

INTEGRATED TRANSPORT PLANNING AT ALL LEVELS – THE REDCLIFFE SEASIDE VILLAGE

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ABSTRACT

Transportation planning instruments involving land-use and infrastructure assessments are required to find a balance between the forces of demand and the constraints of supply. When developing transportation models the focus of numerous platforms allows for this balance to be redirected. Many policy decisions derived from strategic scale models are assessed with the balance in favour of the demand generated and distributed. Detailed town centre transport models, including many infrastructure projects, are often driven by supply limitations within the network but reduce the impacts of a land-use driver.

To combat such deficits within the transport planning of town centres, PTV has developed an integrated framework incorporating the demand and the supply oriented platforms. This solution reflects greater complexity of capacity constraints within the networks (including intersection operations and turn specifications) before providing for simulation of the detailed operational evaluations. This approach allows for complex scenario assessments in VISUM to be directly matched within the VISSIM micro-simulation landscape. At Redcliffe Seaside Village, this approach allowed for town centre planning within the context of the Brisbane Strategic Transport Model. This mesoscopic transport model reflected network and trip complexity for contemporary and forecast conditions producing an integrated transportation plan of the town centre.

INTRODUCTION

Transportation planning models and travel demand models typically sit within a strategic framework or a policy driven context. These strategic transportation and land use models are applied by regional and state organisations for larger scale decision making within the metropolitan framework. Such analytical models comprise the traditional four step process, with a great emphasis on the activity patterns and trip making behaviour of residents (the demand). As demand is assigned across a metropolitan network, decisions makers can then determine urban land use and transportation policies – typically associated with major projects, urban boundaries and the statutory planning choices between urban growth and urban consolidation.

Within the context of these transportation demand models, less attention is provided to the supply side of the network. Major projects receive significant attention and investment in planning and design, including staging of works. This emphasises the role of the metropolitan transport models, with a focus on motorways, highways and arterial roads. However away from this emphasis, the residual of the network receives less attention for network management, operations and planning within the context of the metropolitan transport and land use decision making process. This is the realm of the local government who is required to fund, manage and ameliorate conditions within the local network, in the context of the strategic decision making process. Managing the urban landscape for councils does not need to be a separate analytical process. This was emphasised by Moreton Bay Regional Council in the Redcliffe Seaside Village rejuvenation whereby the management and planning of Council matters were undertaken within the Brisbane Strategic Transportation Model using the PTV VISUM platform. Such a solution allowed for macroscopic and mesoscopic travel demand analysis with direct interface capability with VISSIM for micro-simulation modelling.

THE ISSUE

Transportation demand and land use models have been developed for major cities in Australia to investigate the future growth and planning considerations across metropolitan landscapes. These demand models typically explore policy driven issues (expansion or containment) or methods to assess the staging of new land releases within the metropolitan setting for new residences and workplaces. Metropolitan demand models are developed as a graph of movements typically across the key routes covered by motorways, highways and arterial roads. Demand travels along these links between travel activity zones - the large polygons designed to represent a myriad of land uses. Route choices are influenced by impedance measures as directed by volume delay functions on these links. Demand models are refined and checked against observed flow volumes at selected locations (screenlines) across the network, typically on points of strategic importance across the metropolitan landscape.

These actions operate effectively when determining strategic planning decisions including the staging of major projects, or the definition of an urban growth boundary. However, given the metropolitan wide approach to determine such transportation and land use connections (and management of such data), these models have limited effectiveness to reflect more localised conditions. This is of particular concern for local councils within metropolitan networks that also plan and assess the operational conditions of their jurisdiction in managing and ameliorating traffic and transport conditions.

The limited effectiveness of metropolitan travel demand models to examine localised council characteristics and historic trends is due to a number of key factors in the methods of developing these models, including:

- Metropolitan network models omit many lower hierarchic roads, for which the responsibility lies with councils rather than state planning authorities. Hence a large component of the council's responsibility may not even be included within the travel model.
- The scale of the zones within the transportation zones typically reflects a significant number of residences across a broad geographic space. Zones may encapsulate entire suburbs (or more) which limits the effectiveness to be utilised by Council for their daily purposes including development planning and assessment. This approach also omits the local trips made within a network which is classed as an intra-zonal trip within a metropolitan transportation model.
- Transportation models traditionally reflect impedance and capacity on a link (road) rather than a node (intersection). In this way demand is not significantly affected by the constraints of different turn movements (right turn capacity vs left turn capacity). Some measures may be introduced to reflect turn movement delay as a function of travel time across the route albeit omits a functional capacity of turn movements at the intersection. Typically these actions lead to a "predict and provide" mentality across industry whereby demand has a limited number of constraining functions within the network. Councils are therefore reactive to managing network operations within the locality including intersection upgrades and traffic control system operations.
- The accuracy of demand within metropolitan transportation land use models (at the base year) is typically checked at key locations (screenlines) across a network on major arterial roads and highways. At other locations the accuracy of demand flows is subject to a greater degree of error than the benchmarked conditions. For local councils preparing for future conditions in response to the metropolitan decision making, this means that the accuracy of the demand flows in the base year model is subject to further review.

The above issues reflect some of the difficulties in translating the network, demand and operational constraints into a meaningful context for councils to assess and ameliorate future transportation considerations. In addition to the planning considerations (residences, urban networks, employment locations) detailed above, councils also need to consider and often provide focus for the following series of actions, as outlined in **Figure 1**:

- Assessment of impacts for development planning applications that can influence the setting of a locality, including traffic and operational impacts;
- Economic development within town centres, including employment for supporting industries (retail, health services, etc);
- Urban design issues within town centres;
- Pedestrian and cycle interaction with motorised traffic;
- Management of local parking, including on street and off street capabilities;
- Public transportation connections including stops and services within plus external to council areas;
- Control systems (Traffic Lights, Roundabouts, Give way/ Stop signs) that can influence traffic operations within council areas. Often traffic signals are managed by state authorities and are beyond the control of Council, albeit councils still need resolution in planning and consideration for future growth and network operations;
- Environmental sustainability within the actions and programs of many councils; and
- Management of budgets to control local public works in achieving the intended vision/ masterplan and resolution of traffic/transportation/planning issues over the longer term.

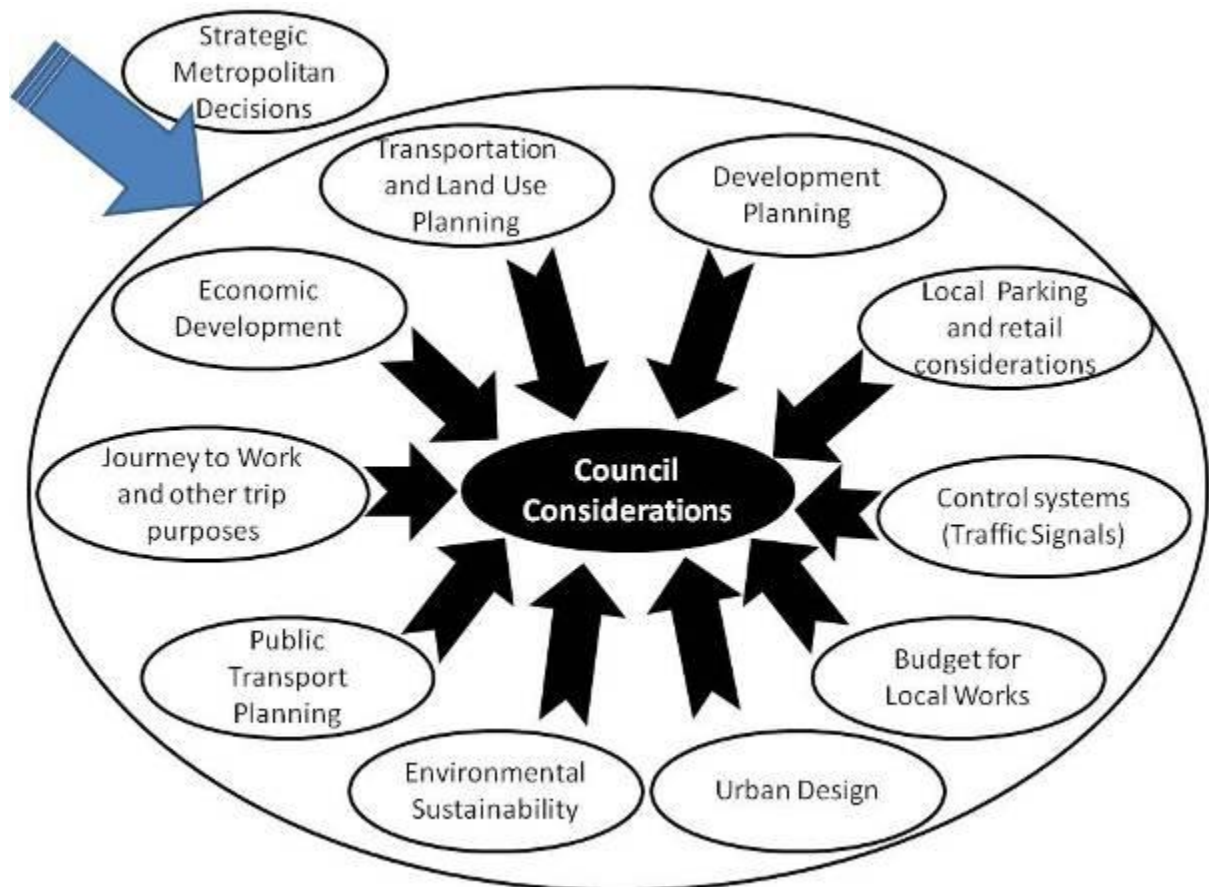


Figure 1: Selected Transport and Land Use Planning Considerations for Councils

Many councils have historically explored development of systems to assess local conditions within the context of **Figure 1** through a series of external measures. Some councils have assessed operational conditions against a series of isolated intersection analysis measures. A number of councils have examined operational constraints and associated measures through the action of micro-simulation modelling. However, the precision of moving from a metropolitan analytical tool to that of examining the individuality of vehicles in one single step ignores a number of considerations – including all of the complexities associated with mode choice, trip purpose and end destination. As micro-simulation models examine the individuality of vehicles

within the network and the operational complexities of the traffic control systems, this serves as a very useful measure for examining site specific conditions within a small network.

To better resolve the above conundrum, PTV introduces the term of mesoscopic modelling, whereby detail is introduced into the metropolitan network model to examine the complexities considered by local councils. This action involves disaggregation of travel zones, representation of geometric considerations and turn specific capacity constraints, introduction of signal controls and enhancement of the road and public transport networks within the transportation model. Typically these actions are contained within the metropolitan wide transportation and land use model, with refinement and consideration not to adjust the network impedance inappropriately. Such actions have recently been pursued in the PTV VISUM software for the Redcliffe Seaside Village to examine proposed schemes and changes in the medium and longer terms, in line with many of the issues raised in **Figure 1**.

With a breakdown of the zones and enhancement of the network to match local council considerations within the landscape, any section of the landscape can be exported into VISSIM for micro-simulation modelling. The PTV Adaptive Abstract Network Model (ANM) structure allows for direct comparison between a VISUM network (preferably at mesoscopic level) and that in a VISSIM micro-simulation context. This adaptive export process can generate the equivalent of demand matrices and/or assignment paths and volumes, road network including geometric turns, signal control systems and public transport operations. This process is designed not just to model one assignment run, but to consider the impacts of network refinements through scenario testing.

THE PTV VISION SUITE

The PTV Group provides cutting-edge software and technology to enable agencies to plan and manage their traffic and transportation systems. PTV provides software development and innovation with close links to research and educational institutions. The PTV Vision suite contains the VISUM software for transportation planning, land use investigations, public transportation servicing and choice decisions (PTV 2009a) and VISSIM for traffic, transport and pedestrian simulation purposes (PTV 2009b). The PTV Vision suite shown in **Figure 2** is the world's only software system that covers the entire range of transportation infrastructure planning and traffic engineering tasks, solving current problems in an efficient manner in order to meet future challenges. The integrated solutions within the PTV Vision suite have allowed for successful model development and analysis within this investigation.

VISUM is a transportation planning software package for all sizes of infrastructure planning at both macroscopic and mesoscopic scales. This application can be integrated with the VISSIM micro-simulation software to provide more detailed analytical assessments of capacity from a traffic engineering perspective plus crowding and 'level of service' conditions from a passenger perspective.

VISUM is a comprehensive, flexible software system for strategic planning, travel demand modelling and network data management. The system is used on all continents for metropolitan, regional, and national infrastructure planning applications. Designed for multimodal analysis, VISUM integrates all relevant modes of transportation into one consistent network model. The system provides a number of assignment and four-stage transport modelling components, which include both trip-end based and activity based approaches.

VISSIM is a microscopic simulation software and is the most powerful tool available for simulating multi-modal conditions including cars, trucks, buses, heavy rail, LRT, cyclists and pedestrians. VISSIM is based on decades of intensive research and includes algorithms for car following and lane changing conditions. The simulation software is particularly useful for assessment of detailed operations of transportation performance in urban locations. The flexible network structure provides the user with the opportunity to model any geometric configuration or unique operational /driver behaviour encountered within the transportation system. The link-connector topology provides the highest versatility allowing complex vehicle movements including on-street and angled parking as well as the interaction of pedestrians and vehicles.

The PTV Vision suite is the first transportation modelling and analysis solution to integrate microscopic simulation with strategic transport planning/travel demand modelling. PTV can extract directly from a strategic planning network, for detailed review and refinement of operational conditions at a local level of planning. This proves to be of significant value when examining the details of strategic planning initiatives.

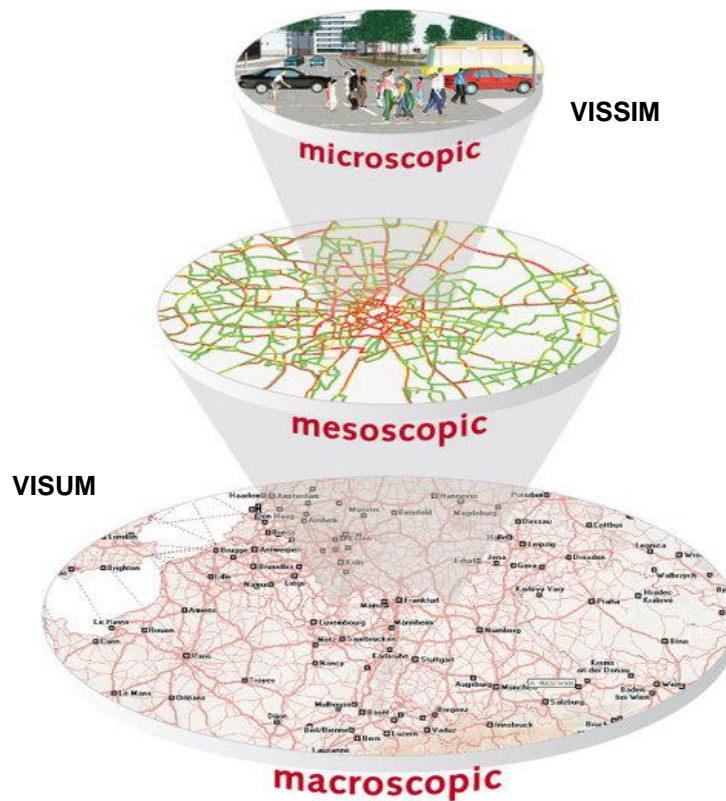


Figure 2: The PTV VISION Suite

BACKGROUND RESEARCH

While the term integration can often be loosely applied to cover inclusion of transport and land use connections within a platform (Feldman *et al*, 2009), or inclusion of both public and private transport systems, integration shall refer to the modelling and connections between macroscopic, mesoscopic and microscopic levels within the context of this paper. The provision of consistency in transportation and land use models at all levels for network and operational analysis is important in managing travel demands across the landscape.

Holyoak and Stazic (2009) examined the benefits of integrating macroscopic demand models and micro-simulation models from a demand oriented perspective. This paper identified advantages in providing an integrated solution including consistency of travel demand patterns (trip distribution) and improved cost-effectiveness of running more than one platform to examine broad based and detailed vehicle interaction. This paper also identifies the ability of micro-simulation models to be used to assess and influence the decision making undertaken at the metropolitan wide level. Holyoak and Stazic also discuss practical issues with integrated modelling platforms including significant discrepancies in the structure of zones and the derivation of the transportation network. However this paper does emphasise to the developers of software modelling platforms that “

“Macro-level models that traditionally rely on the application of link capacities and that do not include detailed junction modelling should be capable of using detailed junction geometry and traffic control data, thus providing a platform for data integration. Furthermore the use of more disaggregate demand travel demand data would allow better data exchanges with micro models”, Holyoak and Stazic (2009, pp38-39).

By comparison, investigations undertaken by Ma *et al* (2009), Hall and Dichev (2009) and Perone and Won (2010) identified network modelling connections between macroscopic contexts to the micro-simulation through the use of the PTV VISION suite. These transportation modelling studies identified the consistency in analysis between use of VISUM for land use transportation connections, through to VISSIM for micro-simulation modelling, courtesy of the direct integration between software modules. Ma *et al* (2009) examined various interchange designs connecting a township with a passing motorway, as well as investigation of network route choice through the use of a High Occupancy Toll Lane. Perone and Won (2010) examined an extraction of journeys from a regional travel model passing through the complex grid network of Portland, Oregon. This study examined numerous vehicle types and a disaggregation to fifteen minute intervals plus the precision of intersection geometry and signal timings to refine the behaviour in VISUM before exporting to VISSIM for micro-simulation modelling. Hall and Dichev (2009) documented similar studies in the UK and in Bahrain where a similar approach maintained the consistency across the modelling platforms.

Other investigations including Ahuja *et al* (2005) examined the disaggregation of travel activity zones in Coventry (UK) to reflect the complexity of choices and land use decisions to be assessed within the town centre including both corridor redevelopment and impact assessments for major business parks. A similar study for the arterial road network within the Singapore Central Business District was undertaken by Laufer *et al* (2010), whereby zones were disaggregated by land uses before being exported to VISSIM for simulation modelling. This paper emphasised the consistency of assigned paths determined in the transportation and land use VISUM model when developed in the VISSIM platform for micro-simulation analysis. The overall approach identified the consistency of transportation zones, travel demand, intersection geometry and traffic control systems across the PTV VISION platform.

MORETON BAY AND REDCLIFFE SEASIDE VILLAGE

Moreton Bay Regional Council is located within the northern region of the Brisbane metropolitan area and the coast of the hinterland. The authority sits immediately between Brisbane City Council and Sunshine Coast Regional Council, covering an area between the suburbs of Ferny Hills, Strathpine, Caboolture, Bribie Island and Redcliffe. This area represents a merger of the former councils of Caboolture Shire, Shire of Pine Rivers and the City of Redcliffe (Queensland Local Government Reform Commission, July 2007). The regional Council has a population of over 350,000 (30 June 2008) making it the third largest local government population across Australia. This population is expected to grow to over 520,000 by 2031 (Moreton Bay Region Profile, 2009). The Brisbane International Airport is within close proximity to the council location, courtesy of the Bruce Highway and Gateway Motorway.

The Redcliffe Seaside Village primarily represents a residential location on the eastern extent of Moreton Bay Regional Council within the Redcliffe peninsula. The former designation of Redcliffe Council was a locality of over 51,000 residents (2006 Census, Moreton Bay Planning, Information and Forecasting Unit) with some light industrial and commercial areas. The Redcliffe Seaside Village also provides an access point (public jetty) for regional marine activities including viewing for migrating whales. Consequently there are a number of different weekend activities and demands to those in the village on the weekday, including bus and coach services transferring tourists from Brisbane for recreational outings. A rejuvenation project is being proposed at the Redcliffe Seaside Village for enhanced urban design and resolution of village requirements over the longer term.

TRANSPORTATION MODEL DEVELOPMENT

The Brisbane Strategic Transport Model (BSTM) in the VISUM platform has been utilised to develop a mesoscopic model of the Redcliffe Seaside Village and surrounding region. This model has been developed with the intention of extracting a VISSIM micro-simulation model to identify the operational considerations within the mesoscopic transport model. The Brisbane Strategic Transport Model covers the entire Brisbane metropolitan area including Moreton Bay region. The Redcliffe Seaside Village is represented by only two zones within this strategic demand model, with simplified access to the remainder of the strategic travel network. Both the travel activity zones and the road network within the region were refined to represent the complexity of the local site. It is important to note that this network adjustment was maintained

within the context of the Brisbane wide Strategic Transport Model. A Sunday equivalent model was also developed to examine the different sets of activities and complexities within this study area.

To manage the village landscape in the context of items discussed in **Figure 1**, a number of council parties were involved in the assessment process when operating future year design scenarios. However, to manage their direct interests, these parties were also involved in the mesoscopic modelling process. The council parties involved in this VISUM network development process including the following:

- the project team involved in the Redcliffe Village Rejuvenation process;
- the transportation modelling team managing the road network, with consideration to respond to the Rejuvenation project and
- the development assessment team; who identified that the disaggregated travel zone could be used to identify traffic impact assessments within the village landscape.

The study area for this mesoscopic model, as outlined in **Figure 3** is bounded by Humpybong Park to the west, Anzac Avenue to the south, Redcliffe waterfront to the east and Humpybong Esplanade to the north. The rejuvenation project covers the entire coastal facade within the study area, along Redcliffe Parade. To the northern end of this location is the pier for boat access to Moreton Bay.



Figure 3: Study Area of Redcliffe Village within the BSTM

In 2006 Moreton Bay Regional Council (then Redcliffe City Council) employed traffic consultants to assess the parking supply and demand in the village, and to devise strategies for Council to manage the provision of public car parking. One of the recommendations in the report was to convert Redcliffe Parade, between Anzac Avenue and Humpybong Esplanade, into one way northbound operation. The proposed conversion would potentially enable an increase in on-street parking supply along Redcliffe Parade. However, a one way pairs solution would resolve one component of the issues raised in **Figure 1**, but the southbound routes would need to be diverted, which would impact negatively on traffic and bus services travelling in this direction. The rerouting of bus services would affect a significant number of passengers who board and alight at these locations. For this reason a reassessment of the study findings was undertaken within this mesoscopic transportation modelling study.

Zoning System in Redcliffe Seaside Village

The zone system in the study area was disaggregated to a sufficient level of detail to represent the specific land uses within the Redcliffe Seaside Village. This area was covered by only two zones in the Brisbane Strategic Travel Model. However a new zoning system was devised based on the Australian Bureau of Statistics census collector district zones, planning lot definitions, land use density, vehicular access and parking facility arrangements. The two zones in the macroscopic model were into a total of 77 local area zones to assist with the redevelopment and planning of traffic circulation in the village landscape. The spatial disaggregation of the travel activity zones in the VISUM mesoscopic model can be seen in Figure 4.

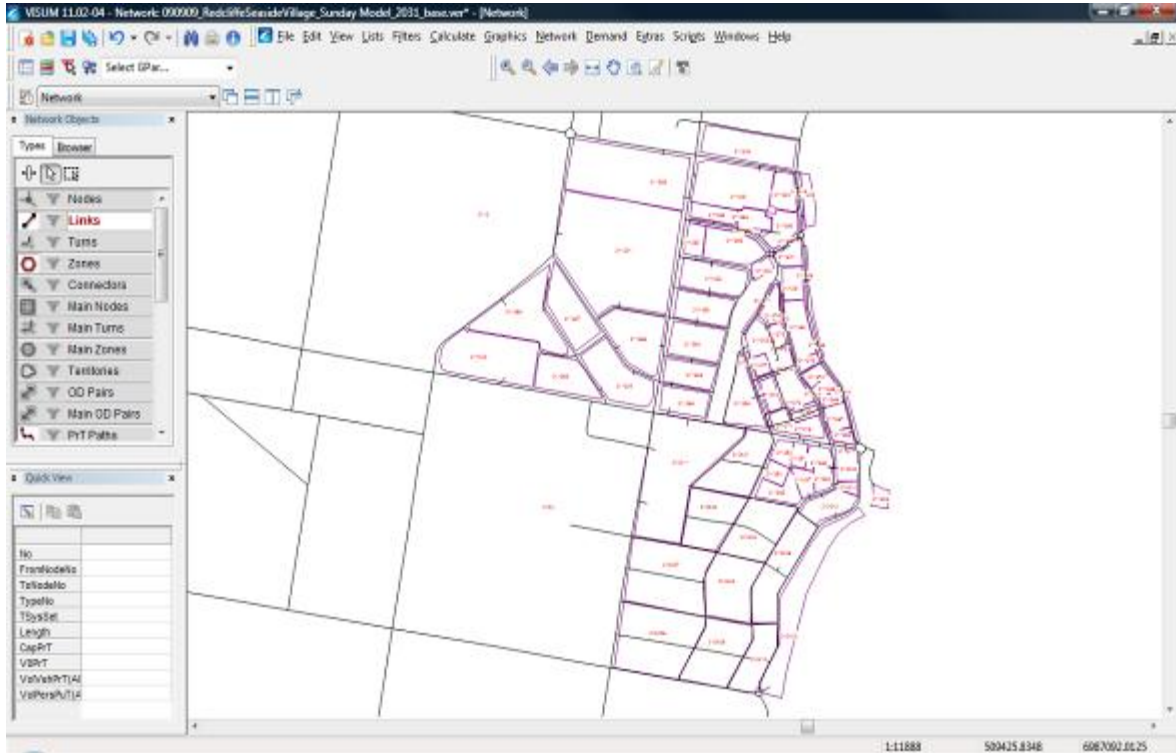


Figure 4: Disaggregated Travel Zones for the Redcliffe Seaside Village, within the BSTM

Network Enhancement in VISUM BSTM

All roads within the study area were defined in the VISUM Brisbane Strategic Transport Model with correct number of lanes, road classification, speeds, capacities, pedestrian crossings and traffic signal phasing. Roundabouts were also explicitly coded for the following three junctions for seamless export to VISSIM:

- Redcliffe Parade/ Humpybong Esplanade;
- Humpybong Esplanade/ Irene Street; and
- Redcliffe Parade/ Anzac Avenue.

Two roundabouts immediately adjacent to the study area were also explicitly modelled to reflect capacity restraints on links entering and exiting the site of investigation. These locations were at Scarborough Road / Klingner Road and also at Marine Parade / MacDonnell Road.

Details of signalised intersections such as lane configuration and geometry, cycle time and phasing were coded based on STREAMS phasing plans at the several locations in the study area along both Anzac Avenue and Oxley Avenue.

Matrix Refinement

Classified traffic surveys were conducted in June 2009 at fourteen intersections within and adjacent to the periphery of the study area. Based on the latest 2009 land use information in the study area provided by the council a revised travel matrix was developed from the initial strategic transportation matrix, as determined to match the revised zoning system. Utilising VISUM matrix calibration procedures known as “TFlowFuzzy”, an assignment was produced to match the observed link and turn flows at the surveyed locations within the enhanced road network, while still maintaining the structure and consistency across the remainder of the original Brisbane Strategic Transportation Model.

Public Transportation Services

During weekdays, there are ten bus services per hour per direction along Redcliffe Parade, with bus stops at The Jetty; at Charlsh Park and at Settlement Cove. Information detailing the directional boarding passengers was obtained from TransLink (Public Transport Authority) and indicates a regular volume of 400-500 persons per day at “The Jetty” bus stop (March 2009). Lower boarding volumes indicate that neither Charlsh Park nor Settlement Cove are utilised significantly.

As noted previously, a one way pairs solution would have addressed issues of on-street parking, but could have significantly impacted on the boarding and alighting of passengers at these bus stops. Hence, careful consideration needs to be taken should a one way traffic management scheme be pursued - as southbound services would need to be diverted, impacting negatively on a significant number of passengers.

VISSIM MODEL DEVELOPMENT AND ENHANCEMENT

A sub-network of the Redcliffe Seaside Village study area was created by extracting a cordon from the revised Brisbane Strategic Transportation Model. The sub-network, together with assigned paths of trips generated within, attracted to, or traversing the study area, was imported into VISSIM for a more detailed investigation of the site specific complexities. Three simulation time periods, each of two hours were directly extracted from the PTV VISUM model using the Adaptive ANM process between VISUM and VISSIM.

This “top-down” approach ensures consistency in the modelling and analysis between the VISUM Brisbane Strategic Transport Model and the VISSIM micro-simulation models. The process directly imports into VISSIM the network structure, intersection geometry, number of lanes and turn lanes, signal cycle times/ phase times, speed occurrences, public transport stops and services and a series of other attributes. Travel demand flow bundles were represented as static paths directly from the VISUM model ensuring direct consistency between the mesoscopic assignment and the VISSIM micro-simulation routes. A high resolution aerial photography was used to convert the network model from an abstract network intersection into site specific stop line locations. As all intersections had the detail of the intersection coded into the refined Brisbane Strategic Transport Model, the impedance of the signalised intersections and roundabouts are maintained across the platforms. Only the conversion of the geometric shape from an abstract representation needs to be undertaken as shown in **Figure 5**. Further details of the connections between VISUM and VISSIM transportation models and the network refinement process are discussed in Laufer *et al* (2010).

Pedestrian crossings were also represented in the VISSIM micro-simulation model to reflect the interaction between traffic, transport and pedestrians within the landscape. The pedestrian crossings on Redcliffe Parade, Sutton Street and Anzac Avenue were incorporated into the simulation model. VISSIM functionality was also utilised to simulate the complexity of the uncontrolled pedestrian crossings at Redcliffe Jetty over the Sunday lunchtime period. Surveys indicate that there were approximately 3,000 pedestrians crossing at this location over a two hour period in August 2009. This stochastic arrival pattern was modelled within the VISSIM micro-simulation software to reflect the varying queuing patterns observed.

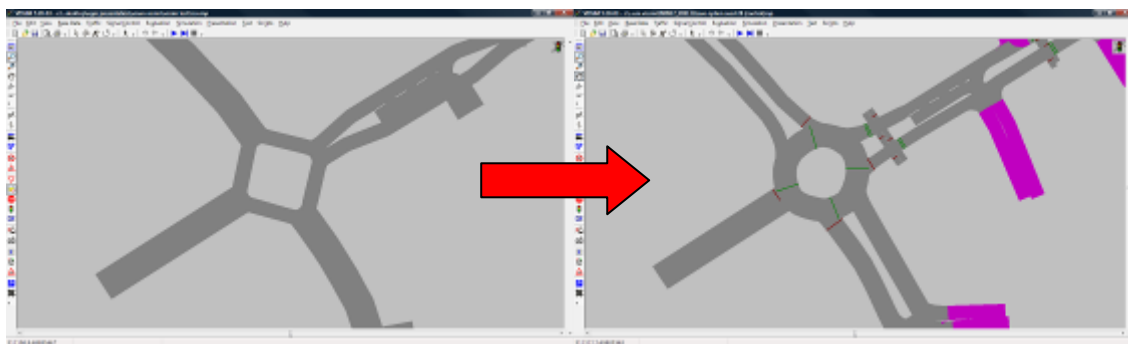


Figure 5: ANM Conversion of Humpybong Esplanade/ Irene Street Roundabout

Vehicular routes have been exported from the Brisbane Strategic Transportation sub-network model and imported to the micro-simulation model. A static route within the traffic simulation means that the link and turn volumes in the micro-simulation model are common across VISUM and VISSIM platforms. Again, the commonality between VISUM and VISSIM turn and link flows can be found in Laufer *et al* (2010). While the simulation seed allows for subtle variations within the distribution of attributes to (demand loading and driver response times in car following behaviour) this simulation seed does not vary the overall traffic demand flows, network design or signal operations. Rather it reflects the subtleties in the release of traffic over the network. A total of three VISSIM simulation runs were undertaken with different random seeds. An average measure of these flows were benchmarked against performance measures from the VISUM platform.



Figure 6: Snapshot of VISSIM operations, including public transport and on-street parking.

A series of quantitative performance measures were produced to benchmark the intersection performance and the operation across the entire network. Network performance measures are provided within **Table 1**.

FUTURE YEAR PLANNING

Future employment and population data for the Redcliffe Village was provided by Moreton Bay Regional Council at the lot level, which is consistent with the disaggregated zoning system defined in the revised Brisbane Strategic Transportation Model. Forecasts through to 2031 indicate an increase in population of 33% within the study area, plus an additional 16% of employment through this period. This is due to a number of specific developments (commercial, retail and residential), plus general underlying growth across the demographics. Using the planning data provided by Moreton Bay Regional Council, the trip ends (generation, attraction) of all 77 disaggregated travel zones in the Redcliffe Village were input to the 2031 Brisbane

Strategic Transportation Models for morning, evening and Sunday lunchtime periods. The emphasis of this approach allows for inclusion of all future year infrastructure, network, land use and public transport service changes across the metropolitan landscape as examined by state and regional authorities, with incorporation to the site specific conditions at Redcliffe Seaside Village.

In addition to the 2031 Future Year (Do Nothing) model (benchmark of conditions with no network changes) three traffic management options were examined for all three time periods modelled in 2031. These revisions to the transport network are:

- Option 1 – One way northbound on Redcliffe Parade, between Anzac Avenue and Humpybong Esplanade;
- Option 2 – Option 1 plus one way southbound on Sutton Street, between Creek Street and Violet Street;
- Option 3 – Option 1 plus one way southbound on John Street, between Creek Street and Anzac Avenue.

These three options incorporate the preferred parking strategy proposed in an independent investigation that was undertaken in 2006. The traffic management options investigated were developed into the Brisbane Strategic Transportation Model and assigned together with the 2031 demand matrices. The VISUM network, now complete with the details of the Redcliffe Seaside Village at a mesoscopic level included intersection turn operations, lane definition and disaggregated zone structure was assigned and again exported into VISSIM for micro-simulation modelling. However, while the initial export process required a refinement of the abstract node design to match the stop line and angles within the geometry, each subsequent revision was run through the Adaptive ANM procedure, as depicted in **Figure 7**. This measure within the PTV Vision suite allows for consistency in the VISSIM simulation structure, as per the operations of the VISUM network. Only changes defined in the VISUM transportation model are updated in the VISSIM micro-simulation model. All other elements remain unchanged within the VISSIM network.

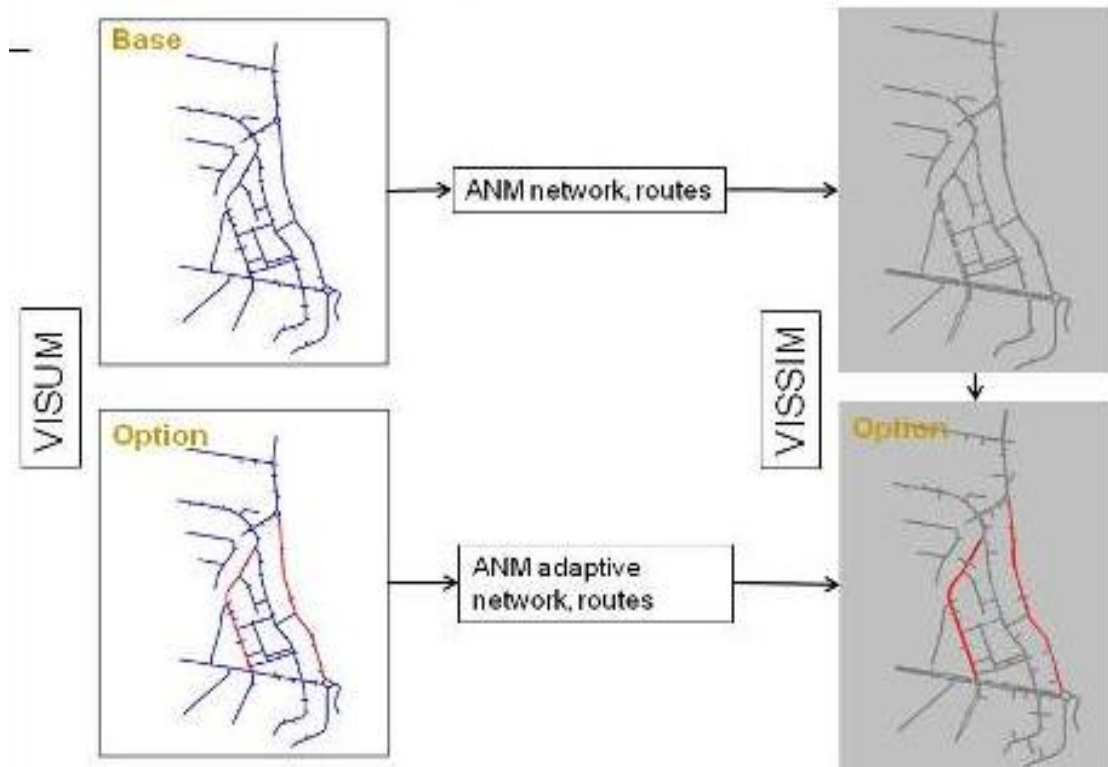


Figure 7: Adaptive Abstract Network Model (ANM) process between VISUM and VISSIM

The analysis of the various scenarios investigated identified that there is little change between base year model and the future conditions in terms of key performance measures – namely intersection Level of Service plus (Redcliffe Seaside Village) network wide statistics of speed and delay, as depicted in **Table 1**. However the VISSIM simulation modelling does indicate additional problems in the future for queuing on Redcliffe Parade, due to the high volume of pedestrians crossing unaided and uncontrolled near the jetty.

The VISSIM micro-simulation results indicate that the average delays across the network are forecast to double from 2009 to 2031 (from 36 to 75 seconds per vehicle) for all scenarios in the Sunday lunchtime period. The average speeds of all vehicles are expected to reduce considerably from 27 km/hr (2009) to 18-19 km/hr for all 2031 options in the same time period. Queues on Redcliffe Parade are expected to grow in the future beyond the roundabout at Anzac Parade, adversely impacting on the remainder of the network. Average speeds for the morning and evening weekday periods were identified as similar to current conditions.

Table 1: Speed and Delay at selected Locations at Redcliffe Seaside Village

Time Period	Year	Option	Average vehicle speed (km/hr)	Average delay per vehicle (s)	Average stopped delay per vehicle (s)
Weekday AM	2009	Base	28	13	6
	2031	Do Nothing	28	16	8
	2031	Option 1	27	17	9
	2031	Option 2	27	18	9
	2031	Option 3	27	20	9
Weekday PM	2009	Base	27	18	9
	2031	Do Nothing	26	22	12
	2031	Option 1	26	23	13
	2031	Option 2	26	22	12
	2031	Option 3	25	25	12
Sunday LT	2009	Base	27	36	14
	2031	Do Nothing	19	75	33
	2031	Option 1	19	67	31
	2031	Option 2	18	74	35
	2031	Option 3	19	67	28

Mitigation

The forecast congested and queuing conditions for Sunday lunchtime are caused by the uncontrolled nature of the pedestrian crossing by the jetty on Redcliffe Parade. Due to the number of pedestrians crossing at the jetty the capacity of the through traffic movement at that location is seriously compromised as vehicles need to continuously yield to pedestrians during the busy Sunday lunchtime period. This action is of significant economic value to village retail and recreational services. Road safety remains an issue within this context.

For this reason PTV examined the impacts of providing a controlled crossing at this location on Redcliffe Parade to mitigate the conflict between vehicles and pedestrians. The control is only required during the weekend and would not need to be operational on weekdays. This form of control would better platoon the pedestrians across the road, enhancing the safety of individuals and by producing larger gaps in the flow, would reduce overall vehicular delays. As an actuated crossing, it is envisaged that groups of pedestrians would cross together, enhancing the overall green times for vehicles but without significant delay for the pedestrian operations.

The figures in **Table 2** indicate that this proposed solution would have the desired effects of increasing overall speeds of vehicles across the village landscape to similar to current levels. The overall delay (and stopped delay) across the study area would be reduced significantly from levels initially envisaged, irrespective of the preferred future option.

Table 2: Speed and Delay (2031 Sunday Lunchtime) from mitigation solutions at Redcliffe Parade

Time Period	2031 Option	Average vehicle speed (km/hr)	Average delay per vehicle (s)	Average stopped delay per vehicle (s)
Without mitigations	Do Nothing	19	75	33
	Option 1	19	67	31
	Option 2	18	74	35
	Option 3	19	67	28
With mitigations	Do Nothing	28	26	11
	Option 1	26	28	13
	Option 2	27	27	11
	Option 3	27	25	10

Bus Rerouting and Bus Stop Relocation Consideration

Currently there are bus services along Redcliffe Parade in both northbound and southbound directions. However, were either of the alternate (Do Something) options be instigated, then the southbound bus services will be affected by the one way northbound traffic flow on Redcliffe Parade. Southbound services would need to be rerouted and the bus stops relocated. After consultation with Moreton Bay Regional Council and TransLink, plus examination of bus service information, ticket data and site visits a suitable southbound solution was identified along Sutton Street. Three existing bus stops on Redcliffe Parade could be relocated close to the pedestrian malls linking Redcliffe Parade and Sutton Street. This solution would continue to meet the needs of council outlined within **Figure 1**, including transportation planning, economic development, public transport services, urban design and parking provision within the Redcliffe Seaside Village through to 2031.

CONCLUSION

This paper has outlined the approach developed by PTV to use the PTV Vision suite to investigate and model transportation considerations at all levels of scale. By utilising the VISUM Brisbane Strategic Transportation Model, Council was able to identify growth and demand over time from a policy decision level. The disaggregation of two zones in the macroscopic Strategic Transportation Model into 77 zones allowed for council to further comprehend transportation planning and development planning within the Redcliffe Seaside Village. With the enhancement of the road network to complement this disaggregation, issues relating to the metropolitan projects and growth and public transportation planning were reflected within a mesoscopic model. This measure has included intersection geometry at the village level to accurately reflect operations constraints including capacity of turning movements and signal timings. After an assignment run, PTV has used the Adaptive Abstract Network Model process to export the paths, control systems and intersection layouts to produce a VISSIM micro-simulation model that examined and mitigated the complexity of pedestrian crossings at the jetty and traffic management issues for future conditions.

The approach of combining macroscopic, mesoscopic and micro-simulation into an integrated solution has allowed Council to examine and ameliorate the complexity of the Redcliffe Seaside Village as a holistic solution. Through this methodology, Council can investigate and manage local conditions associated with transportation planning, parking management and public transport services – not as an isolated measure, but in the context of the design and vision that Council wishes to maintain into the future. The integration of the VISUM modelling with that of the VISSIM micro-simulation modelling ensures that these solutions can be explored within the context of those points raised in **Figure 1**. Through this process any council can explore the policy driven changes implemented onto their local region and simulate for the operational complexities including pedestrian and public transportation interaction. Similar investigative techniques have recently been pursued with other councils across the Australian metropolitan landscapes.

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