"TOD Trips"
A new sketch planning model for assessing TOD’s and Transit Planning

Case studies in best practice from Australia

Dr Mark Bachels
National PlaceMaking Executive
Parsons Brinckerhoff - Australia
All major Australian Cities are pursuing similar growth strategies
- c. 50:50 ratio of greenfield and urban renewal
- Connected and mixed use centres
- Managed growth and urban boundaries
- TOD principles
- Improving Transit (rail, tram, bus) – reducing car dependence

Consistent challenge in concept development and assessment of TODs and corridors
Planning and Assessing TODs and Transit Corridor planning

• Numerous challenges and desires for TODs and transit corridors
  - Understand development potential
  - Understand transit potential
  - Optimize potential land use and transit synergy

• Limited tools for initial concept testing
  - Typically charrettes are used for concept development
  - Quantitative assessment of TOD potential for transit is often very limited (qualitative or “guesstimates”)

• Typical transport modelling tends to be:
  - Time consuming (usually months to create/update a model)
  - Complex (multimodal, data hungry)
  - Costly ($100-200k)
  - Inappropriate for sketch planning
What is TOD Trips?

• An innovative tool for testing integrated land use and transport scenarios
• A single platform for the rapid and detailed appraisal of a range of scenarios
• Built entirely within Excel
• Incorporates GIS features, data sheets and customised programming macros
Key Features

• Fully spatial specification of land use and transport
• Sophisticated user interface for rapid development and testing of scenarios
• Wide range of output capabilities including multi-criteria assessment and benefit-cost analysis
Transport Model Component

- Detailed transit model including trip generation, distribution, mode choice and assignment
- Rapid processing (<1 minute for 100 zones)
- Separate treatment of access and main modes
- Generalised cost mode choice model
Benefits in use

• Rapid development and testing of scenarios (including in a workshop environment)
• Interactive features allow testing of sensitivity to key input parameters
• Incorporates scenario management and multi-criteria assessment
• Useful for:
  - Community engagement and learning
  - Testing density and mix of uses
  - Testing possible transit networks, alignments and types (LRT, BRT, rail, etc.)
PB TOD and Corridor Assessment Tool

- Scenarios for mixed uses (density, jobs, etc.), mode share, transit networks
- Greenfield or urban renewal applications
- Transit corridor studies
- TOD site studies
- Quick and facile
- Integrates land use and transport/transit modelling
Building Livable Communities with Transit

Tests Connectivity - Local and Regional

Higher activity centre, excellent regional connectivity, permeable core area with mix of uses and transport modes

Mixed use, excellent permeability, connected to other centres via public transport and roads
Base - structure plan or aerial map
Land uses are graphical

Centres consist of precincts with different densities

Create new centre
Specify Land Uses

Edit precinct dwelling and employment mix
Test Land Use Yields, Population and Employment
Transport Network - very flexible and facile

Primary transport corridor defined as links and nodes.
Allows for easy changes in location and connections.
External Zones modelled

Representation of centres outside Study Area
Building Livable Communities with Transit

**Typical TOD Info**

Data would be mapped for two areas
- “strategic” area (area dependent) and
- specific to site and TOD at 400m and 800m catchments

**Land Use**
- Residential GFA and/or Density (existing)
- Commercial GFA and/or Density (existing)
- Retail GFA and/or Density (existing)
- Zoning Residential
- Zoning Commercial
- Zoning Retail
- Zoning other uses (eg civic, cultural, etc)
- Allowable building height
- Bonus Density provisions (if any)
- View shed restrictions (zoning)
- Height restrictions covenants (Dept Nat Resources)
- land ownership

- open space overlay
- heritage overlay
- flooding overlay
- vegetation overlay

- Household Building Stock Age
- No. of Blocks/Ha ("Permeability")
- Population (and density)
- No. Dwellings
- Employment/jobs (and Density)
- Household Income
Transport
• Traffic volumes on key surrounding streets (arterials, sub-arterials, etc.) peak period and total daily volumes
• Car Ownership rates
• Public Transport Routes bus and rail (existing and planned/committed)
• Public Transport Frequency (existing and planned/committed)
• Parking provisions (numbers on-street and off-street)
• Parking policies (time period policies and rate of development (maximum/min))
• Current mode split
• Public transport fares
• Identified rail or bus station sites
• Identified interchange sites (bus and/or rail)
• Park and ride (existing and planned)
Model Outputs

Outputs/parameters:
- Pop’n, job and mixed use density
- Transit types (LRT, bus, rail)
- Mode split
- Walkability/permeability
- Transit trips, frequency and costs
- Parking effects/policies
- Scenario tests
## Model output - typical summary tables

<table>
<thead>
<tr>
<th>Output</th>
<th>Current Scenario</th>
<th>Base</th>
<th>Last</th>
<th>Current</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total dwellings</td>
<td>19,468</td>
<td>17,339</td>
<td>28,629</td>
<td>19,468</td>
<td>24,000</td>
</tr>
<tr>
<td>Total GFA</td>
<td>500,191</td>
<td>440,748</td>
<td>538,049</td>
<td>500,191</td>
<td>500,000</td>
</tr>
<tr>
<td>Total population</td>
<td>56,337</td>
<td>54,000</td>
<td>82,875</td>
<td>56,337</td>
<td>70,000</td>
</tr>
<tr>
<td>Total employment</td>
<td>20,883</td>
<td>18,054</td>
<td>22,145</td>
<td>20,883</td>
<td></td>
</tr>
<tr>
<td>Average dwellings per ha</td>
<td>7.4</td>
<td>8.6</td>
<td>10.9</td>
<td>7.4</td>
<td>11.0</td>
</tr>
<tr>
<td>Total AM peak transit trips</td>
<td>5,278</td>
<td>5,200</td>
<td>6,134</td>
<td>5,278</td>
<td></td>
</tr>
<tr>
<td>Total annual transit trips, million</td>
<td>4.3</td>
<td>4.2</td>
<td>5.0</td>
<td>4.3</td>
<td></td>
</tr>
<tr>
<td>Transit mode share</td>
<td>22.6%</td>
<td>17.0%</td>
<td>22.9%</td>
<td>22.6%</td>
<td>24.0%</td>
</tr>
<tr>
<td>Annual VKT, million</td>
<td>176</td>
<td>270</td>
<td>201</td>
<td>176</td>
<td>200</td>
</tr>
<tr>
<td>System operating costs, $ mill p.a.</td>
<td>38.9</td>
<td>34.2</td>
<td>38.9</td>
<td>38.9</td>
<td></td>
</tr>
<tr>
<td>System fare revenue, $ mill p.a.</td>
<td>10.7</td>
<td>11.4</td>
<td>12.4</td>
<td>10.7</td>
<td></td>
</tr>
<tr>
<td>System cost recovery, %</td>
<td>27%</td>
<td>30%</td>
<td>32%</td>
<td>27%</td>
<td>35%</td>
</tr>
<tr>
<td>Annual travel time savings, $</td>
<td>8.6</td>
<td>9.9</td>
<td>8.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional operating costs, $ mill p.a.</td>
<td>7.8</td>
<td>7.8</td>
<td>7.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Additional capital costs, $ mill p.a.</td>
<td>6.8</td>
<td>6.8</td>
<td>6.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefit Cost Ratio</td>
<td>0.59</td>
<td>0.68</td>
<td>0.59</td>
<td>1.20</td>
<td></td>
</tr>
</tbody>
</table>
Output: Transit Assessments

- **Base Case Southern Drive**
- **First Avenue Sub Grade**
- **First Avenue Elevated**
- **First Avenue At Grade**
- **Carnaby Street Sub Grade**
- **Carnaby Street Elevated**
- **Carnaby Street At Grade**

- **Trips leaving**
- **Trips entering**
- **Total**

**AM peak two hour transit trips**

- **Base Case**
- **Southern Drive**
- **First Avenue Sub Grade**
- **First Avenue Elevated**
- **First Avenue At Grade**
- **Carnaby Street Sub Grade**
- **Carnaby Street Elevated**
- **Carnaby Street At Grade**
Case #1: Lockerbie greenfield master planning and transit type (Melbourne)

- Large scale greenfield master plan
- Existing rail line
- Desire for new transit to service c. 40,000 new residents and mixed use town centres
- Test of density and transit networks to optimize:
  - transit type (LRT or bus)
  - Transit performance (patronage, cost) and
  - land use yield
Building Livable Communities with Transit

Lockerbie - Starting point

Sketch plan of greenfields site

Villages

Transport Network

Lockerbie Town Centre
Lockerbie: Defining Land Use Zones

Zones consist of precincts with different densities.
Lockerbie: Transit Outcomes

- Trip generation
- Trip distribution
- Mode Choice
- Transit Assignment

Transit network volumes
Lockerbie Findings

• Bus base solution was best based on cost
• LRT would generate more patronage but for location was difficult to justify additional cost
• Mix of density enabled either BRT or LRT (with a likely greater theoretical yield for LRT but market location suggested higher densities were doubtful)
Case #2: Maroochydore, Queensland

Context:
- 1.5 hours north of Brisbane
- One of Australia’s fastest growing regions

1. Develop a City Centre concept plan and TOD in an existing “messy” centre

2. Identify appropriate role, function and location for passenger rail in new city centre
Maroochydore Challenges - Rail Integration

- Assessing rail re-alignment:
  - At grade
  - Elevated
  - Underground

- Maximize benefit to CBD, rail and prospective development of the Golf Course
Maroochydore: Drivers and Context

- Population growth (275k now to 450k by 2026)
- Lack of connectivity and major congestion looming
- Chaotic development – disconnected development
- Lack of “city heart”
- Threat other centres out compete (eg Caloundra/Kawana)
- Major infrastructure planned/committed
  - New multi-modal corridor, major regional hospital,
  - Major new passenger railway – CAMCOS - $3B and 40km spur
- Desire for:
  - Mixed uses, improved civic and public spaces
  - “A real city centre” for the Sunshine Coast
  - Improved public transport and specifically rail connectivity
Sunshine Coast
Major Transit and TOD Developments

- Pop’n growth
- New rail line planned
- Green field and urban renewal
- Poor alternative transport
- Requires complementary nodes and corridors

- High Density Core Mixed Land Use
- Short distance origin and destination patterns within core districts

- Medium density pedestrian pockets around rail stations
- Long distance, radial origin and destination patterns
Multi-criteria assessment of options:

- Land use
- Transport
- TOD / placemaking
- Environment
- Engineering
Develop some concept options with stakeholders.

**Concept Plan Rail Options Tested**

- Option 1 and 2 – current alignment (at grade and elevated)
- Option 3 at motorway
- Option 4 and 5 (at grade, elevated and underground)
- Recommended Option 5 - elevated
• 7 alignments tested:
  - Existing alignment
    • At grade
  - Alternative 1 - Concept Plan
    • At grade
    • Elevated
    • Underground
  - Alternative 2 - at edge of golf course
    • At grade
    • Elevated
    • Underground
Recommended Rail Alignment

1. At edge of town centre – more flexible development
2. Station mixed use TOD
3. Elevation alignment improves connectivity
4. 2nd best performance from TOD Trips scenario testing
5. Enables Golf Course redevelopment
6. No additional water crossing (reducing cost)
Case #3: Sydney Northwest Metro
Proposed Route
Sydney NW Metro corridor - TOD Trips Modelling
Sydney - Northwest Metro

- $12 billion proposed 38 km underground metro
- Sydney CBD to outer fringes existing development (Rouse Hill)
- TOD Trips used to evaluate entire corridor potential land uses and transit patronage
  - corridor alignment
  - station locations
  - density

- Proposed route is on hold due to change in state leadership and funding concerns (likely proceed with inner city portion)
**TOD Trips - Summary**

- Highly flexible, requires less time and budget
  - setup 4-6 weeks for model and less than 1 minute to run (typical model takes 8 hours)!
- Greater understanding of interaction between transit networks and master plans
- Quantifies what has often been too difficult:
  - housing mix, retail/commercial mix, transit patronage and transit operating costs, transport energy and CO2 emissions.
- Useful for developing/testing scenarios
- Improves client/team understanding
- Useful for greenfield/urban renewal site and corridor
END
Building Livable Communities with Transit

**Typical trip length by mode**
**Christchurch, New Zealand**

Source: 1991 Home Interview Surveys for CTS Model