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Modification of the PMV Test to Evaluate the Frictional Properties of Natural Sands Used in PCC Pavements in Ontario.

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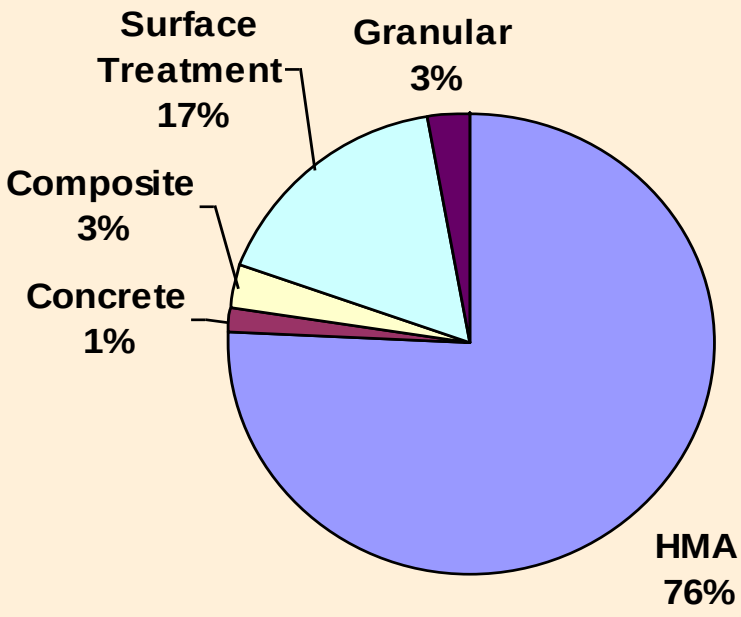
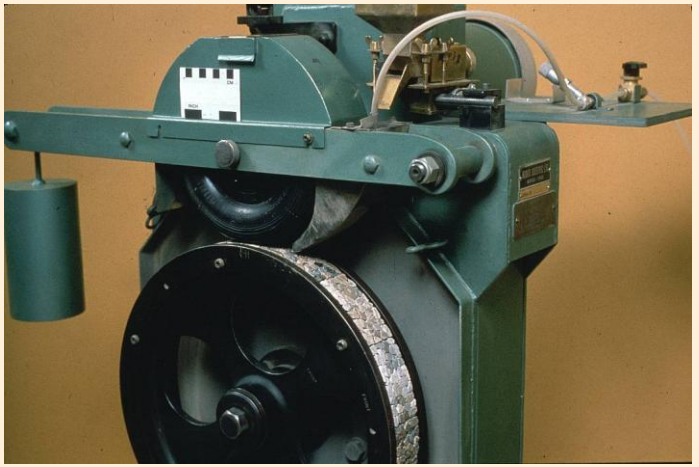
- Bob Gorman – Geologist
- Carole Anne MacDonald – Petrographer

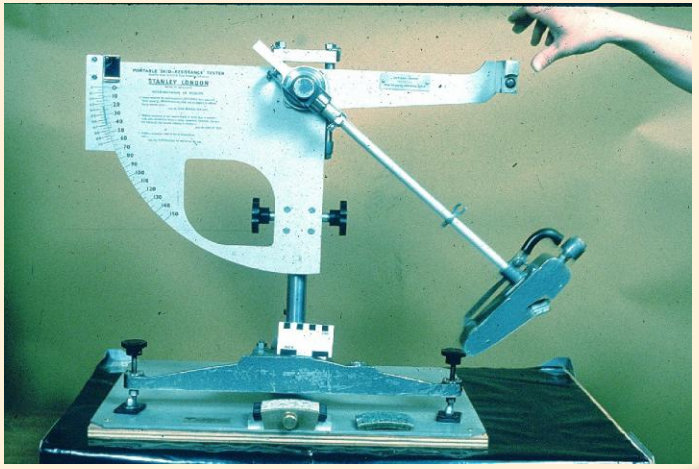
Ontario Pavement Types

- Concrete pavements ~ 1.1% of provincial road network
- Freeways > 2500 AADT/lane

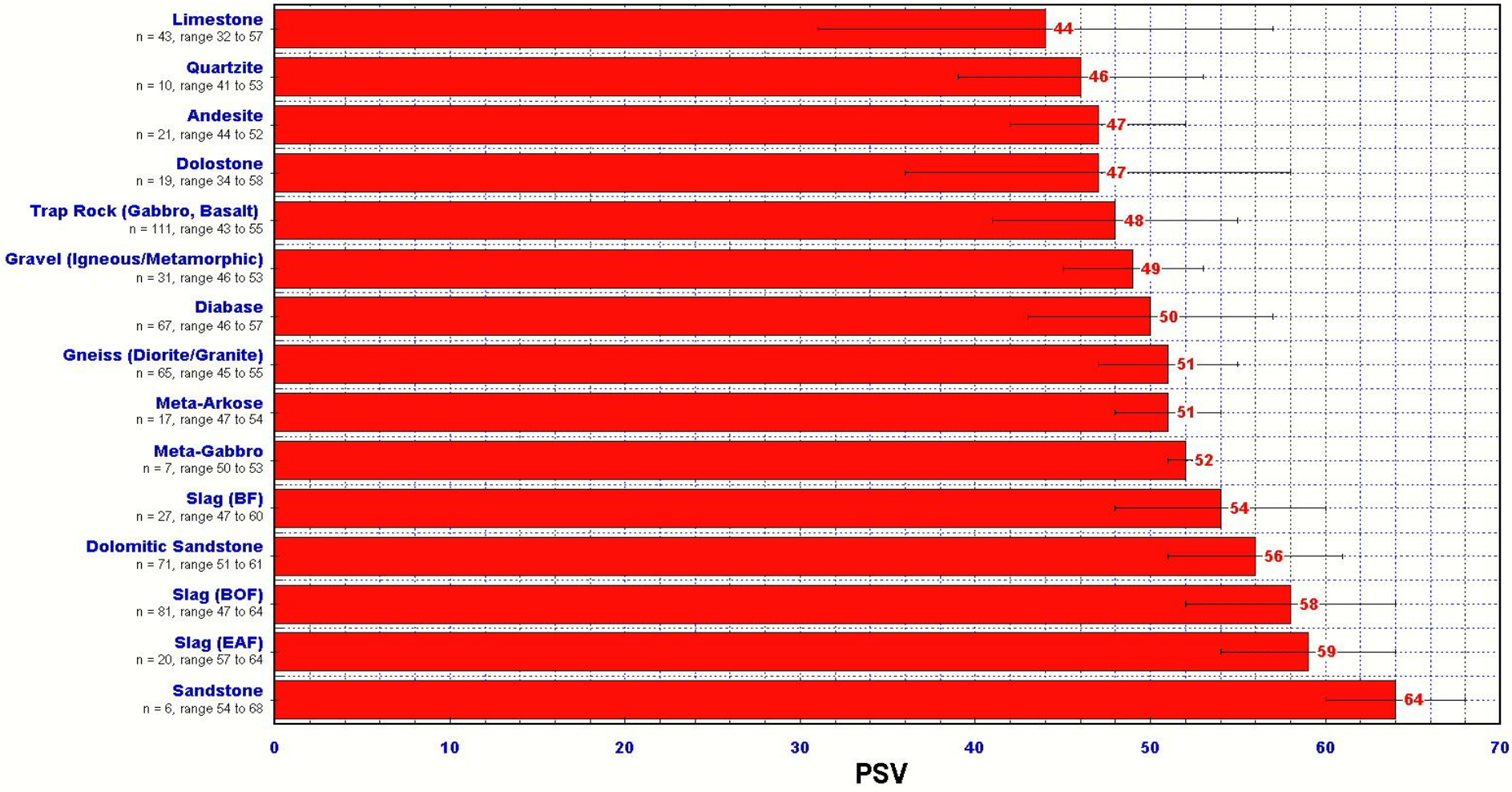


Polished Stone Value (PSV)





Polished Stone Values (PSV) for Different Ontario Aggregate Types

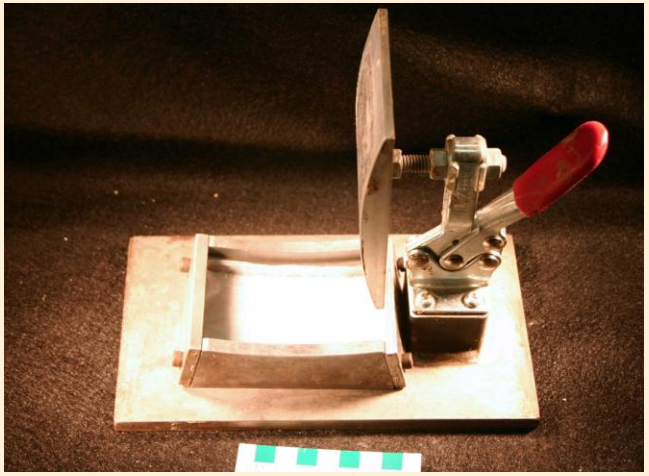


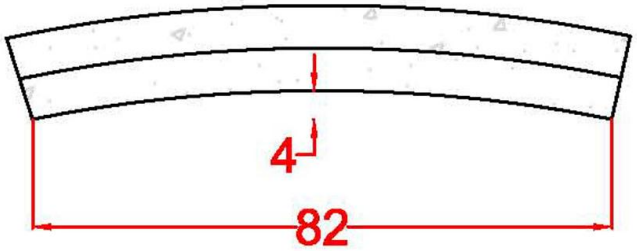
Polished Mortar Value (PMV)

- **Pavement friction in concrete pavements is related to fine aggregate properties**
  - **Microtexture**
  - **Durability**
  - **Hardness**
- **PMV test developed by Transport and Road Research Laboratory (1978)**

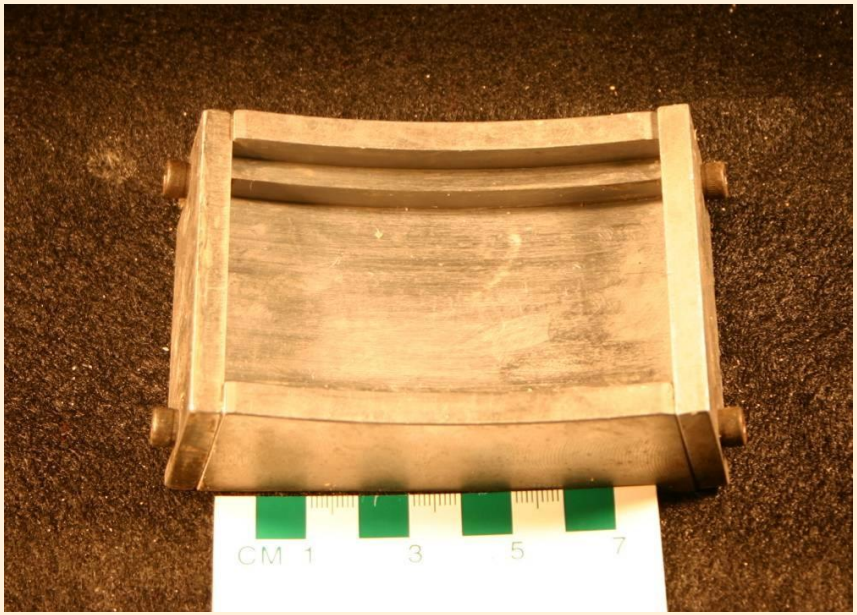
Modifications to PMV Test

- **Specimen preparation**
  - **Aggregate gradation**
  - **Mix design**
  - **Cement type**
- **PSV mould**
- **Accelerated Polishing**
- **Friction test**





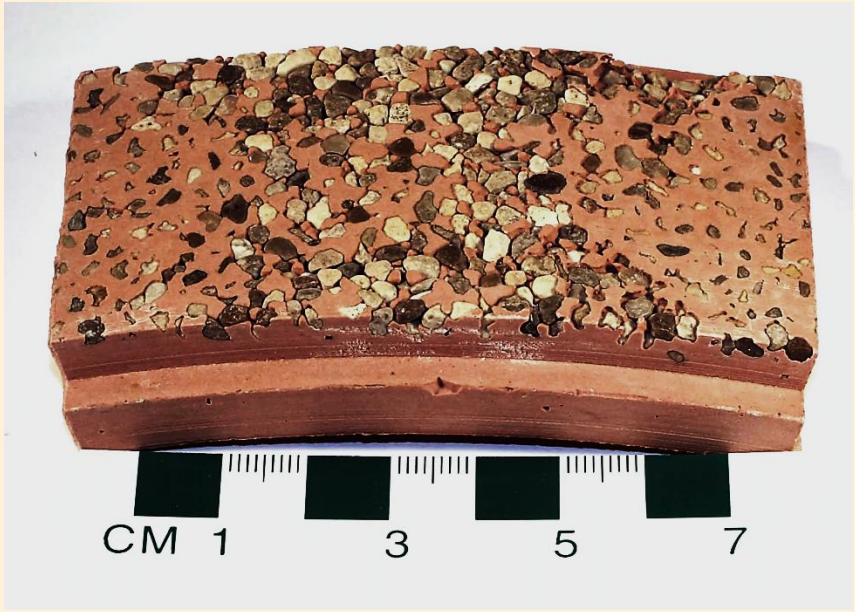
Specimen preparation



PSV mould

60% sand, epoxy resin

Epoxy resin base



Pass 4.75mm/Ret 2.36 mm particles

Resin coupons not satisfactory when made with sand

Mix design

- **standard aggregate gradation**

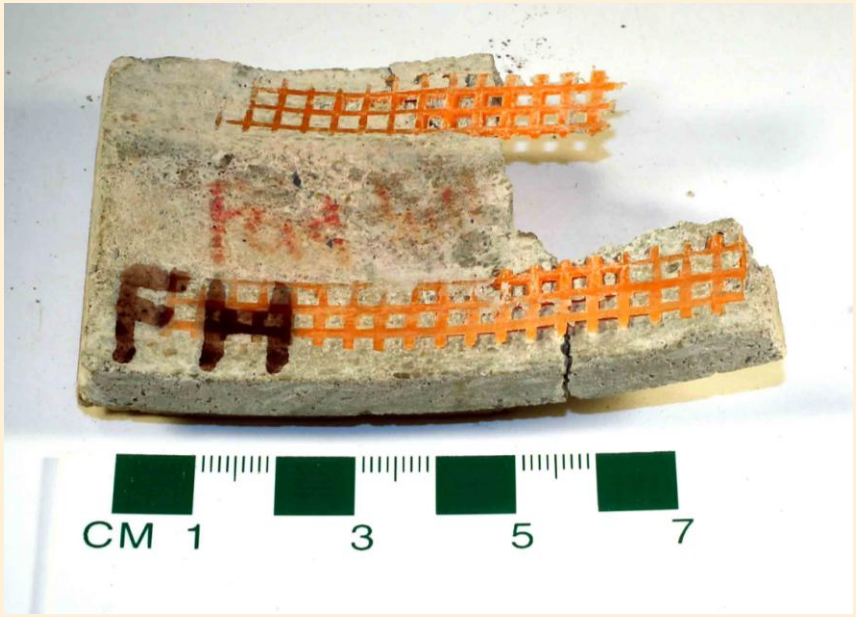
Material	Sieve Size (retained)	Mass (g)
Aggregate	2.36 mm	198
	1.18 mm	495
	600 µm	495
	300 µm	495
	150 µm	297
Water	-	387
Cement	-	880

Mould Preparation

- moulds prepared with wax applied to dry surfaces
- mineral oil coating prior to casting
- layer of wax paper, mineral oil
- mortar coupons wet-cured in mould for 24 hr – 24° C @ 100% RH before removal
- 7 day curing before testing (limewater)

Additional concerns

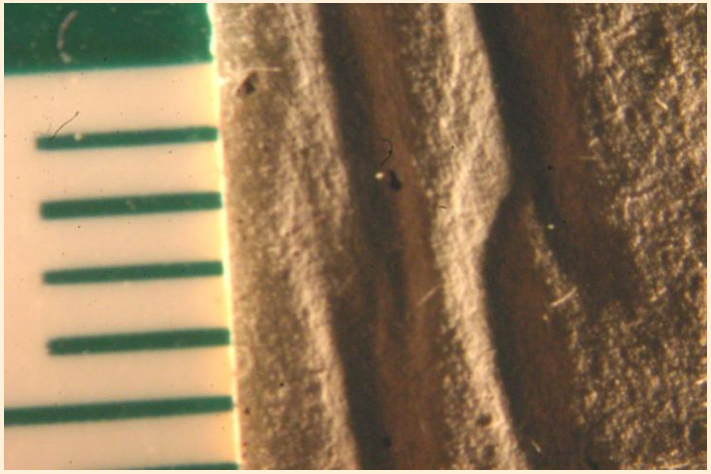
wax paper to improve removal



reinforcement to prevent breakage

Cast surface issues

- Marred by voids, creases
- partially solved through experience/care
- TRRL study used “reverse” PSV moulds
  - test surface finished by hand



Challenges in test development

- **Cement mortar coupons are delicate:**
  - **Age at least 7 days before testing**
  - **Reinforce with plastic mesh**
  - **Handle with care**

Polishing Wheel Testing

- Polish for 3 hours with corn emery (coarse grit)
- Polish for 3 hours with emery flour (fine grit)

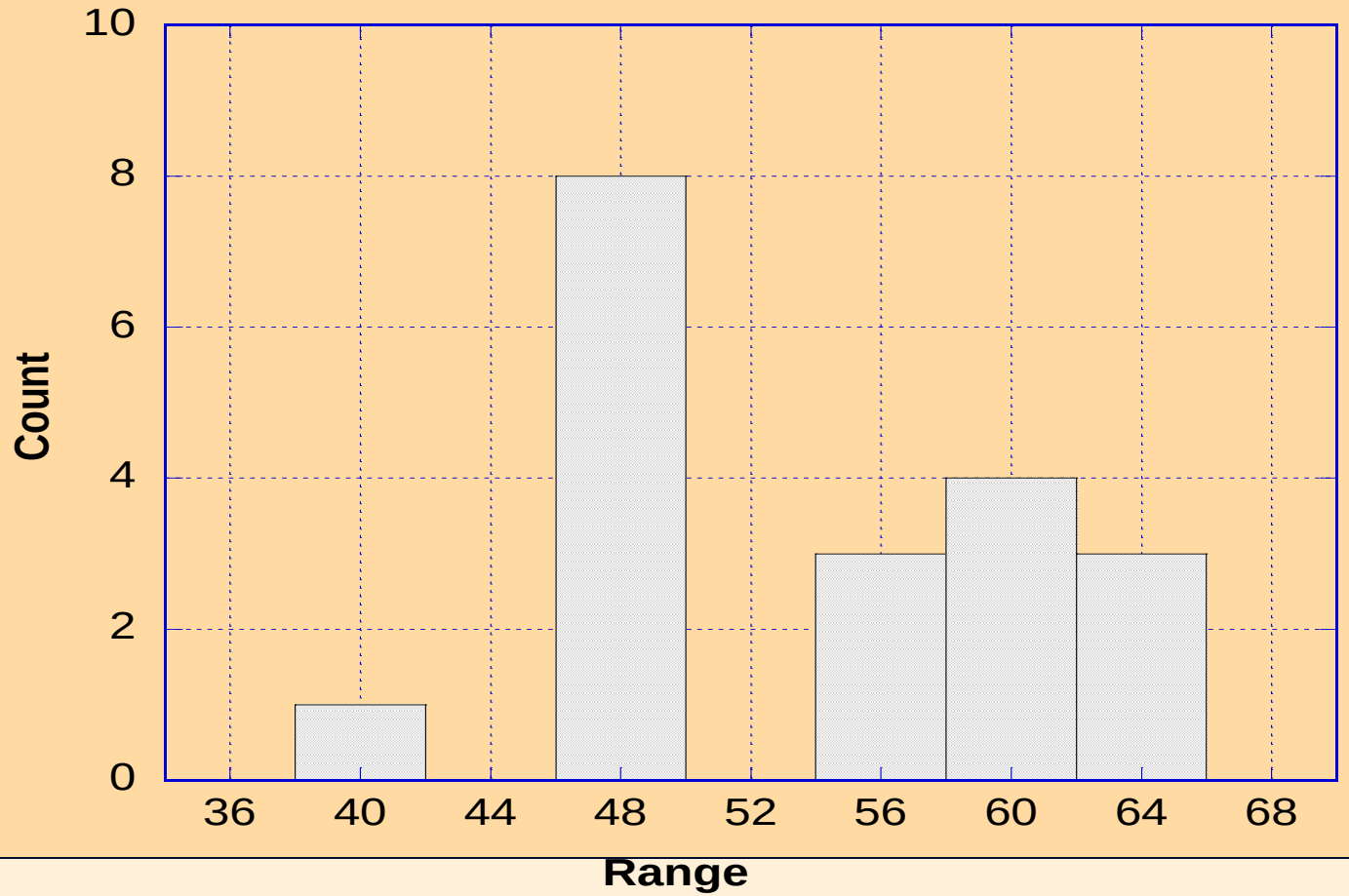
Polishing Evaluation

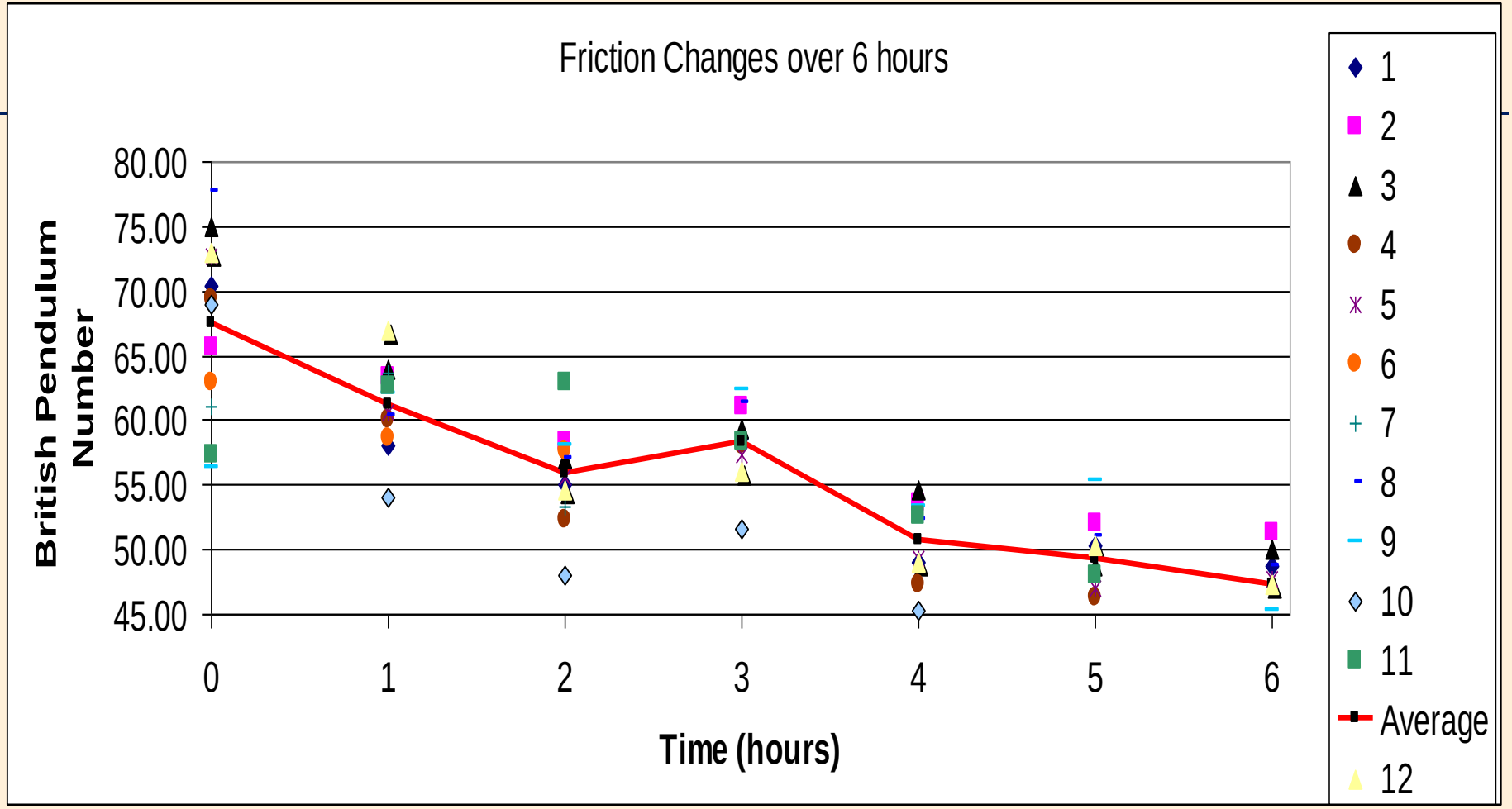
- **Each hour:**
  - **Clean emery feeders**
  - **Remove test coupons**
  - **Test for frictional resistance on “British Pendulum” friction tester**

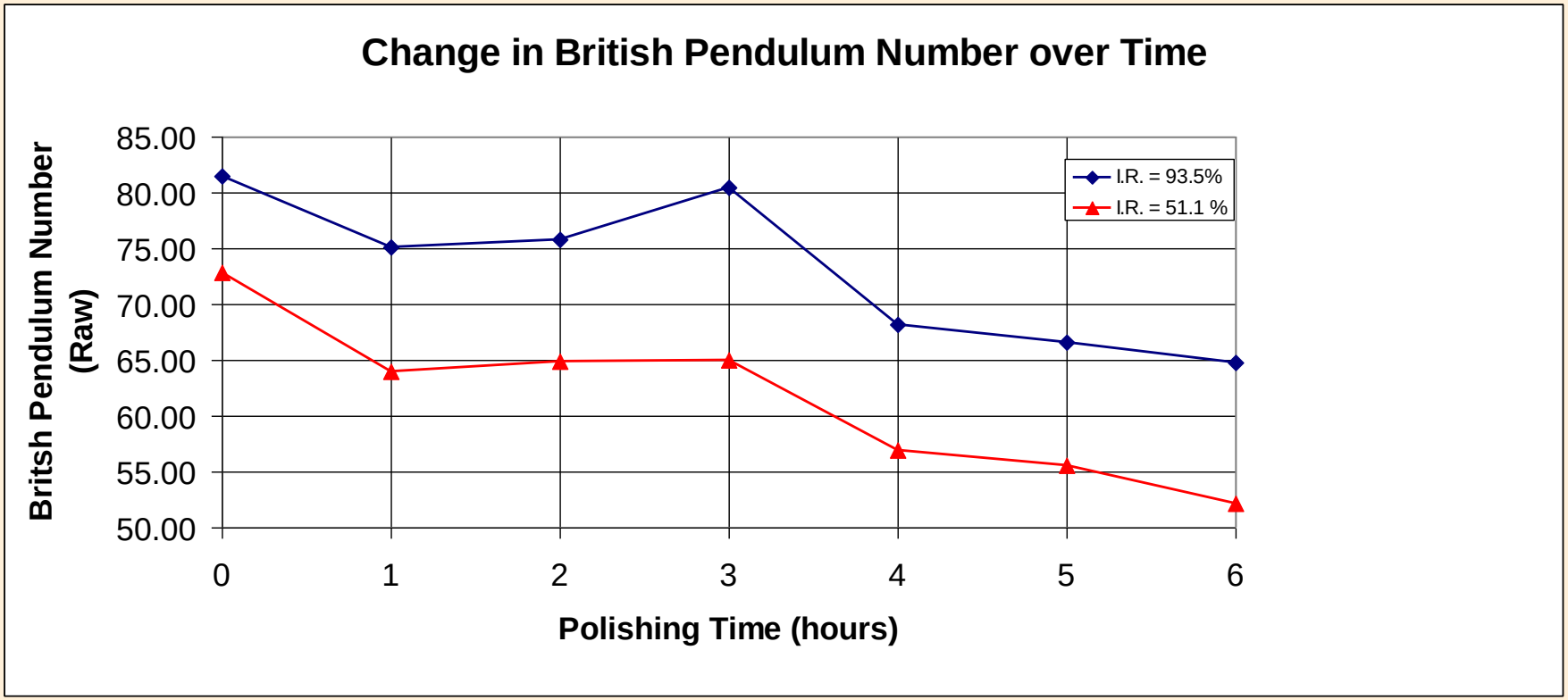

CM 1
3
5
7


CM 1
3
5
7

Control Aggregate




Friction Changes over 6 hours
British Pendulum Number
80.00
75.00
70.00
65.00
60.00
55.00
50.00
45.00
0
1
2
3
4
5
6
Time (hours)
1
2
3
4
5
6
7
8
9
10
11
Average
12


Change in British Pendulum Number over Time
Britsh Pendulum Number (Raw)
85.00
80.00
75.00
70.00
65.00
60.00
55.00
50.00
0
1
2
3
4
5
6
Polishing Time (hours)
I.R. = 93.5%
I.R. = 51.1 %

Challenges in Test Development

- Difficulty demoulding coupons
- Inconsistent cast surface finish
- Fragile coupons
  - Reinforced with plastic mesh
  - Handle with care

Conclusions and Recommendations

- Optimize specimen preparation to reduce variability
  - Aggregate gradation
  - Mix additives
  - Use of “reversed” moulds?
- PMV as assessment tool for potential PCC pavement sands
  - Test more sands - gather PMV database
  - Evaluate PMV with field friction data