Attachment 1

Issue History

File Name	Prepared by	Reviewed by	Issued by	Date	Issued to
P0941.001T Meadowbank Netanal Model Review.doc	B Lo	A Finlay	A Finlay	13/01/2012	Harry Muker, CoR
P0941.002T Meadowbank Model Technical Review	B Lo	A Finlay	A Finlay	16/01/2012	Harry Muker, CoR

Meadowbank Traffic Model Technical Review

1. BACKGROUND

Bitzios Consulting has been commissioned by City of Ryde to undertake a technical review of the traffic modelling for the Meadowbank Employment Area. The modelling, undertaken in late 2010, included a Netanal model by Road Delay Solutions Pty Ltd, and aaSIDRA modelling undertaken by Varga Traffic Planning Pty Ltd. The later modelling results were then used in a Transport Management and Accessibility Plan (TMAP), prepared by Varga Traffic Planning, in support of the submission of the proposed Shepherds Bay Urban Renewal Concept Proposal. The study area is shown in Figure 1.1.

Figure 1.1: Study Area

Further, Council has requested Bitzios Consulting to recommend a way forward for future modelling that might address any issues with the modelling work to date, as well as consolidating other traffic models in the vicinity of the Meadowbank precinct.

2. SCOPE OF REVIEW

The review considers and comments on the following issues:

- Details of the model;
- Model input, data and assumptions;
- Model output, interpretations and suitability; and
- Limitations of existing method.

The scope of the review did not include actually running either the Netanal or aaSIDRA models.

3. DOCUMENTATION

The documents and information supplied by Council were:

- *Shepherds Bay Meadowbank Traffic Model Output*, Road Delay Solutions Pty Ltd, October 2010;
- *Proposed Shepherds Bay Urban Renewal Concept Proposal TMAP*, Varga Traffic Planning Pty Ltd, 19 November 2010;

- *Review of Proposed Shepherds Bay Urban Renewal Concept*, (by TAR Technologies Pty Ltd, February 2011;
- Review of Exhibition Plan of Proposed Shepherds Bay Urban Renewal Concept Plan, City of Ryde, March 2011; and
- The SIDRA model files developed by Varga Traffic Planning, November 2010.

In undertaking this review, Bitzios Consulting used the following reference documents:

- Paramics Microsimulation Modelling RTA Manual (Version 1.0).

4. MODEL REVIEW

4.1 DETAILS OF MODEL

The proponent employed a network wide equilibrium assignment model (Netanal) for the purpose of analysing the traffic impact of the proposed development in the years 2016 and 2026, based on a model of the existing network and traffic flows in 2010. The existing network intersection assessment coverage included 14 intersections and considered turning movement traffic impacts on each of the intersections by further analysis using SIDRA.

The existing network in 2010 was modelled using SIDRA and actual traffic surveys taken in June 2010. Future year SIDRA models (2016 and 2026) used as inputs, the turning volumes output by the Netanal model.

4.2 MODEL INPUT, DATA AND ASSUMPTIONS

For the purpose of assessing the traffic impacts of the proposed development, the proponent's model used the following data:

- Intersection Traffic Counts (by ROAR Data in June 2010);
- Bureau of Transport Statistics trip matrices (BTS); and
- Ryde Local Government Area Journey to Work (JTW) Mode Share data.

The data and assumptions used by Road Delay Solutions in the process of Netanal modelling are listed as follows (based on reported information):

- Traffic survey counts by ROAR Data (June 2010);
- JTW data and BTS trip matrices (trip distributions);
- The disaggregation of Meadowbank travel zone (to seven zones);
- Adjustments to Ryde LGA mode split of car driver;
- Incorporation of proposed future years infrastructure upgrades to 2026;
- Travel time is assumed to be the only factor for vehicle route choice within the modelling process;
- Traffic flow is assumed to be "free-flow" unless the degree of saturation exceeds 0.90;
- Incorporation of SCATS operation within the model.

Based on the above information, we raise the following matters which do not appear to have been addressed clearly in the model output report:

1. In Chapter 2, section titled *Assignment Calculations*, it is claimed that SCATS operation was simulated within the Netanal model. Given the complexity and dynamic nature of SCATS, the author has not specified exactly which elements of SCATS were used in the model. For example, does the Netanal model faithfully replicate the ability of SCATS to dynamically adjust Cycle Length, Phase Splits and Offsets?

2. In Chapter 3, section titled *Data Collation*, the author provided a schematic display of the Principal Road Infrastructure Projects to Year 2036, and accordingly claimed that all major infrastructure projects to the future model dates have been incorporated in the model as part of the assessment. The author has not, however, provided any further specific details (type and timing) of the upgrades that were included in the future year (2016 and 2026) assessments. In particular, there are no details of proposed upgrades within the study area or on major arterial roads in the immediate vicinity. This makes it very difficult to assess the validity of the 2016 and 2026 'base' traffic volumes produced by the Netanal model.

3. In the same chapter, section titled *Calibration*, the author discussed the results of model calibration by way of GEH statistical calculations. The following issues are raised in regards to the GEH calculations of the model:

   - The GEH values have not achieved the basic criteria of minimum of 85% of assessed intersections within a value of no more than 5 and no GEH values should be 10 or above;
   - It is noted that the author used link volumes as the bases of GEH assessments. Given the scale of the network, and the reliance on the model to project intersection turning movements, we believe the GEH assessment should be undertaken on the basis of intersection counts;

4. In Chapter 4 section titled *Future Year 2036 Trip Matrix*, the author recognised the coarse zone structure of the BTS matrices and subsequently disaggregated the zone into seven subdivided zones. However, the author has not provided any further detail of these sub-zones, making it difficult to assess whether the traffic generation from these sub-zones is reasonable.

5. In the same section, the author stated that the future year (2036) trip distribution was based on the BTS trip matrices. Whilst the author has demonstrated the external trip distribution (18% in total) in Figure 9 of the report, the report has not provided further detail regarding the remainder of the trip distribution (82%). The author has also omitted any detail regarding internal trips. Further, Figure 9 indicates that Sydney CBD would attract only 1% of all JTW trips from the Meadowbank zone in 2036, which appears unrealistically low.

4.3 MODEL OUTPUT AND INTERPRETATIONS

The outputs of this model were:

- Hourly projected link volumes of the local network for the years 2010, 2016 and 2026 for each AM and PM peak period;
- Hourly projected intersection turning movements and volumes of the local network intersections for the years 2016 and 2026 for each AM and PM peak periods;

Based on the above information, we raise the following issues which may require further clarification:

1. In a brief comparison between the surveyed intersection counts and the calibrated 2010 link counts, we identified several modelled volume discrepancies along Church Street and Victoria Road. In particular, some links have model flows approximately 20% lower than those surveyed. Examples are shown in Table 4.1 and 4.2. As a result, the confidence that can be placed on the 2016 and 2026 modelled volumes is questionable.

Table 4.1 : AM Link Volumes Comparison (Examples)

Location	Direction	2010 Surveyed Volume (hourly)	2010 Modelled Volume (hourly)	Difference compared to surveyed volumes
Church Street south of the Loop Road	Northbound	3425	3192	-7 %
	Southbound	3130	3140	0 %
Church Street south of Morrison Road	Northbound	3149	2763	-12 %
	Southbound	3313	2736	-17 %

Devlin Street North of Victoria Road off ramp	Northbound Southbound	2997 3430	2928 2705	-2 % -21 %
Victoria Road West of Belmore Street	Eastbound Westbound	2742 2023	2276 1686	-17 % -17 %
Bowden Street South of Victoria Road	Northbound Southbound	412 323	388 316	-6 % -2 %
Constitution Road East of Bowden Street	Eastbound Westbound	670 490	597 476	-11 % -3 %
Bank Street Rail Crossing	Eastbound Westbound	873 344	663 291	-24 % -15 %

Table 4.2: PM Link Volumes Comparison (Examples)

Location	Direction	2010 Surveyed Volume (hourly)	2010 Modelled Volume (hourly)	Difference compared to surveyed volumes
Church Street south of the Loop Road	Northbound Southbound	3635 3126	3344 2917	-8 % -7 %
Church Street south of Morrison Road	Northbound Southbound	3045 3313	2855 2673	-6 % -19 %
Devlin Street North of Victoria Road off ramp	Northbound Southbound	2783 3430	2767 2785	-1 % -19 %
Victoria Road West of Belmore Street	Eastbound Westbound	1964 2268	1709 2010	-13 % -11 %
Bowden Street South of Victoria Road	Northbound Southbound	340 356	389 393	14 % 10 %
Constitution Road East of Bowden Street	Eastbound Westbound	385 643	412 909	7 % 41 %
Bank Street Rail Crossing	Eastbound Westbound	338 894	287 676	-15 % -24 %

2. Some of the 2016 Base (i.e. no development) modelled traffic volumes are **less** than the 2010 traffic survey volumes. Examples are shown in Tables 4.3 and 4.4. Normally, it would be expected that 'background' traffic on the network (especially major arterial roads) would increase in a six year period, unless there were major road or public transport improvements to draw traffic away or cause a mode shift.

Table 4.3: Counter-intuitive 2016 AM base volumes (Examples)

Location	Direction	2010 Surveyed Volume (hourly)	2016 Base Modelled Volume (hourly)	Difference compared to surveyed volumes
Off Ryde Bridge	Northbound	3425	3356	-2 %

Victoria St/Belmore St	Eastbound Westbound (L + T)	2742 1999	2591 1104	-6 % -45 %
Victoria St/ Bowden St	Westbound (L + T)	2023	1131	-44 %
Bowden St/Constitution Rd	Northbound	198	64	-68 %
Railway Rd/Bank St	Eastbound (L + R)	872	426	-51 %
Junction St to Church St	RT	152	0	-100%

Table 4.4: Counter-intuitive 2016 PM base volumes (Examples)

Location	Direction	2010 Surveyed Volume (hourly)	2016 Base Modelled Volume (hourly)	Difference compared to surveyed volumes
Bank St across Railway Bridge	Westbound	894	733	-18 %
Bowden St/ Constitution Rd	Northbound	182	17	-91 %
Junction St to Church St	RT	125	0	-100%

3. The SIDRA model files were received late in our review period and so we have not had an opportunity to review thoroughly all of the SIDRA inputs and outputs. Our approach was to investigate the files for intersections that showed counter-intuitive results in Table 3.1 of the Varga Traffic Planning report, reproduced below:

TABLE 3.1 - RESULTS OF SIDRA ANALYSIS

	2010 Existing		2016 Base		2016 Proposed		2026 Base		2026 Proposed	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Church Street and Morrison Road										
LOS	B	B	B	D	B	D	D	C	E	D
Church Street and Junction Street										
LOS	B	B	B	B	B	B	B	B	B	B
Church Street and Well Street										
LOS	A	A	A	A	A	A	A	A	A	A
Victoria Road and Belmore Street										
LOS	A	A	A	A	A	A	A	F	A	F
Belmore Street and Junction Street										
LOS	C	C	B	B	B	B	C	C	C	C
Porter Street and Loop Street And Parsonage Street										
LOS	A	A	A	A	B	B	F	F	F	F
Belmore Street and Constitution Road										
LOS	C	C	C	C	C	C	C	C	C	C
Constitution Road and Hamilton Crescent										
LOS	A	A	A	A	A	A	B	C	D	C
Constitution Road and Bowden Street										
LOS	A	A	A	A	A	A	A	A	A	A
Victoria Road and Bowden Street										
LOS	C	C	C	B	C	B	C	B	C	C
Railway Road and Bank Street										
LOS	A	A	A	A	A	A	F	F	F	F

Source: *Proposed Shepherds Bay Urban Renewal Concept Proposal TMAP*, Varga Traffic Planning Pty Ltd, 19 November 2010

The counter-intuitive results are:

1. Victoria Road/Belmore Street in 2026 Base and Proposed – LOS A in AM peak but LOS F in PM peak.
2. Porter Street/Loop Road/Parsonage Street in 2026 Base and Proposed – LOS F compare to LOS B in 2016.
3. Belmore Street/Junction Street (2010 to 2016) – improvement from LOS C to LOS B
4. Railway Road/Bank Street in 2026 Base and Proposed – LOS F compared to LOSA in 2016.

A review of the SIDRA files for these intersections revealed the following issues:

- Generally, it would appear that the Highway Capacity Manual (HCM) delay method was used, rather than the RTA delay method, as specified by Road and Maritime Services (RMS, formerly RTA).
- No peak hour flow factor has been used, meaning that the input flows have not been increased to take account of small variation in peak hourly flows (worst case scenario). This means that the results could be considered 'optimistic'.
- At Church/Junction Street, it was noted that the gradient factor had been applied to the kerbside lanes only.
- The AM results for Victoria Road/Belmore Street (item 1 above) should also be LOS F, using the same rationale for reporting the PM results as LOS F.
- At the Porter Street/Loop Road/Parsonage Street intersection, the model showed that the queue on the northern approach to the roundabout would exceed the block length and extend beyond the next intersection (AM peak) or into Church Street (PM peak). This is a major network impact and calls into question the ability of SIDRA to adequately model the overall performance of the network.

- At the Railway Road/Bank Street intersection, the model showed that the queue on the southern approach to the roundabout would exceed 1.3 km, and on the northern approach 1 km, in the AM peak. In the PM peak, the southern approach queue would exceed 3 km. Again, these are major network impacts.

4.4 LIMITATIONS OF EXISTING METHOD

Whilst the chosen Netanal model is capable of assessing traffic operations over a wider network, it is limited mathematically in its ability to represent traffic operations accurately. Sections 4.2 and 4.3 discussed issues which we believe require further clarification with respect to the accuracy of the impact assessment. We understand that Netanal has not been used by RMS (formerly RTA) since 2003 and so the degree to which it has been maintained or upgraded is unknown.

As stated in the TMAP technical review by TAR Technologies, the choice of intersection analysis method (i.e. SIDRA) is considered inadequate given the scale of the network on which the development would impact. Additionally, we note SIDRA is an isolated intersection analytical tool which does not sufficiently analyse traffic impact as a result of signal coordination or closely spaced intersections.

Given the level of details (individual intersection and link impacts) that Council seeks from the assessment, the "strategic" approach of the model did not appear to provide sufficient reflection of the traffic impact on the network, locally and network wide. For example:

1. We note that, due to the nature of the modelling approach, the model was very broad and presented a more "strategic" network layout. In turn, some local routes, in particular those that could be used as 'rat runs' within close vicinity of the proposed development have not been coded into the model. The exclusion of these local roads could potentially impact vehicle route choices, and would not reflect a precise traffic turning impact as a result of the development. This may lead to either under-design or over-design of intersections within the network.
2. In 2016 and 2026, the Netanal model appears to have allocated excessive flows to the route comprising Rothesay Avenue, its extension to Bowden Street, Bay Drive and Railway Road, as an alternative to Constitution Road. This may not be in line with Council's preferred road hierarchy for the precinct.
3. The overall coverage of the network appears to be insufficient and has not considered wider traffic impact as a result of the development. This was confirmed following brief morning peak and afternoon peak period site inspections on 12 and 13 January 2012. These revealed (even during this School Holiday period) the existing northbound congestion in the Church Street corridor. This congestion is caused by the Devlin Street/Blaxland Road intersection at Top Ryde, but this intersection is not included in the SIDRA analysis. From experience, it is also known that westbound PM peak traffic on Victoria Road is often queued from Hermitage Road to beyond Bowden Street. The SIDRA models did not include any intersections west of Bowden Street.

5. RECOMMENDATIONS

In view of the scale of the development and its potential impact on the existing traffic network, we recommend the following potential next steps:

Short term

1. In the short term, seek revalidation or recalibration of the Netanal model to address the concerns about the modelled 2010 and 2016 traffic volumes, and the issue of other potential routes that have not been coded.

2. Then, using the revised Netanal outputs, re-model intersections using SIDRA but consider queue lengths as well as LOS as key performance indicators. Also, extend the SIDRA modelling to include the Victoria Road/Devlin Street, Victoria Road/Hermitage Road, and Devlin Street/Blaxland Road intersections.

Medium Term

3. The development of a Mesoscopic model covering the Meadowbank Employment Area and its surrounding road and transport networks. Such a Mesoscopic model would be the most cost effective type of model to suit the future needs of Council, and we understand the RMS is supportive of such a strategy. (A simulation model for the precinct would not be practical given the size of the area and the complexity of the network. It would simply be too difficult to maintain and too cumbersome to run.)

   Overall, the major cost in setting up a Mesoscopic model for the precinct will be establishment of the network "database" and then validating the model to a comprehensive set of counts. Coding every key intersection (geometry, signal arrangements, etc.) is the most costly set-up component regardless of which Mesoscopic model package is chosen. The size of the network means a good spread of counts is needed which can be a significant component of the budget. It should be possible, however, to use some of the existing traffic counts (subject to spot checks on currency) and so reduce the overall cost.

   The advantages of such a Mesoscopic model are:

- It would allow Council to assess comprehensively either individual or multiple development proposals in the precinct;
- Council could make the model available to proponents' traffic consultants so that a consistent assessment process is followed; and
- The superior assessment capabilities of a Mesoscopic model could validate that development potential greater than Council's planning instruments might be supported from a transport capacity perspective.