

# Road Aggregates: *Properties and Efficient Use*

NZ Wide Aggregates Inventory Working Group

Presented by  
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**Road Controlling**  
AUTHORITIES FORUM (NZ) INC

# Fit of Study with RCA Forum Mandate

- RCA Forum Statement of Purpose

“We provide a knowledge community for all owners of road assets within New Zealand to support the development of nationally consistent best practice, and **standards and guidelines** for roading investment and management, through **research, education and the exchange of information for the benefit of all road owners and road users.**”

- Imperative undergirding Univ of Auck/Industry study:

The **aggregate industry’s efficient contribution** is essential to New Zealand’s **national wellbeing, economy and future development**

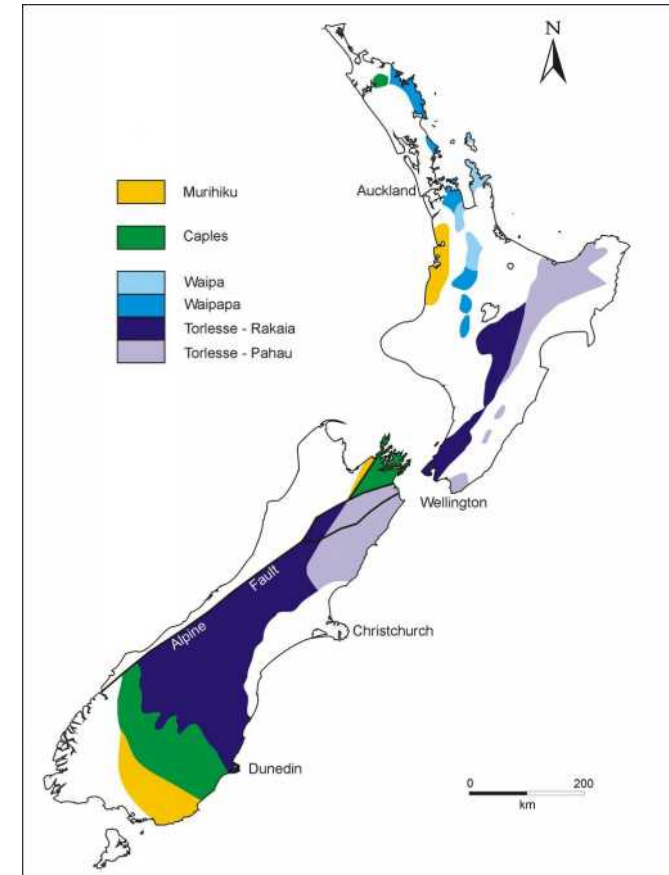
# Context

- Aggregates are a non-renewable (mineral) resource.
- Resource Management Act: *sustainable management* of the natural and built environment
- High quality aggregate resources are very limited
  - many have already been exhausted.
- Increasing transportation costs (fuel and congestion) limit aggregate range of transportation



# Needs

- Local optimisation of use
  - Transportation cost balanced with effective life of pavement aggregate
- Opportunity to
  - Grow sources near to consumption/market, via iwi engagement
  - Use more marginal aggregates
    - For example in low traffic volume roads,
    - Use more in subbase (lower strata) in high traffic volume roads
  - Amend material specifications
    - For example, to focus on performance (i.e. correlating history with laboratory properties)
    - Introduce new tests that better predict aggregate's performance and
    - Are specific to the source rock type (Volcanics v Greywackes)
- We need to understand local materials' properties and variability and reasons for any non-compliance with NZTA specifications





# Aggregates are Important

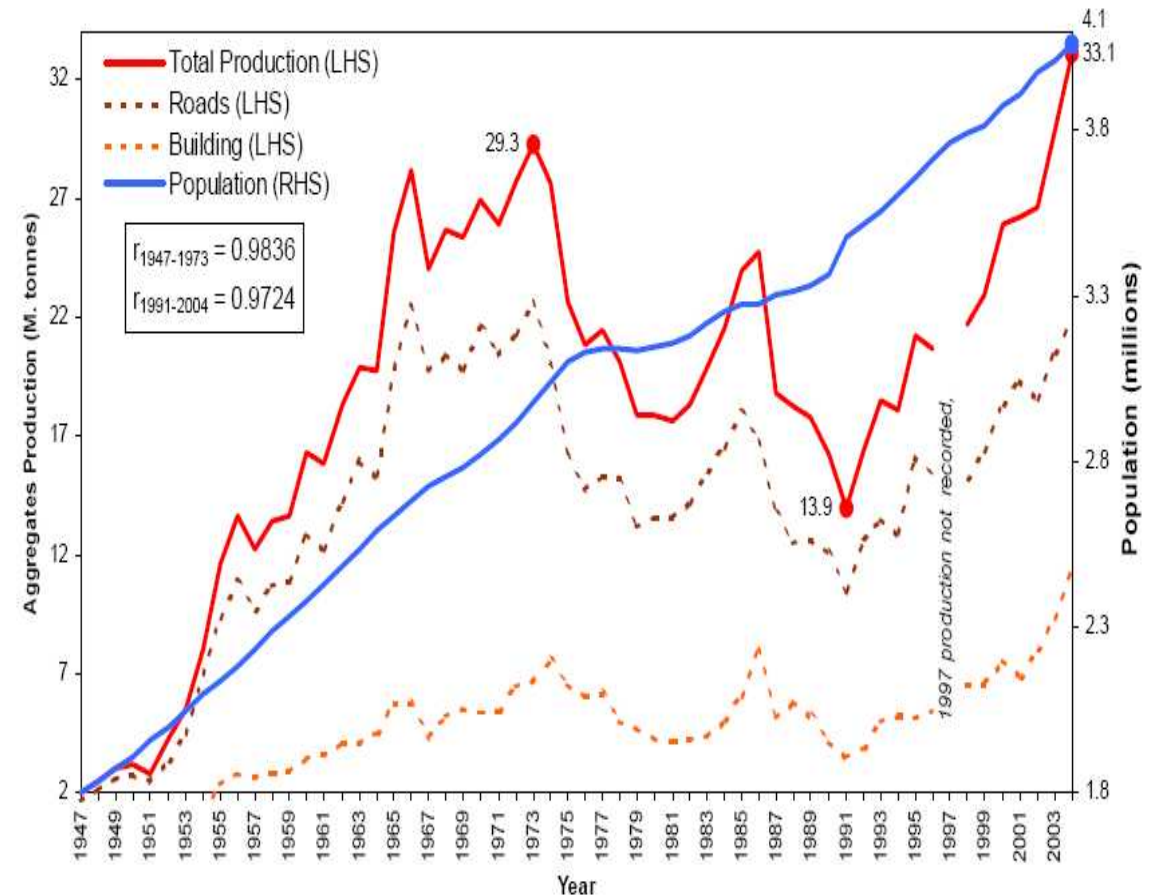
- \$425 million of aggregate produced nationally per annum
- Each New Zealander consumes around 7.6 tonnes of aggregate per annum
- The economic benefit of the aggregate industry to New Zealand (direct, indirect and induced) is \$2.1 billion per annum
- Approximately 10,000 jobs
- ~250 tonnes per averaged sized house



Source: Winstones Aggregates

# Aggregates are Important

- Primary Uses of Aggregates
- NZ public road network
  - 100,000 km total length
  - 20 million tonnes consumed annually, mostly for renewals / maintenance
- Concrete industry
  - Buildings and civil structures
  - 10 million tonnes consumed annually



# MBIE-Funded Study

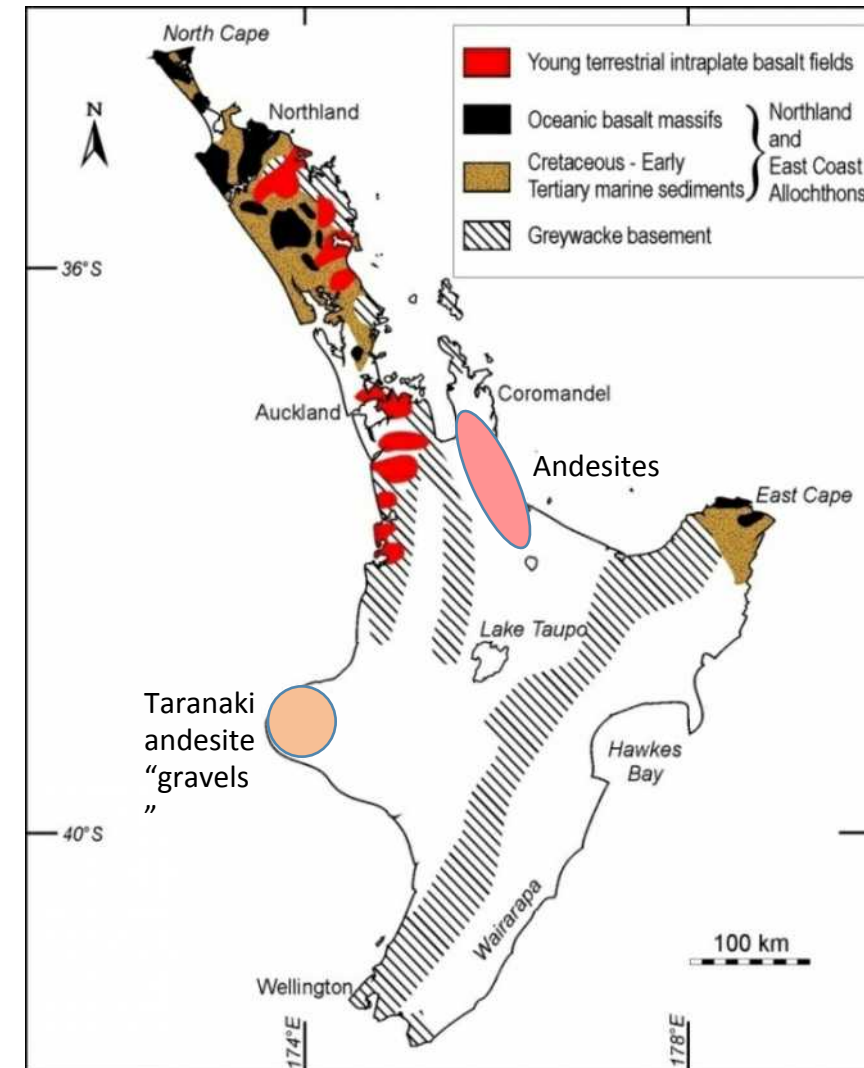
Three streams being progressed:

- Extraction process with Iwi engagement
- Marginal aggregates and improving durability
- Skid resistance and surface characteristics

Industry is represented on the Working Group

# Diversity of Aggregates: North Island

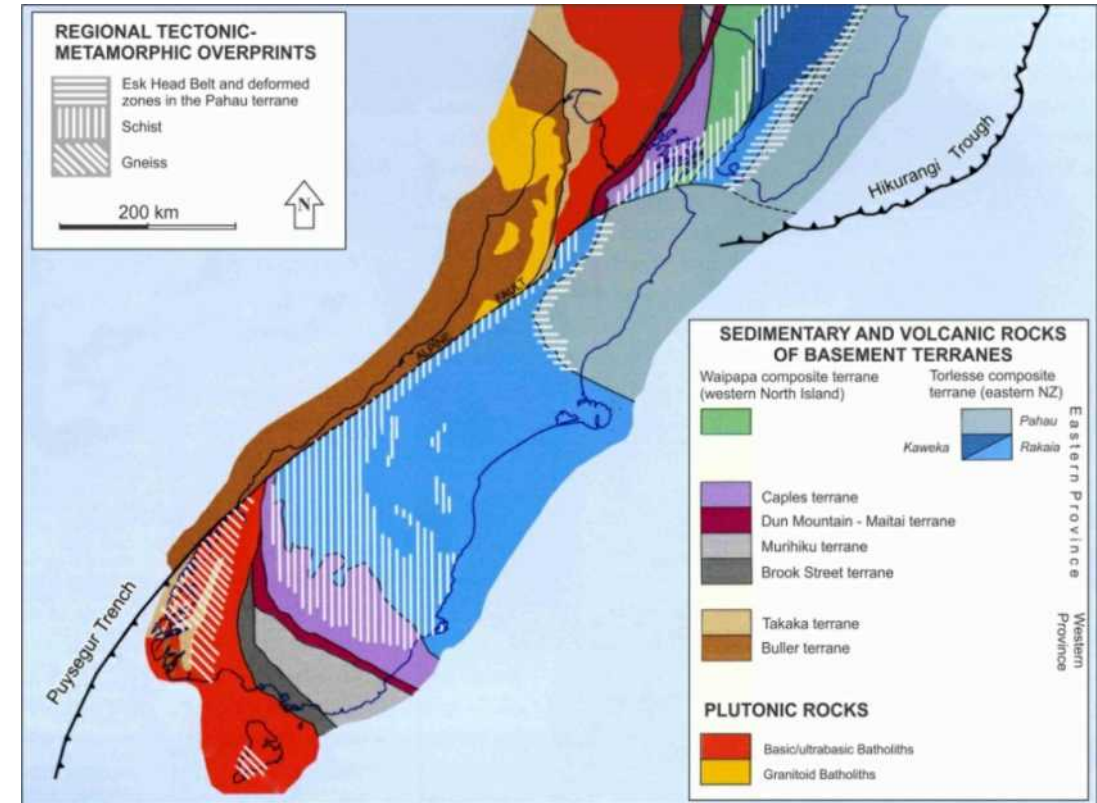
- Greywacke is the source rock for close to 75% of aggregates produced in New Zealand.
- Volcanic rocks are the major resource for the production of aggregates in
  - much of Northland,
  - the Bay of Plenty, and
  - the Taranaki region
- Approximately 25% of all aggregates produced are sourced from volcanic rocks; different volcanic rock types contain different minerals, have different physical properties and propensities for alteration.
- Greywackes can also be divided into different types with different physical properties.
- Large areas of central and southern North Island rely on the extraction and processing of river gravels for their aggregate supply.





# Diversity of Aggregates: South Island

- Much more variable materials than North Island
- Most roading aggregate sources are alluvial (pits/ rivers)
- Mixed via river transport across faults and other geological boundaries: many different rock types
- Properties of aggregate derived from gravels determined by the **nature of the mix**
- Current specifications do not recognize the variability of engineering properties within a mix.



# A Mixture

Stockpiled aggregate  
west Southland

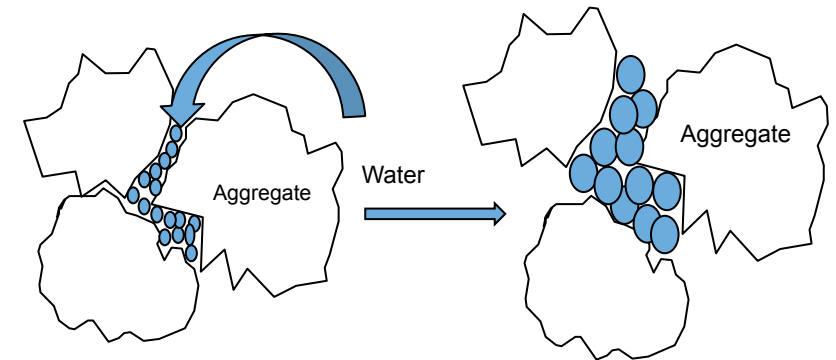




# Marginal Aggregates

- These do not satisfy all of specified requirements
  - E.g. NZTA M/4 crushing resistance, clay index or plasticity index
- They are much more abundant than NZTA compliant aggregates
- Therefore we need to learn how best to use them
  - E.g. NZTA M/3 Notes recognise that lower quality aggregate can be deeper in the pavement
- Opportunity to measure performance of common aggregates in your area
  - On road: historic performance (sealed/unsealed)
  - In laboratory through keeping good records of source of aggregates used in pavements and monitoring of their in-service performance
- And to seek alternative sources
  - Notably via engagement with iwi and including them in production

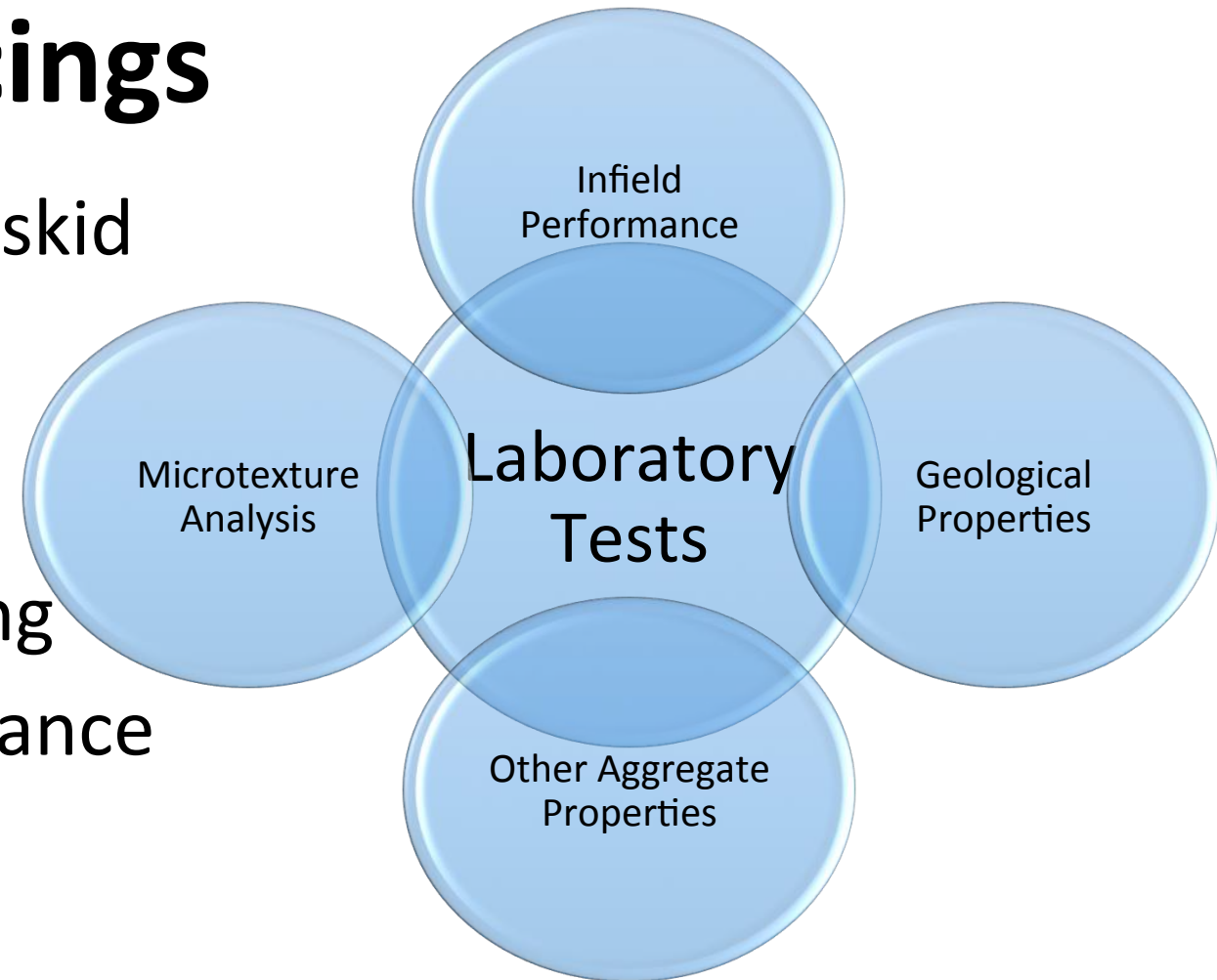
## Swelling Clay Minerals



Li W, 2016

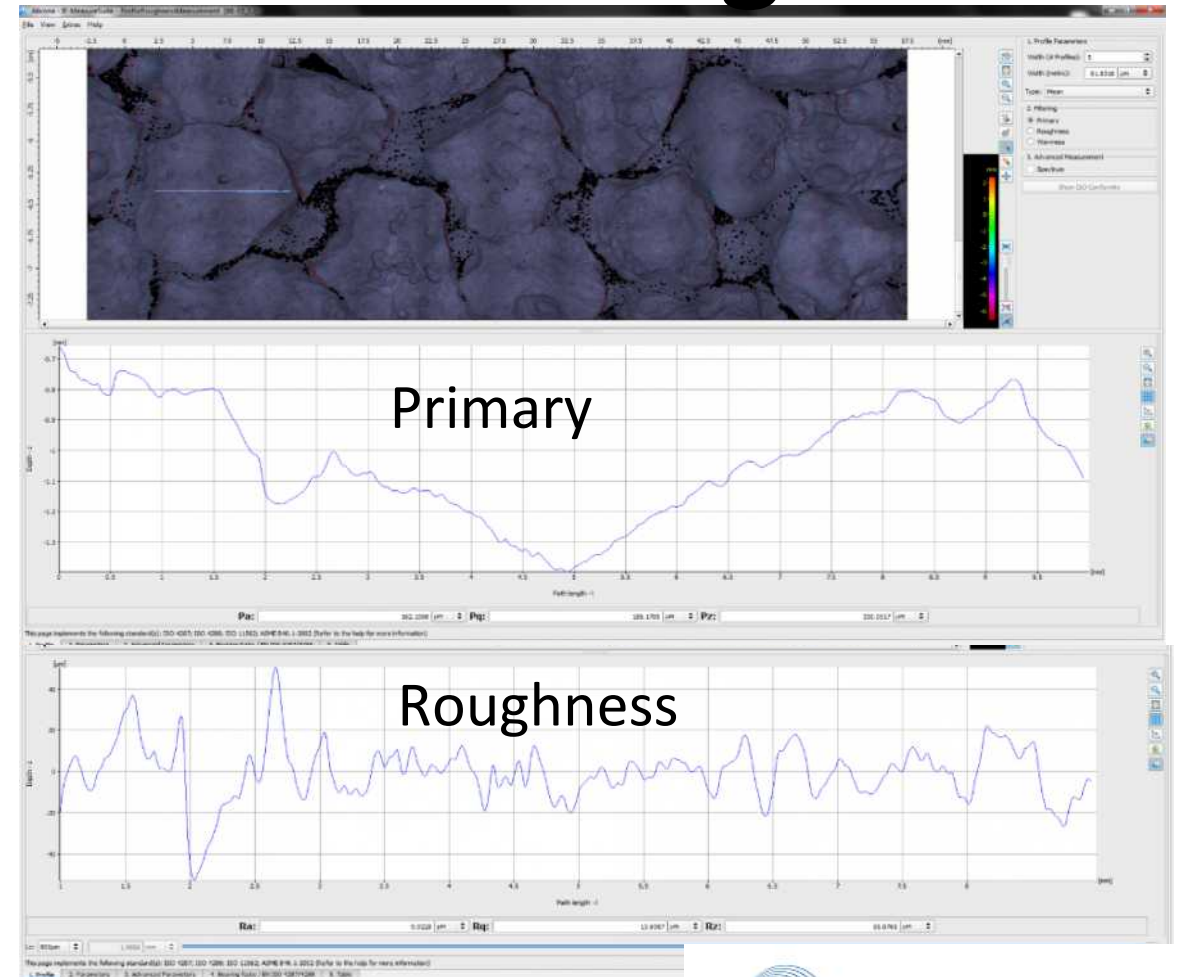
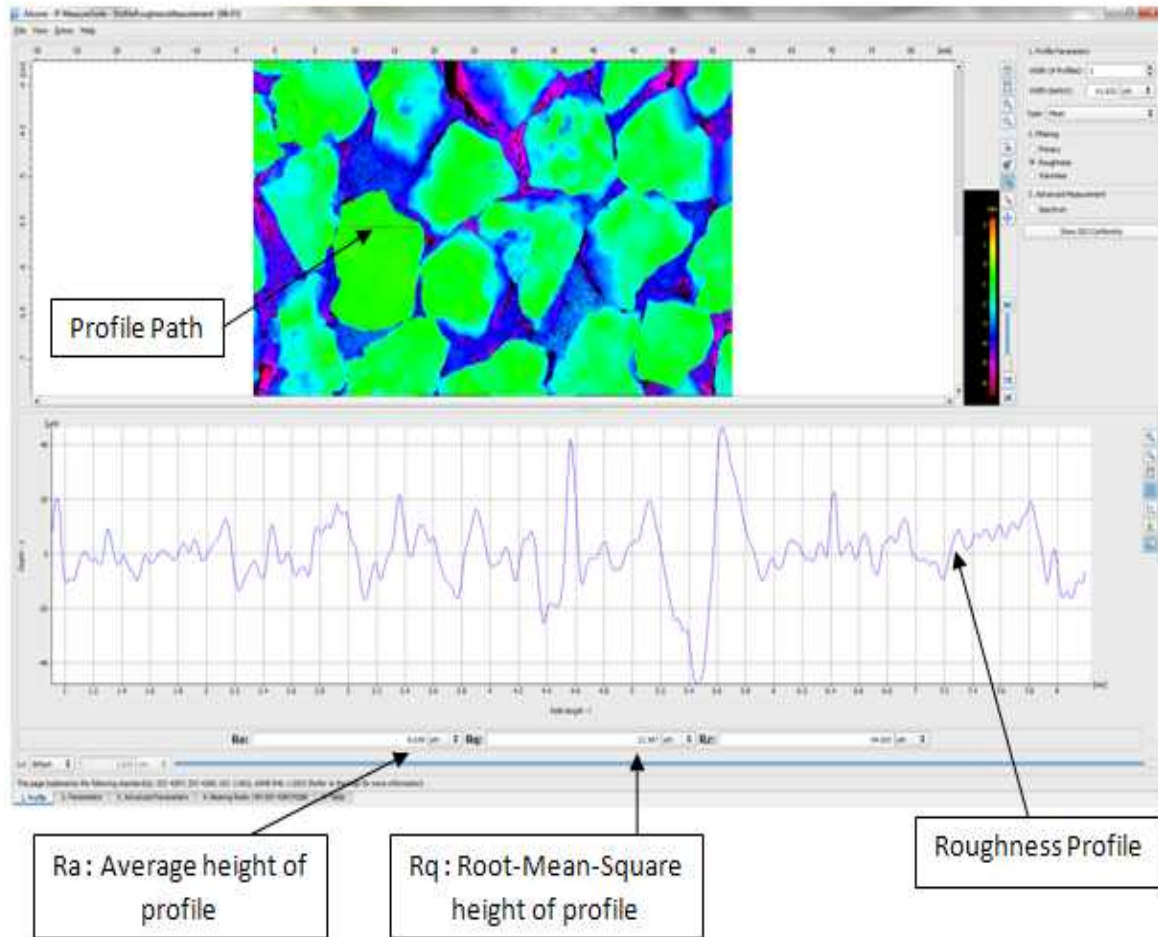
# Aggregates for Surfacing

- Balancing Safety outcomes with skid resistance performance
- Understanding microtexture for different minerals & how they perform under vehicular polishing
- Relationship between skid resistance and mechanical durability





# Microtextural Analysis of Polishing





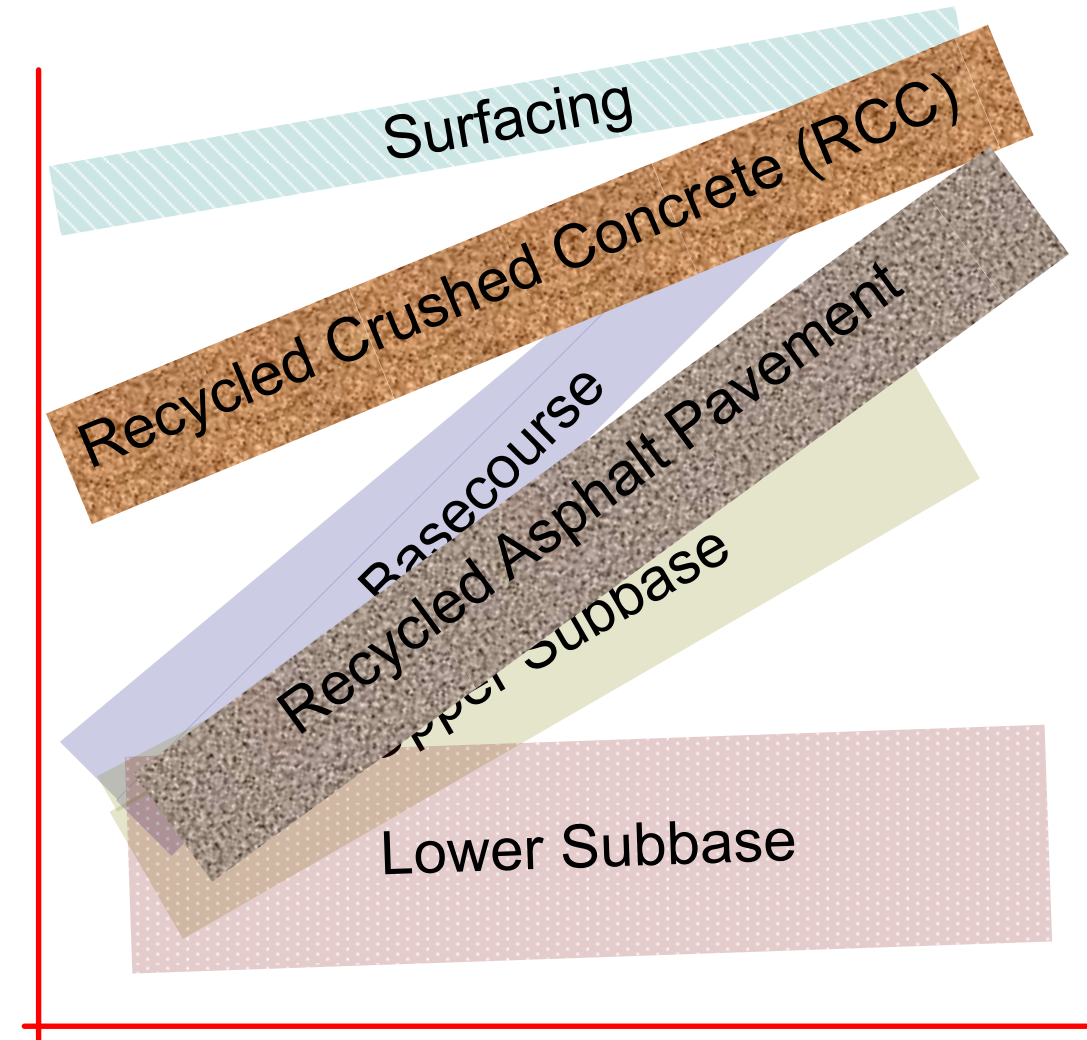
Ministry of Business,  
Innovation & Employment



# Recycled Aggregates

- Funded by multiple parties
- Need to understand engineering strength durability and variability
- Develop industry guidelines & specifications for use
- Contaminants, leaching

↑  
Quality



Design ESA



# How can we help you?

- There is wide diversity in aggregate sources between many RCAs
- Better use of local resources will reduce costs
- We are happy to propose sampling and testing procedures and to comment on results
- We would need some financial assistance to prepare a report for your RCA



# Summary

- Aggregates are a valuable and non-renewable mineral resource
- There is an economic imperative to include more “marginal aggregates” in pavements
- Our present testing focuses largely on physical properties; we know little about the chemical changes that occur when an aggregate is exposed to water / moisture in pavements
- New tests are needed
  - Testing mixtures of minerals in gravels; are any deleterious minerals present?
  - Deducing weathering characteristics and predicting durability of the material.



# Thank you – Questions?



**ENGINEERING**

