ROAD DELAY SOLUTIONS

North West Growth Centre
Indicative Layout Plan Revision

Traffic and Transport Model
Year 2036

Prepared in association with...

URBANHORIZON

for

NSW GOVERNMENT
Department of Planning

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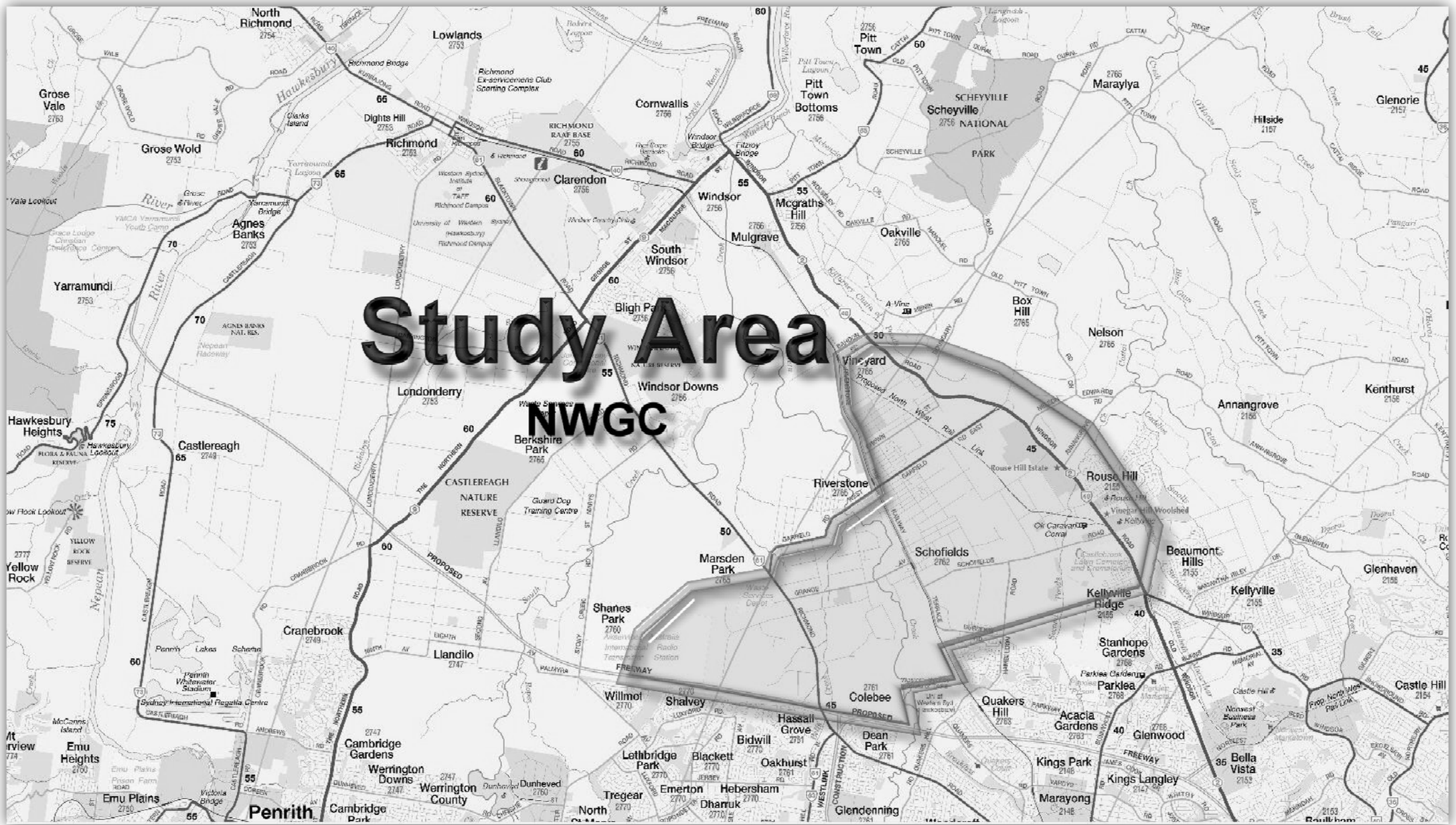

DOCUMENT STATUS

D:\Documents and Drawings\Marsden Park\2008 Transport Study\Report\GCC 2009\Infrastructure Scenario Model.docx

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TABLE OF CONTENTS

ABSTRACT

Road Delay Solutions has been engaged by Urbanhorizon Pty Ltd, on behalf of the Department of Planning, NSW, to undertake strategic modelling and review of the Indicative Layout Plans (ILP) for Riverstone and Alex Avenue, with respect to the possible revision and timing of infrastructure.

The Riverstone and Alex Avenue ILPs proposes a framework of improvements to the local and arterial road networks to sustain the level of planned development growth through the North West Growth Centre (NWGC).

The modelling is to be utilised in qualification of impacts resulting from the ILPs and provide a basis for further enhancement of infrastructure to meet community and regional expectations and needs.

The modelling performed, considers the implied impacts and incorporates the recommendations from previous studies, undertaken by Road Delay Solutions Pty Ltd, and ratified by Growth Centres Commission and DoP. These former studies include...

- *'North West Growth Centre Study', Urbanhorizon, 2008*, and
- *'Marsden Park Master Plan'*, ARUP 2009.

1 STRATEGIC OBJECTIVES AND TASKS

GENERAL

The purpose of this strategic report is to provide traffic flow projections associated with revision to the Riverstone and Alex Avenue ILPs.

Based on agreed data and model input parameters, the principle tasks, as directed by the Department of Planning (DoP), are outlined below...

- Update the traffic model with the road network as shown on the exhibited draft ILP, including intersections with restricted movements (eg. Westminster and Railway Terrace).
- Run the model above with the Westminster rail bridge removed, and assess how traffic is redistributed across the network as a result. Identify any changes to other roads that would be required as a result. Identify the required classification of Westminster (collector or sub-arterial).
- Include Bandon Road as a sub-arterial (if not already done).
- Run the model without the Edmund/Loftus intersection... what does this do to traffic volumes esp. heavies on surrounding roads, including Hamilton, McCulloch etc? Can we define a threshold in terms of timing for when the Edmund-Clark-Oak route through to Hambledon would need to be constructed (to avoid too much traffic using Hamilton-McCulloch or because of congestion on Windsor Road).
- Can we look at what the effect would be on use of McCulloch-Boundary as a route from the north of Riverstone Precinct through to Schofields Road if we were to not make a direct link between McCulloch and Boundary (ie keep the intersections in their current locations at Westminster?
- Does Riverstone Road need to cross First Ponds Creek or is it's role served by Garfield and Westminster?
- Changes are proposed on Schofields Road, in particular removal of the intersection into the Alex Avenue Precinct between Railway Terrace and Junction Road, and potential replacement with on/off ramps at Railway Tce. Further advice is needed on this from DoP, but please factor into any re-run of the model.
- Once all above changes are tested and agreed, run the model on a final draft road network to test it works as we expect.

Figure 1 : Riverstone Precinct Indicative Layout Plan

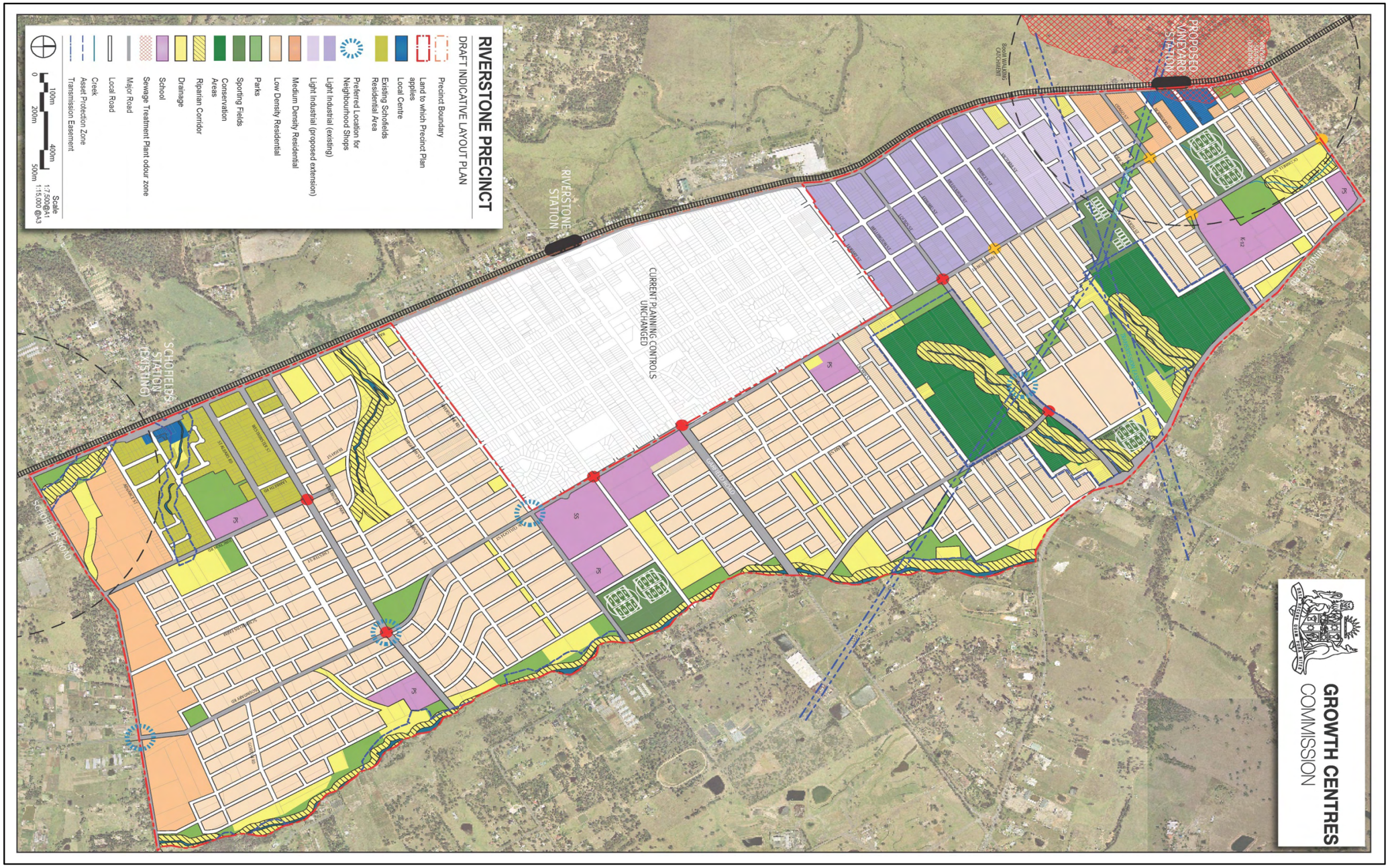
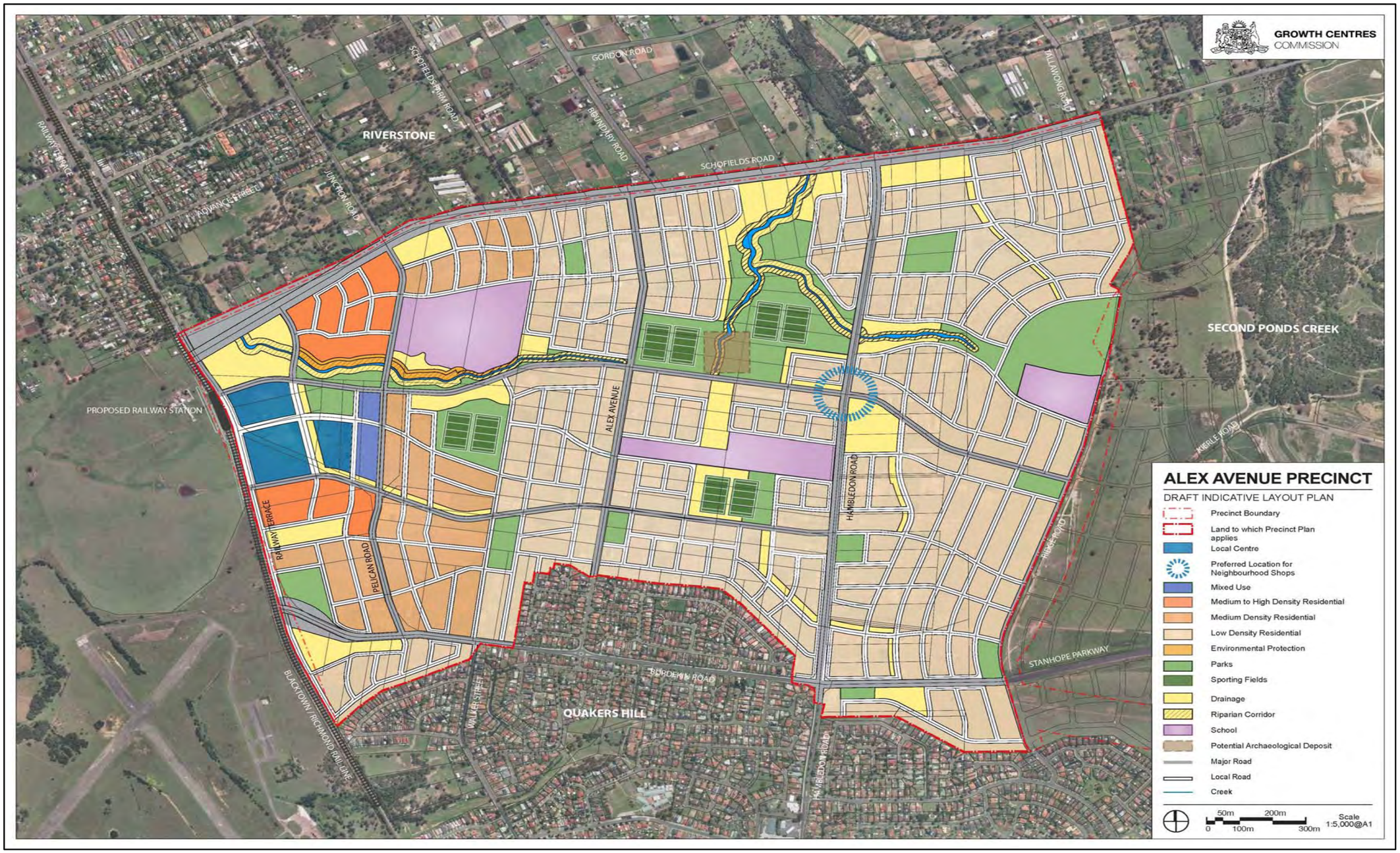


Figure 2 : Alex Avenue Precinct Indicative Layout Plan



PLANNING POLICIES AND GUIDELINES

Planning Provisions - SEPP No. 59 – Central Western Sydney Economic and Employment Areas

State Environmental Planning Policy No.59 (SEPP 59) presents guiding principles for sustaining efficient transport with future developments and the requirements to be met in the preparation of a long-term transport plan. The aims of the policy include...

- *"promote economic development and the creation of employment in Western Sydney by providing for the development of major warehousing, industrial, high technology, research or ancillary facilities with good access to the existing and proposed road freight network, including the M4 motorway and the Westlink M7".*
- *"provide for the optimal environmental and planning outcomes for the land to which the policy applies by helping to achieve the goals set out in Action for Air, to contain the per capita growth in VKT (vehicle kilometres travelled) by achieving higher than normal public transport usage."*

The policy states that in developing Precinct plans, attention must be given to the following relevant issues that expand on the foregoing general provisions...

"A transport plan should be prepared that addresses the following...

i) roads, transit ways, and provision for walking and cycling, both within the Precinct and off site linkages,

ii) freight transport provisions, including initiatives for integrating freight handling within the precinct, and maximising opportunities for synergies between industries with regard to materials handling,

iii) the relationship between the staging of development and the provision of transport infrastructure,

iv) ways, including the design and layout of the proposal, in which the mode split to public transport, cycling and walking is to be increased above levels typical of areas surrounding the development. It is expected as a minimum that the proposal demonstrates that...

iv) the mode split of "cars as driver" for the journey to work can be reduced by at least 10% (eg from 75% down to 65%) compared to existing surrounding areas, and

- *the total VKT (vehicle kilometres travelled) to be generated by the proposed development should be reduced by at least 5% below that which would be generated by a 'conventional' approach to development, and*

v) funding proposals for the development of transport infrastructure."

Metropolitan Planning Strategies - Employment Lands for Sydney Action Plan, 2007

The strategic framework in '*City of Cities Metropolitan Strategy, a Plan for Sydney's Future'*, dictates transport systems and urban structures with equitable access to jobs, services and leisure.

It also identifies the priority outcomes and presents the key policies and actions to achieve them. The regional strategy bridges the gap between local area needs and opportunities and the broader goals of the City of Cities strategy.

The purpose of the Employment Lands Action Plan is to create more job opportunities and stimulate economic growth, providing a cleaner environment, an improved transport network, safe community neighbourhoods and affordable housing. Further, it aims to reduce the growth of private vehicle use and curb urban sprawl.

2 THE STRATEGIC MODEL

The Netanal model utilises defined travel demand between zonal pairs, represented as assimilated traffic movements, throughout the Sydney Metropolitan Area. The program incrementally assigns vehicular traffic onto a, computer based, road network developing link demand forecasts on each modelled section of road.

ROUTE SELECTION

Route selection between zonal pairs is determined on the basis of the shortest travel time or cost, considering the inherent route delays incurred along possible link(s). Parameters such as link capacity, speed and distance are coded into the model, by the user, from which the program determines the relative vehicular delays on each route, selecting, after undertaking a prescribed number of iterations, the route with the shortest travel time. Costs and travel time are relative within the Netanal model. Time penalties are applied to turn movements, stops and delays, etc... which in turn have a corresponding cost.

In the most general form, this 'cost' represents a combination of factors that drivers take into account when choosing routes through the road network; the most important of these factors are time and distance. Also where tolls are charged for the use of a specific section of road, these costs are included in the driver's route choice and are based on a driver's willingness to pay the toll.

The process that Netanal uses to determine the 'cost' of travel on competing paths, is based on travel time only. The toll value on a specific link is included indirectly by converting the monetary toll value to time (in minutes) based on the driver's perceived value of time. This 'time value of the toll' is applied as a 'penalty' to the link and is known as the Toll Diversion Penalty (TDP).

The premise on which the future year modelling has been based, specifically the route selection process, is the current value of time. Toll values, toll diversion penalties and socio economic decision making defaults, have not been increased with CPI or standard of living projections.

INCREMENTAL ASSIGNMENT

In order to reflect the impact of congestion on route selection, Netanal assigns the traffic from the trip table as a series of equal increments. This process is outlined below:

- The process commences by identifying the routes with the shortest travel times, for each origin-destination pair, with no traffic using the roads (ie based on sign-posted speed limits, green lights, etc). Known colloquially as increment 0 (zero), the link and intersection delays, accumulated over the modelled 0ne hour, are tabulated for later reference.
- The first incremental run of the model imposes the time delays recorded during Increment 0 and adds the delays to the travel time of each link. During the increment, routes yielding the lowest travel time between zonal pairs are chosen. Again the resultant delays on each link, inclusiv intersection, are recorded by the program.
- Each subsequent increment performs ongoing route selection based on recorded delay and the resultant link travel times. As delays stabilise, so too does the route selection within the model, until the optimum number of increments are run.
- At the completion of the incremental run, the optimum routes and vehicle demands, on each link, are reported.

Incremental convergence is employed to determine the projective stability and optimum number of increments. The process of incremental convergence involves the running of sensitivity models reflecting a differing number of increments, with the projected volumes on a select number of key links, reported. Once the differential change between the projected volumes, on each reported link, minimises, the model is considered stable and the resultant number of increments are utilised in the project model runs.

For this project, 20 increments were found to provide stability in link demand.

ASSIGNMENT CALCULATIONS

Netanal calculates travel time on the basis of the capacity related, geometric and operational characteristics of roads and intersections defining the road network. The following are specifically incorporated in the calculations for the mid-block section of each link...

- **Speed-flow relationships** As traffic volume increases, speeds on roads decrease and the relationships within Netanal take this into account. The speed is based on the ratio of the traffic flow to the nominated road capacity. Netanal assumes free flow conditions on links up to a set value of degree of saturation (DS). This value is set to equal 90%. When traffic flows on a particular link exceeds the DS set value, the speed drops according to a speed flow relationship, to the power of four.
- **Transit lanes** The proportion of traffic using the transit and non-transit lanes on a section of road is based on RTA surveys of Epping Road, Military Road and Victoria Road. This survey reported that the transit lanes operated to a maximum of 50% of the adjacent trafficable lane. Illegal use was reported as 25% while the DS of the adjacent lane was below 0.75.

With an increase above 0.75 in the adjacent lane, a proportionate increase in the illegal use of the transit lane results. Netanal applies this principle on all transit lanes, within the model.

The program assumes a 40% maximum usage of T3 transit lanes while the DS of the adjacent lane remains below 0.75. The program assumes the illegal usage of a T3 lane is the same as that of a T2.

- Bus lanes, and bus stops, can be included as part of the network. Netanal can report on travel time changes on these routes.
- On-street parking.
- Speed limits.
- LATM devices (eg speed humps, raised thresholds, road narrowings, etc...).
- Pedestrian crossings.
- Toll plazas A delay of seven seconds per vehicle is applied at toll plazas that have manual payment collection. This delay is reduced as some manual collection is retained and the proportion of electronic tolling increases. Electronic tolling invokes no toll plaza delay.
- Toll fees Tolls are collected in dollars but have the effect of making a route less attractive. Therefore the toll has to be converted to a time value that can be attributed to the relevant link in Netanal to reflect additional travel time in the route selection process. This conversion factor is the TDP, and is expressed in minutes per dollar.

Those network characteristics, which may vary across a 24hr time of day operation, such as transit lanes, bus lanes, parking restrictions, toll fees, turn prohibitions, etc,,, are included in the network definition and further impact on the assignment route selection.

Intersection delay, calculated within the model, employs the *Austroad's* and *AARB* established formulae for the control of intersections operating as Give Way or Stop Sign, roundabout or traffic signals. For the latter, the benefits of Sydney's coordinated signal control system, SCATS, on improved traffic flow is incorporated. A turn penalty is added to the travel time to represent the delay that is associated with pedestrian conflict with left turns and opposing traffic for right turns.

Netanal specifically calculates both road mid-block and intersection performance. The model is therefore able to calculate queues when traffic demand exceeds capacity and incorporate the queuing delay in the calculation of travel time for each route. If the travel time remains lower on a particular route with queues, Netanal will continue to assign traffic to that route, until such time as the queue results in a time delay that makes an alternative route more attractive.

FUTURE TRIP MATRIX

The geographic region to be modelled is represented by a trip matrix (trip table), that details the individual travel demands between origin and destination pairs. Each distinct area representing a trip origin or end is called a '*Zone*'. The Sydney Netanal model contains some 960 zones, following disaggregation. These elements define areas of homogenous land use (eg. residential, industrial, retail, education, airports, hospitals) enclosed and linked by physical features such as major roads, railways and rivers. The trip table specifies the number of car trips travelling from each zone to every other zone in the modelled area.

The zone locations, within the NWGC, are presented in *Figure 3.*

The boundaries of these zones for the Sydney Metropolitan Area were defined in 1996, by the NSW Department of Transport's TPDC, and have been generic across all traffic and transport modelling activities undertaken in Sydney. New boundaries and a refined zonal pattern was defined by TPDC at the end of 2008, but have yet to be employed.

The assignment process described above essentially determines the anticipated route selection made by motorist between the 'origin' and 'destination' zone during a designated time period. The total number of trips between all the zonal pairs produces the projected traffic volumes reported by the model. Netanal models the road network assignment over a 1hr period.

The future Year trip matrices, produced by TPDC, have been developed from a 4 step travel model based on forecast population, employment and the transport network. These trip tables form the basis for the Netanal future year trip demands.

Generally, the Netanal distribution for the future year trip tables of the Sydney Metropolitan Region has been retained from the TPDC trip matrices. However, irregularities have been found between the land use assumptions within the TPDC matrices and available data, making it necessary to disaggregate the course zone structure to better reflect the future year demand generations.

Following the zonal disaggregation process, the sensitivity of the trip end distribution, for the NWGC, has been reported between select zones within the NWGC and regional catchments, as noted in *Table 1*.

For the NWGC, an option has been written for Netanal to extract the zonal distribution of a trip matrix between a specified zone and an external zone, or region of zones, within or outside a cordon. This option has been utilised to discern the distribution from Riverstone, Schofields and Marsden Park for the purpose of trip matrix verification. *Figures 4 through 6* present the reported trip distribution for the year 2036 morning peak trip matrix utilised in the modelling of the 'End State' conditions for the NWGC.

The vehicle generation parameters applied to land use and growth levels throughout the Western Sydney region, have been adapted from recent studies undertaken by Road Delay Solutions and Sims Varley Traffic Systems. Typically...

- North West Growth Centre,
- South West Growth Centre,
- Eastern Creek Precinct,
- Huntingwood Stage1 and Stage 2,
- Erskine Park,
- Penrith LGA Arterial Road Study, and
- St Marys ADI Transport Study.

The vehicle generation parameters, adopted for this project, are presented in *Table 2*.

Table 1: Typical Trip Distribution Pattern for NWGC

Trip Destination	% Netanal Trip Distribution from... Riverstone	Schofields	Marsden Park
Windsor / Richmond	5	3	1
Hornsby	1	2	1
Sydney CBD	2	1	1
Parramatta CBD	4	3	3
Blacktown CBD	5	3	13
Liverpool CBD	1	1	1
WSEH	16	8	8
Marsden Park	8	7	2
Penrith CBD	3	2	2

Table 2: Vehicle Generation Parameters by Land Use

	Year CURRENT	2036	Total
Number of dwellings	10,274	64,605	74,879
Commercial Land (employees)	7,045	39,835	46,880
Area of retail land (hectare)	0	0	0
Area of industral land (hectare)	0	0	0
Area of educational land (hactare)	0	0	0
Trip Generation Rates (Peak Hour)			
Residential			
- Vehicle Trips per Dwelling		0.57	
- Reduction in Vehicle Trips due to Transport Initiatives		0.0%	
- Percent Outbound in Morning Peak		80%	
- Percent Outbound in Evening Peak		20%	
Commercial			
- Calculated on...100m2 GLFA=2 or Employees=1		1	
- Trips , as above, per Morning Peak		0.79	
- Trips, as above, per Evening Peak		0.79	
- Reduction in Vehicle Trips due to Transport Initiatives		12.5%	
- Percent Outbound in Morning Peak		15%	
- Percent Outbound in Evening Peak		85%	
Retail			
- Employees per hectare		25	
- Trips per Employee in Morning Peak		0.83	
- Trips per Employee in Evening Peak		0.83	
- Percent Car Driver		50%	
- Reduction in Vehicle Trips due to Transport Initiatives		12.5%	
- Percent Outbound in Morning Peak		15%	
- Percent Outbound in Evening Peak		85%	
Industrial			
- Employees per hectare		20	
- Trips per Employee in Morning Peak		0.83	
- Trips per Employee in Evening Peak		0.83	
- Percent Car Driver		50%	
- Reduction in Vehicle Trips due to Transport Initiatives		12.5%	
- Percent Outbound in Morning Peak		15%	
- Percent Outbound in Evening Peak		85%	
Education			
- Employees per hectare		25	
- Trips per Employee in Morning Peak		0.7	
- Trips per Employee in Evening Peak		0.7	
- Percent Car Driver		50%	
- Reduction in Vehicle Trips due to Transport Initiatives		12.5%	
- Percent Outbound in Morning Peak		15%	
- Percent Outbound in Evening Peak		85%	
Trip Containment		20%	

Figure 3: Year 2036 Netanal Zone Disagregation

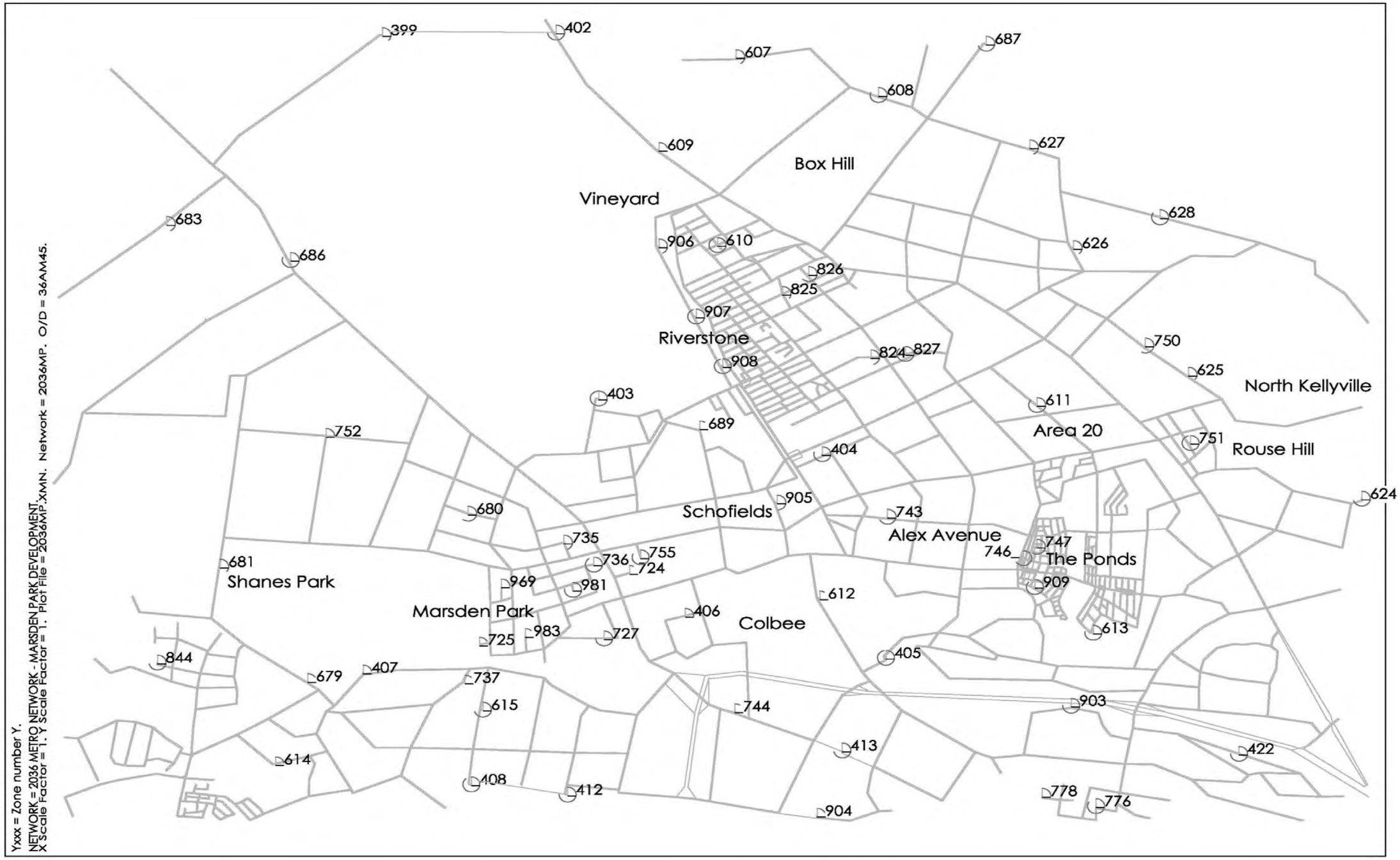


Figure 4: 2036 Morning Peak Hour Riverstone Zone 610 - Trip Distribution

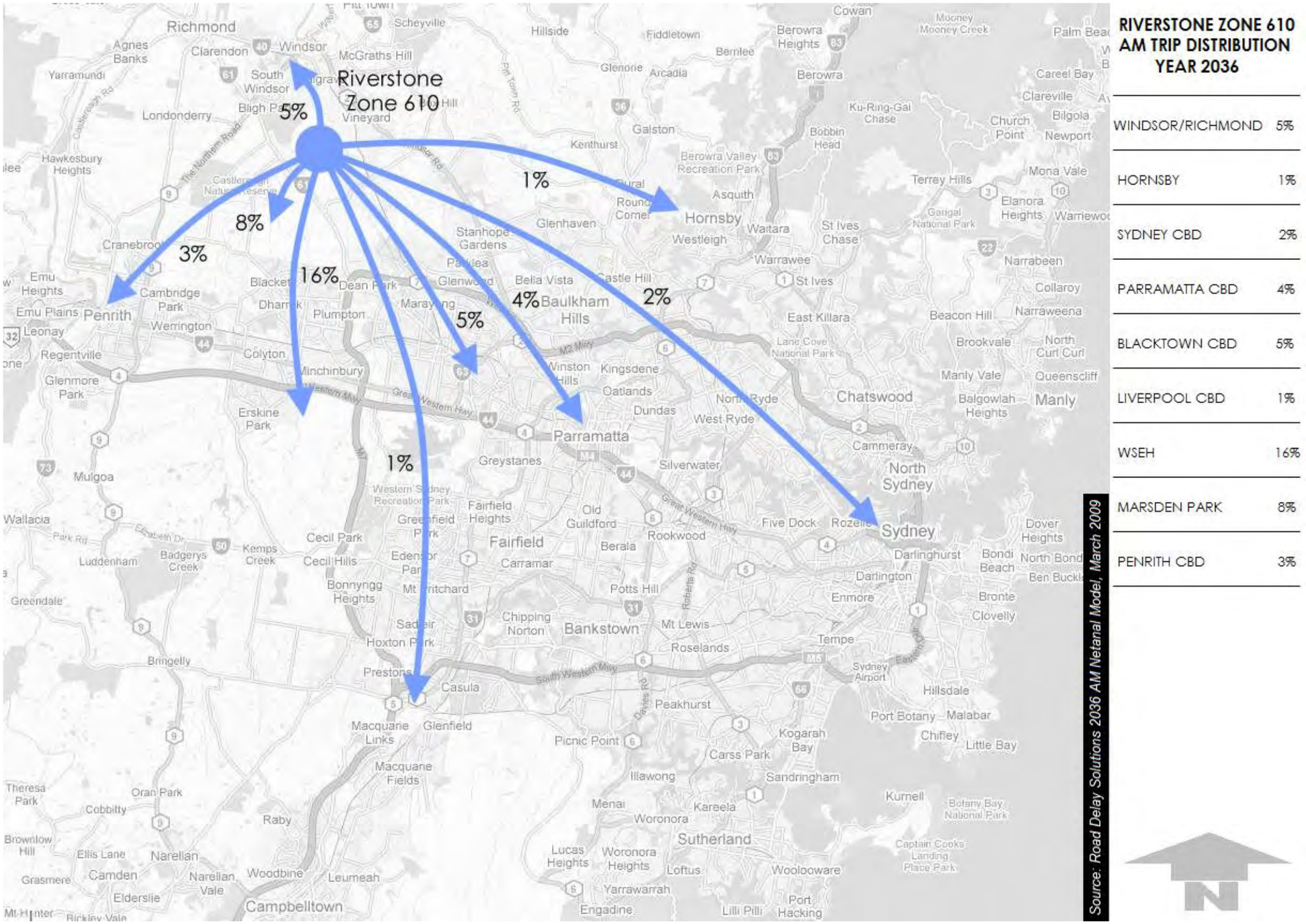
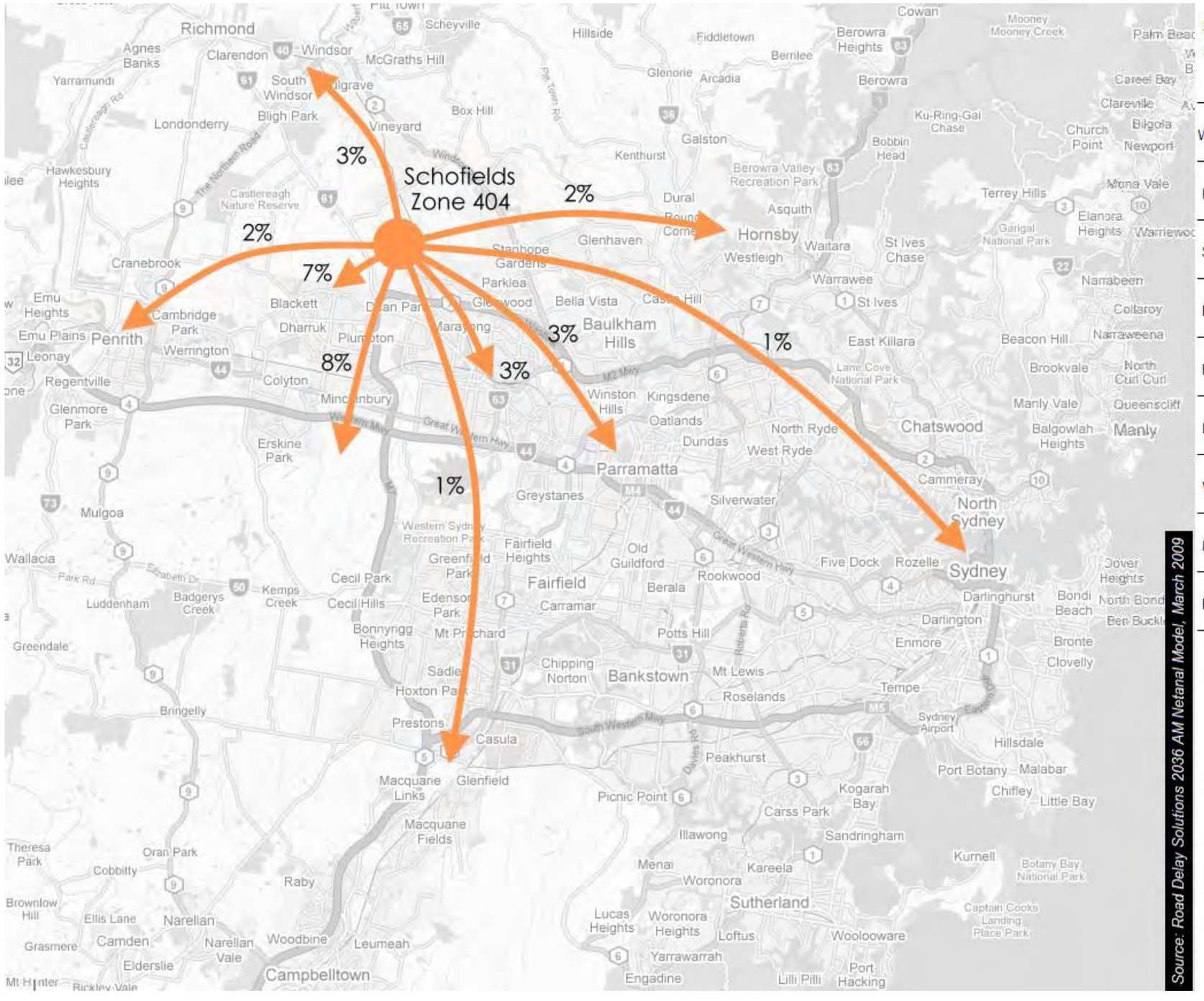
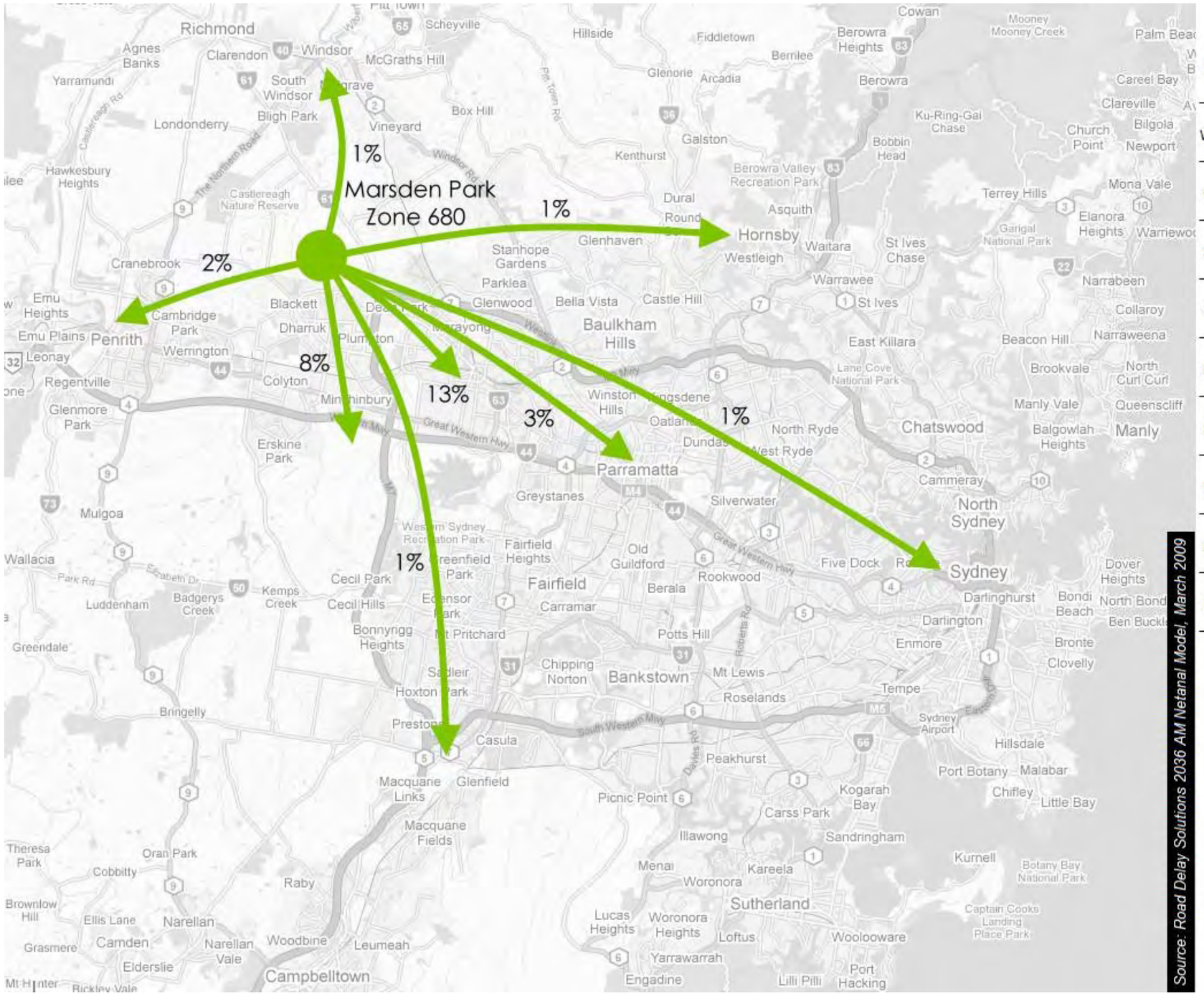


Figure 5: 2036 Morning Peak Hour Schofields Zone 404 - Trip Distribution



SCHOFIELDS ZONE 404 AM TRIP DISTRIBUTION YEAR 2036	
WINDSOR/RICHMOND	3%
HORNSBY	2%
SYDNEY CBD	1%
PARRAMATTA CBD	3%
BLACKTOWN CBD	3%
LIVERPOOL CBD	1%
WSEH	8%
MARSDEN PARK	7%
PENRITH CBD	2%

Figure 6: 2036 Morning Peak Hour Marsden Park Zone 680 - Trip Distribution



MARSDEN PARK ZONE 680 AM TRIP DISTRIBUTION YEAR 2036	
WINDSOR/RICHMOND	1%
HORNSBY	1%
SYDNEY CBD	1%
PARRAMATTA CBD	3%
BLACKTOWN CBD	13%
LIVERPOOL CBD	1%
WSEH	8%
MARSDEN PARK	2%
PENRITH CBD	2%

Table 3: Model Link Volume Projections

LOCATION	2016 ILP Model		2021 ILP Model		2036 ILP Model		2036 No Westminster Bridge Model		2016 No Clarke/Oak Corridor		2021 No Clarke/Oak Corridor		2036 No Clarke/Oak Corridor		2036 No Edmund/Loftus Intersection		2036 McCulloch and Boundary Existing Conditions		2036 No Riverstone Rd Crossing of First Ponds Creek		2036 Schofields Rd EB Offload Ramp to Railway Terrace	
	16AMILP	16PMILP	21AMILP	21PMILP	36AMILP1	36PMILP1	36AMILWB	36PMILWB	16AMLOF	16PMLOF	21AMLOF	21PMLOF	36AMLOF	36PMLOF	36AMLOF1	36PMLOF1	36AMBOU	36PMBOU	36AMRIV	36PMRIV	36AMTER	36PMTER
WINDSOR NB S BANDON	713	1189	745	1182	1398	1566	1422	1498	670	1128	702	1154	1388	1591	1548	1718	1394	1563	1393	1562	1394	1576
WINDSOR SB N BANDON	1598	523	1647	637	1589	996	1623	1092	1460	511	1489	619	1556	1106	1617	1154	1616	997	1590	996	1590	1002
WINDSOR SB N GARFIELD	858	381	884	396	961	654	939	715	881	391	908	407	981	690	982	721	962	656	937	654	937	664
WINDSOR NB N GARFIELD	359	902	368	911	858	1168	870	1137	475	983	469	1032	905	1315	832	1290	856	1168	856	1167	857	1183
WINDSOR NB N SCHOFIELDS	679	1505	708	1661	1120	2494	1208	2372	755	1604	775	1733	1182	2444	1118	2395	1119	2494	1120	2494	1120	2487
WINDSOR SB N SCHOFIELDS	1930	913	1994	1028	2194	1205	2140	1282	2053	935	2107	1003	2172	1117	2192	1216	2195	1207	2161	1205	2160	1211
EDMUND NB N SYDNEY	1234	943	1318	1480	1108	1304	1007	1287	819	260	856	887	373	565	460	746	1158	1304	1104	1298	1102	1301
EDMUND SB N SYDNEY	1140	347	1145	680	1171	700	1139	657	417	170	428	555	578	421	745	480	1178	737	1171	700	1187	701
HAMILTON NB N GARFIELD	356	202	373	589	607	713	474	605	562	475	617	943	936	1094	757	751	464	647	606	712	607	698
HAMILTON SB N GARFIELD	638	284	674	389	914	1054	827	974	1018	350	1079	468	1305	1143	1029	1020	838	979	909	1054	895	1060
RIVERSTONE PDE NB S BANDON	149	137	161	213	341	571	431	664	184	139	189	219	359	574	339	544	368	626	344	576	344	605
RIVERSTONE PDE SB S BANDON	372	221	399	238	456	182	482	214	426	232	441	255	441	189	481	205	487	196	457	182	456	179
RIVERSTONE PDE NB S CROWN	150	144	162	215	454	612	681	757	192	153	198	232	477	635	454	604	533	675	460	617	460	649
RIVERSTONE PDE SB S CROWN	385	221	410	238	498	220	533	244	474	232	490	273	517	226	533	222	527	249	499	220	497	218
GARFIELD EB W RIVERSTONE	995	657	1011	1873	3315	1969	3583	2541	998	665	1047	1859	3357	2010	3311	1897	3304	1983	3315	1969	3317	1931
GARFIELD WB W RIVERSTONE	1546	1066	1619	1239	1824	3450	2417	3946	1591	1060	1639	1211	1840	3487	1821	3406	1823	3457	1824	3450	1820	3441
GARFIELD WB W WINDSOR	911	132	1014	337	1478	1070	1538	1196	990	187	1030	406	1398	1166	1629	1213	1465	1049	1486	1069	1487	1039
GARFIELD EB W WINDSOR	279	281	290	678	871	1622	1053	1670	315	217	324	563	836	1346	585	1355	867	1558	873	1621	873	1614
SPINE NB N GARFIELD	411	531	414	632	3571	1157	3503	1313	442	598	457	618	3600	1216	3539	1156	3575	1213	3573	1159	3573	1139
SPINE SB N GARFIELD	854	1401	899	1343	993	3697	1022	3614	894	1404	940	1332	1016	3710	1005	3671	997	3735	994	3697	991	3707
LOFTUS EB W WINDSOR	928	802	996	887	1135	1350	1119	1377	499	399	543	515	739	1068	687	946	1133	1350	1131	1346	1131	1355
LOFTUS WB W WINDSOR	1155	302	1163	406	1183	560	1201	565	725	234	748	324	989	477	955	432	1187	563	1180	560	1180	563
BOUNDARY EB E WINDSOR	529	378	565	487	606	862	638	957	589	428	590	553	660	1109	977	1145	607	865	605	862	606	858
BOUNDARY WB E WINDSOR	622	113	602	184	808	433	872	407	517	124	564	182	956	434	969	402	811	435	805	433	805	417
WESTMINSTER EB W WINDSOR	371	278	409	419	855	874	578	518	391	261	420	443	929	882	917	997	857	881	889	874	855	896
WESTMINSTER WB W WINDSOR	727	153	782	257	1011	751	637	401	742	135	784	270	943	681	1037	753	1014	751	1013	751	1027	761
TULLAWONG NB N SCHOFIELDS	264	186	281	482	260	679	302	890	358	444	383	689	414	1012	215	722	261	677	258	678	258	633
TULLAWONG SB N SCHOFILEDS	683	250	712	526	886	490	997	647	1010	427	1020	725	1232	751	803	535	910	493	911	490	914	490
GRANGE EB E RICHMOND	218	39	282	977	119	375	30	193	270	37	249	1024	126	353	116	376	119	362	119	375	118	373
GRANGE WB E RICHMOND	895	643	884	862	1236	879	647	596	958	658	1038	828	1282	818	1393	904	1252	883	1236	881	1254	923
SOUTH EB E RICHMOND	1975	1150	2046	2128	2056	3087	2160	3033	2031	1129	2193	2103	2088	3058	2085	2943	2062	3088	2065	3087	2057	3141
SOUTH WB E RICHMOND	1213	758	1437	1020	1535	1190	2077	1311	1263	831	1261	1014	1672	1204	1565	1153	1542	1184	1529	1184	1517	1186
TOWNSON EB E RICHMOND	545	268	530	401	273	1071	278	968	456	265	425	434	292	1013	278	1067	273	1072	272	1072	271	1128
TOWNSON WB E RICHMOND	200	193	207	208	1197	433	1176	464	205	184	216	198	1292	406	1239	431	1229	433	1194	433	1192	426
RICHMOND NB N GARFIELD	960	1236	1075	1324	1206	1991	1167	1957	987	1234	1030	1340	1190	1997	1192	1999	1204	1984	1202	1990	1210	1970
RICHMOND SB N GARFIELD	1576	752	1625	3336	2093	1473	2091	1435	1590	753	1636	3337	2070	1463	2098	1465	2106	1477	2103	1473	2103	1471
RICHMOND NB N ROOTY HILL	1553	1643	1555	2108	3188	4277	3057	3915	1531	1592	1597	2438	2979	4375	3172	4089	3146	4275	3200	4277	3211	4157
RICHMOND SB N ROOTY HILL	2931	1551	3086	1785	4225	3638	4024	3766	3004	1539	3178	1784	4345	3724	4301	3675	4219	3642	4215	3637	4224	3695
HAMILTON NB S LOFTUS	41	13	43	39	157	434	82	398	163	158	198	279	443	722	358	558	98	372	157	433	157	415
HAMILTON SB S LOFTUS	301	172	330	211	652	556	600	519	683	232	718	316	977	677	878	616	589	521	649	556	635	563
SPINE NB S BANDON	280	430	278	540	286	1172	311	1468	314	502	322	530	311	1225	287	1198	285	1216	286	1172	287	1166
SPINE SB N BANDON	344	171	368	183	914	270	1035	326	388	180	410	177	934	276	958	271	912	295	913	268	911	291
SCHOFIELDS EB E RAILWAY	1474	436	1527	970	1591	2043	1742	2587	1501	451	1548	1021	1510	2103	1567	2025	1569	2040	1602	2121	1595	1921
SCHOFIELDS WB E RAILWAY	550	568	614	826	1038	1036	1108	1185	551	602	579	852	1155	1184	1040	1026	995	1031	1041	1035	1049	1067
SCHOFIELDS EB W RAILWAY	2275	1104	2350	2128	2216	3203	2584	3344	2245	1180	2415	2089	2213	3100	2223	3167	2190	3205	2224	3203	2217	3046
SCHOFIELDS WB W RAILWAY	1360	678	1655	1104	2143	1425	2860	1703	1465	650	1592	1116	2396	1520	2082	1379	2116	1419	2139	1418	2127	1388
JUNCTION NB N SCHOFIELDS	575	388	648	847	459	1478	433	1398	626	495	625	855	413	1298	473	1323	445	1435	459	1399	458	1295
JUNCTION SB N SCHOFIELDS	816	108	831	262	991	457	1934	610	812	115	970	299	1213	459	906	446	587	400	949	440	997	459
BOUNDARY NB N SCHOFIELDS	2	11	3	5	85	49	384	522	287	218	311	502	546	644	92	76	40	22	84	125	83	26
BOUNDARY SB N SCHOFIELDS	131	74	159	94	382	342	360	406	732	195	689	266	813	685	380	288	316	297	385	342	370	350
MCCULLOCH NB S GARFIELD	123	37	129	81	330	264	433	260	287	211	312	342	632	614	380	259	149	308	329	264	329	278
MCCULLOCH SB S GARFIELD	320	198	350	238	533	675	523	812	685	306	720	333	924	941	643	673	405	541	527	675	514	679
CLARKE NB N SCHOFIELDS	676	969	712	1086	891	1342	868	1444	0	0	0	0	0	0	949	1502	981	1377	890	1337	887	1434
CLARKE SB N SCHOFIELDS	1585	414	1642	506	1499	735	1613	801	0	0	0	0	0	0	1463	738	1505	744	1499	735	1511	748

3 PROJECT TASKS

CONFORMING IPL MODEL

The first task requires the update the NWGC traffic model to incorporate the road network as shown on the exhibited draft ILP shown in *Figure 1*, including all intersections with restricted movements (eg. Westminster and Railway Terrace).

(See *Figures 7 and 8*)

The typical ILP model, and associated traffic vehicle flows, is represented in *Figures 7 and 8*.

The ILP model includes, but is not limited to...

- Grade separation of Burdekin Road at Railway Terrace with no connection to Railway Terrace,
- Grade separation at Schofields Road at Railway Terrace,
- Eastbound on-load ramp from Railway Terrace to Schofields Road,
- Closure of Railway Terrace at Westminster Street,
- No intersection of Westminster Street with Railway Terrace,
- Introduction of a signalised intersection at Westminster Street and Princes Road with all movements permitted,
- The extension Junction Road to Kensington Park Road,
- Retention of the road over rail bridge on Westminster Street, west of railway Terrace,
- Introduction of Bridge Street to Grange Avenue, sub arterial, connection, and
- Bandon Road/ Spine Road route, as a sub arterial corridor through Riverstone West with a regulatory speed of 70km/h and four (4) lanes.

WESTMINSTER BRIDGE REMOVAL

Run the model above with the Westminster rail bridge removed, and assess how traffic is redistributed across the network as a result. Identify any changes to other roads that would be required as a result. Identify the required classification of Westminster (collector or sub-arterial).

(See *Figures 9, 10, 11 and 12*)

The resultant model outcomes and redistribution of traffic, reflecting removal of the Westminster Street Bridge over the railway, west of Railway Terrace, are presented in the following table.

Table 4: No Westminster Street Bridge Option - Link Differential

LOCATION	2036 ILP Model		2036 No Westminster Bridge Model		Differential		% Differential	
	36AMILP1	36PMILP1	36AMILWB	36PMILWB	AM	PM	AM	PM
WINDSOR NB S BANDON	1398	1566	1422	1498	24	-68	2%	-4%
WINDSOR SB N BANDON	1589	996	1623	1092	34	96	2%	10%
WINDSOR SB N GARFIELD	961	654	939	715	-22	61	-2%	9%
WINDSOR NB N GARFIELD	858	1168	870	1137	12	-31	1%	-3%
WINDSOR NB N SCHOFIELDS	1120	2494	1208	2372	88	-122	8%	-5%
WINDSOR SB N SCHOFIELDS	2194	1205	2140	1282	-54	77	-2%	6%
EDMUND NB N SYDNEY	1108	1304	1007	1287	-101	-17	-9%	-1%
EDMUND SB N SYDNEY	1171	700	1139	657	-32	-43	-3%	-6%
HAMILTON NB N GARFIELD	607	713	474	605	-133	-108	-22%	-15%
HAMILTON SB N GARFIELD	914	1054	827	974	-87	-80	-10%	-8%
RIVERSTONE PDE NB S BANDON	341	571	431	664	90	93	26%	16%
RIVERSTONE PDE SB S BANDON	456	182	482	214	26	32	6%	18%
RIVERSTONE PDE NB S CROWN	454	612	681	757	227	145	50%	24%
RIVERSTONE PDE SB S CROWN	498	220	533	244	35	24	7%	11%
GARFIELD EB W RIVERSTONE	3315	1969	3583	2541	268	572	8%	29%
GARFIELD WB W RIVERSTONE	1824	3450	2417	3946	593	496	33%	14%
GARFIELD WB W WINDSOR	1478	1070	1538	1196	60	126	4%	12%
GARFIELD EB W WINDSOR	871	1622	1053	1670	182	48	21%	3%
SPINE NB N GARFIELD	3571	1157	3503	1313	-68	156	-2%	13%
SPINE SB N GARFIELD	993	3697	1022	3614	29	-83	3%	-2%
LOFTUS EB W WINDSOR	1135	1350	1119	1377	-16	27	-1%	2%
LOFTUS WB W WINDSOR	1183	560	1201	565	18	5	2%	1%
BOUNDARY EB E WINDSOR	606	862	638	957	32	95	5%	11%
BOUNDARY WB E WINDSOR	808	433	872	407	64	-26	8%	-6%
WESTMINSTER EB W WINDSOR	855	874	578	518	-277	-356	-32%	-41%
WESTMINSTER WB W WINDSOR	1011	751	637	401	-374	-350	-37%	-47%
TULLAWONG NB N SCHOFIELDS	260	679	302	890	42	211	16%	31%
TULLAWONG SB N SCHOFILEDS	886	490	997	647	111	157	13%	32%
GRANGE EB E RICHMOND	119	375	30	193	-89	-182	-75%	-49%
GRANGE WB E RICHMOND	1236	879	647	596	-589	-283	-48%	-32%
SOUTH EB E RICHMOND	2056	3087	2160	3033	104	-54	5%	-2%
SOUTH WB E RICHMOND	1535	1190	2077	1311	542	121	35%	10%
TOWNSON EB E RICHMOND	273	1071	278	968	5	-103	2%	-10%
TOWNSON WB E RICHMOND	1197	433	1176	464	-21	31	-2%	7%
RICHMOND NB N GARFIELD	1206	1991	1167	1957	-39	-34	-3%	-2%
RICHMOND SB N GARFIELD	2093	1473	2091	1435	-2	-38	0%	-3%
RICHMOND NB N ROOTY HILL	3188	4277	3057	3915	-131	-362	-4%	-8%
RICHMOND SB N ROOTY HILL	4225	3638	4024	3766	-201	128	-5%	4%
HAMILTON NB S LOFTUS	157	434	82	398	-75	-36	-48%	-8%
HAMILTON SB S LOFTUS	652	556	600	519	-52	-37	-8%	-7%
SPINE NB S BANDON	286	1172	311	1468	25	296	9%	25%
SPINE SB N BANDON	914	270	1035	326	121	56	13%	21%
SCHOFIELDS EB E RAILWAY	1591	2043	1742	2587	151	544	9%	27%
SCHOFIELDS WB E RAILWAY	1038	1036	1108	1185	70	149	7%	14%
SCHOFIELDS EB W RAILWAY	2216	3203	2584	3344	368	141	17%	4%
SCHOFIELDS WB W RAILWAY	2143	1425	2860	1703	717	278	33%	20%
JUNCTION NB N SCHOFIELDS	459	1478	433	1398	-26	-80	-6%	-5%
JUNCTION SB N SCHOFIELDS	991	457	1934	610	943	153	95%	33%
BOUNDARY NB N SCHOFIELDS	85	49	384	522	299	473	352%	965%
BOUNDARY SB N SCHOFIELDS	382	342	360	406	-22	64	-6%	19%
MCCULLOCH NB S GARFIELD	330	264	433	260	103	-4	31%	-2%
MCCULLOCH SB S GARFIELD	533	675	523	812	-10	137	-2%	20%
CLARKE NB N SCHOFIELDS	891	1342	868	1444	-23	102	-3%	8%
CLARKE SB N SCHOFIELDS	1499	735	1613	801	114	66	8%	9%

BANDON ROAD AND SPINE ROAD

Include Bandon Road as a sub-arterial (if not already done).

(See *Figures 7 and 8*)

The Bandon Road/Spine Road corridor has been modelled as a sub arterial route with a regulatory speed of 70km/h.

EDMUND STREET AND LOFTUS STREET INTERSECTION – EDMUND STREET, CLARKE STREET AND OAK STREET ROUTE

Run the model without the Edmund/Loftus intersection... what does this do to traffic volumes esp. heavies on surrounding roads, including Hamilton, McCulloch etc? Can we define a threshold in terms of timing for when the Edmund-Clark-Oak route through to Hambledon would need to be constructed (to avoid too much traffic using Hamilton-McCulloch or because of congestion on Windsor Road).

(See *Figures 13 through 22*)

a) The redistribution of traffic with the removal of the proposed intersection of Loftus Street with Edmund Street, is shown in the following table.

The resultant volumes would suggest that Windsor Road is not significantly impacted by the by the removal of the intersection. The model indicates motorists leaving the Edmund Street precinct and choosing to travel south on Windsor Road, under this option, will generally use Garfield Road. Northbound motorists accessing Windsor Road, are shown, to utilise Junction Road.

This model also indicates that vehicles accessing the Edmund Road precinct, will generally do so from Garfield Road and Junction Street.

The link differentials with removal of the Loftus/Edmund intersection, are presented in *Table 5*.

The ILP base model indicates that the predominant heavy vehicle trips will occur along Loftus Street, Hamilton Street (north of Garfield Road) and Garfield Road, accessing the North Riverstone industrial precinct, the Riverstone West precinct and Marsden Park.

With removal of the Loftus Street intersection with Edmund Street, will result in a small increase of some 10 to 12 heavy vehicles per hour on Hobart Street and Sydney Street.

Table 5: No Loftus Street Intersection with Edmund Street Option – Link Differential

LOCATION	2036 ILP Model		2036 No Edmund/Loftus Intersection		Differential		% Differential	
	36AMILP1	36PMILP1	36AMLOF1	36PMLOF1	AM	PM	AM	PM
WINDSOR NB S BANDON	1398	1566	1548	1718	150	152	11%	10%
WINDSOR SB N BANDON	1589	996	1617	1154	28	158	2%	16%
WINDSOR SB N GARFIELD	961	654	982	721	21	67	2%	10%
WINDSOR NB N GARFIELD	858	1168	832	1290	-26	122	-3%	10%
WINDSOR NB N SCHOFIELDS	1120	2494	1118	2395	-2	-99	0%	-4%
WINDSOR SB N SCHOFIELDS	2194	1205	2192	1216	-2	11	0%	1%
EDMUND NB N SYDNEY	1108	1304	460	746	-648	-558	-58%	-43%
EDMUND SB N SYDNEY	1171	700	745	480	-426	-220	-36%	-31%
HAMILTON NB N GARFIELD	607	713	757	751	150	38	25%	5%
HAMILTON SB N GARFIELD	914	1054	1029	1020	115	-34	13%	-3%
RIVERSTONE PDE NB S BANDON	341	571	339	544	-2	-27	-1%	-5%
RIVERSTONE PDE SB S BANDON	456	182	481	205	25	23	5%	13%
RIVERSTONE PDE NB S CROWN	454	612	454	604	0	-8	0%	-1%
RIVERSTONE PDE SB S CROWN	498	220	533	222	35	2	7%	1%
GARFIELD EB W RIVERSTONE	3315	1969	3311	1897	-4	-72	0%	-4%
GARFIELD WB W RIVERSTONE	1824	3450	1821	3406	-3	-44	0%	-1%
GARFIELD WB W WINDSOR	1478	1070	1629	1213	151	143	10%	13%
GARFIELD EB W WINDSOR	871	1622	585	1355	-286	-267	-33%	-16%
SPINE NB N GARFIELD	3571	1157	3539	1156	-32	-1	-1%	0%
SPINE SB N GARFIELD	993	3697	1005	3671	12	-26	1%	-1%
LOFTUS EB W WINDSOR	1135	1350	687	946	-448	-404	-39%	-30%
LOFTUS WB W WINDSOR	1183	560	955	432	-228	-128	-19%	-23%
BOUNDARY EB E WINDSOR	606	862	977	1145	371	283	61%	33%
BOUNDARY WB E WINDSOR	808	433	969	402	161	-31	20%	-7%
WESTMINSTER EB W WINDSOR	855	874	917	997	62	123	7%	14%
WESTMINSTER WB W WINDSOR	1011	751	1037	753	26	2	3%	0%
TULLAWONG NB N SCHOFIELDS	260	679	215	722	-45	43	-17%	6%
TULLAWONG SB N SCHOFILEDS	886	490	803	535	-83	45	-9%	9%
GRANGE EB E RICHMOND	119	375	116	376	-3	1	-3%	0%
GRANGE WB E RICHMOND	1236	879	1393	904	157	25	13%	3%
SOUTH EB E RICHMOND	2056	3087	2085	2943	29	-144	1%	-5%
SOUTH WB E RICHMOND	1535	1190	1565	1153	30	-37	2%	-3%
TOWNSON EB E RICHMOND	273	1071	278	1067	5	-4	2%	0%
TOWNSON WB E RICHMOND	1197	433	1239	431	42	-2	4%	0%
RICHMOND NB N GARFIELD	1206	1991	1192	1999	-14	8	-1%	0%
RICHMOND SB N GARFIELD	2093	1473	2098	1465	5	-8	0%	-1%
RICHMOND NB N ROOTY HILL	3188	4277	3172	4089	-16	-188	-1%	-4%
RICHMOND SB N ROOTY HILL	4225	3638	4301	3675	76	37	2%	1%
HAMILTON NB S LOFTUS	157	434	358	558	201	124	128%	29%
HAMILTON SB S LOFTUS	652	556	878	616	226	60	35%	11%
SPINE NB S BANDON	286	1172	287	1198	1	26	0%	2%
SPINE SB N BANDON	914	270	958	271	44	1	5%	0%
SCHOFIELDS EB E RAILWAY	1591	2043	1567	2025	-24	-18	-2%	-1%
SCHOFIELDS WB E RAILWAY	1038	1036	1040	1026	2	-10	0%	-1%
SCHOFIELDS EB W RAILWAY	2216	3203	2223	3167	7	-36	0%	-1%
SCHOFIELDS WB W RAILWAY	2143	1425	2082	1379	-61	-46	-3%	-3%
JUNCTION NB N SCHOFIELDS	459	1478	473	1323	14	-155	3%	-10%
JUNCTION SB N SCHOFIELDS	991	457	906	446	-85	-11	-9%	-2%
BOUNDARY NB N SCHOFIELDS	85	49	92	76	7	27	8%	55%
BOUNDARY SB N SCHOFIELDS	382	342	380	288	-2	-54	-1%	-16%
MCCULLOCH NB S GARFIELD	330	264	380	259	50	-5	15%	-2%
MCCULLOCH SB S GARFIELD	533	675	643	673	110	-2	21%	0%
CLARKE NB N SCHOFIELDS	891	1342	949	1502	58	160	7%	12%
CLARKE SB N SCHOFIELDS	1499	735	1463	738	-36	3	-2%	0%

b) It is considered the timing of infrastructure for the proposed Edmund Street/Clarke Street corridor to Schofields Road is dependant on the take up and occupancy of the Riverstone (Zone 825) and Riverstone Northeast (Zone 826) precincts which adjoin Edmund Street.

Models developed for the years 2016, 2021 and 2036 reflect removal of the corridor and of the ILP to determine the resultant link differentials, as shown in *Table 7*.

The link capacity thresholds shown in *Table 6* should be applied to determine the vehicle capacity ratios, triggering any necessary road widening or management improvements as a result of increased traffic volumes associated with development growth or restructuring of the planned ILP infrastructure.

Table 6: Mid Block Link Capacity Thresholds

Road Type Conditions	Lane Capacity at LoS 'F' (veh/hour)	Assumed Maximum Satisfactory Lane Flow in Vehicles/hour (LoS 'D')
Urban Divided / Undivided Highways with Clearways and signal coordination	1,500	1,350
Urban Divided / Undivided Highway conditions with interruptions	1,200	1,080
Rural Two-Way Two-Lane	1,400	896
2 Lane Residential Street with on street parking	700	630

Table 7: No Clarke Street and Oak Street Corridor Impacts – 2016, 2021 and 2036

LOCATION	2016 ILP Model		2021 ILP Model		2036 ILP Model		2016 No Clarke/Oak Corridor		2016 Differential		2016 % Differential		2021 No Clarke/Oak Corridor		2021 Differential		2021 % Differential		2036 No Clarke/Oak Corridor		Differential		% Differential	
	16AMILP	16PMILP	21AMILP	21PMILP	36AMILP1	36PMILP1	16AMLOF	16PMLOF	AM	PM	AM	PM	21AMLOF	21PMLOF	AM	PM	AM	PM	36AMLOF	36PMLOF	AM	PM	AM	PM
WINDSOR NB S BANDON	713	1189	745	1182	1398	1566	670	1128	-43	-61	-3%	-4%	702	1154	-43	-28	-6%	-2%	1388	1591	-10	25	-1%	2%
WINDSOR SB N BANDON	1598	523	1647	637	1589	996	1460	511	-138	-12	-9%	-1%	1489	619	-158	-18	-10%	-3%	1556	1106	-33	110	-2%	11%
WINDSOR SB N GARFIELD	858	381	884	396	961	654	881	391	23	10	2%	2%	908	407	24	11	3%	3%	981	690	20	36	2%	6%
WINDSOR NB N GARFIELD	359	902	368	911	858	1168	475	983	116	81	14%	7%	469	1032	101	121	27%	13%	905	1315	47	147	5%	13%
WINDSOR NB N SCHOFIELDS	679	1505	708	1661	1120	2494	755	1604	76	99	7%	4%	775	1733	67	72	9%	4%	1182	2444	62	-50	6%	-2%
WINDSOR SB N SCHOFIELDS	1930	913	1994	1028	2194	1205	2053	935	123	22	6%	2%	2107	1003	113	-25	6%	-2%	2172	1117	-22	-88	-1%	-7%
EDMUND NB N SYDNEY	1234	943	1318	1480	1108	1304	819	260	-415	-683	-37%	-52%	856	887	-462	-593	-35%	-40%	373	565	-735	-739	-66%	-57%
EDMUND SB N SYDNEY	1140	347	1145	680	1171	700	417	170	-723	-177	-62%	-25%	428	555	-717	-125	-63%	-18%	578	421	-593	-279	-51%	-40%
HAMILTON NB N GARFIELD	356	202	373	589	607	713	562	475	206	273	34%	38%	617	943	244	354	65%	60%	936	1094	329	381	54%	53%
HAMILTON SB N GARFIELD	638	284	674	389	914	1054	1018	350	380	66	42%	6%	1079	468	405	79	60%	20%	1305	1143	391	89	43%	8%
RIVERSTONE PDE NB S BANDON	149	137	161	213	341	571	184	139	35	2	10%	0%	189	219	28	6	17%	3%	359	574	18	3	5%	1%
RIVERSTONE PDE SB S BANDON	372	221	399	238	456	182	426	232	54	11	12%	6%	441	255	42	17	11%	7%	441	189	-15	7	-3%	4%
RIVERSTONE PDE NB S CROWN	150	144	162	215	454	612	192	153	42	9	9%	1%	198	232	36	17	22%	8%	477	635	23	23	5%	4%
RIVERSTONE PDE SB S CROWN	385	221	410	238	498	220	474	232	89	11	18%	5%	490	273	80	35	20%	15%	517	226	19	6	4%	3%
GARFIELD EB W RIVERSTONE	995	657	1011	1873	3315	1969	998	665	3	8	0%	0%	1047	1859	36	-14	4%	-1%	3357	2010	42	41	1%	2%
GARFIELD WB W RIVERSTONE	1546	1066	1619	1239	1824	3450	1591	1060	45	-6	2%	0%	1639	1211	20	-28	1%	-2%	1840	3487	16	37	1%	1%
GARFIELD WB W WINDSOR	911	132	1014	337	1478	1070	990	187	79	55	5%	5%	1030	406	16	69	2%	20%	1398	1166	-80	96	-5%	9%
GARFIELD EB W WINDSOR	279	281	290	678	871	1622	315	217	36	-64	4%	-4%	324	563	34	-115	12%	-17%	836	1346	-35	-276	-4%	-17%
SPINE NB N GARFIELD	411	531	414	632	3571	1157	442	598	31	67	1%	6%	457	618	43	-14	10%	-2%	3600	1216	29	59	1%	5%
SPINE SB N GARFIELD	854	1401	899	1343	993	3697	894	1404	40	3	4%	0%	940	1332	41	-11	5%	-1%	1016	3710	23	13	2%	0%
LOFTUS EB W WINDSOR	928	802	996	887	1135	1350	499	399	-429	-403	-38%	-30%	543	515	-453	-372	-45%	-42%	739	1068	-396	-282	-35%	-21%
LOFTUS WB W WINDSOR	1155	302	1163	406	1183	560	725	234	-430	-68	-36%	-12%	748	324	-415	-82	-36%	-20%	989	477	-194	-83	-16%	-15%
BOUNDARY EB E WINDSOR	529	378	565	487	606	862	589	428	60	50	10%	6%	590	553	25	66	4%	14%	660	1109	54	247	9%	29%
BOUNDARY WB E WINDSOR	622	113	602	184	808	433	517	124	-105	11	-13%	3%	564	182	-38	-2	-6%	-1%	956	434	148	1	18%	0%
WESTMINSTER EB W WINDSOR	371	278	409	419	855	874	391	261	20	-17	2%	-2%	420	443	11	24	3%	6%	929	882	74	8	9%	1%
WESTMINSTER WB W WINDSOR	727	153	782	257	1011	751	742	135	15	-18	1%	-2%	784	270	2	13	0%	5%	943	681	-68	-70	-7%	-9%
TULLAWONG NB N SCHOFIELDS	264	186	281	482	260	679	358	444	94	258	36%	38%	383	689	102	207	36%	43%	414	1012	154	333	59%	49%
TULLAWONG SB N SCHOFILEDS	683	250	712	526	886	490	1010	427	327	177	37%	36%	1020	725	308	199	43%	38%	1232	751	346	261	39%	53%
GRANGE EB E RICHMOND	218	39	282	977	119	375	270	37	52	-2	44%	-1%	249	1024	-33	47	-12%	5%	126	353	7	-22	6%	-6%
GRANGE WB E RICHMOND	895	643	884	862	1236	879	958	658	63	15	5%	2%	1038	828	154	-34	17%	-4%	1282	818	46	-61	4%	-7%
SOUTH EB E RICHMOND	1975	1150	2046	2128	2056	3087	2031	1129	56	-21	3%	-1%	2193	2103	147	-25	7%	-1%	2088	3058	32	-29	2%	-1%
SOUTH WB E RICHMOND	1213	758	1437	1020	1535	1190	1263	831	50	73	3%	6%	1261	1014	-176	-6	-12%	-1%	1672	1204	137	14	9%	1%
TOWNSON EB E RICHMOND	545	268	530	401	273	1071	456	265	-89	-3	-33%	0%	425	434	-105	33	-20%	8%	292	1013	19	-58	7%	-5%
TOWNSON WB E RICHMOND	200	193	207	208	1197	433	205	184	5	-9	0%	-2%	216	198	9	-10	4%	-5%	1292	406	95	-27	8%	-6%
RICHMOND NB N GARFIELD	960	1236	1075	1324	1206	1991	987	1234	27	-2	2%	0%	1030	1340	-45	16	-4%	1%	1190	1997	-16	6	-1%	0%
RICHMOND SB N GARFIELD	1576	752	1625	3336	2093	1473	1590	753	14	1	1%	0%	1636	3337	11	1	1%	0%	2070	1463	-23	-10	-1%	-1%
RICHMOND NB N ROOTY HILL	1553	1643	1555	2108	3188	4277	1531	1592	-22	-51	-1%	-1%	1597	2438	42	330	3%	16%	2979	4375	-209	98	-7%	2%
RICHMOND SB N ROOTY HILL	2931	1551	3086	1785	4225	3638	3004	1539	73	-12	2%	0%	3178	1784	92	-1	3%	0%	4345	3724	120	86	3%	2%
HAMILTON NB S LOFTUS	41	13	43	39	157	434	163	158	122	145	78%	33%	198	279	155	240	360%	615%	443	722	286	288	182%	66%
HAMILTON SB S LOFTUS	301	172	330	211	652	556	683	232	382	60	59%	11%	718	316	388	105	118%	50%	977	677	325	121	50%	22%
SPINE NB S BANDON	280	430	278	540	286	1172	314	502	34	72	12%	6%	322	530	44	-10	16%	-2%	311	1225	25	53	9%	5%
SPINE SB N BANDON	344	171	368	183	914	270	388	180	44	9	5%	3%	410	177	42	-6	11%	-3%	934	276	20	6	2%	2%
SCHOFIELDS EB E RAILWAY	1474	436	1527	970	1591	2043	1501	451	27	15	2%	1%	1548	1021	21	51	1%	5%	1510	2103	-81	60	-5%	3%
SCHOFIELDS WB E RAILWAY	550	568	614	826	1038	1036	551	602	1	34	0%	3%	579	852	-35	26	-6%	3%	1155	1184	117	148	11%	14%
SCHOFIELDS EB W RAILWAY	2275	1104	2350	2128	2216	3203	2245	1180	-30	76	-1%	2%	2415	2089	65	-39	3%	-2%	2213	3100	-3	-103	0%	-3%
SCHOFIELDS WB W RAILWAY	1360	678	1655	1104	2143	1425	1465	650	105	-28	5%	-2%	1592	1116	-63	12	-4%	1%	2396	1520	253	95	12%	7%
JUNCTION NB N SCHOFIELDS	575	388	648	847	459	1478	626	495	51	107	11%	7%	625	855	-23	8	-4%	1%	413	1298	-46	-180	-10%	-12%
JUNCTION SB N SCHOFIELDS	816	108	831	262	991	457	812	115	-4	7	0%	2%	970	299	139	37	17%	14%	1213	459	222	2	22%	0%
BOUNDARY NB N SCHOFIELDS	2	11	3	5	85	49	287	218	285	207	335%	422%	311	502	308	497	10267%	9940%	546	644	461	595	542%	1214%
BOUNDARY SB N SCHOFIELDS	131	74	159	94	382	342	732	195	601	121	157%	35%	689	266	530	172	333%	183%	813	685	431	343	113%	100%
MCCULLOCH NB S GARFIELD	123	37	129	81	330	264	287	211	164	174	50%	66%	312	342	183	261	142%	322%	632	614	302	350	92%	133%
MCCULLOCH SB S GARFIELD	320	198	350	238	533	675	685	306	365	108	68%	16%	720	333	370	95	106%	40%	924	941	391	266	73%	39%
CLARKE NB N SCHOFIELDS	676	969	712	1086	891	1342	0	0	-676	-969	-76%	-72%	0	0	-712	-1086	-100%	-100%	0	0	-891	-1342	-100%	-100%
CLARKE SB N SCHOFIELDS	1585	414	1642	506	1499	735	0	0	-1585	-414	-106%	-56%	0	0	-1642	-506	-100%	-100%	0	0	-1499	-735	-100%	-100%

McCULLOCH STREET AND BOUNDARY ROAD

Can we look at what the effect would be on use of McCulloch-Boundary as a route from the north of Riverstone Precinct through to Schofields Road if we were to not make a direct link between McCulloch and Boundary (ie keep the intersections in their current locations at Westminster?

(See *Figures 23, 24, 25 and 26*)

Models have been run reflecting the retention of the McCulloch Street/Kensington Park Road/Boundary Road intersections in their current form.

From the link volume comparison plots, shown in *Figures 25 and 26*, it is evident that the Hamilton Road/McCulloch Street/Boundary Road route is slightly less attractive to motorists with retention of the current intersection conditions at Kensington Park Road, with only minor deviation to alternate routes.

Table 8: Retain Existing McCulloch Street and Boundary Road Intersection – Link Differential

LOCATION	2036 ILP Model		2036 McCulloch and Boundary Existing Conditions		Differential		% Differential	
	36AMILP1	36PMILP1	36AMBOU	36PMBOU	AM	PM	AM	PM
WINDSOR NB S BANDON	1398	1566	1394	1563	-4	-3	0%	0%
WINDSOR SB N BANDON	1589	996	1616	997	27	1	2%	0%
WINDSOR SB N GARFIELD	961	654	962	656	1	2	0%	0%
WINDSOR NB N GARFIELD	858	1168	856	1168	-2	0	0%	0%
WINDSOR NB N SCHOFIELDS	1120	2494	1119	2494	-1	0	0%	0%
WINDSOR SB N SCHOFIELDS	2194	1205	2195	1207	1	2	0%	0%
EDMUND NB N SYDNEY	1108	1304	1158	1304	50	0	5%	0%
EDMUND SB N SYDNEY	1171	700	1178	737	7	37	1%	5%
HAMILTON NB N GARFIELD	607	713	464	647	-143	-66	-24%	-9%
HAMILTON SB N GARFIELD	914	1054	838	979	-76	-75	-8%	-7%
RIVERSTONE PDE NB S BANDON	341	571	368	626	27	55	8%	10%
RIVERSTONE PDE SB S BANDON	456	182	487	196	31	14	7%	8%
RIVERSTONE PDE NB S CROWN	454	612	533	675	79	63	17%	10%
RIVERSTONE PDE SB S CROWN	498	220	527	249	29	29	6%	13%
GARFIELD EB W RIVERSTONE	3315	1969	3304	1983	-11	14	0%	1%
GARFIELD WB W RIVERSTONE	1824	3450	1823	3457	-1	7	0%	0%
GARFIELD WB W WINDSOR	1478	1070	1465	1049	-13	-21	-1%	-2%
GARFIELD EB W WINDSOR	871	1622	867	1558	-4	-64	0%	-4%
SPINE NB N GARFIELD	3571	1157	3575	1213	4	56	0%	5%
SPINE SB N GARFIELD	993	3697	997	3735	4	38	0%	1%
LOFTUS EB W WINDSOR	1135	1350	1133	1350	-2	0	0%	0%
LOFTUS WB W WINDSOR	1183	560	1187	563	4	3	0%	1%
BOUNDARY EB E WINDSOR	606	862	607	865	1	3	0%	0%
BOUNDARY WB E WINDSOR	808	433	811	435	3	2	0%	0%
WESTMINSTER EB W WINDSOR	855	874	857	881	2	7	0%	1%
WESTMINSTER WB W WINDSOR	1011	751	1014	751	3	0	0%	0%
TULLAWONG NB N SCHOFIELDS	260	679	261	677	1	-2	0%	0%
TULLAWONG SB N SCHOFILEDS	886	490	910	493	24	3	3%	1%
GRANGE EB E RICHMOND	119	375	119	362	0	-13	0%	-3%
GRANGE WB E RICHMOND	1236	879	1252	883	16	4	1%	0%
SOUTH EB E RICHMOND	2056	3087	2062	3088	6	1	0%	0%
SOUTH WB E RICHMOND	1535	1190	1542	1184	7	-6	0%	-1%
TOWNSON EB E RICHMOND	273	1071	273	1072	0	1	0%	0%
TOWNSON WB E RICHMOND	1197	433	1229	433	32	0	3%	0%
RICHMOND NB N GARFIELD	1206	1991	1204	1984	-2	-7	0%	0%
RICHMOND SB N GARFIELD	2093	1473	2106	1477	13	4	1%	0%
RICHMOND NB N ROOTY HILL	3188	4277	3146	4275	-42	-2	-1%	0%
RICHMOND SB N ROOTY HILL	4225	3638	4219	3642	-6	4	0%	0%
HAMILTON NB S LOFTUS	157	434	98	372	-59	-62	-38%	-14%
HAMILTON SB S LOFTUS	652	556	589	521	-63	-35	-10%	-6%
SPINE NB S BANDON	286	1172	285	1216	-1	44	0%	4%
SPINE SB N BANDON	914	270	912	295	-2	25	0%	9%
SCHOFIELDS EB E RAILWAY	1591	2043	1569	2040	-22	-3	-1%	0%
SCHOFIELDS WB E RAILWAY	1038	1036	995	1031	-43	-5	-4%	0%
SCHOFIELDS EB W RAILWAY	2216	3203	2190	3205	-26	2	-1%	0%
SCHOFIELDS WB W RAILWAY	2143	1425	2116	1419	-27	-6	-1%	0%
JUNCTION NB N SCHOFIELDS	459	1478	445	1435	-14	-43	-3%	-3%
JUNCTION SB N SCHOFIELDS	991	457	587	400	-404	-57	-41%	-12%
BOUNDARY NB N SCHOFIELDS	85	49	40	22	-45	-27	-53%	-55%
BOUNDARY SB N SCHOFIELDS	382	342	316	297	-66	-45	-17%	-13%
MCCULLOCH NB S GARFIELD	330	264	149	308	-181	44	-55%	17%
MCCULLOCH SB S GARFIELD	533	675	405	541	-128	-134	-24%	-20%
CLARKE NB N SCHOFIELDS	891	1342	981	1377	90	35	10%	3%
CLARKE SB N SCHOFIELDS	1499	735	1505	744	6	9	0%	1%

RIVERSTONE ROAD

Does Riverstone Road need to cross First Ponds Creek or is it's role served by Garfield and Westminster?

(See *Figures 27 and 28*)

The classification and function of Riverstone Road, in the context of the local road system, is dictated by its failure to cross the railway line at Railway Terrace and connect between Windsor Road to Richmond Road.

No traffic volumes are reported in the models along Riverstone Road, suggesting that it serves the function of a local road, providing access to and from the local precinct.

The model suggests that Riverstone Road does not carry a significant volume of through traffic between Clarke Street and Railway Terrace.

The existing crossing of Second Ponds Creek on Riverstone Road, appears to be utilised by local residents only. The modelling would suggest that the existing conditions on Riverstone Road may be retained in the future with no significant impact on the surrounding road network.

Table 9: Riverstone Road Non Crossing of First Ponds Creek – Link Differential

LOCATION	2036 ILP Model		2036 No Riverstone Rd Crossing of First Ponds Creek		Differential		% Differential	
	36AMILP1	36PMILP1	36AMRIV	36PMRIV	AM	PM	AM	PM
WINDSOR NB S BANDON	1398	1566	1393	1562	-5	-4	0%	0%
WINDSOR SB N BANDON	1589	996	1590	996	1	0	0%	0%
WINDSOR SB N GARFIELD	961	654	937	654	-24	0	-2%	0%
WINDSOR NB N GARFIELD	858	1168	856	1167	-2	-1	0%	0%
WINDSOR NB N SCHOFIELDS	1120	2494	1120	2494	0	0	0%	0%
WINDSOR SB N SCHOFIELDS	2194	1205	2161	1205	-33	0	-2%	0%
EDMUND NB N SYDNEY	1108	1304	1104	1298	-4	-6	0%	0%
EDMUND SB N SYDNEY	1171	700	1171	700	0	0	0%	0%
HAMILTON NB N GARFIELD	607	713	606	712	-1	-1	0%	0%
HAMILTON SB N GARFIELD	914	1054	909	1054	-5	0	-1%	0%
RIVERSTONE PDE NB S BANDON	341	571	344	576	3	5	1%	1%
RIVERSTONE PDE SB S BANDON	456	182	457	182	1	0	0%	0%
RIVERSTONE PDE NB S CROWN	454	612	460	617	6	5	1%	1%
RIVERSTONE PDE SB S CROWN	498	220	499	220	1	0	0%	0%
GARFIELD EB W RIVERSTONE	3315	1969	3315	1969	0	0	0%	0%
GARFIELD WB W RIVERSTONE	1824	3450	1824	3450	0	0	0%	0%
GARFIELD WB W WINDSOR	1478	1070	1486	1069	8	-1	1%	0%
GARFIELD EB W WINDSOR	871	1622	873	1621	2	-1	0%	0%
SPINE NB N GARFIELD	3571	1157	3573	1159	2	2	0%	0%
SPINE SB N GARFIELD	993	3697	994	3697	1	0	0%	0%
LOFTUS EB W WINDSOR	1135	1350	1131	1346	-4	-4	0%	0%
LOFTUS WB W WINDSOR	1183	560	1180	560	-3	0	0%	0%
BOUNDARY EB E WINDSOR	606	862	605	862	-1	0	0%	0%
BOUNDARY WB E WINDSOR	808	433	805	433	-3	0	0%	0%
WESTMINSTER EB W WINDSOR	855	874	889	874	34	0	4%	0%
WESTMINSTER WB W WINDSOR	1011	751	1013	751	2	0	0%	0%
TULLAWONG NB N SCHOFIELDS	260	679	258	678	-2	-1	-1%	0%
TULLAWONG SB N SCHOFILEDS	886	490	911	490	25	0	3%	0%
GRANGE EB E RICHMOND	119	375	119	375	0	0	0%	0%
GRANGE WB E RICHMOND	1236	879	1236	881	0	2	0%	0%
SOUTH EB E RICHMOND	2056	3087	2065	3087	9	0	0%	0%
SOUTH WB E RICHMOND	1535	1190	1529	1184	-6	-6	0%	-1%
TOWNSON EB E RICHMOND	273	1071	272	1072	-1	1	0%	0%
TOWNSON WB E RICHMOND	1197	433	1194	433	-3	0	0%	0%
RICHMOND NB N GARFIELD	1206	1991	1202	1990	-4	-1	0%	0%
RICHMOND SB N GARFIELD	2093	1473	2103	1473	10	0	0%	0%
RICHMOND NB N ROOTY HILL	3188	4277	3200	4277	12	0	0%	0%
RICHMOND SB N ROOTY HILL	4225	3638	4215	3637	-10	-1	0%	0%
HAMILTON NB S LOFTUS	157	434	157	433	0	-1	0%	0%
HAMILTON SB S LOFTUS	652	556	649	556	-3	0	0%	0%
SPINE NB S BANDON	286	1172	286	1172	0	0	0%	0%
SPINE SB N BANDON	914	270	913	268	-1	-2	0%	-1%
SCHOFIELDS EB E RAILWAY	1591	2043	1602	2121	11	78	1%	4%
SCHOFIELDS WB E RAILWAY	1038	1036	1041	1035	3	-1	0%	0%
SCHOFIELDS EB W RAILWAY	2216	3203	2224	3203	8	0	0%	0%
SCHOFIELDS WB W RAILWAY	2143	1425	2139	1418	-4	-7	0%	0%
JUNCTION NB N SCHOFIELDS	459	1478	459	1399	0	-79	0%	-5%
JUNCTION SB N SCHOFIELDS	991	457	949	440	-42	-17	-4%	-4%
BOUNDARY NB N SCHOFIELDS	85	49	84	125	-1	76	-1%	155%
BOUNDARY SB N SCHOFIELDS	382	342	385	342	3	0	1%	0%
MCCULLOCH NB S GARFIELD	330	264	329	264	-1	0	0%	0%
MCCULLOCH SB S GARFIELD	533	675	527	675	-6	0	-1%	0%
CLARKE NB N SCHOFIELDS	891	1342	890	1337	-1	-5	0%	0%
CLARKE SB N SCHOFIELDS	1499	735	1499	735	0	0	0%	0%

SCHOFIELDS ROAD

Changes are proposed on Schofields Road, in particular removal of the intersection into the Alex Avenue Precinct between Railway Terrace and Junction Road, and potential replacement with on/off ramps at Railway Tce. Further advice is needed on this from DoP, but please factor into any re-run of the model.

(See *Figures 29, 30, 31 and 32*)

The eastbound on-load ramp from Railway Terrace onto Schofields Road forms part of the ILP base model and has been included in all subsequent scenario models undertaken for this project.

This option removes the western most access, directly to the east of the Schofields town centre, and introduces a westbound offload ramp from Schofields Road to Railway Terrace, culminating at a signalised T-junction, permitting all vehicle movements.

Table 10: Westbound Offload Ramp to Railway Terrace – Link Differential

LOCATION	2036 ILP Model		2036 Schofields Rd EB Offload Ramp to Railway Terrace		Differential		% Differential	
	36AMILP1	36PMILP1	36AMTER	36PMTER	AM	PM	AM	PM
WINDSOR NB S BANDON	1398	1566	1394	1576	-4	10	0%	1%
WINDSOR SB N BANDON	1589	996	1590	1002	1	6	0%	1%
WINDSOR SB N GARFIELD	961	654	937	664	-24	10	-2%	2%
WINDSOR NB N GARFIELD	858	1168	857	1183	-1	15	0%	1%
WINDSOR NB N SCHOFIELDS	1120	2494	1120	2487	0	-7	0%	0%
WINDSOR SB N SCHOFIELDS	2194	1205	2160	1211	-34	6	-2%	0%
EDMUND NB N SYDNEY	1108	1304	1102	1301	-6	-3	-1%	0%
EDMUND SB N SYDNEY	1171	700	1187	701	16	1	1%	0%
HAMILTON NB N GARFIELD	607	713	607	698	0	-15	0%	-2%
HAMILTON SB N GARFIELD	914	1054	895	1060	-19	6	-2%	1%
RIVERSTONE PDE NB S BANDON	341	571	344	605	3	34	1%	6%
RIVERSTONE PDE SB S BANDON	456	182	456	179	0	-3	0%	-2%
RIVERSTONE PDE NB S CROWN	454	612	460	649	6	37	1%	6%
RIVERSTONE PDE SB S CROWN	498	220	497	218	-1	-2	0%	-1%
GARFIELD EB W RIVERSTONE	3315	1969	3317	1931	2	-38	0%	-2%
GARFIELD WB W RIVERSTONE	1824	3450	1820	3441	-4	-9	0%	0%
GARFIELD WB W WINDSOR	1478	1070	1487	1039	9	-31	1%	-3%
GARFIELD EB W WINDSOR	871	1622	873	1614	2	-8	0%	0%
SPINE NB N GARFIELD	3571	1157	3573	1139	2	-18	0%	-2%
SPINE SB N GARFIELD	993	3697	991	3707	-2	10	0%	0%
LOFTUS EB W WINDSOR	1135	1350	1131	1355	-4	5	0%	0%
LOFTUS WB W WINDSOR	1183	560	1180	563	-3	3	0%	1%
BOUNDARY EB E WINDSOR	606	862	606	858	0	-4	0%	0%
BOUNDARY WB E WINDSOR	808	433	805	417	-3	-16	0%	-4%
WESTMINSTER EB W WINDSOR	855	874	855	896	0	22	0%	3%
WESTMINSTER WB W WINDSOR	1011	751	1027	761	16	10	2%	1%
TULLAWONG NB N SCHOFIELDS	260	679	258	633	-2	-46	-1%	-7%
TULLAWONG SB N SCHOFILEDS	886	490	914	490	28	0	3%	0%
GRANGE EB E RICHMOND	119	375	118	373	-1	-2	-1%	-1%
GRANGE WB E RICHMOND	1236	879	1254	923	18	44	1%	5%
SOUTH EB E RICHMOND	2056	3087	2057	3141	1	54	0%	2%
SOUTH WB E RICHMOND	1535	1190	1517	1186	-18	-4	-1%	0%
TOWNSON EB E RICHMOND	273	1071	271	1128	-2	57	-1%	5%
TOWNSON WB E RICHMOND	1197	433	1192	426	-5	-7	0%	-2%
RICHMOND NB N GARFIELD	1206	1991	1210	1970	4	-21	0%	-1%
RICHMOND SB N GARFIELD	2093	1473	2103	1471	10	-2	0%	0%
RICHMOND NB N ROOTY HILL	3188	4277	3211	4157	23	-120	1%	-3%
RICHMOND SB N ROOTY HILL	4225	3638	4224	3695	-1	57	0%	2%
HAMILTON NB S LOFTUS	157	434	157	415	0	-19	0%	-4%
HAMILTON SB S LOFTUS	652	556	635	563	-17	7	-3%	1%
SPINE NB S BANDON	286	1172	287	1166	1	-6	0%	-1%
SPINE SB N BANDON	914	270	911	291	-3	21	0%	8%
SCHOFIELDS EB E RAILWAY	1591	2043	1595	1921	4	-122	0%	-6%
SCHOFIELDS WB E RAILWAY	1038	1036	1049	1067	11	31	1%	3%
SCHOFIELDS EB W RAILWAY	2216	3203	2217	3046	1	-157	0%	-5%
SCHOFIELDS WB W RAILWAY	2143	1425	2127	1388	-16	-37	-1%	-3%
JUNCTION NB N SCHOFIELDS	459	1478	458	1295	-1	-183	0%	-12%
JUNCTION SB N SCHOFIELDS	991	457	997	459	6	2	1%	0%
BOUNDARY NB N SCHOFIELDS	85	49	83	26	-2	-23	-2%	-47%
BOUNDARY SB N SCHOFIELDS	382	342	370	350	-12	8	-3%	2%
MCCULLOCH NB S GARFIELD	330	264	329	278	-1	14	0%	5%
MCCULLOCH SB S GARFIELD	533	675	514	679	-19	4	-4%	1%
CLARKE NB N SCHOFIELDS	891	1342	887	1434	-4	92	0%	7%
CLARKE SB N SCHOFIELDS	1499	735	1511	748	12	13	1%	2%

REVISED ILP MODEL

Once all above changes are tested and agreed, run the model on a final draft road network to test it works as we expect.

(See *Figures 33 and 34)*

The revised Year 2036 ILP model has been proposed by the DoP, in consultation with key stakeholders, and is presented for consideration. The revisions to the current ILP include...

- Removal of the Westminster Street rail bridge,
- The intersection of Railway Terrace and Westminster Street as a 'T' intersection,
- Westminster Street downgraded to a local road terminating at Boundary Road,
- Kensington Park Road upgraded to a collector road for its full length and extended, east, to link with Guntawong Road (east of First Ponds Creek),
- St Albans Road modelled as a local road,
- Removal of the intersection of Edmund Street and Loftus Street, and removal of the section of Edmund Street, north of Wellington Street,
- Downgrade Edmund Street to a lower order collector road while retaining the current road reserve,
- McCulloch Street to be upgraded on its current alignment,
- Boundary Road to be upgraded on its current alignment (excluding southern end) and extended to Kensington Park Road,
- Removal of Riverstone Road crossing of First Ponds Creek (current causeway to be retained).
- Town Centre link road (from Schofields Road to Alex Avenue town centre) is retained, but the intersection is priority left in/left out controlled, only (eastbound right turn to and from Schofields Road removed).

Table 11: 2036 Revised ILP Model – Link Differential

LOCATION	2036 ILP Model		2036 Revised ILP Model		Differential		% Differential	
	36AMILP1	36PMILP1	36AMILPR	36PNILPR	AM	PM	AM	PM
WINDSOR NB S BANDON	1398	1566	1591	1656	193	90	14%	6%
WINDSOR SB N BANDON	1589	996	1606	1210	17	214	1%	21%
WINDSOR SB N GARFIELD	961	654	988	769	27	115	3%	18%
WINDSOR NB N GARFIELD	858	1168	853	1234	-5	66	-1%	6%
WINDSOR NB N SCHOFIELDS	1120	2494	1240	2455	120	-39	11%	-2%
WINDSOR SB N SCHOFIELDS	2194	1205	2165	1295	-29	90	-1%	7%
EDMUND NB N SYDNEY	1108	1304	467	784	-641	-520	-58%	-40%
EDMUND SB N SYDNEY	1171	700	749	493	-422	-207	-36%	-30%
HAMILTON NB N GARFIELD	607	713	645	671	38	-42	6%	-6%
HAMILTON SB N GARFIELD	914	1054	891	824	-23	-230	-3%	-22%
RIVERSTONE PDE NB S BANDON	341	571	414	613	73	42	21%	7%
RIVERSTONE PDE SB S BANDON	456	182	513	214	57	32	13%	18%
RIVERSTONE PDE NB S CROWN	454	612	685	768	231	156	51%	25%
RIVERSTONE PDE SB S CROWN	498	220	592	264	94	44	19%	20%
GARFIELD EB W RIVERSTONE	3315	1969	3555	2532	240	563	7%	29%
GARFIELD WB W RIVERSTONE	1824	3450	2423	3943	599	493	33%	14%
GARFIELD WB W WINDSOR	1478	1070	1672	1327	194	257	13%	24%
GARFIELD EB W WINDSOR	871	1622	570	1403	-301	-219	-35%	-14%
SPINE NB N GARFIELD	3571	1157	3490	1299	-81	142	-2%	12%
SPINE SB N GARFIELD	993	3697	1041	3613	48	-84	5%	-2%
LOFTUS EB W WINDSOR	1135	1350	768	1060	-367	-290	-32%	-21%
LOFTUS WB W WINDSOR	1183	560	937	406	-246	-154	-21%	-28%
BOUNDARY EB E WINDSOR	606	862	1027	1172	421	310	69%	36%
BOUNDARY WB E WINDSOR	808	433	1008	391	200	-42	25%	-10%
WESTMINSTER EB W WINDSOR	855	874	827	653	-28	-221	-3%	-25%
WESTMINSTER WB W WINDSOR	1011	751	772	539	-239	-212	-24%	-28%
TULLAWONG NB N SCHOFIELDS	260	679	268	882	8	203	3%	30%
TULLAWONG SB N SCHOFILEDS	886	490	950	587	64	97	7%	20%
GRANGE EB E RICHMOND	119	375	33	188	-86	-187	-72%	-50%
GRANGE WB E RICHMOND	1236	879	675	578	-561	-301	-45%	-34%
SOUTH EB E RICHMOND	2056	3087	2139	3068	83	-19	4%	-1%
SOUTH WB E RICHMOND	1535	1190	2136	1347	601	157	39%	13%
TOWNSON EB E RICHMOND	273	1071	281	1051	8	-20	3%	-2%
TOWNSON WB E RICHMOND	1197	433	1174	446	-23	13	-2%	3%
RICHMOND NB N GARFIELD	1206	1991	1146	1962	-60	-29	-5%	-1%
RICHMOND SB N GARFIELD	2093	1473	2103	1422	10	-51	0%	-3%
RICHMOND NB N ROOTY HILL	3188	4277	3032	3949	-156	-328	-5%	-8%
RICHMOND SB N ROOTY HILL	4225	3638	4056	3740	-169	102	-4%	3%
HAMILTON NB S LOFTUS	157	434	282	529	125	95	80%	22%
HAMILTON SB S LOFTUS	652	556	771	513	119	-43	18%	-8%
SPINE NB S BANDON	286	1172	309	1451	23	279	8%	24%
SPINE SB N BANDON	914	270	1066	322	152	52	17%	19%
SCHOFIELDS EB E RAILWAY	1591	2043	1649	2446	58	403	4%	20%
SCHOFIELDS WB E RAILWAY	1038	1036	1070	1288	32	252	3%	24%
SCHOFIELDS EB W RAILWAY	2216	3203	2593	3292	377	89	17%	3%
SCHOFIELDS WB W RAILWAY	2143	1425	2696	1685	553	260	26%	18%
JUNCTION NB N SCHOFIELDS	459	1478	635	1466	176	-12	38%	-1%
JUNCTION SB N SCHOFIELDS	991	457	1967	640	976	183	98%	40%
BOUNDARY NB N SCHOFIELDS	85	49	243	476	158	427	186%	871%
BOUNDARY SB N SCHOFIELDS	382	342	330	268	-52	-74	-14%	-22%
MCCULLOCH NB S GARFIELD	330	264	274	238	-56	-26	-17%	-10%
MCCULLOCH SB S GARFIELD	533	675	518	674	-15	-1	-3%	0%
CLARKE NB N SCHOFIELDS	891	1342	975	1443	84	101	9%	8%
CLARKE SB N SCHOFIELDS	1499	735	1538	869	39	134	3%	18%

Table 12: Anticipated Development Levels for the North West Growth Centre

		CURRENT					2011				2016				2021				2036			
NWGC Population Projections	Netanal Zone	Pop (Persons)	Dwellings (Households)	Employ (Employees)	Inbound	Outbound	Dev hhld	Total hhld by Zone	Employees	Total Zone (Employees)	Dev hhld	Total hhld by Zone	Employees	Total Zone (Employees)	Dev hhld	Total hhld by Zone	Employees	Total Zone (Employees)	Total Dev hhld	Total hhld by Zone	Total Employees	Total Zone (Employees)
Marsden Park North AM	403	547	191	119	**43**	**8**	0	191	0	119	0	191	0	119	400	591	8	127	4,000	4,191	400	519
Marsden Park North PM		547	191	119	**8**	**43**	0	191	0	119	0	191	0	119	400	591	8	127	4,000	4,191	400	519
Marsden Park Residential and Industry AM	680	208	75	243	**87**	**15**	0	75	0	243	245	320	0	243	510	585	0	243	2,500	2,575	0	243
Marsden Park Residential and Industry PM		208	75	243	**15**	**87**	0	75	0	243	245	320	0	243	510	585	0	243	2,500	2,575	0	243
Marsden Park Residential and Industry AM	680725	0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park Residential and Industry PM		0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park Residential and Industry AM	680727	0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park Residential and Industry PM		0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park Residential and Industry AM	680735	0	0	0	0	0	0	0	0	0	235	235	115	115	460	460	467	582	2,500	2,500	1,100	1,100
Marsden Park Residential and Industry PM		0	0	0	0	0	0	0	0	0	235	235	115	115	460	460	467	582	2,500	2,500	1,100	1,100
Marsden Park Residential and Industry AM	680736	0	0	0	0	0	0	0	0	0	75	75	0	0	150	150	0	0	750	750	0	0
Marsden Park Residential and Industry PM		0	0	0	0	0	0	0	0	0	75	75	0	0	150	150	0	0	750	750	0	0
Marsden Park Residential and Industry AM	680752	0	0	0	0	0	0	0	0	0	225	225	57	57	460	460	234	291	2,500	2,500	550	550
Marsden Park Residential and Industry PM		0	0	0	0	0	0	0	0	0	225	225	57	57	460	460	234	291	2,500	2,500	550	550
Marsden Park Residential and Industry AM	680969	0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park Residential and Industry PM		0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park Residential and Industry AM	680981	0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park Residential and Industry PM		0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park Residential and Industry AM	680983	0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park Residential and Industry PM		0	0	0	0	0	0	0	0	0	0	0	174	174	0	0	708	882	0	0	1,667	1,667
Marsden Park West - Shanes Park AM	681	417	153	160	**57**	**10**	0	153	0	160	500	653	27	187	1,000	1,153	28	214	2,500	2,653	550	710
Marsden Park West - Shanes Park PM		417	153	160	**10**	**57**	0	153	0	160	500	653	27	187	1,000	1,153	28	214	2,500	2,653	550	710
Marsden Park East - West Schofields AM	689	327	118	212	**76**	**13**	0	118	0	212	0	118	0	212	0	118	0	212	2,000	2,118	400	612
Marsden Park East - West Schofields PM		327	118	212	**13**	**76**	0	118	0	212	0	118	0	212	0	118	0	212	2,000	2,118	400	612
Colebee - West Schofields AM	406	635	229	201	**72**	**13**	290	519	29	230	890	1,119	95	325	1,000	1,229	55	380	1,000	1,229	1,100	1,301
Colebee - West Schofields PM		635	229	201	**13**	**72**	290	519	29	230	890	1,119	95	325	1,000	1,229	55	380	1,000	1,229	1,100	1,301
Riverstone - South AM	404	2,685	854	197	**70**	**12**	150	1,004	15	212	400	1,254	43	255	1,300	2,154	72	326	4,100	4,954	1,100	1,297
Riverstone - South PM		2,685	854	197	**12**	**70**	150	1,004	15	212	400	1,254	43	255	1,300	2,154	72	326	4,100	4,954	1,100	1,297
Riverstone - Southwest AM	905	0	0	0	**0**	**0**	150	150	24	24	575	575	101	125	1,100	1,100	100	224	2,500	2,500	1,800	1,800
Riverstone - Southwest PM		0	0	0	**0**	**0**	150	150	24	24	575	575	101	125	1,100	1,100	100	224	2,500	2,500	1,800	1,800
Quakers Hill AM	612	13,163	4,341	1,371	**490**	**86**	0	4,341	0	1,371	500	4,841	87	1,458	1,000	5,341	91	1,549	2,500	6,841	1,800	3,171
Quakers Hill PM		13,163	4,341	1,371	**86**	**490**	0	4,341	0	1,371	500	4,841	87	1,458	1,000	5,341	91	1,549	2,500	6,841	1,800	3,171
Schofields - South AM	743	1,134	361	160	**57**	**10**	0	361	0	160	200	561	8	168	1,100	1,461	22	190	4,200	4,561	400	560
Schofields - South PM		1,134	361	160	**10**	**57**	0	361	0	160	200	561	8	168	1,100	1,461	22	190	4,200	4,561	400	560
Alex Avenue AM	746	974	317	136	**49**	**9**	200	517	7	143	700	1,017	27	170	1,200	1,517	24	195	2,800	3,117	400	536
Alex Avenue PM		974	317	136	**9**	**49**	200	517	7	143	700	1,017	27	170	1,200	1,517	24	195	2,800	3,117	400	536
Vineyard - North AM	609	824	305	485	**173**	**31**	0	305	0	485	0	305	0	485	0	305	0	485	2,500	2,805	400	885
Vineyard - North PM		824	305	485	**31**	**173**	0	305	0	485	0	305	0	485	0	305	0	485	2,500	2,805	400	885
Vineyard AM	610	663	210	1,826	**652**	**115**	0	210	0	1,826	0	210	0	1,826	0	210	0	1,826	2,600	2,810	400	2,226
Vineyard PM		663	210	1,826	**115**	**652**	0	210	0	1,826	0	210	0	1,826	0	210	0	1,826	2,600	2,810	400	2,226
Paclib North Industrial AM	906	0	0	0	**0**	**0**	0	0	87	87	0	0	750	750	0	0	1,500	1,500	0	0	3,000	3,000
Paclib North Industrial PM		0	0	0	**0**	**0**	0	0	87	87	0	0	750	750	0	0	1,500	1,500	0	0	3,000	3,000
Paclib Middle Industrial AM	907	0	0	0	**0**	**0**	0	0	43	43	0	0	375	375	0	0	750	750	0	0	1,500	1,500
Paclib Middle Industrial PM		0	0	0	**0**	**0**	0	0	43	43	0	0	375	375	0	0	750	750	0	0	1,500	1,500
Paclib South Commercial AM	908	0	0	0	**0**	**0**	0	0	173	173	0	0	1,500	1,500	0	0	3,000	3,000	0	0	6,000	6,000
Paclib South Commercial PM		0	0	0	**0**	**0**	0	0	173	173	0	0	1,500	1,500	0	0	3,000	3,000	0	0	6,000	6,000
Riverstone - South AM	824	2,718	863	646	**231**	**41**	0	863	0	646	325	1,188	13	659	575	1,438	12	670	900	1,763	400	1,046
Riverstone - South PM		2,718	863	646	**41**	**231**	0	863	0	646	325	1,188	13	659	575	1,438	12	670	900	1,763	400	1,046
Riverstone AM	825	2,622	832	391	**140**	**25**	0	832	0	391	325	1,157	13	404	575	1,407	12	415	900	1,732	400	791
Riverstone PM		2,622	832	391	**25**	**140**	0	832	0	391	325	1,157	13	404	575	1,407	12	415	900	1,732	400	791
North Kellyville AM	625	651	200	250	**89**	**16**	100	300	4	254	1,000	1,200	39	292	2,500	2,700	50	343	2,800	3,000	400	650
North Kellyville PM		651	200	250	**16**	**89**	100	300	4	254	1,000	1,200	39	292	2,500	2,700	50	343	2,800	3,000	400	650
Box Hill Industrial AM	626	1,639	509	302	**108**	**19**	0	509	0	302	0	509	0	302	400	909	72	374	3,500	4,009	3,600	3,902
Box Hill Industrial PM		1,639	509	302	**19**	**108**	0	509	0	302	0	509	0	302	400	909	72	374	3,500	4,009	3,600	3,902
Box Hill AM	627	386	118	57	**20**	**4**	0	118	0	57	0	118	0	57	700	818	39	96	6,500	6,618	1,100	1,157
Box Hill PM		386	118	57	**4**	**20**	0	118	0	57	0	118	0	57	700	818	39	96	6,500	6,618	1,100	1,157
Riverstone Northeast AM	826	86	27	35	**13**	**2**	0	27	0	35	800	827	31	66	1,200	1,227	24	90	1,200	1,227	400	435
Riverstone Northeast PM		86	27	35	**2**	**13**	0	27	0	35	800	827	31	66	1,200	1,227	24	90	1,200	1,227	400	435
Riverstone East AM	827	228	72	96	**34**	**6**	0	72	0	96	0	72	0	96	500	572	10	106	3,400	3,472	400	496
Riverstone East PM		228	72	96	**6**	**34**	0	72	0	96	0	72	0	96	500	572	10	106	3,400	3,472	400	496
Rouse Hill West - Area 20 AM	611	472	151	158	**56**	**10**	50	201	0	158	25	176	0	158	50	201	0	158	75	226	20	178
Rouse Hill West - Area 20 PM		472	151	158	**10**	**56**	50	201	0	158	25	176	0	158	50	201	0	158	75	226	20	178
Rouse Hill West - Area 20 AM	611928	0	0	0	**0**	**0**	0	0	0	0	95	95	0	0	100	100	0	0	195	195	20	20
Rouse Hill West - Area 20 PM		0	0	0	**0**	**0**	0	0	0	0	95	95	0	0	100	100	0	0	195	195	20	20
Rouse Hill West - Area 20 AM	611947	0	0	0	**0**	**0**	0	0	0	0	30	30	0	0	0	0	0	0	30	30	20	20
Rouse Hill West - Area 20 PM		0	0	0	**0**	**0**	0	0	0	0	30	30	0	0	0	0	0	0	30	30	20	20
Rouse Hill West - Area 20 AM	611948	0	0	0	**0**	**0**	0	0	0	0	50	50	0	0	50	50	0	0	100	100	20	20
Rouse Hill West - Area 20 PM		0	0	0	**0**	**0**	0	0	0	0	50	50	0	0	50	50	0	0	100	100	20	20
Rouse Hill West - Area 20 AM	611949	0	0	0	**0**	**0**	0	0	0	0	400	400	1	1	100	100	0	1	500	500	20	20
Rouse Hill West - Area 20 PM		0	0	0	**0**	**0**	0	0	0	0	400	400	1	1	100	100	0	1	500	500	20	20
Rouse Hill West - Area 20 AM	611819	0	0	0	**0**	**0**	0	0	0	0	100	100	0	0	100	100	0	0	200	200	20	20
Rouse Hill West - Area 20 PM		0	0	0	**0**	**0**	0	0	0	0	100	100	0	0	100	100	0	0	200	200	20	20
Rouse Hill West - Area 20 AM	611848	0	0	0	**0**	**0**	0	0	0	0	600	600	1	1	100	100	0	1	700	700	20	20
Rouse Hill West - Area 20 PM		0	0	0	**0**	**0**	0	0	0	0	600	600	1	1	100	100	0	1	700	700	20	20
Rouse Hill West - Area 20 AM	611849	0	0	0	**0**	**0**	0	0	0	0	100	100	0	0	200	200	0	0	300	300	20	20
Rouse Hill West - Area 20 PM		0	0	0	**0**	**0**	0	0	0	0	100	100	0	0	200	200	0	0	300	300	20	20
Rouse Hill West - Area 20 AM	611763	0	0	0	**0**	**0**	0	0	0	0	200	200	0	0	200	200	0	1	400	400	20	20
Rouse Hill West - Area 20 PM		0	0	0	**0**	**0**	0	0	0	0	200	200	0	0	200	200	0	1	400	400	20	20
Rouse Hill AM	624	389	169	0	**0**	**0**	0	169	0	0	500	669	19	19	1,000	1,169	20	40	1,700	1,869	400	400
Rouse Hill PM		389	169	0	**0**	**0**	0	169	0	0	500	669	19	19	1,000	1,169	20	40	1,700	1,869	400	400
The Ponds AM	747	412	179	0	**0**	**0**	0	179	0	0	1,200	1,379	117	117	1,855	2,034	93	210	1,855	2,034	1,000	1,000
The Ponds PM		412	179	0	**0**	**0**	0	179	0	0	1,200	1,379	117	117	1,855	2,034	93	210	1,855	2,034	1,000	1,000
			10,274	**7,045**			**940**	**11,119**	**382**	**7,367**	**10,295**	**20,569**	**4,287**	**11,411**	**19,885**	**30,159**	**10,172**	**18,840**	**64,205**	**74,479**	**37,515**	**44,560**

APPENDIX A

NETANAL NWGC PLOTS

Figure 7: 2036 Morning Peak Hour ILP Conforming Model

Figure 8: 2036 Evening Peak Hour ILP Conforming Model

Figure 9: 2036 Morning Peak Hour Westminster Street - Collector Volumes

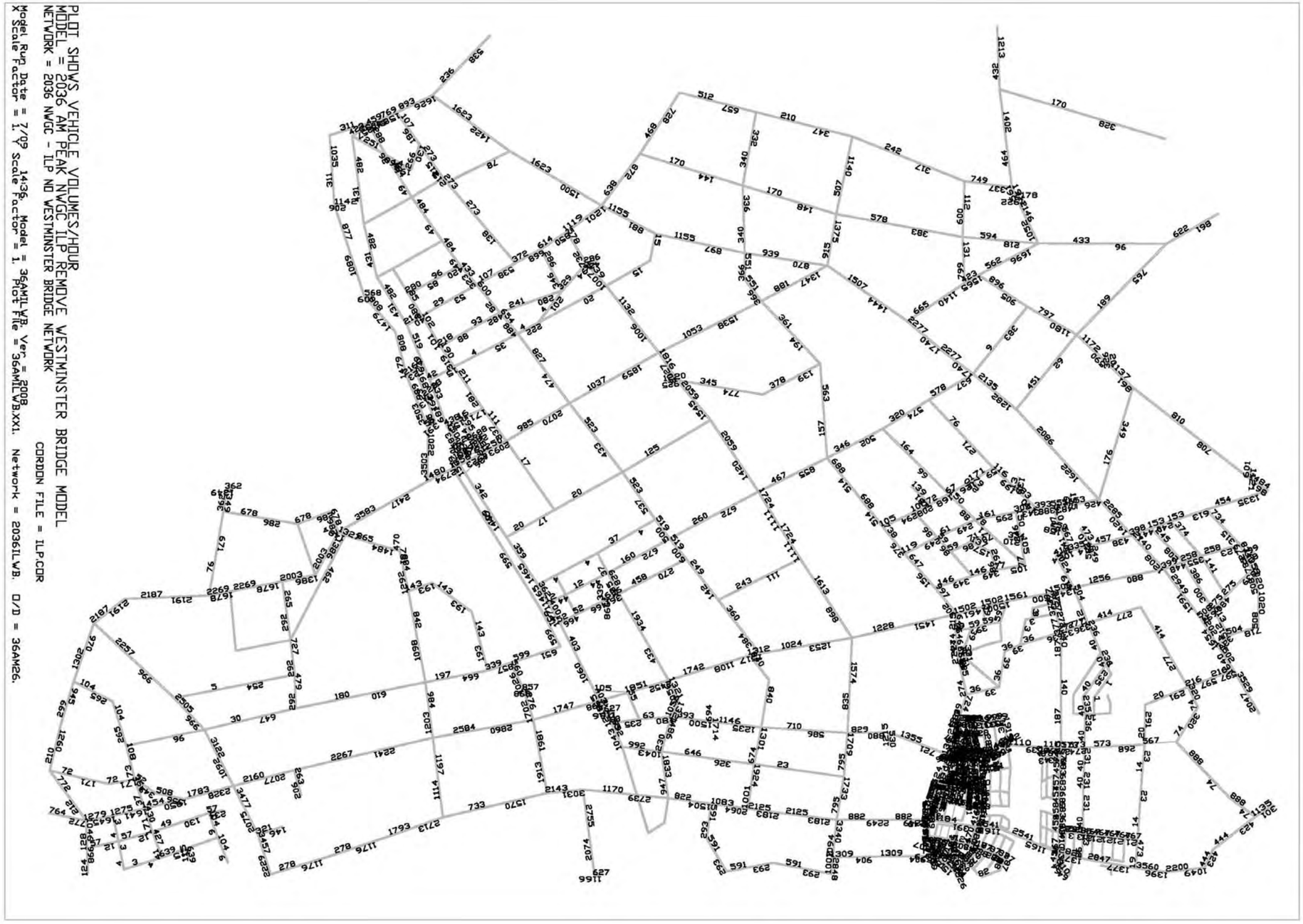


Figure 10: 2036 Evening Peak Hour Westminster Street - Collector Volumes

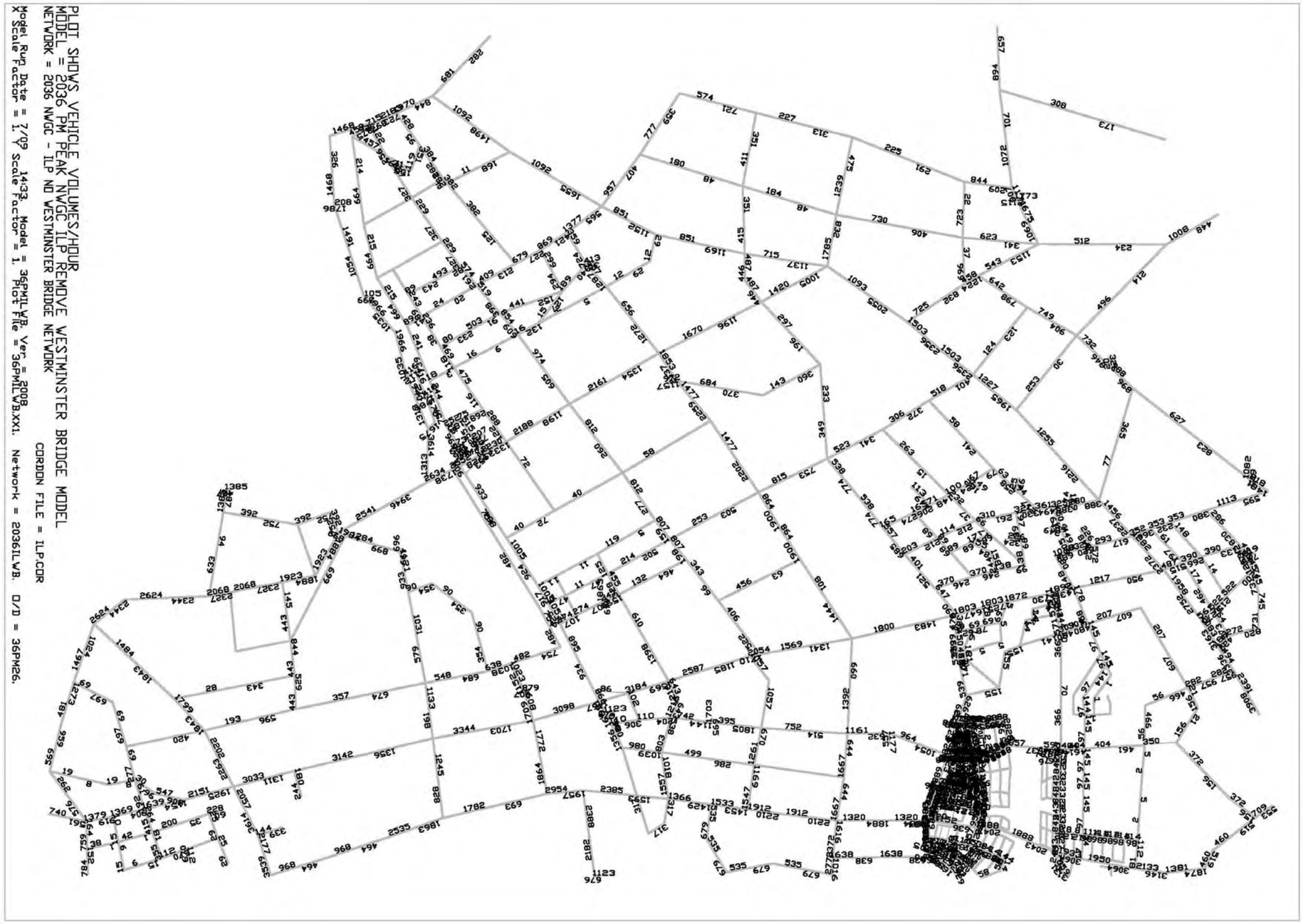


Figure 11: 2036 Morning Peak Hour Westminster Street Model minus ILP Model - Link Difference

Figure 12: 2036 Evening Peak Hour Westminster Street Model minus ILP Model - Link Difference

Figure 13: 2036 Morning Peak Hour Edmund Street Model

Figure 14: 2036 Evening Peak Hour Edmund Street Model

Figure 15: 2036 Morning Peak Hour Edmund Street Model minus ILP Model - Link Difference

Figure 16: 2036 Evening Peak Hour Edmund Street Model minus ILP Model - Link Difference

Figure 17: 2036 Morning Peak Hour No Clarke Street/Oak Street Model

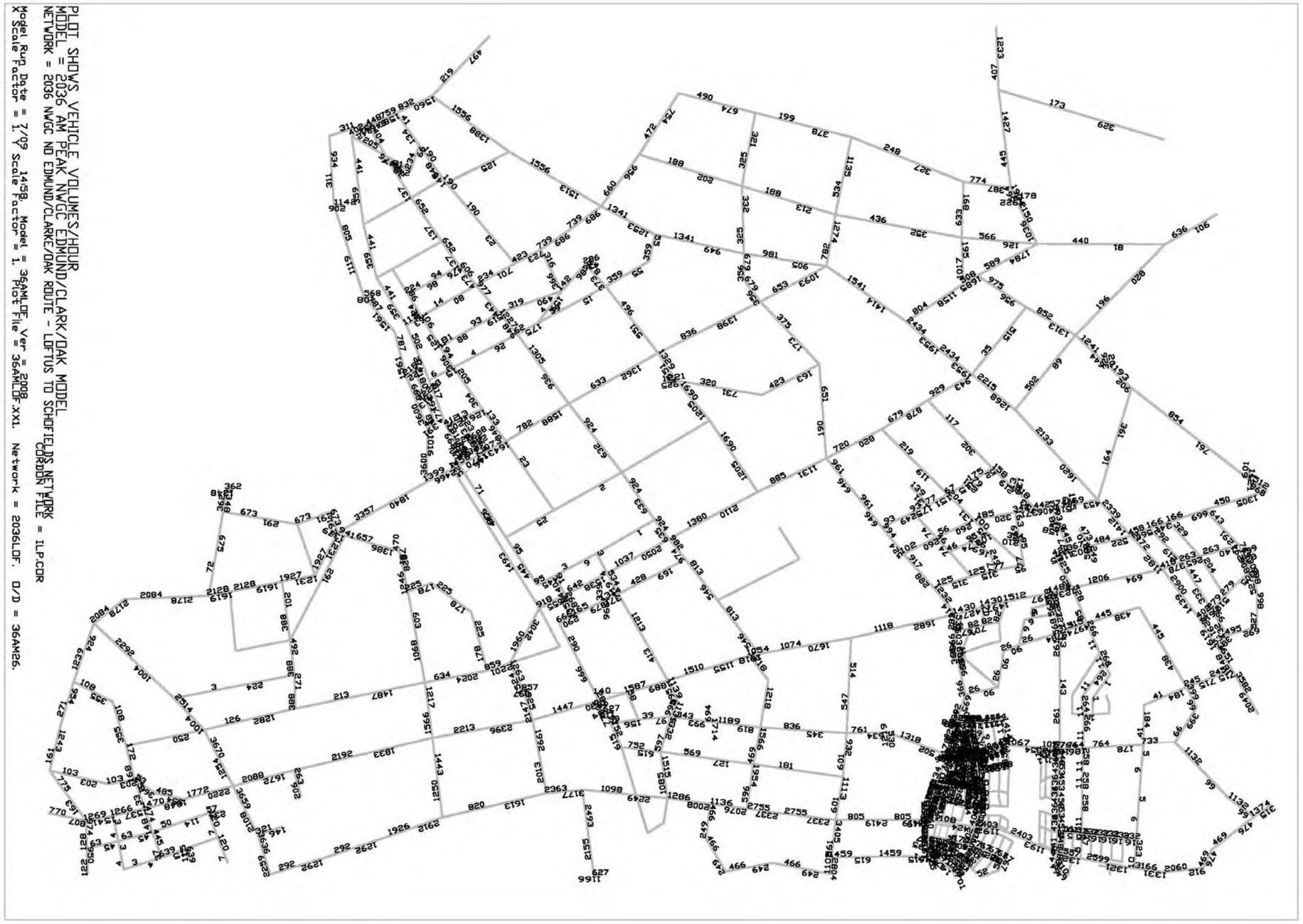


Figure 18: 2036 Evening Peak Hour No Clarke Street/Oak Street Model

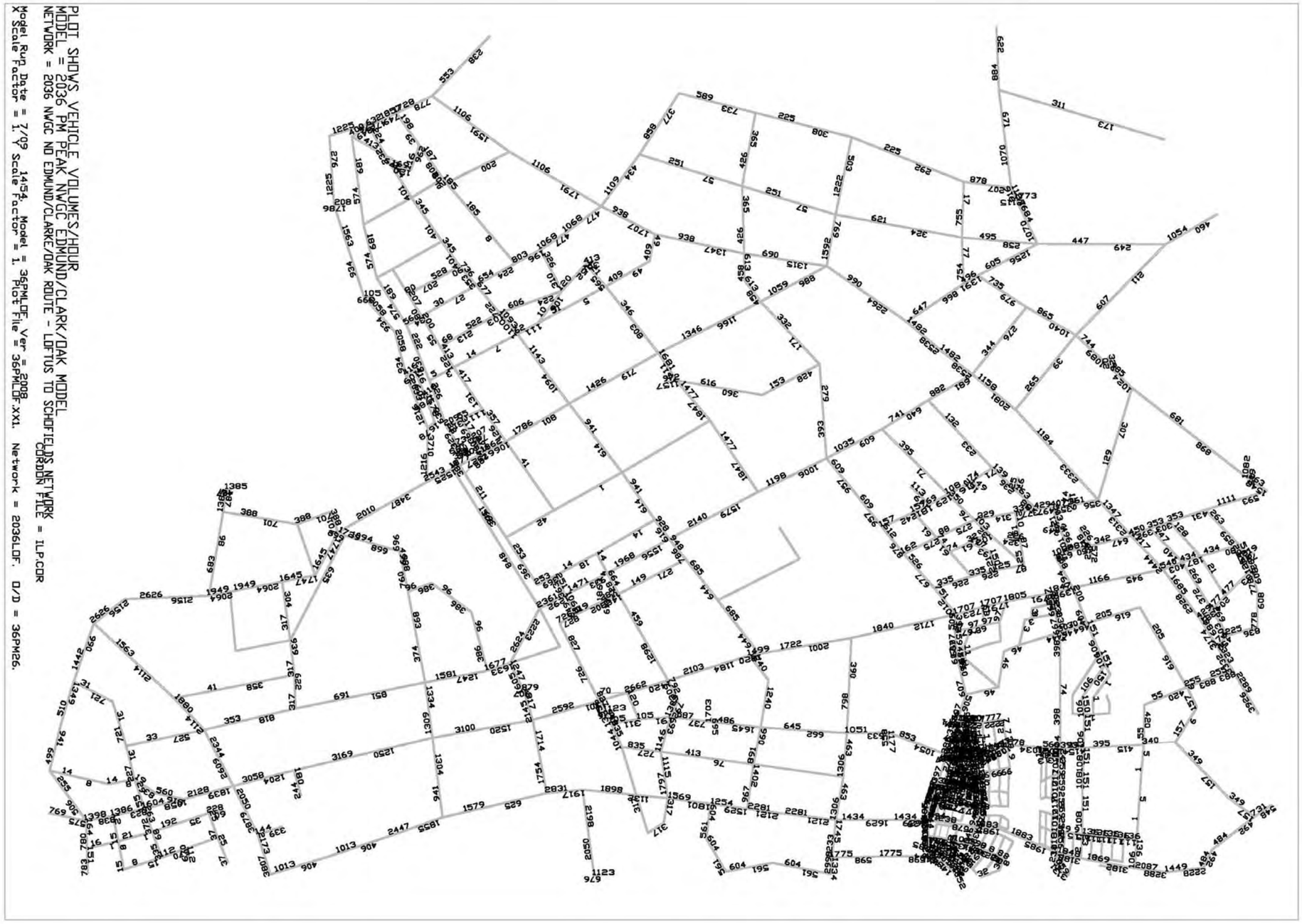


Figure 19: 2016 Morning Peak Hour No Clarke Street/Oak Street Model

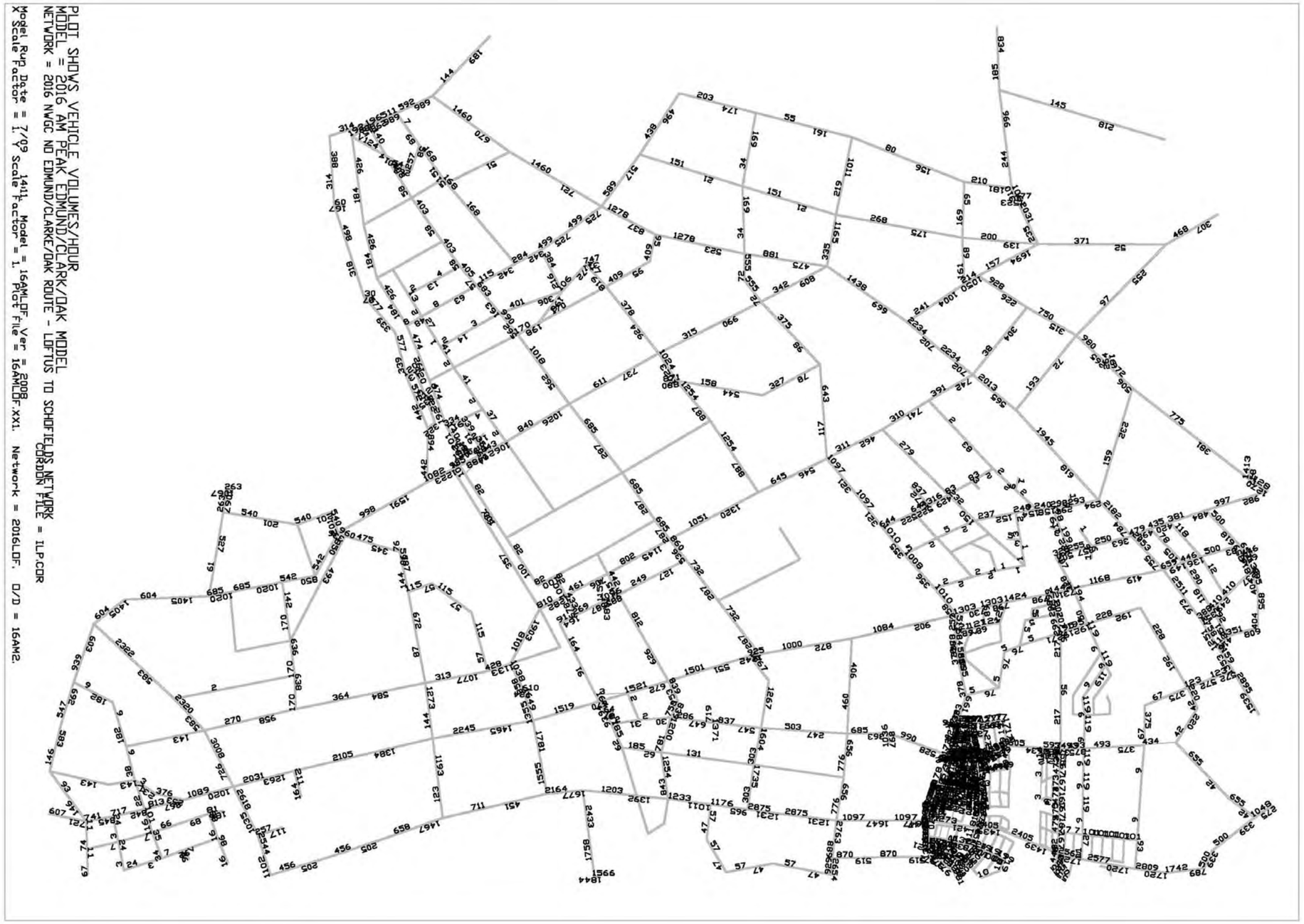


Figure 20: 2016 Evening Peak Hour No Clarke Street/Oak Street Model

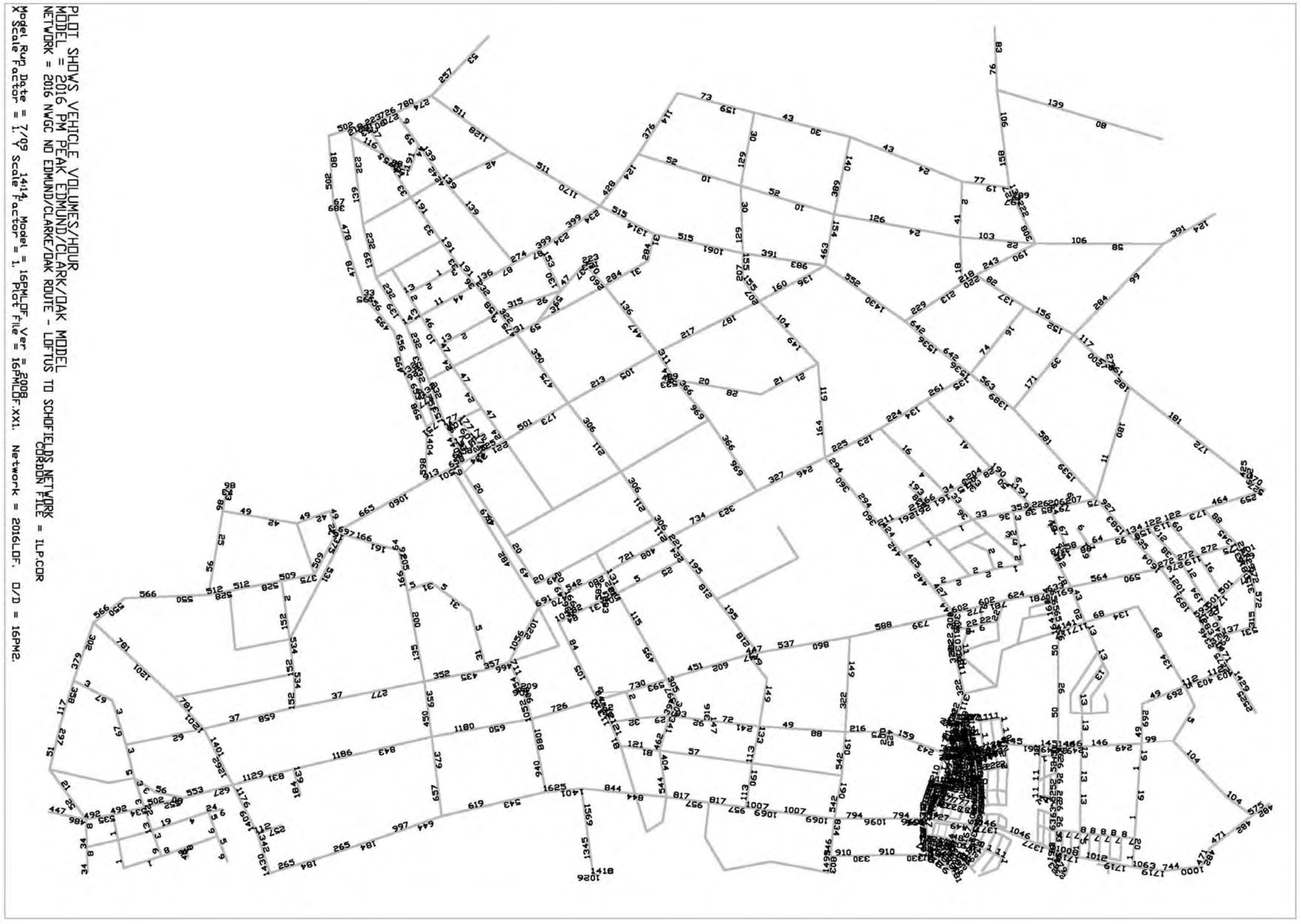


Figure 21: 2021 Morning Peak Hour No Clarke Street/Oak Street Model

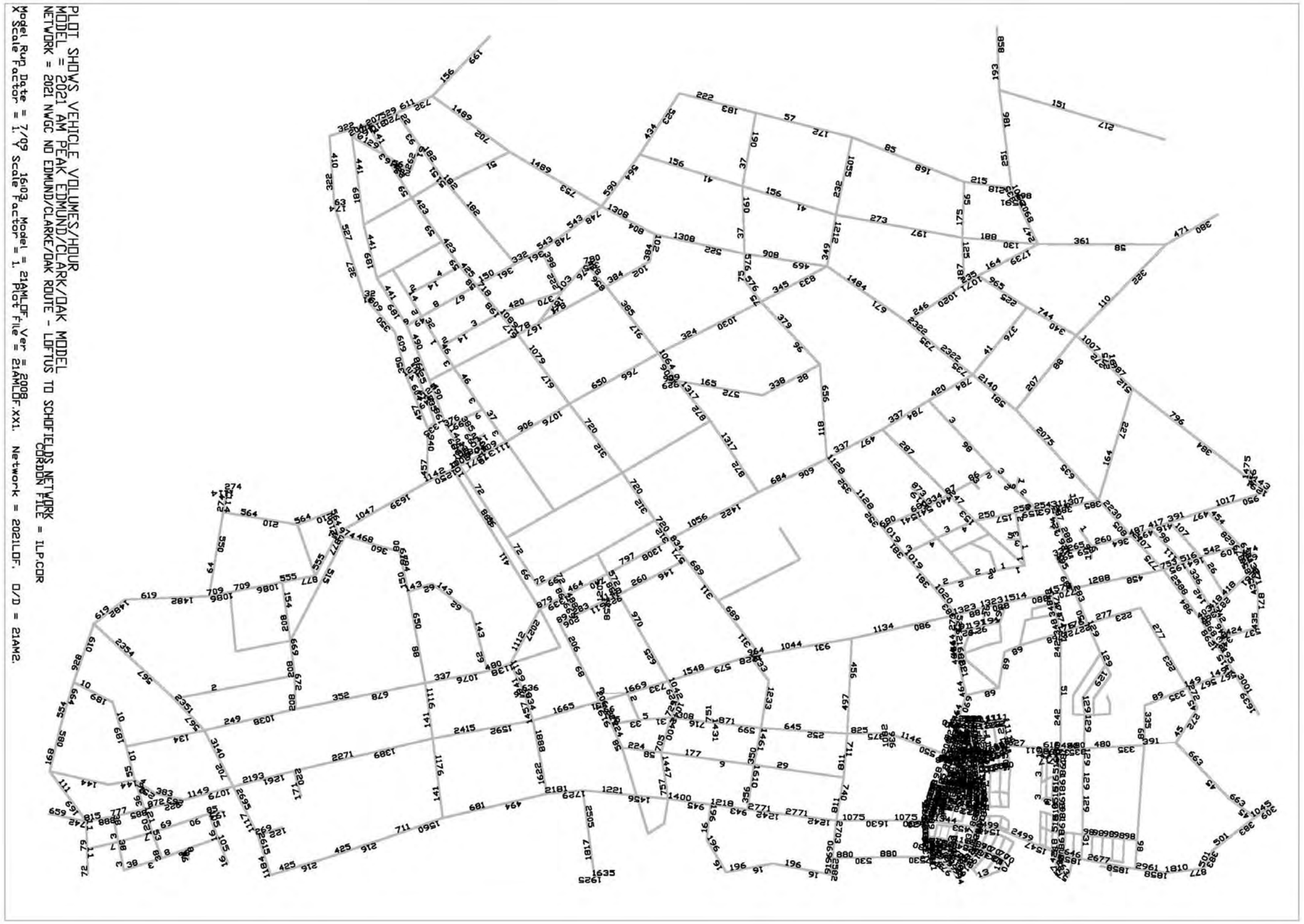


Figure 22: 2021 Evening Peak Hour No Clarke Street/Oak Street Model

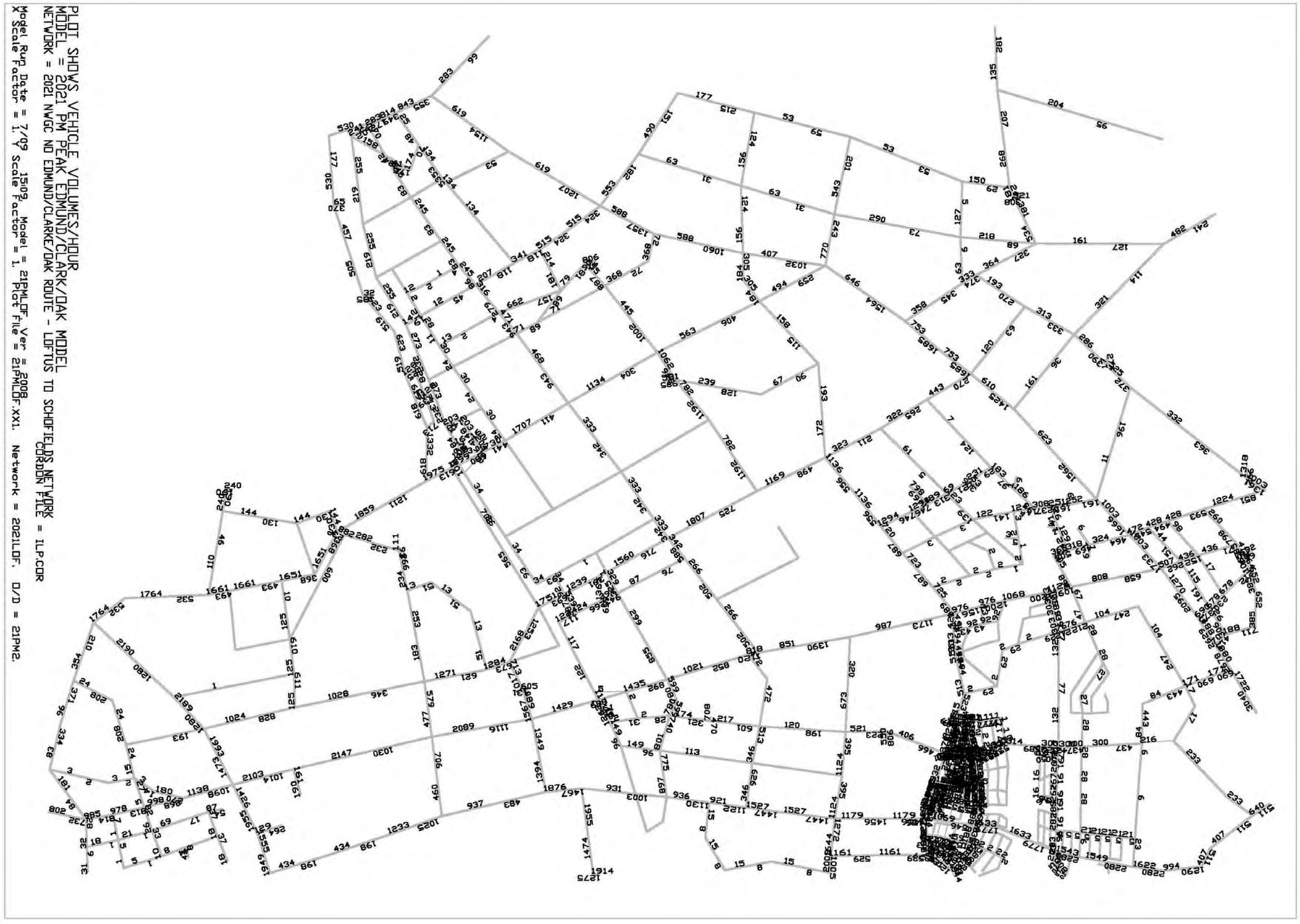


Figure 23: 2036 Morning Peak Hour Boundary Road Model

Figure 24: 2036 Evening Peak Hour Boundary Road Model

Figure 25: 2036 Morning Peak Hour Boundary Road Model Minus ILP Model – Link Difference

Figure 26: 2036 Evening Peak Hour Boundary Road Model Minus ILP Model – Link Difference

Figure 27: 2036 Morning Peak Hour Riverstone Road Model

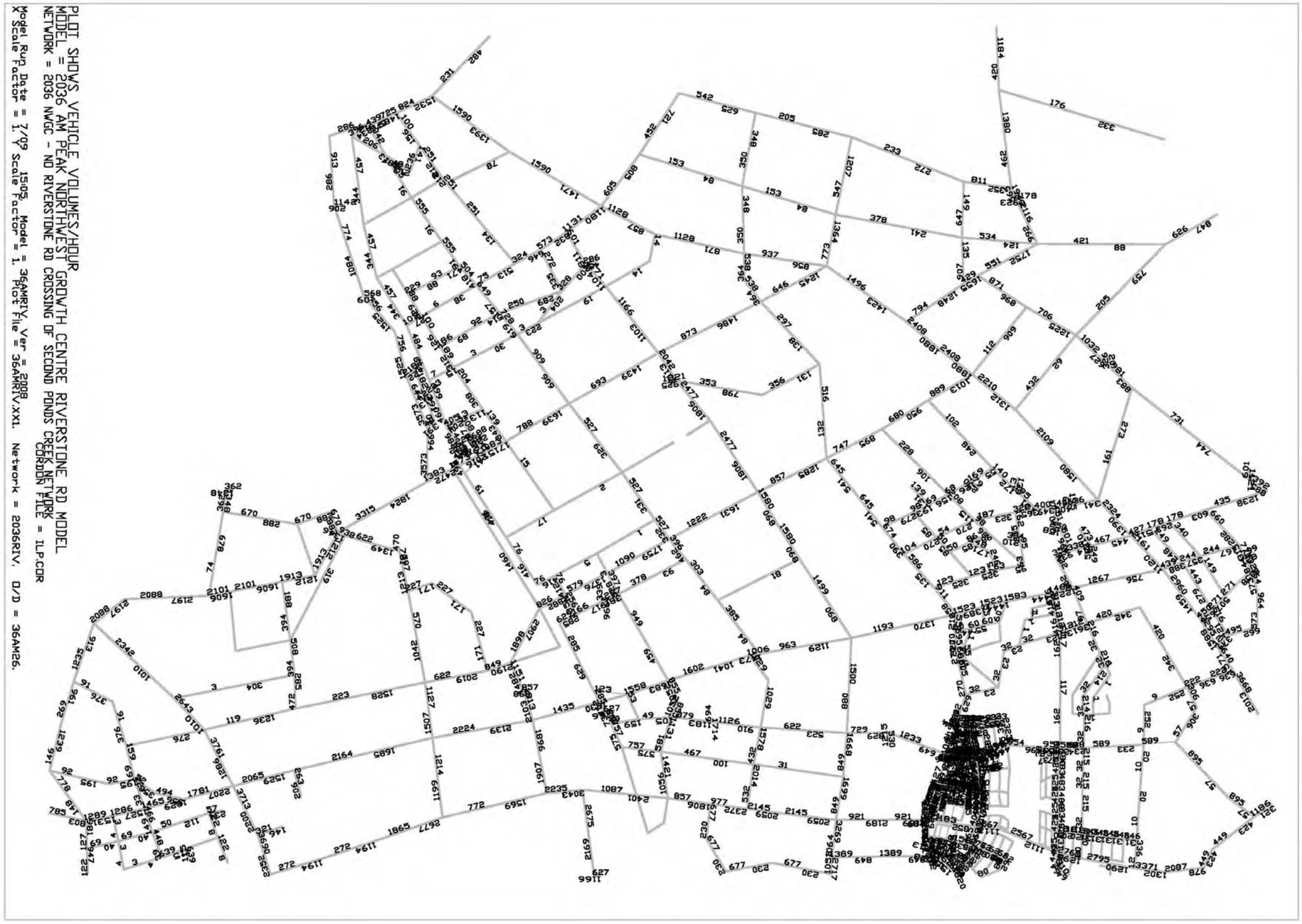


Figure 28: 2036 Evening Peak Hour Riverstone Road Model

Figure 29: 2036 Morning Peak Hour Schofields Road and Railway Terrace Model

Figure 30: 2036 Evening Peak Hour Schofields Road and Railway Terrace Model

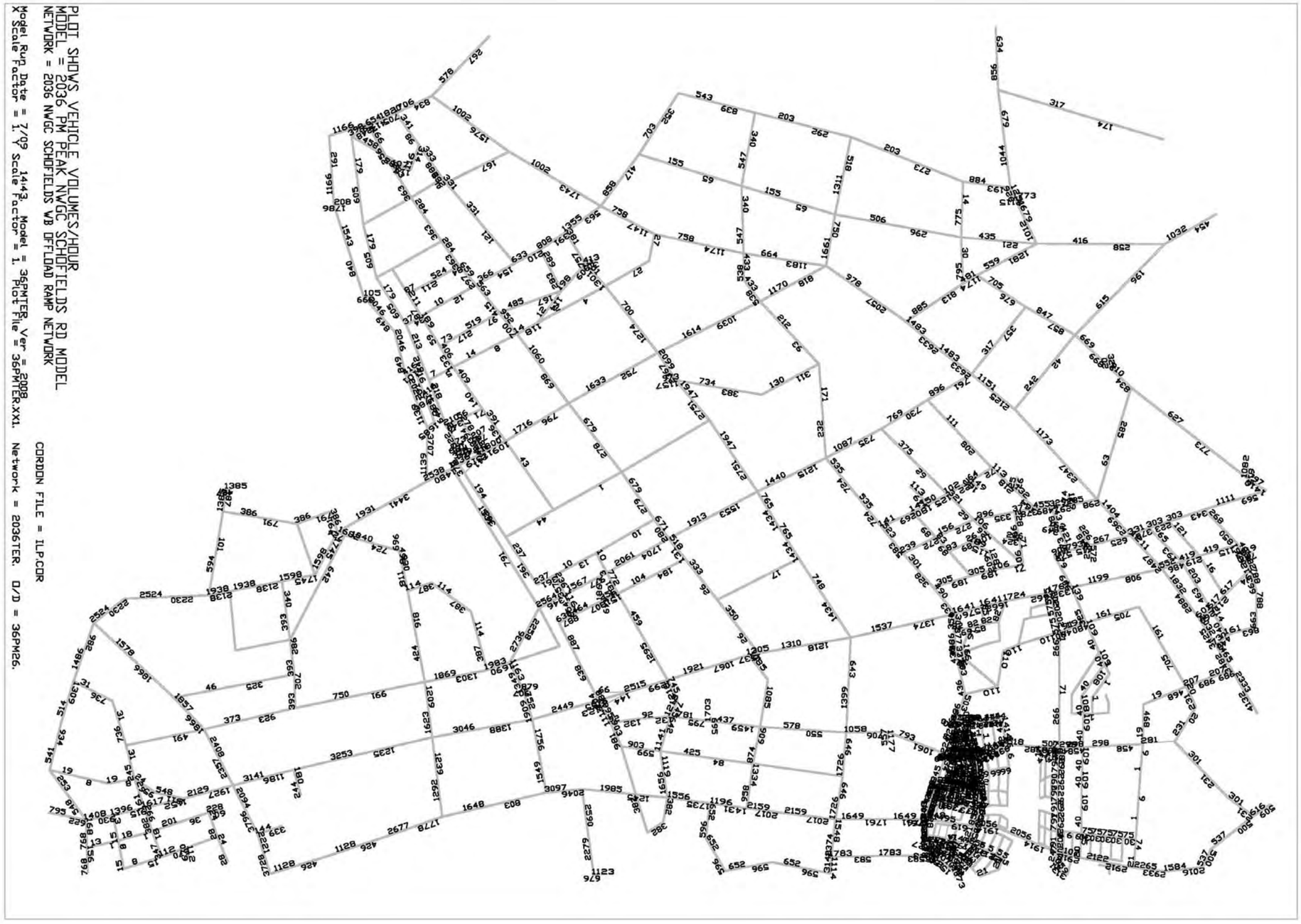


Figure 31: 2036 Morning Peak Hour Schofields Road and Railway Terrace Model Minus ILP Model

Figure 32: 2036 Evening Peak Hour Schofields Road and Railway Terrace Model Minus ILP Model

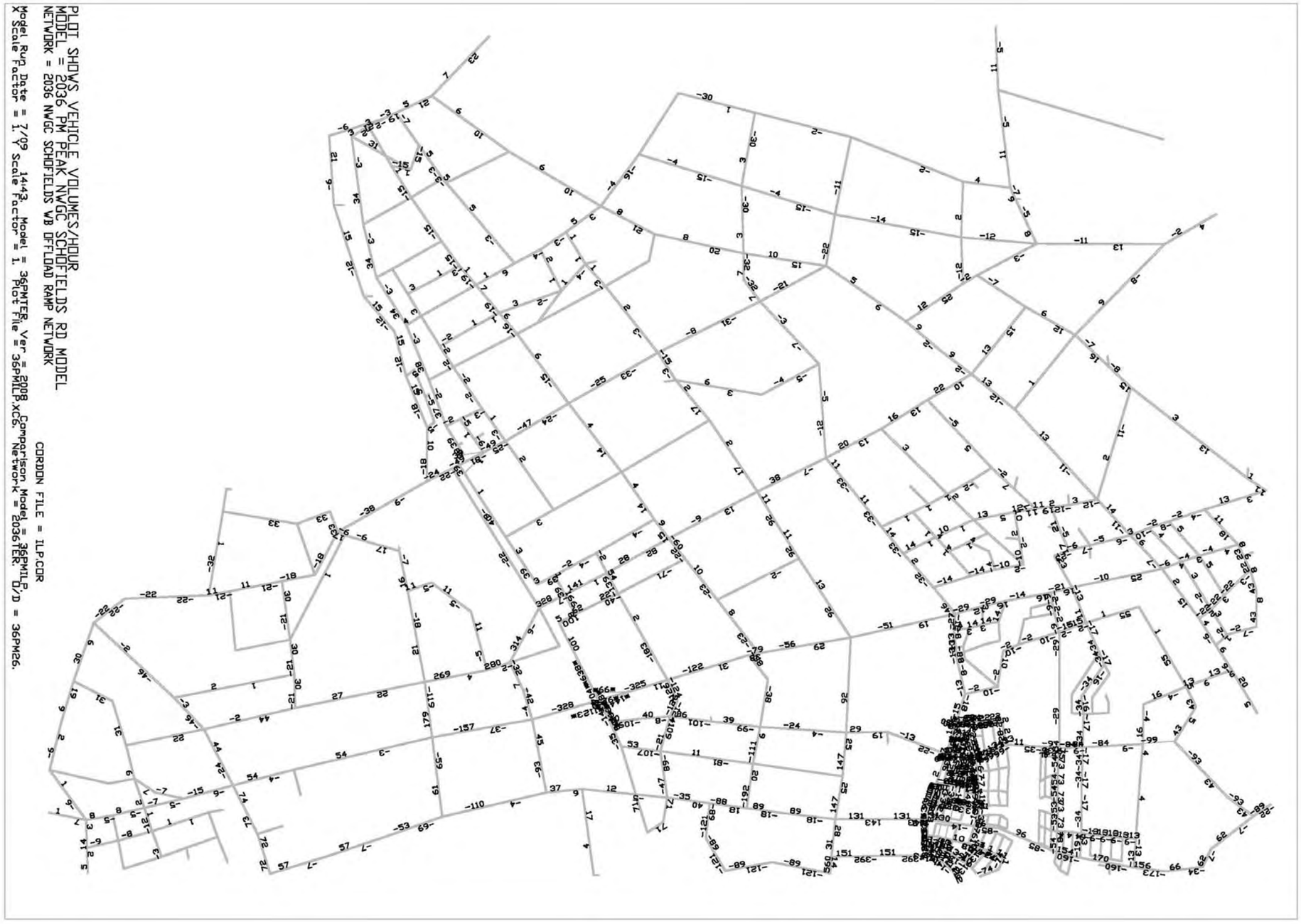


Figure 33: 2036 Morning Peak Hour Revised ILP Model

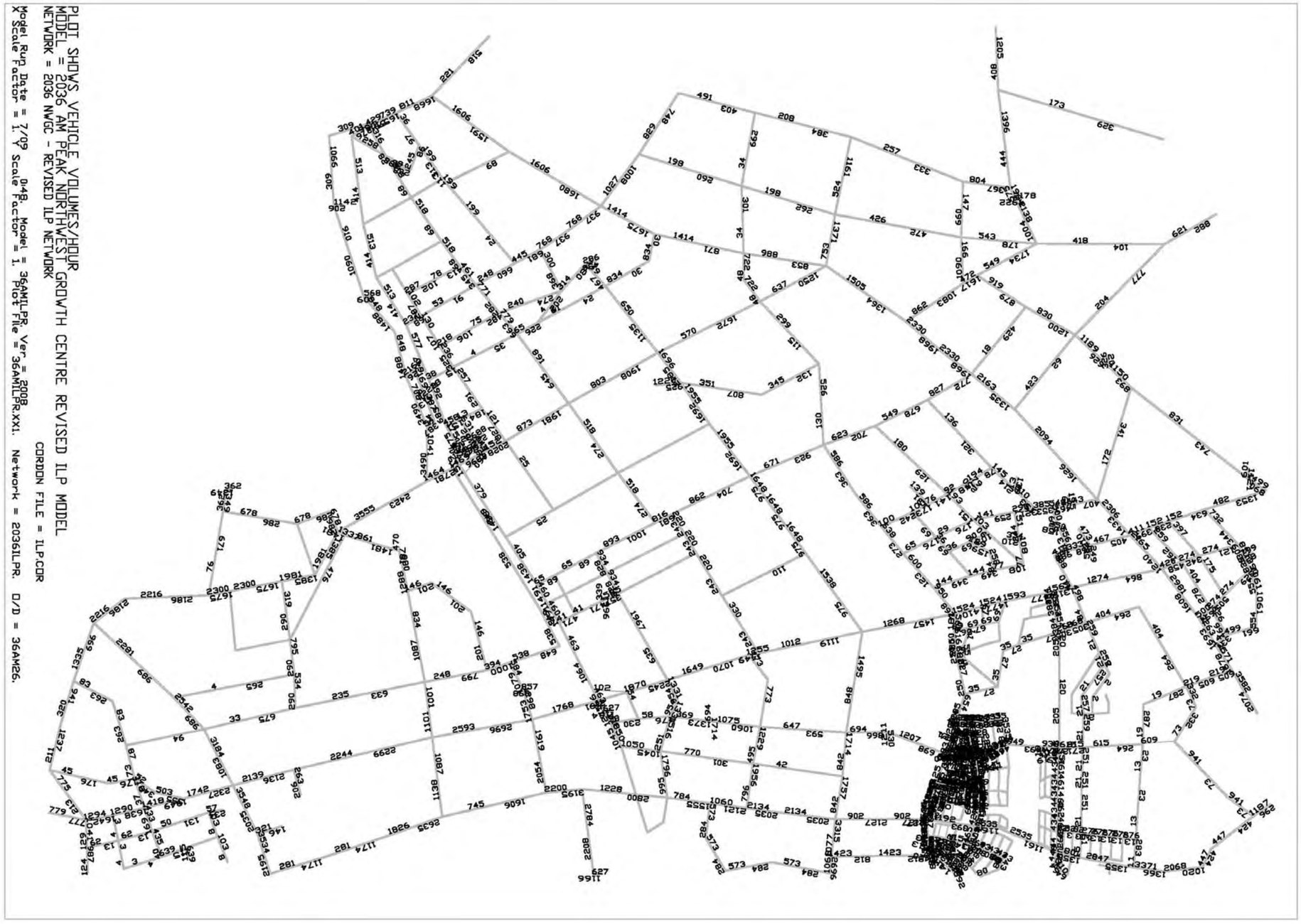


Figure 34: 2036 Evening Peak Hour Revised ILP Model