NATIONAL LAND TRANSPORT NOISE MAP

Road Traffic Noise

Transport Environment Knowledge Hub (TEKH)

Transport Acoustics Forum

9 May 2019
This session...

- Previous noise mapping projects
- National road traffic noise map
- Technical matters
- Outputs
- Lessons learned
2009
Auckland Motorway Alliance
BECA / MDA
- Auckland Motorway Network
- > 65 dB LAeq(24 hour)

2012
AMA
- Auckland Motorway Network
- NZTA led
- Lots of noise barriers
- Full SoundPLAN model out to 100 m from road
- 55 - 70 dB LAeq(24 hour)
- Used for various internal purposes (complaint investigation)
2014
NZTA

- Land-use control
- Buffer and effects areas calculated for state highway network
- GIS calculations by Transport Agency
- Web map
- Submissions on district plans
2017
AECOM

- Retrospective noise mitigation planning (PBC)
- All receivers within 100m of state highway network (c 90,000)
- Treatment options for >64 dB
- Mixture of building footprints and approximations from parcel centroids
Quiz...

Which of the following conditions is NOT a critical health outcome for populations exposed to road traffic noise?

- A  Cardiovascular disease
- B  Effects on sleep
- C  Irritable bowel syndrome
- D  Cognitive impairment
- E  Annoyance
Project Brief 2019

Map the noise emissions from all NZ state highways, regional and arterial roads, prepare noise contours and perform statistical analysis to determine the population noise exposure distribution.
15,000+ km²

14,000+ km

1,600,000+

3,000+

88+ km
Model Data

- Terrain data collection and division into model sections
- Building outline and receiver point collection, collaboration and filtering
- Road string attribute assignment and combining datasets
More about data...

- **Terrain**

<table>
<thead>
<tr>
<th>Area</th>
<th>Contour</th>
<th>Elevation</th>
<th>Availability</th>
<th>Authority</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nelson City</td>
<td>Contour</td>
<td>1m</td>
<td>Full</td>
<td>Tasman District Council</td>
<td>Dropbox</td>
</tr>
<tr>
<td>Marlborough District</td>
<td>Contour</td>
<td>1m</td>
<td>Most</td>
<td>Marlborough District Council</td>
<td>Download</td>
</tr>
<tr>
<td>Buller District</td>
<td>Contour</td>
<td>20m</td>
<td>Full</td>
<td>LINZ</td>
<td>Download</td>
</tr>
</tbody>
</table>

- **Building outline data incomplete for Dunedin, Gisborne, Kawerau, Opotiki, New Plymouth, South Taranaki, Stratford, Western Bay of Plenty.**

- **Some roads using assumed attribute values:**

<table>
<thead>
<tr>
<th>ONRC</th>
<th>Area</th>
<th>AADT</th>
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</thead>
<tbody>
<tr>
<td>Regional</td>
<td>Urban</td>
<td>15000</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>10000</td>
</tr>
<tr>
<td>Arterial</td>
<td>Urban</td>
<td>5000</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>3000</td>
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</table>

<table>
<thead>
<tr>
<th>Surface</th>
<th>$R_c$</th>
<th>$R_t$</th>
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</thead>
<tbody>
<tr>
<td>Chip seal</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Asphalt</td>
<td>0</td>
<td>-2</td>
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</table>
Then the wish list...

- New data release – LINZ, StatsNZ
- Improve the method for Residential vs Commercial identification
- Noise barrier dataset update
Modelling and Data Management

- Modelled the country by districts
- Divided districts up into manageable pieces (161 models for the 66 districts)
- Established a template type model process in SoundPLAN v8.0
- Tiled the calculations in 2km square sections
- Conducted hardware and setting trials to minimise the calculation times and provide reliable stability
Noise Maps

- Noise contours
- PPF Category assignment
- Population exposure counts
- Noise complaint tracing
Complaints: 3

compid  8
address  17 Kakapo Place, Papatoetoe, Auckland
datetime 17/03/2018 2:03 a.m.
type  Noise complaint
complaint Loud trucks crashing and banging along motorway
NZ Population Noise Exposures

- StatsNZ 2013 census data
- Even distribution of population numbers per mesh block
- Counted the number of people exposed to each noise level
- Raw data to Excel for analysis (∞ graphs!!)
<table>
<thead>
<tr>
<th>Region</th>
<th>Category A</th>
<th>Category B</th>
<th>Category C</th>
<th>Lden</th>
<th>Lnight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$L_{Aeq}(24 \text{ hour}) &lt; 64 \text{ dB}$</td>
<td>$64 \text{ dB} \leq L_{Aeq}(24 \text{ hour}) &lt; 67 \text{ dB}$</td>
<td>$67 \text{ dB} \leq L_{Aeq}(24 \text{ hour}) &lt; 45 \text{ dB}$</td>
<td>$L_{Aeq}(24 \text{ hour}) \geq 45 \text{ dB}$</td>
<td>$L_{Aeq}(24 \text{ hour}) &gt; 44 \text{ dB}$</td>
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<tr>
<td></td>
<td>Regional &amp; Arterial</td>
<td>State Highway</td>
<td>Total</td>
<td>Regional &amp; Arterial</td>
<td>State Highway</td>
</tr>
<tr>
<td>Auckland</td>
<td>1,127,637</td>
<td>86,365</td>
<td>1,213,602</td>
<td>4,089</td>
<td>3,213</td>
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<tr>
<td>Bay of Plenty</td>
<td>75,786</td>
<td>59,398</td>
<td>135,184</td>
<td>248</td>
<td>862</td>
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<tr>
<td>Gisborne</td>
<td>6,286</td>
<td>10,511</td>
<td>16,797</td>
<td>19</td>
<td>19</td>
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<tr>
<td>Hawke’s Bay</td>
<td>70,208</td>
<td>27,268</td>
<td>97,476</td>
<td>247</td>
<td>675</td>
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<tr>
<td>Manawatu-Wanganui</td>
<td>90,692</td>
<td>61,559</td>
<td>152,251</td>
<td>90</td>
<td>886</td>
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<tr>
<td>Northland</td>
<td>40,518</td>
<td>45,143</td>
<td>85,661</td>
<td>114</td>
<td>586</td>
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<tr>
<td>Taranaki</td>
<td>8,702</td>
<td>29,405</td>
<td>38,107</td>
<td>2</td>
<td>480</td>
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<tr>
<td>Waikato</td>
<td>134,494</td>
<td>108,048</td>
<td>242,542</td>
<td>581</td>
<td>1,710</td>
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<tr>
<td>Wellington</td>
<td>277,914</td>
<td>71,769</td>
<td>349,683</td>
<td>5,424</td>
<td>1,644</td>
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<tr>
<td>Canterbury</td>
<td>317,040</td>
<td>96,468</td>
<td>413,508</td>
<td>980</td>
<td>2,302</td>
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<tr>
<td>Marlborough</td>
<td>11,846</td>
<td>11,150</td>
<td>22,996</td>
<td>0</td>
<td>168</td>
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<tr>
<td>Nelson</td>
<td>22,290</td>
<td>14,996</td>
<td>37,286</td>
<td>71</td>
<td>344</td>
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<tr>
<td>Otago</td>
<td>28,641</td>
<td>55,888</td>
<td>84,529</td>
<td>30</td>
<td>852</td>
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<tr>
<td>Southland</td>
<td>17,905</td>
<td>32,382</td>
<td>50,287</td>
<td>3</td>
<td>602</td>
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<tr>
<td>Tasman</td>
<td>5,119</td>
<td>15,407</td>
<td>20,526</td>
<td>26</td>
<td>663</td>
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<tr>
<td>West Coast</td>
<td>745</td>
<td>19,220</td>
<td>19,965</td>
<td>0</td>
<td>82</td>
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</tbody>
</table>
Lesson Learned

- Trials...
- Model overlaps
- Computation hardware
- Reduce the number of model sections
- Noise barrier dataset
- Terrain resolution
- National road dataset – NZTA Open Data
Open Data

- Monthly snapshots available
- Includes state highways and roads from territorial authorities
- Not sufficient for noise modelling – but could be with some investment by the Transport Agency
- Potential for significant return on investment
Consider Alternative Methods

- SoundPLAN alternatives
- Exposure count methods (Literature review)
Data Hosting

- Maps and input data currently stored in Shapefile and Geodatabase format on the AECOM server
- Exploring the most attractive ways to host the data
- NZTA may access the data via login to the AECOM ESRI licenced portal
Innovation

- Data mashing and analytics
- Collaboration with territorial authorities for planning – consent applications
Thank you...