Using ITS Data Fusion to Assess Network Performance and Corridor Initiatives

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Content of Paper

- ITS Infrastructure and Data Fusion
- Performance Reporting
- International Case Studies
- Floating Car / Average Car and Sample Size
- ITS Tools for Corridor Assessment
- Conclusions – Data Fusion

Data Fusion





ITS Infrastructure and Data Fusion

- Vehicle Counts, ATMS, Floating Car, Vehicle Tracking, SCATS, *etc.*
- Benefits of Data Fusion (Sarma & Raju, 1991;Lin et al., 1991):
  - Increased confidence
  - Reduced ambiguity
  - Improved detection
  - Increased robustness
  - Decreased costs
  - Enhanced spatial and temporal coverage

Performance Reporting

- Traffic Volumes (throughput)
- Travel Times (Efficiency) / Productivity (throughput & TT)
- Reliability of Travel Times
- Public Transport Information
- Environmental (air quality, run-off, noise)
- Customer Satisfaction

- Also:
  Spatial and temporal characteristics; longer term trends

International Case Studies

- Data Fusion, mix of sensors and data
- Requirement for coverage of whole transport network
- Customer Perceptions
- Lost Throughput Productivity (a commercial approach)
- Floating Car surveys remain a crucial component

Floating Car / Average Car and Sample Size

- Data Collection:
  - "The effect of larger 'errors' in individual runs are reduced by the number of runs, and for very large samples the mean will approach the actual mean travel time."
- Tyranny of Coverage
- Fusion of Data Sources
- Sample Sizes
- Variability in congestion
- Degree of Confidence

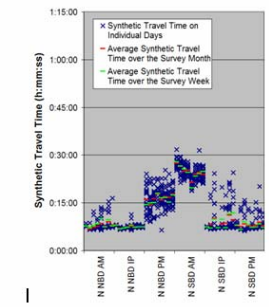
ITE Manual of Transportation Engineering Studies

Table 1: Extract from ITE Manual of Transportation Engineering Studies

Average range in running speed (kph)	Minimum number of runs for a permitted error of:				
	2 kph	3.5 kph	5 kph	6.5 kph	8 kph
5 kph	4	**3**	2	2	2
10 kph	8	**4**	3	3	2
15 kph	14	7	5	3	3
20 kph	21	9	6	5	4
25 kph	28	13	8	6	5
30 kph	38	16	10	7	6

5 Day Floating Car versus Actual Mean TT

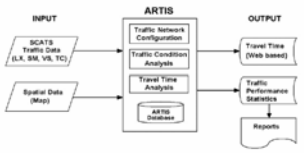
- 5 day sample, assuming coverage of Monday to Friday, gives high level of confidence that it reflects the monthly mean TT.
- Methodology requires care around 'extreme' events.
- Complete network coverage
- Limited temporal coverage



ITS Tools for Corridor Assessment

- Current Technology and Methods:
  - Limited data
  - Some reliance on modelling, especially micro-simulation
  - Range of costs
  - Limited data
- New Generation of ITS tools:
  - Better use of existing data
  - Use of new data sources
  - Better monitoring and reporting

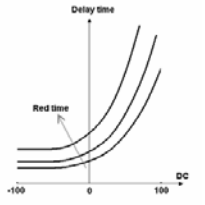
ARTIS – Using ITS Data



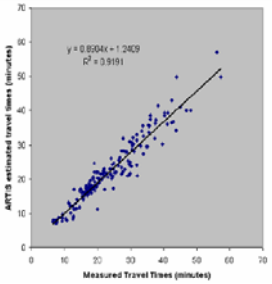
Link travel time = Cruise time + Stopping/Delay time
= $x_i/v_i + s_{i+1}$

Where
x_i is the distance of link i
v_i is the average traffic speed, estimated from SCATS data at signal i
s_{i+1} stop time at the downstream signal (i+1)

ARTIS



Journey time = $\sum(x_i / v_i + s_{i+1})$



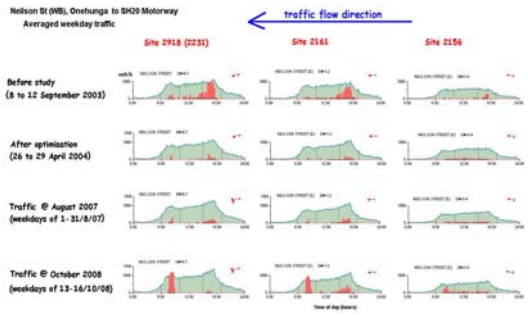
ARTIS

ARTIS

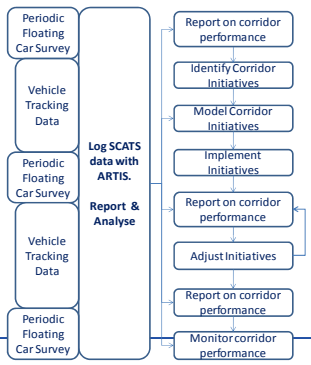
ARTIS

- Provides 24/7 data
- Key Route Reporting
- 'Real-Time Analysis'
- Trends – spatial and temporal
- Wider Network Coverage
- Productivity Measures (and spare capacity)
- Fuse with other data – particularly floating car
- Reduce reliance on modelling
- Pedestrian Information
- Requires SCATS expertise

ARTIS – Before and After Analysis



Using ARTIS as part of Corridor Initiatives



- Reduce Cost
- Reduce Time (instant feedback)
- Monitor Performance
- Query trends
- Less 'blackbox'

Conclusions

- **ITS Data Fusion** is established concept that needs implementation in New Zealand.
- **Floating Vehicle** surveys remain best-practise and valuable; important to understand the statistics.
- **Performance Reporting** requires Arterial information – ARTIS is a valid and cost-effective tool.
- **Corridor Optimisation** can use ITS data fusion based processes to be quicker and cheaper.