

Abrasion characteristics of recycled concrete



Vincent Phua and Sarah Woodward



Why are aggregates needed?



Introduction

Definitions:

- Recycled Crushed Concrete (RCC): aggregates containing recycled concrete aggregate and other constituents.



Sources of recycled concrete aggregates:

- Old concrete: originating from the demolition of structures.
- New concrete: originating from concrete leftover from plants which is left to harden.



Introduction

1.

Assess whether the age of concrete has an affect on the amount of abrasion loss.

2.

Determine the abrasion loss of recycled concrete aggregates and recycled masonry brick in wet and dry conditions.

Methodology

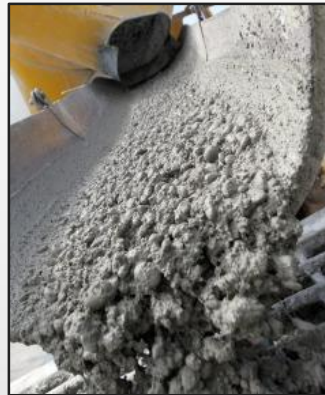
Aggregate Selection:

- Three individual stockpiles were made from

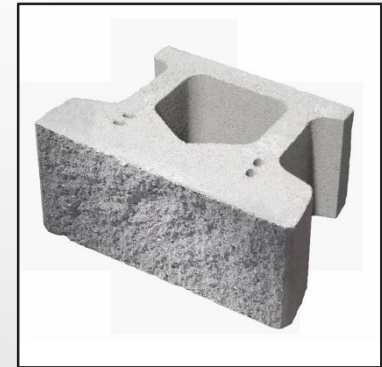
1. Old concrete



2. New concrete



3. Masonry brick



Methodology

Micro Deval Calibration Tests:

1. Fulton Hogan's machine
2. University of Auckland's machine



- Results were analysed and the University of Auckland's machine was considered to be calibrated

Methodology

Micro Deval Testing:

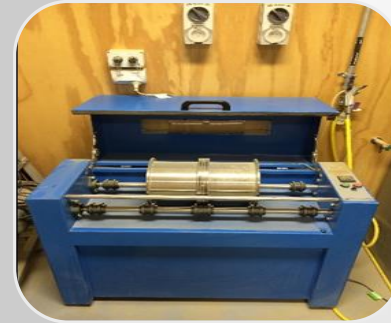
- ASTM D6928-10 Standard Test Method
- Dry test method



Sieving



Soaking



Testing

$$\text{Percentage Loss} = \frac{\text{Initial Weight (A)} - \text{Final Weight (B)}}{\text{Initial Weight (A)}} \times 100$$

Methodology

Los Angeles Testing:

- NZS 4407:1991 Test 3.12
- Wet test method



Sieving



Testing

$$\text{Percentage Loss} = \frac{\text{Initial Weight (M1)} - \text{Final Weight (M2)}}{\text{Initial Weight (M1)}} \times 100$$

Methodology

Constituent Analysis:

- RTA T276 standard test method



Drying

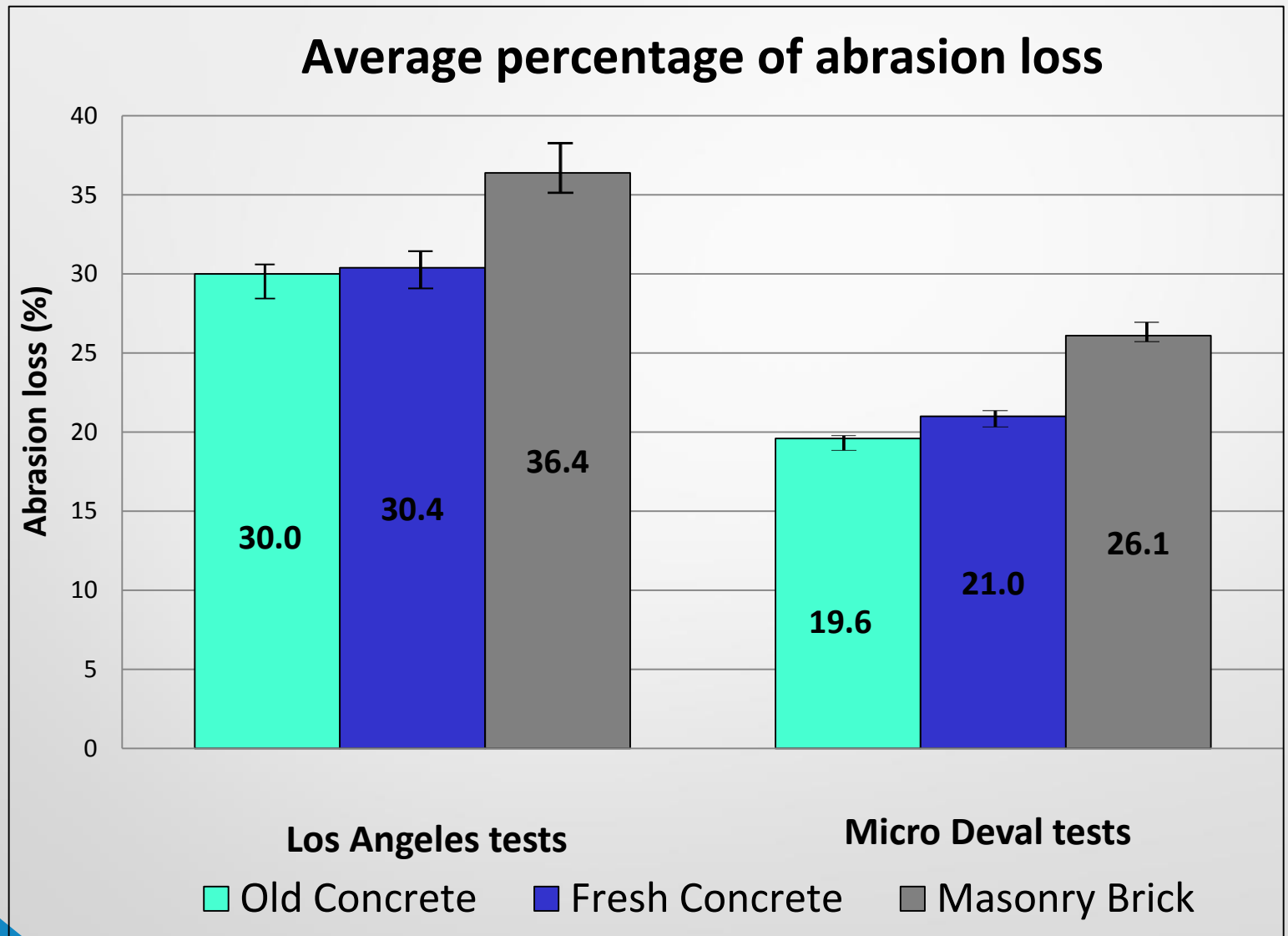


Sieving



Visual Analysis

Average Abrasion Loss



Old vs. New Concrete

Sample	MD	LA
	Mean %	Mean %
Old concrete	19.6	30.0
New concrete	21.0	30.4

- The age of the concrete **did not** have an effect on the abrasion resistance for the Los Angeles machine.
- The age of concrete **did** have an effect on the abrasion resistance for the Micro Deval machine.

Why is the age of concrete significant in wet conditions?

Quality Control

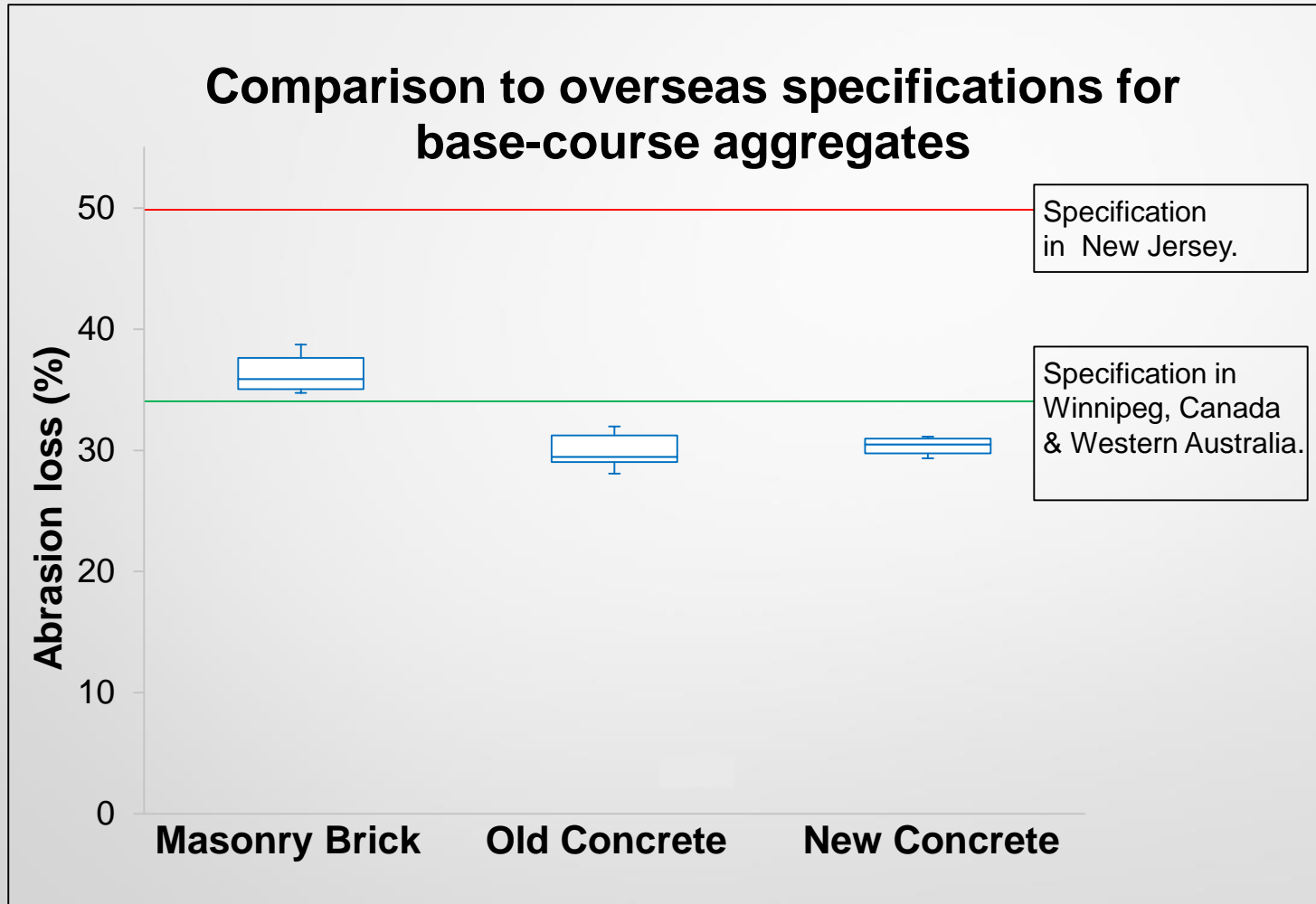
- Less stringent quality controls for the old concrete resulting in cement that had not fully binded to the aggregates.

Time since hydration

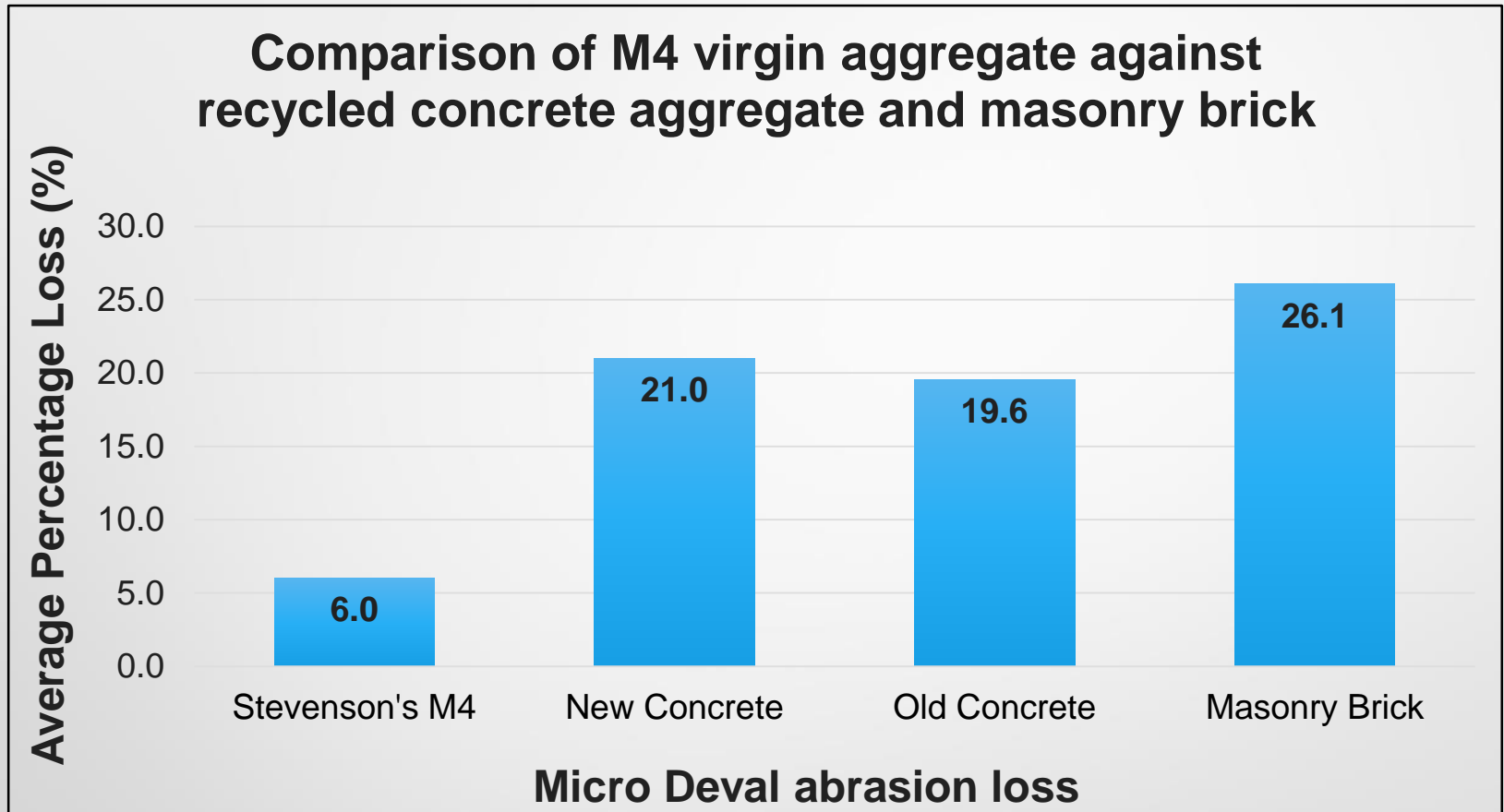
- Old concrete undergoing a hydration reaction due to the time since substantial amount of water had been applied.



Overseas Specifications



Comparison to virgin aggregate



- It is important to consider the quality of fines produced from recycled concrete aggregates.

Conclusions

1. The age of concrete does not have a significant effect on abrasion loss in dry environments, however it does in wet environments.
2. The concrete aggregates conform to the overseas specifications for abrasion limits.
3. Masonry brick exceeds the standard set by Canada and Western Australia, however it is only 5.2% of the total stockpile and so the overall RCC mix should still be acceptable.

Future Research

- The abrasion loss of the overall recycled crushed concrete mix should be tested.
- The quality of the fines produced from abrasion should be tested.
- New Zealand needs to determine a value for the maximum acceptable percentage of abrasion loss.



Thank you. Any questions?

Acknowledgements:

Dr Tam Larkin

Dr Doug Wilson

Bernard Jacobson

Nazanin Ardalan

Sponsors listed below:

