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Maintaining the effectiveness of audio tactile profiled roadmarkings

The New Zealand Roadmarkers Federation Inc

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Presented by
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Maintaining the effectiveness of audio tactile profiled roadmarkings

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  - Vince Dravitzki
  - Tiffany Lester
  - Dr Joel Burton
  - Richard Jackett
  - Dr Jared Thomas

- Presented by
  - Dr Kym Neaylon

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Intro: Audio tactile profiled road markings

- NZ has adopted the raised rib ATP road marking
- Safety benefits
- Visual effects
- Audio effects
- Tactile effects
- What happens at reseal time?
  - Early practice was to remove ATPs
  - This removed any remaining value.
  - ‘In-lane reseal’ or ‘seal-over’?
- What should happen?

Safety benefits

- ATPs significant breakthrough in driver safety
- Proactive implementation by NZTA
- 3,300 linear km by end 2012
- Review by Steve James (2014) NZTA
- 34% reduction in fatal crashes
- 24% reduction in serious crashes
- BCR ≈ 25

James, S (2014). The safety effectiveness of the audio tactile profiled markings programme. International Safer Roads Conference, 4th. Cheltenham, UK.

The problem

- ATPs last 6 to 8+ years
- Roads may require a reseal whilst ATPs have remaining life
- 2 techniques commonly practiced:
  - ‘In-lane reseal’
  - ‘seal over’
- Which method should be preferred?
- Why?

‘In-lane’ reseal or ‘seal over’?

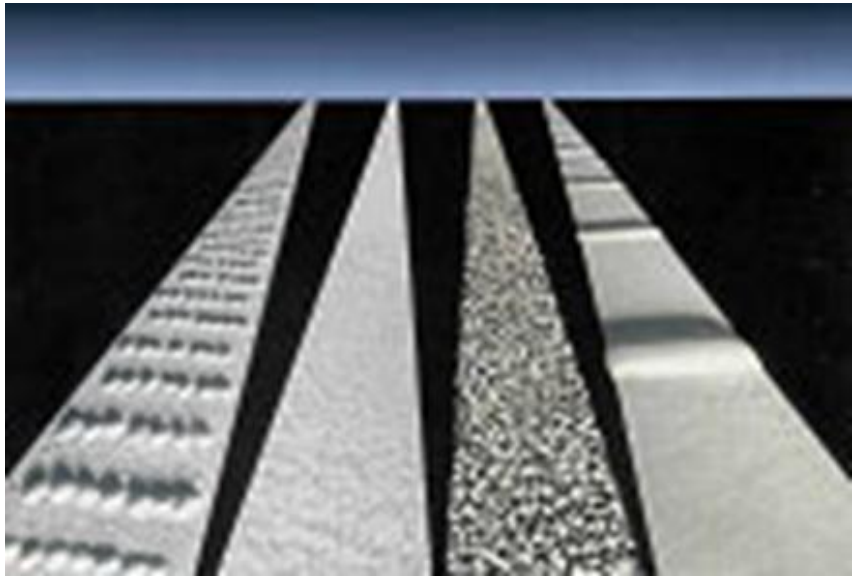
Existing knowledge

- Australia has ATPs on chip seals, UK & USA do not
  - ‘sealing over’ gives reasonable results with smaller chip sizes
- NZ practices, experiences & observations workshop
  - Advantages and disadvantages for both
    - In-lane reseals
    - Sealing over ATPs
- NZ practices very subjective

Example of in-lane reseal in heavy rain

Visual effects of ATP

- Visibility of road marking is expected
  - Day
  - Night
  - Wet
  - Dry
- Conspicuity (day)
- Retroreflectivity (night)
- ATPs considered to have better reflectivity
  - Raised faces shed water

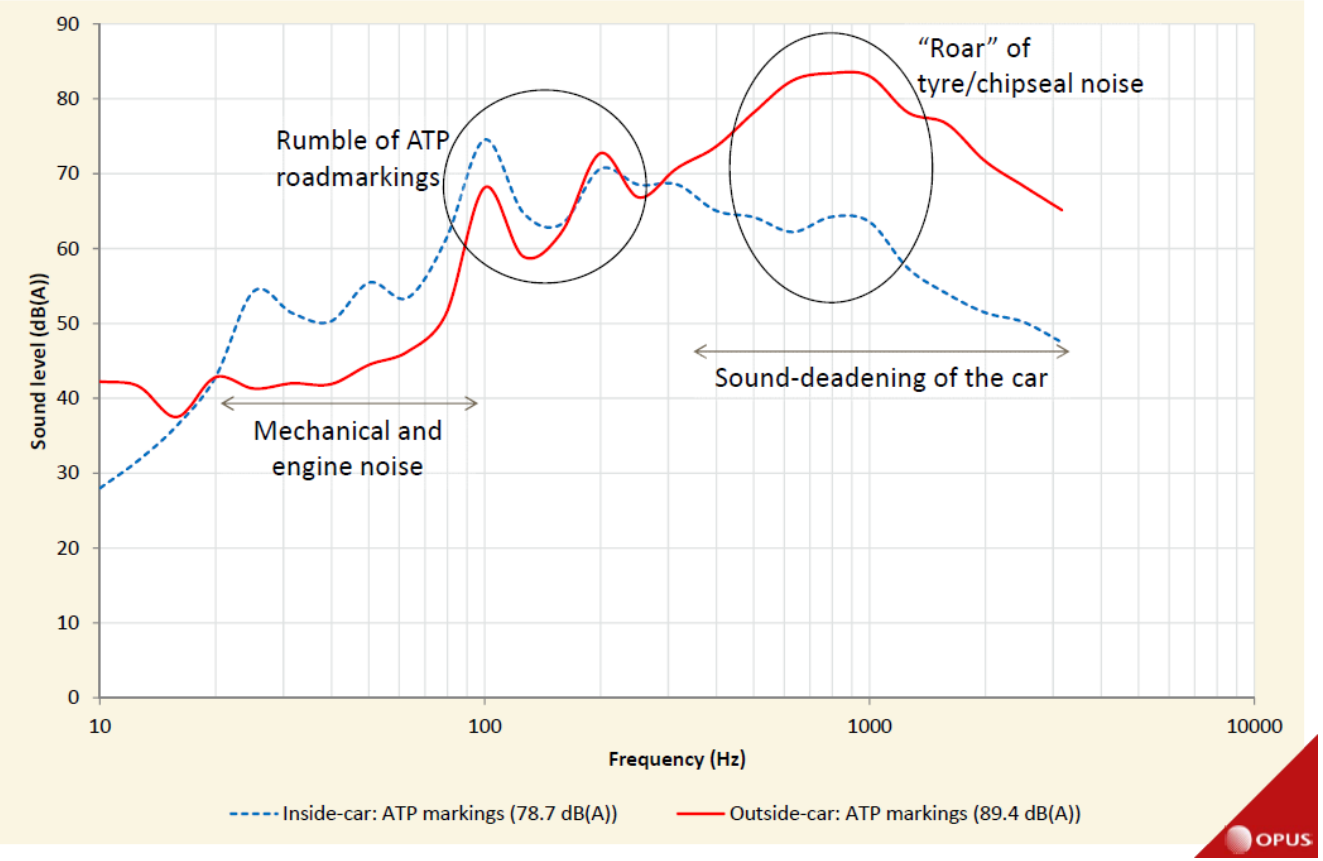


Audio/tactile effects

- Audio/tactile effects depend on spacing and prominence of the raised ribs
- Depends on the vehicle speed and vehicle type
- Tactile effects are felt through the steering wheel, seat, pedals, foot-well
- Audio effects are heard at the drivers ear level
- Vehicles are designed for occupant comfort
- Sounds and vibrations entering the cabin are dampened
- Dampening focuses on particular frequencies

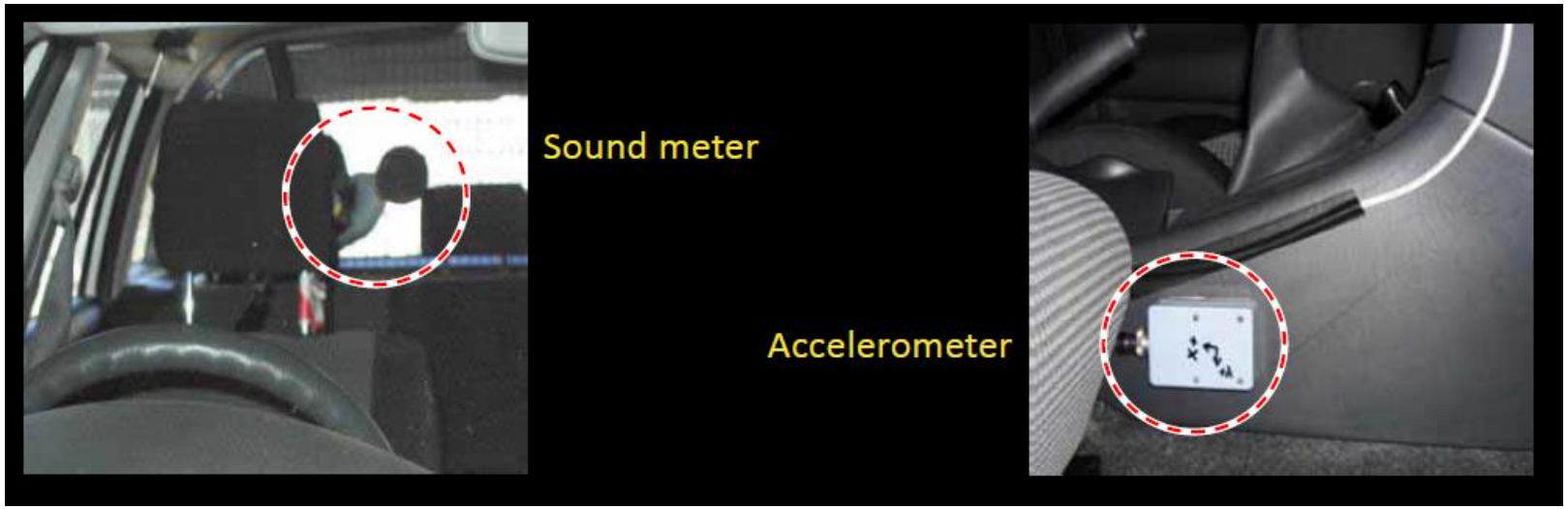
Audio effects

- Graph shows noise measured inside and outside a car cabin
- ATP road marking noise is distinctive inside



Dravitzki, V 2013, 'Are the audio tactile profiled road markings still effective?'

Audio/tactile effects measured



Dravitzki & Thomas 2011, Measuring the effect of audio tactile profiled road markings

- In-lane reseal:
  - Audio/tactile effects unchanged
- Seal over:
  - Variable success
  - Initial condition of the raised ribs
  - Chip size of reseal

Audio/tactile effects simulated

- Real road markings
  - Variations in block profile
  - Variations in cars
- Simulation
  - Block profile constant
  - Car a constant
  - Different block heights can be compared

Audio/tactile simulation

Headphones
Generating ATP marking noise (plus music)

Television stimuli
Showing Stroop test

Steering wheel
With buttons for participant to respond to Stroop test

Computer with operator
Controlling test

Sub woofer
Generating vibrations under participant's seat

Foot pedal
For participant to press when detecting ATP marking

Findings #1

- Visual effects of ATP road markings are largely independent of their audio/tactile effects - must be considered separately.
  - Visual performance can deteriorate first
  - Audio/tactile performance can deteriorate later

Findings #2

- If a reseal is intended where ATP road markings have still effective audio/tactile effects, it is recommended **in-lane** reseal be considered.
  - Particularly effective on edgelines where the ribs are placed adjacent to the continuous line
  - Lines and ribs can be remarked later to renew visual effects

Findings #3

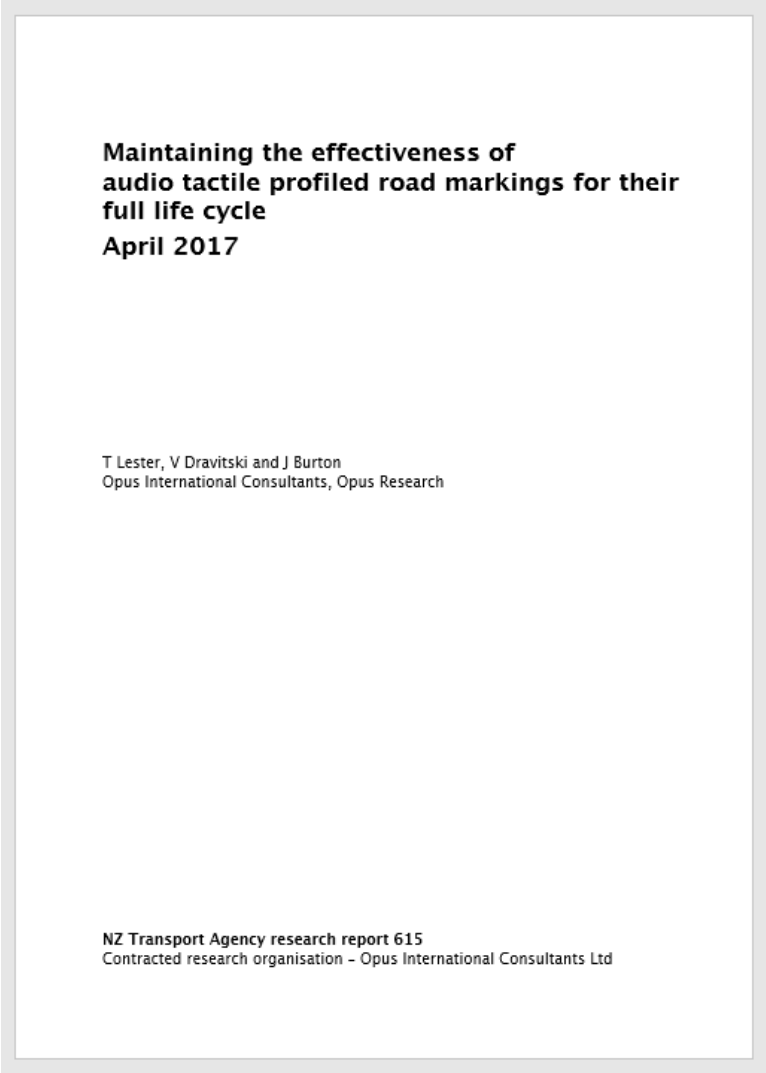
- ATP road markings should be included in the RAMM database, and monitored like signs or road surfaces.
- There are subjective and objective measures
- Regularly monitor visual effects (e.g. dynamic retroreflectometer)
  - Once per year
  - Ideally monitor visuals day & night, wet & dry
- Regularly monitor audio tactile effects
  - Once every two years
  - If objectively – use sound and vibration measurements
  - If subjectively – use two people

Findings #4

- Define ‘effective’.
- ‘The effects are easily discerned and recognisable’?
  - otherwise considered not effective.
- Need consistency & uniformity
- Provide a training video
- Subjective interpretations can be variable
- Research has found no ‘noticeable’ audio/tactile difference in rib spacing's 250 mm to 500 mm

Further information

- **NZ Transport Agency Research Report 615** ‘Maintaining the effectiveness of Audio tactile profiled road markings for their full life cycle’
- Dravitzki, V, Thomas, J and Mora, K (2012), Improved effectiveness and innovation for audio tactile profiled roadmarkings**, Research Report 478,** NZ Transport Agency,
- Dravitzki, VK and Thomas, J (2011). Audio tactile profiled roadmarkings: Understanding how they work and when they are effective. NZRF/RIAA Roadmarking Conference. NZ Roadmarkers Federation. Rotorura.



Maintaining the effectiveness of audio tactile profiled road markings for their full life cycle

April 2017

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Opus International Consultants, Opus Research

NZ Transport Agency research report 615
Contracted research organisation – Opus International Consultants Ltd