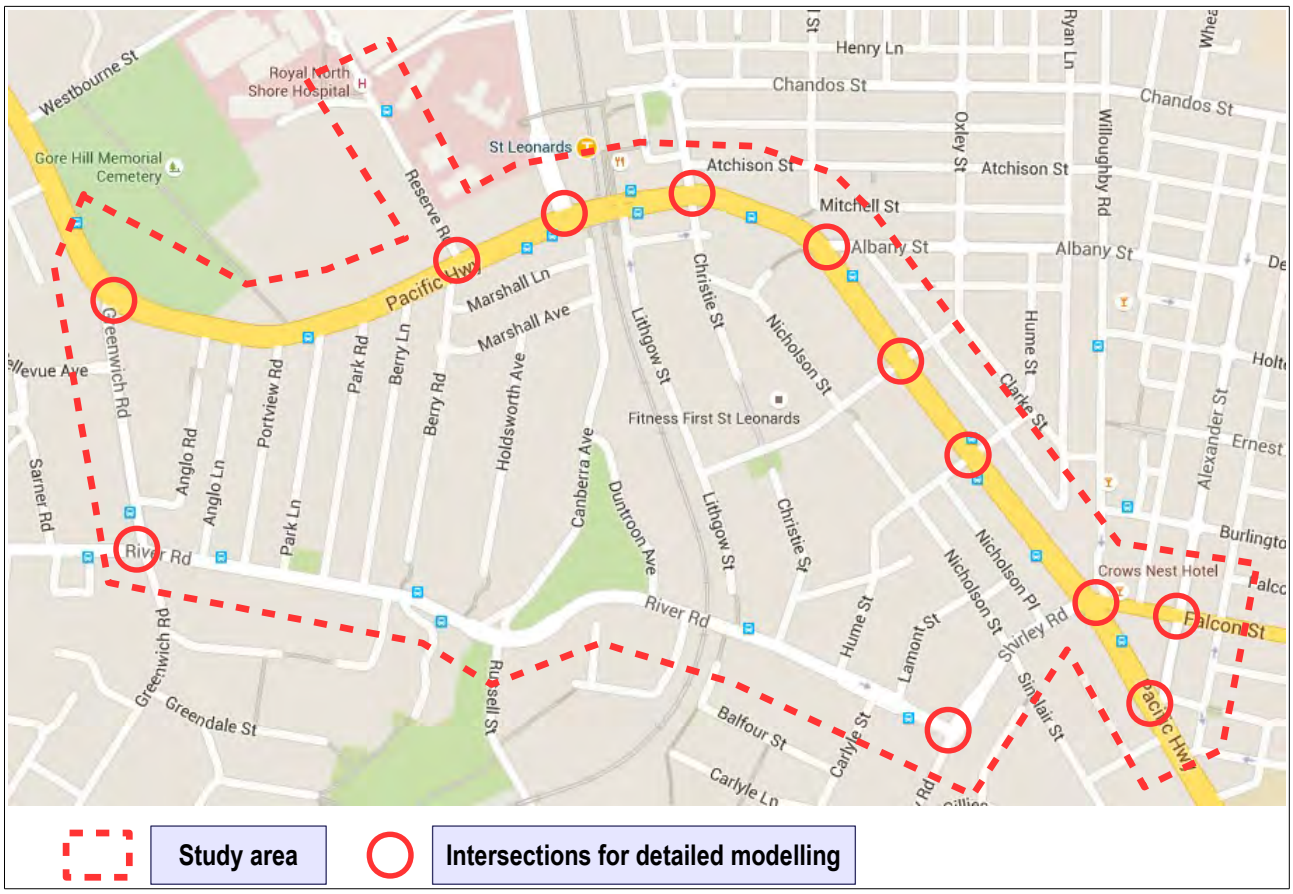


Figure 1: Study area.

2.3.1 Road Network

- The study area includes the following arterial roads:
  - Pacific Highway
  - River Road
  - Chandos Street
  - Shirley Road
  - Falcon Street
  - Alexander Street
- All other roads within the study area are local or local collector roads
- On street parking is available on Pacific Highway for both sides on some sections of the roads
  - Parking is restricted by time limits
- Local streets have a mixture of time restrictions and permit parking

2.3.2 Public Transport

- St Leonards has very good public transport provision
  - St Leonards railway station is located between Herbert and Christie Streets
    - Services the T1 North Shore line
  - There are multiple bus routes on Pacific Highway and River Road with frequent services in both directions of travel

2.3.3 Pedestrian Infrastructure

- Most of the roads in the study area incorporate pedestrian footpaths on both sides of the road
- Signalised intersections on the Pacific Highway provide pedestrian crossing facilities

2.4 Time Period

- The modelled time periods were the same as in the GTA Paramics model, as follows.
  - weekday AM peak - from 8:00 a.m. to 9:00 a.m.
  - weekday PM peak - from 5:00 p.m. to 6:00 p.m.
-

2.4.1 Warm up period

- A “warm up period” is required to populate model with traffic so that the model is run and analysed under stabilised conditions
- According to the RMS Traffic Modelling Guidelines 2013 (RMS 2013), the warm up period is required to be at least twice the time length of the longest trip
  - The longest trip was 5 minutes and 13 seconds on the Pacific Highway from the travel time surveys used for model validation by GTA Consultants
    - Refer to Section 3.2 for more information on the travel time surveys
- A 30 minute warm up period was used for the modelling process.

3 TRANSPORT DATA

3.1 Overview

- Comprehensive transport data for the study area was provided by Council to GTA Consultants during the development of the Paramics model, as follows.
  - SCATS traffic volumes
  - Manual turning movements counts
  - O-D surveys
  - Pedestrian counts
  - Queue length surveys
  - SCATS IDM data

3.2 Travel Time Data

- GTA Consultants conducted travel time surveys. These were documented in the GTA calibration report as follows.
  - *"Time travel surveys were undertaken on Thurs 4 April and Thursday 19 September 2013 during the AM peak period using the moving observer method. The surveys were carried out on two bidirectional routes."**
    - Refer to **Figure 2** for locations of the surveys.
- The surveys were carried out on sections of the Pacific Highway (bidirectional)
  - Refer to an extract from the GTA report below.

Route A

Route No.	Route Description
Route 1	Pacific Highway south-east bound (between Greenwich Road and Hume Street)
Route 2	Pacific Highway north-west bound (between Hume Street and Greenwich Road)

Route B

Route No.	Route Description
Route 1	Pacific Highway (between Greenwich Road and Hume Street)
Route 2	River Road via Shirley Road (between Pacific Highway and Greenwich Road)

- *"In order to obtain representative travel time data, the drivers were instructed to maintain a speed consistent with other road users, whilst observing the posted speed limits. Each route was broken down into segments and the travel times were recorded as vehicles pass the centre point of each signalised intersection on its route."**
  - **Table 1** below summarises the number of travel time runs obtained for each route

Table 1. Number of Travel Time Runs*.

Route No.	Direction	4 April 2013	19 September 2013	Total
Route 1	Eastbound	5	2	7
	Westbound	5	2	7
Route 2	Eastbound	0	3	3
	Westbound	0	3	3

- GTA Consultants noted that there was a *"variance in travel time results between each day"* *

- The data was considered to be *"sufficient for this study however, a more comprehensive travel time survey would be recommended to provide more robust travel time information."* *
  - Because the base model developed in Aimsun replicated the same 2012-2013 conditions used by GTA, new surveys, if conducted in 2016, would be inapplicable.

- For GTA survey results, refer to an **Appendix** to this report

Figure 2: Travel time survey locations. *

4 DEVELOPMENT OF BASE MODEL NETWORK

4.1 Network Structure

- The Aimsun model network structure is the same as that of the GTA model.
  - Refer to **Figure 3**

4.2 Overlay

- The road network structure was developed using aerial photograph analysis, based on www.maps.six.nsw.gov.au
  - Configurations of traffic lanes and intersections were confirmed by a site inspection.

4.3 Zoning System

- The Aimsun model adopts the zoning system used by GTA Consultants
  - Refer to **Figure 4**
- 36 zones in total
  - Refer to **Table 2**

* Extracted from St Leonards South Strategy, Paramics Base Model – AM peak, Calibration and Validation Report by GTA Consultants

Figure 3: Aimsun model network structure

Figure 4: Model zoning system *

* Extracted from St Leonards South Strategy, Paramics Base Model – AM peak, Calibration and Validation Report by GTA Consultants

Table 2. Description of Zones *

Zone Number	Road Name	Location	Description
1	Pacific Highway	Western end	Primary State arterial road
2	Reserve Road	Northern end	North / East and West approaches to roundabout – Local Council road
3	Herbert Street	Northern end	Major Council road
4	Chandos Street	Western end	Chandos Street car park
5	Christie Street	Northern end	Residential street – Local Council Road
6	Chandos Street	Eastern end	Retail strip – Secondary State arterial road
7	Albany Street	Eastern end	Retail strip – Local Council Road
8	Oxley Street	Eastern end	Local Council Road
9	Hume Street	Eastern end	Local Council Road
10	Pacific Highway	Eastern end	Primary State arterial road
11	Hume Street	Western end	Local Council Road
12	Christie Street	Southern end	Local Council Road
13	Lithgow Street	Southern end	Local Council Road
14	Shirley Road	Western end	Local Council Road
15	Russell Street	Southern end	Residential street – Local Council Road
16	Greenwich Road	Southern end	Major Council road
17	River Road	Western end	Secondary State arterial road
18	Berry Road	Southern end	Residential street – Local Council Road
19	Holdsworth Avenue	Southern end	Residential street – Local Council Road
20	Marshall Lane	Middle	Rear laneway access to retail on Pacific Highway
21	Bellevue Avenue	Western end	Residential street – Local Council Road
22	Gore Hill Park Access	Northern end	Car park access
23	Royal North Shore Hospital Access	Eastern end	Access to Royal North Shore Hospital
24	Atchison Lane / Atchison Street	Eastern end	Retail strip – Local Council Road
25	Wilona Avenue	Southern end	Residential street – Local Council Road
26	Anglo Lane / Anglo Road	Southern end	Residential street – Local Council Road
27	Anglo Lane / Anglo Road	Northern end	Residential street – Local Council Road
28	Park Lane	Southern end	Residential street – Local Council Road
29	Park Lane	Northern end	Residential street – Local Council Road
30	Duntroon Avenue Access	Eastern end	Residential street – Local Council Road
31	Carlyle Street	Southern End	Residential street – Local Council Road
32	Sinclair Street	Southern End	Residential street – Local Council Road
33	Falcon Street	Eastern End	Primary State arterial road
34	Alexander Street	Northern End	Major Council road
35	Willoughby Road	Northern End	Retail strip – Secondary State arterial road
36	Hayberry Street	Eastern End	Access to Alexander Street and Alexander Lane

* Extracted from St Leonards South Strategy, Paramics Base Model – AM peak, Calibration and Validation Report by GTA Consultants

4.4 Assignment

- Microsimulation was carried out using 100% stochastic route choice with a logit function.
- Similarly to the GTA model, this assignment method is considered to be appropriate to realistically replicate driving behaviour and travel patterns for this network having consideration to the following:
  - Relatively small size of the network
  - Two key routes exist within the model extent along with Pacific Highway corridor and River Road
  - Dynamic assignment provides and opportunity for motorists to realistically seek alternate routes within the network when congestion builds" *

4.5 Nodes and Junctions

- These were modelled using standard Aimsun methods, similarly to the GTA Model
  - Nodes were coded into the model at all intersections
  - Zone connectors were coded at model entry points where it is appropriate the vehicles enter the network at speed

4.6 Links

- Link geometry, lanes and turn restrictions were coded based on aerial photography, checked in the field during the site inspection
- Link speed limits were coded based on street view images and aerial photography, checked in the field during the site inspection.
- Link categories were defined using the standard categories.
- Car parking has not been included on the model as it is not a car parking model assessment, in agreement with the approach utilised in the GTA model as per below.
  - *"It is noted that car parking, particularly along the Pacific Highway, has not been included as this model is not considered a car parking model assessment. Further, site observations indicate little or no friction between general driver behaviour and car parking along the Pacific Highway."**

4.7 Kerbs and Stoplines

- Kerbs and stoplines positioning were coded based on the aerial photography.

4.8 Lane changing and lance choice rules

- Default Aimsun parameters were used for lane changing and lane choice.

4.9 Car following

- Default Aimsun car following model parameters were used.

4.10 Signal Control

- All signalised intersection phasing and timing were modelled based on

* Extracted from St Leonards South Strategy, Paramics Base Model – AM peak, Calibration and Validation Report by GTA Consultants

Intersection Diagnostic Monitor {IDM) data extracted from RMS SCATS system (data provide by Council to GTA and by GTA to TEF Consulting).

- Unlike in the GTA model, TEF model utilises adaptive phasing for all signalised intersections.
    - Intersection operation and actual peak hour phasing sequences were video recorded and the video footage was used to check consistency with the modelled phasing.

4.11 Vehicle parameters

- Standard vehicle parameters from Austroads microsimulation standards Technical Note 2 were used.

4.12 Matrix Demand Development

- The demand matrix was imported from the Paramics model developed by GTA Consultants

4.13 Matrix Structure

- The matrix structure was retained as per the GTA model, quoted below.
    - *"Two matrix levels, Cars/LGVs and HGVs were developed with the proportion of heavy vehicles estimated directly from the intersection turn counts."*[*]

4.14 Profile (Demand)

- Demand profiles were retained as per the GTA model, quoted below.
    - *"To ensure that the correct number of vehicles are released into the network within defined time slices, a demand profile was constructed. To accurately reflect traffic arrival patterns on the external links into the network within the modelled time period, temporal traffic profiles have been adopted on a zone by zone basis. These profiles are based on the existing traffic count data and have been developed for 15 minute periods across the modelled 1.5 hours."*[*]

4.15 Public Transport – Buses

- Public transport services were coded as per the GTA model (refer to quoted text below), except instead of average service frequencies, actual timetables were coded in. This is regarded as an improvement.
    - *"Public transport data was coded into the model using the following information:*
        - *Bus stop information*
            - *Location of bus stops*
            - *Dwell time at key bus stops – dwell time information was based on site observation and the results of the dwell time survey provided by Council.*
        - *Bus route information*
            - *Bus service providers and route number"*[*]

4.16 Pedestrians

- Pedestrian flows were modelled using standard modules in Aimsun software.,

* Extracted from St Leonards South Strategy, Paramics Base Model – AM peak, Calibration and Validation Report by GTA Consultants

based on counts provided in the GTA model.

4.17 Modelling Techniques

- The following modelling techniques were adopted in the course of the development and calibration and the model:
  - In order to reduce modelled queue lengths to better match the observed queue lengths, driver reaction time parameter was reduced on the following intersection approaches
    - Shirley Road / River Road
      - Northern and western approaches
    - River Road / Greenwich Road
      - Northern, western and eastern approaches
    - Pacific Highway / Shirley Road / Falcon Street
      - Eastern approach
  - In order to reduce attractiveness of local streets for transit vehicles, driver reaction time parameter was increased on the following northern approaches to River Road.
    - Portview Road, ParkRoad and Berry Lane

5 MODEL CALIBRATION AND VALIDATION

5.1 Calibration and Validation Criteria

- Model calibration and validation were carried out using the same approach as that used for the GTA model, as quoted from the GTA report below.
  - *"The role of the calibration and validation process in this project was to develop a model that is 'fit for purpose' and produces results that will be suitable for assessing development proposals and improvement options within the study area*
  - *The calibration and validation criteria were based on the RMS Modelling Guidelines, March 2013 and are presented in **Table 3"** **

Table 3: Calibration and Validation Criteria*.

Item	Criteria
Link and Turn Volumes	Tolerance limits for individual link and turn volumes: 85% of individual link or turn volumes to have a GEH ≤ 5 All individual link and turn volumes should have GEH ≤ 10 Plots of observed versus modelled hourly flows: Slope value to be included with plots and be > 0.95 R^2 value to be included with plots and be > 0.9
Travel Time Average	Average modelled travel time to be within 15% or one minute (whichever is greater) of average observed journey time for full length of route. Average modelled travel time to be within 15% of average observed travel time for individual sections. Average and 95% confidence intervals to be plotted for observed and modelled travel times for each journey time route (to modellers and RMS satisfaction).
Visual Checks	Key locations to review in terms queuing, pedestrian movements and vehicle-pedestrian interaction.

- *"In terms of traffic data used in the calibration process, the available turn and link counts were used*
- *The validation process utilised the surveyed travel time data to ensure that the simulated travel times are as close as possible to surveyed travel times"* *

5.2 Model Calibration and Validation Results

5.2.1 Model Stability

- A total of five seed runs were undertaken with the RMS standard seed values (560, 28, 7771, 86524 and 2849).
- The results of five seed runs for total travel time (referred to as Vehicle Hours Travelled or VHT in the GTA report) were plotted on a digram shown in **Figure 5** overleaf. Descriptive statistics are included in **Table 4**.
- **Figures 6** and **7** show comparisons of the total number of vehicles in the network over the modelled period, for the morning and afternoon peak hours respectively.
- The results show consistent values, in line with typical variations in daily traffic volumes.

* Extracted from St Leonards South Strategy, Paramics Base Model – AM peak, Calibration and Validation Report by GTA Consultants

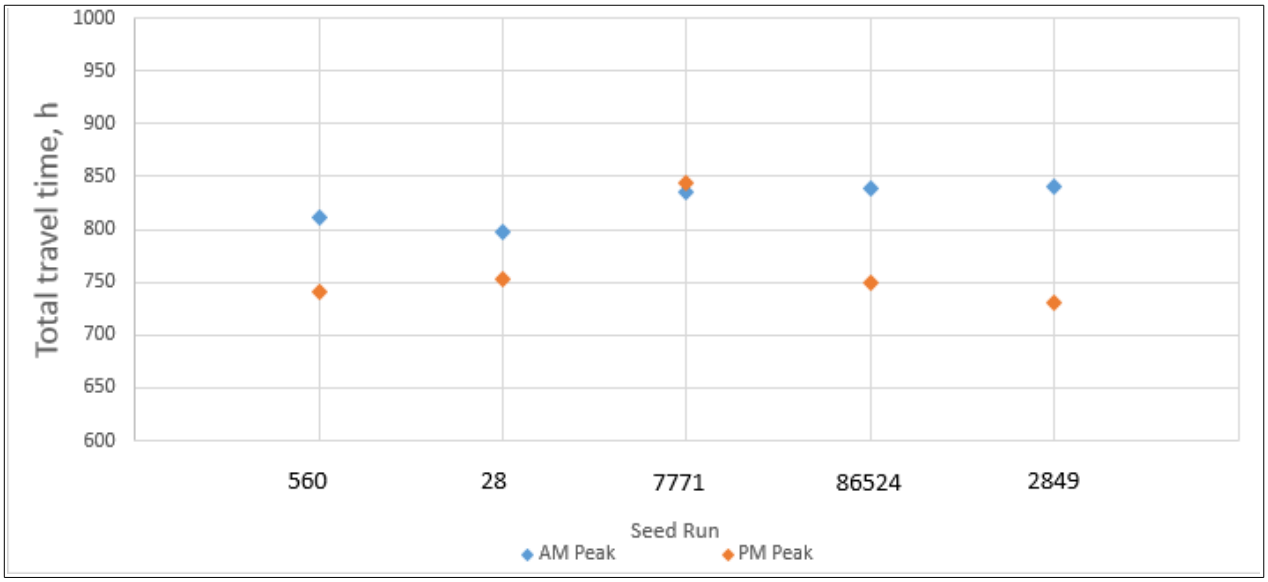


Figure 5: Scatter plot for total travel time.

Table 4: Descriptive statistics for total travel time.

Statistic	AM Peak	PM Peak
Number of Runs	5	5
Mean	825.00	762.80
Standard Deviation	19.04	45.65
Standard Error	8.51	20.41
Range	43.00	113.00
Minimum	798.00	730.00
Maximum	841.00	843.00
Confidence Level(95.0%)	23.64	56.68
Upper Confudence Limit	798.00	730.00
Lower Confidence Limit	841.00	843.00

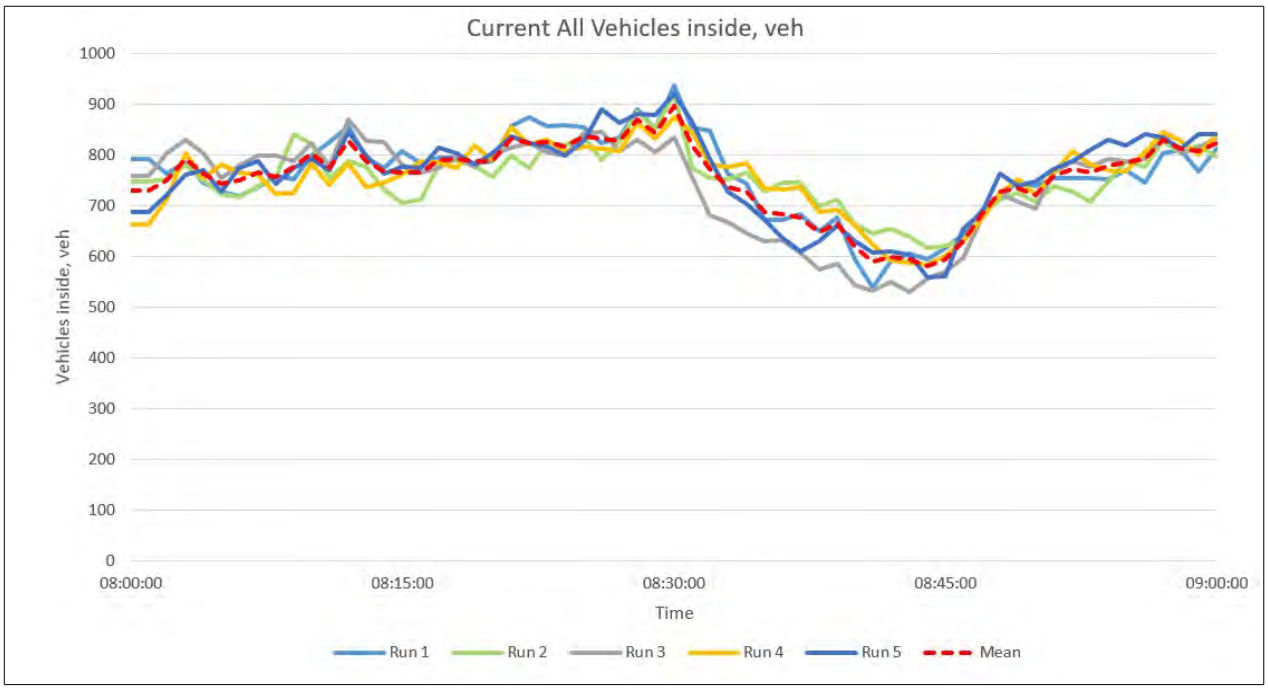


Figure 6: Total vehicles in the network – AM peak.

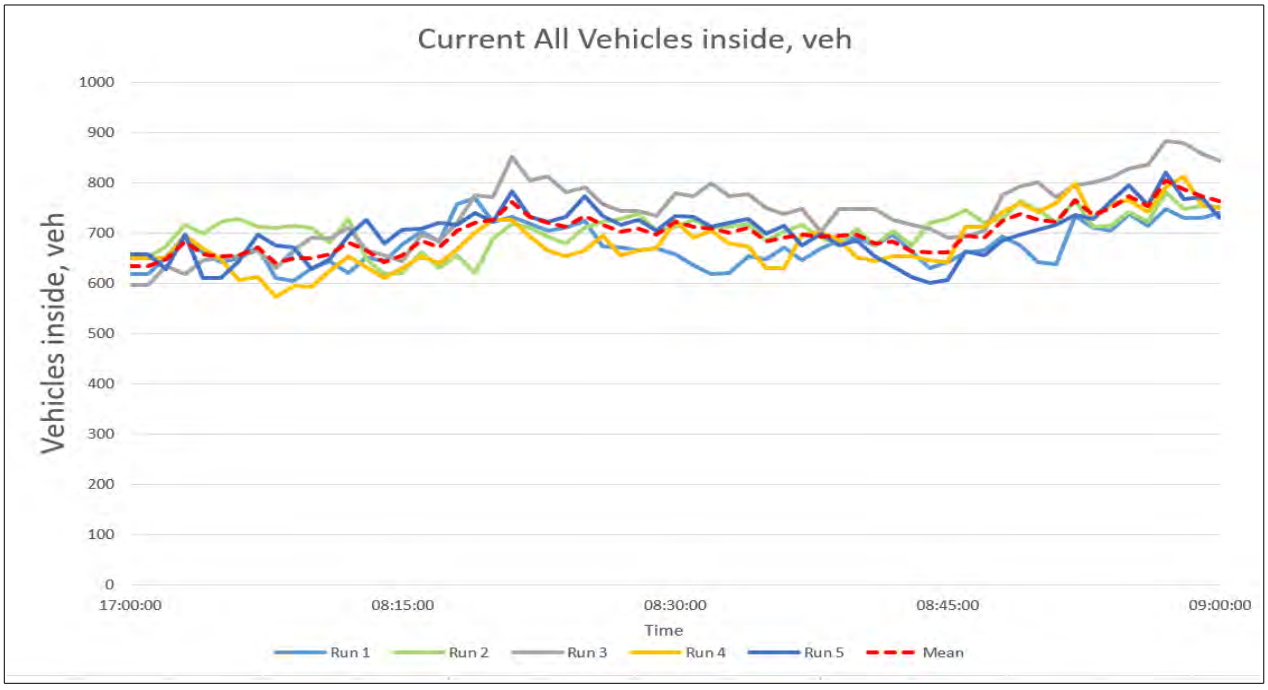


Figure 7: Total vehicles in the network – PM peak.

5.3 Model Calibration Results

- The calibration results are presented for the average of 5 model runs for both morning and afternoon peak hours.
-

5.3.1 Link and Turn Flow Results

- **Table 5** compares the observed versus the modelled vehicle volumes.
- **Figures 8** and **9** present the results of the scatter plot analysis for the AM and PM peak hours respectively.
- For detailed results refer to an **Appendix.**
- The results of turn and link count calibration meet the RMS criteria for GEH and scatter analysis.

Table 5: Descriptive statistics for total travel time.

Measure	Criteria	AM Peak	PM Peak
Detectors			
85% of individual link or turns counts	GEH ≤ 5	83.54%	89.87%
All individual link or turn counts	GEH ≤ 10	100%	100%
Slope	>0.95	1.012	0.996
R^2	>0.90	0.991	0.984
Turns			
85% of individual link or turns counts	GEH ≤ 5	86.00%	91.00%
All individual link or turn counts	GEH ≤ 10	100%	100%
Slope	>0.95	1.015	0.997
R^2	>0.90	0.993	0.990

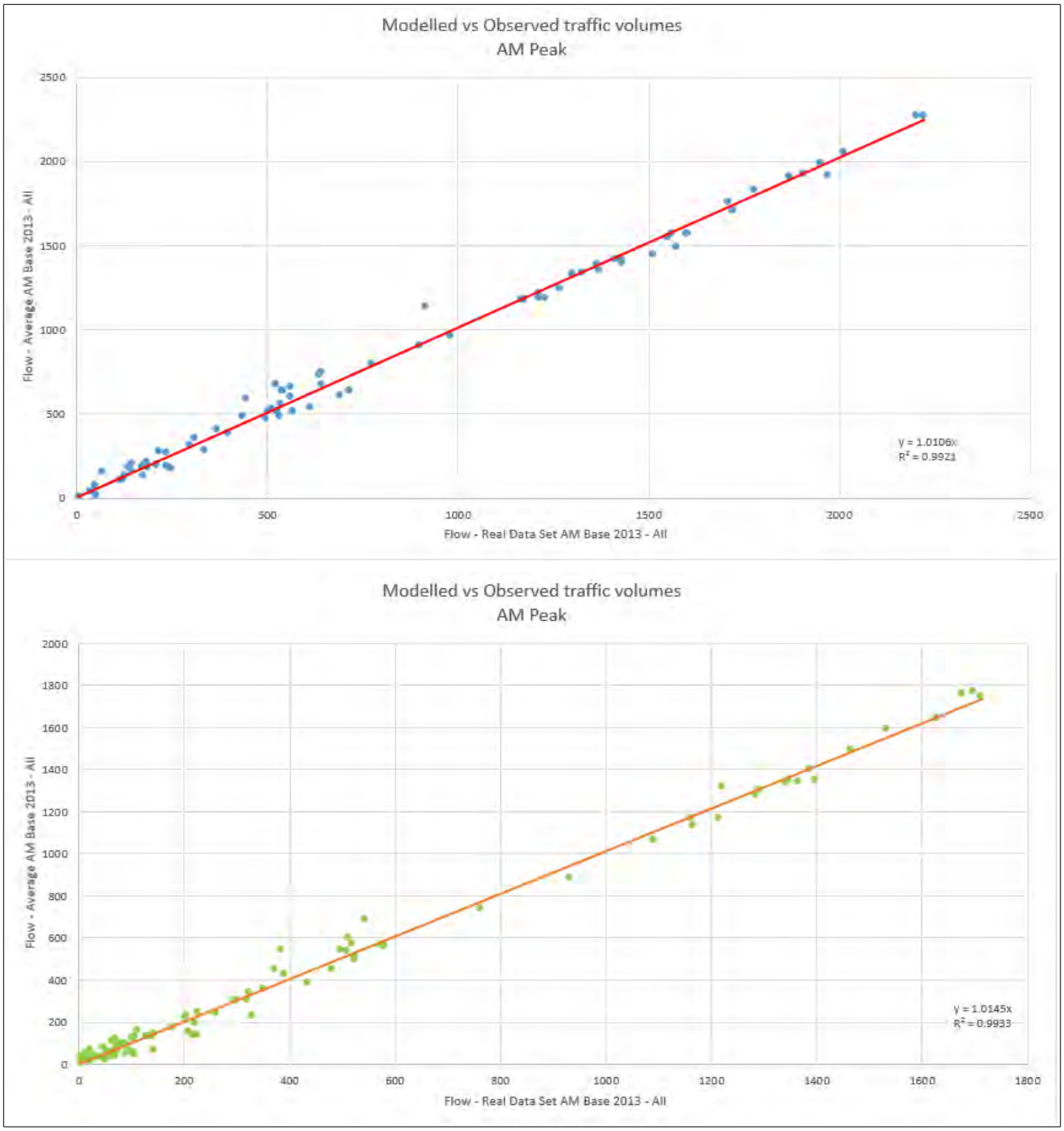


Figure 8: Link and turn flow comparison (8:00 a.m. to 9:00 a.m.)

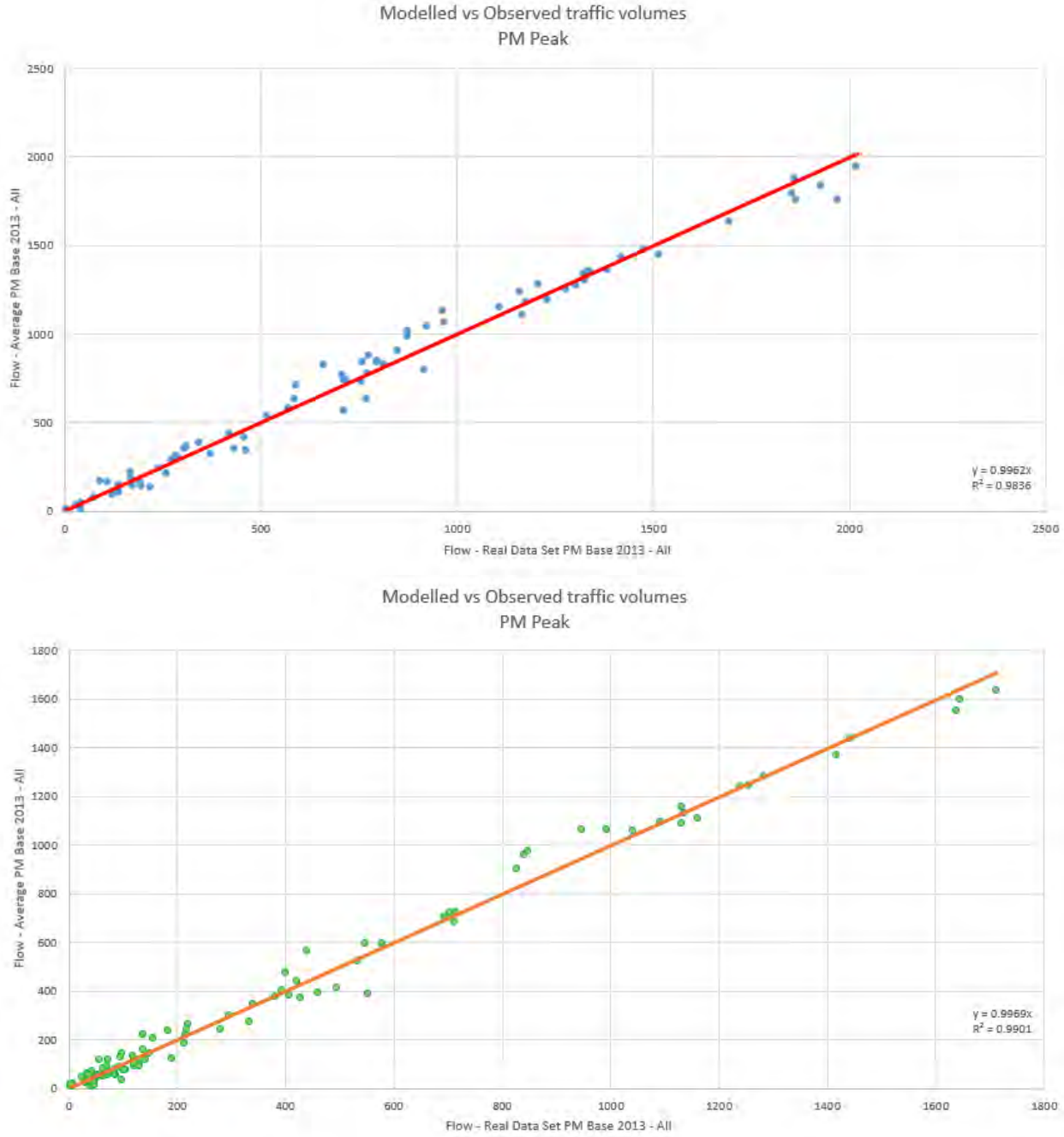


Figure 9: Link and turn flow comparison (5:00 p.m. to 6:00 p.m.)

5.4 Model Validation Results

5.4.1 Demand Release

- Similarly to GTA approach, the demand release percentages were checked for each model run.
    - *"Whilst demand release is not a specific validation criteria in the RMS Traffic Modelling Guidelines, it is considered important to show that the model is correctly releasing the appropriate demands into the network.* ***Table 6*** *presents the demand release percentage for the median seed run in the AM peak model."* *
- In all runs, the number of unreleased vehicles was less than 1%. This is considered to be acceptable. Please refer to **Table 6** overleaf.

5.4.2 Travel Time Results

- Results of travel time surveys carried out by GTA for model validation were used for the validation of the current model.
    - **Figure 10** shows the travel time survey locations.
    - Details of GTA travel time survey results are included in the **Appendix.**
- **Figures 11** to **18** show comparison results of observed and modelled travel times.
    - The comparison results indicate good correspondence of travel times, within 15% or one minute.

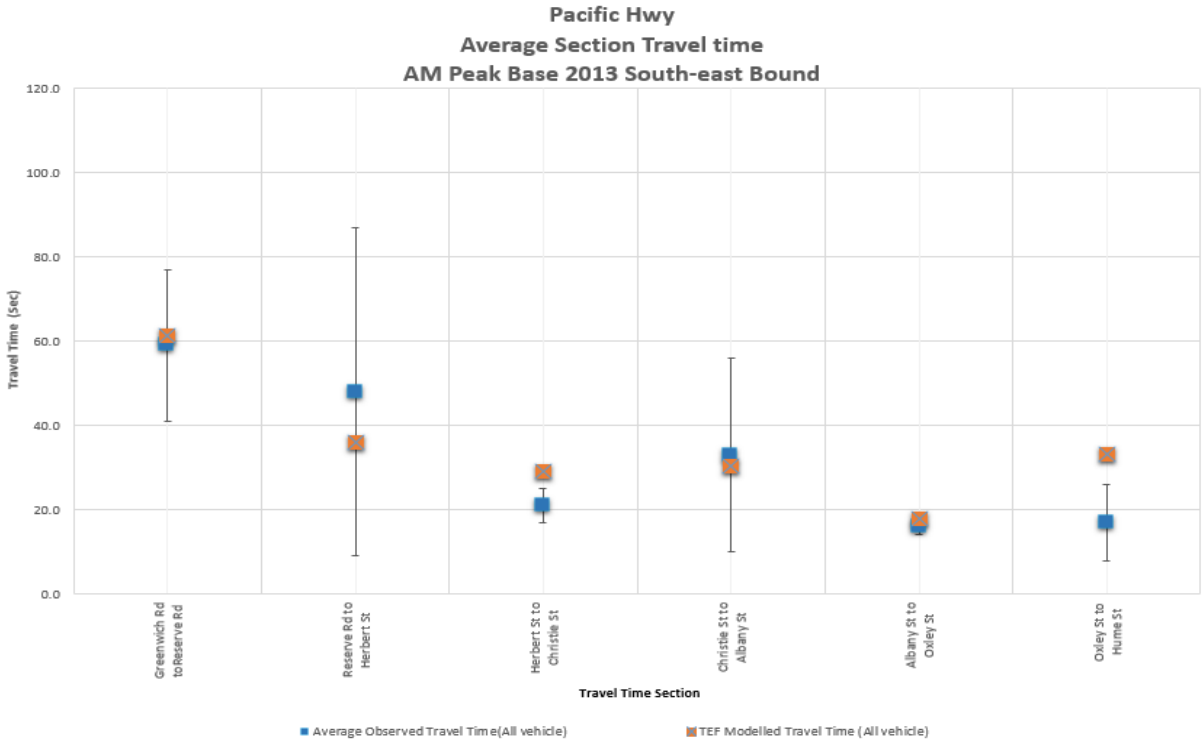
Table 6: Travel time comparison (observed times are those reported by GTA).

AM peak							
Route	Observed Travel Time, Sec	Observed Min Travel Time, Sec	Observed Max Travel Time, Sec	Modelled Travel Time, Sec	Difference Travel Time, Sec	Difference, %	Meets Criteria
Route 1 (South-eastbound)	194	128	245	208	14	7%	YES
Route 1 (North-Westbound)	199	149	313	197	-2	-1%	YES
Route 2 (Eastbound)	235	227	244	200	-35	-15%	YES
Route 2 (Westbound)	153	113	196	212	59	39%	YES
PM peak							
Route	Observed Travel Time, Sec	Observed Min Travel Time, Sec	Observed Max Travel Time, Sec	Modelled Travel Time, Sec	Difference Travel Time, Sec	Difference, %	Meets Criteria
Route 1 (South-eastbound)	182	106	226	188	6	3%	YES
Route 1 (North-Westbound)	217	150	336	190	-27	-13%	YES
Route 2 (Eastbound)	243	160	313	196	-47	-19%	YES
Route 2 (Westbound)	185	133	212	222	37	20%	YES

* Extracted from St Leonards South Strategy, Paramics Base Model – AM peak, Calibration and Validation Report by GTA Consultants

Figure 10: Travel time route sections*.

* Extracted from St Leonards South Strategy, Paramics Base Model – AM peak, Calibration and Validation Report by GTA Consultants



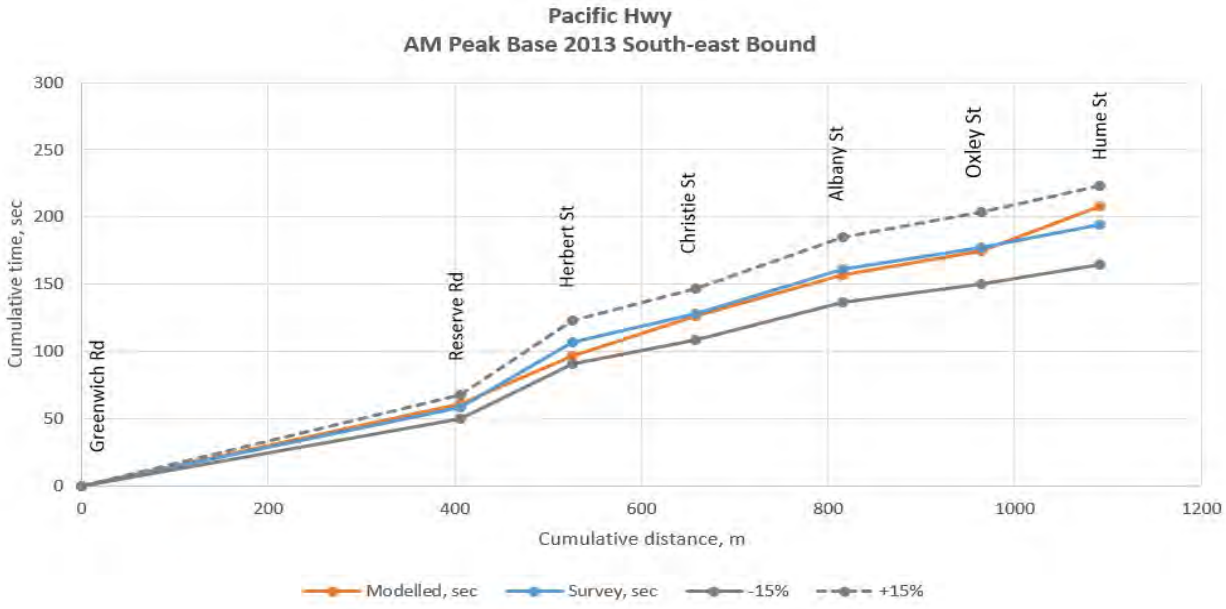


Figure 11: Pacific Hwy South-east bound travel time - AM Peak.

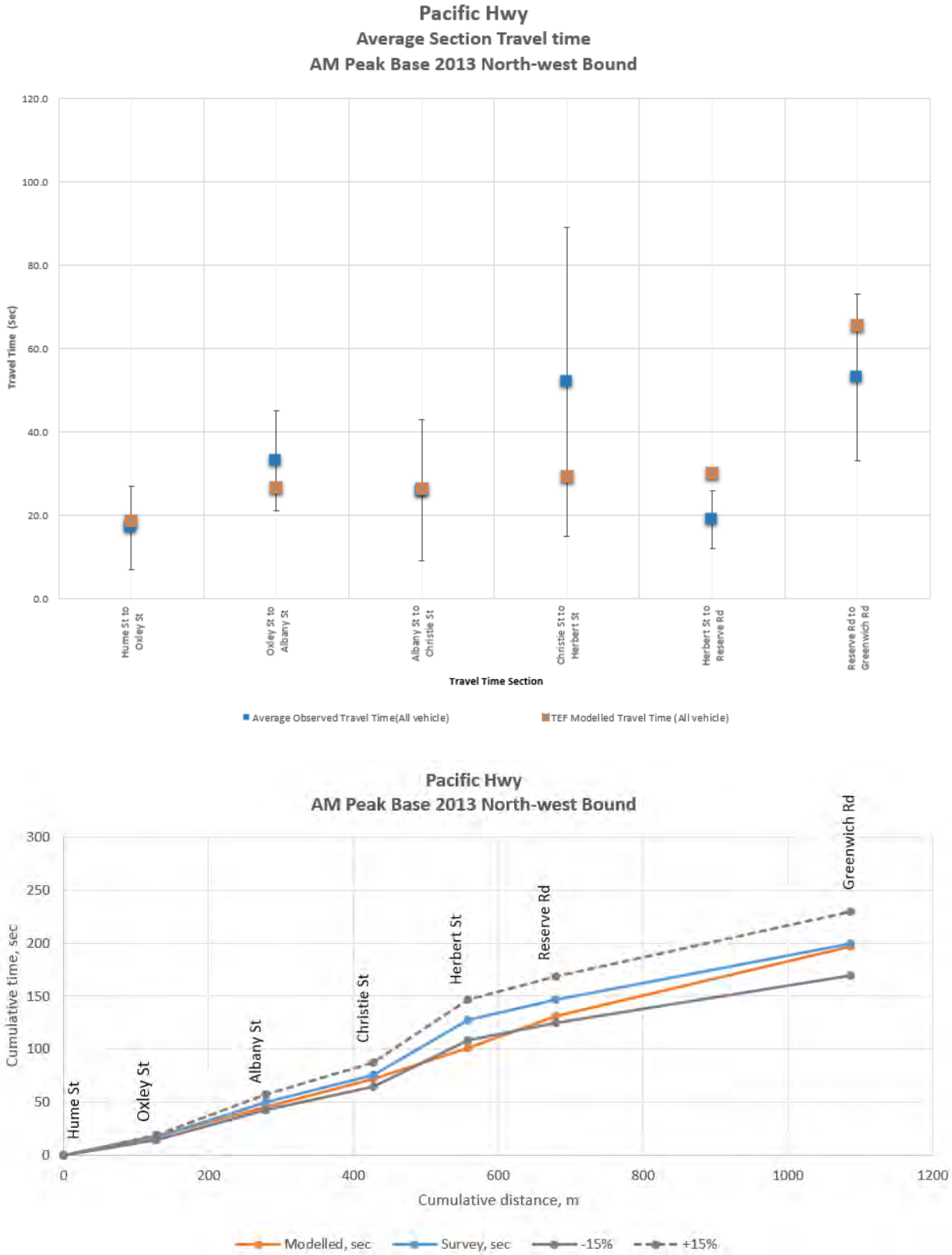
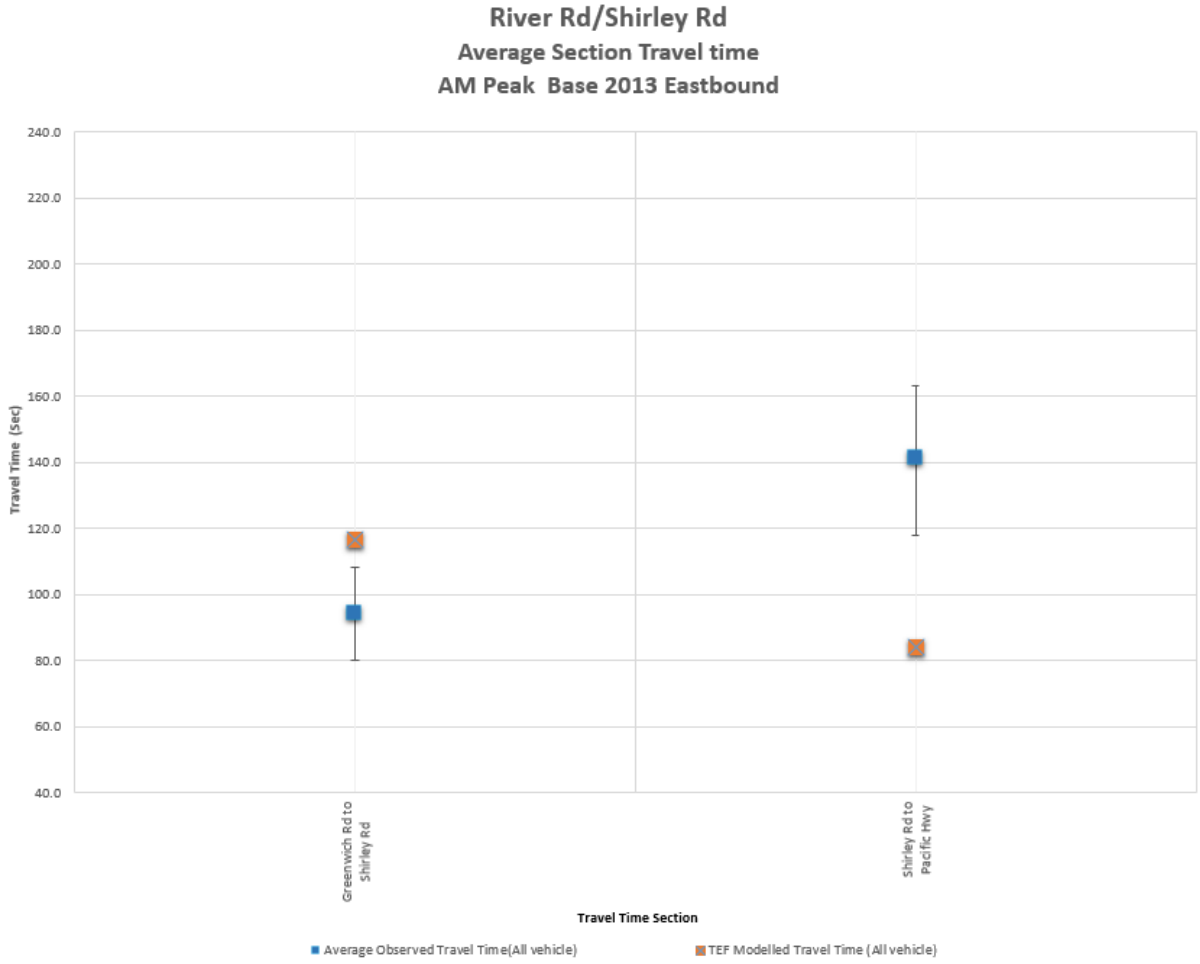


Figure 12: Pacific Hwy North-west bound travel time - AM Peak.



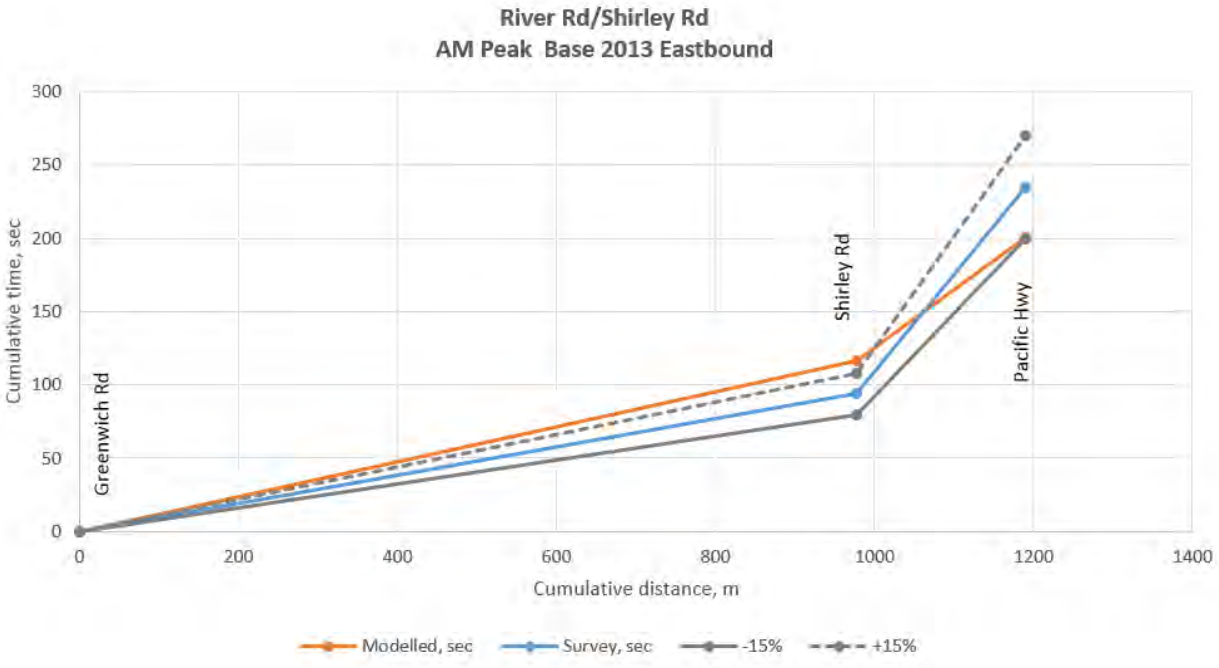
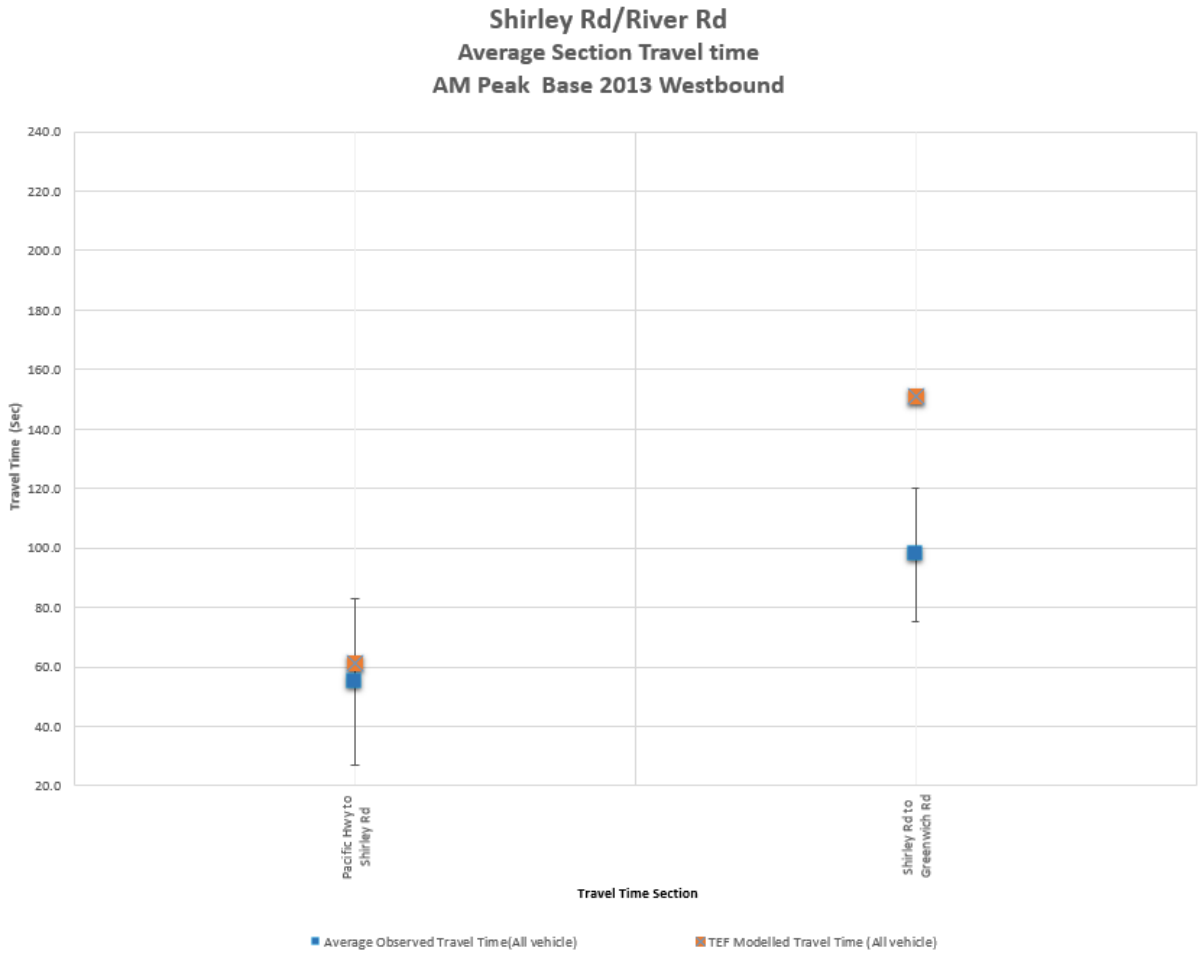


Figure 13: River Rd/Shirley Rd Eastbound travel time - AM Peak.



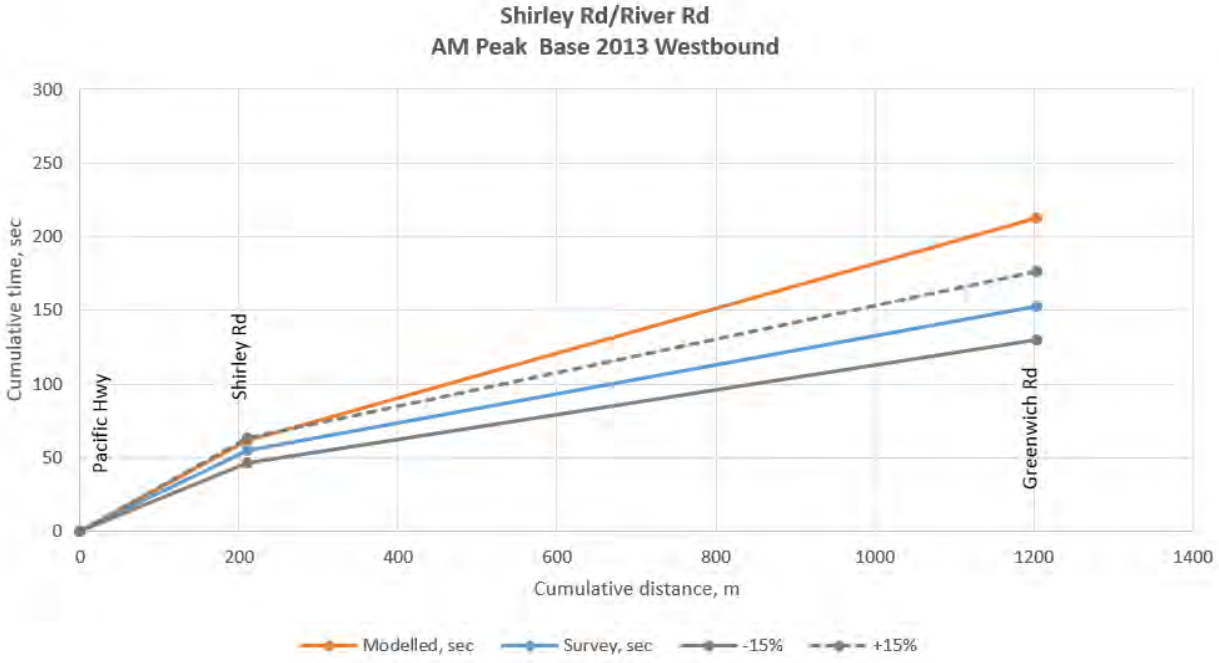
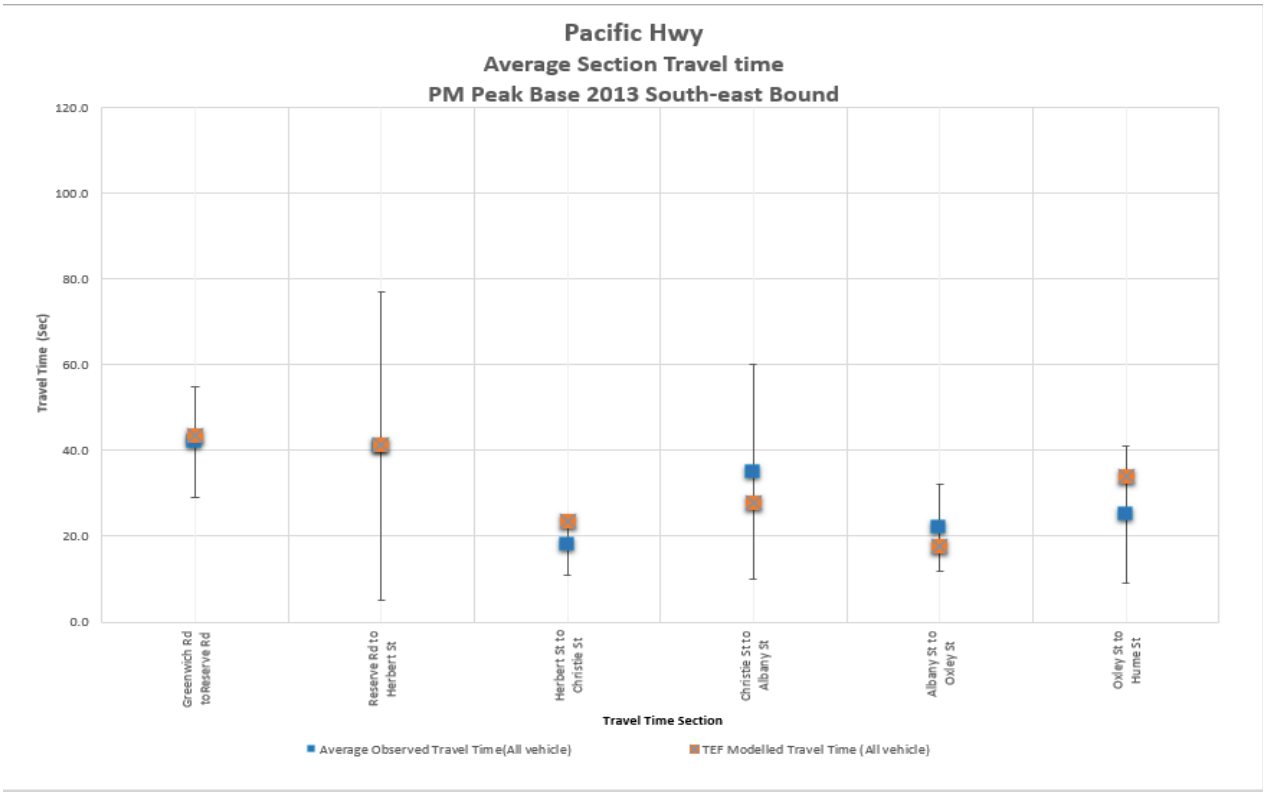


Figure 14: River Rd/Shirley Rd Westbound travel time - AM Peak.



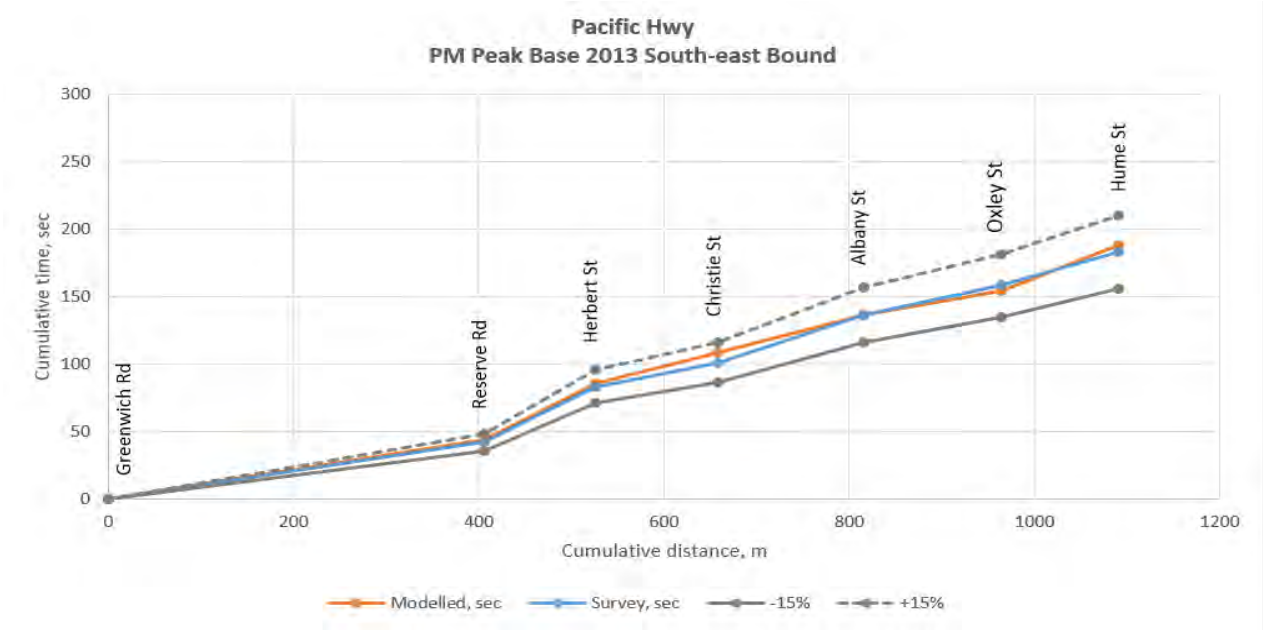
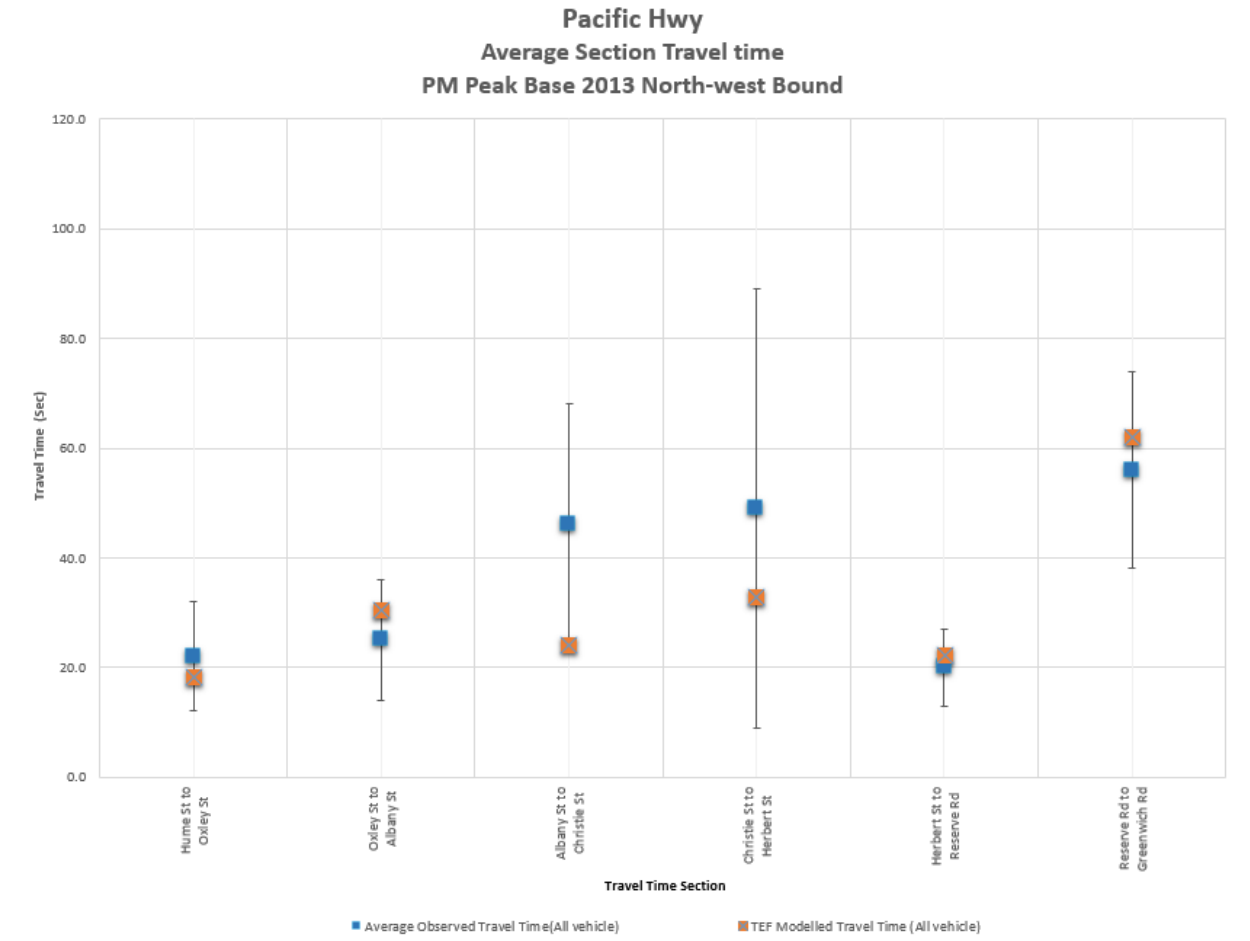


Figure 15: Pacific Hwy South-east bound travel time - PM Peak.



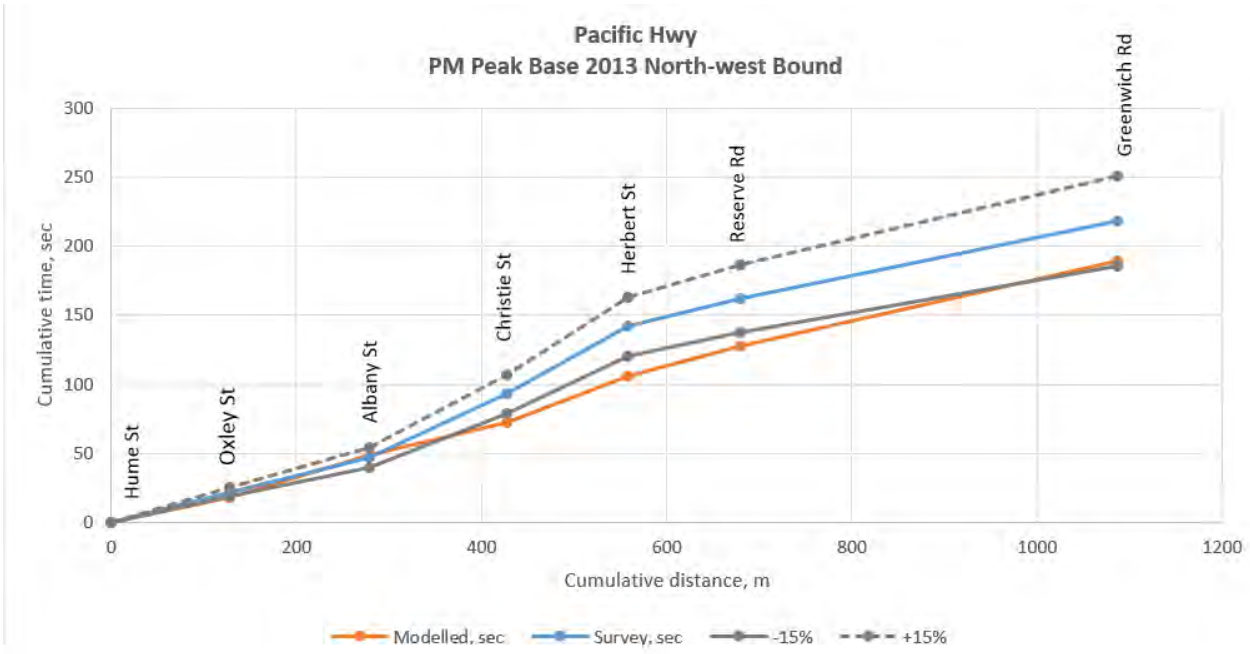
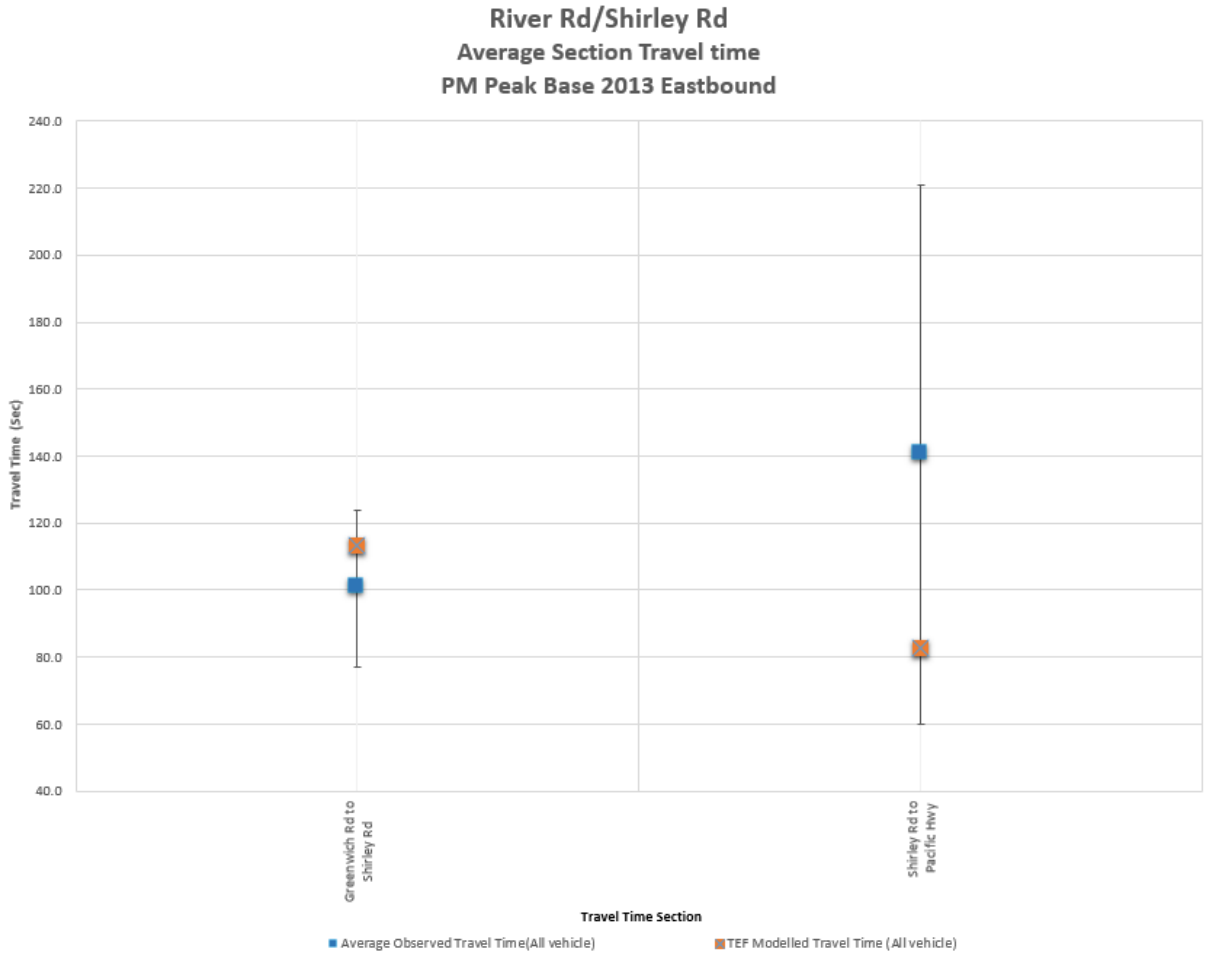


Figure 16: Pacific Hwy North-west bound travel time - PM Peak.



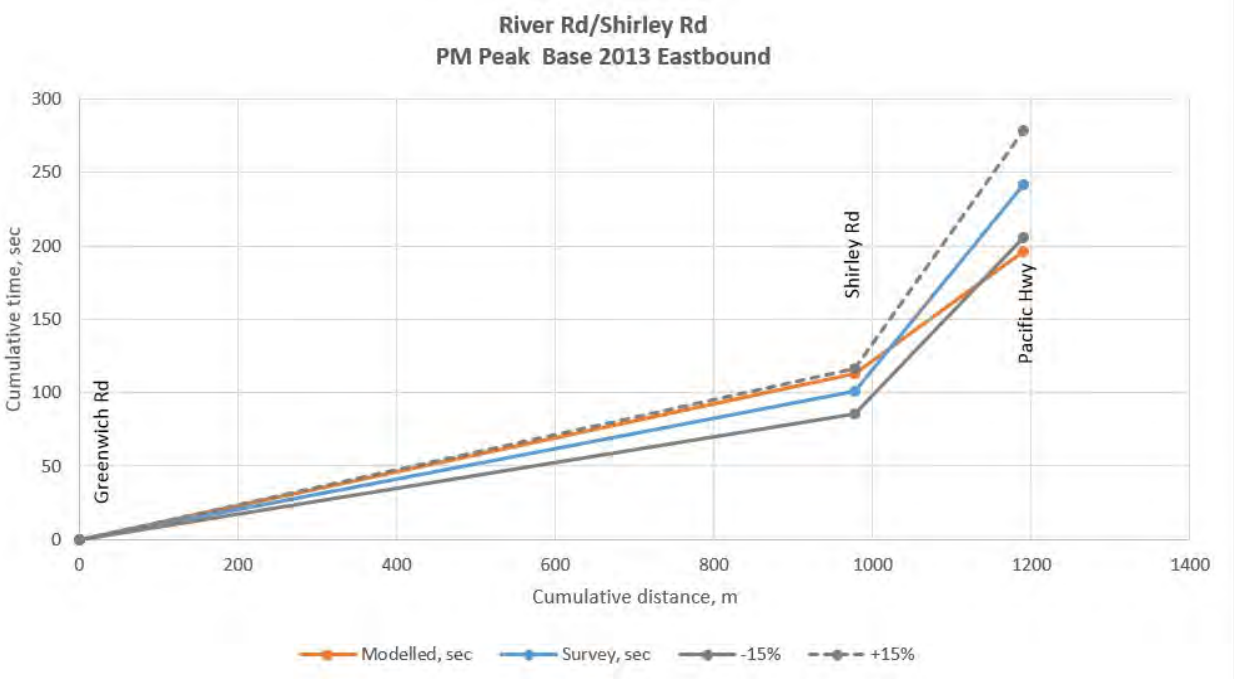
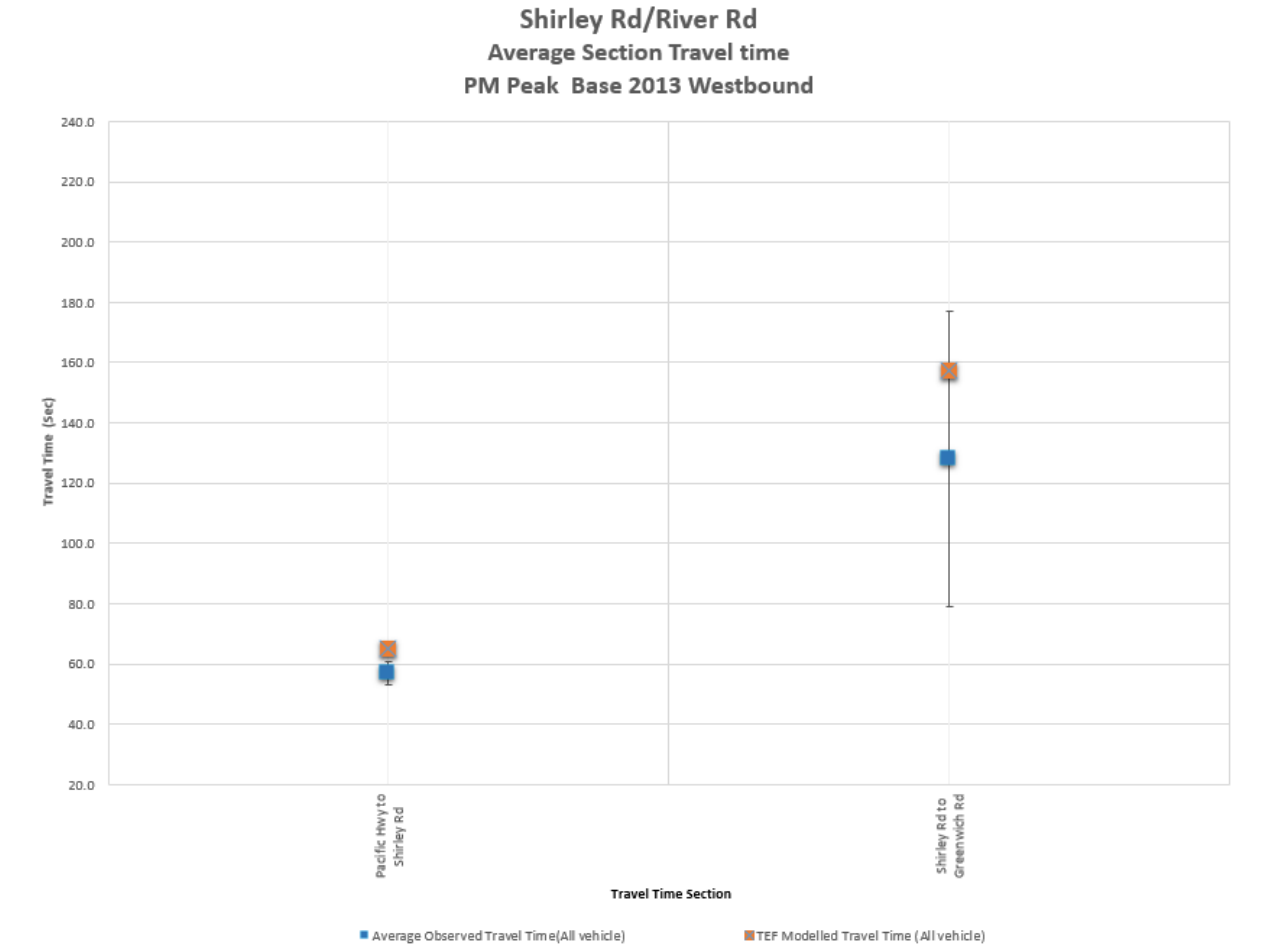


Figure 17: River Rd/Shirley Rd Eastbound travel time - PM Peak.



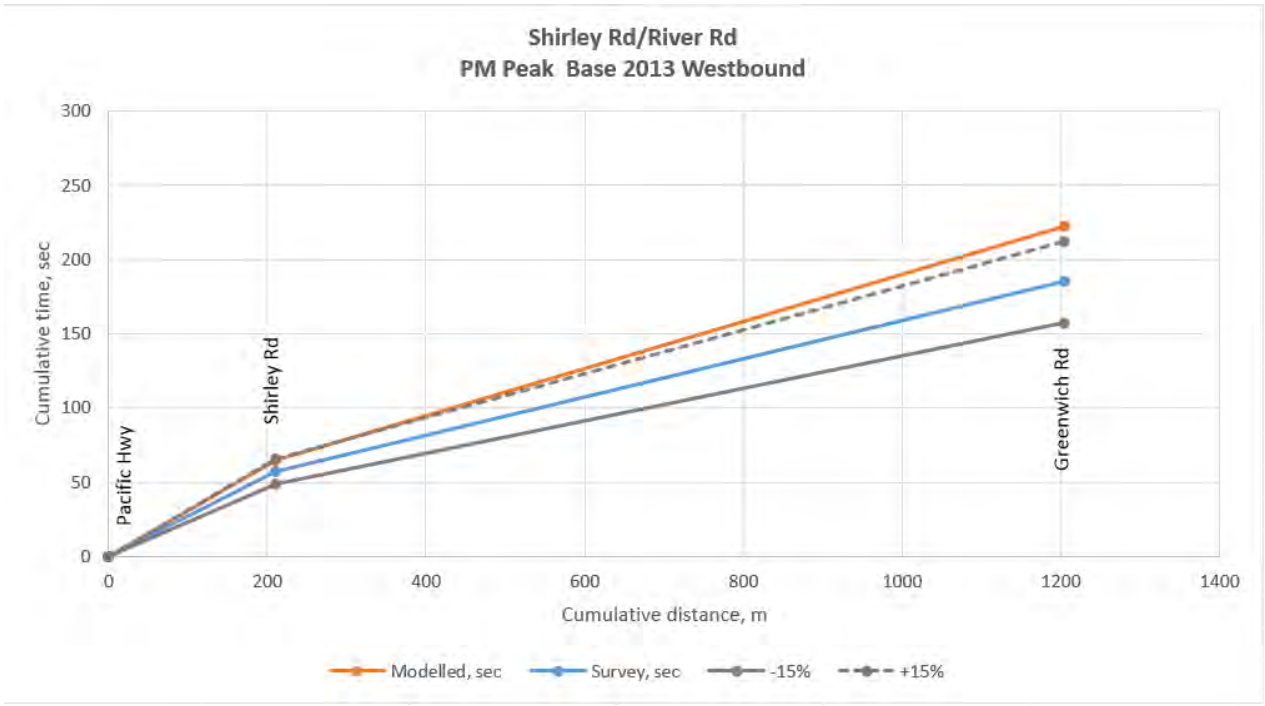


Figure 18: River Rd/Shirley Rd Westbound travel time - PM Peak.

5.4.3 Queuing

- Modelled queues on intersection approaches were compared with the survey results contained in GTA reports where available.
- The results of this comparison, presented in **Table 7**, indicate good matching between the modelled and the observed queues (as stated in the GTA report). It must be noted that comparison of queuing can only be approximate due to differences in definition of queuing between observers in the field and in modelling packages like Aimsun or Paramics.

Table 7: Queue length comparison (observed queues are those reported by GTA).

AM Peak

№	Intersection			SB			EB			NB			WB		
				Modelled Queue max (veh)	Observed Queue (veh) (85%)	Observed Queue (veh) (95%)	Modelled Queue max (veh)	Observed Queue (veh) (85%)	Observed Queue (veh) (95%)	Modelled Queue max (veh)	Observed Queue (veh) (85%)	Observed Queue (veh) (95%)	Modelled Queue max (veh)	Observed Queue (veh) (85%)	Observed Queue (veh) (95%)
1	Pacific Hwy	/	Alexander St	14						8			8		
2	Pacific Hwy	/	Shirley Rd/Falcon St	19			6			9			11		
3	Pacific Hwy	/	Hume St	10	2	2	9	5	5	12	1		6	4	5
4	Pacific Hwy	/	Oxley St	5	5	9	4	3	3	9	7	7	5	9	10
5	Pacific Hwy	/	Albany St	12	6	7				6	21	21	13	20	20
6	Pacific Hwy	/	Christie St	7	17	17	15	9	11				10	12	21
7	Pacific Hwy	/	Herbert St	19	12	12	13	13	15				6	16	18
8	Pacific Hwy	/	Reserve Rd	5	3	5	17	8	12	5	3	4	8	4	7
9	Pacific Hwy	/	Greenwich Rd				7	5	9	10	15	16	11	10	11
11	Shirley Rd	/	River Rd	14			9			5			0		
12	River Rd	/	Greenwich Rd	7	7	10	34	12	19	8	7	9	9	24	25

PM Peak

№	Intersection			SB			EB			NB			WB		
				Modelled Queue max (veh)	Observed Queue (veh) (85%)	Observed Queue (veh) (95%)	Modelled Queue max (veh)	Observed Queue (veh) (85%)	Observed Queue (veh) (95%)	Modelled Queue max (veh)	Observed Queue (veh) (85%)	Observed Queue (veh) (95%)	Modelled Queue max (veh)	Observed Queue (veh) (85%)	Observed Queue (veh) (95%)
1	Pacific Hwy	/	Alexander St	14						8			8		
2	Pacific Hwy	/	Shirley Rd/Falcon St	19			6			9			11		
3	Pacific Hwy	/	Hume St	10	8	9	9	4	5	12	4	6	6	3	4
4	Pacific Hwy	/	Oxley St	5	7	9	4	9	9	9	2	4	5	6	7
5	Pacific Hwy	/	Albany St	12	8	11				6	21	21	13	20	20
6	Pacific Hwy	/	Christie St	7	17	17	15	7	9				10	11	19
7	Pacific Hwy	/	Herbert St	19	16	18	13	10	14				6	19	18
8	Pacific Hwy	/	Reserve Rd	5	4	4	17	8	10	5	3	3	8	5	10
9	Pacific Hwy	/	Greenwich Rd	0			7	4	6	10	8	8	11	5	6
11	Shirley Rd	/	River Rd	14			9			5			0		
12	River Rd	/	Greenwich Rd	7	7	9	34	11	14	8	10	11	9	7	16

6 EXISTING CONDITIONS MODEL RESULTS

6.1 Intersection operation

- The results for the performance of the intersections in the network from the Aimsun model are shown in **Table 8**.

6.2 Specific conditions

- Substantial congestion and queuing were noted at the following intersections.
  - Shirley Rd / River Rd in the eastbound direction
  - River Rd / Greenwich Rd in the southbound direction
  - Alexander St / Falcon St in the westbound direction
  - Pacific Hwy / Herbert St in the southbound direction
- During the calibration process, some transit vehicles which were supposed to use Pacific Hwy, consistently attempted to use local streets. In most instances such behaviour was eliminated by reducing reaction times on the local street approaches to intersections with higher level roads.

Table 8: Intersection operation parameters.

AM Peak

№	Intersection			SB			EB			NB			WB			AVD	LOS
				Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
1	Pacific Hwy	/	Alexander St	1356	21.85	14.00	0	0	0	1173	14.86	8.00	393	24.88	8.00	19.45	B
2	Pacific Hwy	/	Shirley Rd/Falcon St	1453	37.96	19.00	491	44.46	6.00	971	20.88	9.00	860	31.39	11.00	32.91	C
3	Pacific Hwy	/	Hume St	1439	20.15	10.00	183	113.42	9.00	1358	19.19	12.00	182	85.54	6.00	28.90	C
4	Pacific Hwy	/	Oxley St	1443	6.54	5.00	193	53.55	4.00	1429	8.26	9.00	182	55.82	5.00	12.85	A
5	Pacific Hwy	/	Albany St	1831	17.45	12.00	0	0	0	1304	13.52	6.00	554	52.71	13.00	21.36	B
6	Pacific Hwy	/	Christie St	471	30.78	7.00	2271	17.69	15.00	126	0.97	0.00	1685	13.50	10.00	17.03	B
7	Pacific Hwy	/	Herbert St	717	47.48	19.00	1886	25.15	13.00	0	0	0	2029	14.55	6.00	23.96	B
8	Pacific Hwy	/	Reserve Rd	92	41.36	5.00	1876	27.63	17.00	198	41.13	5.00	1798	17.09	8.00	23.84	B
9	Pacific Hwy	/	Greenwich Rd	0	0	0	1584	10.66	7.00	640	50.10	10.00	1565	26.59	11.00	23.90	B
11	Shirley Rd	/	River Rd	566	32.74	14.00	1152	15.16	9.00	172	21.03	5.00	0	0	0	20.96	B
12	River Rd	/	Greenwich Rd	339	54.90	7.00	1558	43.74	34.00	314	61.00	8.00	646	46.28	9.00	47.54	D

PM Peak

№	Intersection			SB			EB			NB			WB			AVD	LOS
				Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)	Flow (veh)	Delay time Sec	Queue max (veh)		
1	Pacific Hwy	/	Alexander St	1356	21.85	14.00	0	0	0	1173	14.86	8.00	393	24.88	8.00	19.45	B
2	Pacific Hwy	/	Shirley Rd/Falcon St	1453	37.96	19.00	491	44.46	6.00	971	20.88	9.00	860	31.39	11.00	32.91	C
3	Pacific Hwy	/	Hume St	1439	20.15	10.00	183	113.42	9.00	1358	19.19	12.00	182	85.54	6.00	28.90	C
4	Pacific Hwy	/	Oxley St	1443	6.54	5.00	193	53.55	4.00	1429	8.26	9.00	182	55.82	5.00	12.85	A
5	Pacific Hwy	/	Albany St	1831	17.45	12.00	0	0	0	1304	13.52	6.00	554	52.71	13.00	21.36	B
6	Pacific Hwy	/	Christie St	471	30.78	7.00	2271	17.69	15.00	126	0.97	0.00	1685	13.50	10.00	17.03	B
7	Pacific Hwy	/	Herbert St	717	47.48	19.00	1886	25.15	13.00	0	0	0	2029	14.55	6.00	23.96	B
8	Pacific Hwy	/	Reserve Rd	92	41.36	5.00	1876	27.63	17.00	198	41.13	5.00	1798	17.09	8.00	23.84	B
9	Pacific Hwy	/	Greenwich Rd	0	0	0	1584	10.66	7.00	640	50.10	10.00	1565	26.59	11.00	23.90	B
11	Shirley Rd	/	River Rd	566	32.74	14.00	1152	15.16	9.00	172	21.03	5.00	0	0	0	20.96	B
12	River Rd	/	Greenwich Rd	339	54.90	7.00	1558	43.74	34.00	314	61.00	8.00	646	46.28	9.00	47.54	D

7 CONCLUSIONS AND RECOMMENDATIONS

- The results of the calibration and validation presented in this report indicated
  - a high level of correlation to observed vehicle counts;
  - that modelled travel times were mostly within the adopted criteria range;
  - that modelled queue lengths generally conformed with the observed conditions.
- The visual analysis also indicates a good representation of the observed performance of the network.

7.1 Model Calibration and Validation Declaration

- Based on the results presented herein, the existing condition model meets the requirements of the RMS Modelling Guidelines for both morning and afternoon peak hour conditions.
- The model is thus proposed to be approved as “fit for purpose”.

Appendix

Details of GEH analysis.

GTA travel time survey data.

№	Intersection			Bound	In/Out	Detector ID	Flow - Real Data Set PM Base 2013 DT - All	Flow - Average PM Base 2013 - All	Absolute Difference	Relative Difference (%)	GEH
1	Pacific Hwy	/	Alexander St	N	In	3279	979.00	964.00	-15.00	-1.53	0.48
2	Pacific Hwy	/	Alexander St	N	Out	3278	1297.00	1332.40	35.40	2.73	0.98
3	Pacific Hwy	/	Alexander St	S	In	3281	1602.00	1573.80	-28.20	-1.76	0.71
4	Pacific Hwy	/	Alexander St	S	Out	3280	1226.00	1189.40	-36.60	-2.99	1.05
5	Pacific Hwy	/	Alexander St	E	In	3283	310.00	354.60	44.60	14.39	2.45
6	Pacific Hwy	/	Alexander St	E	Out	3282	368.00	408.60	40.60	11.03	2.06
7	Pacific Hwy	/	Shirley Rd/Falcon St	W	In	3294	611.00	538.00	-73.00	-11.95	3.05
8	Pacific Hwy	/	Shirley Rd/Falcon St	W	Out	3295	513.00	534.40	21.40	4.17	0.94
9	Pacific Hwy	/	Shirley Rd/Falcon St	E	In	3294	611.00	538.00	-73.00	-11.95	3.05
10	Pacific Hwy	/	Shirley Rd/Falcon St	E	Out	3291	897.00	907.20	10.20	1.14	0.34
11	Pacific Hwy	/	Hume St	N	In	3298	1511.00	1452.20	-58.80	-3.89	1.53
12	Pacific Hwy	/	Hume St	N	Out	3299	1432.00	1400.00	-32.00	-2.23	0.85
13	Pacific Hwy	/	Hume St	W	In	3304	112.00	106.00	-6.00	-5.36	0.57
14	Pacific Hwy	/	Hume St	W	Out	3305	208.00	198.40	-9.60	-4.62	0.67
15	Pacific Hwy	/	Hume St	S	In	3302	1428.00	1422.00	-6.00	-0.42	0.16
16	Pacific Hwy	/	Hume St	S	Out	3303	1369.00	1357.40	-11.60	-0.85	0.31
17	Pacific Hwy	/	Hume St	E	In	3300	144.00	161.00	17.00	11.81	1.38
18	Pacific Hwy	/	Hume St	E	Out	3301	186.00	181.80	-4.20	-2.26	0.31
19	Pacific Hwy	/	Oxley St	W	In	3306	335.00	283.40	-51.60	-15.40	2.93
20	Pacific Hwy	/	Oxley St	W	Out	3307	171.00	182.40	11.40	6.67	0.86
21	Pacific Hwy	/	Oxley St	E	In	3308	143.00	207.20	64.20	44.90	4.85
22	Pacific Hwy	/	Oxley St	E	Out	3309	248.00	180.80	-67.20	-27.10	4.59
23	Pacific Hwy	/	Albany St	N	In	3313	1721.00	1707.00	-14.00	-0.81	0.34
24	Pacific Hwy	/	Albany St	N	Out	3314	1775.00	1828.60	53.60	3.02	1.26
25	Pacific Hwy	/	Albany St	S	In	3317	1412.00	1421.00	9.00	0.64	0.24
26	Pacific Hwy	/	Albany St	S	Out	3318	1325.00	1341.40	16.40	1.24	0.45
27	Pacific Hwy	/	Albany St	E	In	3315	501.00	518.80	17.80	3.55	0.79
28	Pacific Hwy	/	Albany St	E	Out	3316	534.00	563.60	29.60	5.54	1.26
29	Pacific Hwy	/	Christie St	N	In	3321	525.00	516.00	-9.00	-1.71	0.39
30	Pacific Hwy	/	Christie St	N	Out	3322	496.00	472.80	-23.20	-4.68	1.05
31	Pacific Hwy	/	Christie St	W	In	3319	1949.00	1988.60	39.60	2.03	0.89
32	Pacific Hwy	/	Christie St	W	Out	3320	2201.00	2272.20	71.20	3.23	1.51
33	Pacific Hwy	/	Christie St	S	In	3323	174.00	131.80	-42.20	-24.25	3.41
34	Pacific Hwy	/	Herbert St	N	In	3326	688.00	607.80	-80.20	-11.66	3.15
35	Pacific Hwy	/	Herbert St	N	Out	3327	639.00	674.00	35.00	5.48	1.37
36	Pacific Hwy	/	Herbert St	W	In	3324	1708.00	1762.80	54.80	3.21	1.32
37	Pacific Hwy	/	Herbert St	W	Out	3325	1906.00	1924.00	18.00	0.94	0.41
38	Pacific Hwy	/	Herbert St	E	In	3328	2219.00	2273.40	54.40	2.45	1.15
39	Pacific Hwy	/	Herbert St	E	Out	3329	2010.00	2054.60	44.60	2.22	0.99
40	Pacific Hwy	/	Reserve Rd	N	In	3332	234.00	272.40	38.40	16.41	2.41
41	Pacific Hwy	/	Reserve Rd	N	Out	3333	122.00	111.20	-10.80	-8.85	1.00
42	Pacific Hwy	/	Reserve Rd	W	In	3330	1558.00	1568.40	10.40	0.67	0.26
43	Pacific Hwy	/	Reserve Rd	W	Out	3331	1868.00	1908.00	40.00	2.14	0.92
44	Pacific Hwy	/	Reserve Rd	S	In	3334	183.00	210.40	27.40	14.97	1.95
45	Pacific Hwy	/	Reserve Rd	S	Out	3335	177.00	199.60	22.60	12.77	1.65
46	Pacific Hwy	/	Greenwich Rd	W	In	3336	1362.00	1389.40	27.40	2.01	0.74
47	Pacific Hwy	/	Greenwich Rd	W	Out	3337	1598.00	1572.20	-25.80	-1.61	0.65
48	Pacific Hwy	/	Greenwich Rd	S	In	3342	532.00	485.20	-46.80	-8.80	2.08
49	Pacific Hwy	/	Greenwich Rd	S	Out	3343	714.00	640.60	-73.40	-10.28	2.82
50	Pacific Hwy	/	Greenwich Rd	E	In	3338	1968.00	1917.40	-50.60	-2.57	1.15
51	Pacific Hwy	/	Greenwich Rd	E	Out	3339	1550.00	1549.20	-0.80	-0.05	0.02
52	Shirley Rd	/	River Rd	N	In	3351	639.00	750.40	111.40	17.43	4.23
53	Shirley Rd	/	River Rd	N	Out	3350	444.00	586.20	142.20	32.03	6.27
54	Shirley Rd	/	River Rd	W	In	3353	520.00	676.00	156.00	30.00	6.38
55	Shirley Rd	/	River Rd	W	Out	3354	914.00	1137.40	223.40	24.44	6.98
56	Shirley Rd	/	River Rd	S	In	3355	433.00	489.60	56.60	13.07	2.64
57	Shirley Rd	/	River Rd	S	Out	3356	234.00	194.00	-40.00	-17.09	2.73
58	River Rd	/	Greenwich Rd	N	In	3359	568.00	519.00	-49.00	-8.63	2.10
59	River Rd	/	Greenwich Rd	N	Out	3360	394.00	383.40	-10.60	-2.69	0.54
60	River Rd	/	Greenwich Rd	W	In	3357	773.00	800.60	27.60	3.57	0.98
61	River Rd	/	Greenwich Rd	W	Out	3358	1574.00	1489.20	-84.80	-5.39	2.17
62	River Rd	/	Greenwich Rd	S	In	3363	215.00	279.40	64.40	29.95	4.10
63	River Rd	/	Greenwich Rd	S	Out	3364	294.00	314.00	20.00	6.80	1.15
64	River Rd	/	Greenwich Rd	E	In	3361	1265.00	1246.80	-18.20	-1.44	0.51
65	River Rd	/	Greenwich Rd	E	Out	3362	559.00	658.80	99.80	17.85	4.04
66	Berry Rd	/	Marshall Ln	S	In	4374	135.00	181.20	46.20	34.22	3.67
89	River Rd	/	Duntroon Ave	N	In	4395	48.00	74.60	26.60	55.42	3.40
90	River Rd	/	Duntroon Ave	N	Out	4396	66.00	153.40	87.40	132.42	8.34
91	River Rd	/	Duntroon Ave	W	In	4397	538.00	641.20	103.20	19.18	4.25
92	River Rd	/	Duntroon Ave	W	Out	4398	1172.00	1178.80	6.80	0.58	0.20
93	River Rd	/	Duntroon Ave	E	In	4399	1211.00	1219.60	8.60	0.71	0.25
94	River Rd	/	Duntroon Ave	E	Out	4400	559.00	606.40	47.40	8.48	1.96
95	River Rd	/	Canberra Ave	N	In	4401	50.00	21.60	-28.40	-56.80	4.75
96	River Rd	/	Canberra Ave	N	Out	4402	4.00	7.60	3.60	90.00	1.49
97	River Rd	/	Canberra Ave	W	In	4403	635.00	733.20	98.20	15.46	3.75
98	River Rd	/	Canberra Ave	W	Out	4404	1211.00	1190.80	-20.20	-1.67	0.58
99	River Rd	/	Canberra Ave	S	In	4407	33.00	37.80	4.80	14.55	0.81
100	River Rd	/	Canberra Ave	S	Out	4408	126.00	134.00	8.00	6.35	0.70
101	River Rd	/	Canberra Ave	E	In	4405	1165.00	1179.40	14.40	1.24	0.42
102	River Rd	/	Canberra Ave	E	Out	4406	542.00	638.40	96.40	17.79	3.97

№	Intersection			Bound	Turn	Turns ID	Flow - Real Data Set AM Base 2013 DT - All	Flow - Average AM Base 2013 - All	Absolute Difference	Relative Difference (%)	GEH
1	Pacific Hwy	/	Alexander St	N	L	2314	14.00	54.20	40.20	287.14	6.88
2					T	2313	1283.00	1279.60	-3.40	-0.27	0.09
3				S	T	2317	930.00	886.80	-43.20	-4.65	1.43
4					R	2318	296.00	304.80	8.80	2.97	0.51
5				E	L	2315	319.00	305.80	-13.20	-4.14	0.75
6					R	2316	49.00	77.80	28.80	58.78	3.62
7	Pacific Hwy	/	Shirley Rd/Falcon St	N	L	2293	351.00	357.40	6.40	1.82	0.34
8					T	2294	260.00	241.40	-18.60	-7.15	1.17
9				W	L	2295	28.00	46.00	18.00	64.29	2.96
10					T	2294	260.00	241.40	-18.60	-7.15	1.17
11					R	2296	225.00	246.80	21.80	9.69	1.42
12				S	L	2291	203.00	230.60	27.60	13.60	1.87
13					T	2290	762.00	742.20	-19.80	-2.60	0.72
14				E	L	1728	18.00	31.60	13.60	75.56	2.73
15					T	2297	299.00	306.60	7.60	2.54	0.44
16					R	2298	580.00	565.00	-15.00	-2.59	0.63
17	Pacific Hwy	/	Hume St	N	L	2278	68.00	54.20	-13.80	-20.29	1.77
18					T	2277	1364.00	1346.20	-17.80	-1.30	0.48
19				W	L	2287	106.00	44.60	-61.40	-57.92	7.08
20					T	2286	76.00	107.00	31.00	40.79	3.24
21					R	2288	26.00	47.20	21.20	81.54	3.50
22				S	L	2281	23.00	19.20	-3.80	-16.52	0.83
23					T	2280	1346.00	1349.80	3.80	0.28	0.10
24				E	L	2284	38.00	33.60	-4.40	-11.58	0.74
25					T	2283	89.00	86.80	-2.20	-2.47	0.23
26					R	2285	59.00	60.00	1.00	1.69	0.13
27	Pacific Hwy	/	Oxley St	N	L	2268	74.00	85.40	11.40	15.41	1.28
28					T	2267	1341.00	1338.40	-2.60	-0.19	0.07
29				W	L	2271	53.00	36.80	-16.20	-30.57	2.42
30					T	2270	69.00	121.80	52.80	76.52	5.41
31					R	2272	49.00	20.60	-28.40	-57.96	4.81
32				S	L	2265	224.00	142.00	-82.00	-36.61	6.06
33					T	2264	1291.00	1304.60	13.60	1.05	0.38
34				E	L	2273	33.00	36.40	3.40	10.30	0.58
35					T	2275	215.00	141.60	-73.40	-34.14	5.50
36	Pacific Hwy	/	Albany St	N	L	2209	389.00	426.20	37.20	9.56	1.84
37					T	2208	1386.00	1404.40	18.40	1.33	0.49
38					T	2206	1213.00	1167.80	-45.20	-3.73	1.31
39					R	2207	112.00	164.60	52.60	46.96	4.47
40				E	L	2211	26.00	27.40	1.40	5.38	0.27
41					R	2212	508.00	536.80	28.80	5.67	1.26
42	Pacific Hwy	/	Christie St	N	L	2254	70.00	71.40	1.40	2.00	0.17
43					T	2253	103.00	55.40	-47.60	-46.21	5.35
44					R	2255	323.00	343.80	20.80	6.44	1.14
45				W	L	2249	525.00	516.20	-8.80	-1.68	0.39
46					T	2248	1676.00	1763.20	87.20	5.20	2.10
47				E	L	2252	71.00	76.20	5.20	7.32	0.61
48					T	2251	1626.00	1644.80	18.80	1.16	0.46
49	Pacific Hwy	/	Herbert St	N	L	2261	522.00	500.00	-22.00	-4.21	0.97
50					T	2262	177.00	172.60	-4.40	-2.49	0.33
51				W	L	2260	209.00	157.00	-52.00	-24.88	3.84
52					T	2259	1697.00	1774.20	77.20	4.55	1.85
53					T	2257	1531.00	1593.20	62.20	4.06	1.57
54					R	2258	479.00	451.20	-27.80	-5.80	1.29
55	Pacific Hwy	/	Reserve Rd	N	L	2238	90.00	52.80	-37.20	-41.33	4.40
56					T	2239	8.00	19.40	11.40	142.50	3.08
57					R	2240	24.00	37.00	13.00	54.17	2.35
58				W	L	2234	88.00	98.60	10.60	12.05	1.10
59					T	2233	1711.00	1749.60	38.60	2.26	0.93
60					R	2246	69.00	59.40	-9.60	-13.91	1.20
61				S	L	2241	70.00	43.60	-26.40	-37.71	3.50
62					T	2242	5.00	29.60	24.60	492.00	5.91
63					R	2243	102.00	125.80	23.80	23.33	2.23
64				E	L	2236	106.00	132.00	26.00	24.53	2.38
65					T	2235	1464.00	1496.60	32.60	2.23	0.85
66					R	2237	141.00	144.20	3.20	2.27	0.27
67	Pacific Hwy	/	Greenwich Rd		T	2374	1396.00	1349.00	-47.00	-3.37	1.27
68					R	2375	202.00	228.40	26.40	13.07	1.80
69				S	L	2376	142.00	70.00	-72.00	-50.70	6.99
70					R	2377	572.00	569.60	-2.40	-0.42	0.10
71				E	L	2371	330.00	229.80	-100.20	-30.36	5.99
72					T	2370	1220.00	1320.80	100.80	8.26	2.83
73	Shirley Rd	/	River Rd	N	T	2800	62.00	39.00	-23.00	-37.10	3.24
74					R	2799	382.00	546.20	164.20	42.98	7.62
75				W	L	2797	543.00	687.00	144.00	26.52	5.81
76					R	2798	371.00	450.60	79.60	21.46	3.93
77				S	L	2801	138.00	130.60	-7.40	-5.36	0.64
78					T	2802	96.00	63.40	-32.60	-33.96	3.65
79				N	L	2656	72.00	56.60	-15.40	-21.39	1.92
80					T	2655	102.00	129.40	27.40	26.86	2.55

№	Intersection			Bound	Turn	Turns ID	Flow - Real Data Set AM Base 2013 DT - All	Flow - Average AM Base 2013 - All	Absolute Difference	Relative Difference (%)	GEH
81	River Rd	/	Greenwich Rd		R	2657	220.00	198.80	-21.20	-9.64	1.47
82				W	L	2647	433.00	385.60	-47.40	-10.95	2.34
83					T	2646	1091.00	1064.80	-26.20	-2.40	0.80
84					R	2648	50.00	38.00	-12.00	-24.00	1.81
85				S	L	2653	57.00	58.60	1.60	2.81	0.21
86					T	2652	135.00	133.60	-1.40	-1.04	0.12
87					R	2654	102.00	122.40	20.40	20.00	1.93
88				E	L	2650	63.00	112.00	49.00	77.78	5.24
89					T	2649	496.00	543.20	47.20	9.52	2.07
55	River Rd	/	Duntroon Ave	N	L	2617	46.00	83.00	37.00	80.43	4.61
57					R	2616	20.00	69.60	49.60	248.00	7.41
58				W	L	2612	7.00	40.60	33.60	480.00	6.89
59					T	2611	1165.00	1137.00	-28.00	-2.40	0.83
65					T	2614	518.00	571.40	53.40	10.31	2.29
66					R	2613	41.00	34.20	-6.80	-16.59	1.11
55	River Rd	/	Canberra Ave/Russell St	N	L	2635	4.00	7.60	3.60	90.00	1.49
58				W	L	2638	50.00	21.60	-28.40	-56.80	4.75
59					T	2637	1161.00	1171.20	10.20	0.88	0.30
61				S	L	2632	126.00	134.40	8.40	6.67	0.74
64				E	L	2629	33.00	37.80	4.80	14.55	0.81
65					T	2628	509.00	600.00	91.00	17.88	3.86

№	Intersection			Bound	Turn	Turns ID	Flow - Real Data Set PM Base 2013 DT - All	Flow - Average PM Base 2013 - All	Absolute Difference	Relative Difference (%)	GEH
1	Pacific Hwy	/	Alexander St	N	L	2314	33.00	61.20	28.20	85.45	4.11
2					T	2313	946.00	1065.20	119.20	12.60	3.76
3				S	T	2317	1042.00	1060.20	18.20	1.75	0.56
4					R	2318	295.00	296.80	1.80	0.61	0.10
5				E	L	2315	214.00	186.80	-27.20	-12.71	1.92
6					R	2316	67.00	88.80	21.80	32.54	2.47
7	Pacific Hwy	/	Shirley Rd/Falcon St	N	L	2293	392.00	403.00	11.00	2.81	0.55
8					T	2294	406.00	383.20	-22.80	-5.62	1.15
9				W	L	2295	43.00	31.60	-11.40	-26.51	1.87
10					T	2294	406.00	383.20	-22.80	-5.62	1.15
11					R	2296	138.00	219.20	81.20	58.84	6.08
12				S	L	2291	401.00	475.40	74.40	18.55	3.55
13					T	2290	710.00	684.00	-26.00	-3.66	0.98
14				E	L	1728	29.00	26.60	-2.40	-8.28	0.46
15					T	2297	428.00	374.40	-53.60	-12.52	2.68
16					R	2298	459.00	394.60	-64.40	-14.03	3.12
17	Pacific Hwy	/	Hume St	N	L	2278	47.00	31.40	-15.60	-33.19	2.49
18					T	2277	1255.00	1245.20	-9.80	-0.78	0.28
19				W	L	2287	54.00	53.60	-0.40	-0.74	0.05
20					T	2286	90.00	85.00	-5.00	-5.56	0.53
21					R	2288	25.00	45.60	20.60	82.40	3.47
22				S	L	2281	34.00	30.80	-3.20	-9.41	0.56
23					T	2280	1130.00	1089.80	-40.20	-3.56	1.21
24				E	L	2284	46.00	14.60	-31.40	-68.26	5.70
25					T	2283	103.00	76.00	-27.00	-26.21	2.85
26					R	2285	47.00	50.80	3.80	8.09	0.54
27	Pacific Hwy	/	Oxley St	N	L	2268	70.00	90.80	20.80	29.71	2.32
28					T	2267	1092.00	1092.80	0.80	0.07	0.02
29				W	L	2271	131.00	93.20	-37.80	-28.86	3.57
30					T	2270	190.00	125.00	-65.00	-34.21	5.18
31					R	2272	141.00	119.20	-21.80	-15.46	1.91
32				S	L	2265	97.00	34.20	-62.80	-64.74	7.75
33					T	2264	1131.00	1156.40	25.40	2.25	0.75
34				E	L	2273	72.00	56.80	-15.20	-21.11	1.89
35					T	2275	120.00	100.00	-20.00	-16.67	1.91
36	Pacific Hwy	/	Albany St	N	L	2209	339.00	347.20	8.20	2.42	0.44
37					T	2208	1136.00	1131.40	-4.60	-0.40	0.14
38					T	2206	1161.00	1108.60	-52.40	-4.51	1.56
39					R	2207	118.00	135.60	17.60	14.92	1.56
40				E	L	2211	38.00	55.60	17.60	46.32	2.57
41					R	2212	533.00	523.00	-10.00	-1.88	0.44
42	Pacific Hwy	/	Christie St	N	L	2254	51.00	44.00	-7.00	-13.73	1.02
43					T	2253	38.00	31.40	-6.60	-17.37	1.12
44					R	2255	281.00	239.80	-41.20	-14.66	2.55
45				W	L	2249	420.00	438.60	18.60	4.43	0.90
46					T	2248	1441.00	1437.80	-3.20	-0.22	0.08
47				E	L	2252	36.00	47.80	11.80	32.78	1.82
48					T	2251	1646.00	1600.00	-46.00	-2.79	1.14
49	Pacific Hwy	/	Herbert St	N	L	2261	577.00	596.20	19.20	3.33	0.79
50					T	2262	217.00	240.80	23.80	10.97	1.57
51				W	L	2260	136.00	161.00	25.00	18.38	2.05
52					T	2259	1283.00	1280.80	-2.20	-0.17	0.06
53					T	2257	1638.00	1554.00	-84.00	-5.13	2.10
54					R	2258	381.00	377.80	-3.20	-0.84	0.16
55	Pacific Hwy	/	Reserve Rd	N	L	2238	95.00	127.80	32.80	34.53	3.11
56					T	2239	3.00	21.00	18.00	600.00	5.20
57					R	2240	68.00	65.20	-2.80	-4.12	0.34
58				W	L	2234	42.00	70.20	28.20	67.14	3.77
59					T	2233	1239.00	1237.80	-1.20	-0.10	0.03
60					R	2246	51.00	51.40	0.40	0.78	0.06
61				S	L	2241	85.00	61.20	-23.80	-28.00	2.78
62					T	2242	5.00	10.40	5.40	108.00	1.95
63					R	2243	83.00	70.00	-13.00	-15.66	1.49
64				E	L	2236	84.00	75.60	-8.40	-10.00	0.94
65					T	2235	1712.00	1637.60	-74.40	-4.35	1.82
66					R	2237	63.00	82.20	19.20	30.48	2.25
67	Pacific Hwy	/	Greenwich Rd		T	2374	992.00	1065.00	73.00	7.36	2.28
68					R	2375	216.00	220.20	4.20	1.94	0.28
69				S	L	2376	99.00	74.40	-24.60	-24.85	2.64
70					R	2377	332.00	273.60	-58.40	-17.59	3.36
71				E	L	2371	551.00	388.00	-163.00	-29.58	7.52
72					T	2370	1417.00	1371.00	-46.00	-3.25	1.23
73	Shirley Rd	/	River Rd	N	T	2800	122.00	120.60	-1.40	-1.15	0.13
74					R	2799	692.00	702.60	10.60	1.53	0.40
75				W	L	2797	440.00	564.20	124.20	28.23	5.54
76					R	2798	220.00	265.20	45.20	20.55	2.90
77				S	L	2801	155.00	207.00	52.00	33.55	3.87
78					T	2802	149.00	145.40	-3.60	-2.42	0.30
79				N	L	2656	86.00	54.60	-31.40	-36.51	3.75
80					T	2655	130.00	99.40	-30.60	-23.54	2.86

№	Intersection			Bound	Turn	Turns ID	Flow - Real Data Set PM Base 2013 DT - All	Flow - Average PM Base 2013 - All	Absolute Difference	Relative Difference (%)	GEH
81	River Rd	/	Greenwich Rd		R	2657	494.00	411.40	-82.60	-16.72	3.88
82				W	L	2647	184.00	234.40	50.40	27.39	3.48
83					T	2646	548.00	597.60	49.60	9.05	2.07
84					R	2648	44.00	41.00	-3.00	-6.82	0.46
85				S	L	2653	63.00	49.20	-13.80	-21.90	1.84
86					T	2652	104.00	76.20	-27.80	-26.73	2.93
87					R	2654	73.00	116.00	43.00	58.90	4.42
88				E	L	2650	97.00	144.00	47.00	48.45	4.28
89					T	2649	826.00	900.20	74.20	8.98	2.53
55	River Rd	/	Duntroon Ave	N	L	2617	57.00	119.40	62.40	109.47	6.64
57					R	2616	33.00	53.00	20.00	60.61	3.05
58				W	L	2612	9.00	20.40	11.40	126.67	2.97
59					T	2611	703.00	719.80	16.80	2.39	0.63
65					T	2614	841.00	961.40	120.40	14.32	4.01
66					R	2613	32.00	24.60	-7.40	-23.13	1.39
55	River Rd	/	Canberra Ave/Russell St	N	L	2635	4.00	9.80	5.80	145.00	2.21
58				W	L	2638	41.00	9.60	-31.40	-76.59	6.24
59					T	2637	714.00	726.80	12.80	1.79	0.48
61				S	L	2632	120.00	93.80	-26.20	-21.83	2.53
64				E	L	2629	28.00	37.20	9.20	32.86	1.61
65					T	2628	847.00	974.00	127.00	14.99	4.21

№	Intersection			Bound	In/Out	Detector ID	Flow - Real Data Set PM Base 2013 DT - All	Flow - Average PM Base 2013 - All	Absolute Difference	Relative Difference (%)	GEH
1	Pacific Hwy	/	Alexander St	N	In	3279	1109.00	1149.40	40.40	3.64	1.20
2	Pacific Hwy	/	Alexander St	N	Out	3278	963.00	1128.00	165.00	17.13	5.10
3	Pacific Hwy	/	Alexander St	S	In	3281	1160.00	1234.40	74.40	6.41	2.15
4	Pacific Hwy	/	Alexander St	S	Out	3280	1337.00	1354.60	17.60	1.32	0.48
5	Pacific Hwy	/	Alexander St	E	In	3283	312.00	363.60	51.60	16.54	2.81
6	Pacific Hwy	/	Alexander St	E	Out	3282	281.00	307.00	26.00	9.25	1.52
7	Pacific Hwy	/	Shirley Rd/Falcon St	W	In	3294	798.00	849.20	51.20	6.42	1.78
8	Pacific Hwy	/	Shirley Rd/Falcon St	W	Out	3295	587.00	633.80	46.80	7.97	1.89
9	Pacific Hwy	/	Shirley Rd/Falcon St	E	In	3294	798.00	849.20	51.20	6.42	1.78
10	Pacific Hwy	/	Shirley Rd/Falcon St	E	Out	3291	916.00	798.00	-118.00	-12.88	4.03
11	Pacific Hwy	/	Hume St	N	In	3298	1231.00	1191.40	-39.60	-3.22	1.14
12	Pacific Hwy	/	Hume St	N	Out	3299	1302.00	1272.60	-29.40	-2.26	0.82
13	Pacific Hwy	/	Hume St	W	In	3304	137.00	106.80	-30.20	-22.04	2.74
14	Pacific Hwy	/	Hume St	W	Out	3305	169.00	184.00	15.00	8.88	1.13
15	Pacific Hwy	/	Hume St	S	In	3302	1326.00	1300.00	-26.00	-1.96	0.72
16	Pacific Hwy	/	Hume St	S	Out	3303	1164.00	1111.40	-52.60	-4.52	1.56
17	Pacific Hwy	/	Hume St	E	In	3300	137.00	116.40	-20.60	-15.04	1.83
18	Pacific Hwy	/	Hume St	E	Out	3301	196.00	143.00	-53.00	-27.04	4.07
19	Pacific Hwy	/	Oxley St	W	In	3306	217.00	134.20	-82.80	-38.16	6.25
20	Pacific Hwy	/	Oxley St	W	Out	3307	462.00	340.80	-121.20	-26.23	6.05
21	Pacific Hwy	/	Oxley St	E	In	3308	260.00	215.60	-44.40	-17.08	2.88
22	Pacific Hwy	/	Oxley St	E	Out	3309	193.00	160.00	-33.00	-17.10	2.48
23	Pacific Hwy	/	Albany St	N	In	3313	1694.00	1633.80	-60.20	-3.55	1.48
24	Pacific Hwy	/	Albany St	N	Out	3314	1475.00	1478.20	3.20	0.22	0.08
25	Pacific Hwy	/	Albany St	S	In	3317	1174.00	1183.00	9.00	0.77	0.26
26	Pacific Hwy	/	Albany St	S	Out	3318	1279.00	1249.00	-30.00	-2.35	0.84
27	Pacific Hwy	/	Albany St	E	In	3315	457.00	418.60	-38.40	-8.40	1.84
28	Pacific Hwy	/	Albany St	E	Out	3316	571.00	578.40	7.40	1.30	0.31
29	Pacific Hwy	/	Christie St	N	In	3321	420.00	437.80	17.80	4.24	0.86
30	Pacific Hwy	/	Christie St	N	Out	3322	370.00	318.80	-51.20	-13.84	2.76
31	Pacific Hwy	/	Christie St	W	In	3319	1927.00	1839.40	-87.60	-4.55	2.02
32	Pacific Hwy	/	Christie St	W	Out	3320	1861.00	1871.00	10.00	0.54	0.23
33	Pacific Hwy	/	Christie St	S	In	3323	74.00	79.20	5.20	7.03	0.59
34	Pacific Hwy	/	Herbert St	N	In	3326	517.00	538.20	21.20	4.10	0.92
35	Pacific Hwy	/	Herbert St	N	Out	3327	794.00	838.20	44.20	5.57	1.55
36	Pacific Hwy	/	Herbert St	W	In	3324	1855.00	1791.40	-63.60	-3.43	1.49
37	Pacific Hwy	/	Herbert St	W	Out	3325	1419.00	1435.00	16.00	1.13	0.42
38	Pacific Hwy	/	Herbert St	E	In	3328	1860.00	1876.60	16.60	0.89	0.38
39	Pacific Hwy	/	Herbert St	E	Out	3329	2019.00	1941.00	-78.00	-3.86	1.75
40	Pacific Hwy	/	Reserve Rd	N	In	3332	110.00	162.80	52.80	48.00	4.52
41	Pacific Hwy	/	Reserve Rd	N	Out	3333	166.00	217.60	51.60	31.08	3.73
42	Pacific Hwy	/	Reserve Rd	W	In	3330	1865.00	1759.80	-105.20	-5.64	2.47
43	Pacific Hwy	/	Reserve Rd	W	Out	3331	1332.00	1353.40	21.40	1.61	0.58
44	Pacific Hwy	/	Reserve Rd	S	In	3334	138.00	147.80	9.80	7.10	0.82
45	Pacific Hwy	/	Reserve Rd	S	Out	3335	173.00	142.40	-30.60	-17.69	2.44
46	Pacific Hwy	/	Greenwich Rd	W	In	3336	1516.00	1445.20	-70.80	-4.67	1.84
47	Pacific Hwy	/	Greenwich Rd	W	Out	3337	1208.00	1282.80	74.80	6.19	2.12
48	Pacific Hwy	/	Greenwich Rd	S	In	3342	767.00	633.60	-133.40	-17.39	5.04
49	Pacific Hwy	/	Greenwich Rd	S	Out	3343	431.00	351.00	-80.00	-18.56	4.05
50	Pacific Hwy	/	Greenwich Rd	E	In	3338	1324.00	1336.60	12.60	0.95	0.35
51	Pacific Hwy	/	Greenwich Rd	E	Out	3339	1968.00	1756.00	-212.00	-10.77	4.91
52	Shirley Rd	/	River Rd	N	In	3351	589.00	708.60	119.60	20.31	4.70
53	Shirley Rd	/	River Rd	N	Out	3350	814.00	825.80	11.80	1.45	0.41
54	Shirley Rd	/	River Rd	W	In	3353	847.00	909.60	62.60	7.39	2.11
55	Shirley Rd	/	River Rd	W	Out	3354	660.00	830.00	170.00	25.76	6.23
56	Shirley Rd	/	River Rd	S	In	3355	342.00	385.80	43.80	12.81	2.30
57	Shirley Rd	/	River Rd	S	Out	3356	304.00	352.00	48.00	15.79	2.65
58	River Rd	/	Greenwich Rd	N	In	3359	288.00	310.80	22.80	7.92	1.32
59	River Rd	/	Greenwich Rd	N	Out	3360	710.00	563.80	-146.20	-20.59	5.79
60	River Rd	/	Greenwich Rd	W	In	3357	1383.00	1361.60	-21.40	-1.55	0.58
61	River Rd	/	Greenwich Rd	W	Out	3358	776.00	874.20	98.20	12.65	3.42
62	River Rd	/	Greenwich Rd	S	In	3363	271.00	284.20	13.20	4.87	0.79
63	River Rd	/	Greenwich Rd	S	Out	3364	240.00	241.40	1.40	0.58	0.09
64	River Rd	/	Greenwich Rd	E	In	3361	707.00	768.60	61.60	8.71	2.27
65	River Rd	/	Greenwich Rd	E	Out	3362	923.00	1043.40	120.40	13.04	3.84
66	Berry Rd	/	Marshall Ln	S	In	4374	126.00	114.80	-11.20	-8.89	1.02
89	River Rd	/	Duntroon Ave	N	In	4395	41.00	45.20	4.20	10.24	0.64
90	River Rd	/	Duntroon Ave	N	Out	4396	90.00	171.60	81.60	90.67	7.13
91	River Rd	/	Duntroon Ave	W	In	4397	874.00	1013.80	139.80	16.00	4.55
92	River Rd	/	Duntroon Ave	W	Out	4398	712.00	739.20	27.20	3.82	1.01
93	River Rd	/	Duntroon Ave	E	In	4399	760.00	839.00	79.00	10.39	2.79
94	River Rd	/	Duntroon Ave	E	Out	4400	873.00	986.40	113.40	12.99	3.72
95	River Rd	/	Canberra Ave	N	In	4401	41.00	9.60	-31.40	-76.59	6.24
96	River Rd	/	Canberra Ave	N	Out	4402	4.00	10.00	6.00	150.00	2.27
97	River Rd	/	Canberra Ave	W	In	4403	967.00	1067.40	100.40	10.38	3.15
98	River Rd	/	Canberra Ave	W	Out	4404	755.00	736.00	-19.00	-2.52	0.70
99	River Rd	/	Canberra Ave	S	In	4407	28.00	37.00	9.00	32.14	1.58
100	River Rd	/	Canberra Ave	S	Out	4408	120.00	94.00	-26.00	-21.67	2.51
101	River Rd	/	Canberra Ave	E	In	4405	718.00	737.80	19.80	2.76	0.73
102	River Rd	/	Canberra Ave	E	Out	4406	875.00	1011.60	136.60	15.61	4.45

Travel Time Survey

Date of Survey	Thursday 04 April 2013
	Thursday 19 September 2013
Time of Survey	AM Peak (8:00-9:00am) PM Peak (5:00-6:00pm)
Surveyor	Thomas Ng / Chris Slenders

Travel Routes

Figure 1: Travel Time Route along Pacific Highway

Source: Google Map.

AM Peak – Travel Time Results

Table 1: Travel Time Summary (Seconds) - AM Peak Pacific Highway Eastbound.

Date			4 April 2013					19 Sept 2013					
Section	From	To	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Average	Standard Deviation	Lower	Upper
1	Greenwich Rd	Reserve Rd	38	48	89	50	76	66	46	59	18	45	73
2	Reserve Rd	Herbert St	66	12	24	19	101	98	17	48	39	19	77
3	Herbert St	Christie St	24	21	25	22	16	23	16	21	4	18	24
4	Christie St	Albany St	23	71	19	62	21	18	20	33	23	17	50
5	Albany St	Oxley St	15	17	13	19	17	12	16	16	2	14	17
6	Oxley St	Hume St	38	13	13	16	14	12	13	17	9	10	24
All Sections	**Greenwich Rd**	**Hume St**	**204**	**182**	**183**	**188**	**245**	**229**	**128**	**194**	**38**	**166**	**222**

Figure 2: Average Section Travel Time and Confidence Limits – AM Pacific Highway Eastbound.

Table 2: Travel Time Summary (Seconds) - AM Peak Pacific Highway Westbound.

Date			4 April 2013					19 Sept 2013					
Section	From	To	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Average	Standard Deviation	Lower	Upper
1	Hume St	Oxley St	8	20	11	14	38	13	13	17	10	9	29
2	Oxley St	Albany St	34	16	18	15	55	43	50	33	17	20	43
3	Albany St	Christie St	33	16	20	38	43	16	16	26	12	17	40
4	Christie St	Herbert St	17	85	62	16	72	101	12	52	37	25	78
5	Herbert St	Reserve Rd	30	18	16	27	17	10	12	19	7	13	27
6	Reserve Rd	Greenwich Rd	39	39	61	68	88	30	46	53	20	38	77
All Sections	**Hume St**	**Greenwich Rd**	**204**	**182**	**183**	**188**	**245**	**213**	**149**	**199**	**30**	**173**	**217**

Figure 3: Average Section Travel Time and Confidence Limits – AM Pacific Highway Westbound.

Table 3: Travel Time Summary (Seconds) - AM Peak Pacific River Road Eastbound.

Date			19 September 2013						
Section	From	To	Run 1	Run 2	Run 3	Average	Standard Deviation	Lower	Upper
1	Greenwich Rd	Shirley Rd	80	102	100	94	12	80	108
2	Shirley Rd	Pacific Hwy	164	133	127	141	20	119	164
All Sections	**Greenwich Rd**	**Pacific Hwy**	**244**	**235**	**227**	**235**	**9**	**226**	**245**

Figure 4: Average Section Travel Time and Confidence Limits – AM Peak River Road Eastbound.

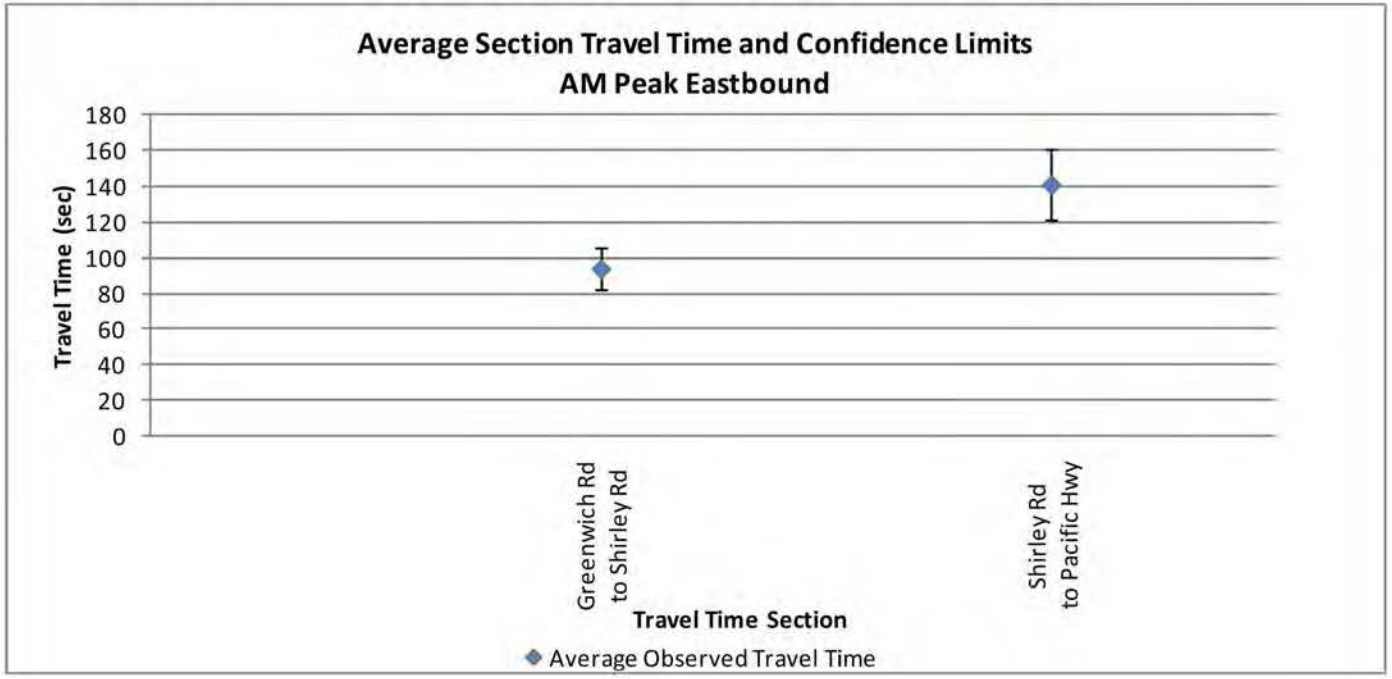
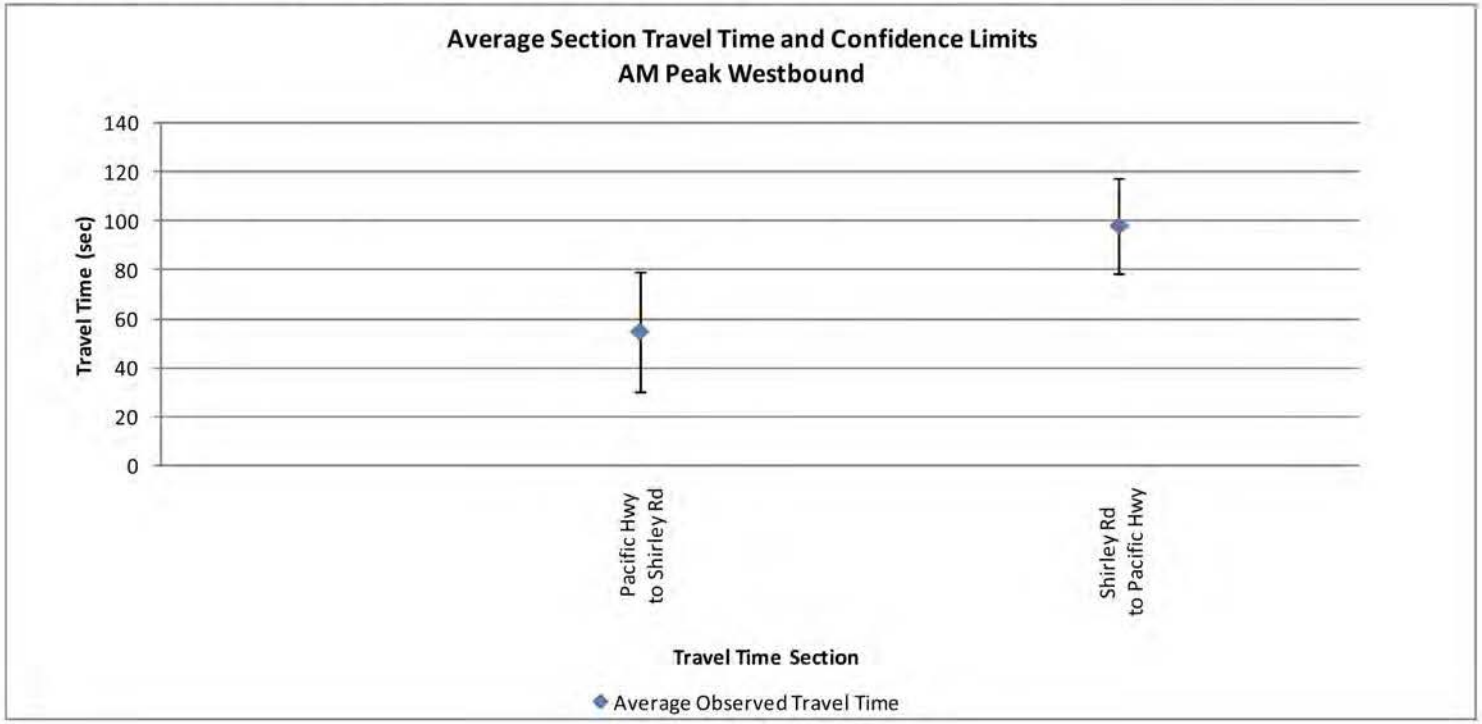


Table 4: Travel Time Summary (Seconds) - AM Peak Pacific River Road Westbound.

Date			19 September 2013						
Section	From	To	Run 1	Run 2	Run 3	Average	Standard Deviation	Lower	Upper
1	Pacific Hwy	Shirley Rd	45	83	37	55	25	27	83
2	Shirley Rd	Greenwich Rd	106	113	76	98	20	76	121
All Sections	**Pacific Hwy**	**Greenwich Rd**	**151**	**196**	**113**	**153**	**42**	**106**	**200**

Figure 5: Average Section Travel Time and Confidence Limits – AM Peak River Road Westbound.



PM Peak – Travel Time Results

Table 5: Travel Time Summary (Seconds) - PM Peak Pacific Highway Eastbound.

Date			4 April 2013							19 Sept 2013					
Section	From	To	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average	Standard Deviation	Lower	Upper
1	Greenwich Rd	Reserve Rd	65	34	34	64	36	37	37	43	30	42	13	34	51
2	Reserve Rd	Herbert St	12	77	55	13	13	90	87	11	9	41	36	17	64
3	Herbert St	Christie St	14	15	33	14	20	22	20	13	10	18	7	14	23
4	Christie St	Albany St	18	18	18	64	56	19	20	82	16	35	25	18	51
5	Albany St	Oxley St	15	13	21	14	19	43	31	11	27	22	10	15	28
6	Oxley St	Hume St	41	21	15	35	57	15	15	8	14	25	16	14	35
All Sections	**Greenwich Rd**	**Hume St**	**165**	**178**	**176**	**204**	**201**	**226**	**210**	**168**	**106**	**182**	**35**	**159**	**205**

Figure 6: Average Section Travel Time and Confidence Limits – PM Pacific Highway Eastbound.

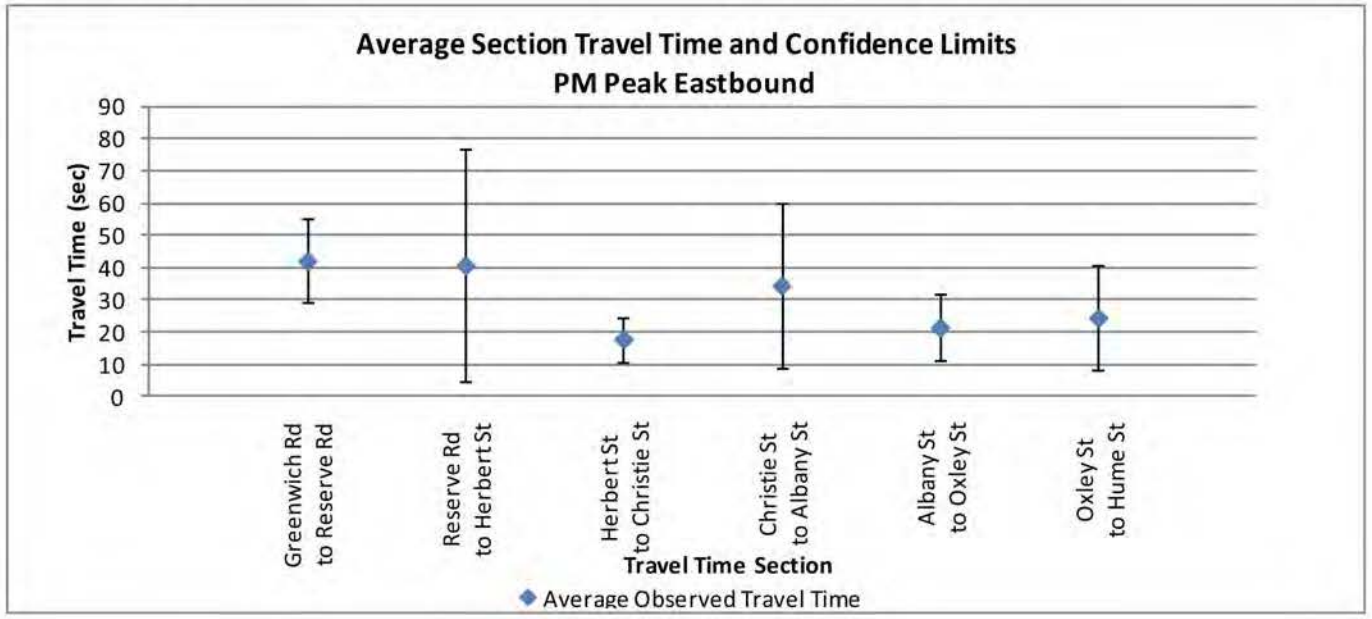


Table 6: Travel Time Summary (Seconds) - PM Peak Pacific Highway Westbound.

Date			4 April 2013							19 Sept 2013					
Section	From	To	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Average	Standard Deviation	Lower	Upper
1	Hume St	Oxley St	11	13	30	34	30	21	18	9	32	22	10	16	28
2	Oxley St	Albany St	12	15	36	22	40	32	19	11	34	25	11	17	32
3	Albany St	Christie St	12	51	47	51	29	32	37	77	78	46	22	32	60
4	Christie St	Herbert St	59	16	80	22	20	14	18	86	125	49	40	23	75
5	Herbert St	Reserve Rd	19	16	16	17	17	15	14	33	31	20	7	15	24
6	Reserve Rd	Greenwich Rd	66	51	57	62	67	36	90	37	36	56	18	44	68
All Sections	**Hume St**	**Greenwich Rd**	**179**	**162**	**266**	**208**	**203**	**150**	**196**	**253**	**336**	**217**	**59**	**179**	**255**

Figure 7: Average Section Travel Time and Confidence Limits – PM Pacific Highway Westbound.

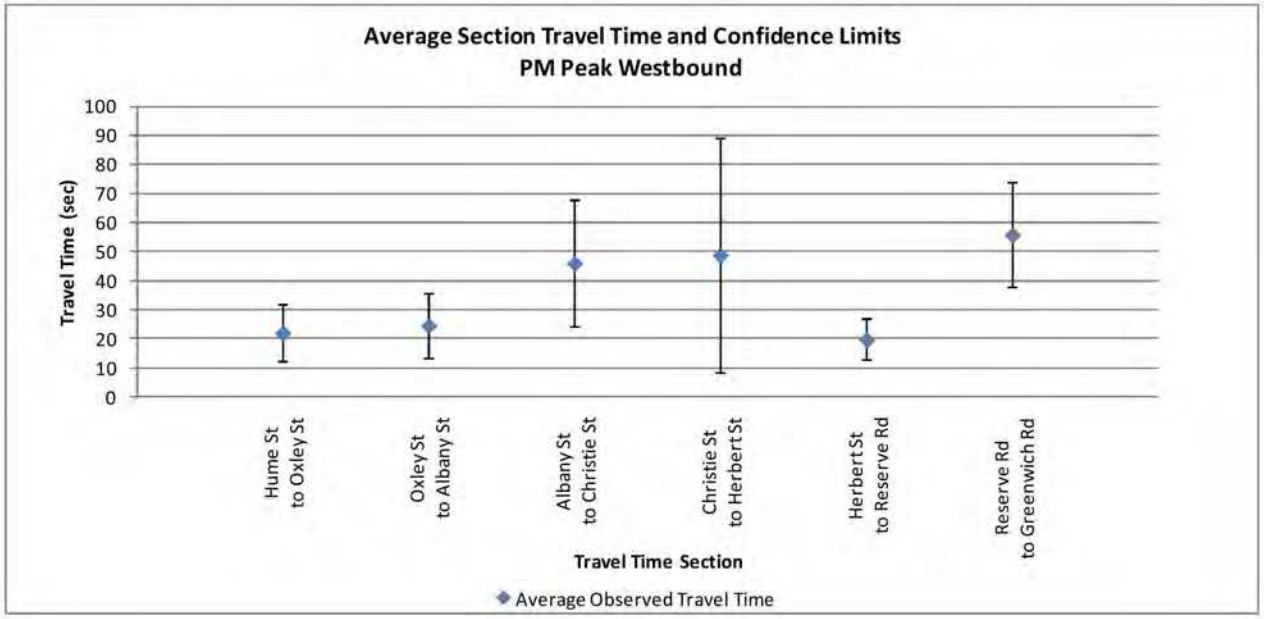


Table 7: Travel Time Summary (Seconds) - PM Peak Pacific River Road Eastbound.

Date			19 September 2013						
Section	From	To	Run 1	Run 2	Run 3	Average	Standard Deviation	Lower	Upper
1	Greenwich Rd	Shirley Rd	124	96	84	101	21	78	125
2	Shirley Rd	Pacific Hwy	131	217	76	141	71	61	222
All Sections	**Greenwich Rd**	**Pacific Hwy**	**255**	**313**	**160**	**242**	**77**	**155**	**330**

Figure 8: Average Section Travel Time and Confidence Limits – PM Peak River Road Eastbound.

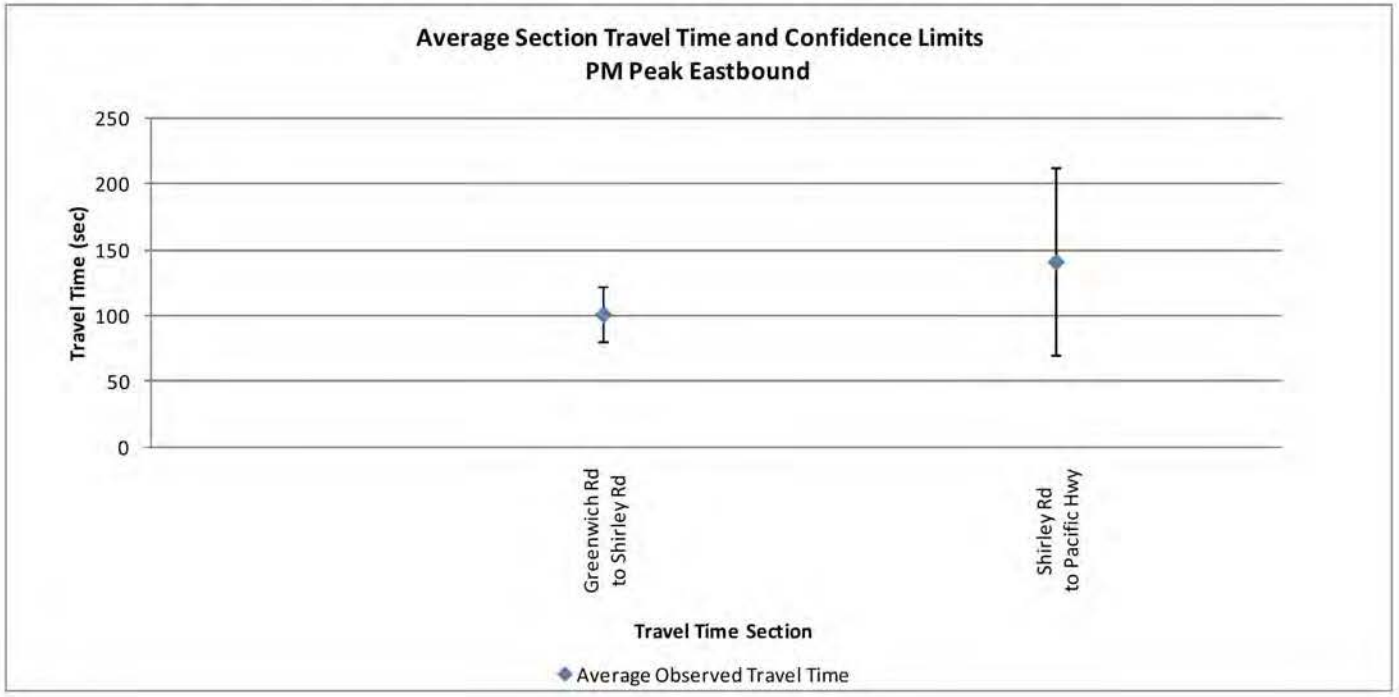
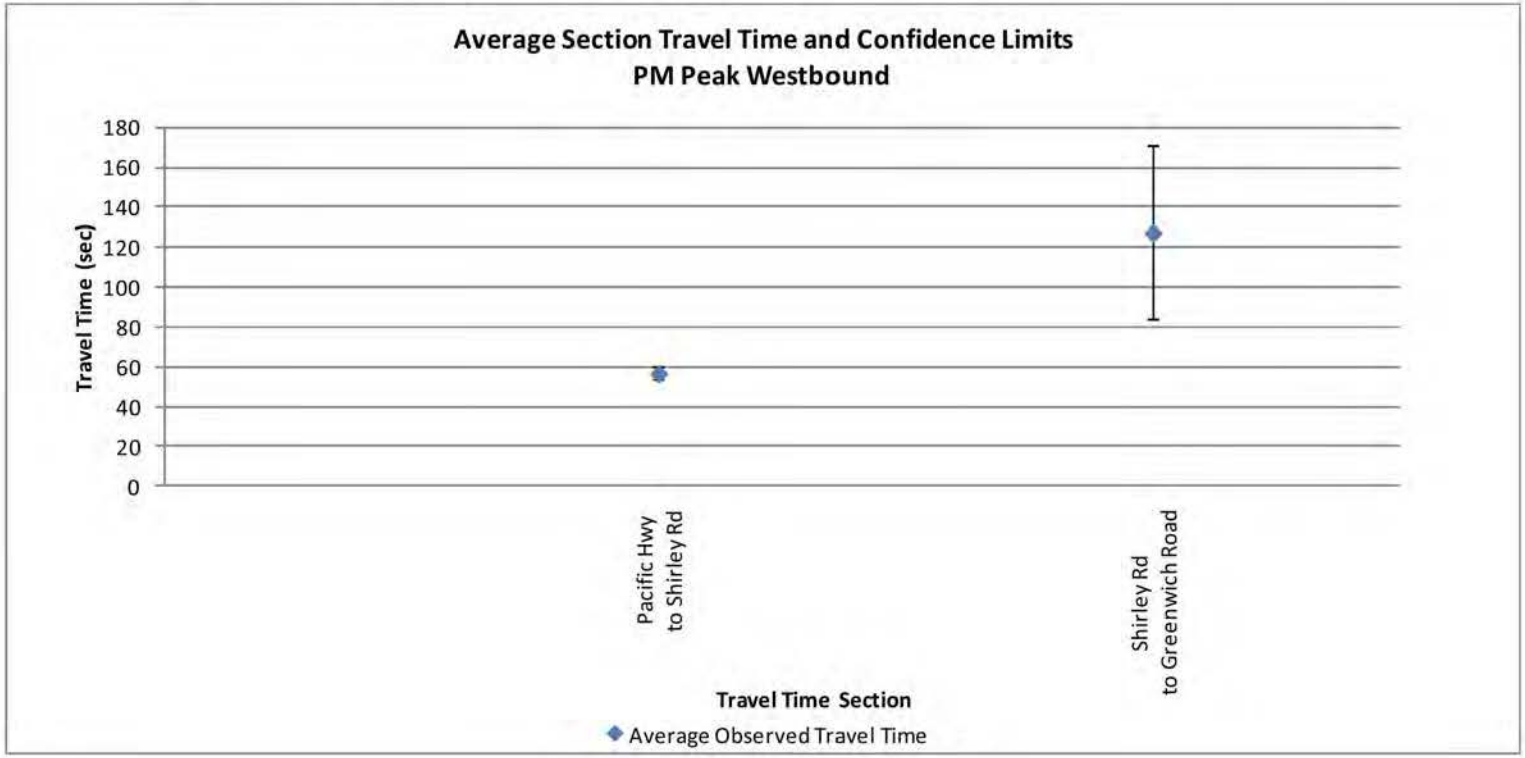


Table 8: Travel Time Summary (Seconds) - PM Peak Pacific River Road Westbound.

Date			19 September 2013						
Section	From	To	Run 1	Run 2	Run 3	Average	Standard Deviation	Lower	Upper
1	Pacific Hwy	Shirley Rd	55	61	55	57	4	53	61
2	Shirley Rd	Greenwich Rd	157	148	78	128	43	79	177
All Sections	**Pacific Hwy**	**Greenwich Rd**	**212**	**209**	**133**	**185**	**45**	**134**	**235**

Figure 9: Average Section Travel Time and Confidence Limits – PM Peak River Road Westbound.



Appendix C

Calculations of trip generation and distribution

Journey to Work data from Bureau of Transport Statistics

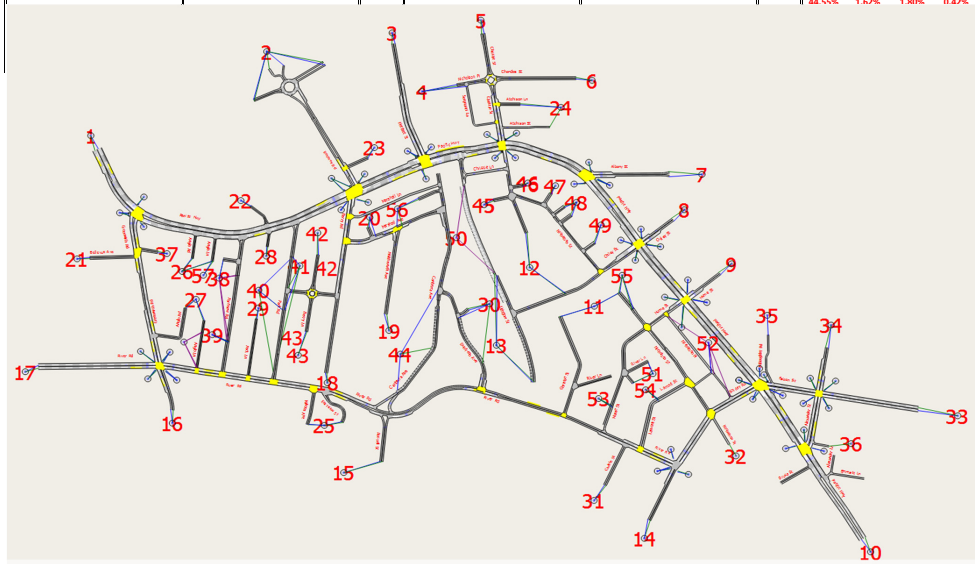
2011 Journey to Work
Source: Tables 12 and 13

AM Peak IN

Selected TZs: 1832
Total people employed in selection: 1738
Total employed people who reside in select 553

ındard Area 3s (SA3s) - where employed people are coming from			Centroid				Flow				Total	Percentage				Rate					1	3	6	7	10	17	33
Origin SA3	Origin SA3 lieh	icle driv																									
Chatswood - Lane Cove	12101	15.02%	1	17			1575.68	1497.91	0	0	3073.59	51.27%	48.73%	0.00%	0.00%	7.70%	7.32%	0.00%	0.00%	15.02%	7.70%	0.00%	0.00%	0.00%	0.00%	7.32%	0.00%
Ku-ring-gai	12103	10.69%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	10.69%	0.00%	0.00%	0.00%	10.69%	10.69%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
North Sydney - Mosman	12104	9.56%	10	33			1093.58	863.82	0	0	1957.4	55.87%	44.13%	0.00%	0.00%	5.34%	4.22%	0.00%	0.00%	9.56%	0.00%	0.00%	0.00%	0.00%	5.34%	0.00%	4.22%
Warringah	12203	7.85%	33				863.82	0	0	0	863.82	100.00%	0.00%	0.00%	0.00%	7.85%	0.00%	0.00%	0.00%	7.85%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	7.85%
Sydney Inner City	11703	5.12%	10	33			1093.58	863.82	0	0	1957.4	55.87%	44.13%	0.00%	0.00%	2.86%	2.26%	0.00%	0.00%	5.12%	0.00%	0.00%	0.00%	0.00%	2.86%	0.00%	2.26%
Eastern Suburbs - North	11801	5.01%	10	33			1093.58	863.82	0	0	1957.4	55.87%	44.13%	0.00%	0.00%	2.80%	2.21%	0.00%	0.00%	5.01%	0.00%	0.00%	0.00%	0.00%	2.80%	0.00%	2.21%
Ryde - Hunters Hill	12602	4.32%	1	17			1575.68	1497.91	0	0	3073.59	51.27%	48.73%	0.00%	0.00%	2.22%	2.11%	0.00%	0.00%	4.32%	2.22%	0.00%	0.00%	0.00%	0.00%	2.11%	0.00%
Baulkham Hills	11501	3.75%	1	3			1575.68	664.06	0	0	2239.74	70.35%	29.65%	0.00%	0.00%	2.64%	1.11%	0.00%	0.00%	3.75%	2.64%	1.11%	0.00%	0.00%	0.00%	0.00%	0.00%
Leichhardt	12002	3.64%	6	10			418.05	1093.58	0	0	1511.63	27.66%	72.34%	0.00%	0.00%	1.01%	2.63%	0.00%	0.00%	3.64%	0.00%	0.00%	1.01%	0.00%	2.63%	0.00%	0.00%
Manly	12201	2.96%	33				863.82	0	0	0	863.82	100.00%	0.00%	0.00%	0.00%	2.96%	0.00%	0.00%	0.00%	2.96%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.96%
Canada Bay	12001	2.84%	1	17			1575.68	1497.91	0	0	3073.59	51.27%	48.73%	0.00%	0.00%	1.46%	1.39%	0.00%	0.00%	2.84%	1.46%	0.00%	0.00%	0.00%	0.00%	1.39%	0.00%
Strathfield - Burwood - Ashfield	12003	2.73%	1	10	17	33	1575.68	1093.58	1497.91	863.82	5030.99	31.32%	21.74%	29.77%	17.17%	0.86%	0.59%	0.81%	0.47%	2.73%	0.86%	0.00%	0.00%	0.00%	0.59%	0.81%	0.47%
Eastern Suburbs - South	11802	2.50%	10	6	33		1093.58	418.05	863.82	0	2375.45	46.04%	17.60%	36.36%	0.00%	1.15%	0.44%	0.91%	0.00%	2.50%	0.00%	0.00%	0.44%	0.00%	1.15%	0.00%	0.91%
Pittwater	12202	2.05%	1	6	7	33	1575.68	418.05	566.17	863.82	3423.72	46.02%	12.21%	16.54%	25.23%	0.94%	0.25%	0.34%	0.52%	2.05%	0.94%	0.00%	0.25%	0.34%	0.00%	0.00%	0.52%
Carlingford	12502	2.05%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	2.05%	0.00%	0.00%	0.00%	2.05%	2.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hornsby	12102	1.71%	1	3			1575.68	664.06	0	0	2239.74	70.35%	29.65%	0.00%	0.00%	1.20%	0.51%	0.00%	0.00%	1.71%	1.20%	0.51%	0.00%	0.00%	0.00%	0.00%	0.00%
Parramatta	12504	1.71%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	1.71%	0.00%	0.00%	0.00%	1.71%	1.71%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Pennant Hills - Epping	12601	1.71%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	1.71%	0.00%	0.00%	0.00%	1.71%	1.71%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kogarah - Rockdale	11904	1.25%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	1.25%	0.00%	0.00%	0.00%	1.25%	1.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hurstville	11903	1.02%	1	33			1575.68	863.82	0	0	2439.5	64.59%	35.41%	0.00%	0.00%	0.66%	0.36%	0.00%	0.00%	1.02%	0.66%	0.00%	0.00%	0.00%	0.00%	0.00%	0.36%
Cronulla - Miranda - Caringbah	12801	1.02%	1	33			1575.68	863.82	0	0	2439.5	64.59%	35.41%	0.00%	0.00%	0.66%	0.36%	0.00%	0.00%	1.02%	0.66%	0.00%	0.00%	0.00%	0.00%	0.00%	0.36%
Blacktown - North	11602	0.80%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.80%	0.00%	0.00%	0.00%	0.80%	0.80%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Canterbury	11902	0.80%	10	17			1093.58	1497.91	0	0	2591.49	42.20%	57.80%	0.00%	0.00%	0.34%	0.46%	0.00%	0.00%	0.80%	0.00%	0.00%	0.00%	0.00%	0.34%	0.46%	0.00%
Penrith	12403	0.80%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.80%	0.00%	0.00%	0.00%	0.80%	0.80%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gosford	10201	0.68%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.68%	0.00%	0.00%	0.00%	0.68%	0.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dural - Wisemans Ferry	11502	0.68%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.68%	0.00%	0.00%	0.00%	0.68%	0.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blacktown	11601	0.68%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.68%	0.00%	0.00%	0.00%	0.68%	0.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mount Druitt	11603	0.68%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.68%	0.00%	0.00%	0.00%	0.68%	0.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bankstown	11901	0.68%	1	10	17		1575.68	1093.58	1497.91	0	4167.17	37.81%	26.24%	35.95%	0.00%	0.26%	0.18%	0.25%	0.00%	0.68%	0.26%	0.00%	0.00%	0.00%	0.18%	0.25%	0.00%
Campbelltown (NSW)	12302	0.68%	1	6	33		1575.68	418.05	863.82	0	2857.55	55.14%	14.63%	30.23%	0.00%	0.38%	0.10%	0.21%	0.00%	0.68%	0.38%	0.00%	0.10%	0.00%	0.00%	0.00%	0.21%
Marrickville - Sydenham - Petersham	11702	0.57%	1	10	17		1575.68	1093.58	1497.91	0	4167.17	37.81%	26.24%	35.95%	0.00%	0.22%	0.15%	0.20%	0.00%	0.57%	0.22%	0.00%	0.00%	0.00%	0.15%	0.20%	0.00%
Camden	12301	0.46%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.46%	0.00%	0.00%	0.00%	0.46%	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
St Marys	12405	0.46%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.46%	0.00%	0.00%	0.00%	0.46%	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Merrylands - Guildford	12503	0.46%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.46%	0.00%	0.00%	0.00%	0.46%	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Queanbeyan	10102	0.34%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wyong	10202	0.34%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bathurst	10301	0.34%	7	10	33		566.17	1093.58	863.82	0	2523.57	22.44%	43.33%	34.23%	0.00%	0.08%	0.15%	0.12%	0.00%	0.34%	0.00%	0.00%	0.00%	0.08%	0.15%	0.00%	0.12%
Coffs Harbour	10402	0.34%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Southern Highlands	11402	0.34%	1	33			1575.68	863.82	0	0	2439.5	64.59%	35.41%	0.00%	0.00%	0.22%	0.12%	0.00%	0.00%	0.34%	0.22%	0.00%	0.00%	0.00%	0.00%	0.00%	0.12%
Blue Mountains	12401	0.34%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Auburn	12501	0.34%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fairfield	12702	0.34%	1				1575.68	0	0	0	1575.68	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sutherland - Menai - Heathcote	12802	0.34%	33				863.82	0	0	0	863.82	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.34%
Lake Macquarie - West	11102	0.00%																			44.55%	1.62%	1.80%	0.47%	16.19%	12.53%	22.90%
Rouse Hill - McGraths Hill	11504	0.00%																									
Botany	11701	0.00%																									
Bringelly - Green Valley	12701	0.00%																									
Liverpool	12703	0.00%																									
North Canberra	80105	0.00%																									

	Flow	Summ
1	1575.68	
3	664.06	
6	418.05	
7	566.17	
10	1093.58	
17	1497.91	
33	863.82	



Journey to Work data from Bureau of Transport Statistics

2011 Journey to Work
Source: Tables 12 and 13

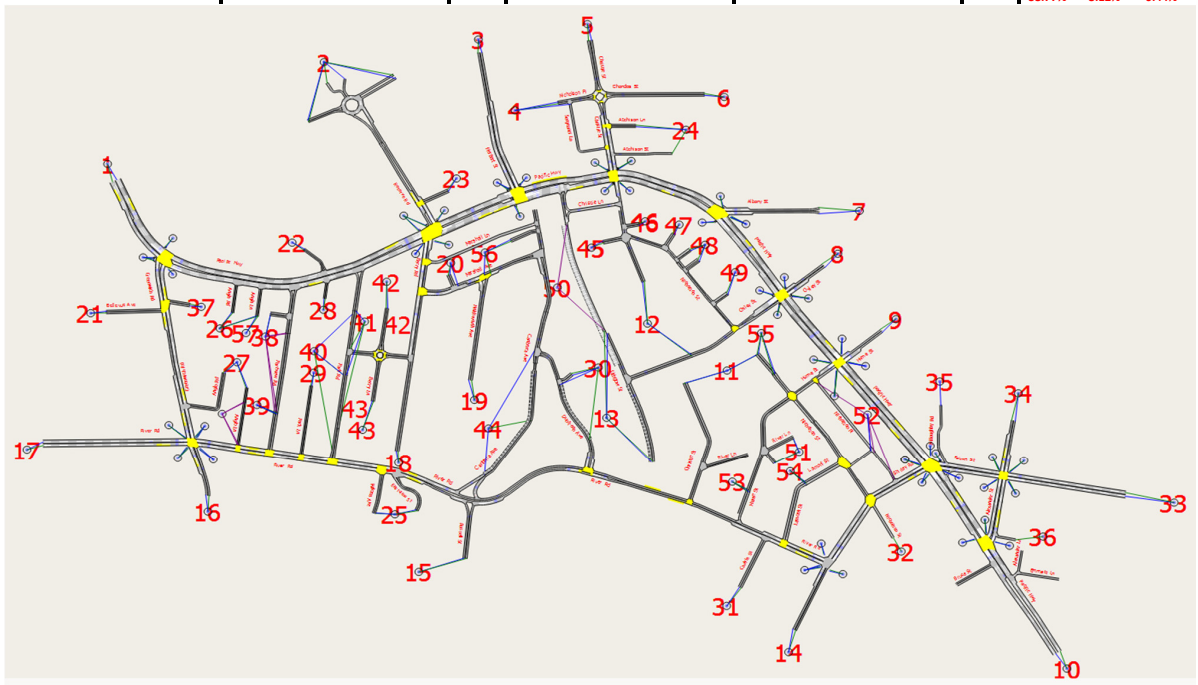
AM Peak Out

Selected TZs: 1832
Total people employed in selection: 1738
Total employed people who reside in selecti 553

andard Area 3s (SA3s) - where employed Residentials are travelling to

Destination SA3	Origin SA3	Itination SA	Centroid				Flow				Total	Percentage				Rate					1	3	6	7	10	17	33
Lower Hunter	12101	0.0000	6	7	10		326.06	549.01	1532.65	0	2407.72	13.54%	22.80%	63.66%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Baulkham Hills	12103	0.0184	1				1326.85	0	0	0	1326.85	100.00%	0.00%	0.00%	0.00%	1.84%	0.00%	0.00%	0.00%	1.84%	1.84%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blacktown	12104	0.0000	1				1326.85	0	0	0	1326.85	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mount Druitt	12203	0.0000	1				1326.85	0	0	0	1326.85	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Botany	11703	0.0368	6	7	10	33	326.06	549.01	1532.65	737.64	3145.36	10.37%	17.45%	48.73%	23.45%	0.38%	0.64%	1.79%	0.86%	3.68%	0.00%	0.00%	0.38%	0.64%	1.79%	0.00%	0.86%
Marrickville - Sydenham - Petersham	11801	0.0000	10	33			1532.65	737.64	0	0	2270.29	67.51%	32.49%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sydney Inner City	12602	0.1718	10	33			1532.65	737.64	0	0	2270.29	67.51%	32.49%	0.00%	0.00%	11.60%	5.58%	0.00%	0.00%	17.18%	0.00%	0.00%	0.00%	0.00%	11.60%	0.00%	5.58%
Eastern Suburbs - North	11501	0.0184	10	33			1532.65	737.64	0	0	2270.29	67.51%	32.49%	0.00%	0.00%	1.24%	0.60%	0.00%	0.00%	1.84%	0.00%	0.00%	0.00%	0.00%	1.24%	0.00%	0.60%
Eastern Suburbs - South	12002	0.0000	6	7	10	33	326.06	549.01	1532.65	737.64	3145.36	10.37%	17.45%	48.73%	23.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Leichhardt	12201	0.0184	6	10	17		326.06	1532.65	793.09	0	2651.8	12.30%	57.80%	29.91%	0.00%	0.23%	1.06%	0.55%	0.00%	1.84%	0.00%	0.00%	0.23%	0.00%	1.06%	0.55%	0.00%
Strathfield - Burwood - Ashfield	12001	0.0000	6	7	10	33	326.06	549.01	1532.65	737.64	3145.36	10.37%	17.45%	48.73%	23.45%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chatswood - Lane Cove	12003	0.2147	1	3	8		1326.85	632.16	0	0	1959.01	67.73%	32.27%	0.00%	0.00%	14.54%	6.93%	0.00%	0.00%	21.47%	14.54%	6.93%	0.00%	0.00%	0.00%	0.00%	0.00%
Hornsby	11802	0.0000	1	3	5		1326.85	632.16	0	0	1959.01	67.73%	32.27%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ku-ring-gai	12202	0.0368	1	3	5		1326.85	632.16	0	0	1959.01	67.73%	32.27%	0.00%	0.00%	2.49%	1.19%	0.00%	0.00%	3.68%	2.49%	1.19%	0.00%	0.00%	0.00%	0.00%	0.00%
North Sydney - Mosman	12502	0.1656	6	5	33		326.06	0	737.64	0	1063.7	30.65%	0.00%	69.35%	0.00%	5.08%	0.00%	11.49%	0.00%	16.56%	0.00%	0.00%	5.08%	0.00%	0.00%	0.00%	11.49%
Manly	12102	0.0000	33				737.64	0	0	0	737.64	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Warringah	12504	0.0245	6	33			326.06	737.64	0	0	1063.7	30.65%	69.35%	0.00%	0.00%	0.75%	1.70%	0.00%	0.00%	2.45%	0.00%	0.00%	0.75%	0.00%	0.00%	0.00%	1.70%
Auburn	12601	0.0184	1				1326.85	0	0	0	1326.85	100.00%	0.00%	0.00%	0.00%	1.84%	0.00%	0.00%	0.00%	1.84%	1.84%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Carlingford	11904	0.0184	1				1326.85	0	0	0	1326.85	100.00%	0.00%	0.00%	0.00%	1.84%	0.00%	0.00%	0.00%	1.84%	1.84%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Parramatta	11903	0.0552	1				1326.85	0	0	0	1326.85	100.00%	0.00%	0.00%	0.00%	5.52%	0.00%	0.00%	0.00%	5.52%	5.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ryde - Hunters Hill	12801	0.1288	1	17			1326.85	793.09	0	0	2119.94	62.59%	37.41%	0.00%	0.00%	8.06%	4.82%	0.00%	0.00%	12.88%	8.06%	0.00%	0.00%	0.00%	0.00%	4.82%	0.00%
Liverpool	11602	0.0184	1	7	10	33	1326.85	549.01	1532.65	737.64	4146.15	32.00%	13.24%	36.97%	17.79%	0.59%	0.24%	0.68%	0.33%	1.84%	0.59%	0.00%	0.00%	0.24%	0.68%	0.00%	0.33%
	11902	0.0552	1	10	33		1326.85	1532.65	737.64	0	3597.14	36.89%	42.61%	20.51%	0.00%	2.04%	2.35%	1.13%	0.00%	5.52%	2.04%	0.00%	0.00%	0.00%	2.35%	0.00%	1.13%
Total		1.0000																			**38.77%**	**8.12%**	**6.44%**	**0.89%**	**18.73%**	**5.37%**	**21.69%**

	Flow Summ
1	1326.85
3	632.16
6	326.06
7	549.01
10	1532.65
17	793.09
33	737.64



Journey to Work data from Bureau of Transport Statistics

2011 Journey to Work
Source: Tables 12 and 13

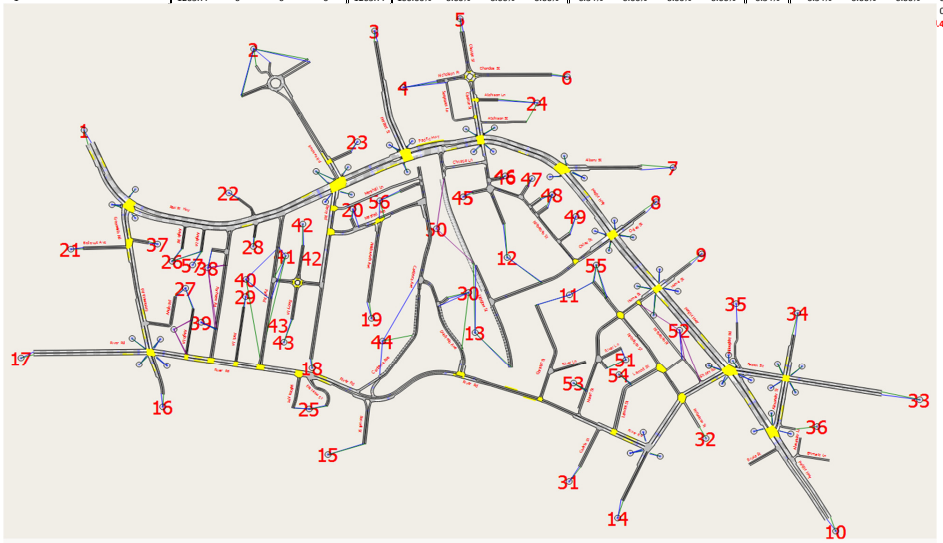
AM Peak IN

Selected TZs: 1832
Total people employed in selection: 1738
Total employed people who reside in select 553

ındard Area 3s (SA3s) - where employed people are coming from

Origin SA3	Origin SA3 lieh	icle driv	Centroid				Flow				Total	Percentage				Rate					1	3	6	7	10	17	33
Chatswood - Lane Cove	12101	15.02%	1	17			1265.77	883.77	0	0	2149.54	58.89%	41.11%	0.00%	0.00%	8.84%	6.17%	0.00%	0.00%	15.02%	8.84%	0.00%	0.00%	0.00%	0.00%	6.17%	0.00%
Ku-ring-gai	12103	10.69%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	10.69%	0.00%	0.00%	0.00%	10.69%	10.69%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
North Sydney - Mosman	12104	9.56%	10	33			1290.57	903.45	0	0	2194.02	58.82%	41.18%	0.00%	0.00%	5.62%	3.94%	0.00%	0.00%	9.56%	0.00%	0.00%	0.00%	0.00%	5.62%	0.00%	3.94%
Warringah	12203	7.85%	33				903.45	0	0	0	903.45	100.00%	0.00%	0.00%	0.00%	7.85%	0.00%	0.00%	0.00%	7.85%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	7.85%
Sydney Inner City	11703	5.12%	10	33			1290.57	903.45	0	0	2194.02	58.82%	41.18%	0.00%	0.00%	3.01%	2.11%	0.00%	0.00%	5.12%	0.00%	0.00%	0.00%	0.00%	3.01%	0.00%	2.11%
Eastern Suburbs - North	11801	5.01%	10	33			1290.57	903.45	0	0	2194.02	58.82%	41.18%	0.00%	0.00%	2.94%	2.06%	0.00%	0.00%	5.01%	0.00%	0.00%	0.00%	0.00%	2.94%	0.00%	2.06%
Ryde - Hunters Hill	12602	4.32%	1	17			1265.77	883.77	0	0	2149.54	58.89%	41.11%	0.00%	0.00%	2.55%	1.78%	0.00%	0.00%	4.32%	2.55%	0.00%	0.00%	0.00%	0.00%	1.78%	0.00%
Baulkham Hills	11501	3.75%	1	3			1265.77	831.08	0	0	2096.85	60.37%	39.63%	0.00%	0.00%	2.27%	1.49%	0.00%	0.00%	3.75%	2.27%	1.49%	0.00%	0.00%	0.00%	0.00%	0.00%
Leichhardt	12002	3.64%	6	10			269.81	1290.57	0	0	1560.38	17.29%	82.71%	0.00%	0.00%	0.63%	3.01%	0.00%	0.00%	3.64%	0.00%	0.00%	0.63%	0.00%	3.01%	0.00%	0.00%
Manly	12201	2.96%	33				903.45	0	0	0	903.45	100.00%	0.00%	0.00%	0.00%	2.96%	0.00%	0.00%	0.00%	2.96%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	2.96%
Canada Bay	12001	2.84%	1	17			1265.77	883.77	0	0	2149.54	58.89%	41.11%	0.00%	0.00%	1.67%	1.17%	0.00%	0.00%	2.84%	1.67%	0.00%	0.00%	0.00%	0.00%	1.17%	0.00%
Strathfield - Burwood - Ashfield	12003	2.73%	1	10	17	33	1265.77	1290.57	883.77	903.45	4343.56	29.14%	29.71%	20.35%	20.80%	0.80%	0.81%	0.56%	0.57%	2.73%	0.80%	0.00%	0.00%	0.00%	0.81%	0.56%	0.57%
Eastern Suburbs - South	11802	2.50%	10	6	33		1290.57	269.81	903.45	0	2463.83	52.38%	10.95%	36.67%	0.00%	1.31%	0.27%	0.92%	0.00%	2.50%	0.00%	0.00%	0.27%	0.00%	1.31%	0.00%	0.92%
Pittwater	12202	2.05%	1	6	7	33	1265.77	269.81	602.07	903.45	3041.1	41.62%	8.87%	19.80%	29.71%	0.85%	0.18%	0.41%	0.61%	2.05%	0.85%	0.00%	0.18%	0.41%	0.00%	0.00%	0.61%
Carlingford	12502	2.05%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	2.05%	0.00%	0.00%	0.00%	2.05%	2.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hornsby	12102	1.71%	1	3			1265.77	831.08	0	0	2096.85	60.37%	39.63%	0.00%	0.00%	1.03%	0.68%	0.00%	0.00%	1.71%	1.03%	0.68%	0.00%	0.00%	0.00%	0.00%	0.00%
Parramatta	12504	1.71%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	1.71%	0.00%	0.00%	0.00%	1.71%	1.71%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Pennant Hills - Epping	12601	1.71%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	1.71%	0.00%	0.00%	0.00%	1.71%	1.71%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kogarah - Rockdale	11904	1.25%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	1.25%	0.00%	0.00%	0.00%	1.25%	1.25%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hurstville	11903	1.02%	1	33			1265.77	903.45	0	0	2169.22	58.35%	41.65%	0.00%	0.00%	0.60%	0.43%	0.00%	0.00%	1.02%	0.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.43%
Cronulla - Miranda - Caringbah	12801	1.02%	1	33			1265.77	903.45	0	0	2169.22	58.35%	41.65%	0.00%	0.00%	0.60%	0.43%	0.00%	0.00%	1.02%	0.60%	0.00%	0.00%	0.00%	0.00%	0.00%	0.43%
Blacktown - North	11602	0.80%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.80%	0.00%	0.00%	0.00%	0.80%	0.80%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Canterbury	11902	0.80%	10	17			1290.57	883.77	0	0	2174.34	59.35%	40.65%	0.00%	0.00%	0.47%	0.32%	0.00%	0.00%	0.80%	0.00%	0.00%	0.00%	0.00%	0.47%	0.32%	0.00%
Penrith	12403	0.80%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.80%	0.00%	0.00%	0.00%	0.80%	0.80%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gosford	10201	0.68%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.68%	0.00%	0.00%	0.00%	0.68%	0.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dural - Wisemans Ferry	11502	0.68%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.68%	0.00%	0.00%	0.00%	0.68%	0.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blacktown	11601	0.68%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.68%	0.00%	0.00%	0.00%	0.68%	0.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mount Druitt	11603	0.68%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.68%	0.00%	0.00%	0.00%	0.68%	0.68%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bankstown	11901	0.68%	1	10	17		1265.77	1290.57	883.77	0	3440.11	36.79%	37.52%	25.69%	0.00%	0.25%	0.26%	0.18%	0.00%	0.68%	0.25%	0.00%	0.00%	0.00%	0.26%	0.18%	0.00%
Campbelltown (NSW)	12302	0.68%	1	6	33		1265.77	269.81	903.45	0	2439.03	51.90%	11.06%	37.04%	0.00%	0.35%	0.08%	0.25%	0.00%	0.68%	0.35%	0.00%	0.08%	0.00%	0.00%	0.00%	0.25%
Marrickville - Sydenham - Petersham	11702	0.57%	1	10	17		1265.77	1290.57	883.77	0	3440.11	36.79%	37.52%	25.69%	0.00%	0.21%	0.21%	0.15%	0.00%	0.57%	0.21%	0.00%	0.00%	0.00%	0.21%	0.15%	0.00%
Camden	12301	0.46%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.46%	0.00%	0.00%	0.00%	0.46%	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
St Marys	12405	0.46%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.46%	0.00%	0.00%	0.00%	0.46%	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Merrylands - Guildford	12503	0.46%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.46%	0.00%	0.00%	0.00%	0.46%	0.46%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Queanbeyan	10102	0.34%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Wyong	10202	0.34%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bathurst	10301	0.34%	7	10	33		602.07	1290.57	903.45	0	2796.09	21.53%	46.16%	32.31%	0.00%	0.07%	0.16%	0.11%	0.00%	0.34%	0.00%	0.00%	0.00%	0.07%	0.16%	0.00%	0.11%
Coffs Harbour	10402	0.34%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Southern Highlands	11402	0.34%	1	33			1265.77	903.45	0	0	2169.22	58.35%	41.65%	0.00%	0.00%	0.20%	0.14%	0.00%	0.00%	0.34%	0.20%	0.00%	0.00%	0.00%	0.00%	0.00%	0.14%
Blue Mountains	12401	0.34%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Auburn	12501	0.34%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Fairfield	12702	0.34%	1				1265.77	0	0	0	1265.77	100.00%	0.00%	0.00%	0.00%	0.34%	0.00%	0.00%	0.00%	0.34%	0.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sutherland - Menai - Heathcote	12802	0.34%																							0.00%	0.00%	0.34%
Lake Macquarie - West	11102	0.00%																							1.48%	17.81%	10.32%	22.71%
Rouse Hill - McGraths Hill	11504	0.00%																										
Botany	11701	0.00%																										
Bringelly - Green Valley	12701	0.00%																										
Liverpool	12703	0.00%																										
North Canberra	80105	0.00%																										

	Flow Summ
1	1265.77
3	831.08
6	269.81
7	602.07
10	1290.57
17	883.77
33	903.45



Journey to Work data from Bureau of Transport Statistics

2011 Journey to Work
Source: Tables 12 and 13

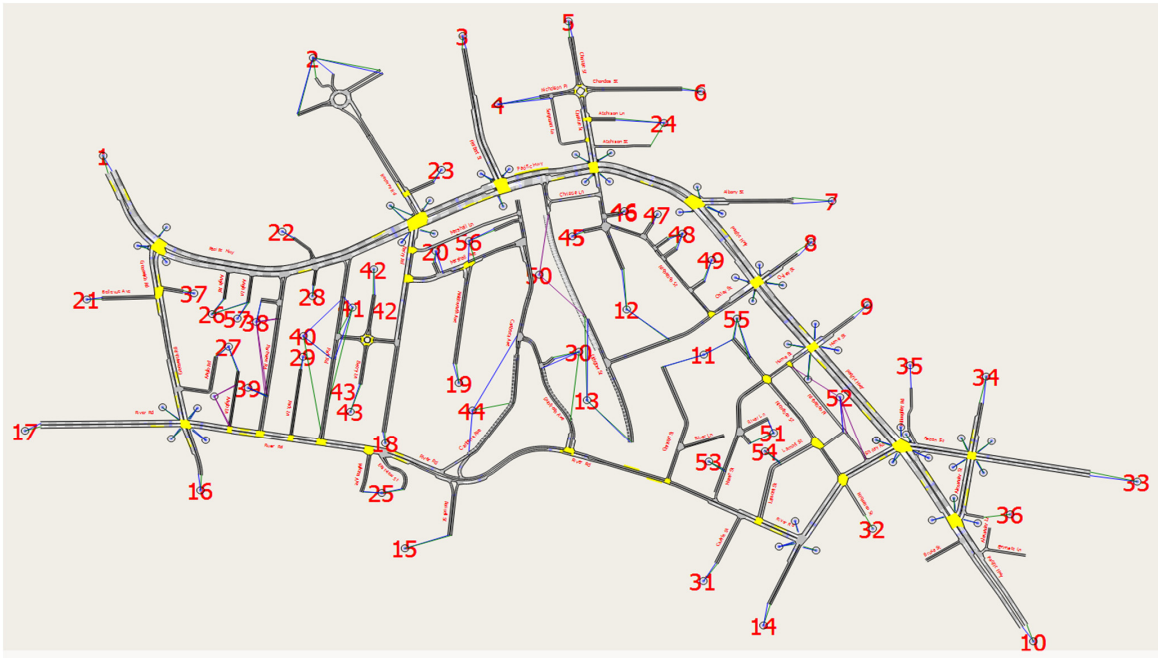
AM Peak Out

Selected TZs: 1832
Total people employed in selection: 1738
Total employed people who reside in selecti 553

:andard Area 3s (SA3s) - where employed Residentials are travelling to

Destination SA3	Origin SA3	Ittination SA	Centroid				Flow				Total	Percentage				Rate					1	3	6	7	10	17	33
Lower Hunter	12101	0.0000	6	7	10		359.04	482.82	1280.61	0	2122.47	16.92%	22.75%	60.34%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Baulkham Hills	12103	0.0184	1				1474.08	0	0	0	1474.08	100.00%	0.00%	0.00%	0.00%	1.84%	0.00%	0.00%	0.00%	1.84%	1.84%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Blacktown	12104	0.0000	1				1474.08	0	0	0	1474.08	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Mount Druitt	12203	0.0000	1				1474.08	0	0	0	1474.08	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Botany	11703	0.0368	6	7	10	33	359.04	482.82	1280.61	999.56	3122.03	11.50%	15.46%	41.02%	32.02%	0.42%	0.57%	1.51%	1.18%	3.68%	0.00%	0.00%	0.42%	0.57%	1.51%	0.00%	1.18%
Marrickville - Sydenham - Petersham	11801	0.0000	10	33			1280.61	999.56	0	0	2280.17	56.16%	43.84%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sydney Inner City	12602	0.1718	10	33			1280.61	999.56	0	0	2280.17	56.16%	43.84%	0.00%	0.00%	9.65%	7.53%	0.00%	0.00%	17.18%	0.00%	0.00%	0.00%	0.00%	9.65%	0.00%	7.53%
Eastern Suburbs - North	11501	0.0184	10	33			1280.61	999.56	0	0	2280.17	56.16%	43.84%	0.00%	0.00%	1.03%	0.81%	0.00%	0.00%	1.84%	0.00%	0.00%	0.00%	0.00%	1.03%	0.00%	0.81%
Eastern Suburbs - South	12002	0.0000	6	7	10	33	359.04	482.82	1280.61	999.56	3122.03	11.50%	15.46%	41.02%	32.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Leichhardt	12201	0.0184	6	10	17		359.04	1280.61	1406.73	0	3046.38	11.79%	42.04%	46.18%	0.00%	0.22%	0.77%	0.85%	0.00%	1.84%	0.00%	0.00%	0.22%	0.00%	0.77%	0.85%	0.00%
Strathfield - Burwood - Ashfield	12001	0.0000	6	7	10	33	359.04	482.82	1280.61	999.56	3122.03	11.50%	15.46%	41.02%	32.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chatswood - Lane Cove	12003	0.2147	1	3	8		1474.08	524.87	0	0	1998.95	73.74%	26.26%	0.00%	0.00%	15.83%	5.64%	0.00%	0.00%	21.47%	15.83%	5.64%	0.00%	0.00%	0.00%	0.00%	0.00%
Hornsby	11802	0.0000	1	3	5		1474.08	524.87	0	0	1998.95	73.74%	26.26%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ku-ring-gai	12202	0.0368	1	3	5		1474.08	524.87	0	0	1998.95	73.74%	26.26%	0.00%	0.00%	2.71%	0.97%	0.00%	0.00%	3.68%	2.71%	0.97%	0.00%	0.00%	0.00%	0.00%	0.00%
North Sydney - Mosman	12502	0.1656	6	5	33		359.04	0	999.56	0	1358.6	26.43%	0.00%	73.57%	0.00%	4.38%	0.00%	12.19%	0.00%	16.56%	0.00%	0.00%	4.38%	0.00%	0.00%	0.00%	12.19%
Manly	12102	0.0000	33				999.56	0	0	0	999.56	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Warringah	12504	0.0245	6	33			359.04	999.56	0	0	1358.6	26.43%	73.57%	0.00%	0.00%	0.65%	1.81%	0.00%	0.00%	2.45%	0.00%	0.00%	0.65%	0.00%	0.00%	0.00%	1.81%
Auburn	12601	0.0184	1				1474.08	0	0	0	1474.08	100.00%	0.00%	0.00%	0.00%	1.84%	0.00%	0.00%	0.00%	1.84%	1.84%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Carlingford	11904	0.0184	1				1474.08	0	0	0	1474.08	100.00%	0.00%	0.00%	0.00%	1.84%	0.00%	0.00%	0.00%	1.84%	1.84%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Parramatta	11903	0.0552	1				1474.08	0	0	0	1474.08	100.00%	0.00%	0.00%	0.00%	5.52%	0.00%	0.00%	0.00%	5.52%	5.52%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ryde - Hunters Hill	12801	0.1288	1	17			1474.08	1406.73	0	0	2880.81	51.17%	48.83%	0.00%	0.00%	6.59%	6.29%	0.00%	0.00%	12.88%	6.59%	0.00%	0.00%	0.00%	0.00%	6.29%	0.00%
Liverpool	11602	0.0184	1	7	10	33	1474.08	482.82	1280.61	999.56	4237.07	34.79%	11.40%	30.22%	23.59%	0.64%	0.21%	0.56%	0.43%	1.84%	0.64%	0.00%	0.00%	0.21%	0.56%	0.00%	0.43%
	11902	0.0552	1	10	33		1474.08	1280.61	999.56	0	3754.25	39.26%	34.11%	26.62%	0.00%	2.17%	1.88%	1.47%	0.00%	5.52%	2.17%	0.00%	0.00%	0.00%	1.88%	0.00%	1.47%
Total		1.0000																			38.99%	6.60%	5.67%	0.78%	15.40%	7.14%	25.41%

	Flow	Summ
1	1474.08	
3	524.87	
6	359.04	
7	482.82	
10	1280.61	
17	1406.73	
33	999.56	



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Flow Other

					In	Out
					20.00%	80.00%
	2400	0.14		336	67	269
Out	All		18	3.912%	3	11
	Other		19	47.941%	32	129
In	All		40	12.501%	8	34
	Other		42	14.245%	10	38
			43	5.401%	4	15
			44	15.994%	11	43

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					Flow Other		
					In	Out	
					80.00%	20.00%	
	2400	0.07		168	134	34	
Out	All		18	3.912%	5	1	
	Other		19	47.941%	64	16	
In	All		40	12.501%	17	4	
	Other		42	14.245%	19	5	
			43	5.401%	7	2	
			44	15.994%	21	5	

D:\DB - do not touch\Dropbox\TEF Consulting\16020 - St Leonards South Model - Lane Cove Council\16020_modelling\16020 aimsun\16020 Google routes\[16020 trips.xlsx]AM Peak OD MarAve

		Rate	
Commercial	290	0.4/110	1-13
Residential	269	0.14	
Commercial	105	0.4/110	15
Residential	66	0.14	

			Residential		Commercial				
			In	Out	In	Out		In	Out
	Res	Com	20.00%	80.00%	75.00%	25.00%	ID		
1-13	38	1	8	30	1	0	59	10	38
15	9	0	2	7	0	0			48

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		Rate	
Commercial	290	0.4/110	1-13
Residential	269	0.15	
Commercial	105	0.4/110	15
Residential	66	0.15	

			Residential		Commercial				
			In	Out	In	Out		In	Out
	Res	Com	20.00%	80.00%	75.00%	25.00%	ID		
1-13	40	1	8	32	1	0	59	11	41
15	10	0	2	8	0	0			52

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			Ex					Residential		Commercial					
								In	Out	In	Out				
Commercial	7760	0.46	6500	30		R	C	20.00%	80.00%	75.00%	25.00%			In	Out
Residential	450	0.14			A	63	36	13	50	27	9			39	59
Out	All	0.92													
	Other	0.08													
In	All	0.58													
	Other	0.42													

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									Residential		Commercial			
			Ex						In	Out	In	Out		
													In	Out
Commercial	7760	0.35	6500	23		R	C	20.00%	80.00%	75.00%	25.00%			
Residential	450	0.07			A	32	27	6	25	20	7		27	32

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		Rate	
Commercial	6874	0.85	
Other	1389	0.00	B
Residential	539	0.14	

Ex

100

			Residential		Commercial					
			In	Out	In	Out			In	Out
	Res	Com	20.00%	80.00%	75.00%	25.00%		ID		
B	75	58	15	60	77	48	B	48	92	108
C							C	47	0	0
			by CBHK						92	108
C	**0**	**0**	**0**	**0**	**0**	**0**				200

Trip generation for supermarket and child care from report (Cells P5, Q5)

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		Rate	
Commercial	6874	0.78	
Retail	1389	0.00	B
Residential	539	0.07	

Ex

93

			Residential		Commercial					
			In	Out	In	Out			In	Out
	Res	Com	20.00%	80.00%	75.00%	25.00%		ID		
B	38	54	8	30	96	56	B	48	104	86
C							C	47	0	0
			by CBHK						104	86
C	**0**	**0**	**0**	**0**	**0**	**0**				190

Trip generation for supermarket and child care from report (Cells P5, Q5)

D:\DB - do not touch\Dropbox\TEF Consulting\16020 - St Leonards South Model - Lane Cove Council\16020_modelling\16020 aimsun\16020 Google routes\[16020 trips.xlsx]AM Peak OD C

		Rate	
Commercial	5628	0.85	C
Residential	495	0.14	

Trip generation for supermarket and child care from report (Cells P5, Q5)

Ex				Residential		Commercial					
				In	Out	In	Out			In	Out
250		Res	Com	20.00%	80.00%	75.00%	25.00%		ID		
	B							B	48	0	0
	C	69	48	14	55	36	12	C	47	81	78
				by CBHK						81	78
	C	69	90	14	55	68	23				159

D:\DB - do not touch\Dropbox\TEF Consulting\16020 - St Leonards South Model - Lane Cove Council\16020_modelling\16020 aimsun\16020 Google routes\[16020 trips.xlsx]PM Peak OD C

		Rate	
Commercial	5628	0.85	C
Residential	495	0.07	

Trip generation for supermarket and child care from report (Cells P5, Q5)

Ex				Residential		Commercial					
				In	Out	In	Out			In	Out
150		Res	Com	20.00%	80.00%	75.00%	25.00%		ID		
								B	48	0	0
	C	35	48	7	28	36	12	C	47	74	50
				by CBHK						74	50
	C	35	90	7	28	68	23				125

Appendix D

Definition of Level of Service (RMS)

Detailed modelling results

Table 4.2
Level of service criteria for intersections

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	< 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & 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

The figures in Table 4.2 are intended as a guide only. Any particular assessment should take into account site-specific factors including maximum queue lengths (and their effect on lane blocking), the influence of nearby intersections and the sensitivity of the location to delays. In many situations, a comparison of the current and future average delay provides a better appreciation of the impact of a proposal, and not simply the change in the level of service.

Although in some situations additional traffic does not alter the level of service, particularly where the level of service is E or F, additional capacity may still be required. This is particularly appropriate for service level F, where small increases in flow can cause disproportionately greater increases in delay. In this situation, it is advisable to consider means of control to maintain the existing level of absolute delay.

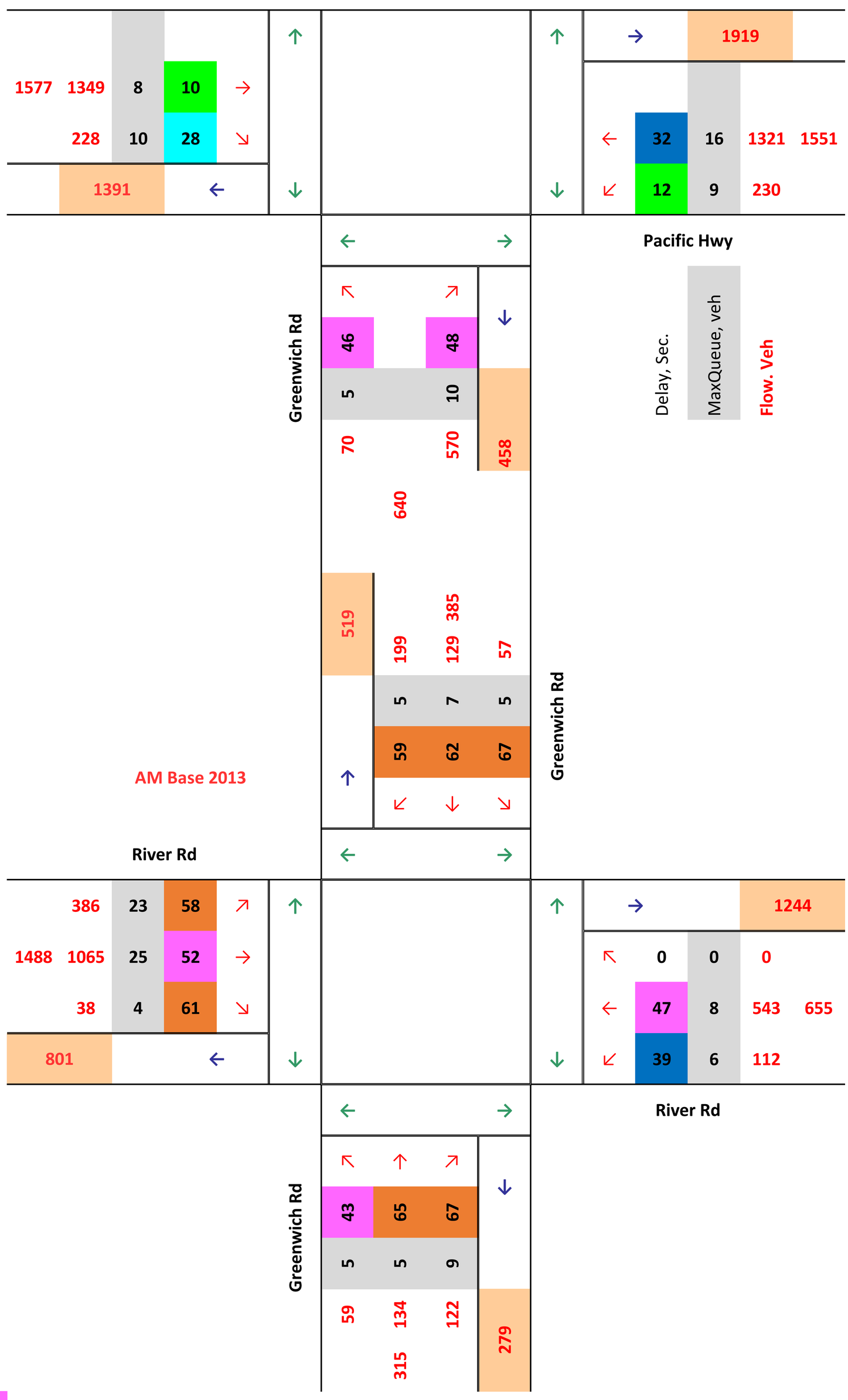
4.2.3 Urban roads.

The capacity of urban roads is generally determined by the capacity of the intersections. Where major reconstruction of intersections is proposed, the ability of the approach roads to feed the intersection at appropriate flow rates may need to be reviewed. As set out in Table 4.3 (reproduced from Table 7.1 of AUSTROADS Guide to Traffic Engineering *Practice - Part 2: Roadway Capacity*, (1988)), typical one-way mid-block lane capacities on urban arterial roads under interrupted flow conditions are 900-1000 veh/hr/lane. This calculation assumes *Clearway* conditions. The capacity falls to 600 veh/hr/lane for a kerbside lane with occasional parked vehicles. These capacities at times may increase under ideal conditions to 1200-1400 veh/hr.

The mid-block level of service on urban roads is assessed on a vehicle's average travel speed. Travel speed surveys may be undertaken to determine the existing level of service. Table 7.2 of AUSTROADS *Guide to Traffic Engineering Practice - Part 2: Roadway Capacity*, (1988) sets out levels of service for different travel speeds.

When assessing the mid-block road capacity requirement in a strategic planning study, the traffic flow limits for different levels of service are of value. Table 4.4 sets out peak hour flows for one and two lanes of unidirectional travel, based on volume / capacity ratios applicable for rural roads in level terrain with no sight distance restrictions on overtaking. It should be noted that these are indicative figures based on the rural volume / capacity ratios with a lane capacity of 1400 veh/hr. This figure can be achieved under normal urban interrupted flow conditions. The lower per lane capacity for one-lane

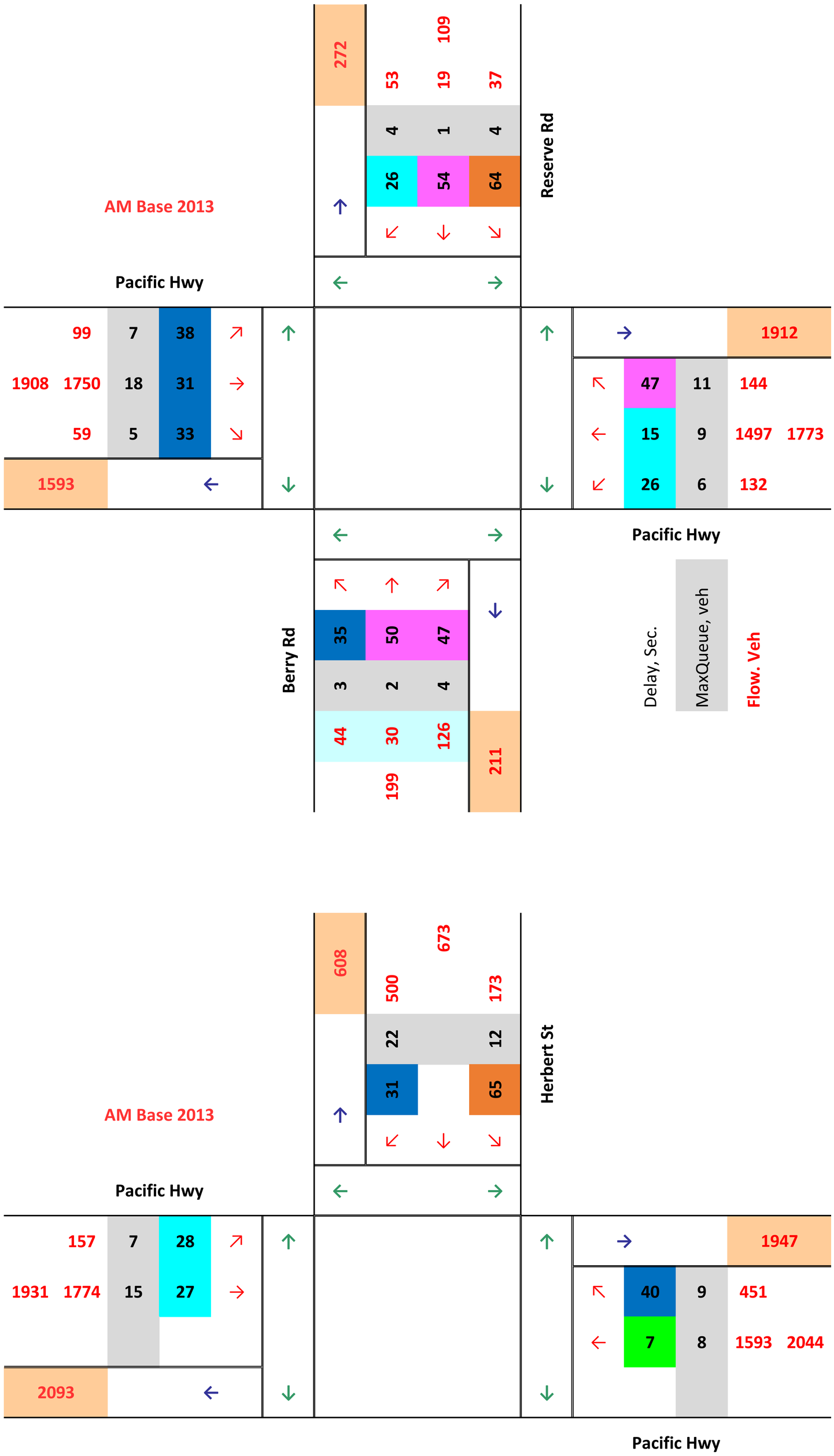
AM Base 2013



AM Base 2013

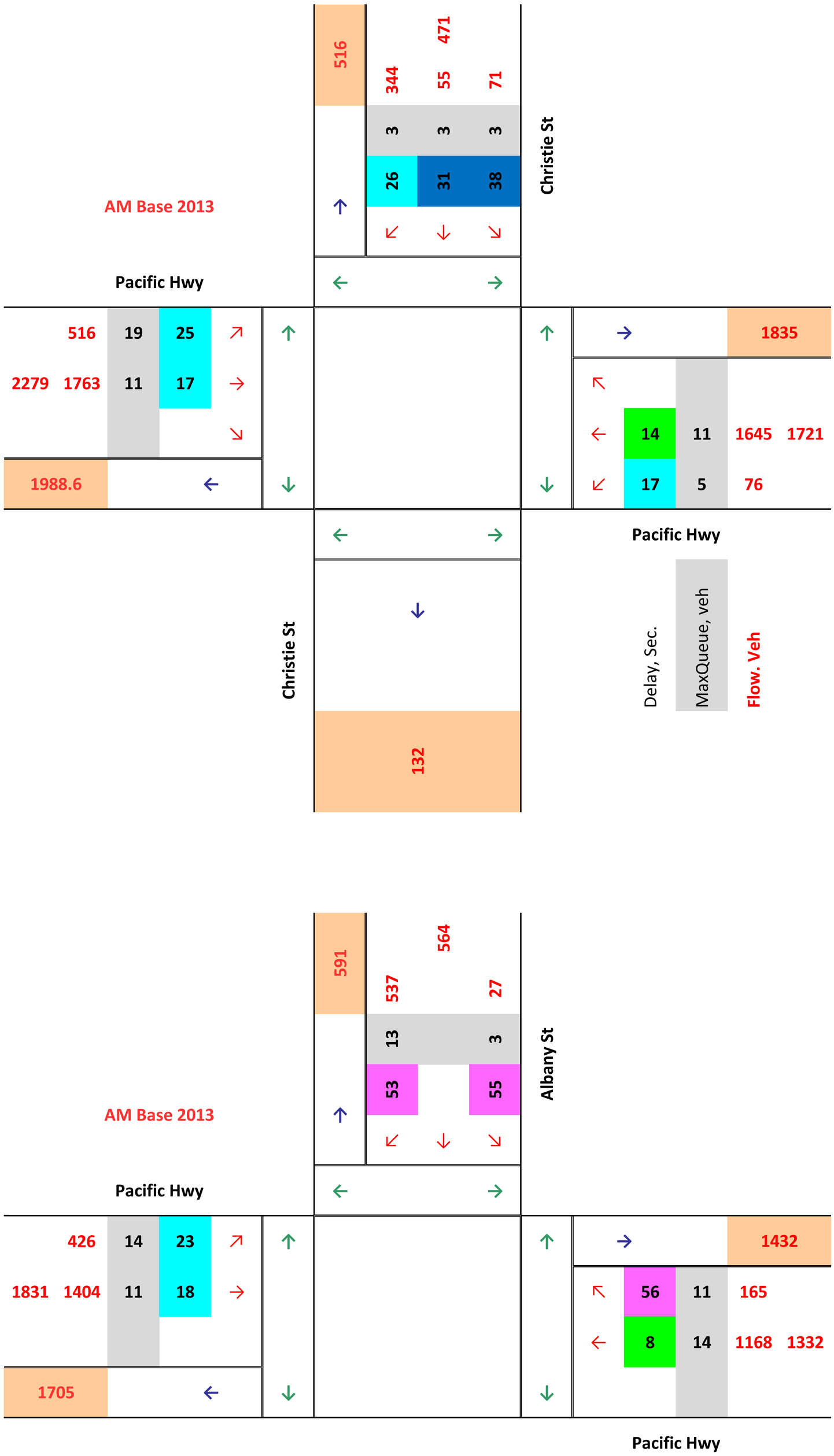
LOS

A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf



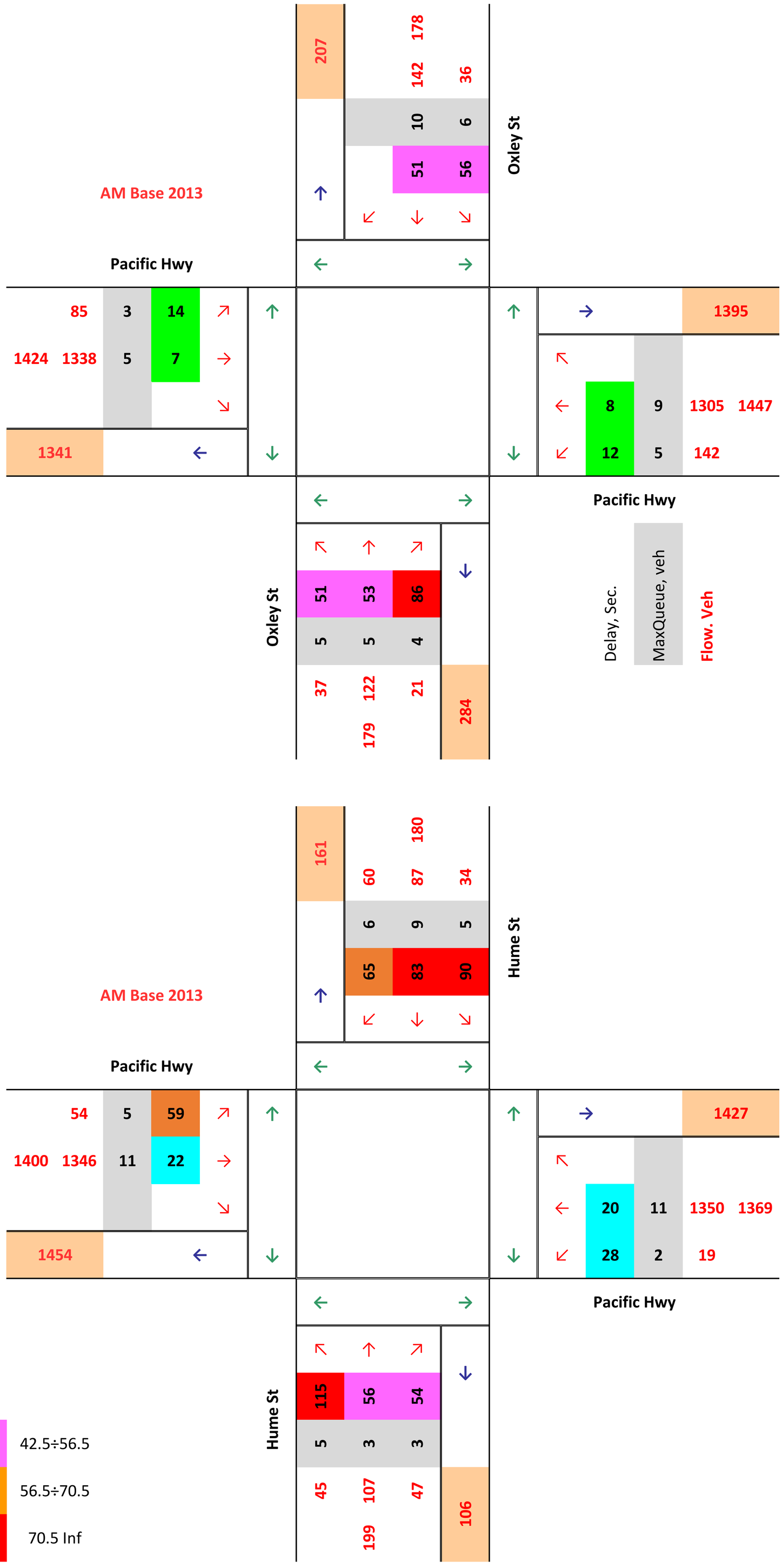
LOS

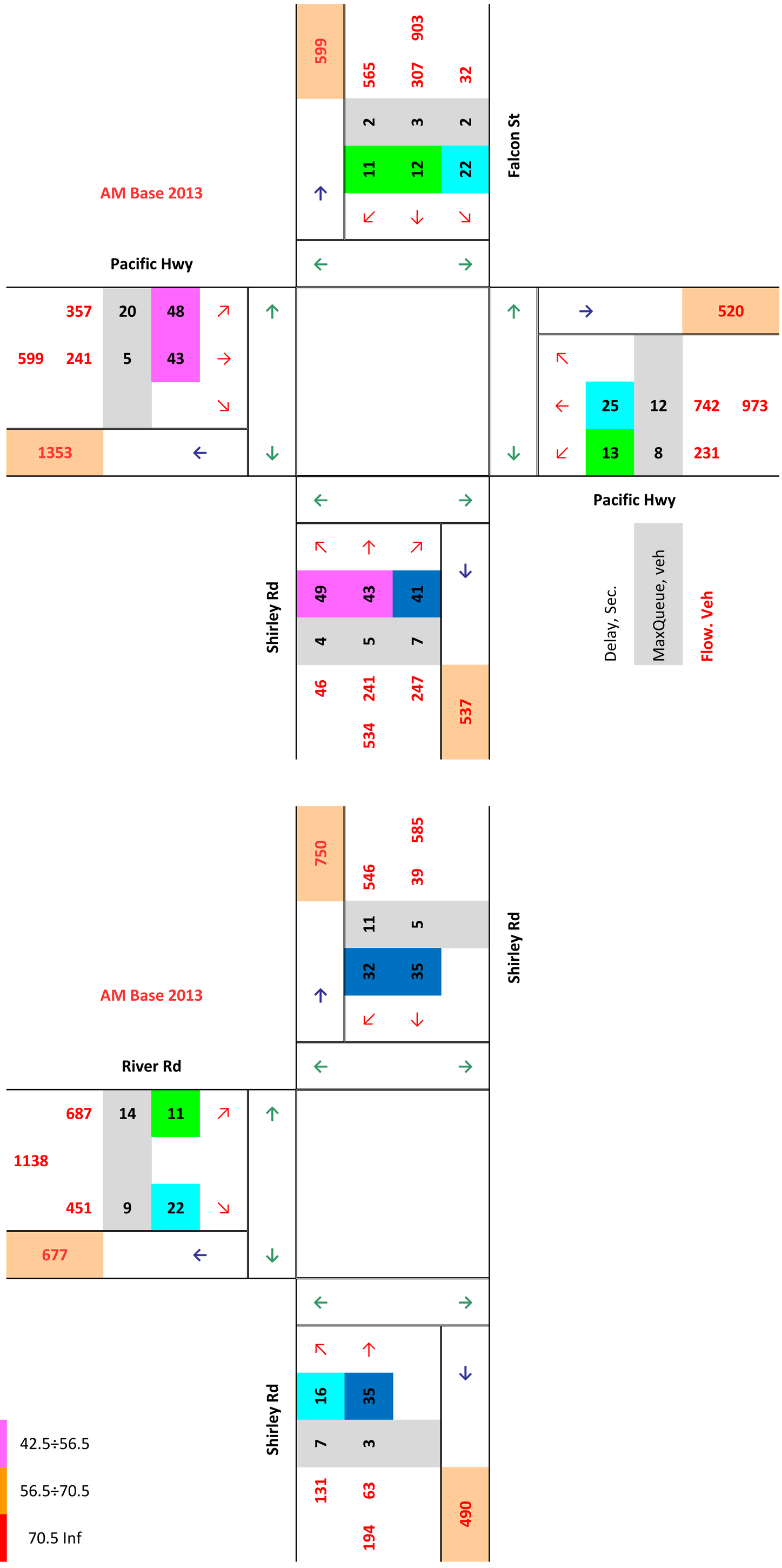
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

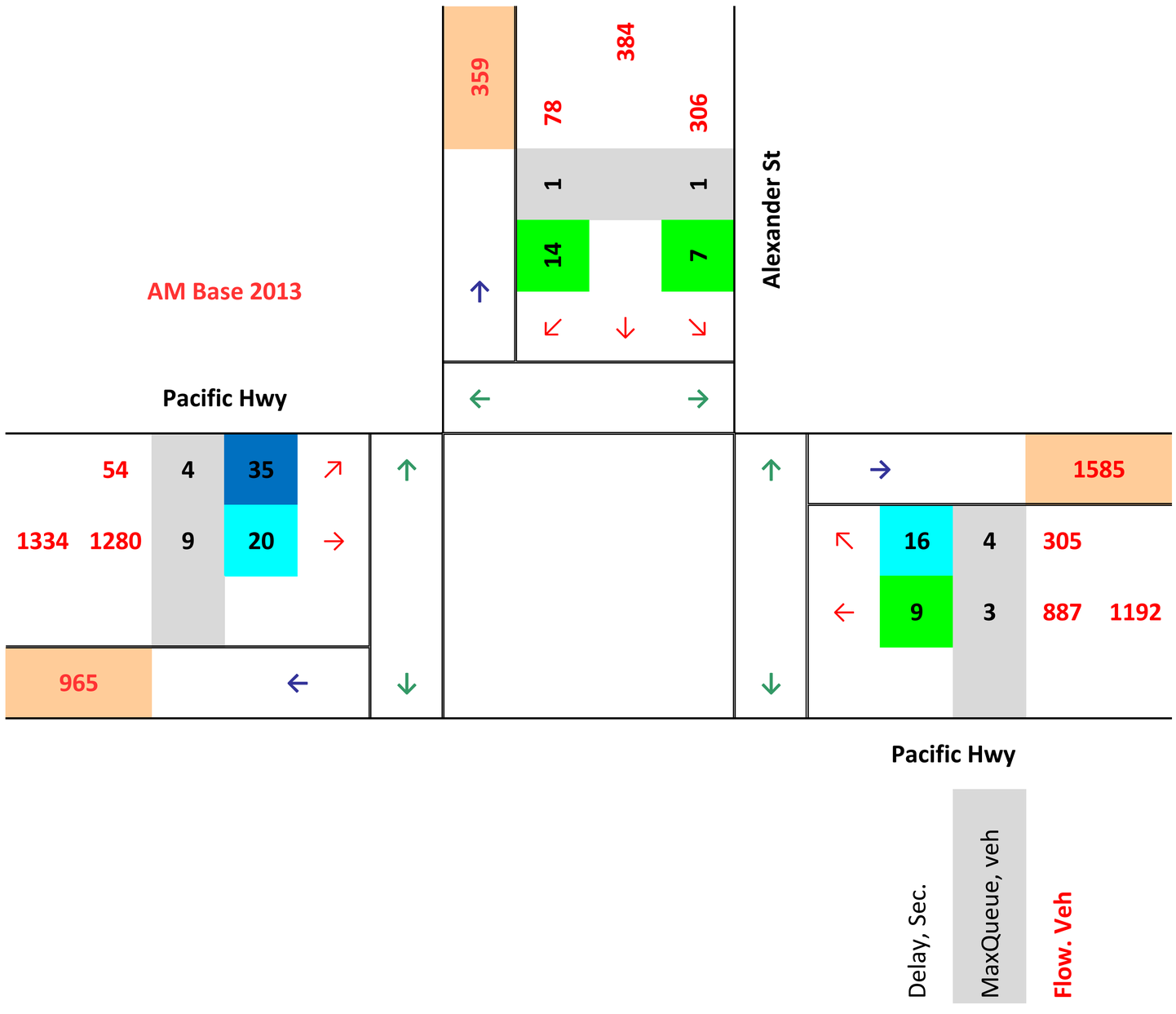


LOS

A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf


AM Base 2013
Pacific Hwy
Oxley St
207
178
142
36
10
6
51
56
85
3
14
1424
1338
5
7
1395
8
9
1305
1447
1341
12
5
142
51
53
86
5
5
4
37
122
21
179
284
Pacific Hwy
Delay, Sec.
MaxQueue, veh
Flow. Veh
AM Base 2013
Pacific Hwy
Hume St
161
180
60
87
34
6
9
5
65
83
90
54
5
59
1400
1346
11
22
1427
20
11
1350
1369
1454
28
2
19
Pacific Hwy
Hume St
115
56
54
5
3
3
45
107
47
199
106
LOS
A 0.0÷14.5
B 14.5÷28.5
C 28.5÷42.5
D 42.5÷56.5
E 56.5÷70.5
F 70.5 Inf

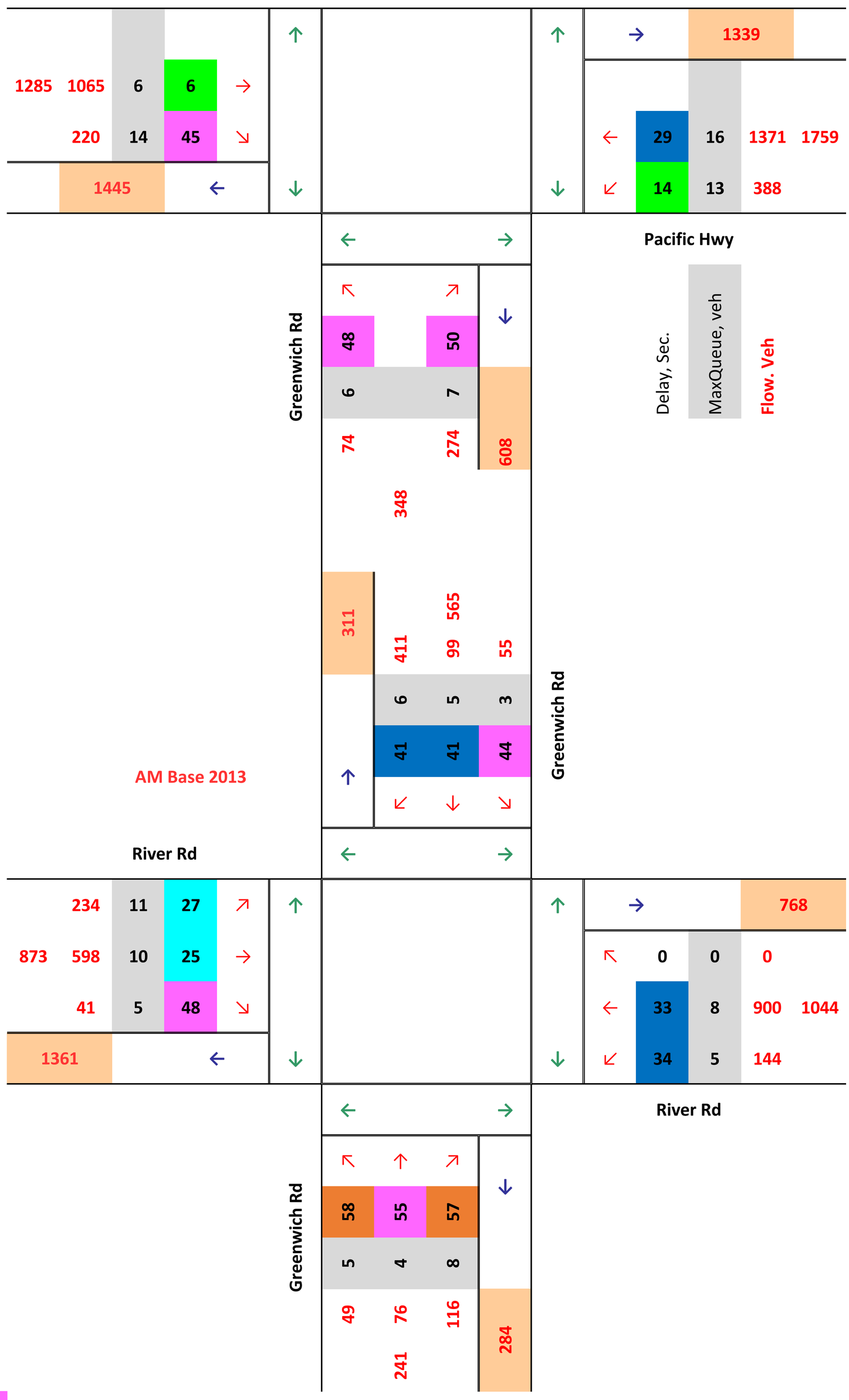

AM Base 2013
Pacific Hwy
Falcon St
Shirley Rd
Delay, Sec.
MaxQueue, veh
Flow. Veh
AM Base 2013
River Rd
Shirley Rd
LOS
A 0.0÷14.5
B 14.5÷28.5
C 28.5÷42.5
D 42.5÷56.5
E 56.5÷70.5
F 70.5 Inf

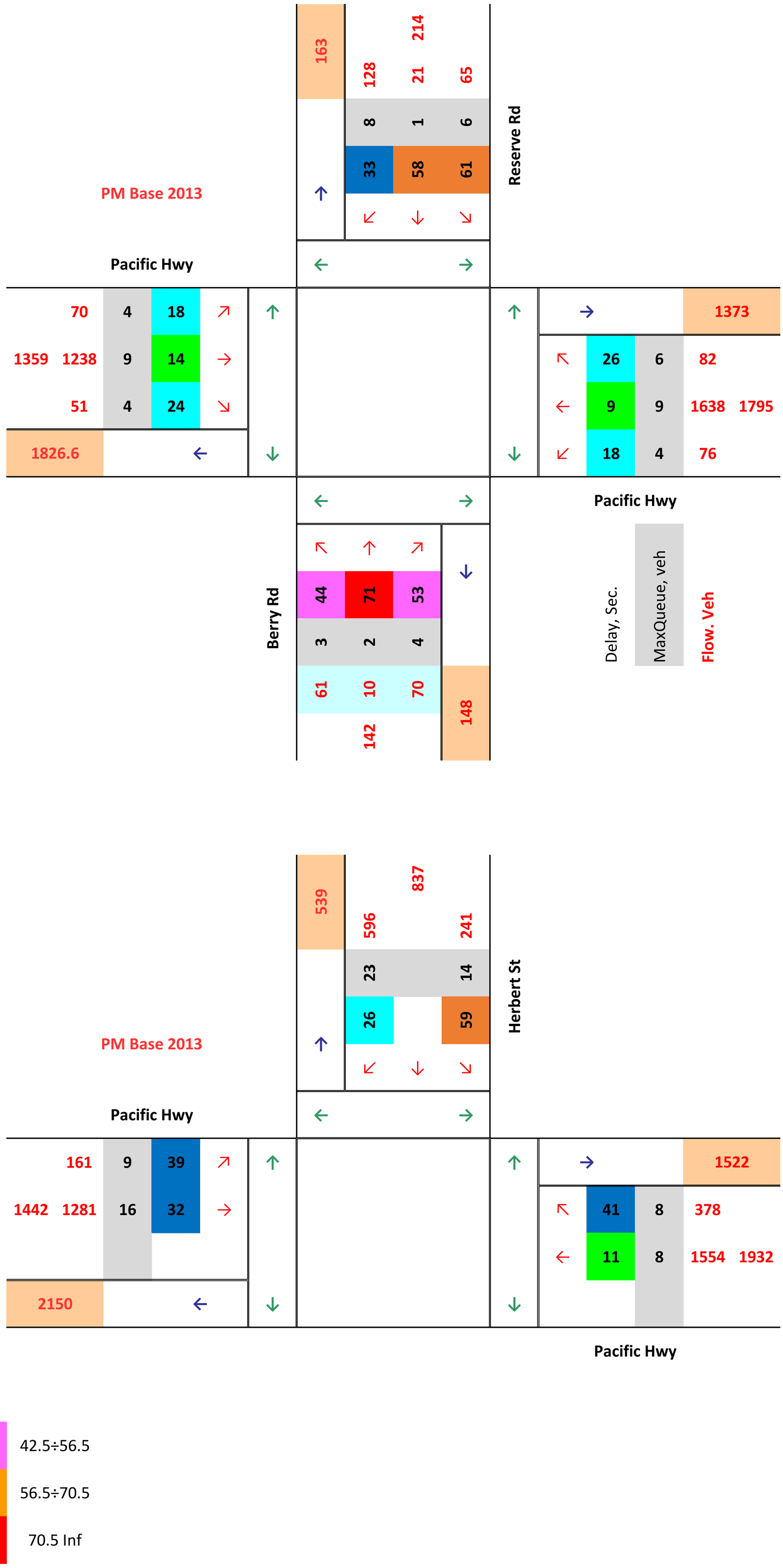


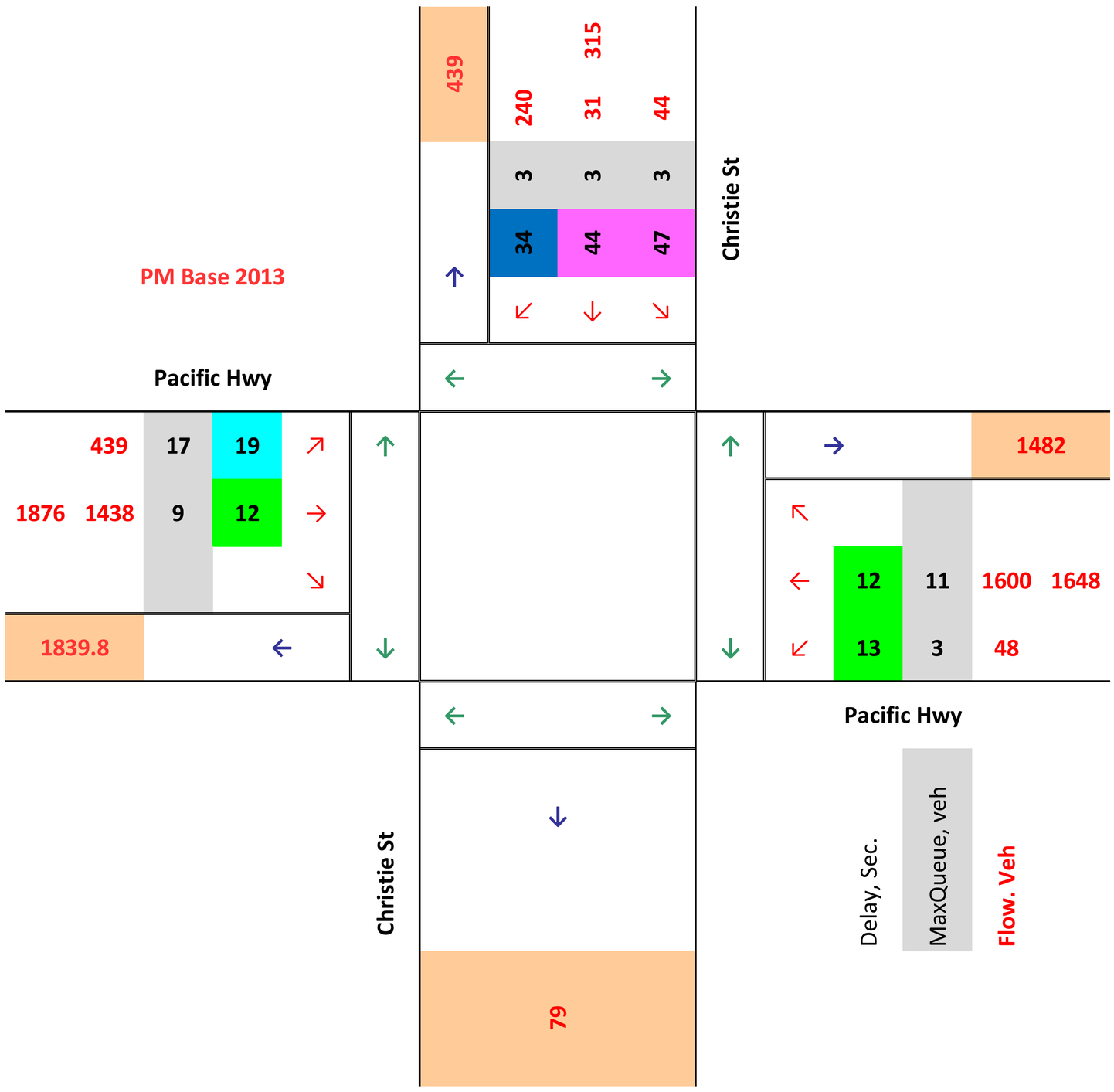
LOS

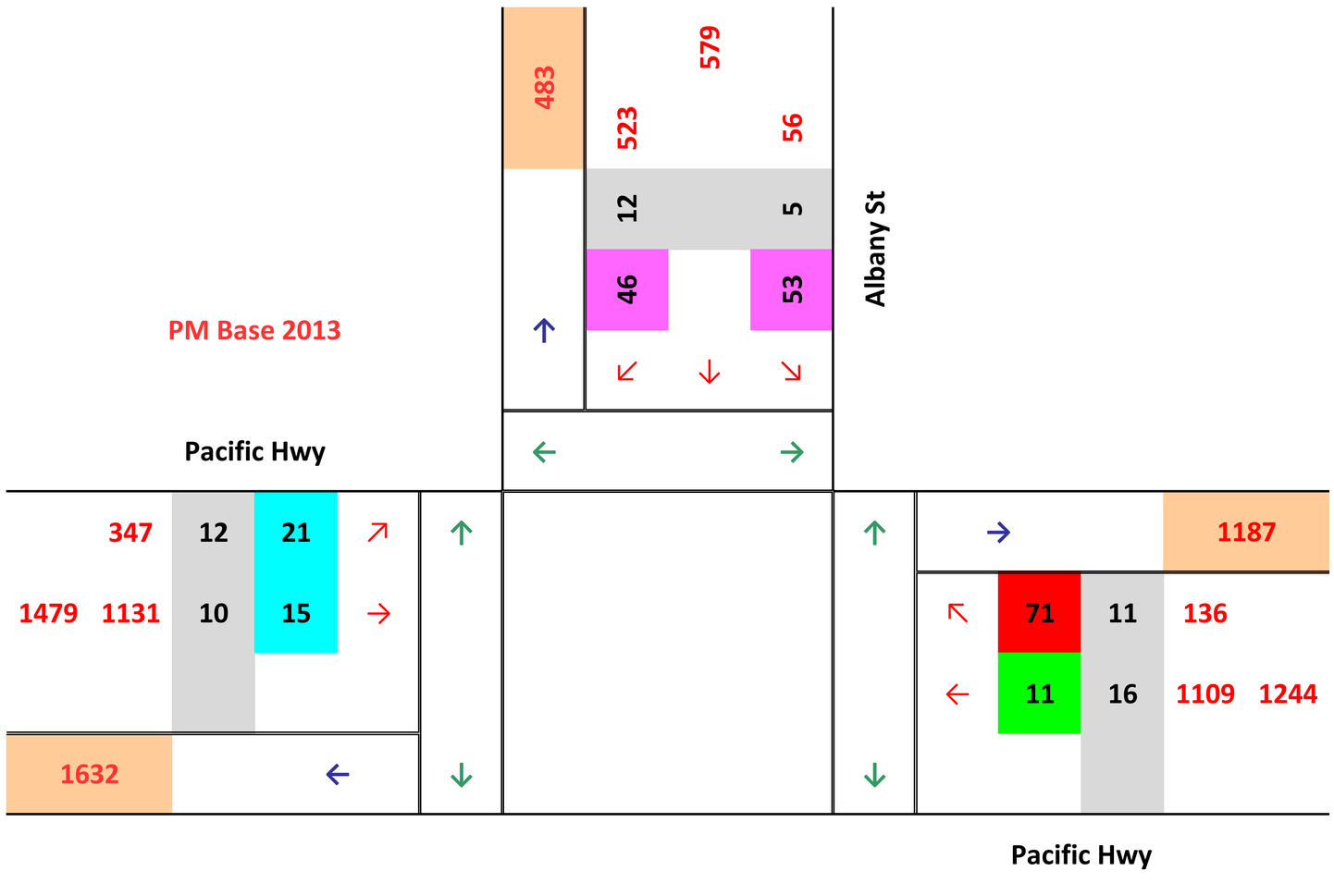
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

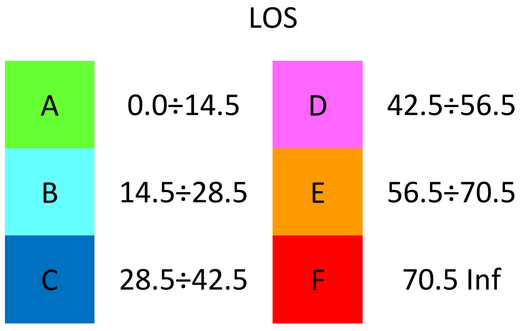
PM Base 2013

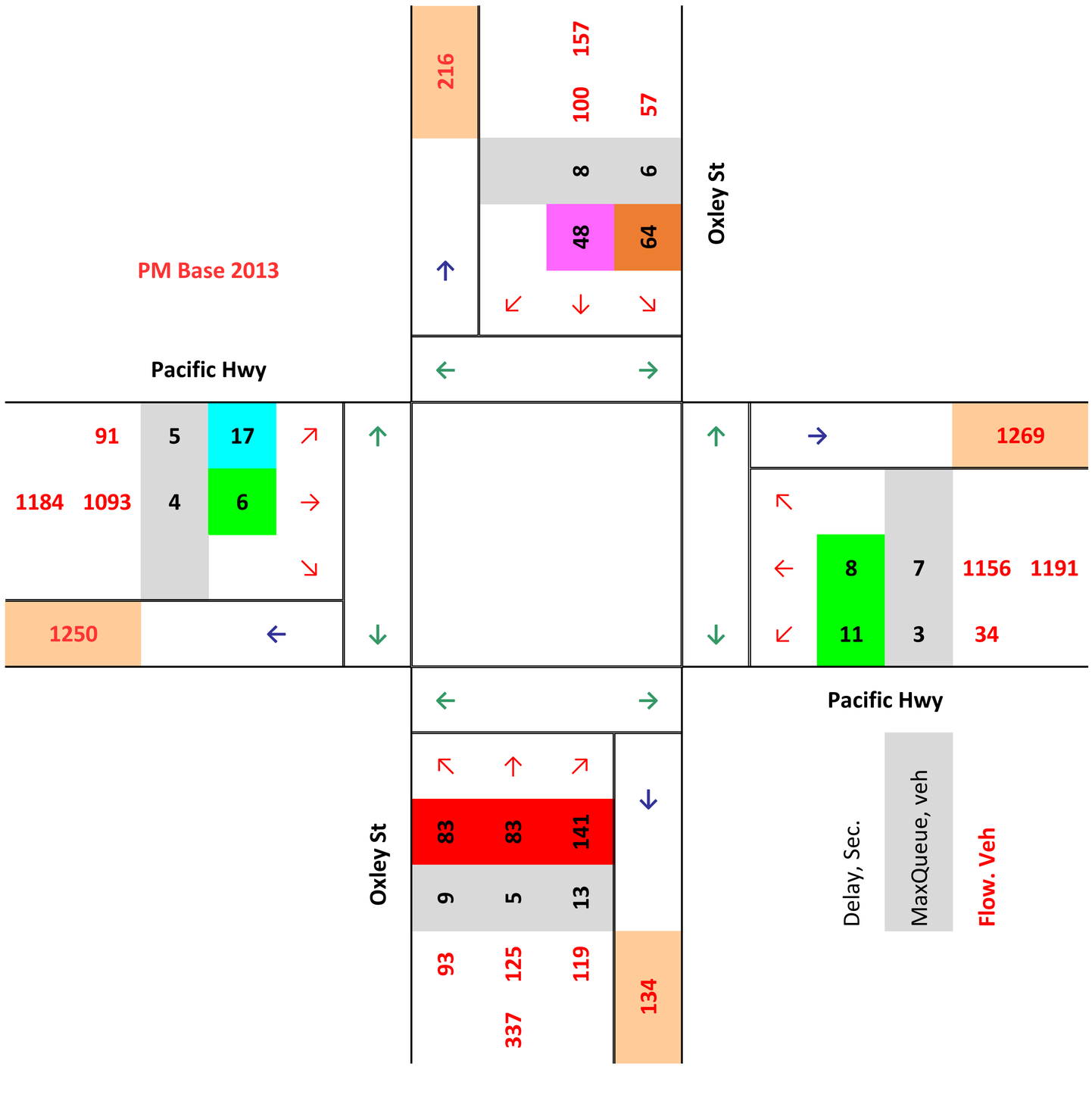

Pacific Hwy
1285 1065 6 6
220 14 45
1445
1339
1759 1371 16 29
388 13 14
Greenwich Rd
74 6 48
348
274 7 50
608
311
411 6 41
99 5 41
55 3 44
565
Pacific Hwy
Delay, Sec.
MaxQueue, veh
Flow. Veh
AM Base 2013
River Rd
234 11 27
873 598 10 25
41 5 48
1361
768
0 0 0
1044 900 8 33
144 5 34
River Rd
Greenwich Rd
58 55 57
5 4 8
49 76 116
241
284
LOS
A 0.0÷14.5
B 14.5÷28.5
C 28.5÷42.5
D 42.5÷56.5
E 56.5÷70.5
F 70.5 Inf


PM Base 2013
Pacific Hwy
Reserve Rd
163
128
21
214
65
8
1
6
33
58
61
70
4
18
1359
1238
9
14
51
4
24
1826.6
1373
26
6
82
9
9
1638
1795
18
4
76
Pacific Hwy
Berry Rd
44
71
53
3
2
4
61
10
70
142
148
Delay, Sec.
MaxQueue, veh
Flow. Veh
PM Base 2013
Pacific Hwy
Herbert St
539
837
596
241
23
14
26
59
161
9
39
1442
1281
16
32
2150
1522
41
8
378
11
8
1554
1932
Pacific Hwy
LOS
A 0.0÷14.5
B 14.5÷28.5
C 28.5÷42.5
D 42.5÷56.5
E 56.5÷70.5
F 70.5 Inf


PM Base 2013
Christie St
Pacific Hwy
439
240
31
315
44
3
3
3
34
44
47
439
17
19
1876
1438
9
12
1839.8
1482
12
11
1600
1648
13
3
48
79
Pacific Hwy
Christie St
Delay, Sec.
MaxQueue, veh
Flow. Veh

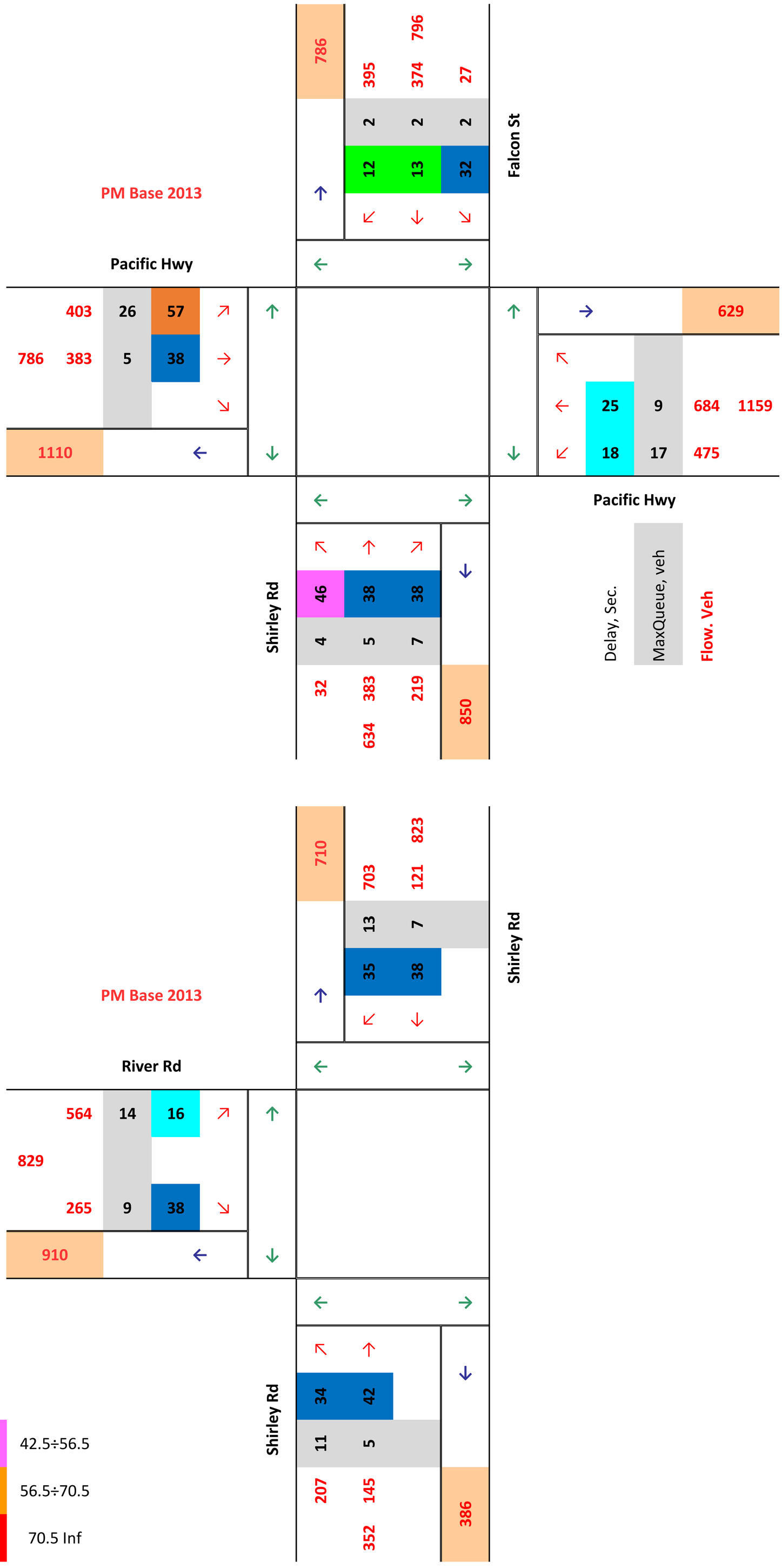

PM Base 2013
Albany St
Pacific Hwy
483
523
579
56
12
5
46
53
347
12
21
1479
1131
10
15
1632
1187
71
11
136
11
16
1109
1244
Pacific Hwy

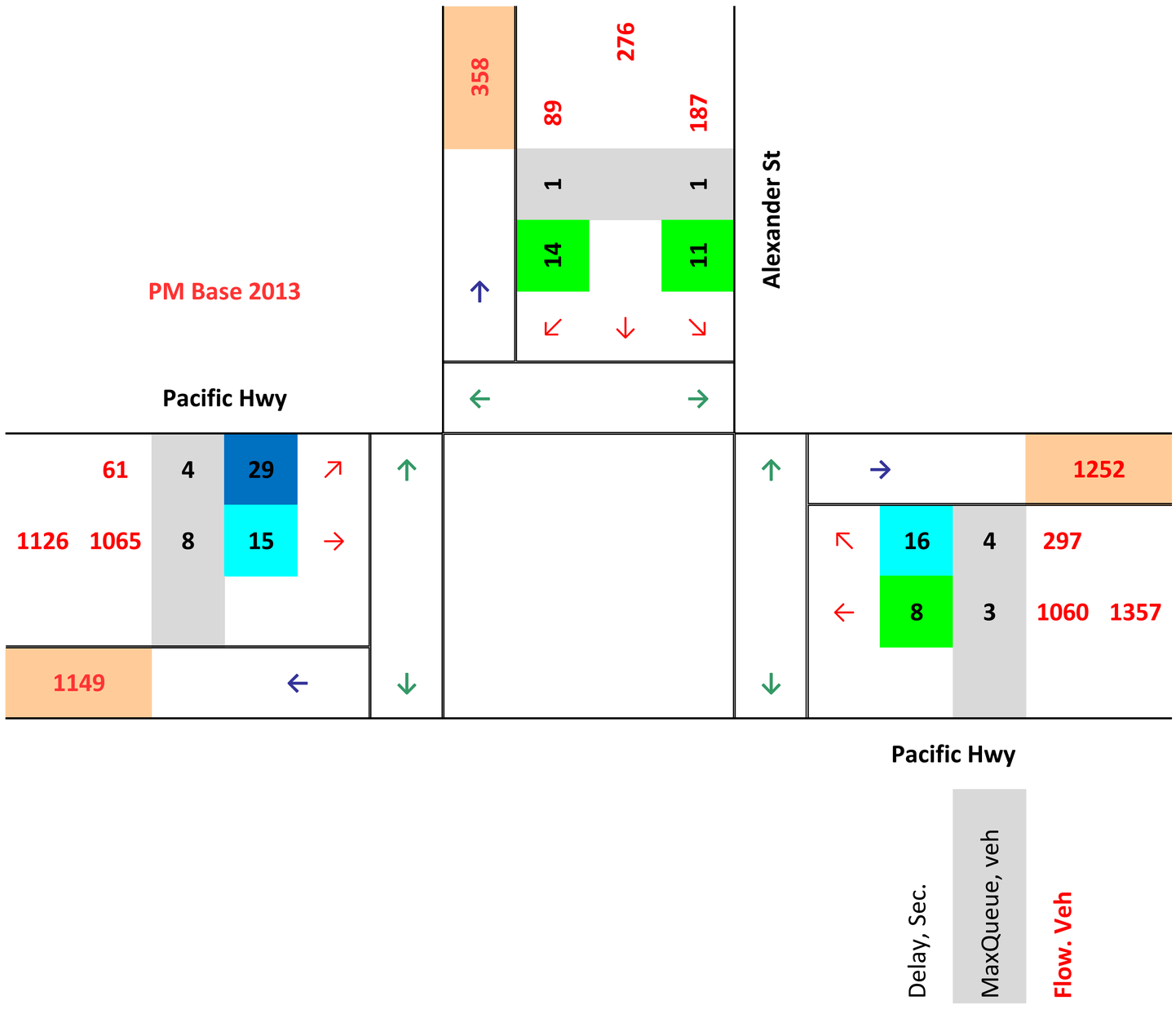

LOS
A
0.0÷14.5
B
14.5÷28.5
C
28.5÷42.5
D
42.5÷56.5
E
56.5÷70.5
F
70.5 Inf

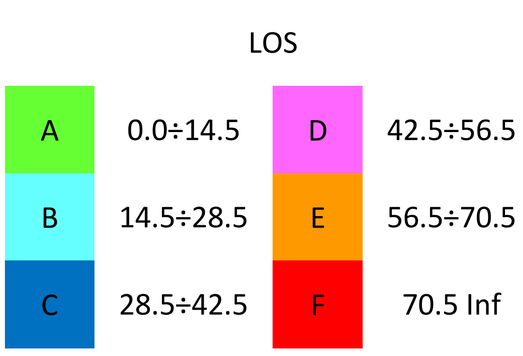


LOS

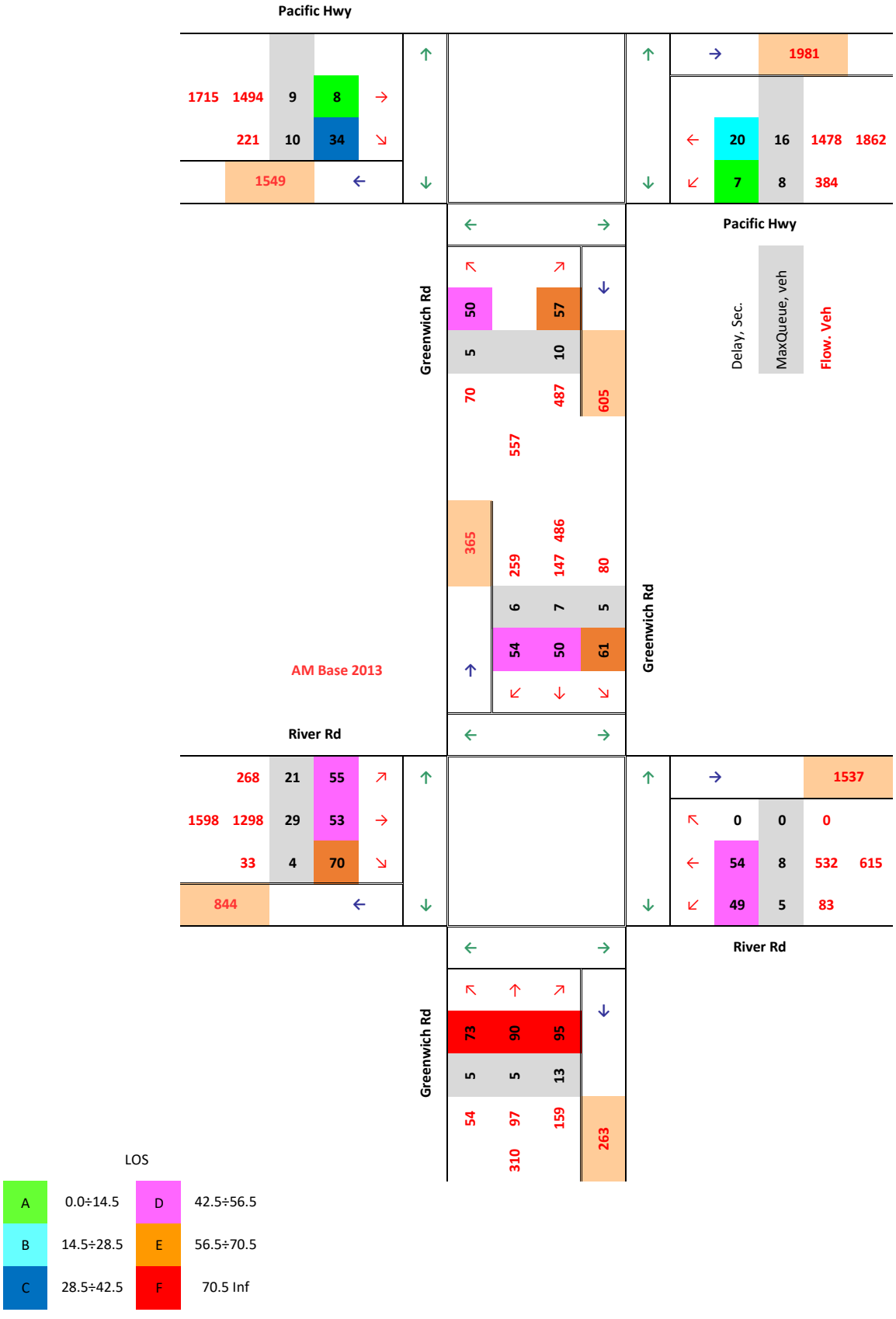
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf


PM Base 2013
Pacific Hwy
Falcon St
Shirley Rd
River Rd
786
395
374
796
27
2
2
2
12
13
32
403
26
57
786
383
5
38
1110
629
25
9
684
1159
18
17
475
46
38
38
4
5
7
32
383
219
634
850
710
703
121
823
13
7
35
38
564
14
16
829
265
9
38
910
34
42
11
5
207
145
352
386
Delay, Sec.
MaxQueue, veh
Flow. Veh
LOS
A 0.0÷14.5
B 14.5÷28.5
C 28.5÷42.5
D 42.5÷56.5
E 56.5÷70.5
F 70.5 Inf


PM Base 2013
Alexander St
Pacific Hwy
358
276
89
187
1
1
14
11
61
4
29
1126
1065
8
15
1252
16
4
297
8
3
1060
1357
1149
Pacific Hwy
Delay, Sec.
MaxQueue, veh
Flow. Veh

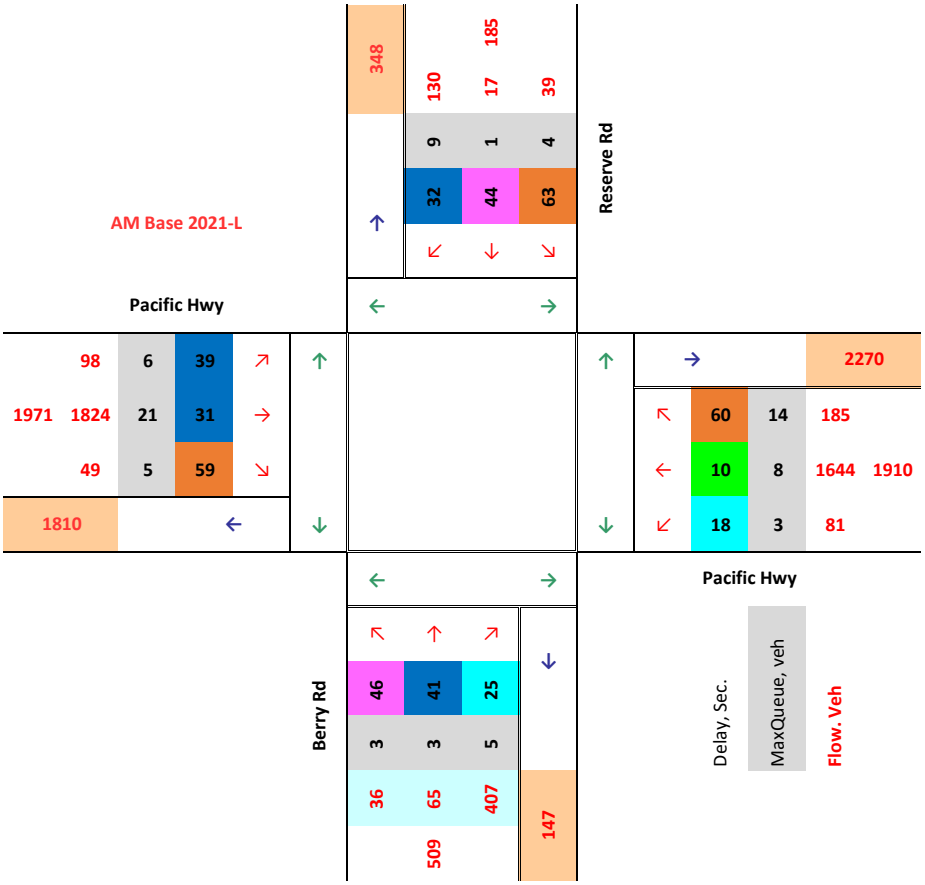

LOS
A
0.0÷14.5
B
14.5÷28.5
C
28.5÷42.5
D
42.5÷56.5
E
56.5÷70.5
F
70.5 Inf

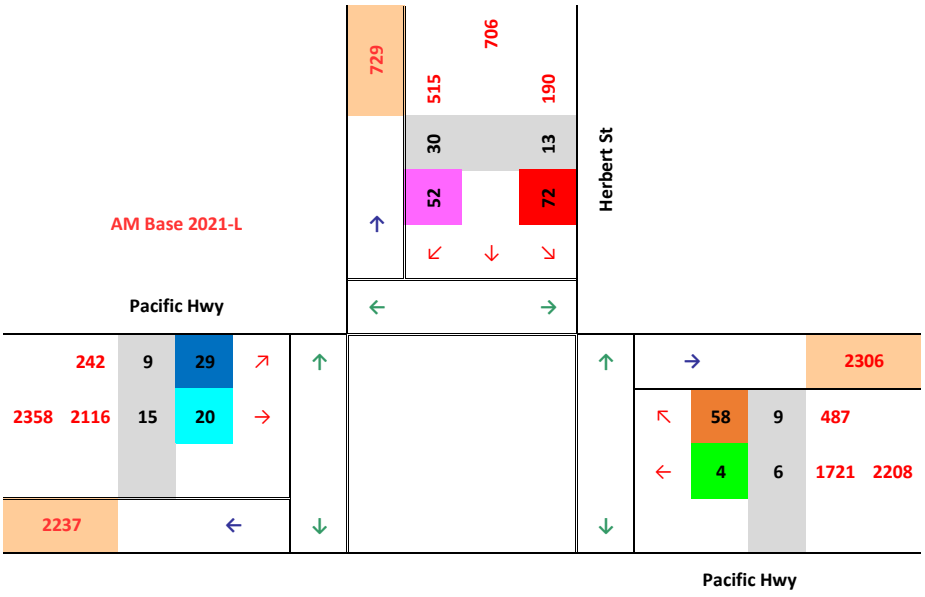
AM Base 2021-L



LOS

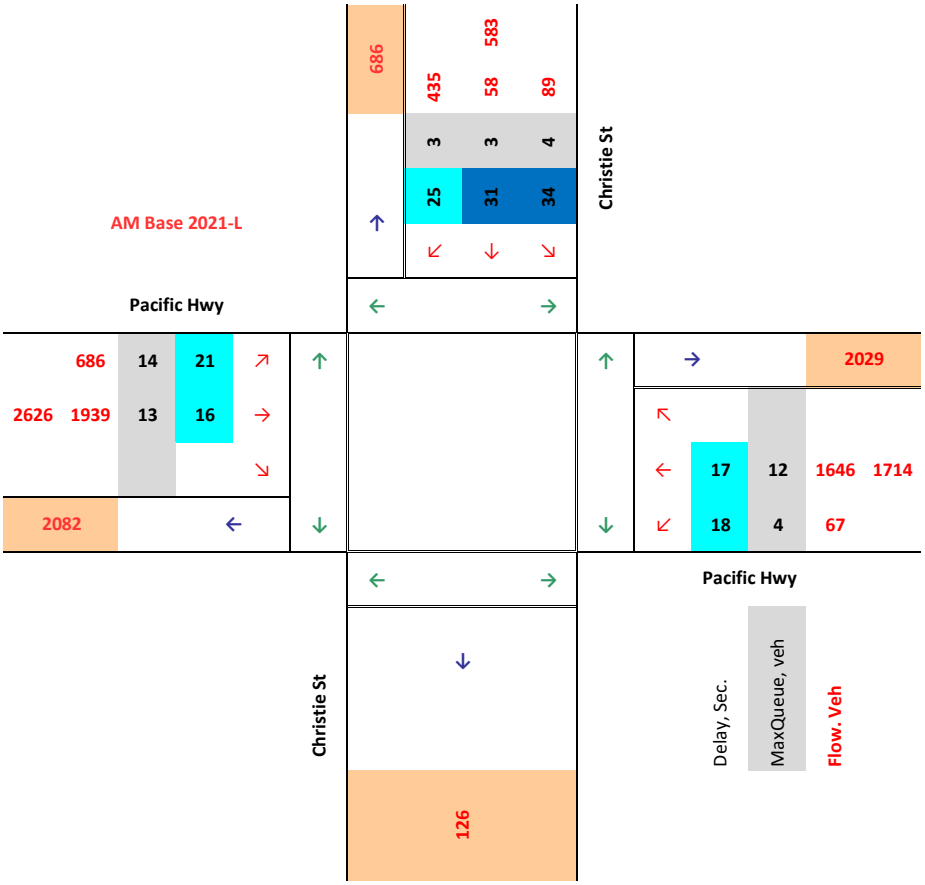
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

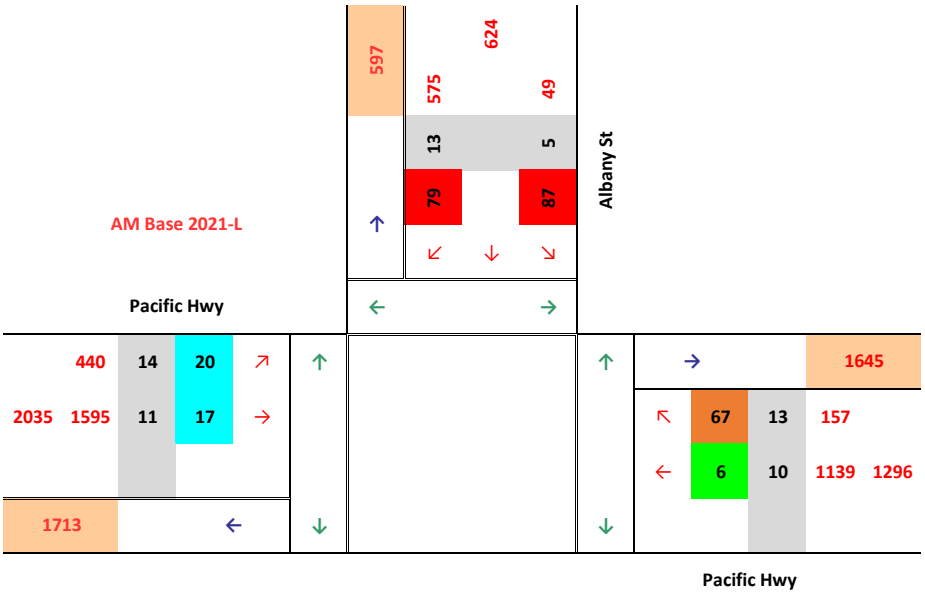




LOS

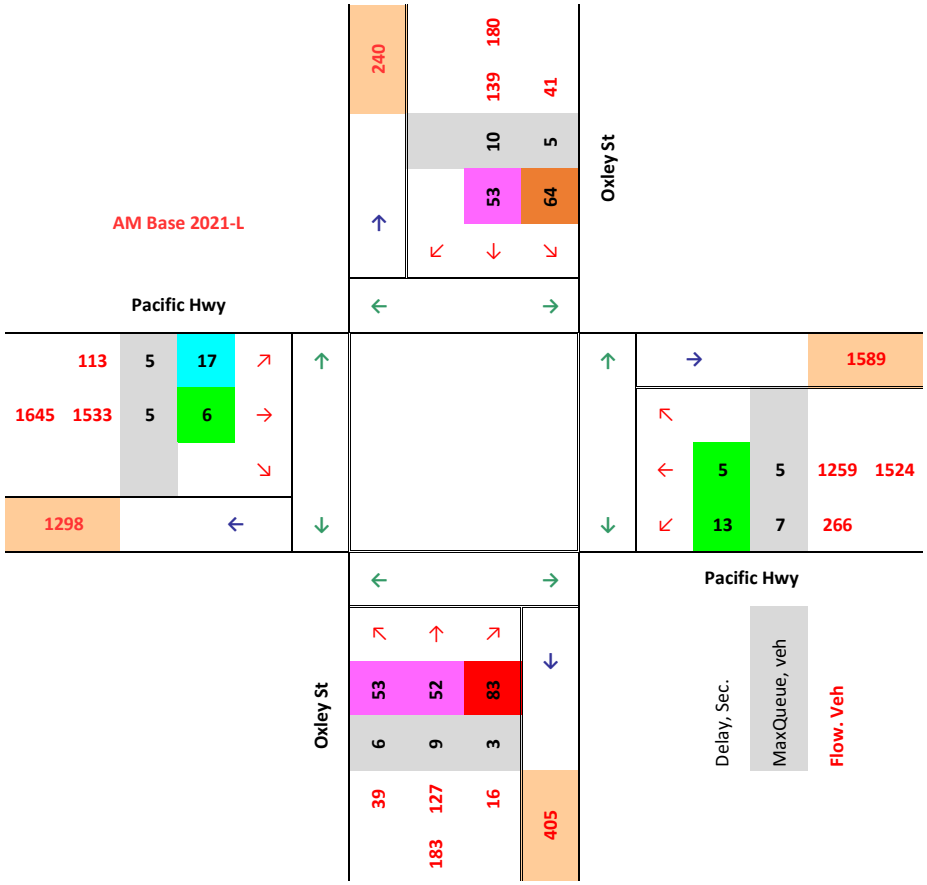
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

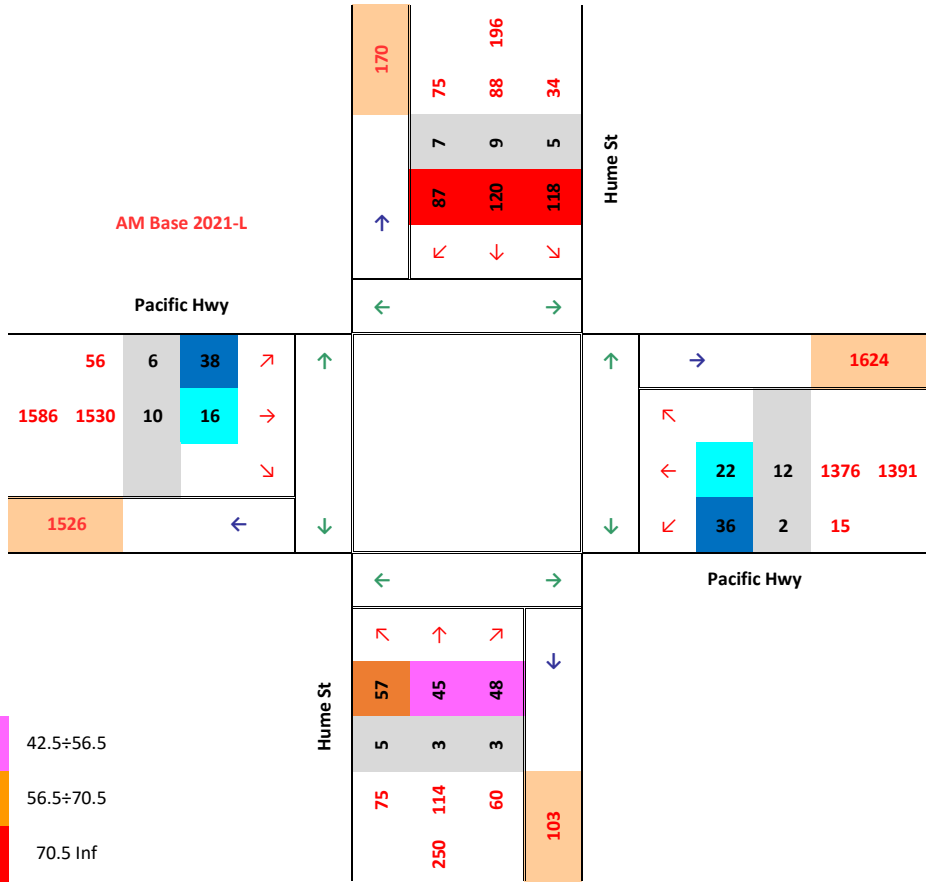




LOS

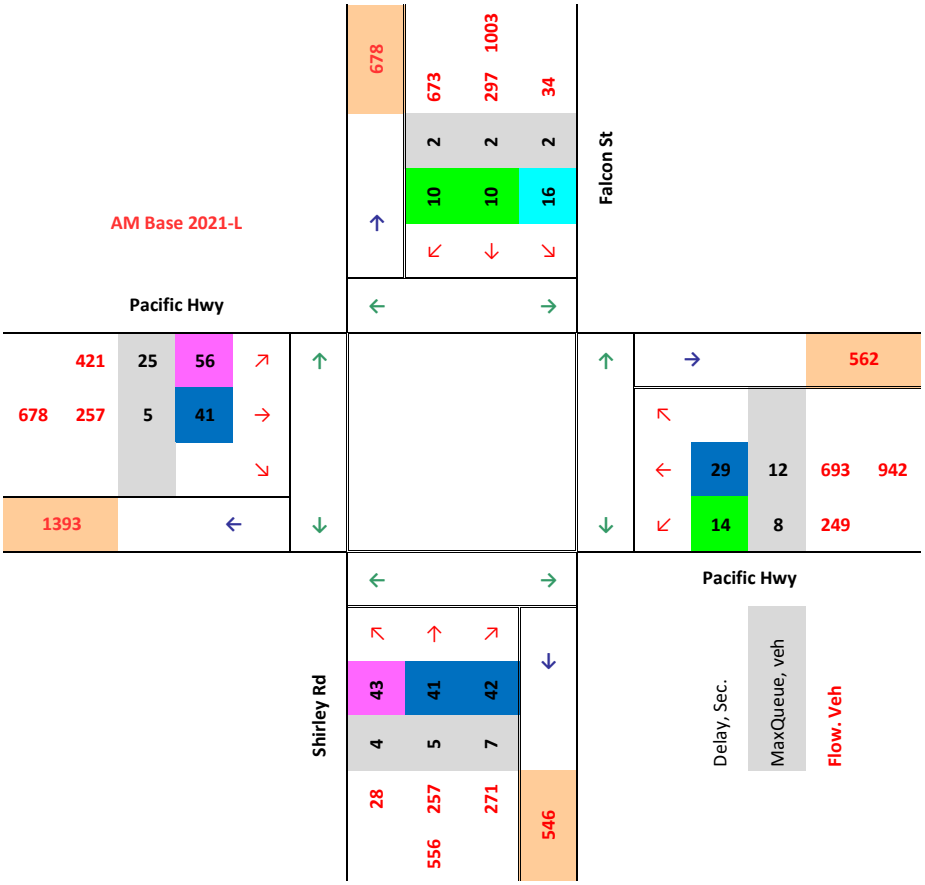
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

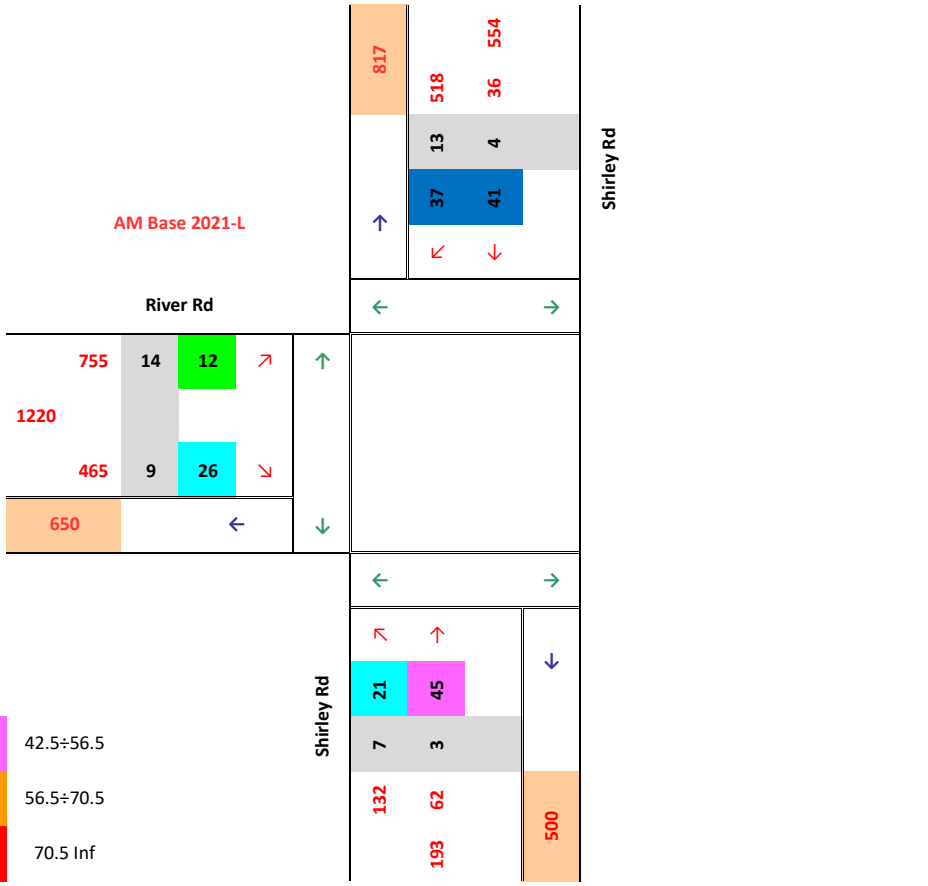




LOS

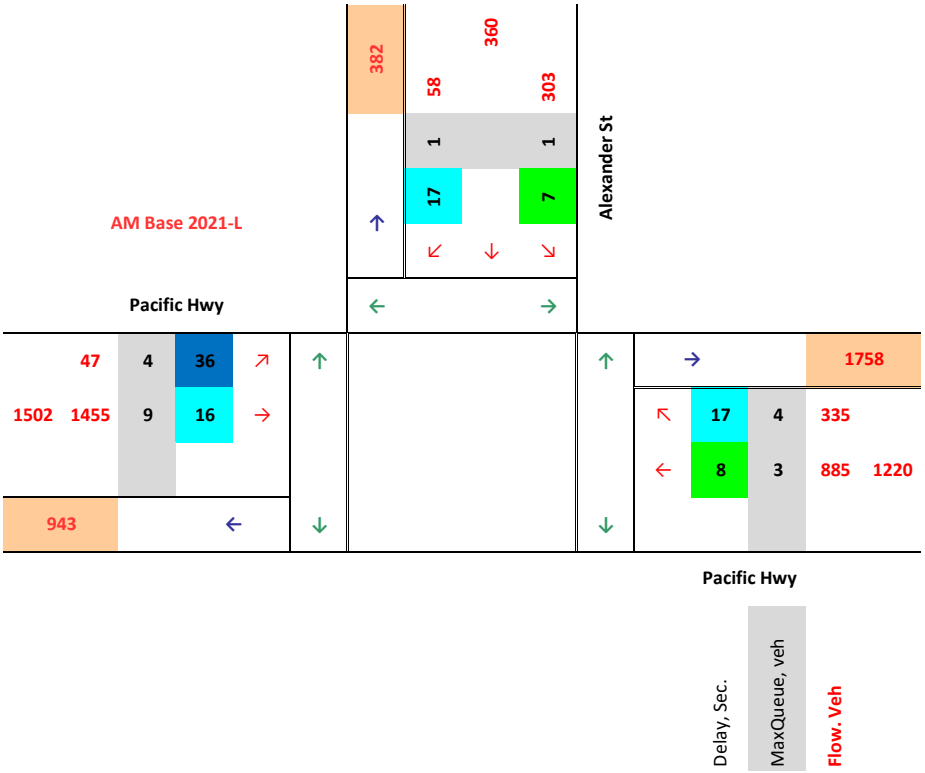
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

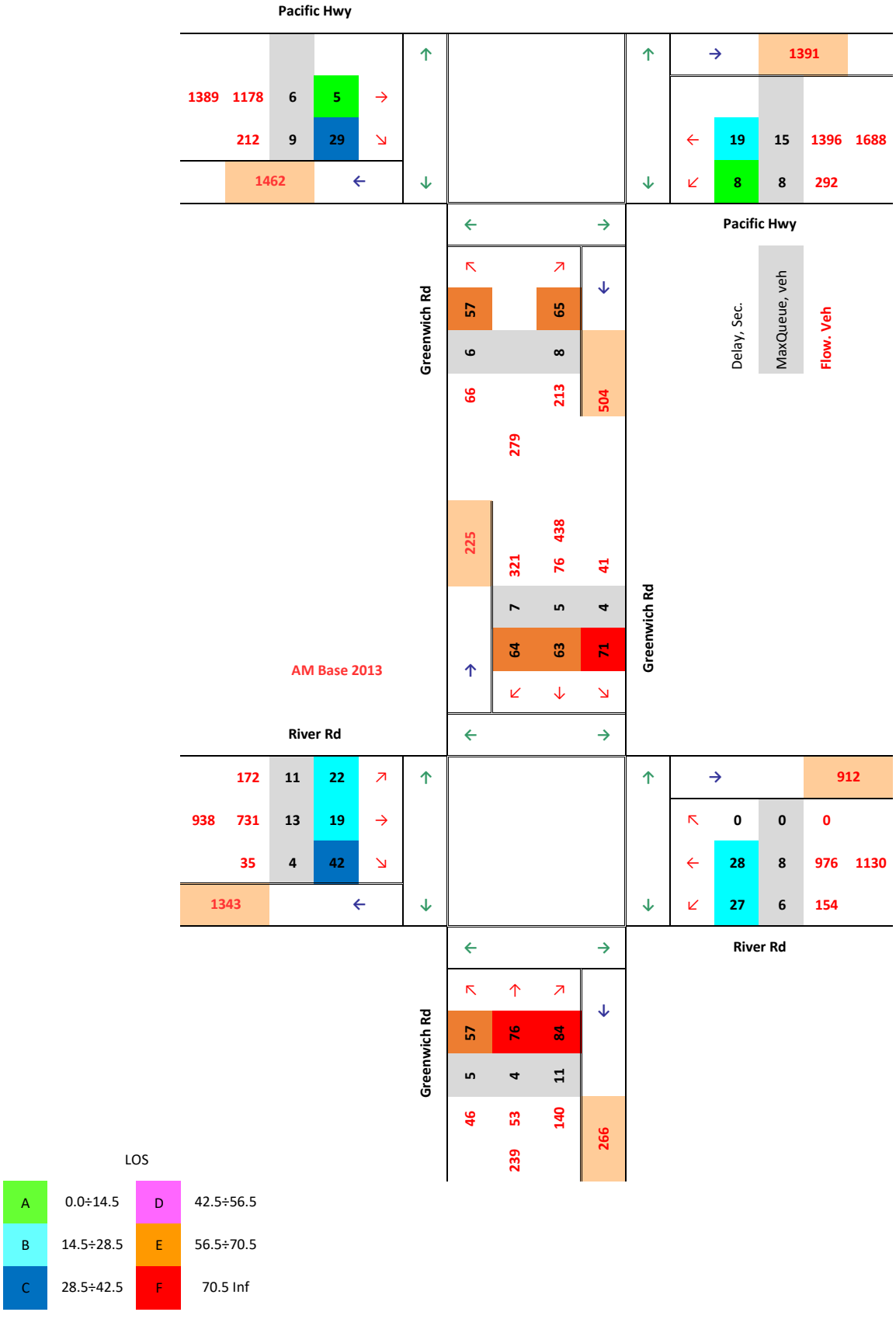
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf



LOS

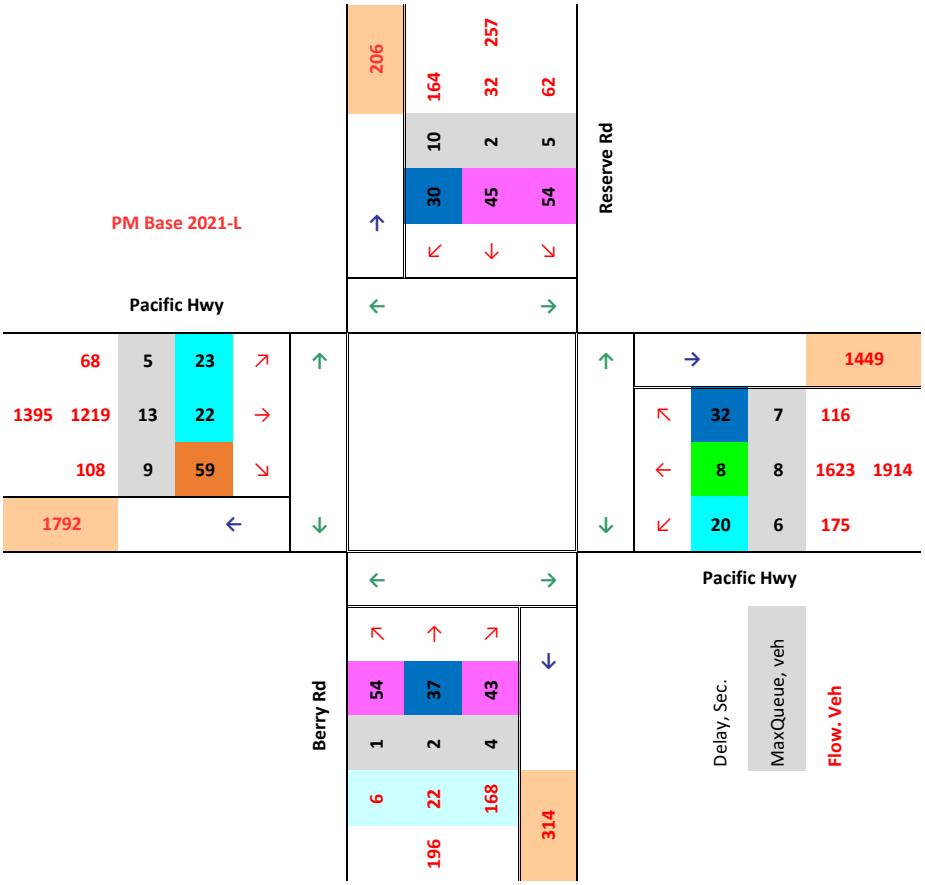
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

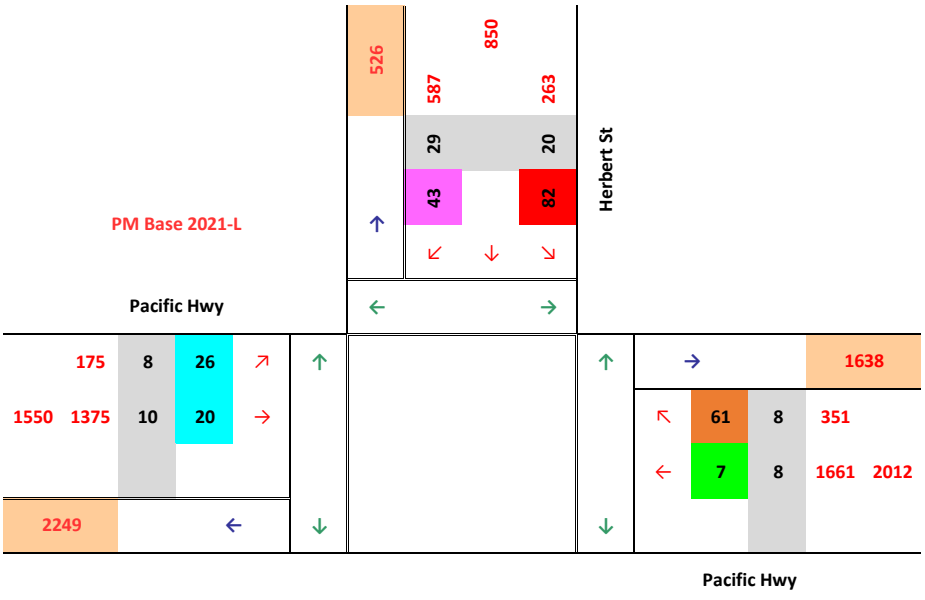
PM Base 2021-L



LOS

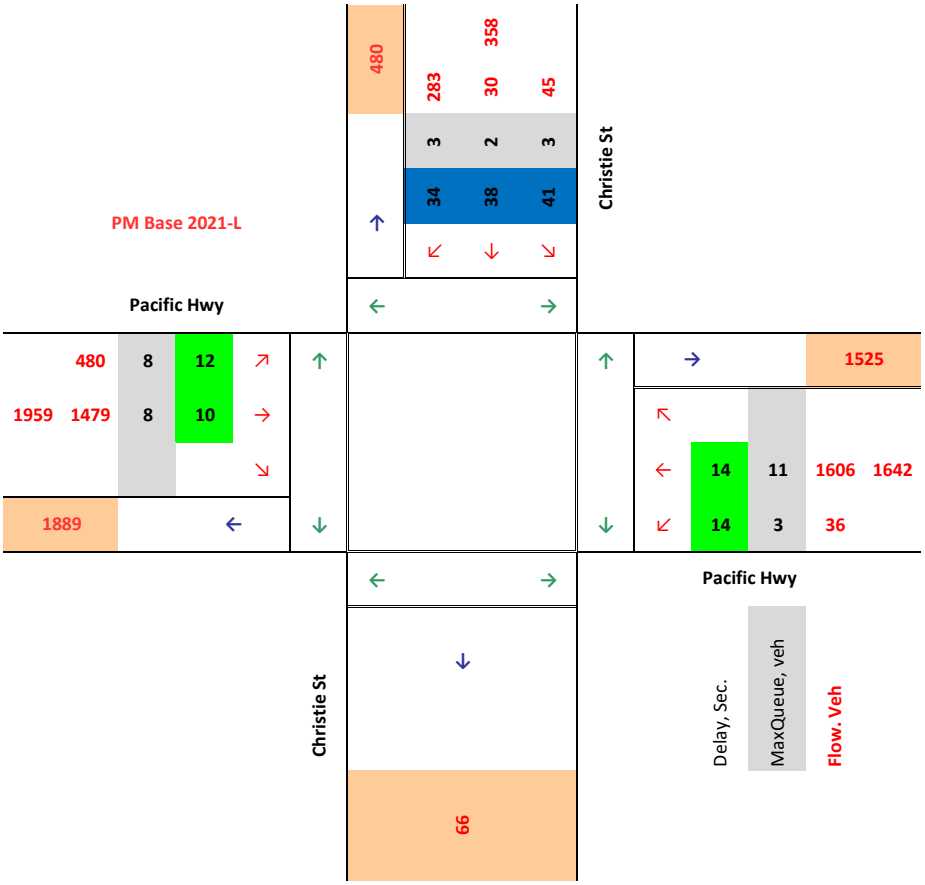
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

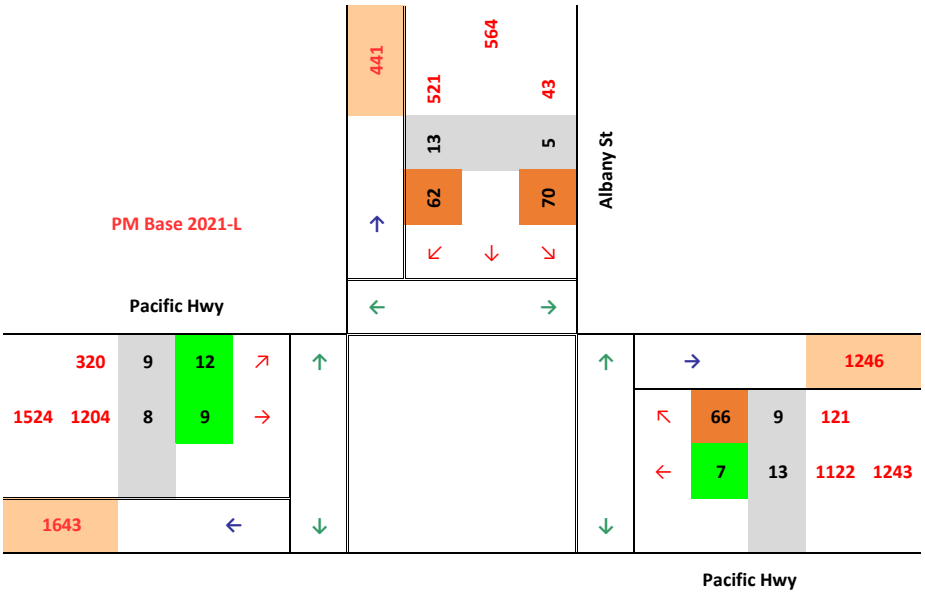




LOS

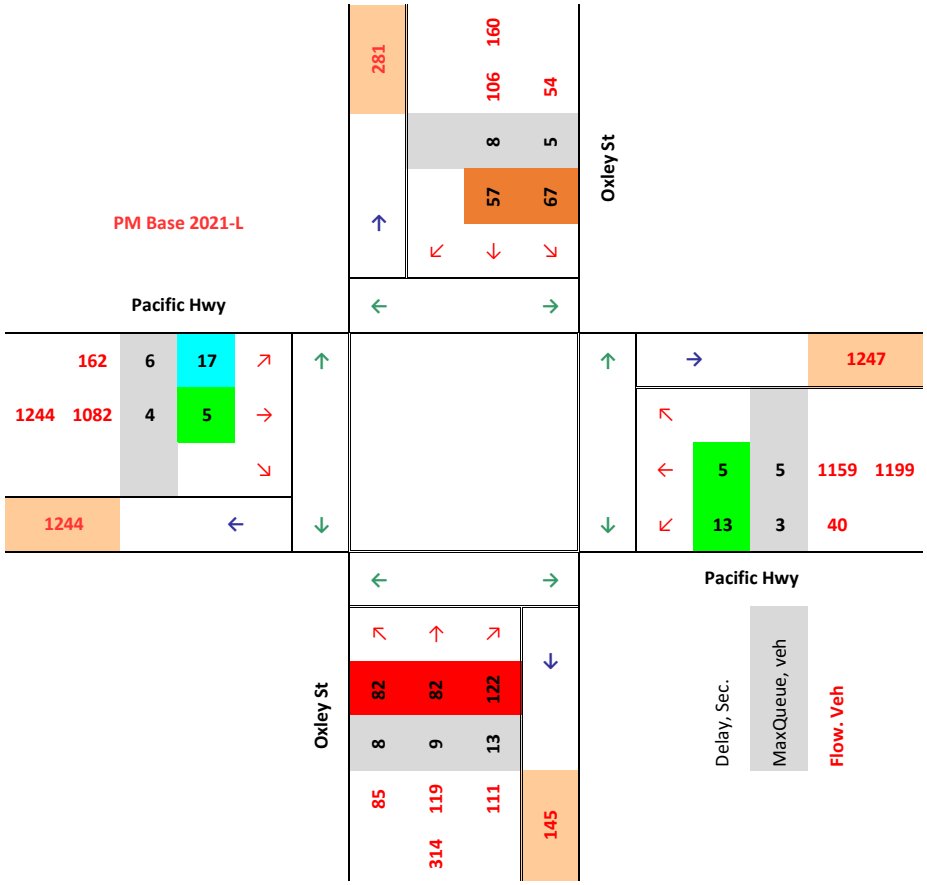
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

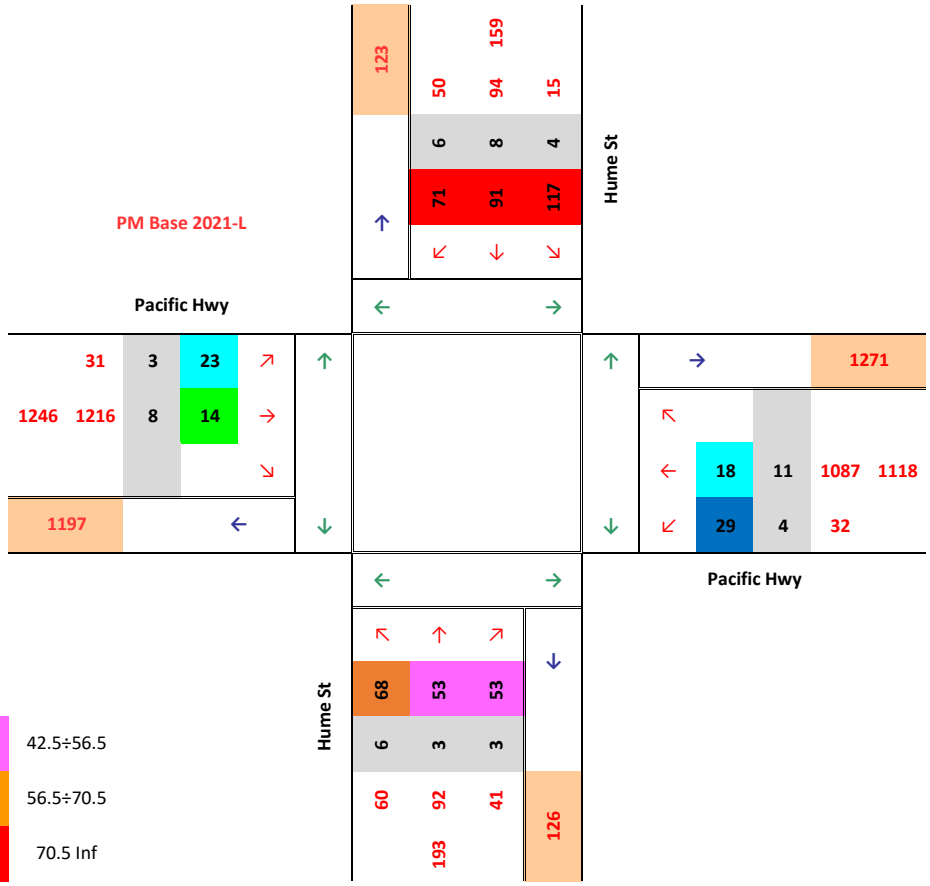




LOS

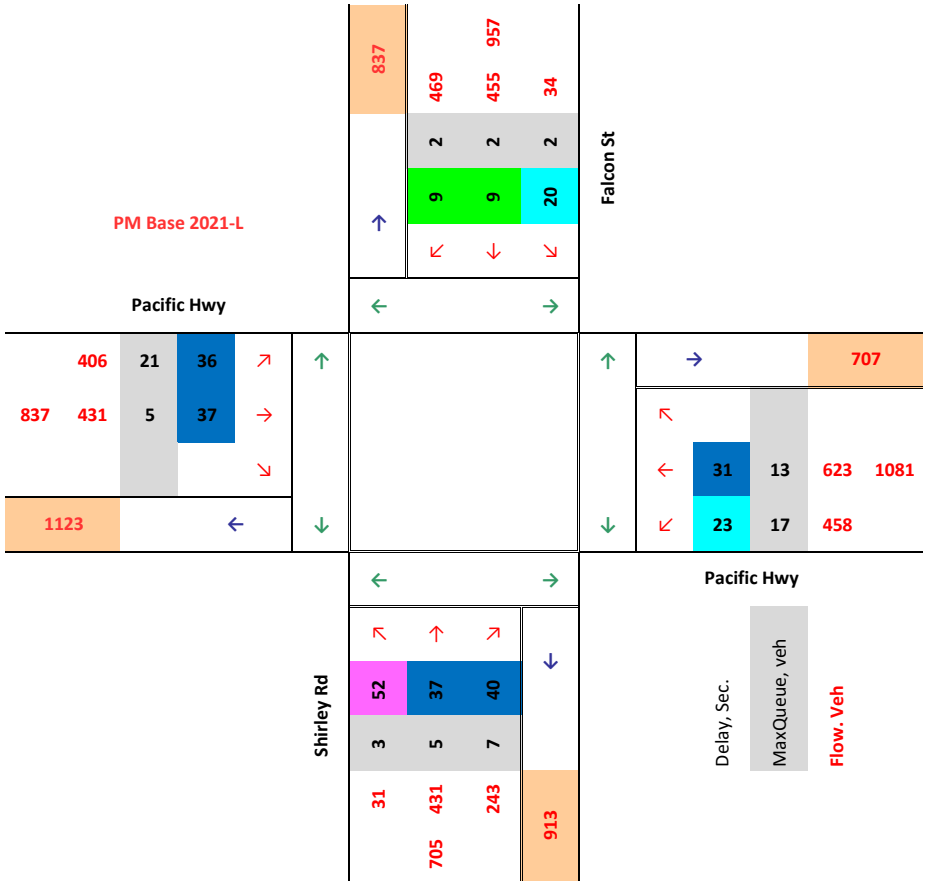
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

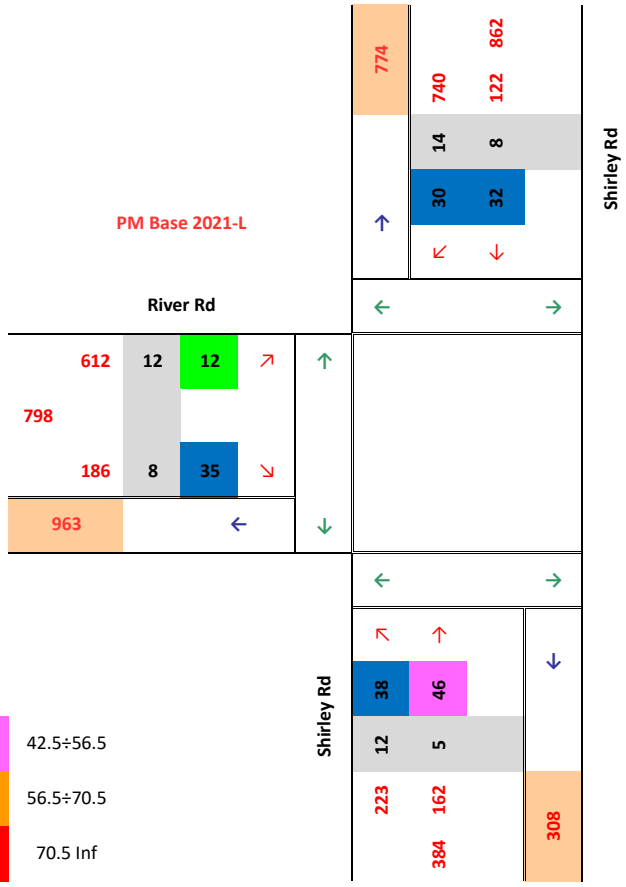




LOS

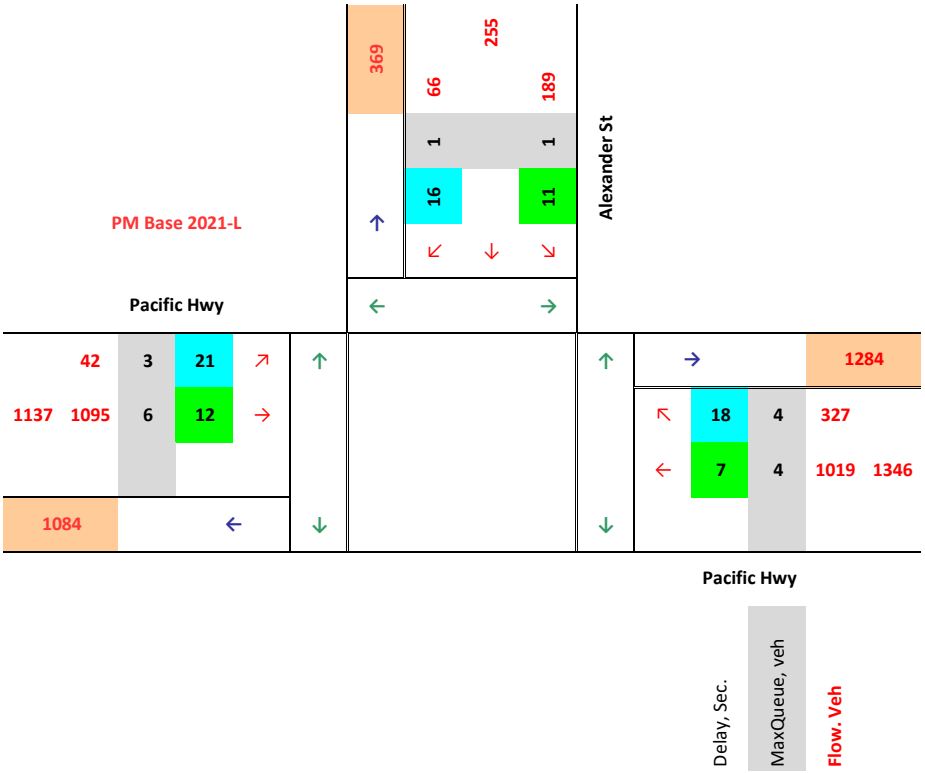
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

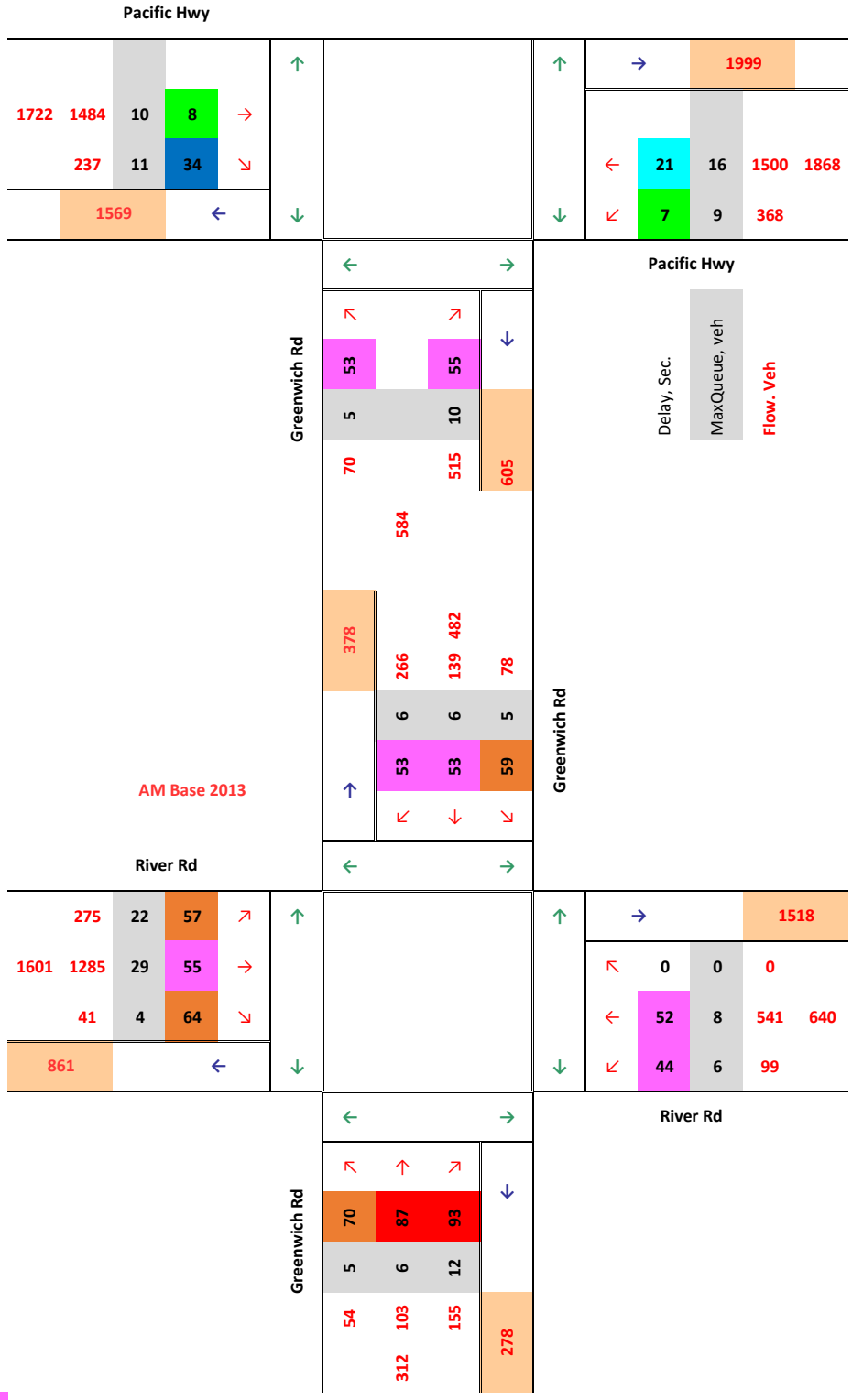
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf



LOS

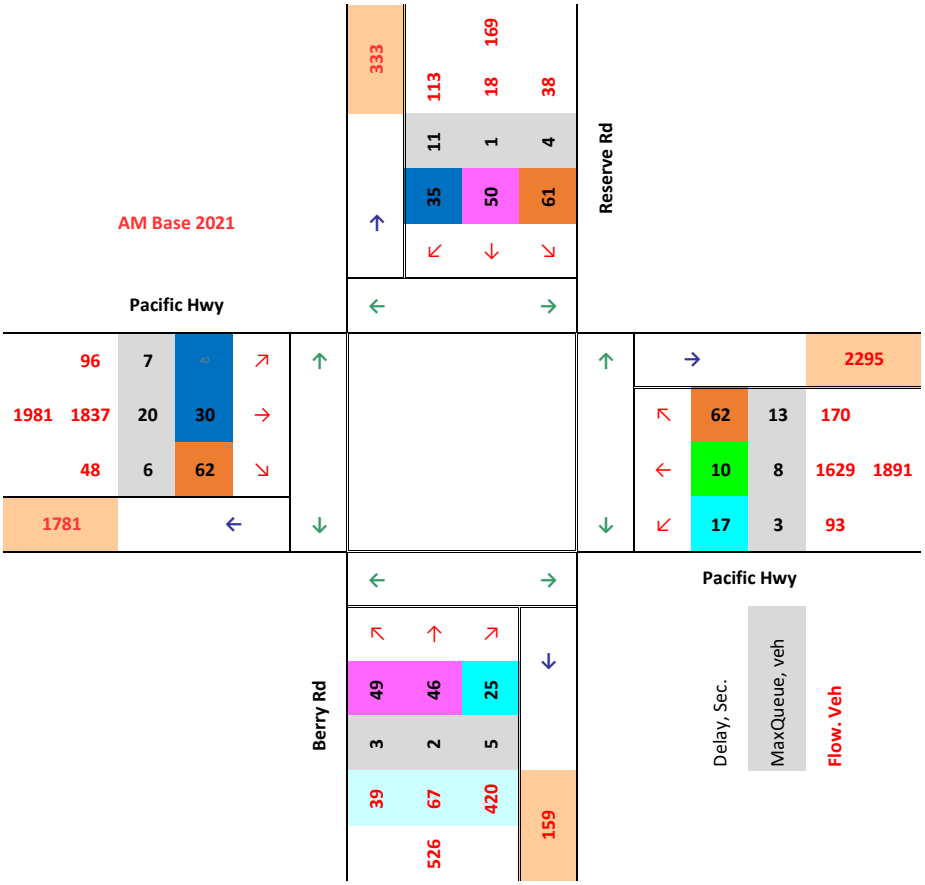
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

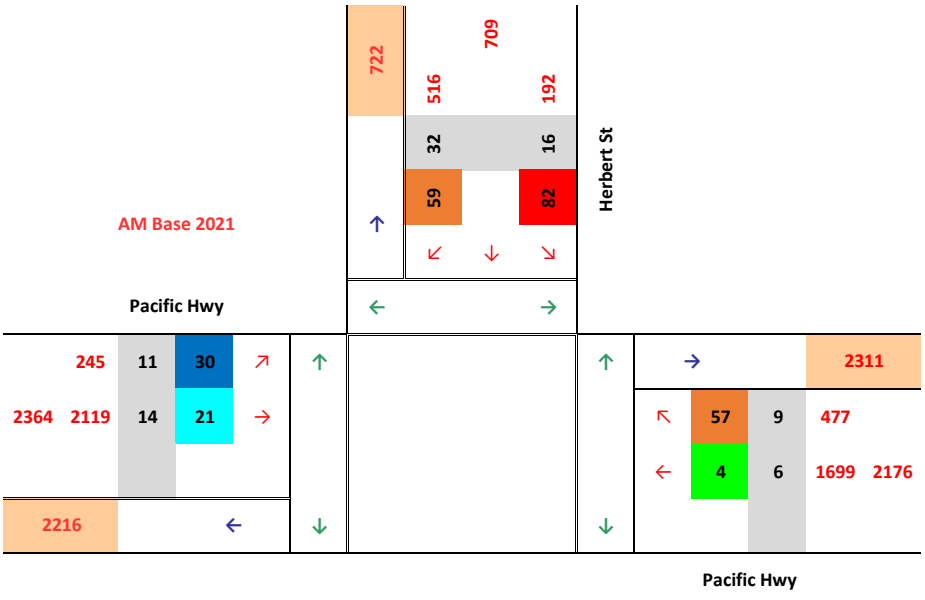
AM Base 2021



LOS

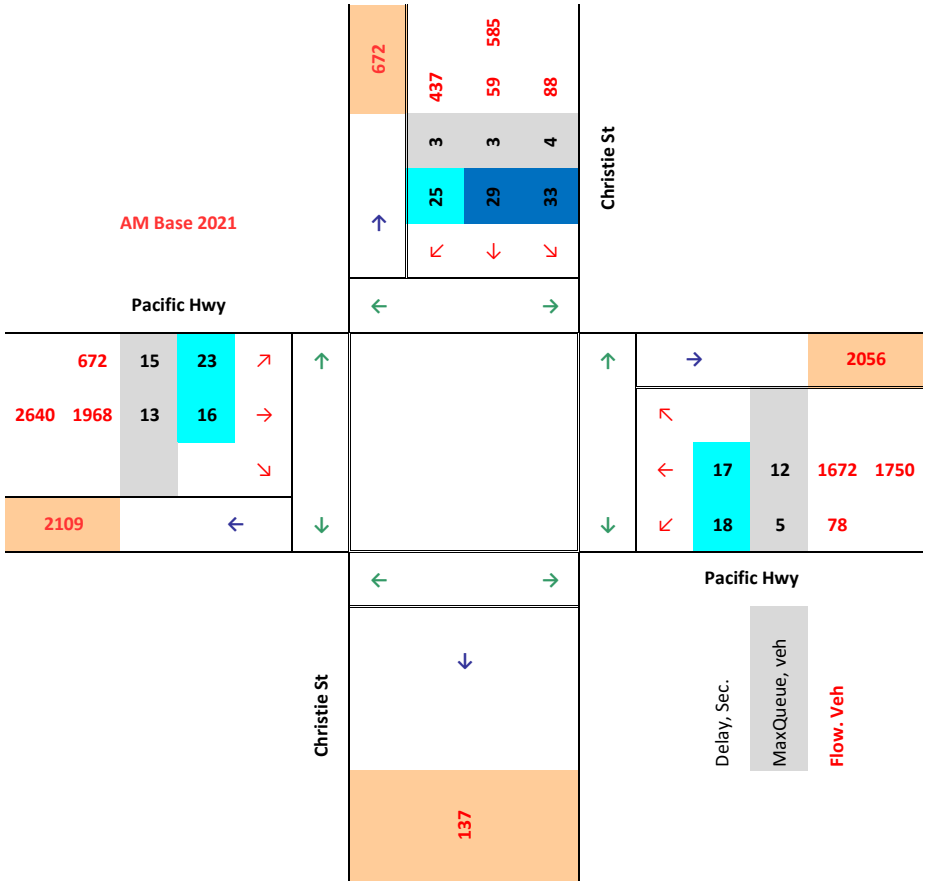
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

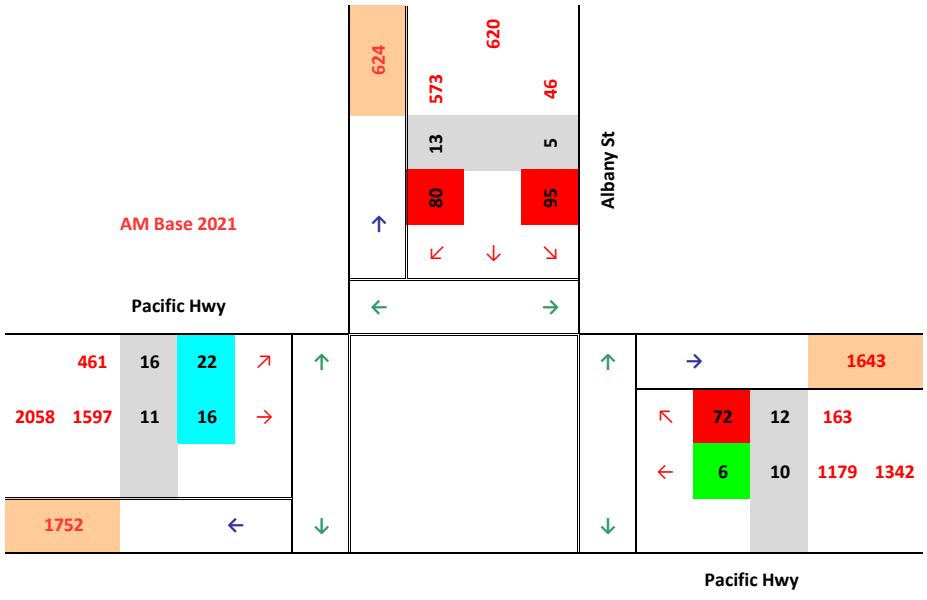




LOS

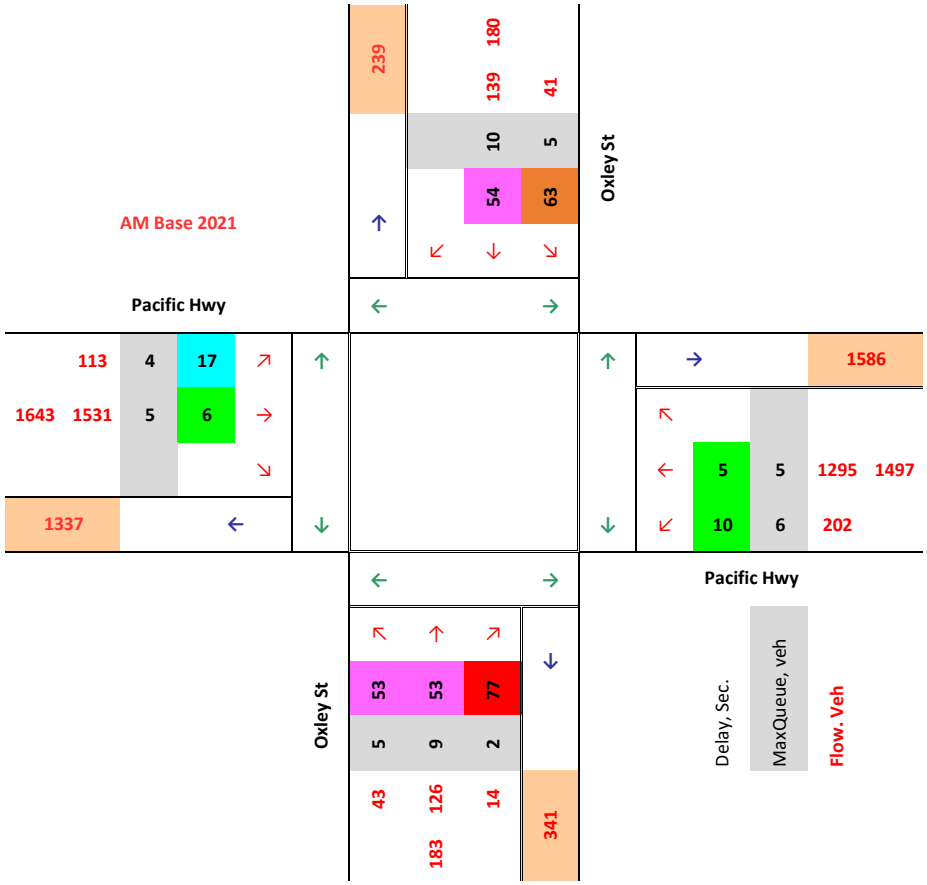
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

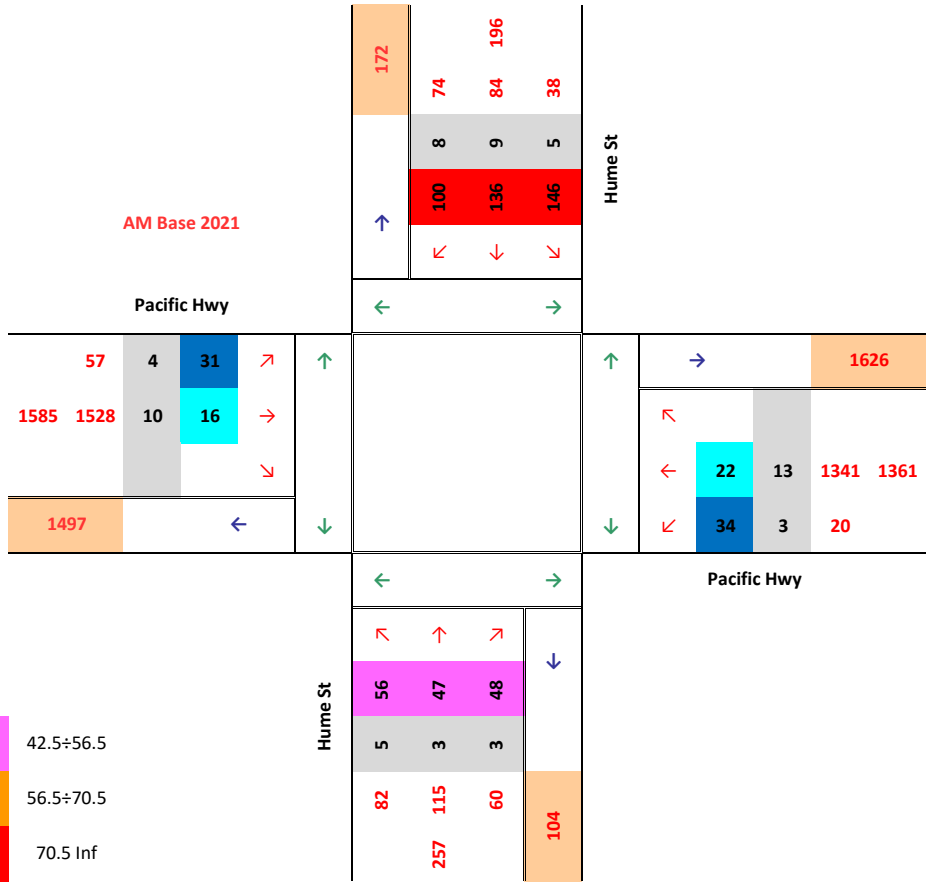




LOS

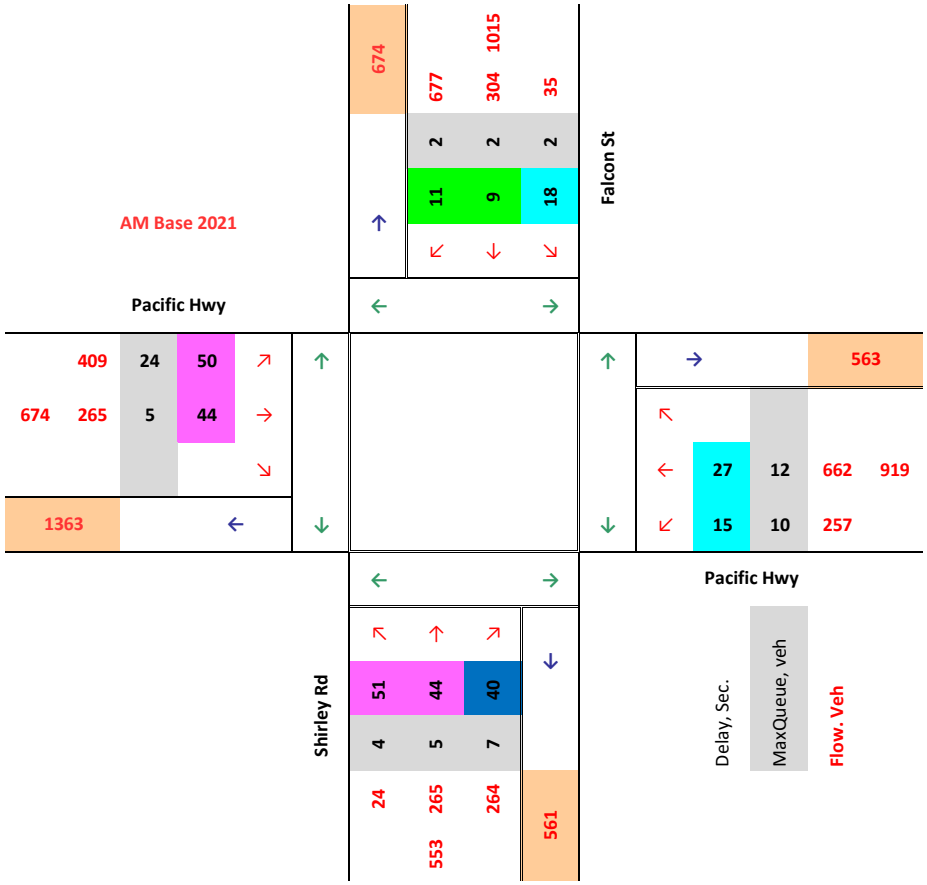
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

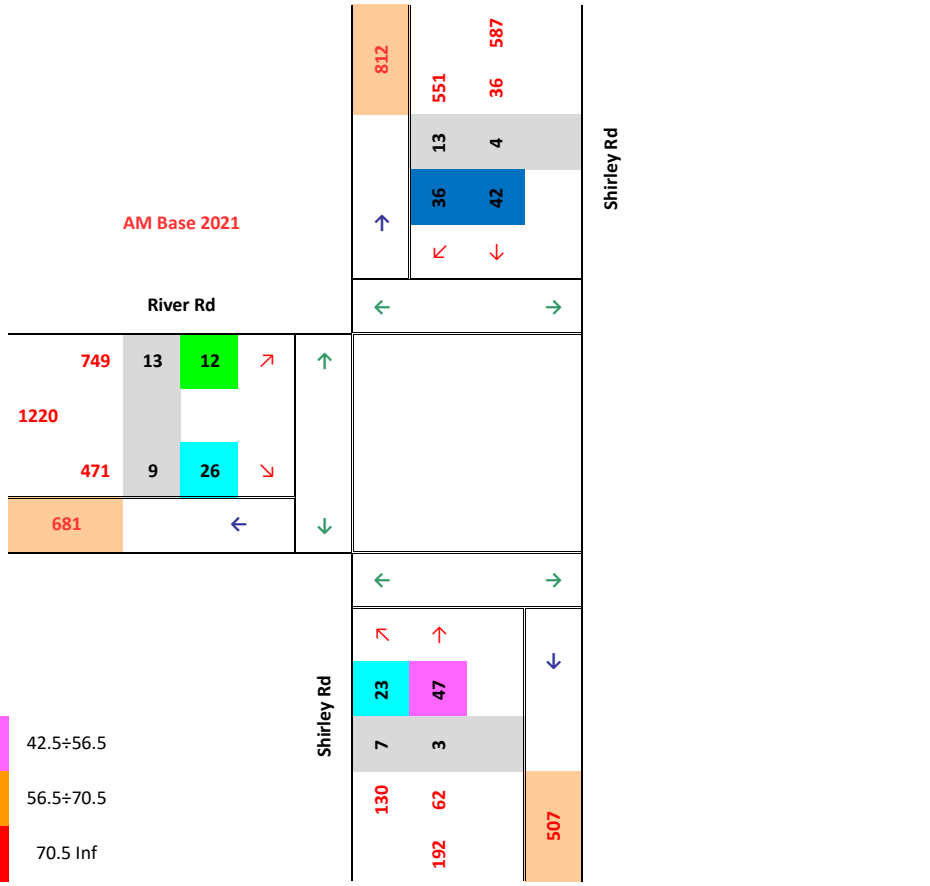




LOS

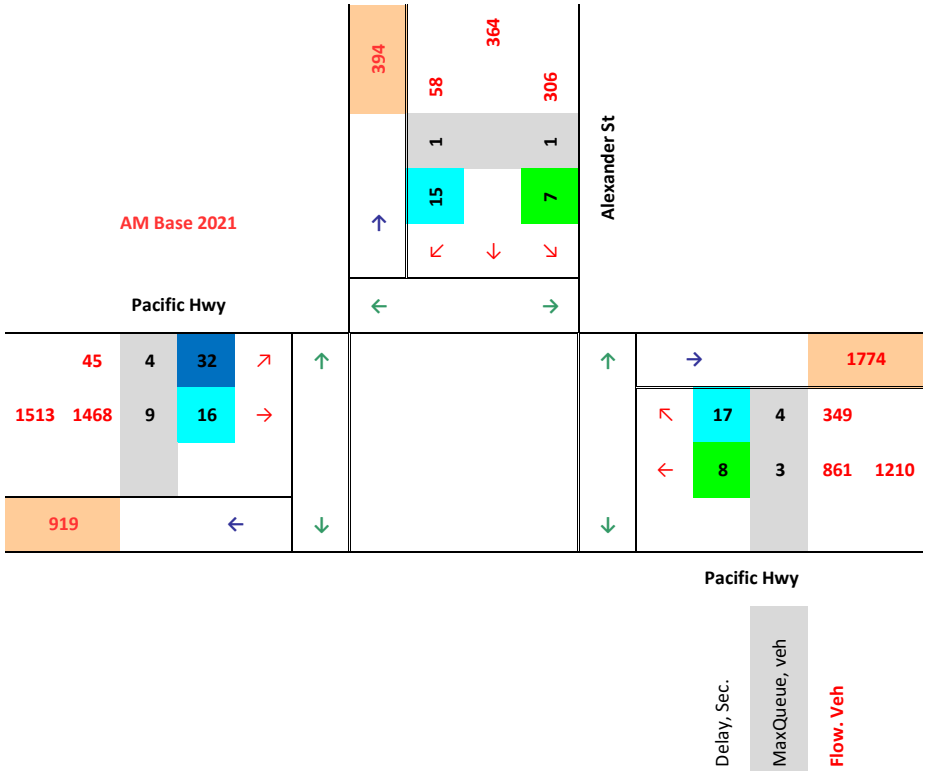
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

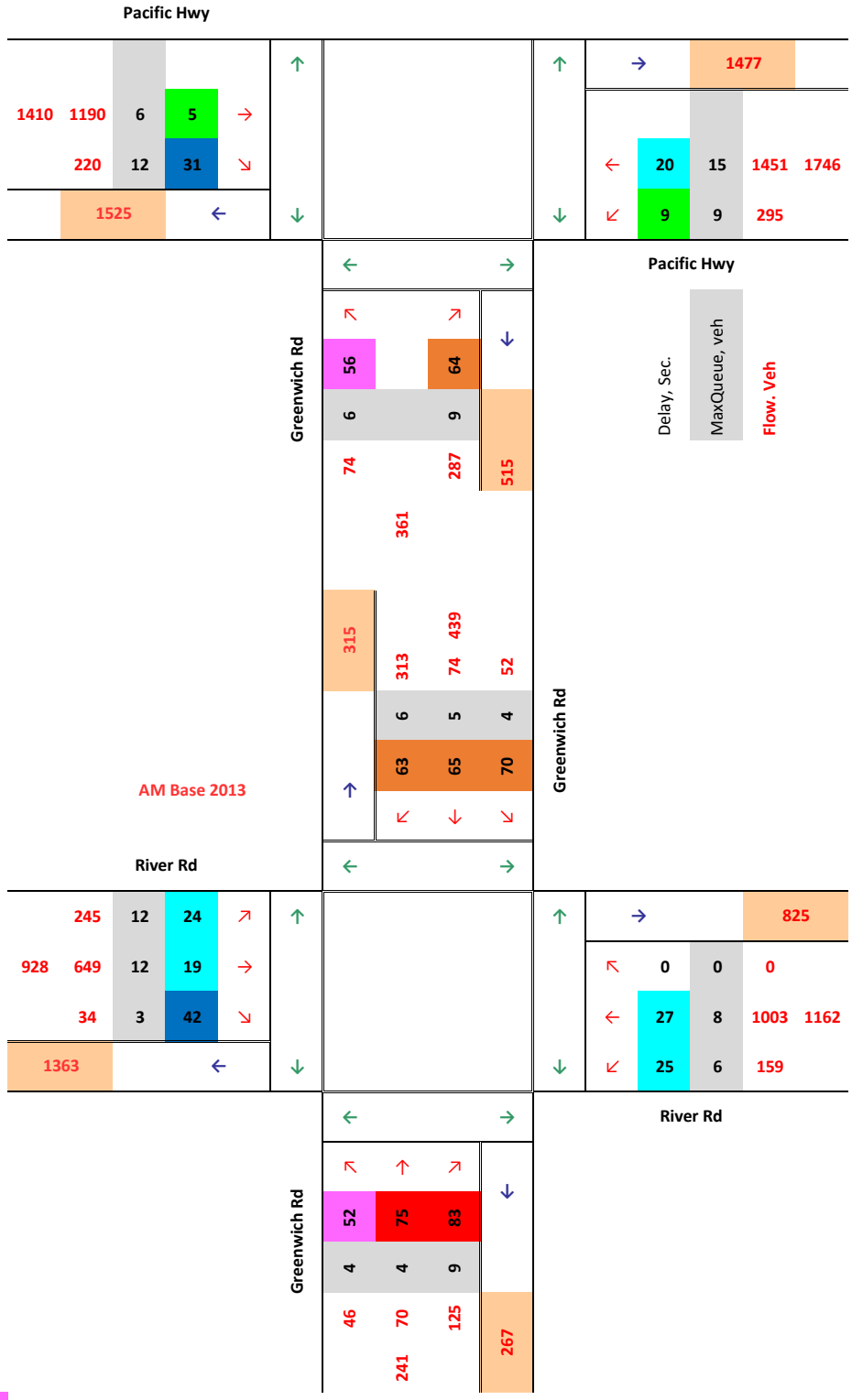
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf



LOS

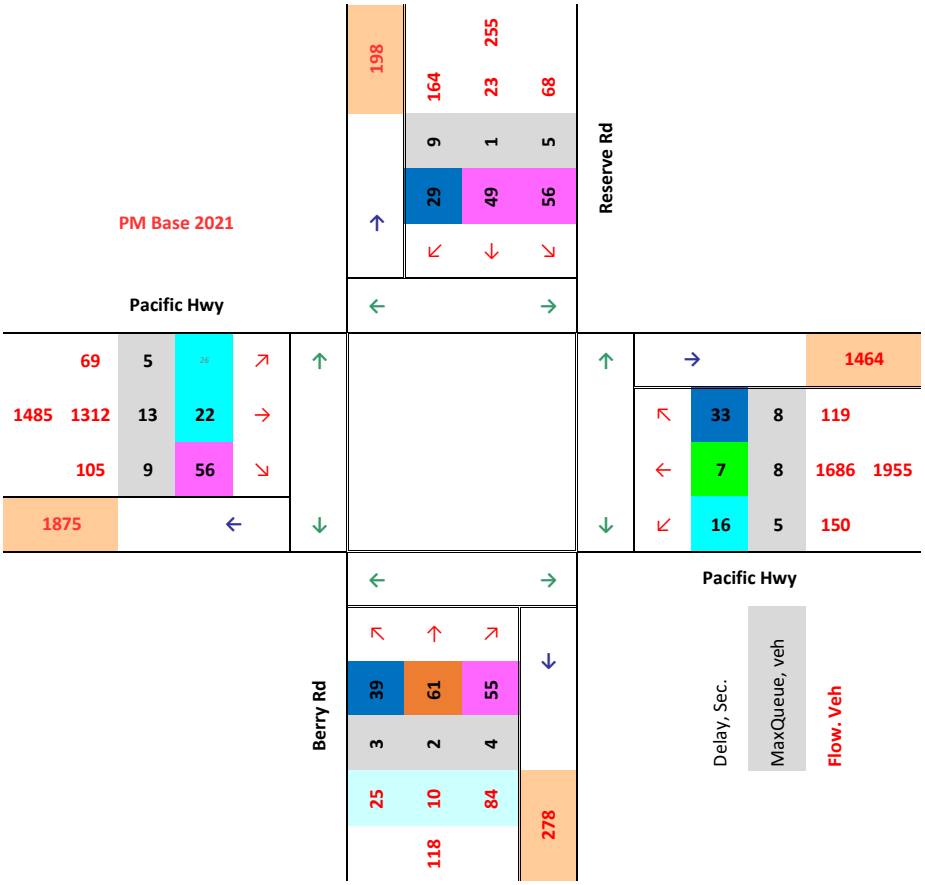
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

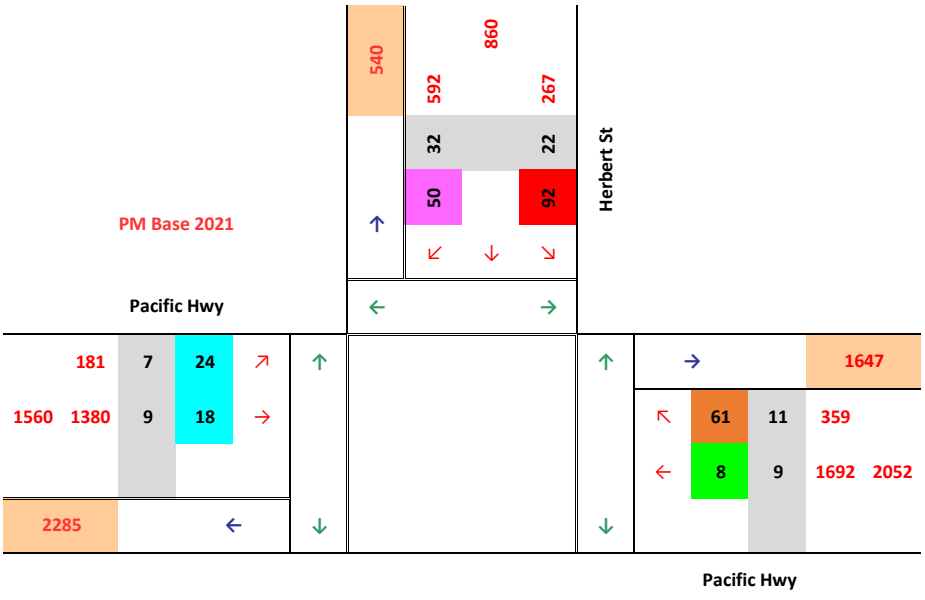
PM Base 2021



LOS

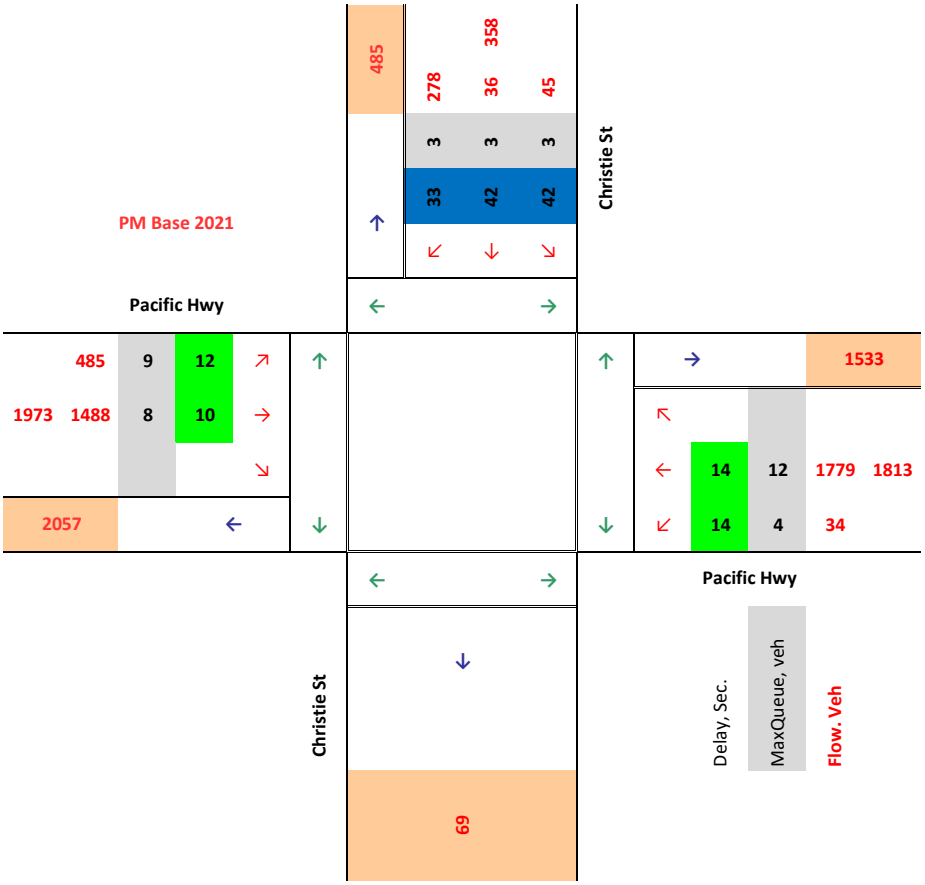
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

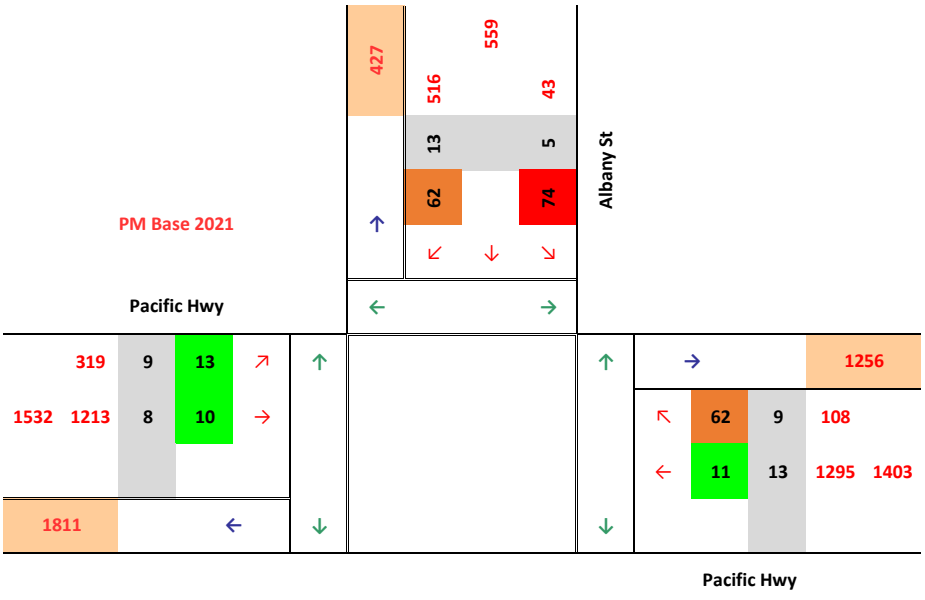




LOS

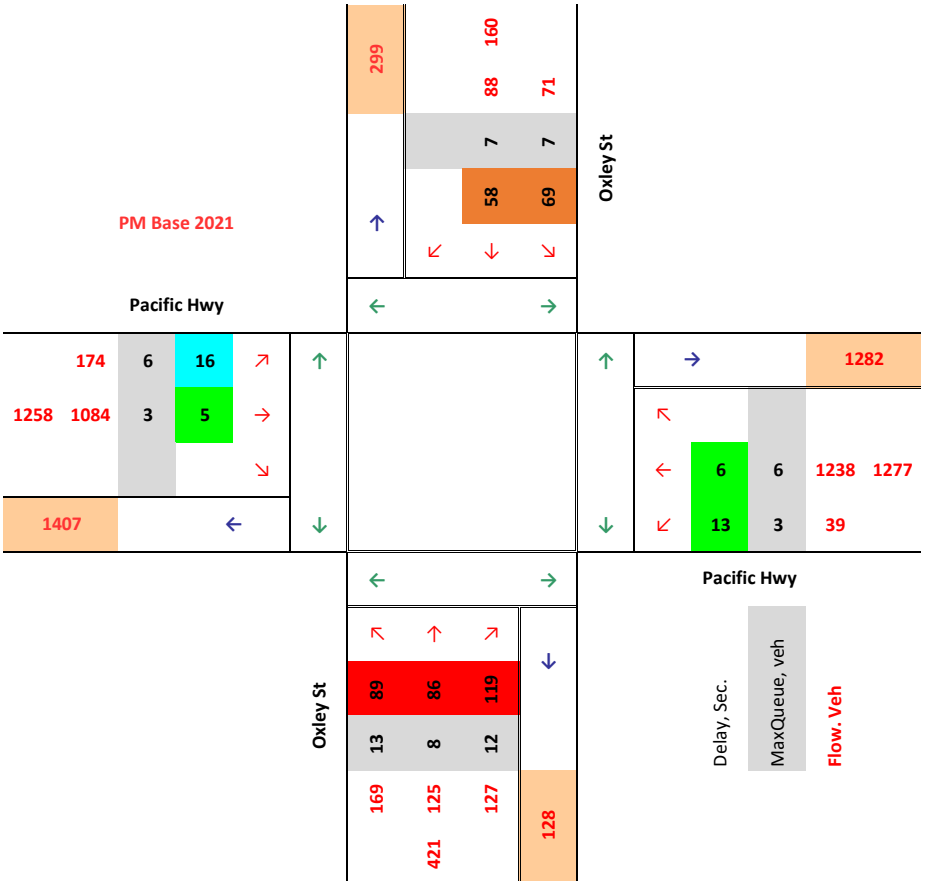
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

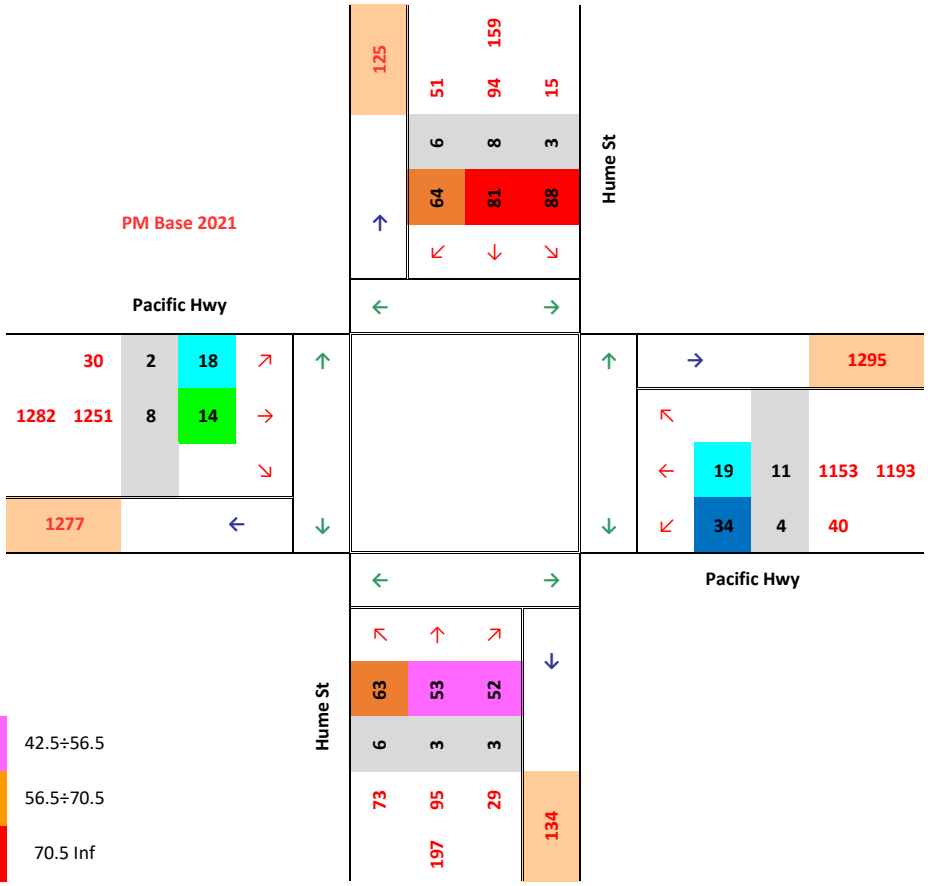




LOS

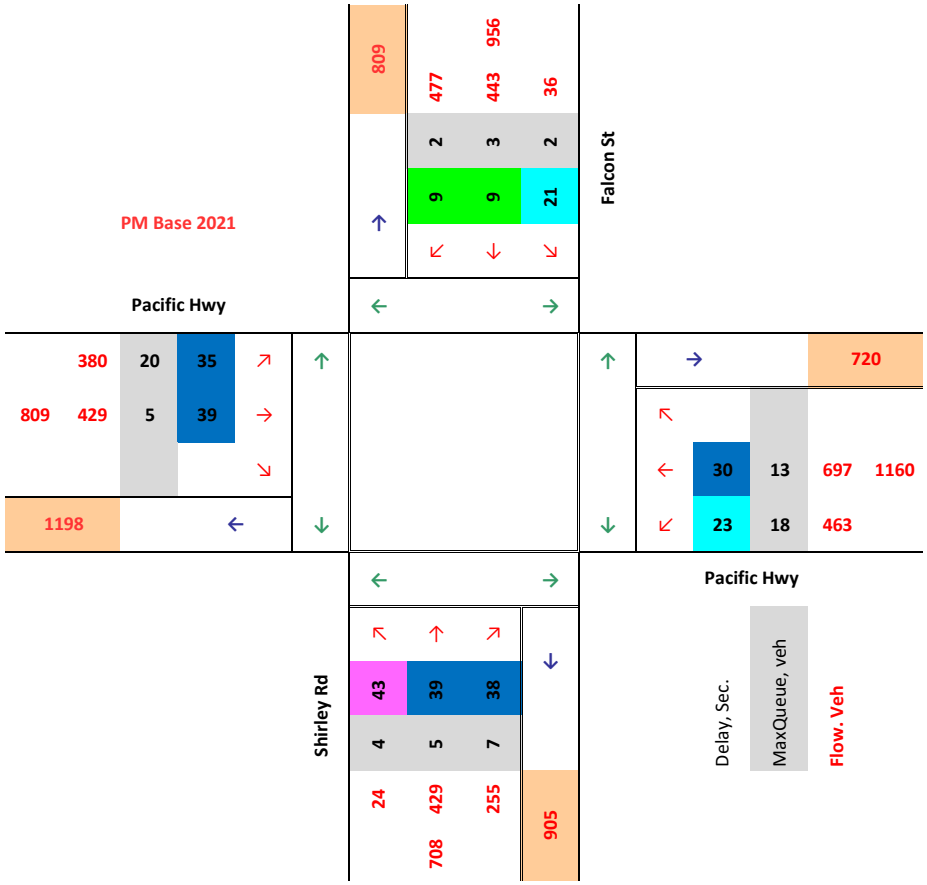
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

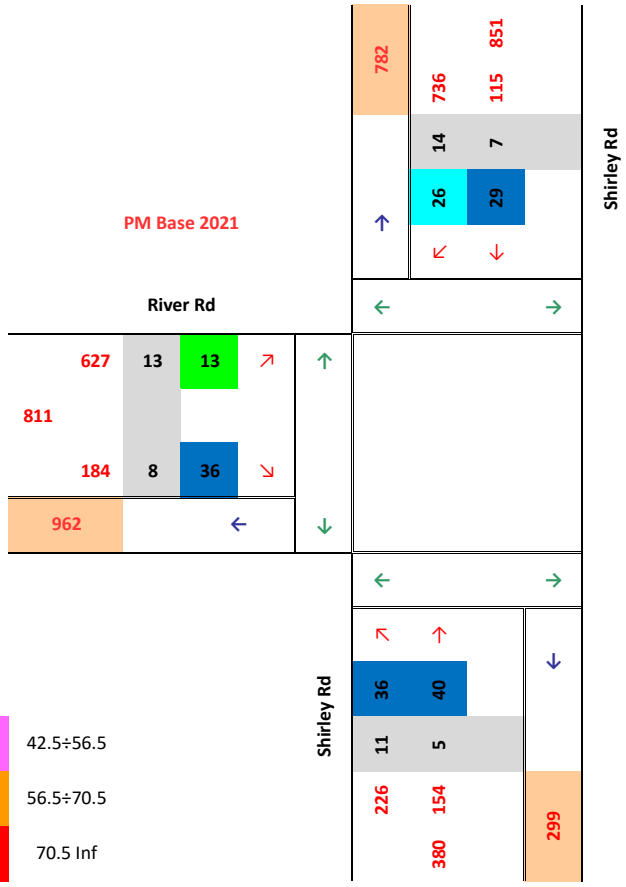




LOS

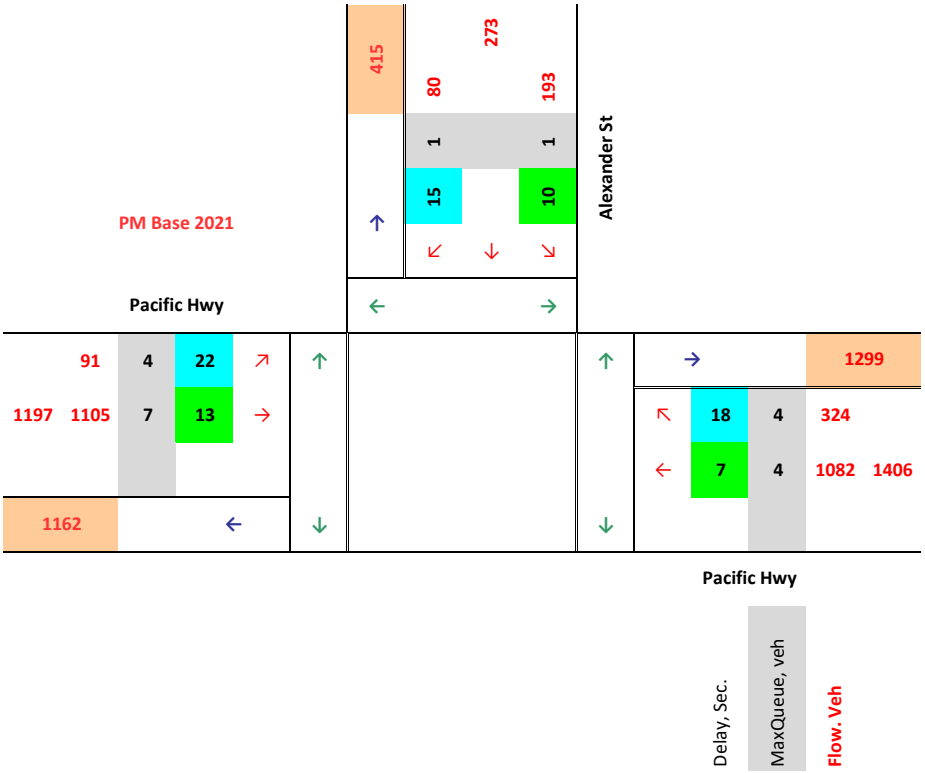
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

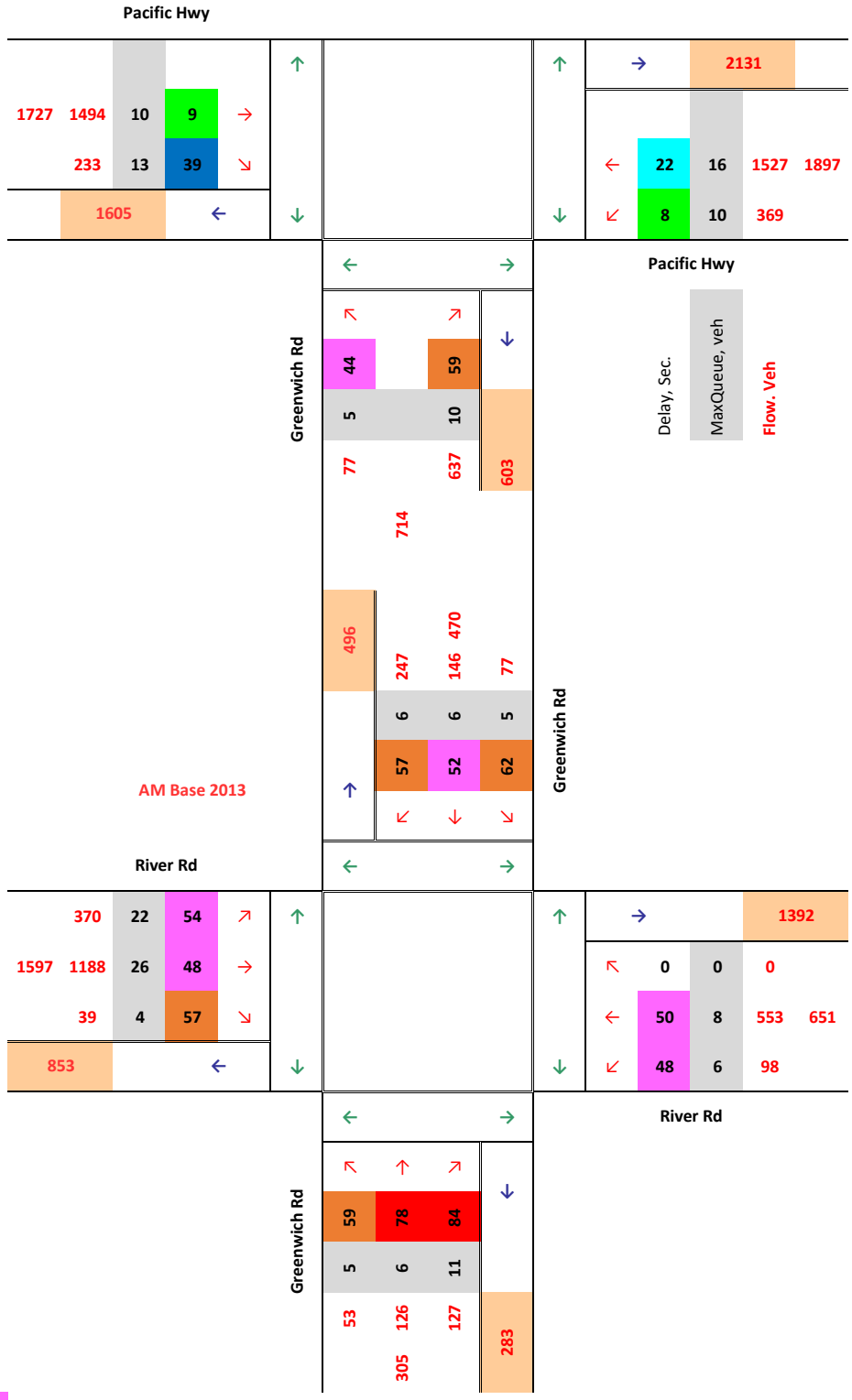
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf



LOS

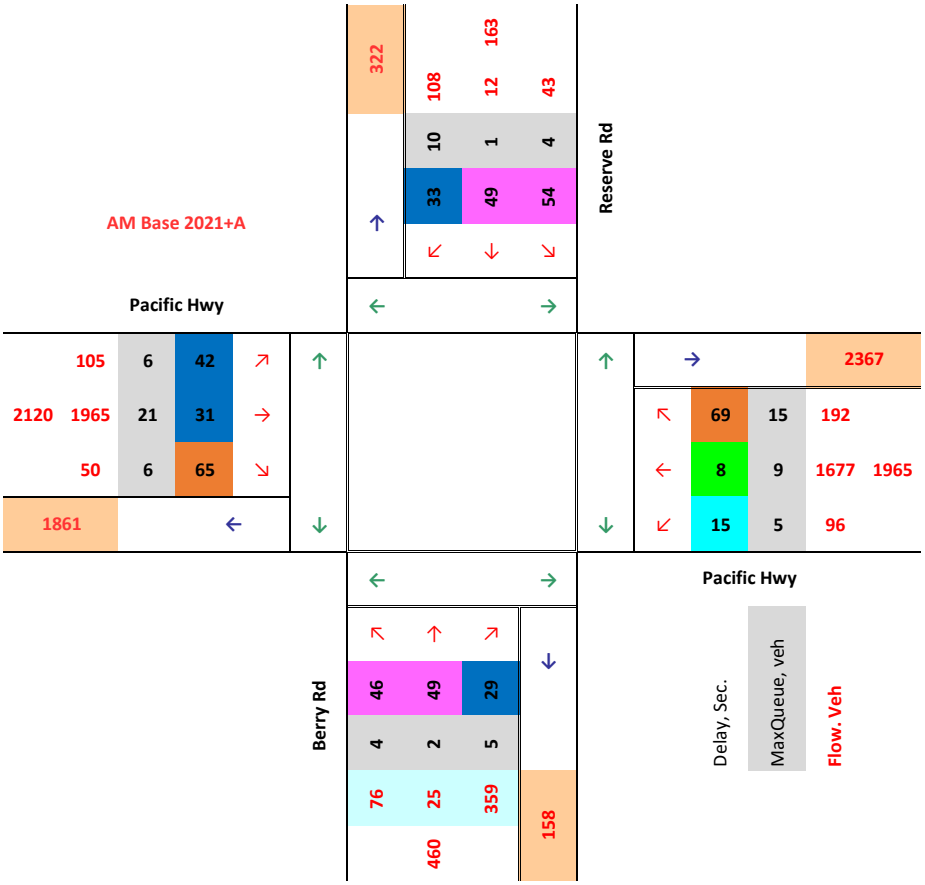
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

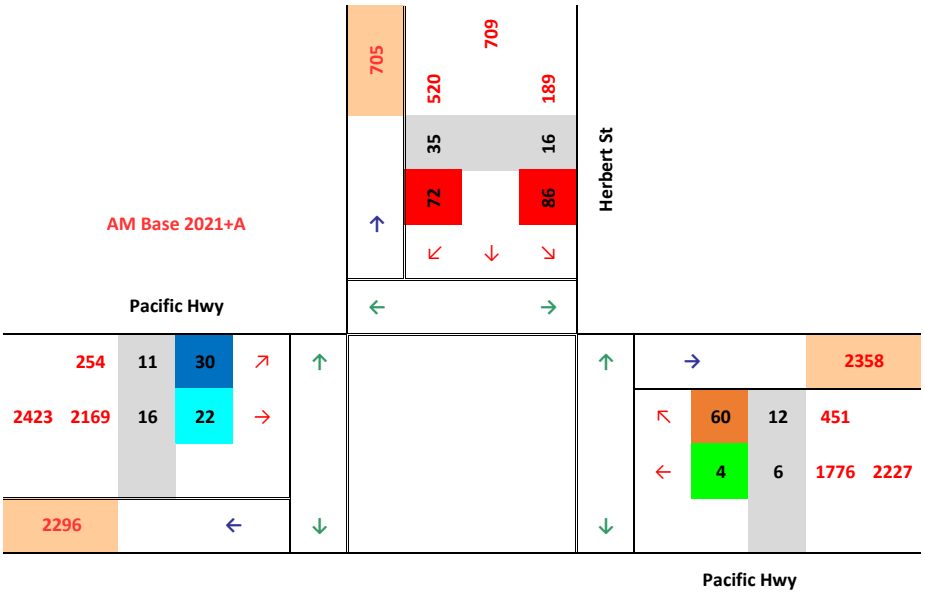
AM Base 2021+A



LOS

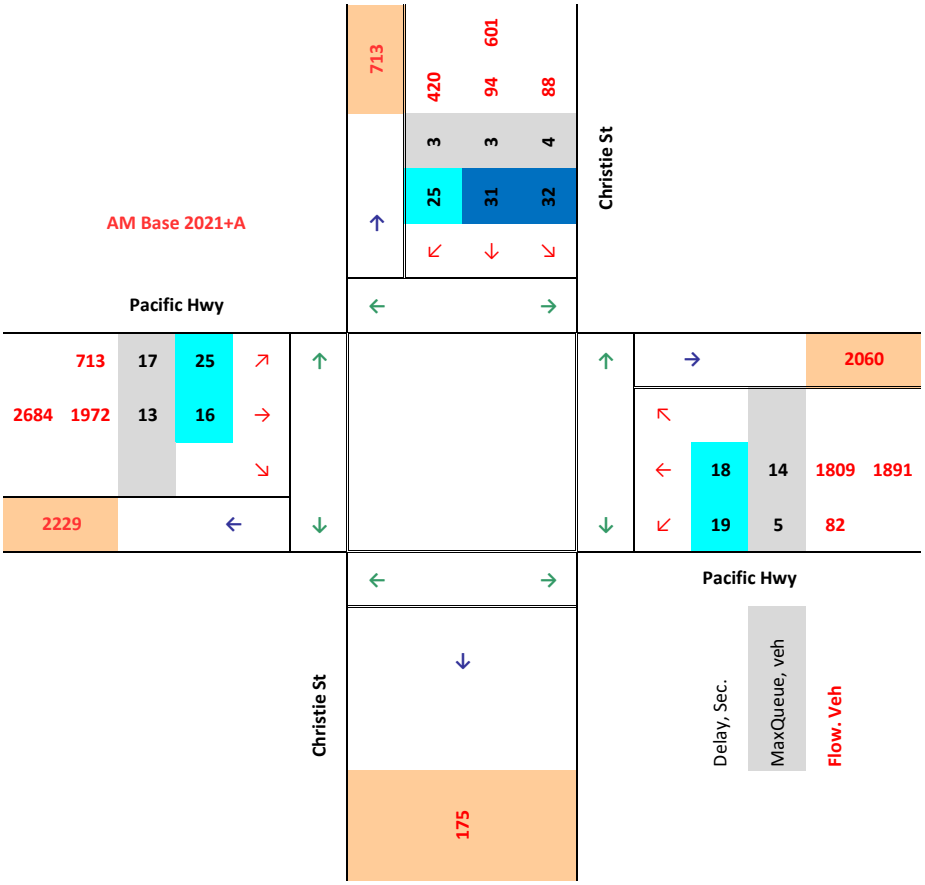
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

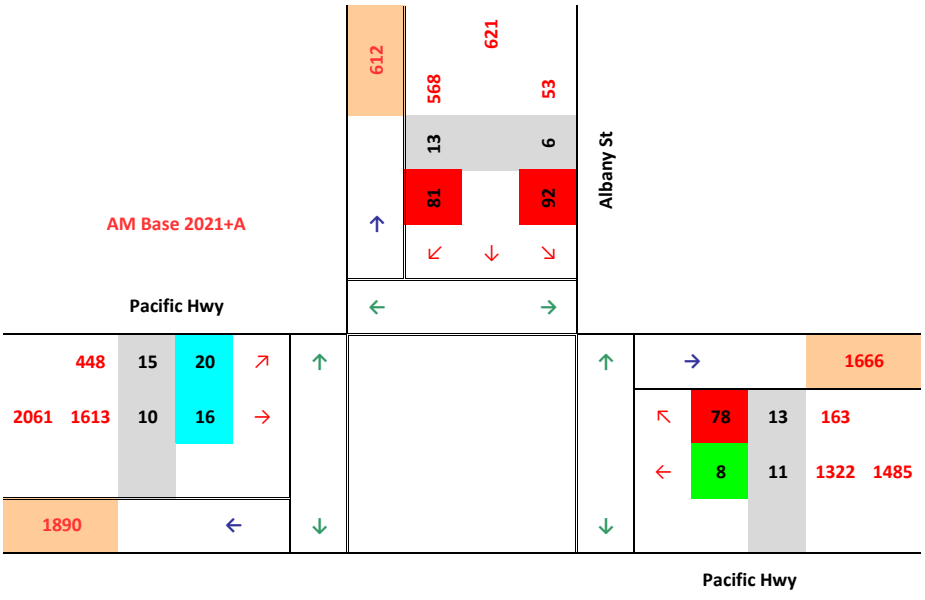




LOS

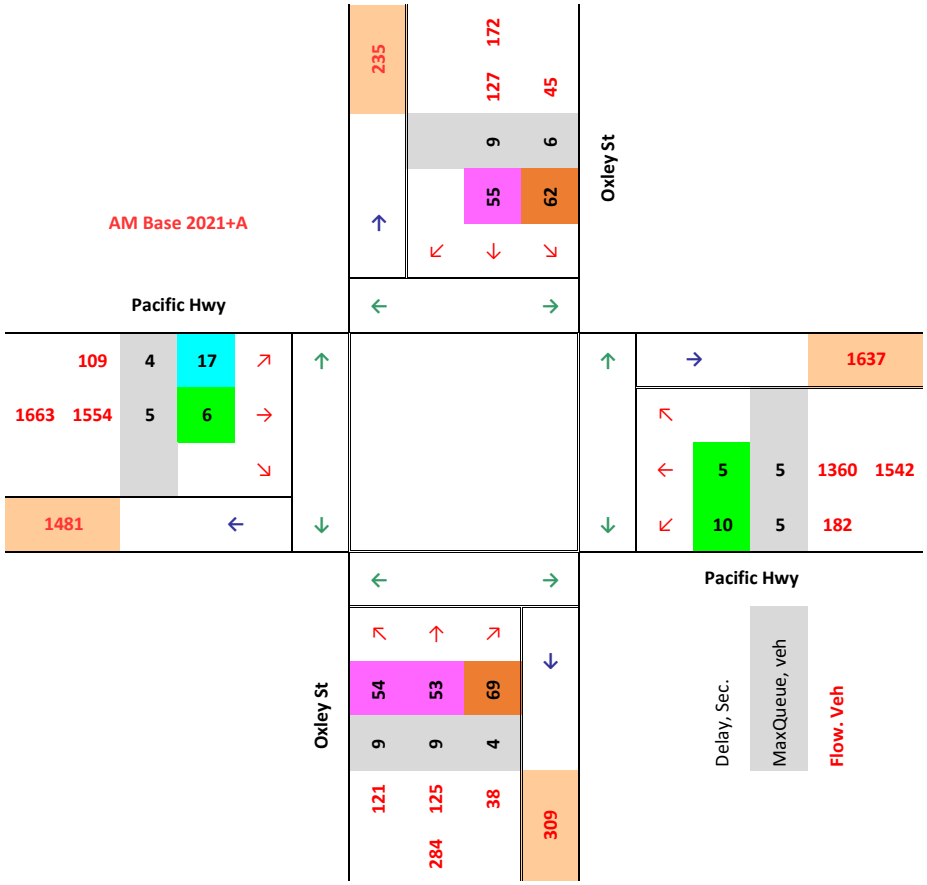
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

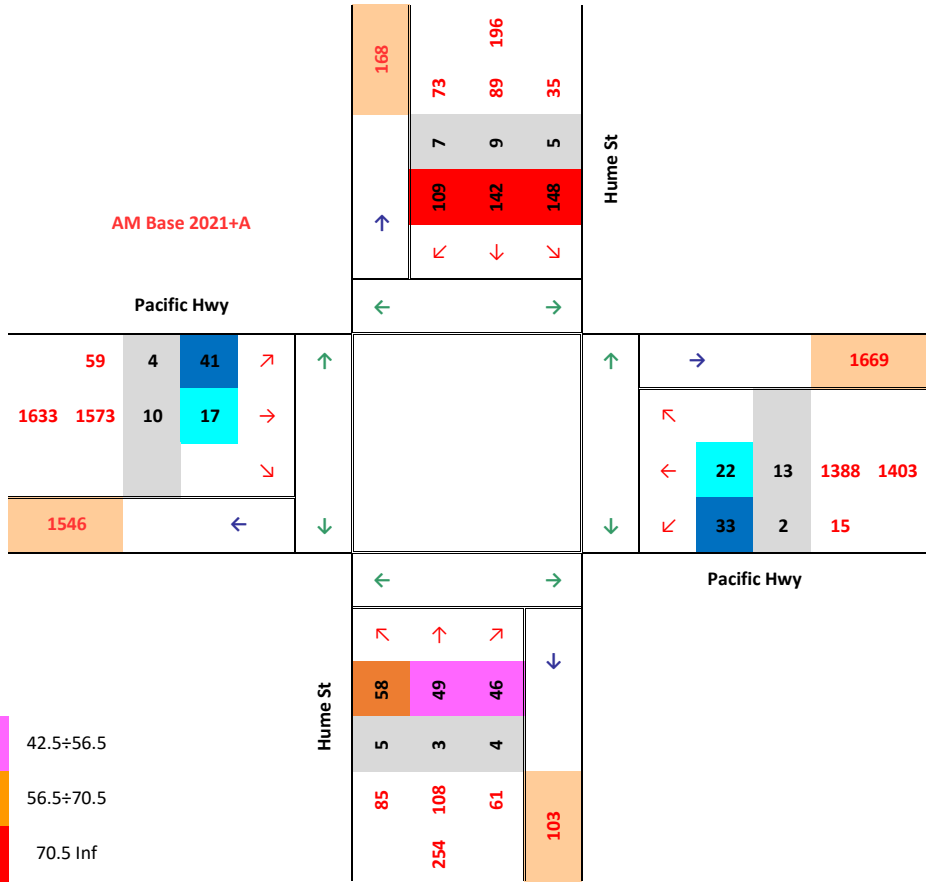




LOS

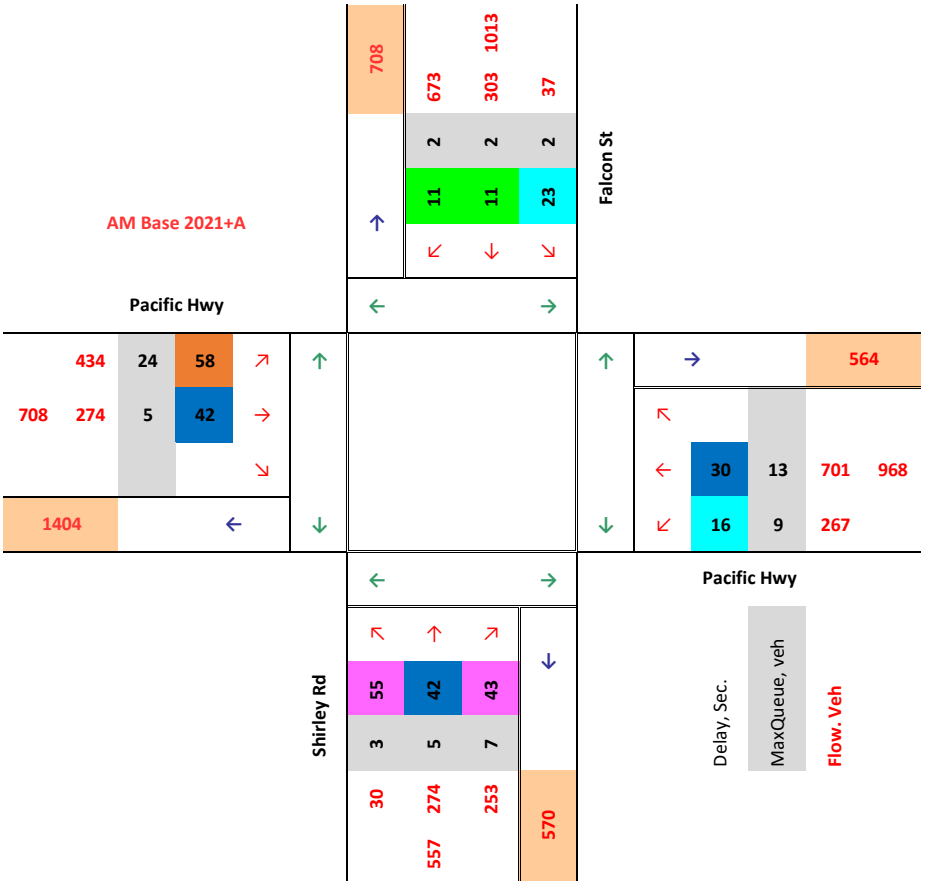
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

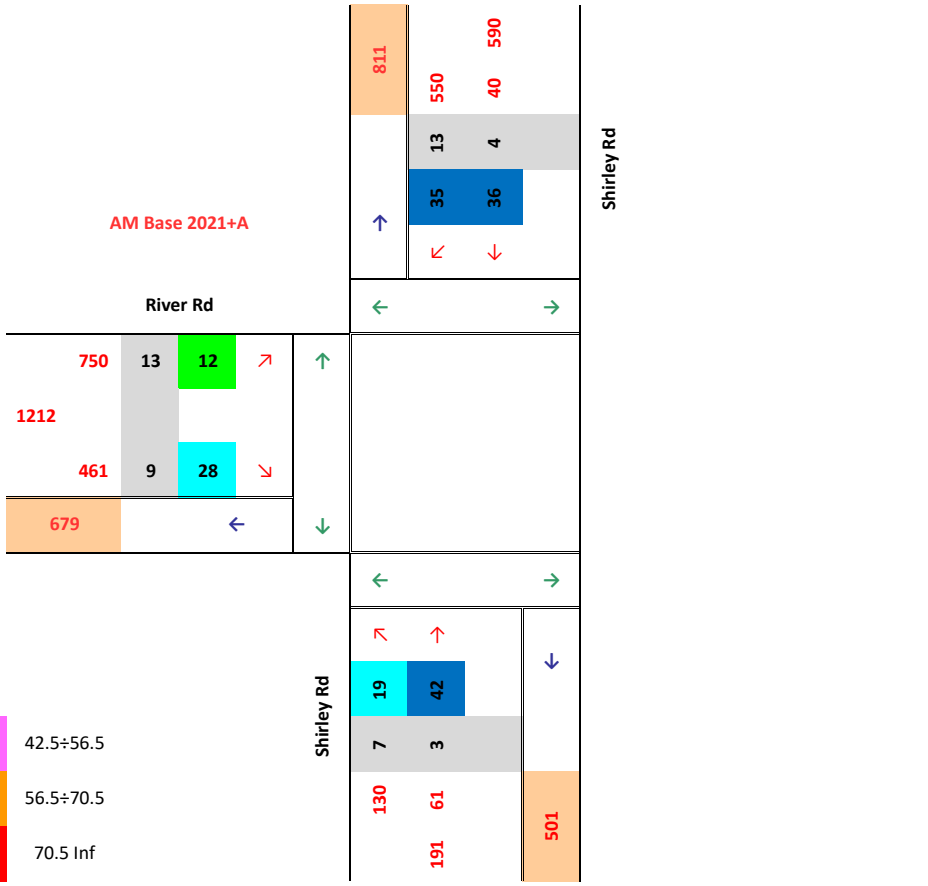




LOS

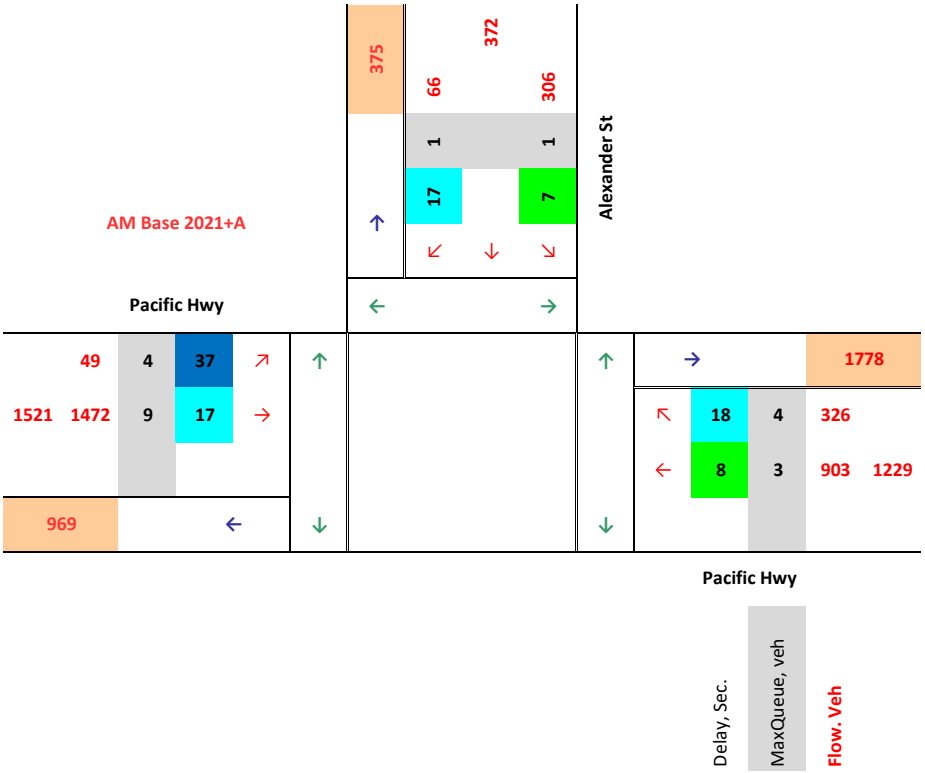
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

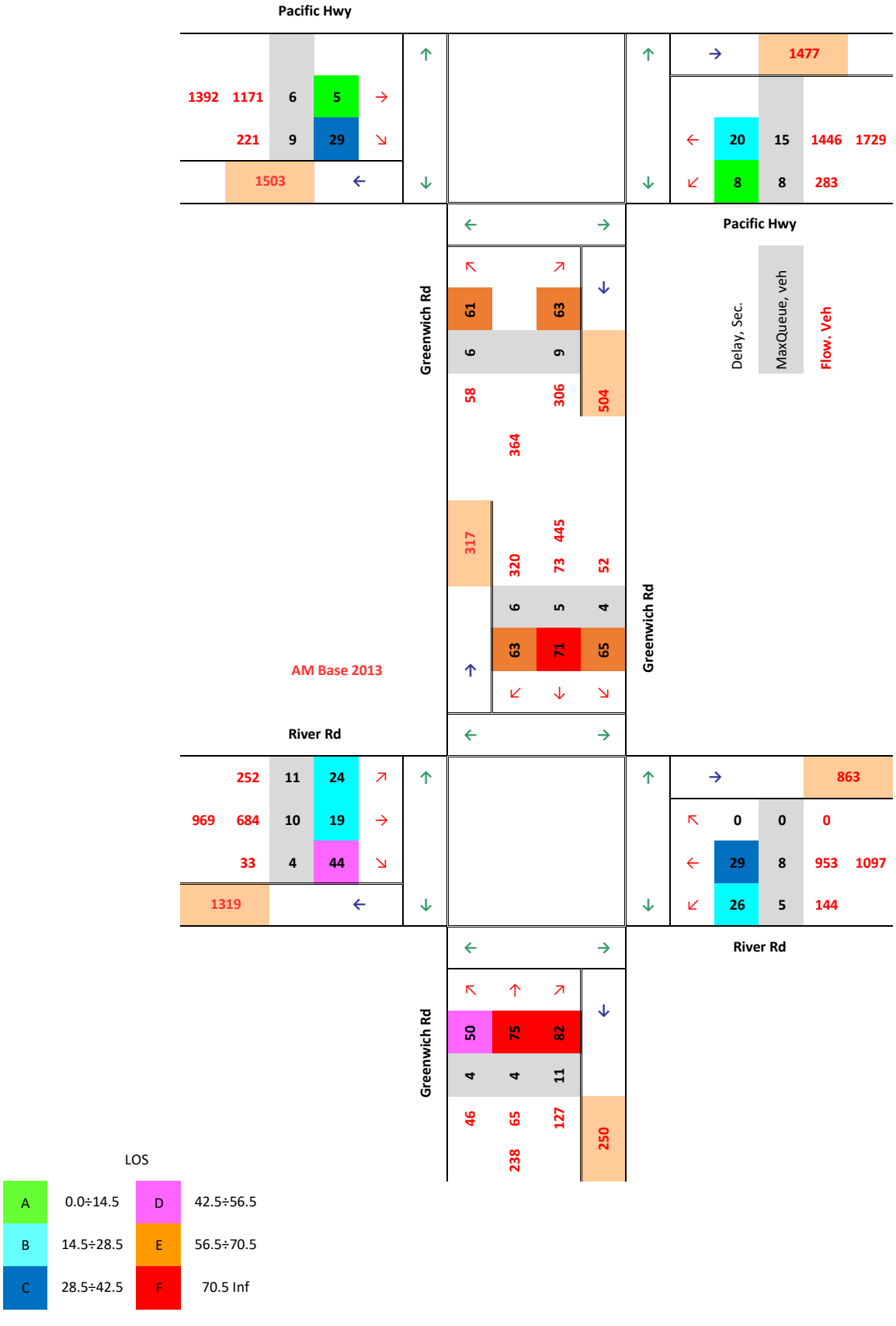
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf



LOS

A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

PM Base 2021+A



LOS

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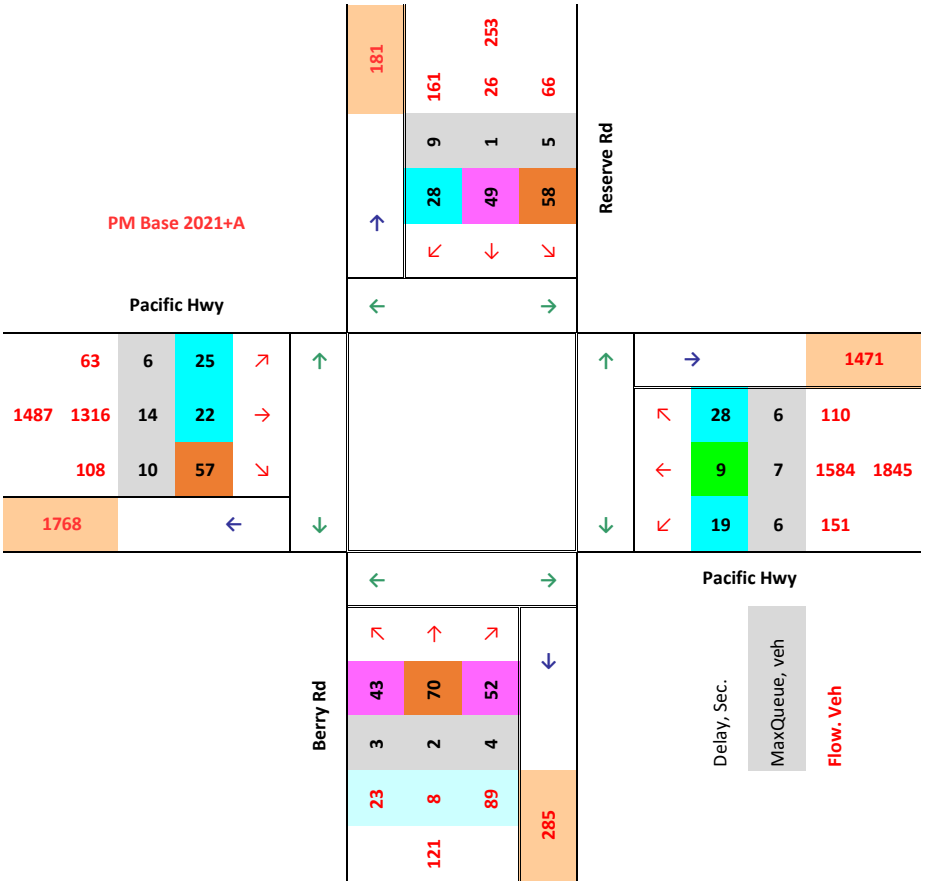
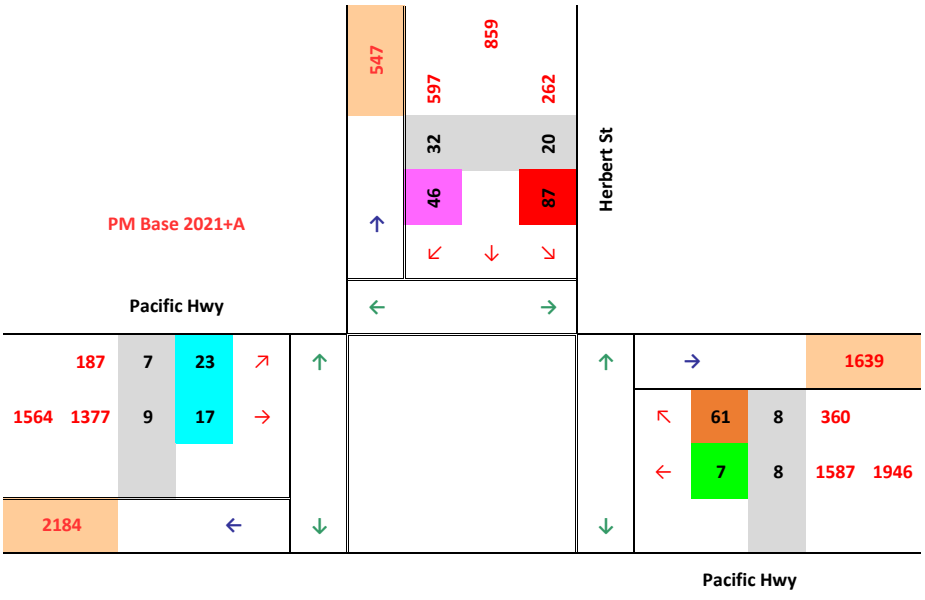
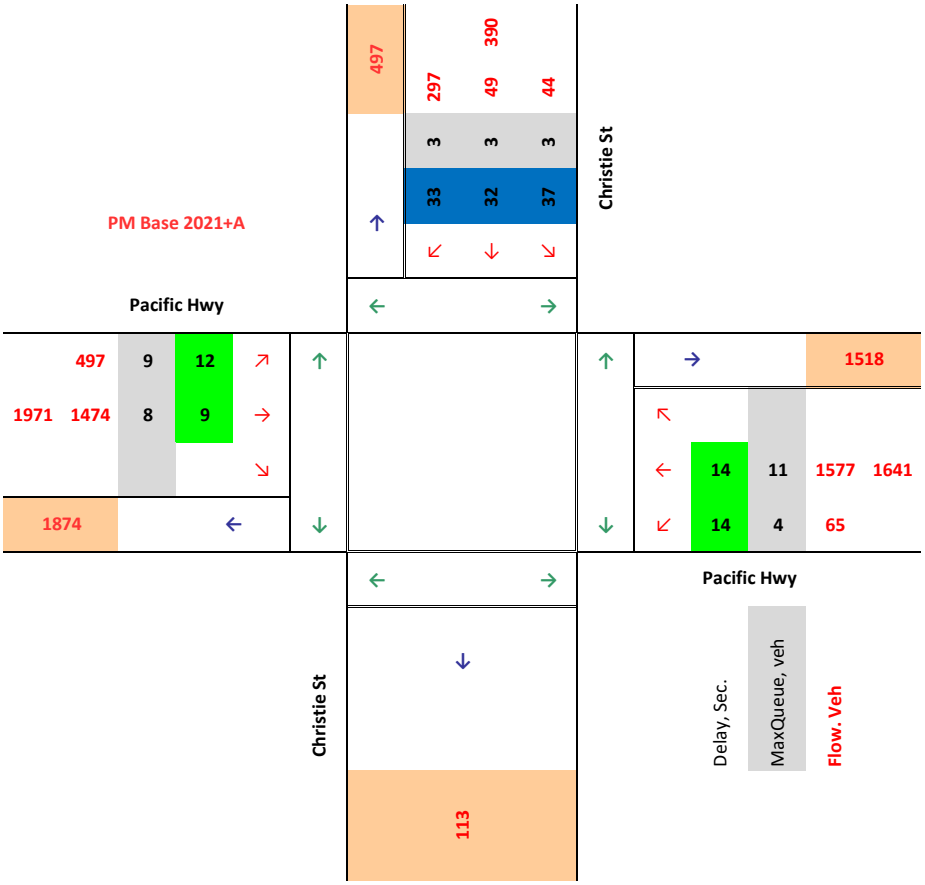
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

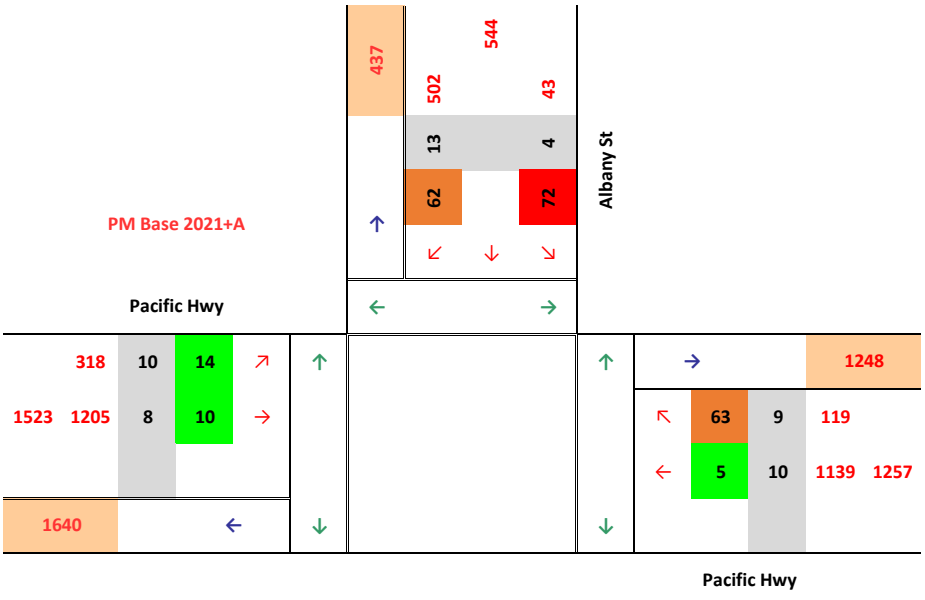




LOS

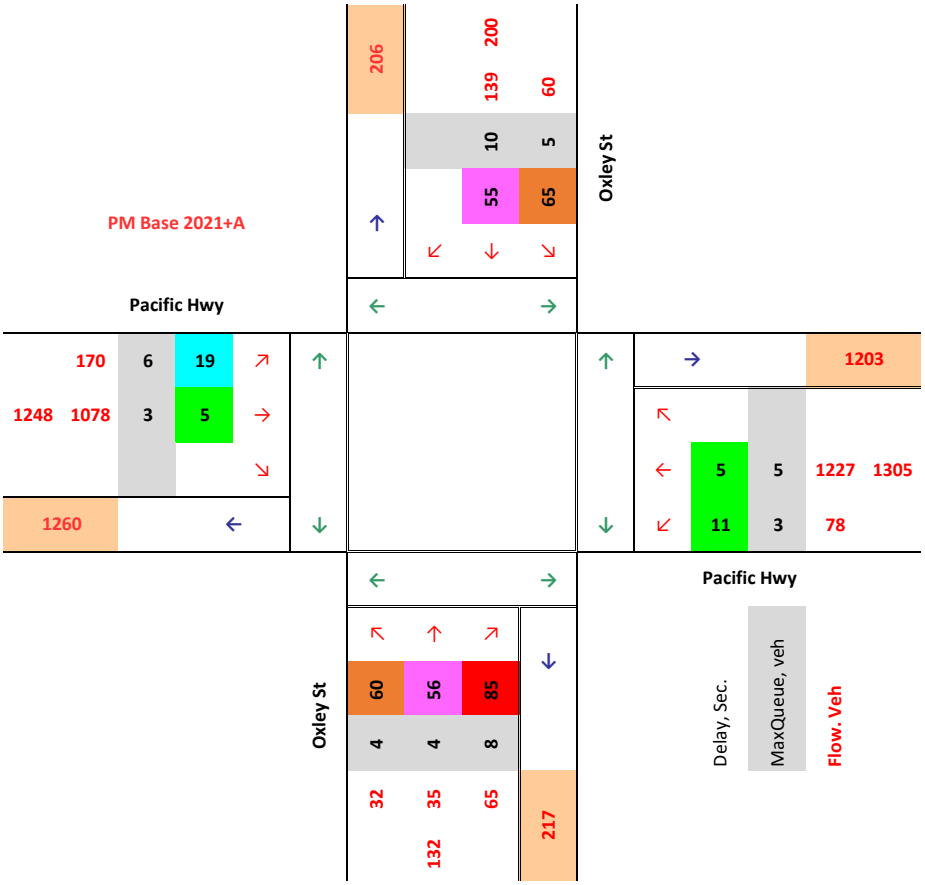
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

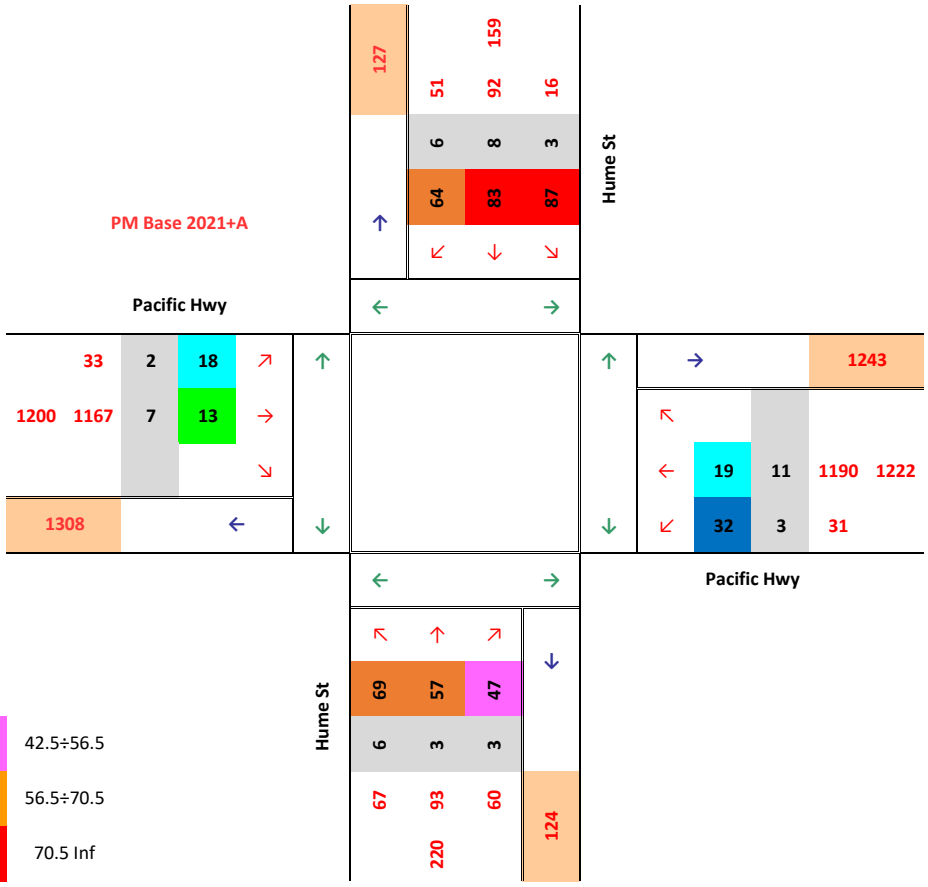




LOS

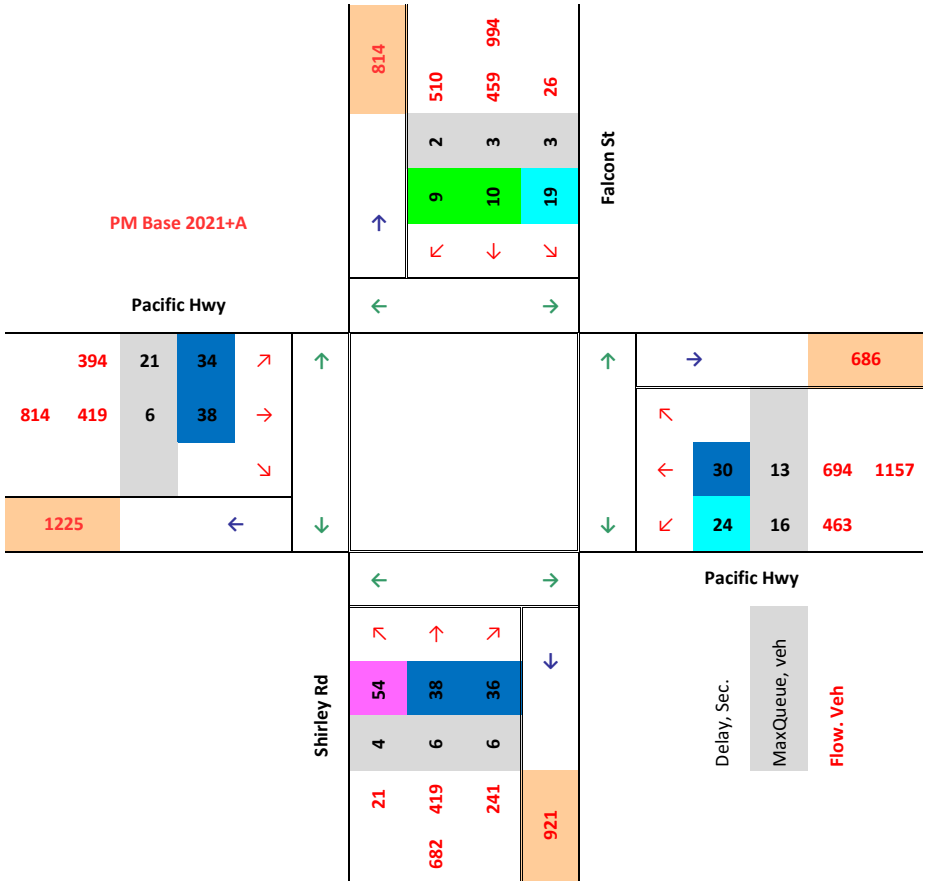
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

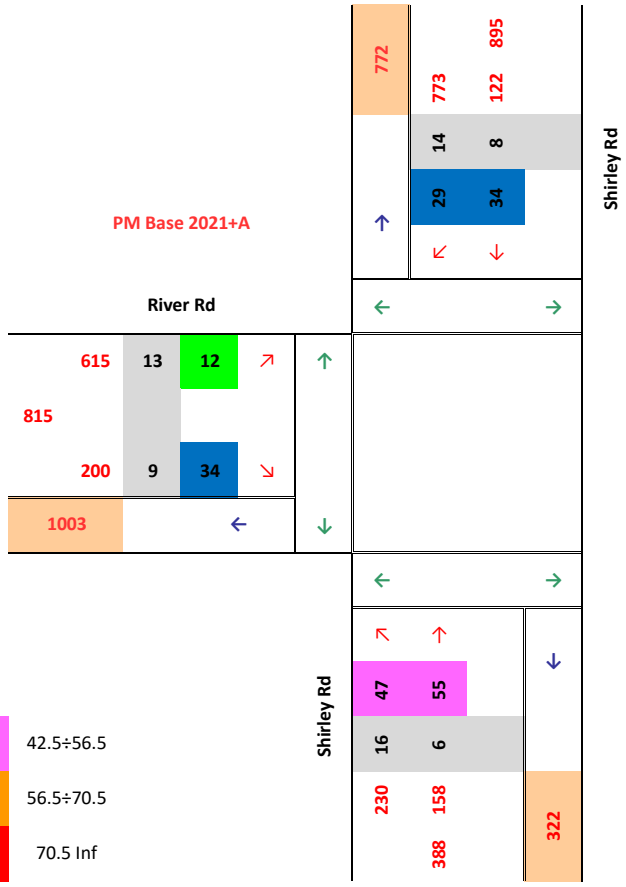




LOS

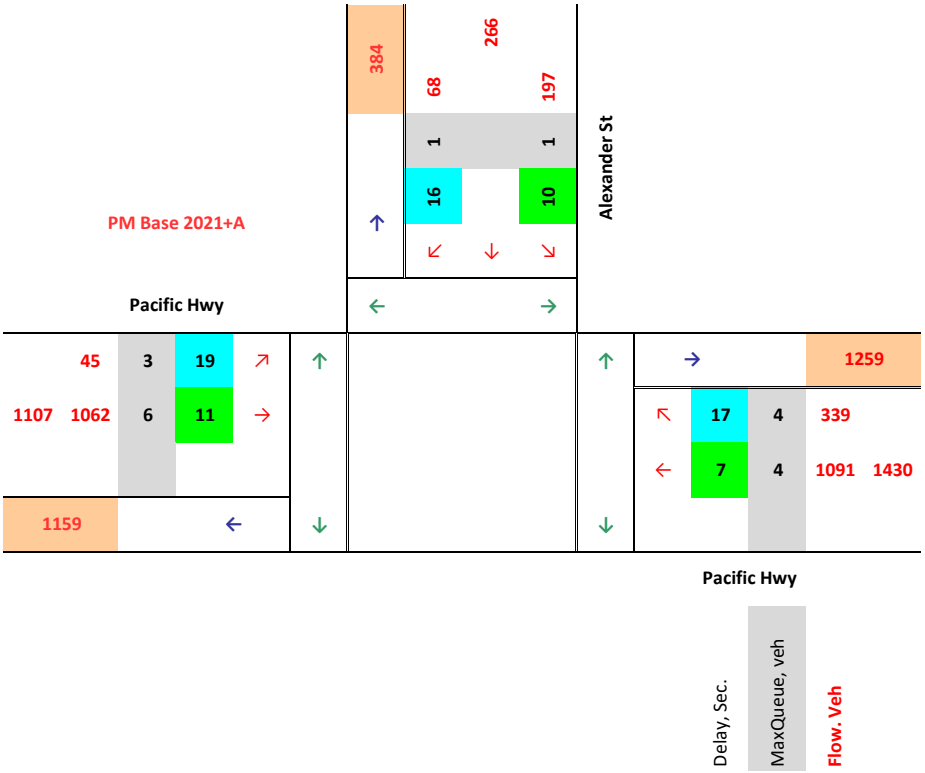
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

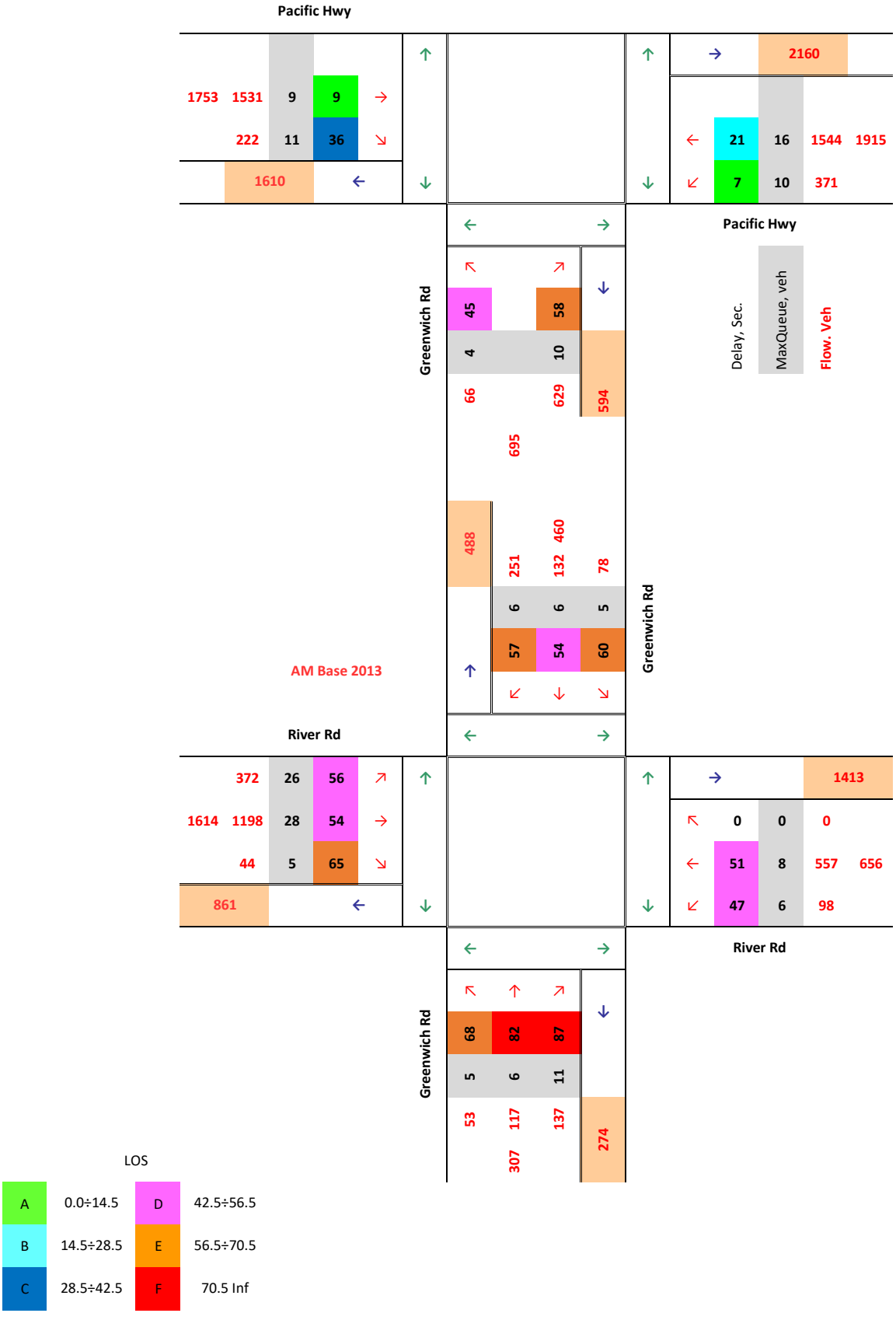
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

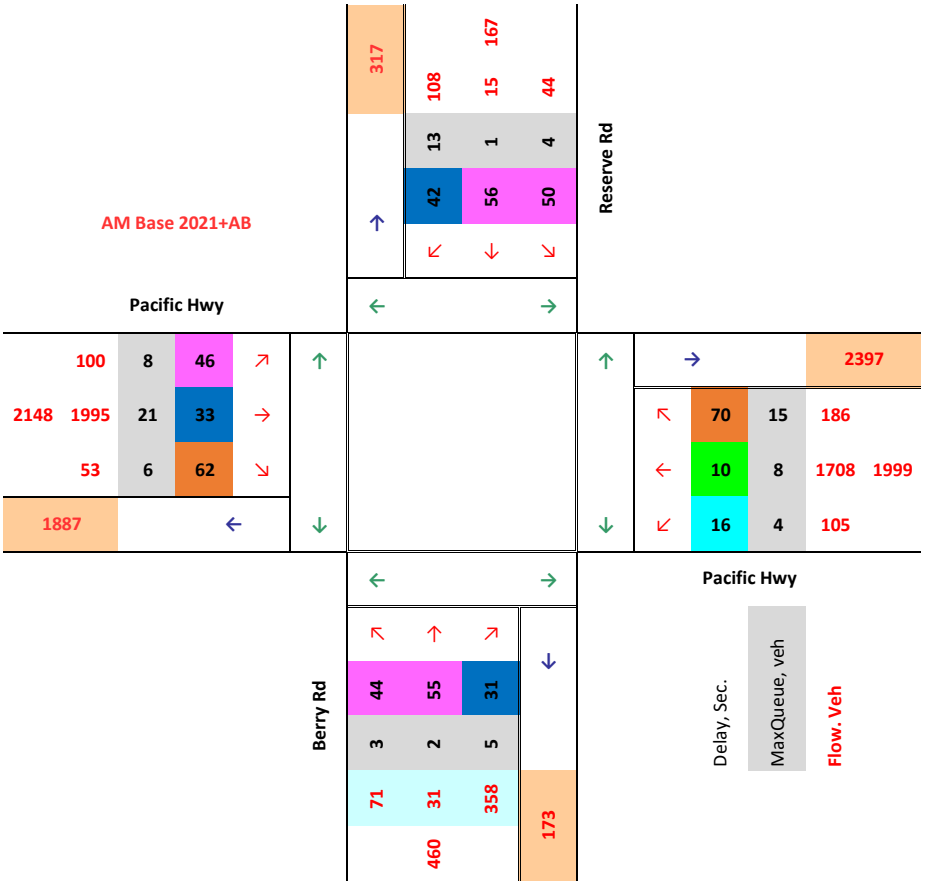


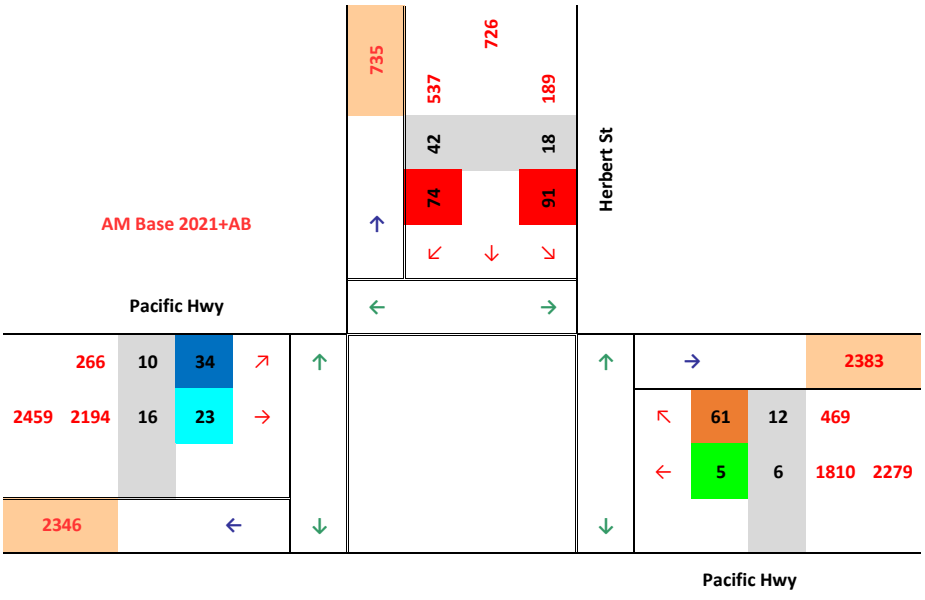
LOS

A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

AM Base 2021+AB

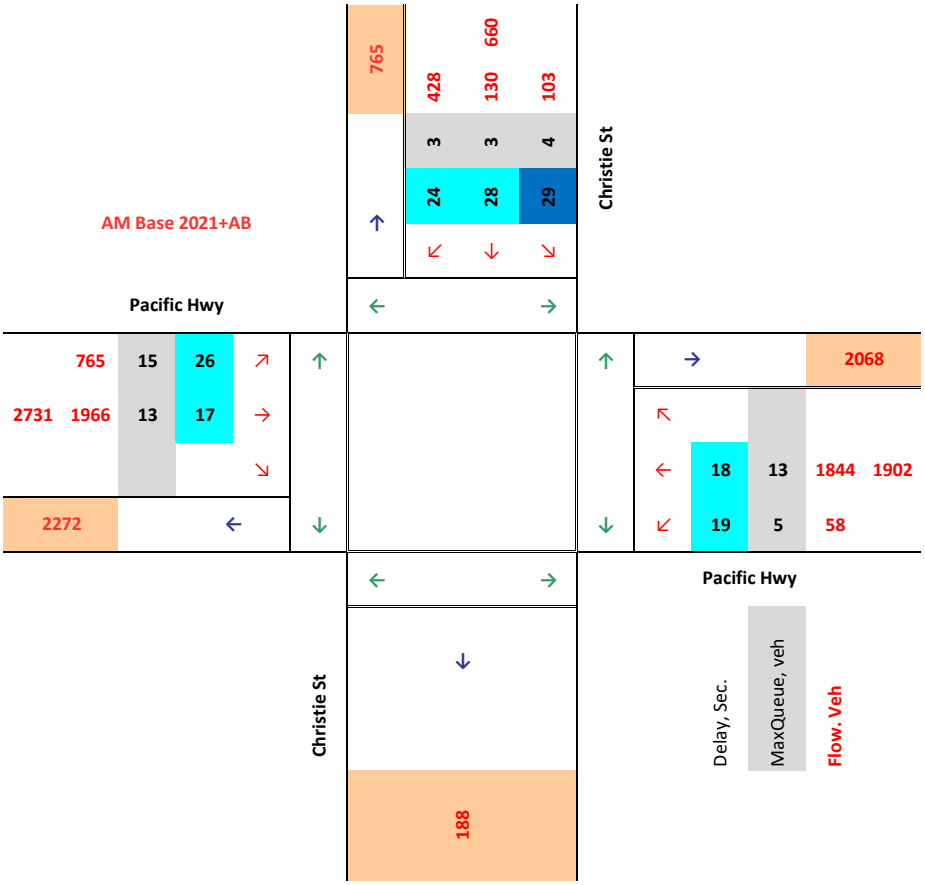


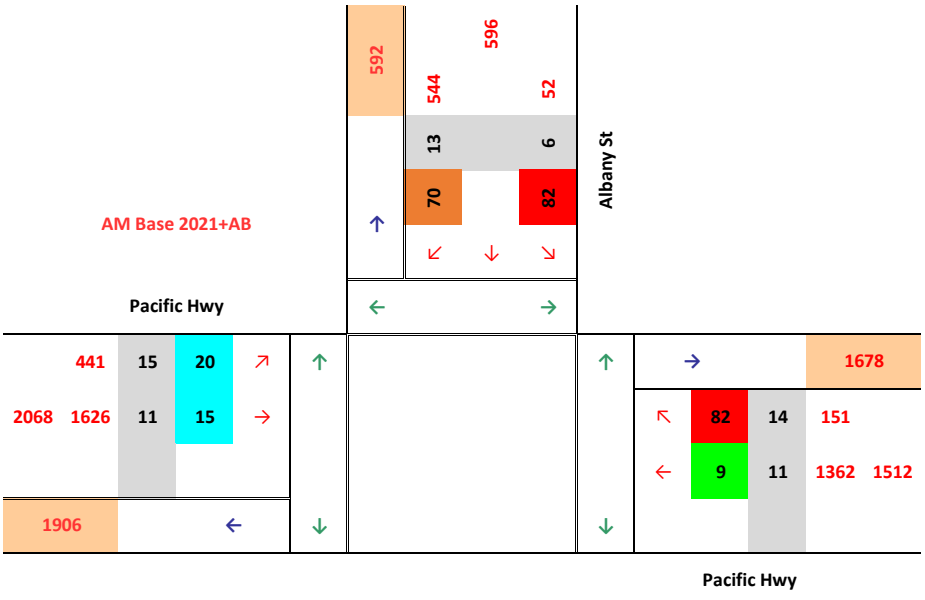




LOS

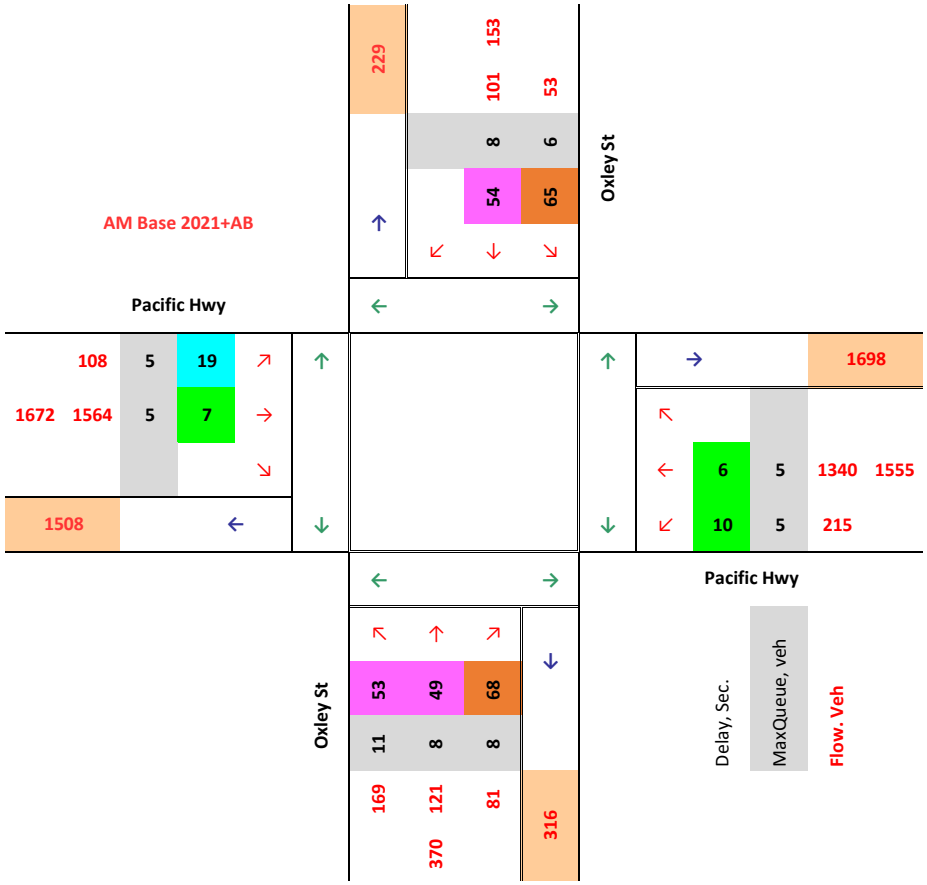
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

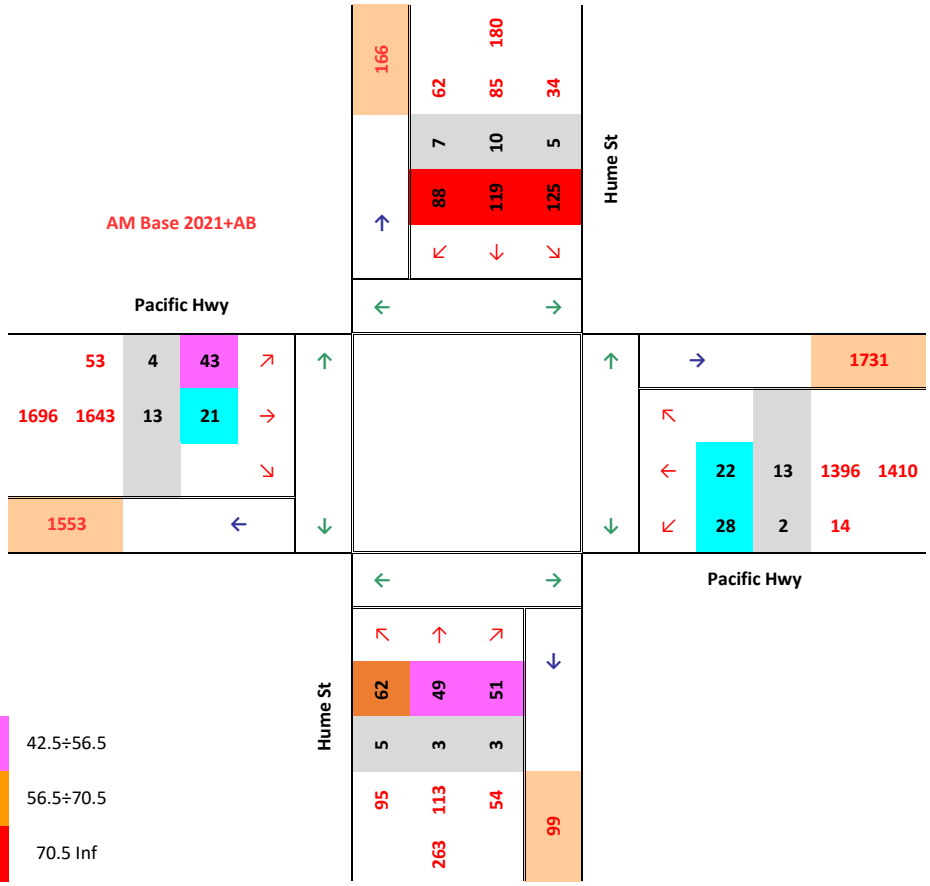




LOS

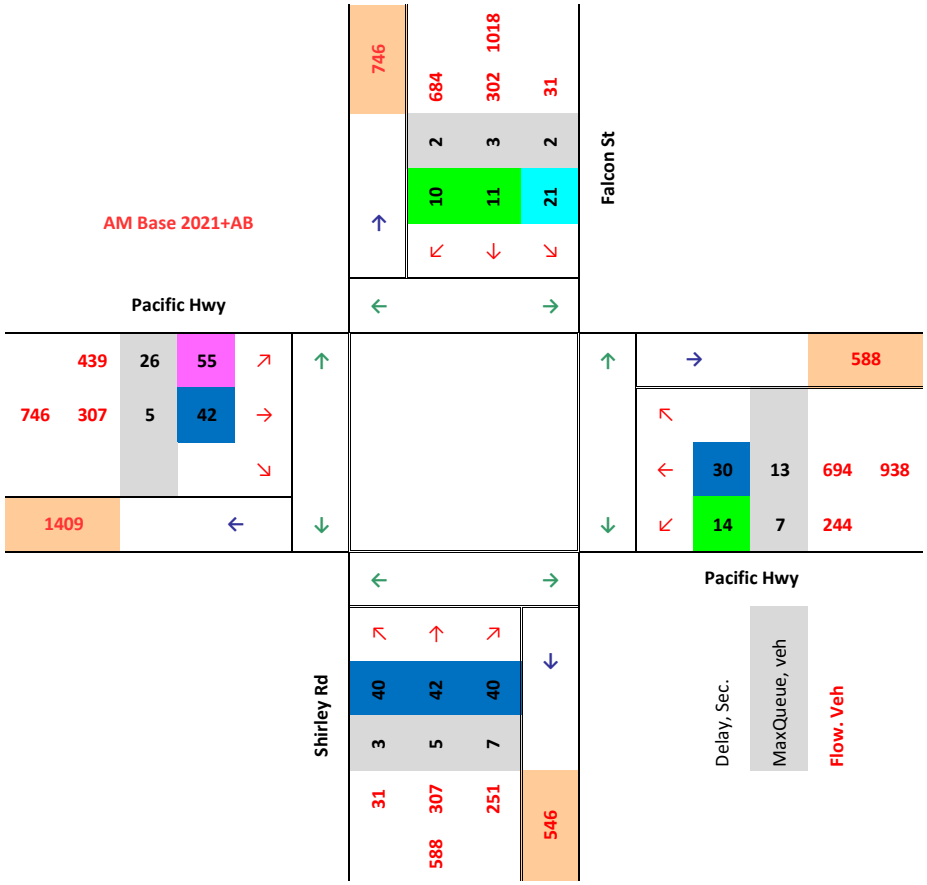
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

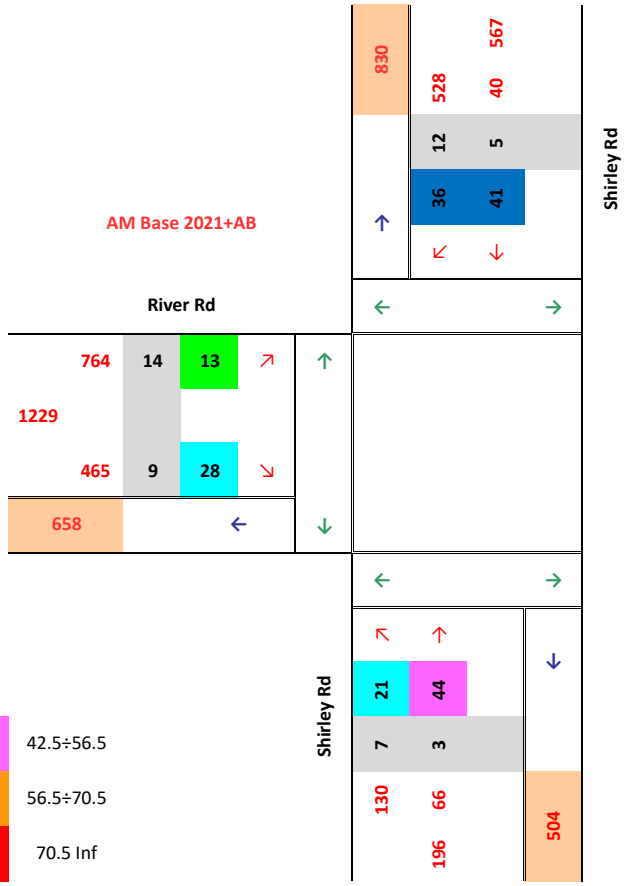




LOS

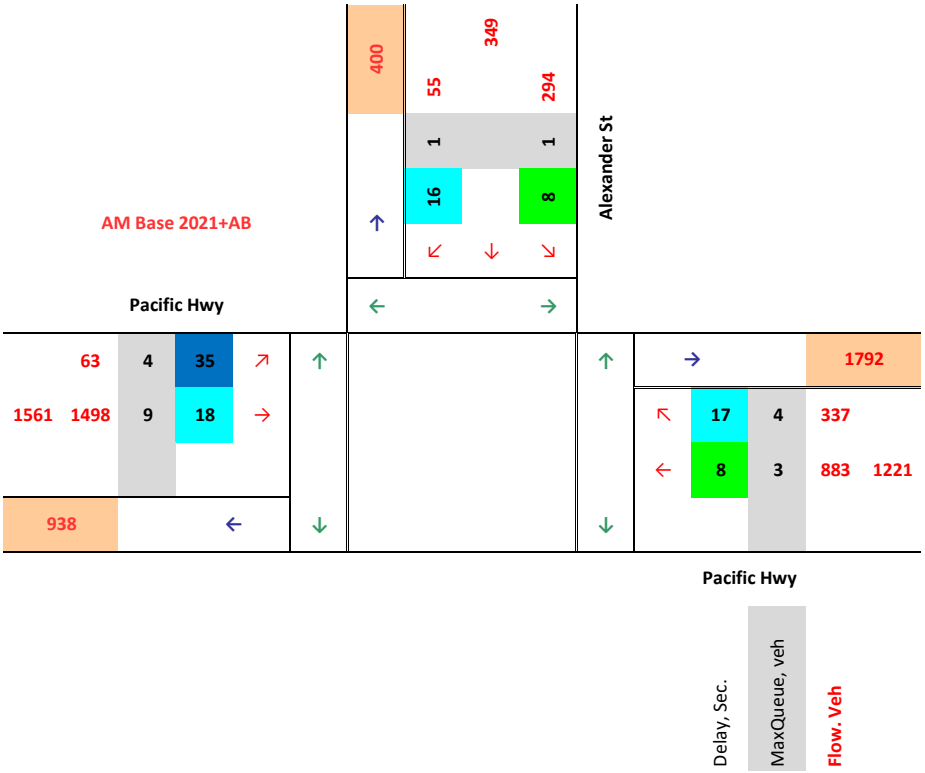
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

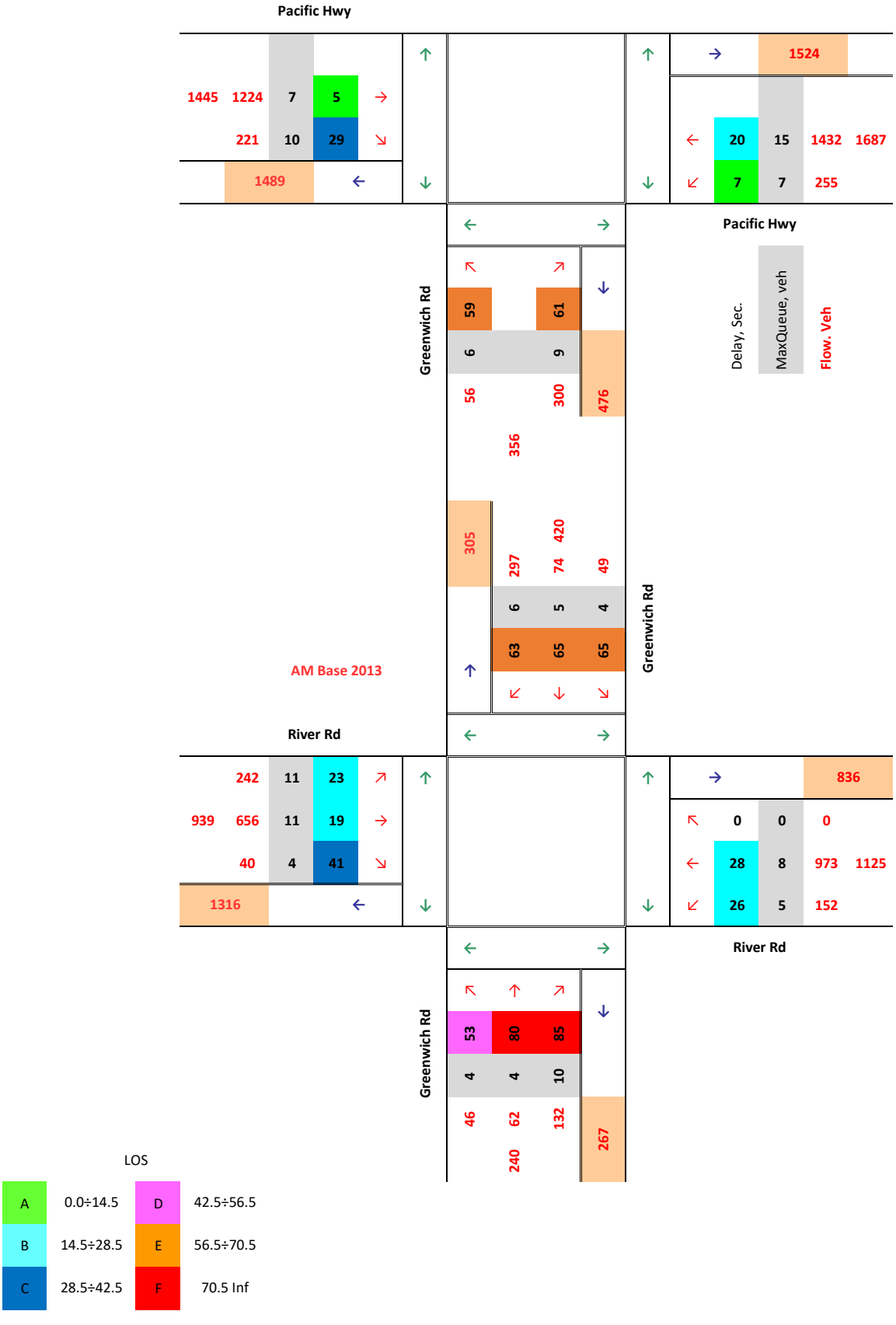
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf



LOS

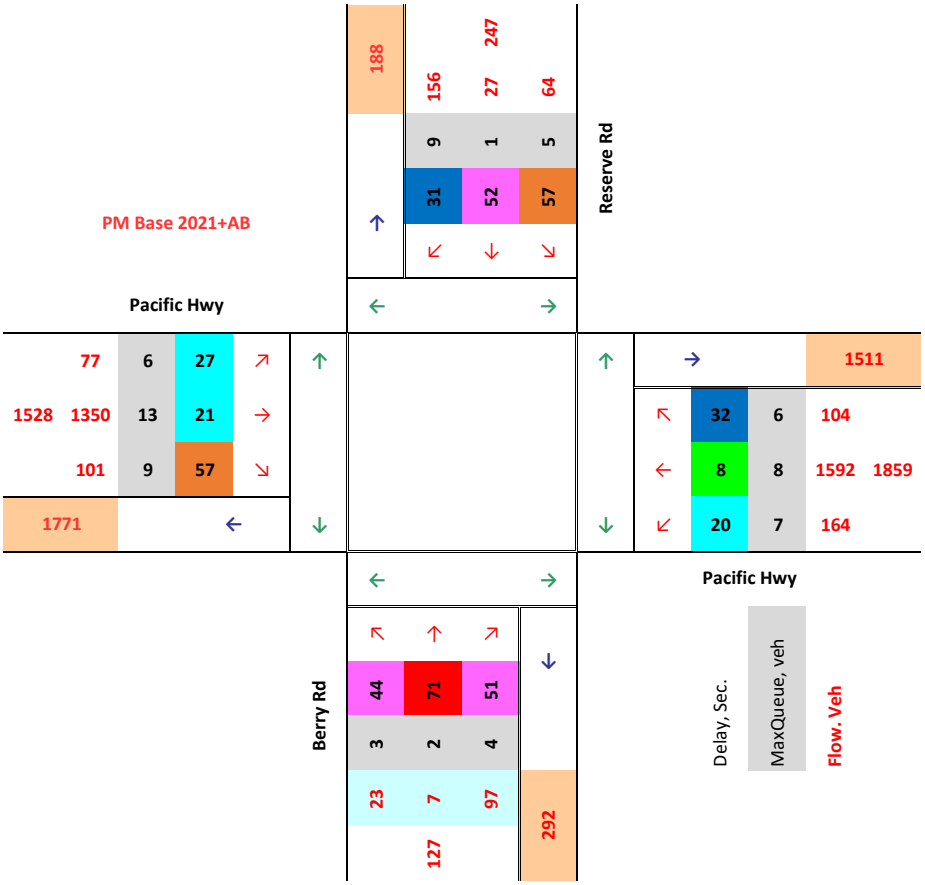
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

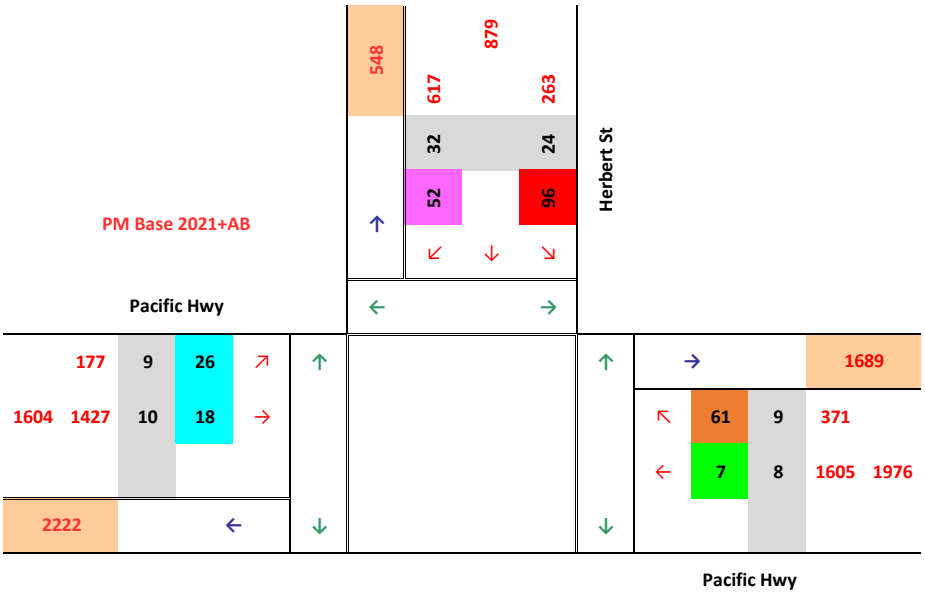
PM Base 2021+AB



LOS

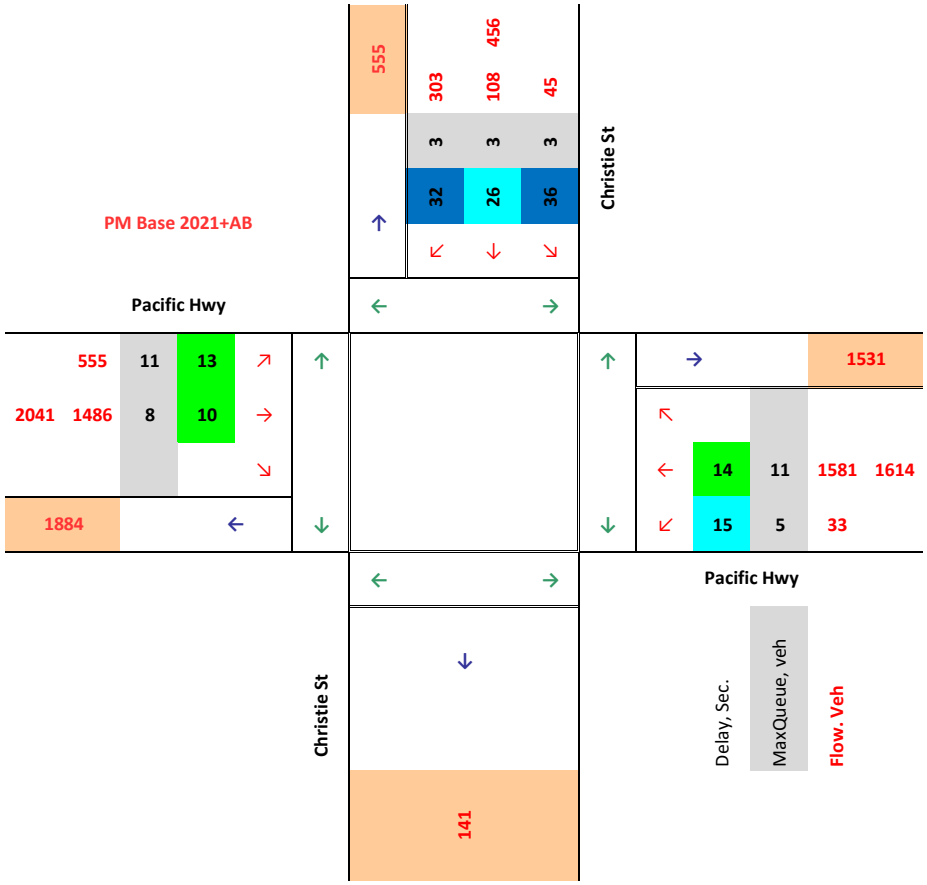
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

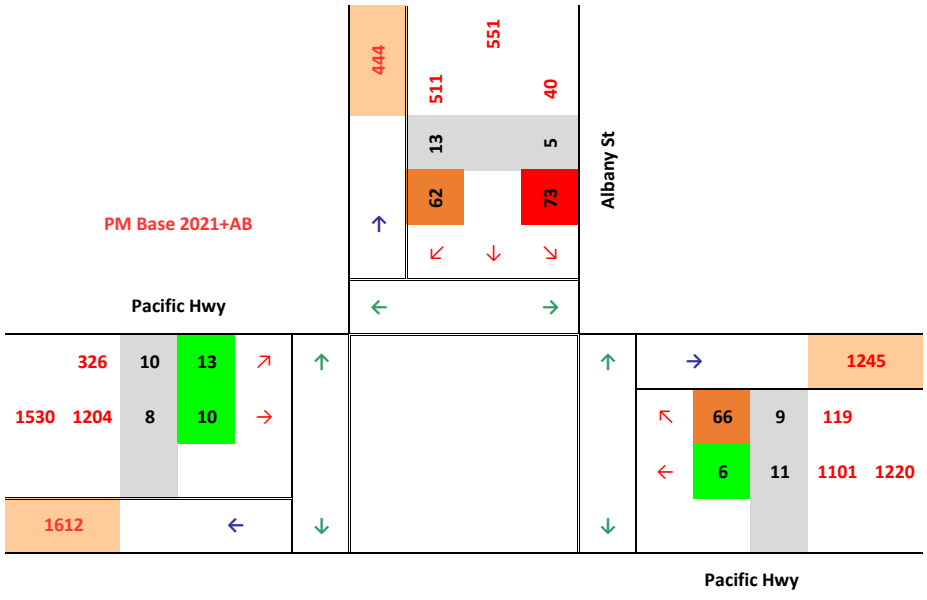




LOS

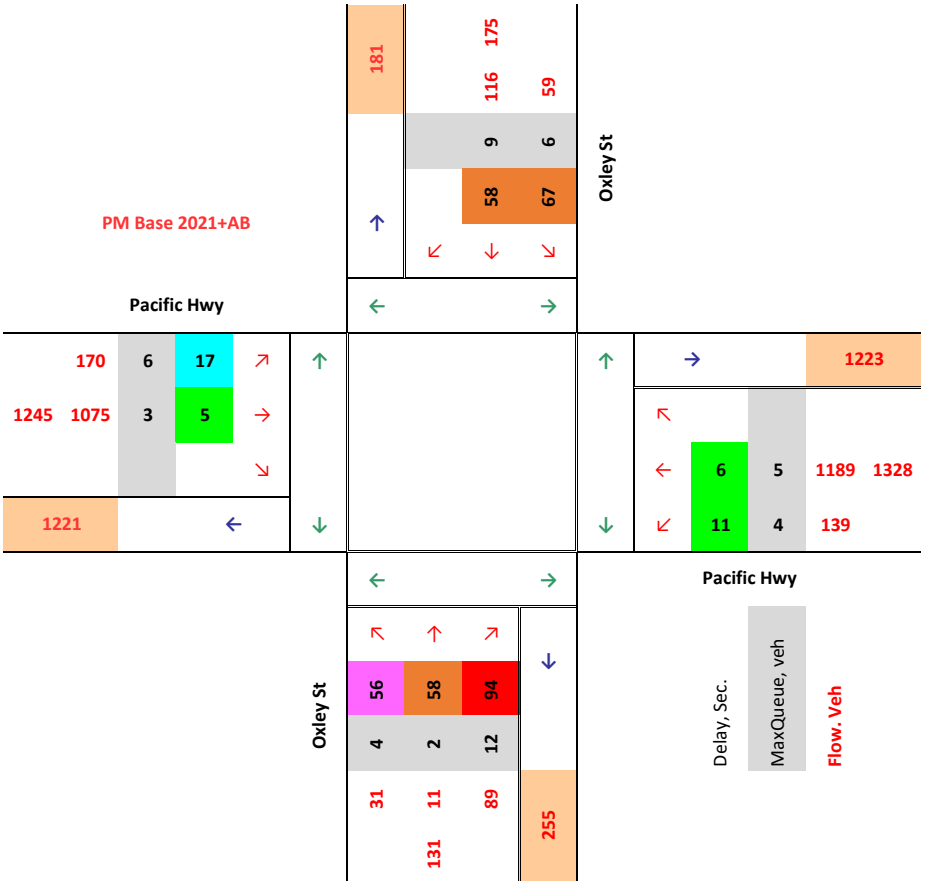
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

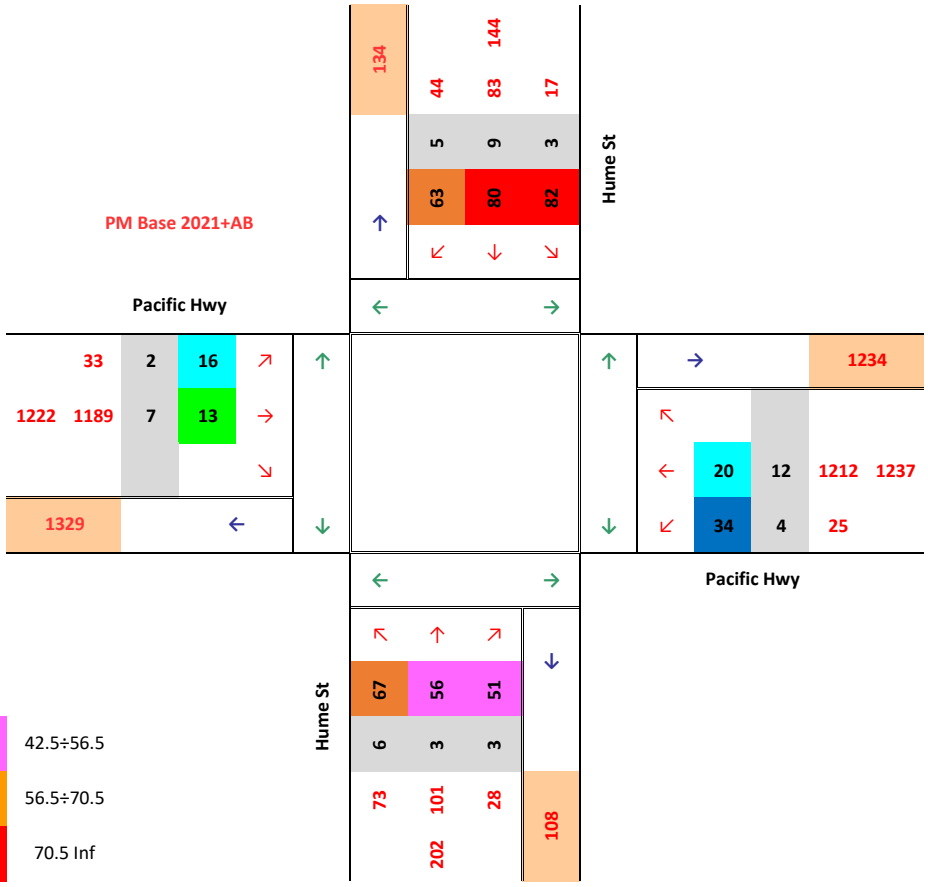




LOS

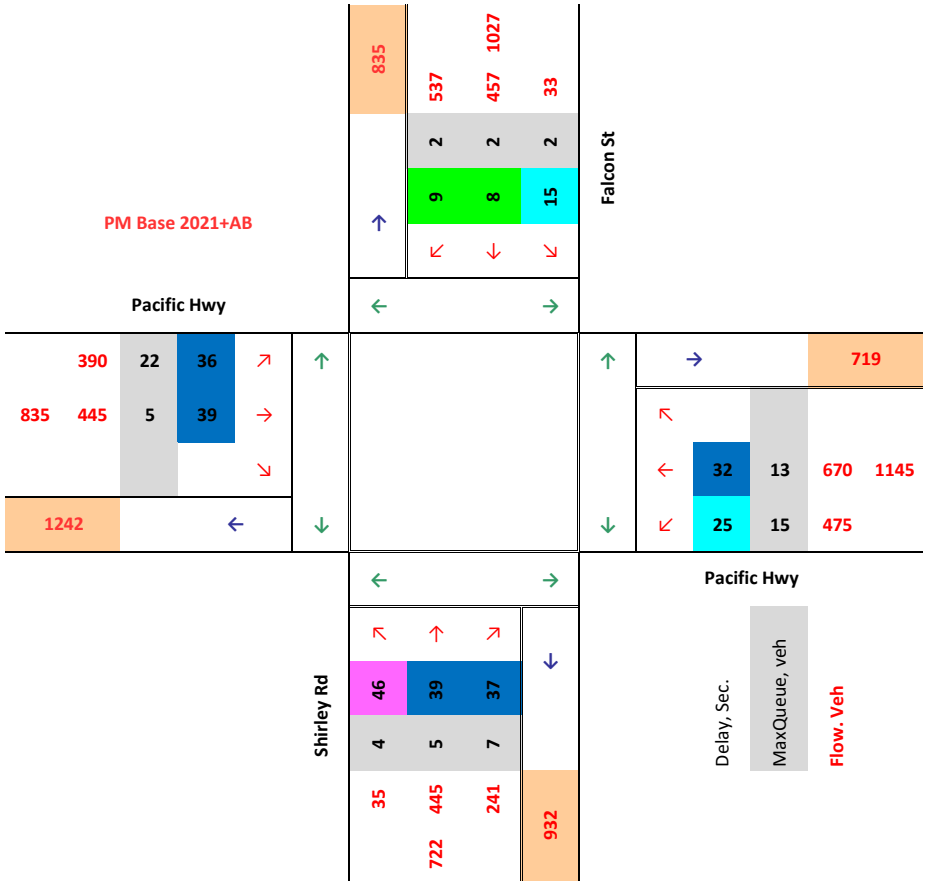
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

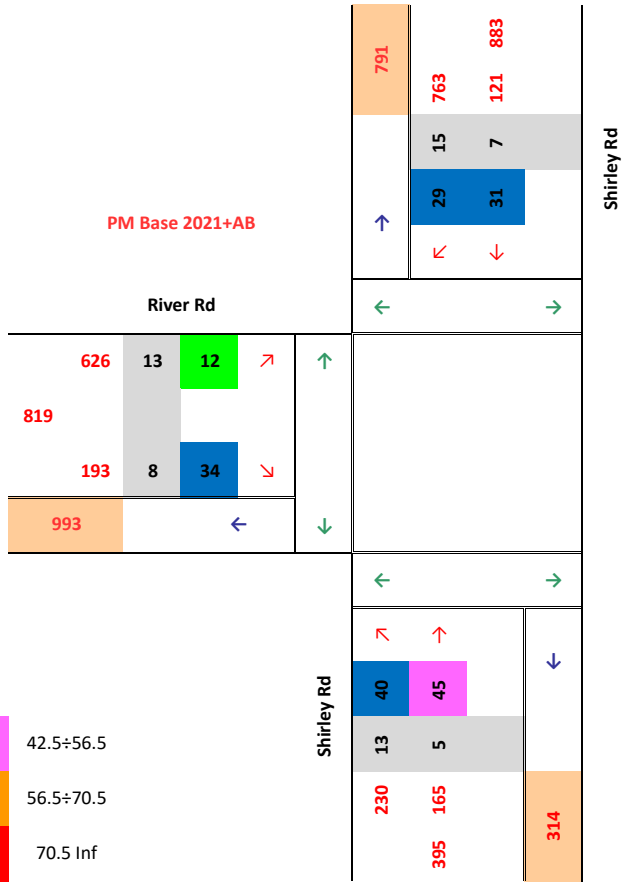




LOS

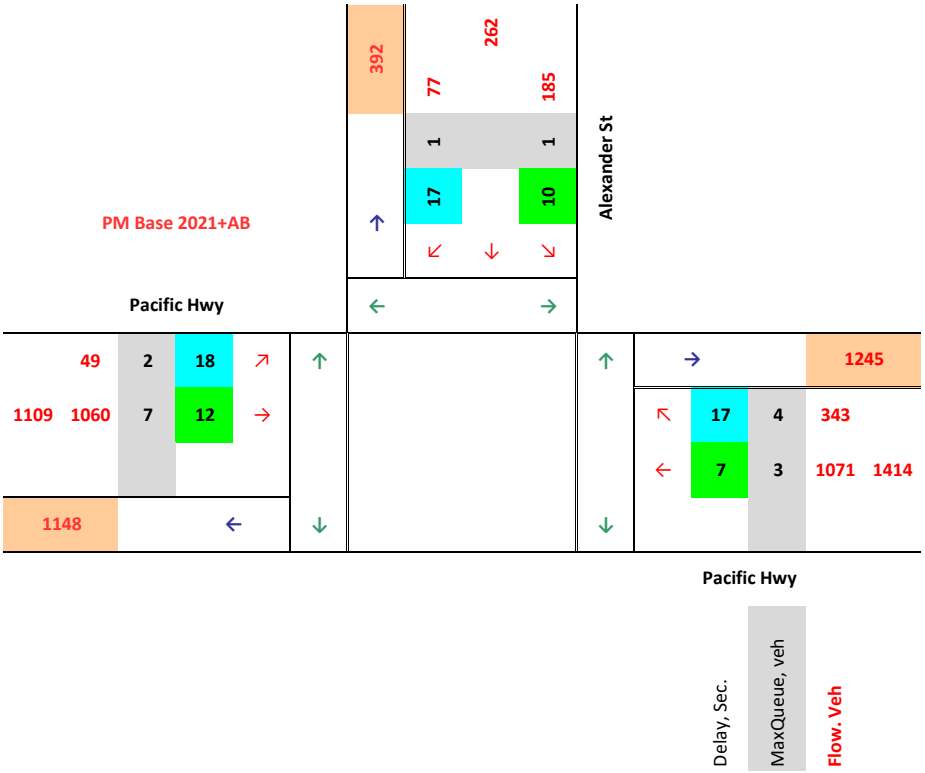
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

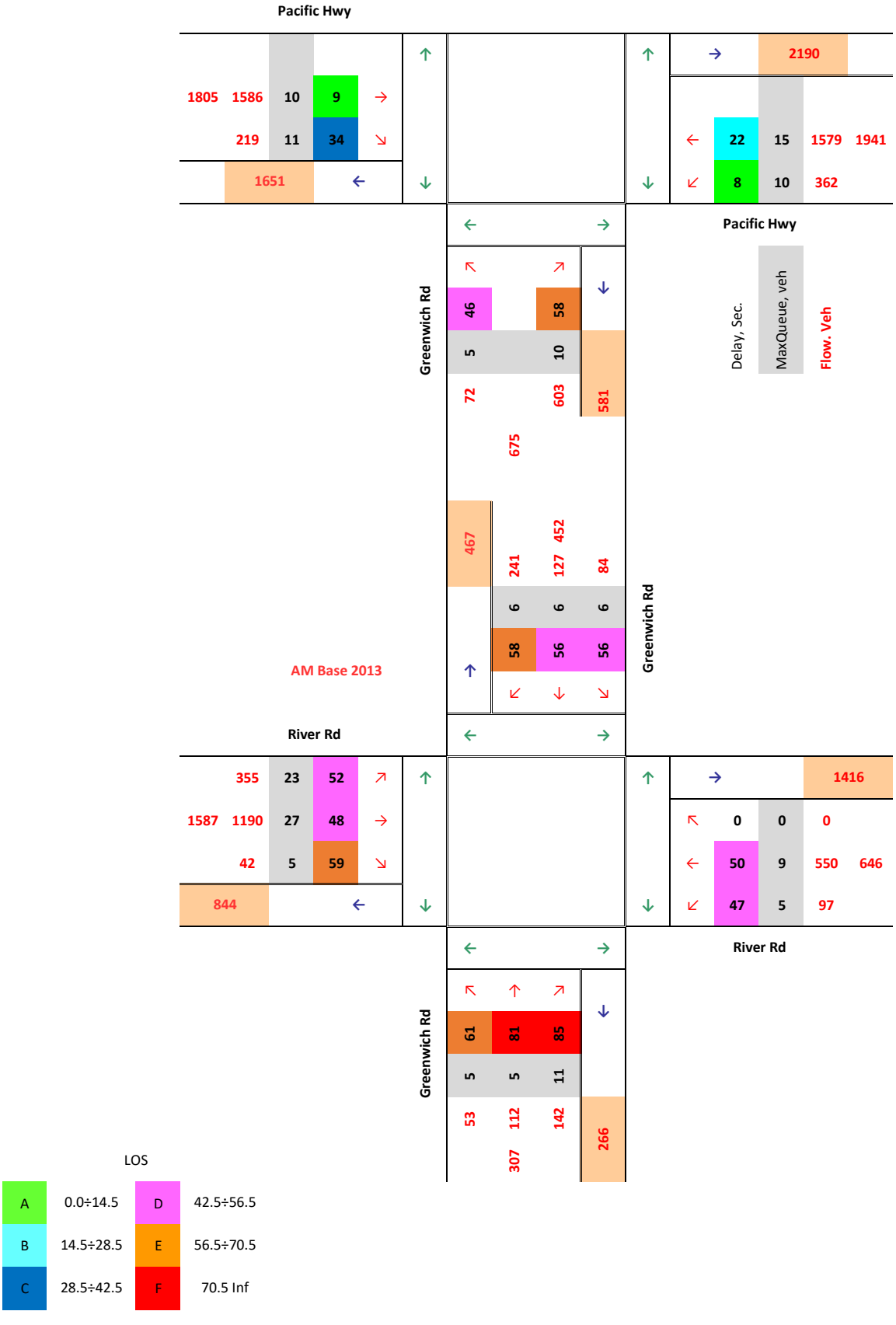
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf



LOS

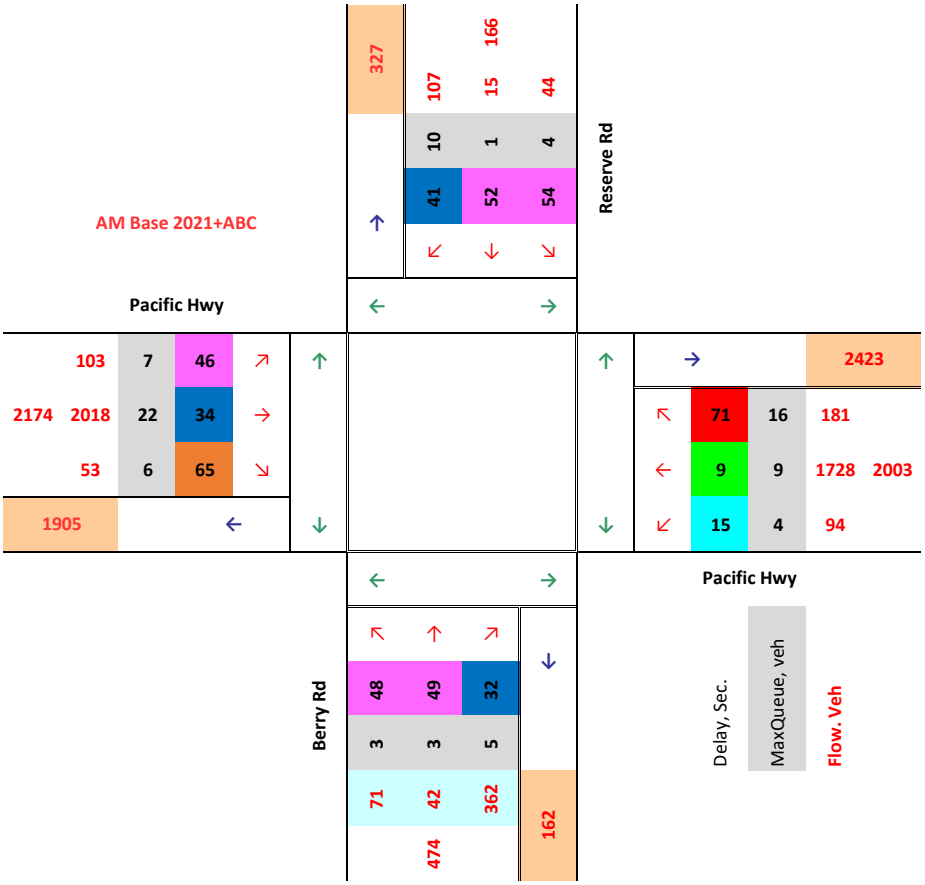
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

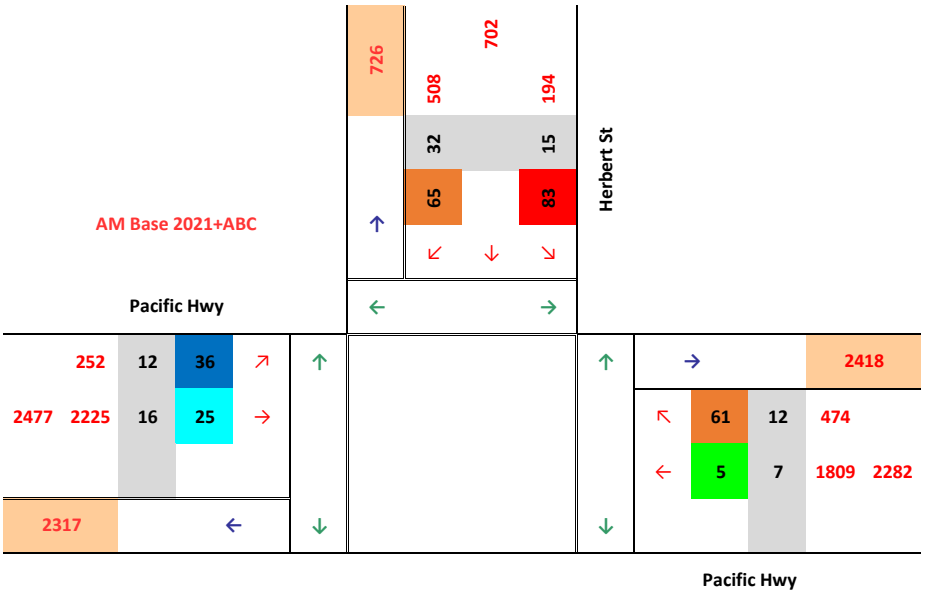
AM Base 2021+ABC



LOS

A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

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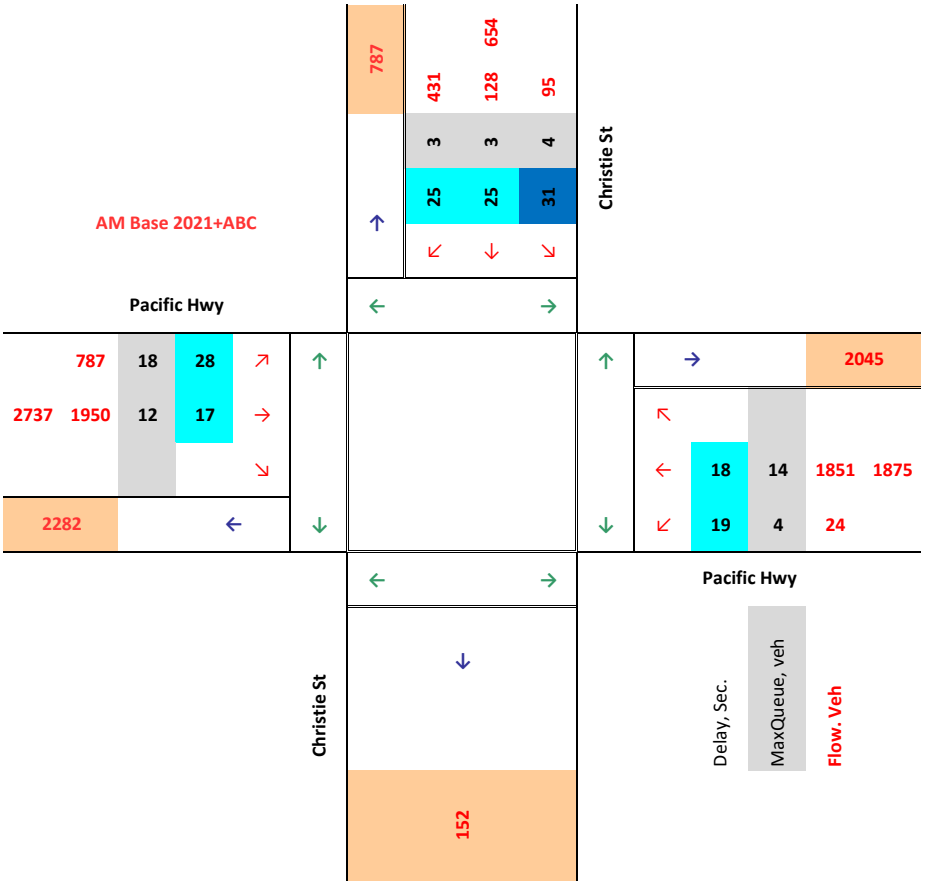
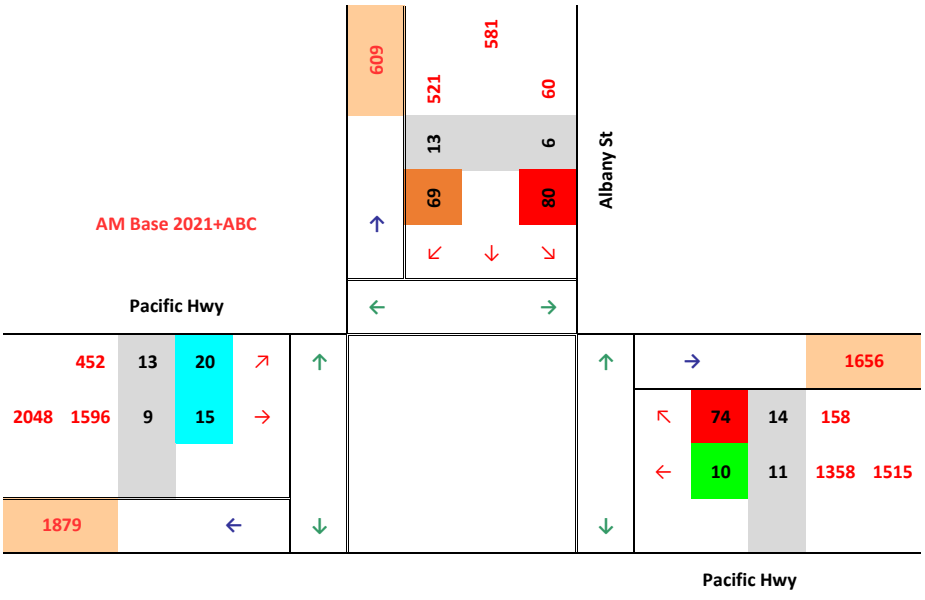
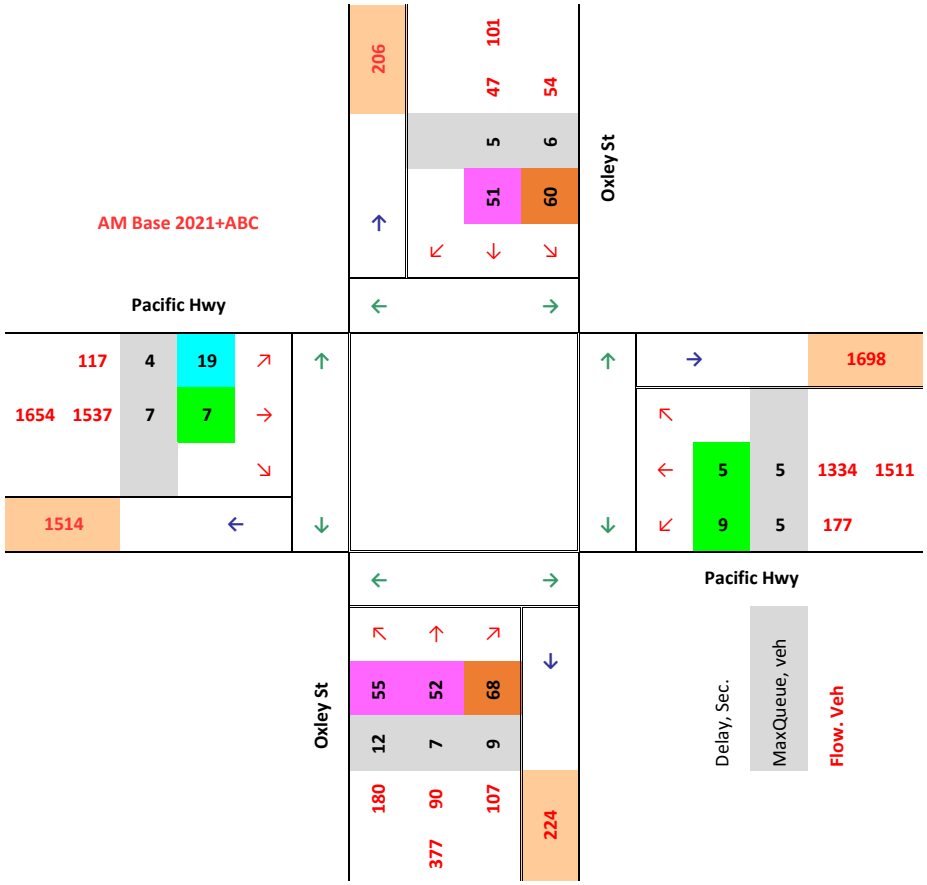
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

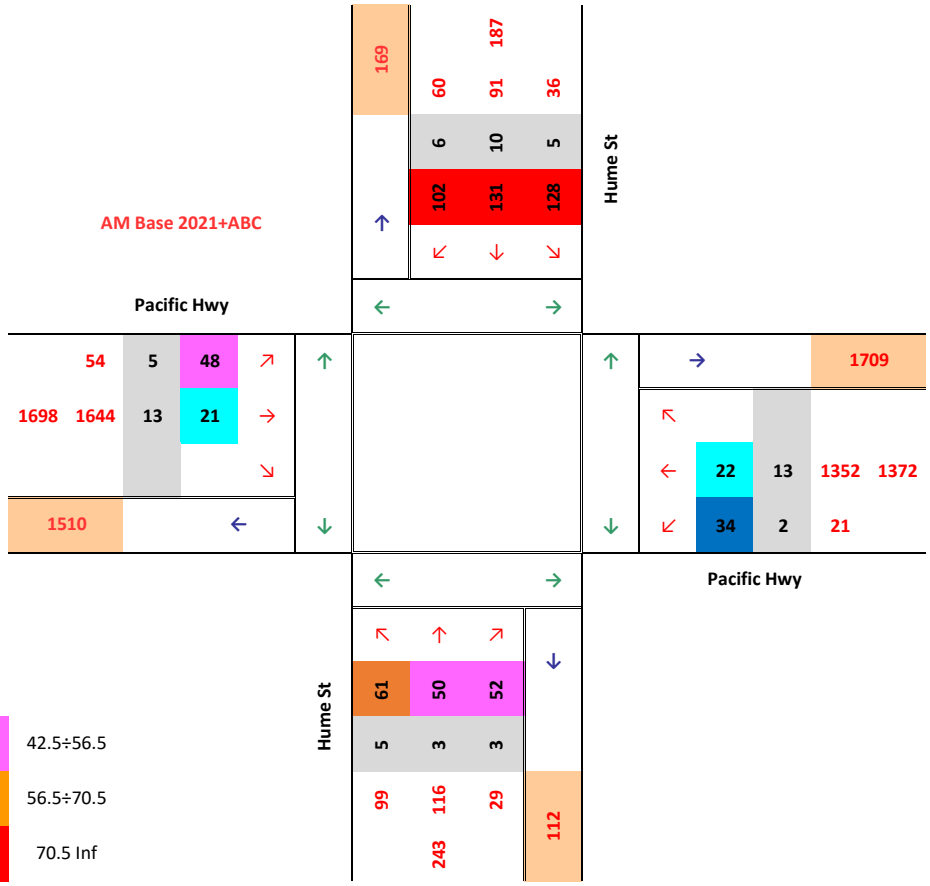




LOS

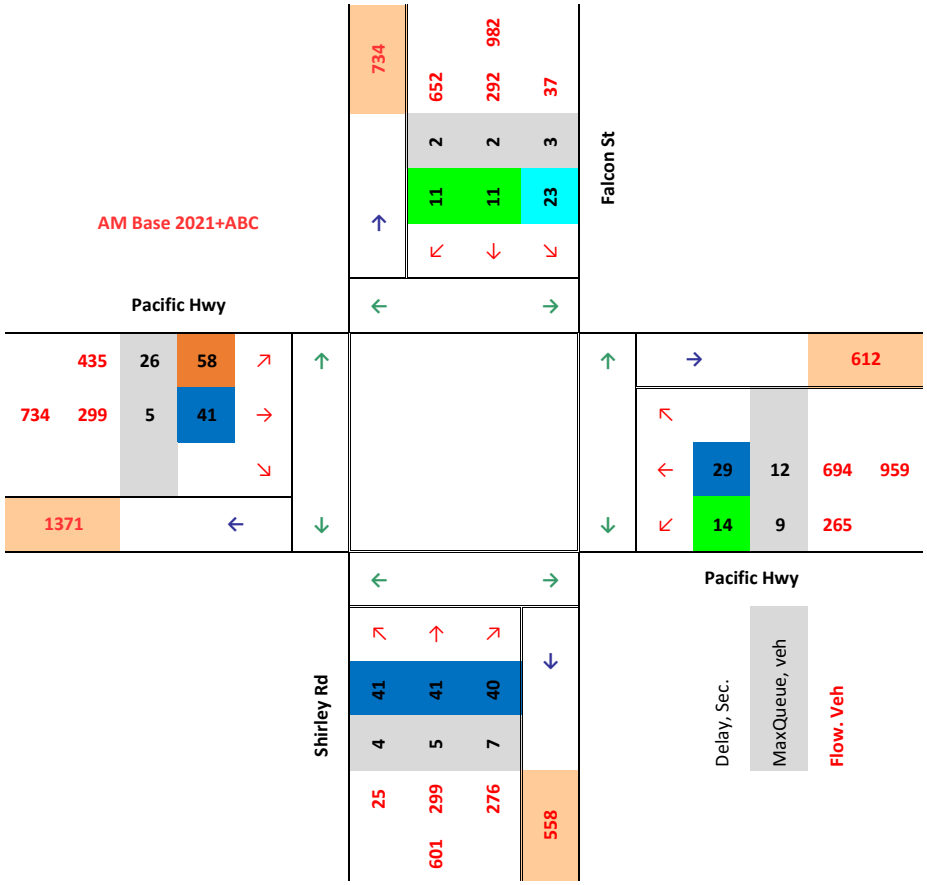
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

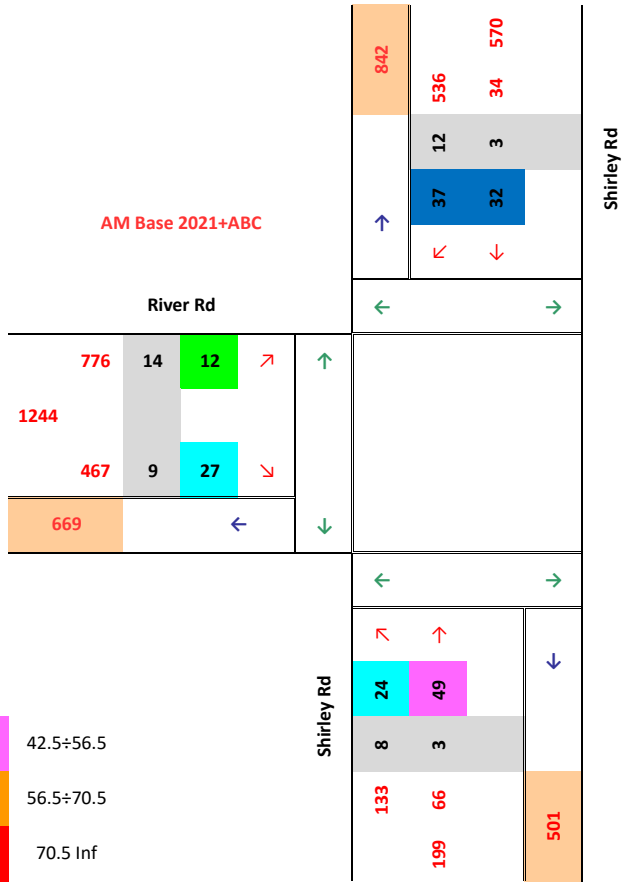




LOS

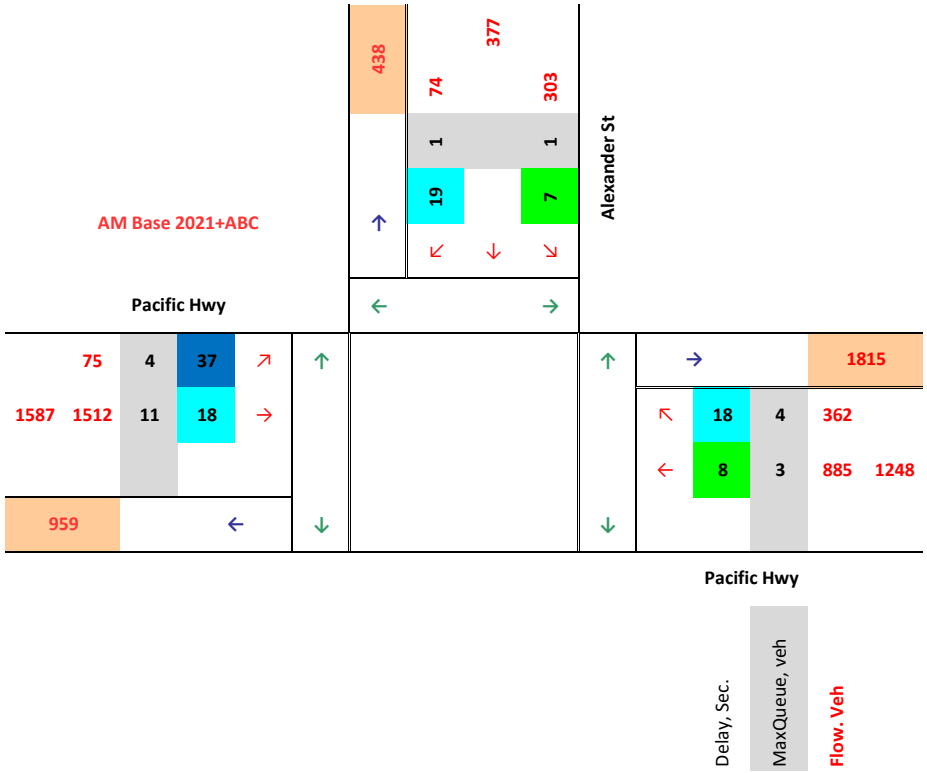
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

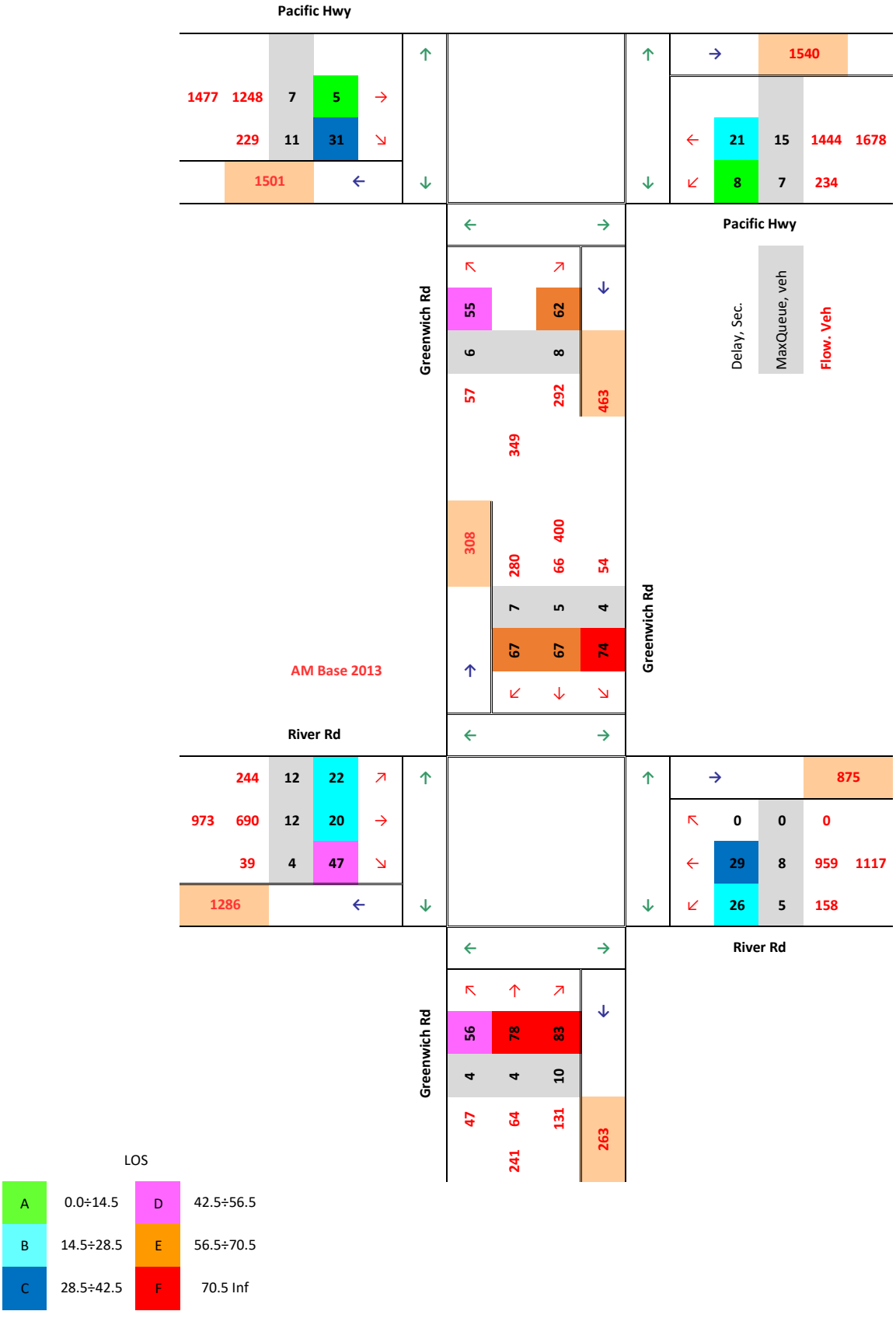
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf



LOS

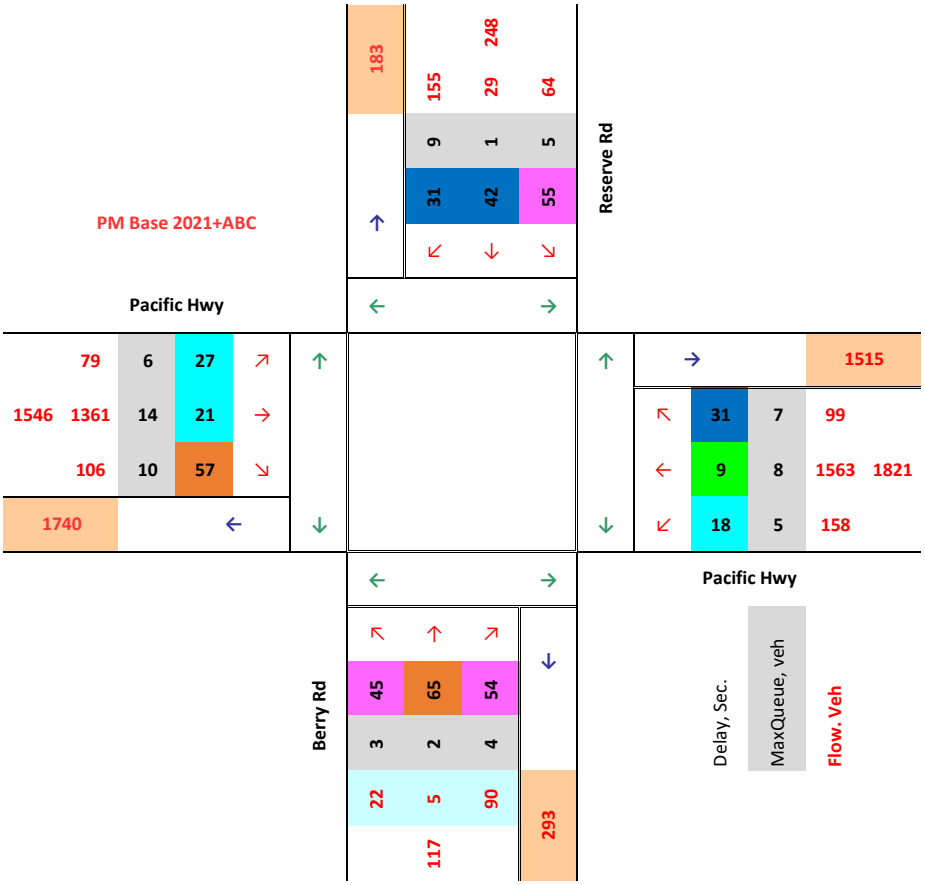
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

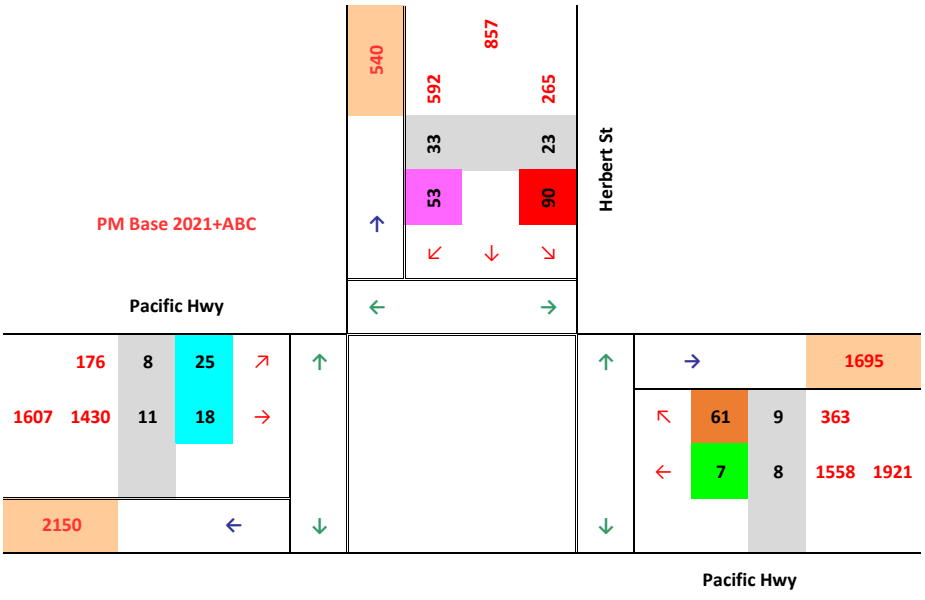
PM Base 2021+ABC



LOS

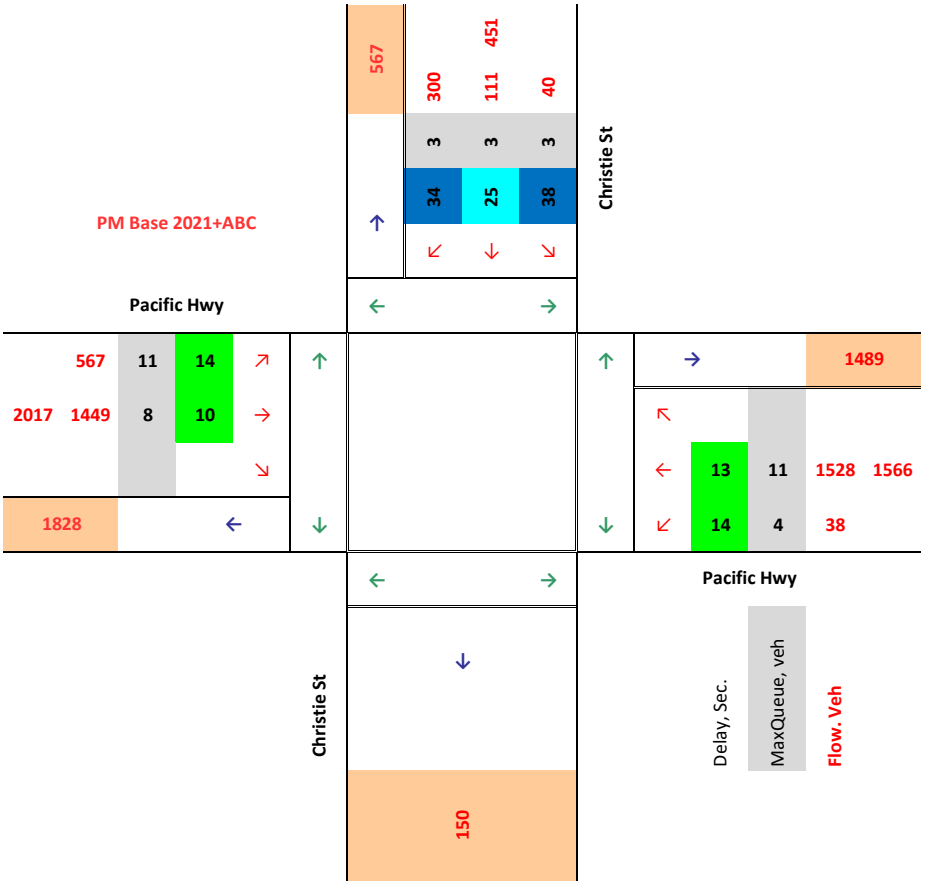
A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf

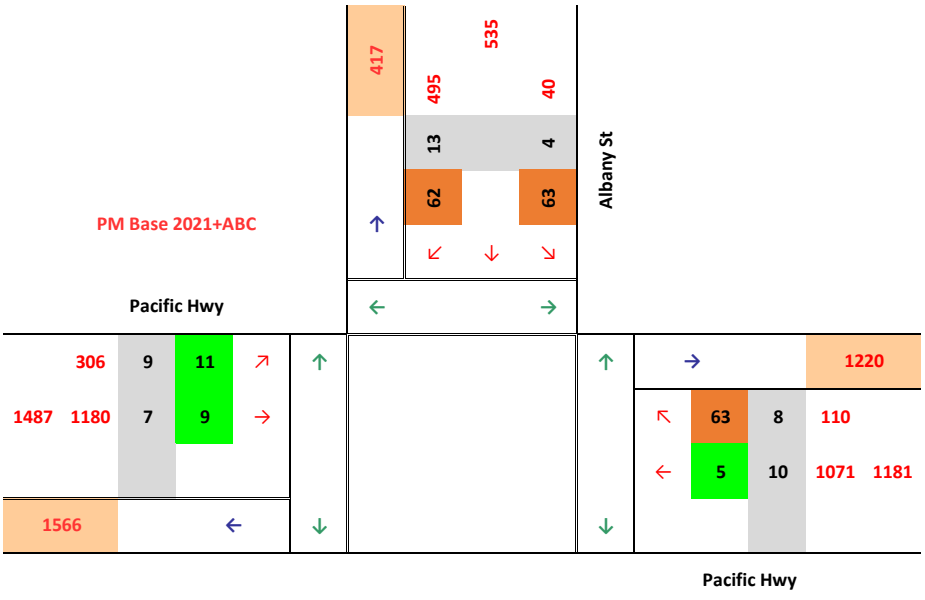




LOS

A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
C	28.5÷42.5	F	70.5 Inf





LOS

A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
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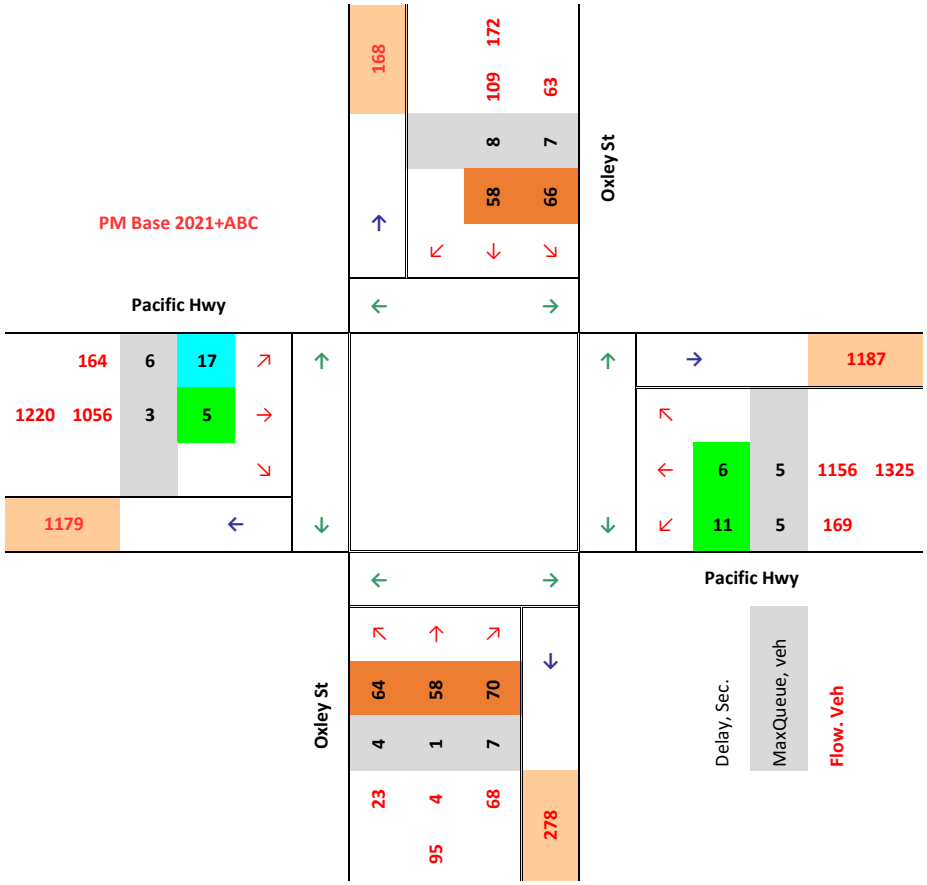

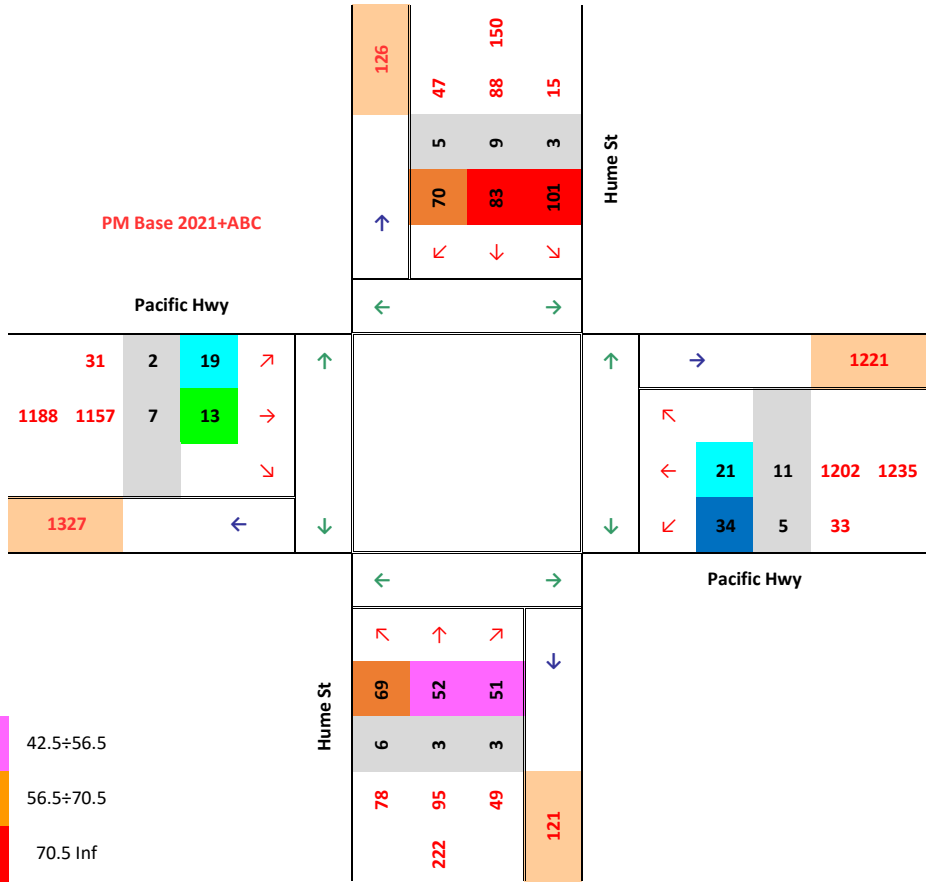

LOS

A	0.0÷14.5	D	42.5÷56.5
B	14.5÷28.5	E	56.5÷70.5
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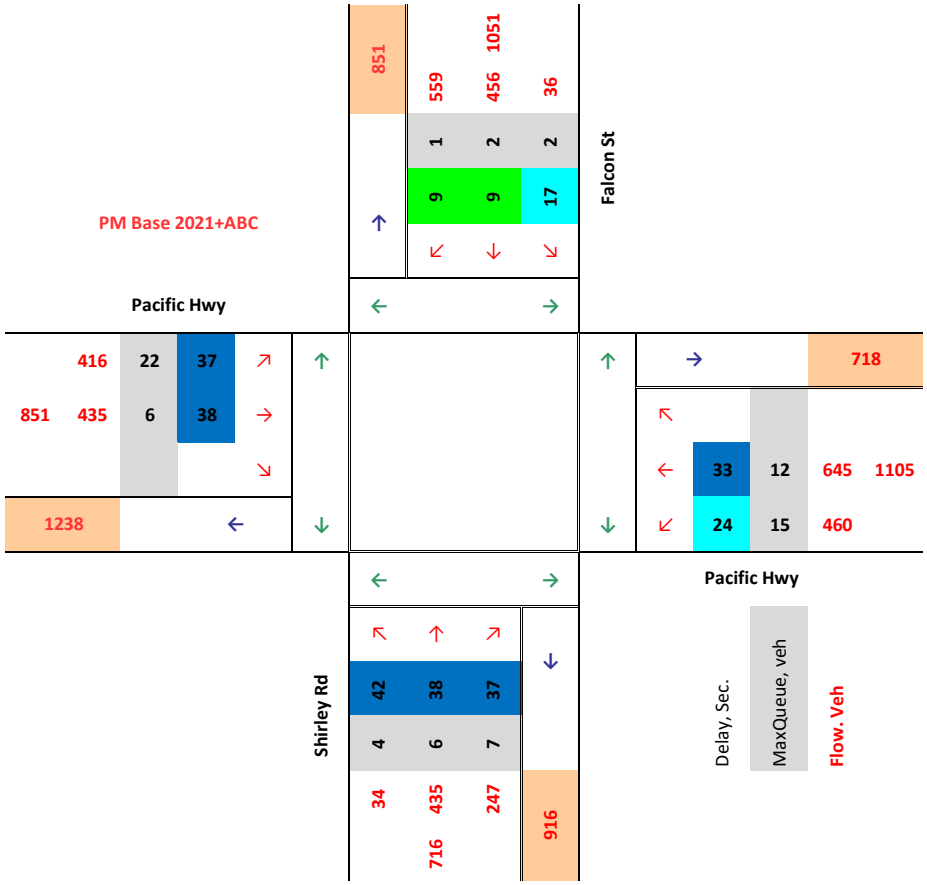

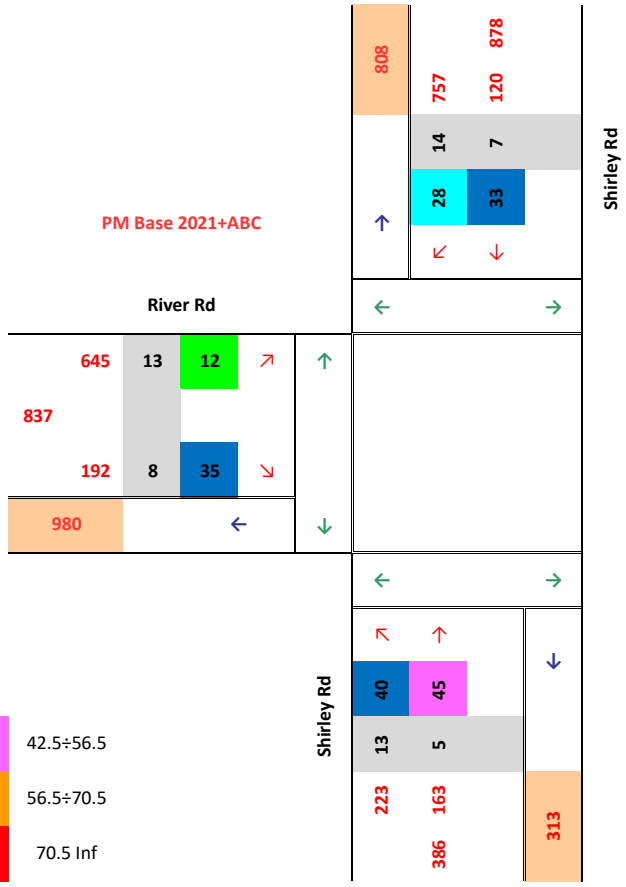

LOS

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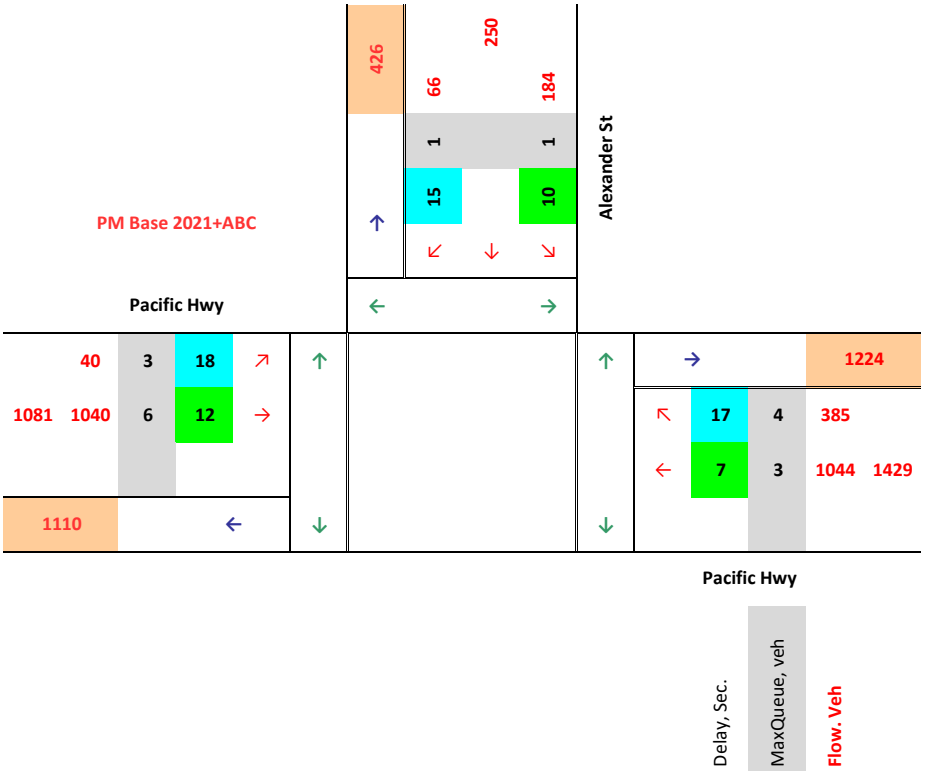

LOS

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