The Scottish National Journey Time System
Experiences with Data Fusion

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Presentation Structure

- Background to Scottish Road Network
- Why Journey Times?
- Transport Scotland ITS Vision & Strategy
- Data Fusion Phase 1 - The A1 Demonstration Project
- Data Fusion Algorithm development and results
- Further work – Data Fusion Phase 2 and other extensions
- Summary
The Scottish road network

- Mix of urban, inter-urban and rural
- Congested conditions in Central Belt
- Rural routes provide lifelines
The Scottish road network

- **ITS provision**
  - Focus on Glasgow area
  - Little coverage remainder of Scotland

- **Infrastructure deficit**
  - Use of “new” approaches
  - Meet STREETWISE Monitoring Recommendations
Why Journey Times?

- **Network Management**
  - Overview of network conditions, quick detection of events
  - Assess an event and likely impact
  - Congested route diversion comparisons
  - Roadworks planning

- **Information Services to travellers**
  - Real time via range of media
  - Historic information – planning and baseline (use in alert services)
Transport Scotland ITS Vision & Strategy

• Transport Scotland agency

• ITS Objectives
  – Improve journey time reliability
  – Reduce disruption from incidents/road works/events
  – Minimise effects of congestion by providing alternative route advice
  – Provide accurate and credible travel information to allow travellers to make informed decisions
  – Improve safety and security for travellers
The A1 Demonstration Project

• Why?
  – Corridor East of Edinburgh
  – Peri-urban
  – Representative of much of Scottish network
  – Pre-existing infrastructure
The A1 Demonstration Project

• Objectives
  – Investigate potential for emerging technologies
  – Build database of journey times for each technology in comparable conditions
  – Benefits from fusion? Best use of available data? Improved accuracy?
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The A1 Demonstration Project

• Technologies
  – ATC (upgraded loop based traffic counters)
  – ANPR
  – FVD
  – Mobile/cell phone

• Inform future ITS deployment
Basic Principles

- Unified standard format – agreed with service providers

Display criteria

- Current speed $\geq 75\%$ Optimal $\Rightarrow$ No delays.

- Current speed $< 75\%$ Optimal but $\geq 50\%$ Optimal $\Rightarrow$ medium delays.

- Current speed $< 75\%$ Normal $\Rightarrow$ delays are normal.

- Current speed $< 50\%$ Optimal $\Rightarrow$ serious delays.

- Current speed $\geq 75\%$ Normal $\Rightarrow$ delays are normal.

- Current speed $< 75\%$ Optimal but $< 50\%$ Optimal $\Rightarrow$ medium delays.

- Current speed $< 75\%$ Normal $\Rightarrow$ delays are abnormal.

- Current speed $< 50\%$ Optimal $\Rightarrow$ serious delays.

- Current speed $< 75\%$ Normal $\Rightarrow$ delays are abnormal.
Data Fusion – Algorithm Development

- Work with project partners TRL
- 5 basic steps in the data fusion process – from raw data to unified value
Extrinsic Factors

- Characteristics of data source and collection process which affect quality of raw data
  - unreliable speeds
  - balanced samples for FVD
  - vehicle mix
  - ANPR covering one lane
Common Temporal Network

- 288 5 minute time bands per day – for each time band, collection of records
- Merge all into single value for each band
Data Patching

- On completion of common temporal network – possible gaps
- Logic based on combination of extrinsic factors and availability of real/reliable data adopted
Common Spatial Network

- Each source based on own spatial network
- Transformation allows journey times to be determined for common links
- Spatial mapping factor applied
Merge Data

- One journey time for each time band, common spatial link and data source
- Merge transformed data to give one common value for each common time band and link
- Takes account of extrinsic factors and overall quality
Assessment of Results

- Test algorithm
  - Different flow conditions
  - Different time periods
- Sensitivity of algorithm and speed of response to changes
Results

• Performance of technologies
  – **ANPR** – reliable and representative, but greatest impact from temporal and spatial transformation
  – **Mobile/cell phone data** – reliable and representative
  – **FVD** – extremely variable, large number of patched records
  – **ATC data** – where provided, reliable, but nature of ATC sites lets it down. Loop data from dense deployments still robust
Results

ANPR

Mobile/cell phone

Floating Vehicle

ATC

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Results

Fused data set
Results

• Performance of technologies
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  – Mobile/cell phone data – reliable and representative
  – FVD – extremely variable, large number of patched records
  – ATC data – where provided, reliable, but nature of ATC sites lets it down. Loop data from dense deployments still robust

• Algorithm successful in delivering fused data set of higher quality than from individual or average of sources
Results

• Concept proven - algorithm successful in delivering fused data set of higher quality than from individual or average of sources

but

• Limited data

• Negative impact of common spatial network and extrinsic factors

• Weaknesses in unified standard and data format
Stage 2 Trial – Validation – A90 Aberdeen

- Technologies
  - ANPR
  - Mobile phone – 2 sources
  - FVD
  - ATC

- Address weaknesses from Stage 1

- Potential extended coverage for East Scotland

- Study commercial/business case
Stage 2 Trial – Validation – A90 Aberdeen

- Technologies
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  - Mobile phone – 2 sources
  - FVD
  - ATC

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Extension of Journey Time System (1)

- Glasgow area and M77 corridor
- Urban and inter-urban
- Key sections of network
- Technologies
  - Loops
  - ANPR
- Extension to Traffic Scotland Web Service
### Journey Times

<table>
<thead>
<tr>
<th>Destination</th>
<th>Journey Time</th>
<th>Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8 J28 Glasgow Airport</td>
<td>14 minutes</td>
<td>high</td>
</tr>
<tr>
<td>M77 J8 Fenwick South</td>
<td>25 minutes</td>
<td>high</td>
</tr>
<tr>
<td>M80 J3 Hornshill</td>
<td>12 minutes</td>
<td>med</td>
</tr>
<tr>
<td>M8 J8 Baillieston</td>
<td>26 minutes</td>
<td>low</td>
</tr>
<tr>
<td>M74 J4 Maryville</td>
<td>42 minutes</td>
<td>low</td>
</tr>
</tbody>
</table>

Click on the map to view details of each stage of the journey.

Traffic Scotland Web Site
Traffic Scotland Emails – Future?

N7  Rathcoole to M50 Travel Time

Report Time: 22/05/2004 21:31

Legend:
- Free Flow
- Moderate
- Heavy

Your User Region:
- Route: All User Regions
- From: R120
- To: M50

Travel Times:

<table>
<thead>
<tr>
<th>TYPICAL</th>
<th>CURRENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>R120 - N82</td>
<td>5</td>
</tr>
<tr>
<td>N82 - Kingswood</td>
<td>3</td>
</tr>
<tr>
<td>Kingswood - R113</td>
<td>4</td>
</tr>
<tr>
<td>R113 - M50</td>
<td>1</td>
</tr>
<tr>
<td>Route Total</td>
<td>13</td>
</tr>
<tr>
<td>Average Speed (Mph)</td>
<td>51</td>
</tr>
</tbody>
</table>

This is an automated email sent from the N7 Traffic Monitoring and Control System. The information was correct at the time of publishing. To Unsubscribe to this email, change your profile and for the latest Traffic Information visit our website [https://www.n7.ie](https://www.n7.ie)
Extension of Journey Time System (2)

- ANPR from Trafficmaster PTFM system
- National coverage
- Uses
  - Network Management & Control
  - Historical travel times, with view to real time in future
Traffic Scotland Control Centre – Urban Network

Legend
- No Data
- Free Flow
- Busy
- Congested

Zoom

<table>
<thead>
<tr>
<th>Time</th>
<th>Link Description</th>
<th>Current JT</th>
<th>Normal JT</th>
</tr>
</thead>
<tbody>
<tr>
<td>17:55</td>
<td>M8 J21 Seaward St to M8 J22 Plantation</td>
<td>4 min</td>
<td>1 min</td>
</tr>
<tr>
<td>17:45</td>
<td>M8 J10 Westerhouse to M8 J9 Easterhouse</td>
<td>5 min</td>
<td>2 min</td>
</tr>
<tr>
<td>13:14</td>
<td>A92 Cowdenbeath to A92 Kirkcaldy</td>
<td>8 min</td>
<td>2 min</td>
</tr>
</tbody>
</table>

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Traffic Scotland Control Centre – Alert Mechanism
Traffic Scotland Control Centre – Inter-Urban Network

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Traffic Scotland Control Centre – Rural Network
Traffic Scotland Control Centre – Rural Network

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Timetable

• Stage 2 Trial & Research – Aberdeen
  - commence July 2007
  - initial results - including commercial and business case analysis – Q4 2007
  - final results – early 2008

• Glasgow & M77 – first phase live July 2007

• Trafficmaster to TS Control Centre – live June 2007
Summary

• In short space of time

  - Tool for national network monitoring
  - Provision of new and improved travel information services
  - Harnessing new technologies
  - Through data fusion - maximising use of all available infrastructure
Summary

Scalable and future proofed

- Geographic expansion
- Additional infrastructure – including other technologies (RUC, PAYD) – meet all STREETWISE monitoring requirements
Summary

• Delivers policy objectives
  - Improve journey time reliability
  - Provide alternative/diversion route advice
  - Provide accurate travel information

• Build on existing successful information services
  - Traffic Scotland
  - Freight Scotland
European Dimension

• **Dissemination of results**
  - Monitoring Expert Group
  - Evaluation Expert Group

• **Future benefits to others**
  - Technical feasibility
  - Commercial arrangements and business case for public - private

• **EasyWay**
  - Potential model for meeting Monitoring and Information targets
Acknowledgements

- Transport Scotland
- TRL
- Datagen
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