Traffic and Parking Surveys

Wednesday 14th October 2009, 5:30pm – 7:00pm
VicRoads Theatrette, 60 Denmark Street, Kew

Our speakers this evening are...

John Piper General Manager – Traffic, CPG Group
Ian Greenwood Director, Austraffic
Deborah Donald Director, O’Brien Traffic
Why are Automatic Traffic Classifiers used so widely?

- Relatively cheap to install for short-term counts
- Allows counting of individual vehicle axles using two tubes
  - Speeds
  - Fine level of classification (Austroads - 12 bins)
- Other techniques available:
  - Inductive loops
  - Treadle Switches
  - Video
  - Radar
  - Magnetic etc
How do Automatic Traffic Classifier data loggers work?

- 2 Pneumatic tubes (generally spaced 1 metre apart)
- Record time of air pulse at Tube A and Tube B
- Calculate the speed of the vehicle based on the time between pulses and the distance between the tubes
- Assign the group of pulses to vehicle classes based on grouping of subsequent pulses

### AustroadsVehicleClassificationSystem

<table>
<thead>
<tr>
<th>Light</th>
<th>Medium</th>
<th>Heavy</th>
<th>Extended</th>
<th>AUSTRoads Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>passenger &lt; 3</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>semi-trailer 1 and 2</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>semi-trailer 3 to 6</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>truck 1 and 2</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>truck 3 to 6</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>bus 1 and 2</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>bus 3 to 6</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>truck 7 to 12</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>truck 13 to 17</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>truck 18 to 20</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>truck 21 to 23</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>truck 24 to 26</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>truck 27 to 29</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>truck 30 to 32</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>truck 33 to 35</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>truck 36 to 38</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>truck 39 to 40</td>
</tr>
</tbody>
</table>

**Legend:**
- Light: vehicles up to 5.5 tonnes
- Medium: vehicles up to 13.5 tonnes
- Heavy: vehicles up to 18 tonnes
- Extended: vehicles over 18 tonnes

- passenger: 0 to 3 passengers
- semi-trailer: 1 to 6 passengers
- truck: 1 to 4 passengers
- bus: 1 to 2 passengers
- truck+1: 5 to 8 passengers
- truck+2: 9 to 12 passengers
- truck+3: 13 to 16 passengers
- truck+4: 17 to 20 passengers
- truck+5: 21 to 24 passengers
- truck+6: 25 to 28 passengers
- truck+7: 29 to 32 passengers
- truck+8: 33 to 36 passengers
- truck+9: 37 to 40 passengers
What can cause errors?

- Tubes are not at right angles across road or to traffic
- Tubes are not parallel
- Spacing of tubes is not correct
- Rutted pavements can cause tubes to bounce creating spurious air pulses
- Slow moving traffic can affect the strength of the air pulses
- Parked cars on tubes can block air flow
- Different length tubes
- Vehicles swerving or changing lanes
- Counting two or more lanes with one classifier can create problems with classification
  - Bi-directional Survey (up to about 4,000 vehicles per day two way can be counted with one classifier)
  - Two lanes in one direction should always use separate classifiers

Preliminary assessment of site for installation of traffic counters

- Number of lanes to be counted
- Assessment of likely traffic volumes
- Location to install counters, somewhere to attach counters
- Avoid curved alignments
- Room to safely park van
- Sight lines to approaching traffic
- Proximity to signals, likelihood of slow or stationary traffic
- Parked cars
Installation Configuration –
Arterial Road, 4 lanes, no median
Installation Configuration – Arterial Road, 4 lanes one way carriageway
Typical site installation

Occupational Health and Safety Issues

- All staff are trained and inducted before working on-site:
  - Quality procedures
  - Traffic management specifically related to classifier installations
- Hold Traffic Controller certificate (renewed 2 yearly)
- Site plans are developed to accord with Worksite Code of Practice
  - Vehicle equipped with twin flashing amber lights
  - Appropriate signing
  - PPE for staff
- Regular on-site inspections and verification
- Procedures are 3rd Party Certified (AS/NZS 4801)
Travel Time Surveys

Travel time surveys are conducted to:

- identify problem locations on roads;
- determine the level of service;
- establish the impact of improvements;
- input to planning, modelling and feasibility studies;
- often coupled with delay - usually defined as the time period when a vehicle is stopped or less than 5 km/h - in order to obtain an overall measure of performance.
Floating Car Surveys

The objective of a ‘floating car’ survey is for the vehicle to travel along the road at the average speed of traffic. This is achieved by ensuring the vehicle passes as many vehicles as pass it.

In practice on congested roads, an ‘average car’ technique is used where the driver travels according to their best judgment as to the traffic stream's speed.

Travel Time Data

Road lengths are divided into sections (or ‘links’) separated by intersections or other intermediate points known as ‘nodes’.

Nodes can be intersections, pedestrian crossings, rail crossings, overpasses, etc.

Consideration needs to be given to sample size - trade-off between large sample and cost.
Rather than traditional methods of human recording of ‘node’ points and delay, GPS enables automatic recording of travel time data. GPS recorders are relatively inexpensive and can record a GPS pulse about once every second.

However, the data collected can have various forms of spikes that can corrupt the overall data.
GPS Data Error – Freeway Noise Barrier

GPS Data Error – Freeway Tunnel
Driver Error

Driver Rest Break
GPS Data Error – Data Spike

Define free-flowing start and end points
### Data Analysis – Travel Times

<table>
<thead>
<tr>
<th></th>
<th>AM</th>
<th>Offpeak</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Travel Time</strong> (hh:mm:ss)</td>
<td>0:11:27</td>
<td>0:11:02</td>
<td>0:11:51</td>
</tr>
<tr>
<td><strong>Max Travel Time</strong> (hh:mm:ss)</td>
<td>0:14:16</td>
<td>0:13:23</td>
<td>0:12:56</td>
</tr>
<tr>
<td><strong>Min Travel Time</strong> (hh:mm:ss)</td>
<td>0:09:07</td>
<td>0:09:10</td>
<td>0:10:12</td>
</tr>
<tr>
<td><strong>Sample Size</strong></td>
<td>31</td>
<td>34</td>
<td>35</td>
</tr>
<tr>
<td><strong>Std Deviation</strong> (hh:mm:ss)</td>
<td>0:01:26</td>
<td>0:01:00</td>
<td>0:00:43</td>
</tr>
<tr>
<td><strong>85th%ile</strong> (hh:mm:ss)</td>
<td>0:12:56</td>
<td>0:12:04</td>
<td>0:12:36</td>
</tr>
</tbody>
</table>

### Data Analysis – Travel Speeds

<table>
<thead>
<tr>
<th></th>
<th>AM</th>
<th>Offpeak</th>
<th>PM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Speed</strong> (km/h)</td>
<td>64.04</td>
<td>66.01</td>
<td>61.13</td>
</tr>
<tr>
<td><strong>Max Speed</strong> (km/h)</td>
<td>79.25</td>
<td>78.83</td>
<td>70.84</td>
</tr>
<tr>
<td><strong>Min Speed</strong> (km/h)</td>
<td>50.55</td>
<td>53.99</td>
<td>55.87</td>
</tr>
<tr>
<td><strong>Sample Size</strong></td>
<td>31</td>
<td>34</td>
<td>35</td>
</tr>
<tr>
<td><strong>Std Deviation</strong> (km/h)</td>
<td>7.86</td>
<td>5.96</td>
<td>3.87</td>
</tr>
<tr>
<td><strong>85th%ile</strong> (km/h)</td>
<td>72.19</td>
<td>72.19</td>
<td>65.13</td>
</tr>
</tbody>
</table>
### Data Analysis – Location of Delay

<table>
<thead>
<tr>
<th>Road</th>
<th>Average</th>
<th>Average Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Distance (km)</td>
<td>Time (s)</td>
</tr>
<tr>
<td>POINT EAST OF HOPKINS RD</td>
<td>1391</td>
<td>0.3044</td>
</tr>
<tr>
<td>DEEP PARK BYPASS</td>
<td>0.218</td>
<td>0.3049</td>
</tr>
<tr>
<td>CARLTON SPRINGS BND</td>
<td>0.434</td>
<td>0.3046</td>
</tr>
<tr>
<td>WESTWOOD DR</td>
<td>1.747</td>
<td>0.3044</td>
</tr>
<tr>
<td>ROBINS RD</td>
<td>0.303</td>
<td>0.0002</td>
</tr>
<tr>
<td>PENNEAR Bewdst ST</td>
<td>0.542</td>
<td>0.0010</td>
</tr>
<tr>
<td>STATION Rd</td>
<td>0.297</td>
<td>0.0002</td>
</tr>
<tr>
<td>CAUTHILL DR</td>
<td>0.376</td>
<td>0.0014</td>
</tr>
<tr>
<td>WESTERN RING Rd SR ramps</td>
<td>0.296</td>
<td>0.0009</td>
</tr>
<tr>
<td>WESTERN RING Rd P ramps</td>
<td>0.192</td>
<td>0.0001</td>
</tr>
<tr>
<td>FITZGERALD DR</td>
<td>2.305</td>
<td>0.0021</td>
</tr>
<tr>
<td>DEEP PARK BYPASS</td>
<td>0.279</td>
<td>0.0003</td>
</tr>
<tr>
<td>POINT NORTH OF BNDry Rd</td>
<td>1.789</td>
<td>0.0010</td>
</tr>
</tbody>
</table>

**Total**

<table>
<thead>
<tr>
<th>Distance (km)</th>
<th>Time (s)</th>
<th>Speed (km/h)</th>
<th>Mid Section</th>
<th>End Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.945</td>
<td>0.9027</td>
<td>86.29</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

### Data Presentation – Location of Delay
**Automatic Video Intersection Counts**

Patented hardware and software system for video recording an intersection and using software to classify and count traffic.

**Manual Recording Techniques**

Current methods to count intersection data by field staff on the ground can have human errors. Recording can by ‘tally boards’ and pen/paper or electronic boards such as Jamars.

However, data collected can be inaccurate, requiring highly-skilled field staff especially for larger surveys.
How does the system work?

Site installation of video equipment
**Software**

Full-tracking of vehicles, not zone detection

Vehicle classifications – cars, buses, medium trucks, large trucks, motorbikes, bicycles

Pedestrian counting (incl. bi-directional)

The system has been tested to better than 95% accuracy – every study can be fully verified by the end-user by online access to the video.
Outputs

Spreadsheet results – interval data with peak hours calculated

Online access to review or download the video

SIDRA input module being developed

Custom outputs such as for VicRoads R.I.S.
Parking Surveys

- Types of Surveys
- Relative Costs
- The need for a good inventory
- OH&S issues
- Things that can go wrong
Deciding on a type of survey

Define objectives clearly. Is the survey:

- to identify existing parking supply?
- to show existing parking practices?
  - occupancy
  - parking duration
  - illegal parking
  - use of resident permits
  - use of disabled permits
- for some other purpose?

Types of Surveys

- Parking occupancy survey
  - patrol
  - cordon
  - automatic (e.g. loops in spaces)
- Parking accumulation survey
- Duration of stay survey
  - patrol
  - cordon
Types of Surveys

- Driver questionnaire survey
  - intercept
  - mail back
- Time to exit
- Length/time of queues to exit
- Survey by aerial photography

Method

- Be clear of why survey is being done
- Select study area
- Collect details of when best to do survey
- Prepare inventory
- Undertake pilot survey
- Undertake survey
- Analyse data
OH&S Issues

- Surveyors recording data on-street or in car parks
- Surveyors travelling to and from sites
- May need driver and recorder if doing survey from car
- Length of survey
- Interview surveys

Relative Costs

Cost reflects number of surveyors and amount of data to be processed.

Generally

- [Lower Cost]: parking occupancy
- [Higher Cost]: duration of stay survey, driver questionnaire survey
Things That Can Go Wrong

- make sure there are no unusual events occurring that will affect survey (e.g. school camps, shop once a year sales)
- don’t rely solely on information provided by others
- difficulty of undertaking surveys in private property or behind closed doors
- incorrect assessment of supply
  - unmarked parking areas
  - narrow streets
  - not allowing clearance to driveways
- dyslexic surveyors

Unmarked and well-marked parking areas
What is the parking supply (capacity)?
Narrow streets do not allow on-street parking on both sides, less parking capacity than wider street.

Parking supply should not include driveways.
More Things That Can Go Wrong

- length of surveyor shifts
- unexpected roadworks in survey area
- semi-trailer front/rear plates don’t match
- additional hidden car park access
- specify if occupied spaces or vacancies are being counted
- ownership of car park (private vs public)
- disabled permit vs overstaying
- check if permit parking area

Still More Things That Can Go Wrong

- accumulation surveys – don’t forget cars already parked or remaining at the end
- check if on site parking is allocated (e.g. spaces may be empty but still unavailable)
- be aware of ‘sabotage’ if users don’t want survey
- be mindful of clients not providing correct information
- make sure the survey area is not too large for the number of surveyors available
- set appropriate times for patrol surveys - make sure you don’t miss the peak period!
Conclusions

• Doing a parking survey is easy.
• Doing it properly takes understanding, preparation and experience!