REAAA Driving Progress

ROAD ENGINEERING ASSOCIATION OF ASIA & AUSTRALASIA (NZ)

The Need for Lower Quality Basecourse on much of the Public Road Network

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For CCNZ /UofA Aggregates Group

LOW VOLUME ROADS WORKSHOP 2017

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Demand and Supply

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- **About 65,000 km of sealed road**
- **26,000 km of this carries less than 1,000 vpd**
  - Many are remote
- **Much of nearby basecourse aggregate is marginal**
- **Aggregate deteriorates through**
  - Traffic-induced wear
  - Chemical changes
- **Roads deteriorate also through lack of traffic**
- **Greater focus on marginal aggregate is required to give effect to RMA**
- **Pricing does not favour use of abundant marginal material**

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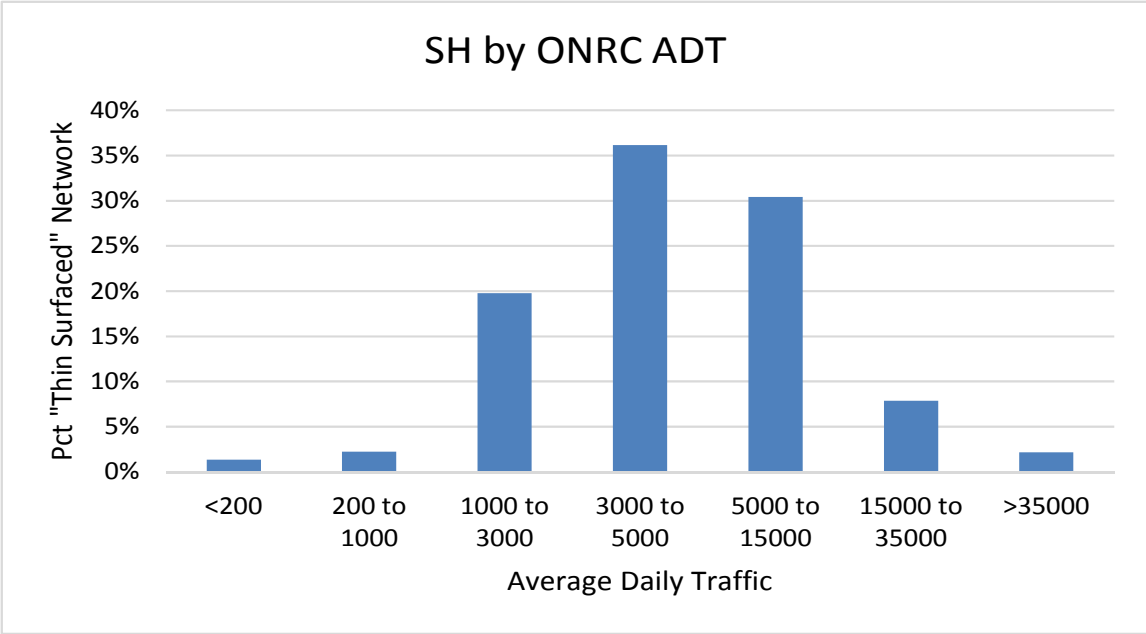
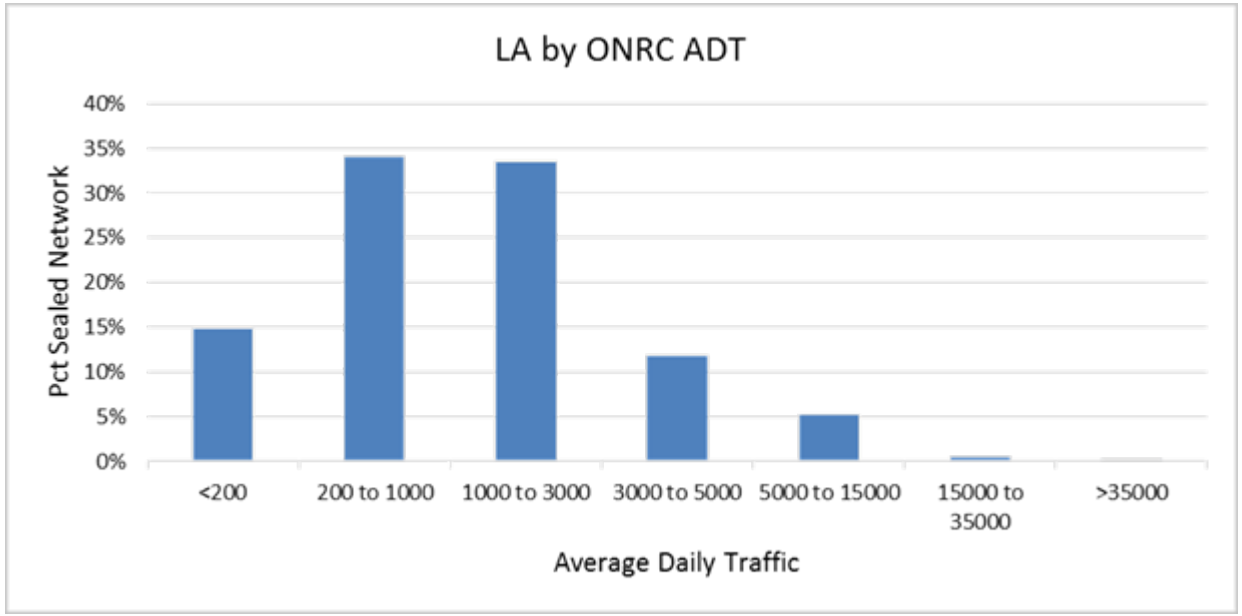
Sealed Road Network and Demand



Sealed Road Network and Demand



Daily Traffic and Design Loading

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- **For a 25 year life, 5% HCV and 2% compound growth**
  - 1,000 vpd ~ 420,000 ESA
  - 3,000 vpd ~ 1,300,000 ESA
- **These very modest demands apply to a significant road length;**
- **1,000 vpd/420,000 ESA covers**
  - 400 km of SH
  - 25,500 km of local roads
- **3,000 vpd/1,300,000 ESA covers**
  - 2,600 km of SH
  - 43,000 km of local roads

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Why Look for Marginality?

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- There are a high proportion of low volume roads on the network
- Utilising marginal materials preserves the high quality component of a non-renewable resource
- Under the Resource Management Act (Pt 2, s5)

5 Purpose

(1) The purpose of this Act is to promote the sustainable management of natural and physical resources.

(2) In this Act, **sustainable management** means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

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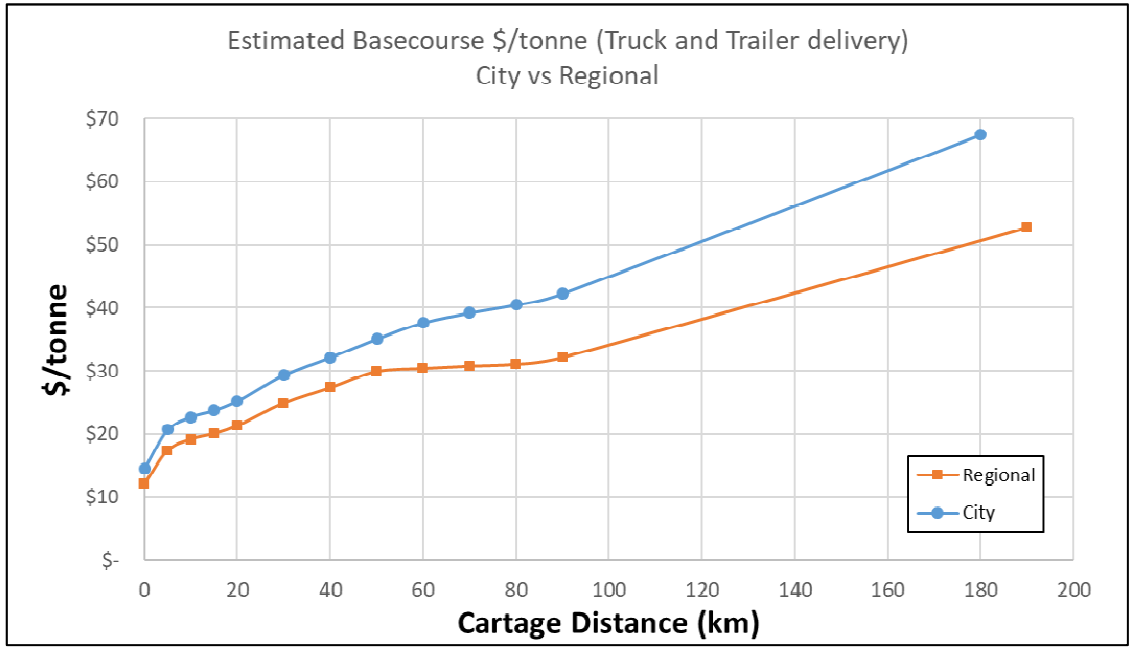
Basecourse: Cost at site



Measures of Basecourse Quality

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- **Basecourse is subjected to**
  - Traffic-induced mechanical demand
  - Deterioration resulting from “weathering” and properties of fines
- **These two take place at different rates, depending on**
  - (Heavy) traffic demand
  - Source and nature of aggregate
- **But they are both measures of service life**
- **We tend to focus on the mechanical resistance, and avoid geochemical issues**
- **Our basecourse selection process is therefore unbalanced from a design perspective**

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Measures of Basecourse Quality

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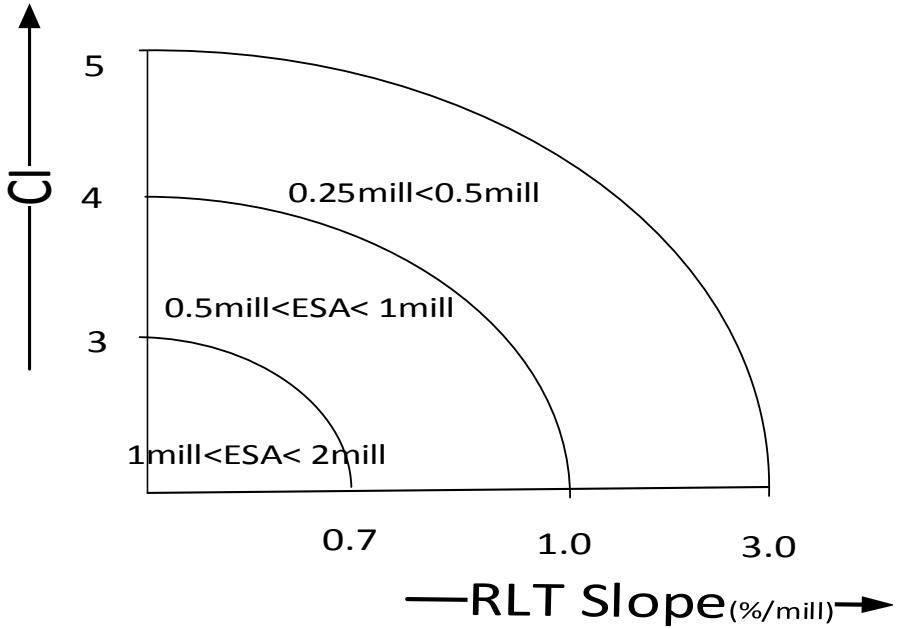
- **Two possible, potential ways of ranking the two basecourse life-determinants for evaluation of sources:**
- **The Repeated Load Triaxial Test (NZTA T/15)**
  - Focus on test at Optimum Moisture Content– sample from two lots from source
  - Provides an assessment of endurable ESA
- **The Clay Index (NZS 4407 : 2015, Test 3.5)**
  - Deduces proportion of expansive clay material

Combining Quality Measures: *An Idea*



Physical Deterioration from *Lack of Traffic*

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- **In its just-placed state, an unbound granular base must satisfy NZTA B/2**
  - Minimum limits on compacted dry density
- **Regular traffic helps to maintain compaction-induced internal compressive stresses**
  - This assists internal shear through friction
  - The rate of rut development is reduced
- **In the absence of regular traffic and with rainfall and time, the base layer relaxes/de-stresses– loses density**
  - Internal friction resistance decreases (Ingress of water/release of clays/fines)
  - Shear strength decreases
- **Thus, *rutting potential develops from too-infrequent vehicle passage***

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Physical Deterioration from *Lack of Traffic*

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- **The effect is mitigated through providing internal tensile strength in basecourse**
  - Chemical prestress to prevent relaxation
  - In the absence of regular traffic-induced pre-stress
- **Some materials have inherent cementing properties**
  - E.g. Whanganui Shellrock
- **Others can be endowed with tensile strength through modification/stabilising**
  - A balanced approach needed

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Conclusion

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- **Low-volume roads are a large proportion of the total ~64,000 sealed network in NZ**
- **RMA points to need to give marginal aggregates strong consideration**
- **Cost-minimisation does not result in scarce high-quality aggregate being conserved:**
  - Market-driven pricing is short-term focussed
- **Chemical deterioration as well as traffic deterioration should be considered**
  - An interaction diagram of RLT and CI has potential
- **Low volume roads may suffer from too few vehicles**
  - Tensile strength in the base is needed to inhibit relaxation
- **Optimal solution may be modified marginal aggregate as basecourse**

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