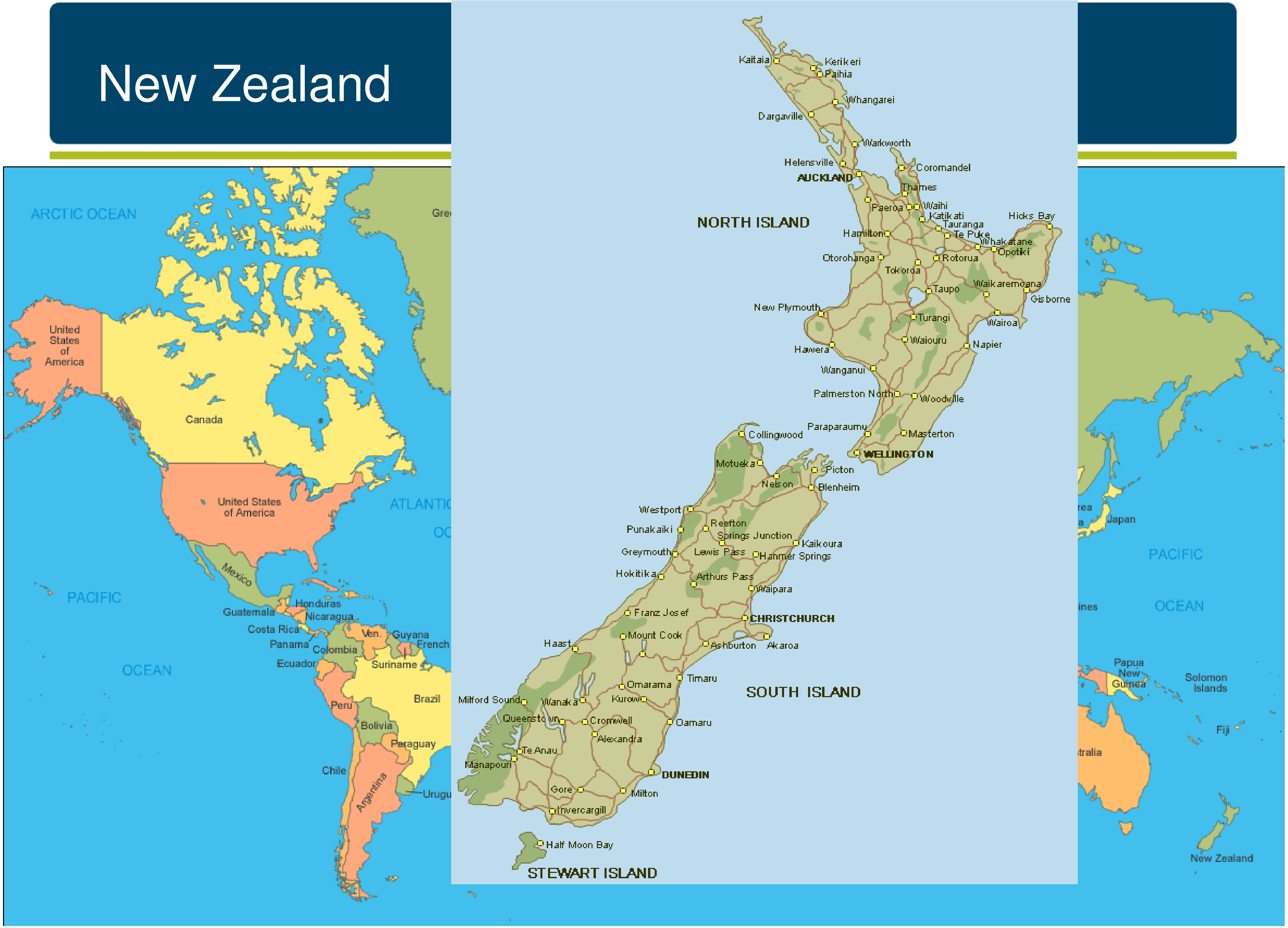
SKID RESISTANCE PERFORMANCE OF MELTER SLAG-BASED SURFACE DRESSINGS ON HAWKES BAY RURAL STATE HIGHWAYS

Written by Shaun Perrin and David Cook

Presented by

John Donbavand

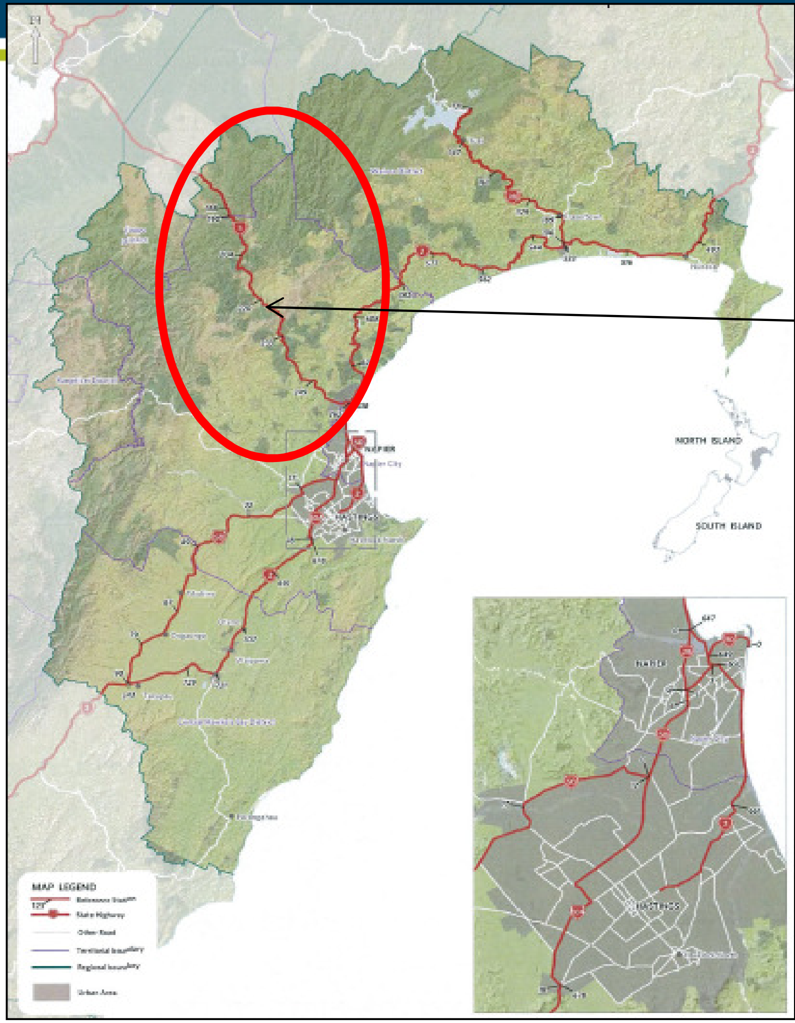
New Zealand



ARCTIC OCEAN
United States of America
Canada
United States of America
Mexico
ATLANTIC
PACIFIC
OCEAN
Guatemala
Honduras
Nicaragua
Costa Rica
Panama
Ven.
Guyana
French
Colombia
Suriname
Ecuador
Peru
Brazil
Bolivia
Paraguay
Chile
Argentina
Japan
PACIFIC
OCEAN
Papua New Guinea
Solomon Islands
Fiji
New Zealand
NORTH ISLAND
Kaitaia
Kerikeri
Paihia
Whangarei
Dargaville
Warkworth
Helensville
Coromandel
AUCKLAND
Thames
Paeroa
Waihi
Katikati
Tauranga
Te Puke
Hicks Bay
Hamilton
Whakatane
Opotiki
Otorohanga
Rotorua
Tokoroa
Taupo
Waikaremoana
Gisborne
New Plymouth
Turangi
Wairoa
Waiouru
Napier
Hawera
Wanganui
Palmerston North
Woodville
Paraparaumu
Masterton
Collingwood
WELLINGTON
Motueka
Picton
Nelson
Blenheim
Westport
Reefton
Punakaiki
Springs Junction
Kaikoura
Greymouth
Lewis Pass
Hanmer Springs
Hokitika
Arthurs Pass
Waipara
Franz Josef
CHRISTCHURCH
Haast
Mount Cook
Ashburton
Akaroa
Timaru
SOUTH ISLAND
Omarama
Milford Sound
Wanaka
Kurow
Queenstown
Cromwell
Oamaru
Alexandra
Te Anau
Manapouri
DUNEDIN
Gore
Milton
Invercargill
Half Moon Bay
STEWART ISLAND

Hawkes Bay

Rural State highways in Hawkes Bay present tight curvilinear alignments, high percentage of heavy commercial traffic and local aggregates with relatively low skid resistance

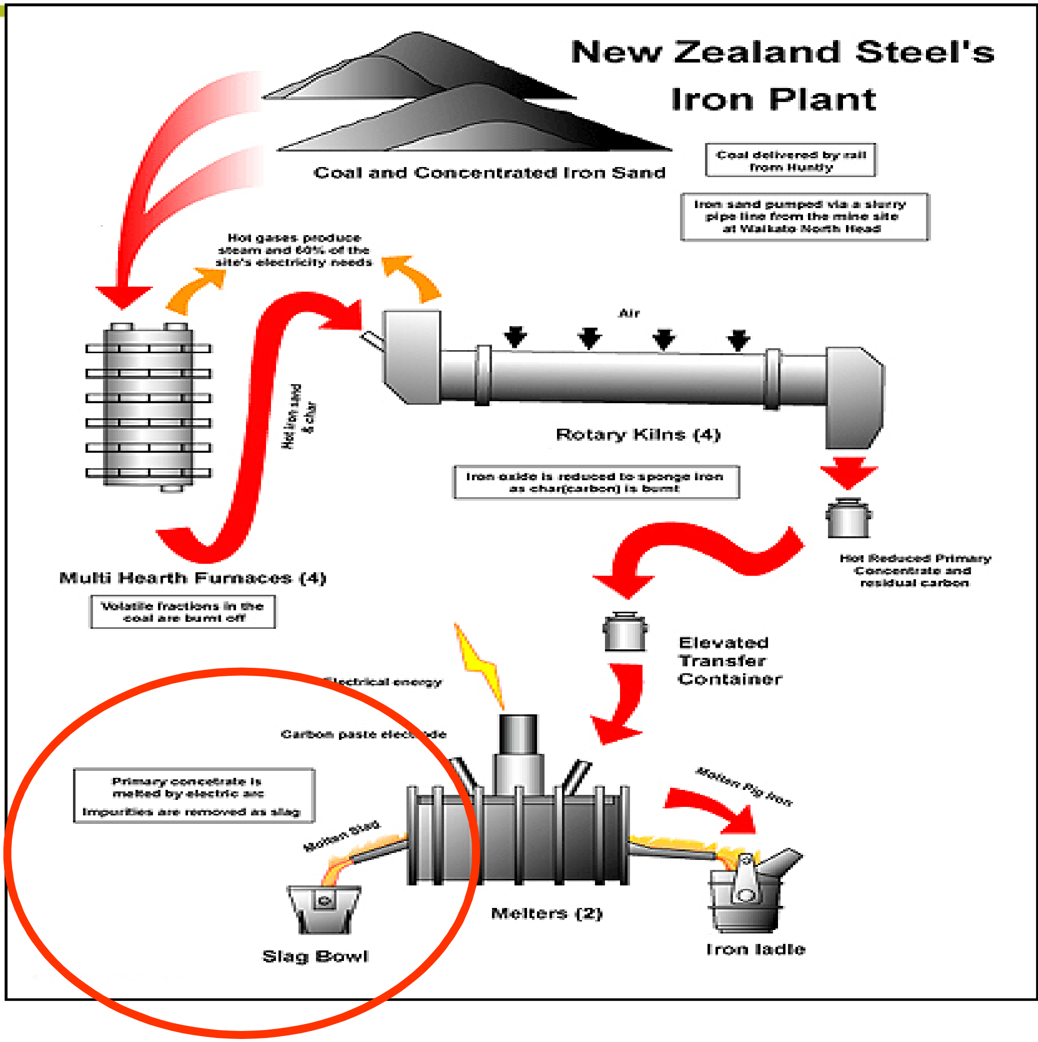


SH 5: 69 km
AADT: 3000
HCV: 23%
Max Alt: 600m
Regional Strategic

Search for Good Aggregate

- Lack of local aggregates to provide the required skid resistance
- A number of aggregates from different regions were evaluated
- One of these aggregates was Melter Slag
- Melter slag was slightly more difficult to use than the natural aggregates but appeared to be providing good initial performance

Melter Slag Production Process



Chemistry of Melter Slag

The major mineral constituents of the melter slag can be divided into three types:

- complex titanium oxides, which have a needle-like form
- spinels and similar metal oxide, which have a rather equi-dimensional shape
- calcium bearing oxides and silicates

The titanium oxides in particular provide strength and a high degree of microtexture

Melter Slag - Vesicular

Melter Slag and PSV

The PSV is between 57 and 60. However GMS is very resistant to long term polishing

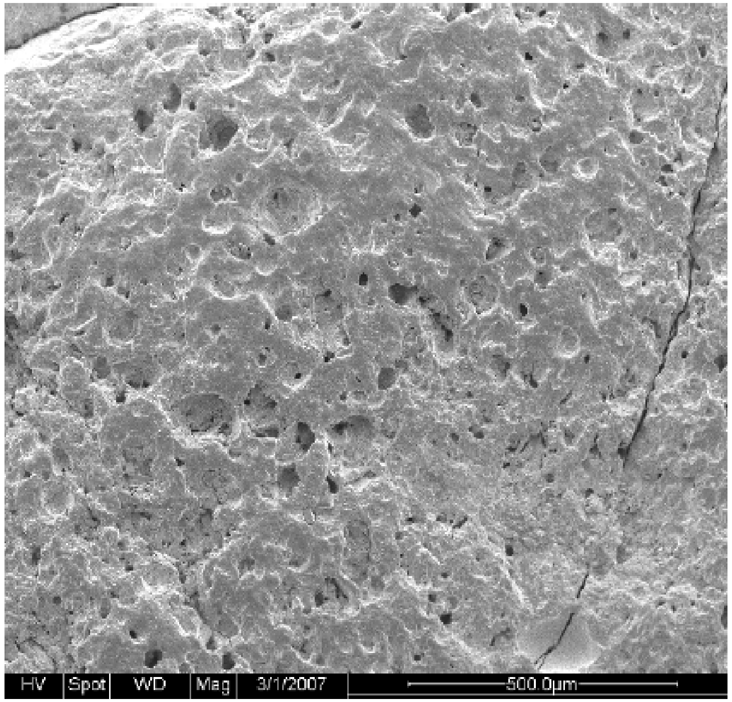


Figure 9(b) Melter slag : polished surface x 200mag

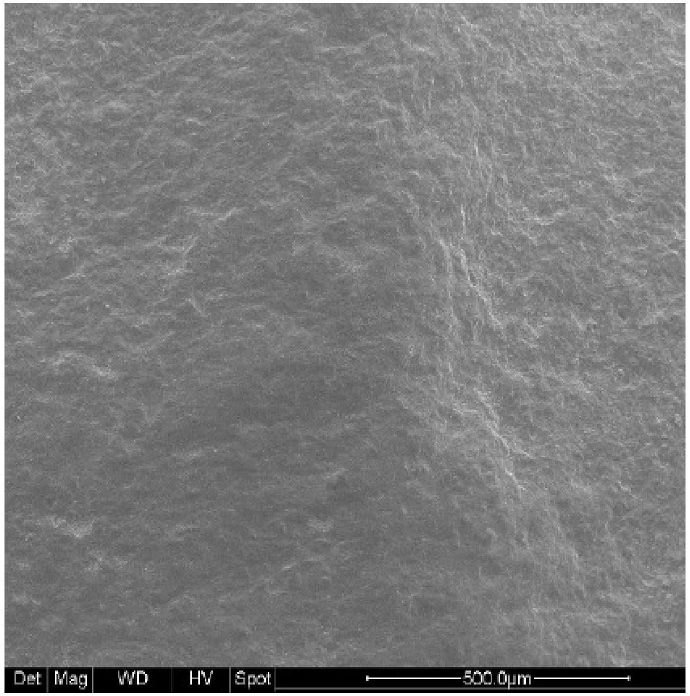


Figure 7(b) Fine grained greywacke sandstone G2 : polished surface x 200mag

Performance of GMS

Ideal comparison

- GMS was placed on SH5 in the same location to replace high PSV natural aggregate
- Five sites with different stress conditions were considered
- Data provided 10 plots of comparison between natural aggregate and GMS

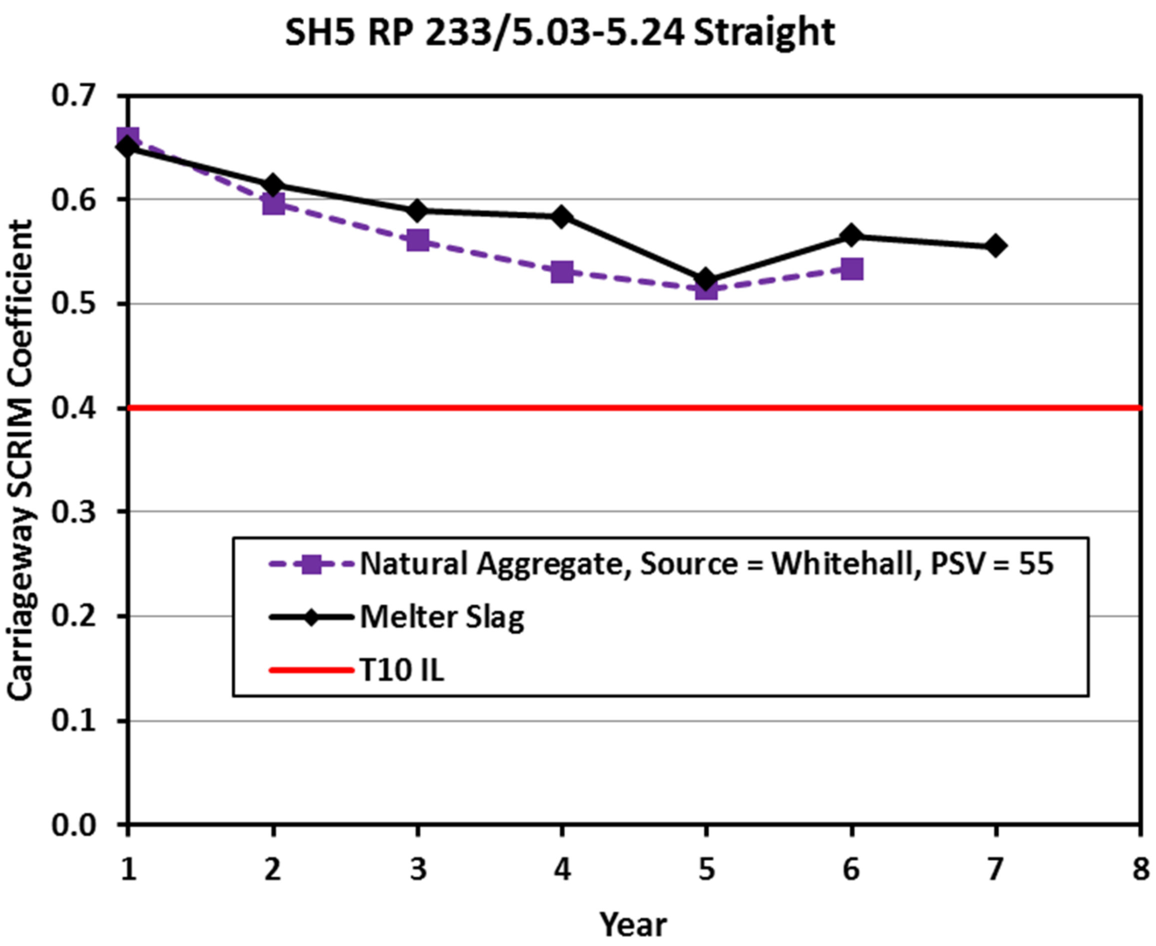
Sites Used in the Study

nt

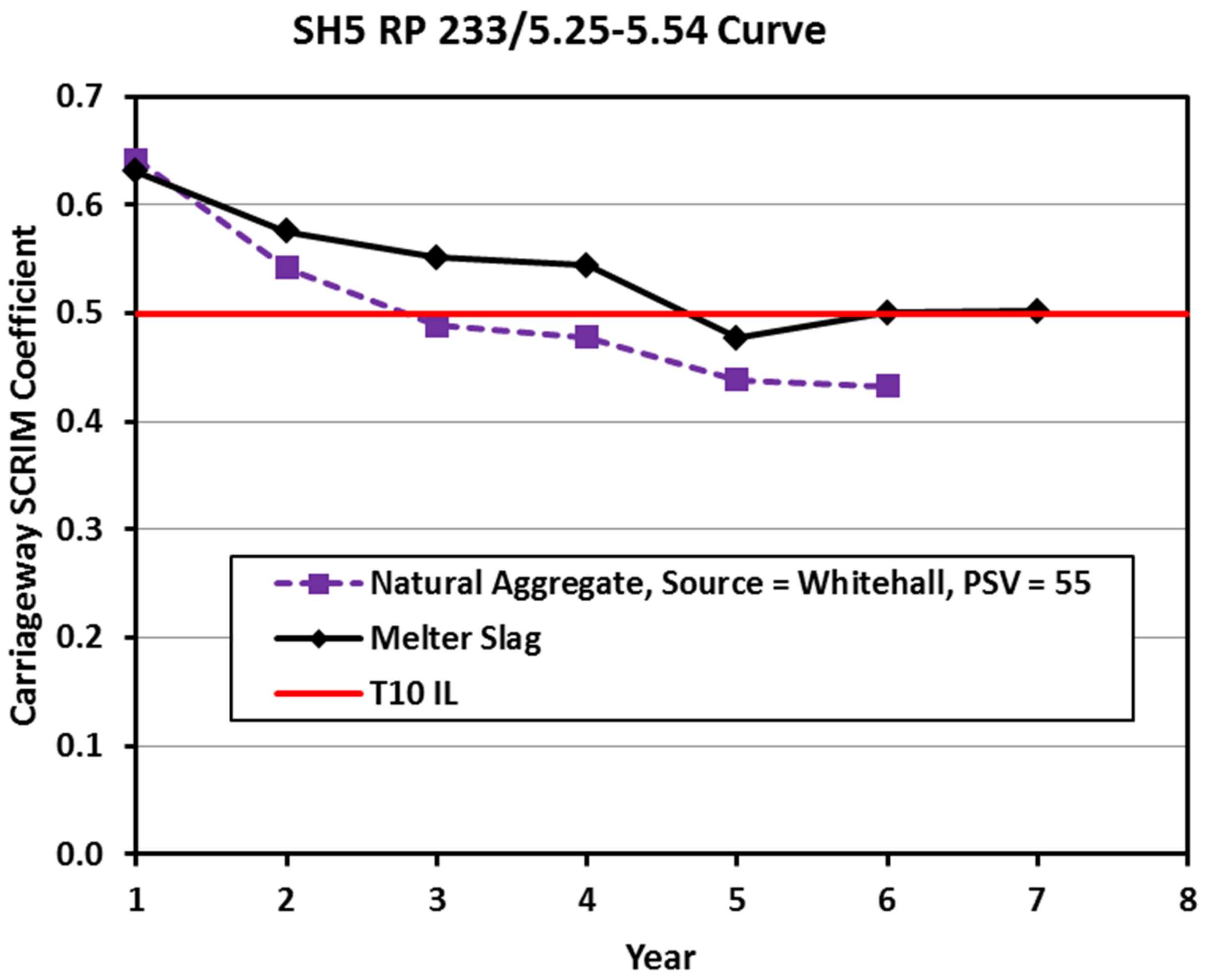
Comparison GMS Versus Natural Aggregate

Melter Slag Reseal Site Number	Natural Aggregate Years of data	Melter Slag Years of data
1	2 (2008 - 2009)	5 (2010 - 2014)
2	4 (2003 - 2006)	4 (2011 - 2014)
3	6 (2002 - 2007)	7 (2008 - 2014)
4	9 (1998 - 2006)	8 (2007 - 2014)
5	2 (2005 - 2006)	8 (2007 - 2014)

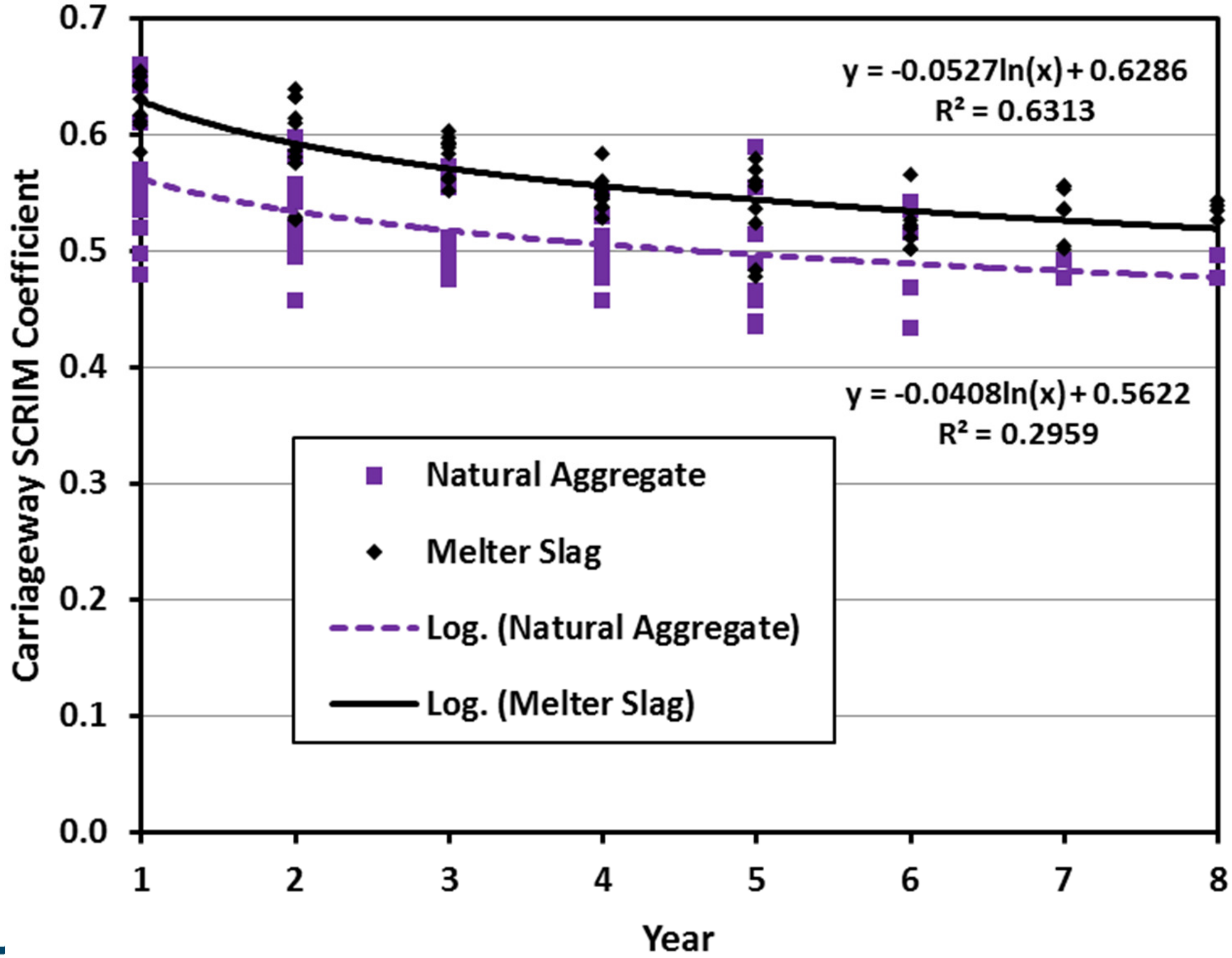
Decrease in Skid Resistance (Straight Roads)



Decrease in Skid Resistance (Curves)

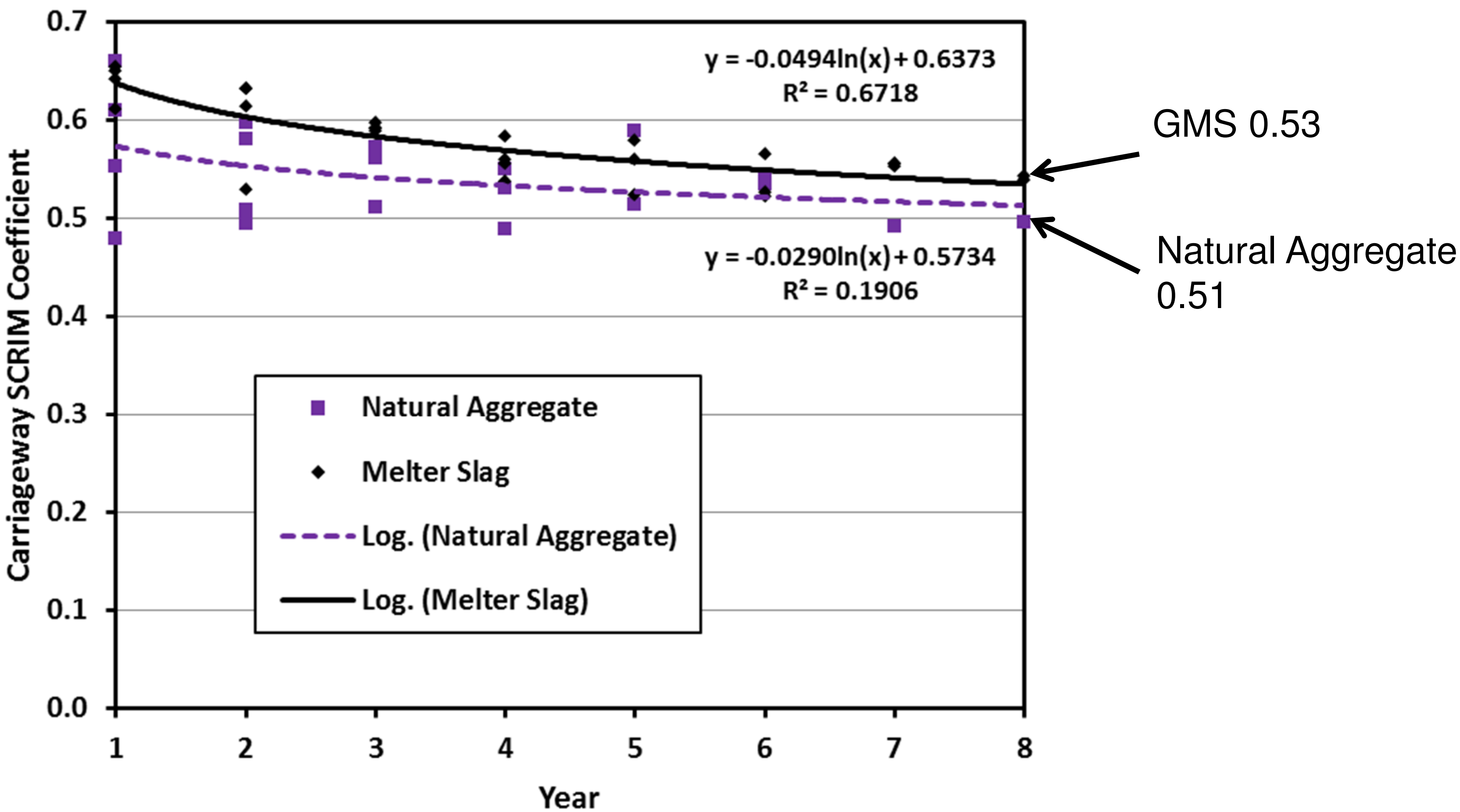


Plot of all Data

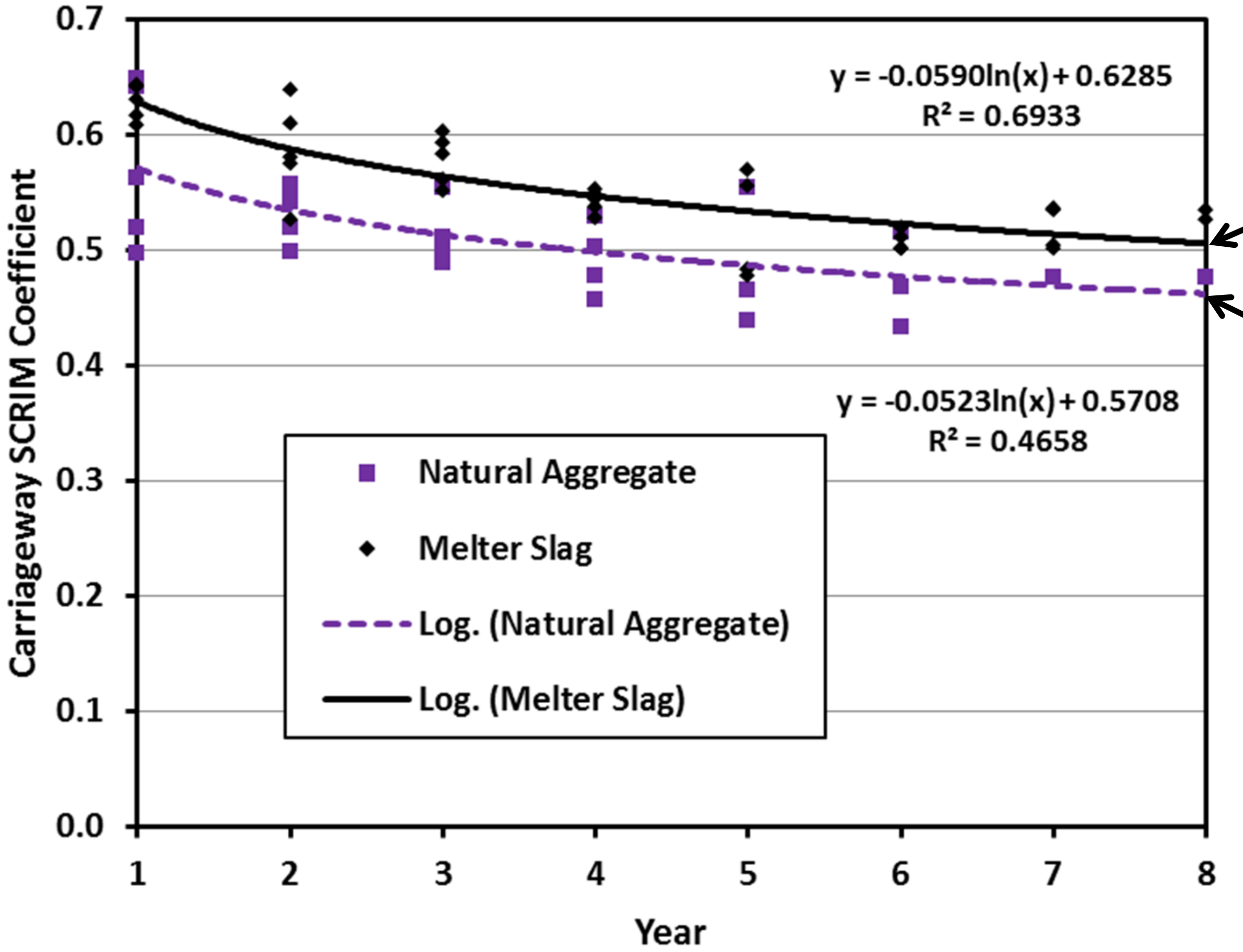


Zealand Government

Plot of all data on straights

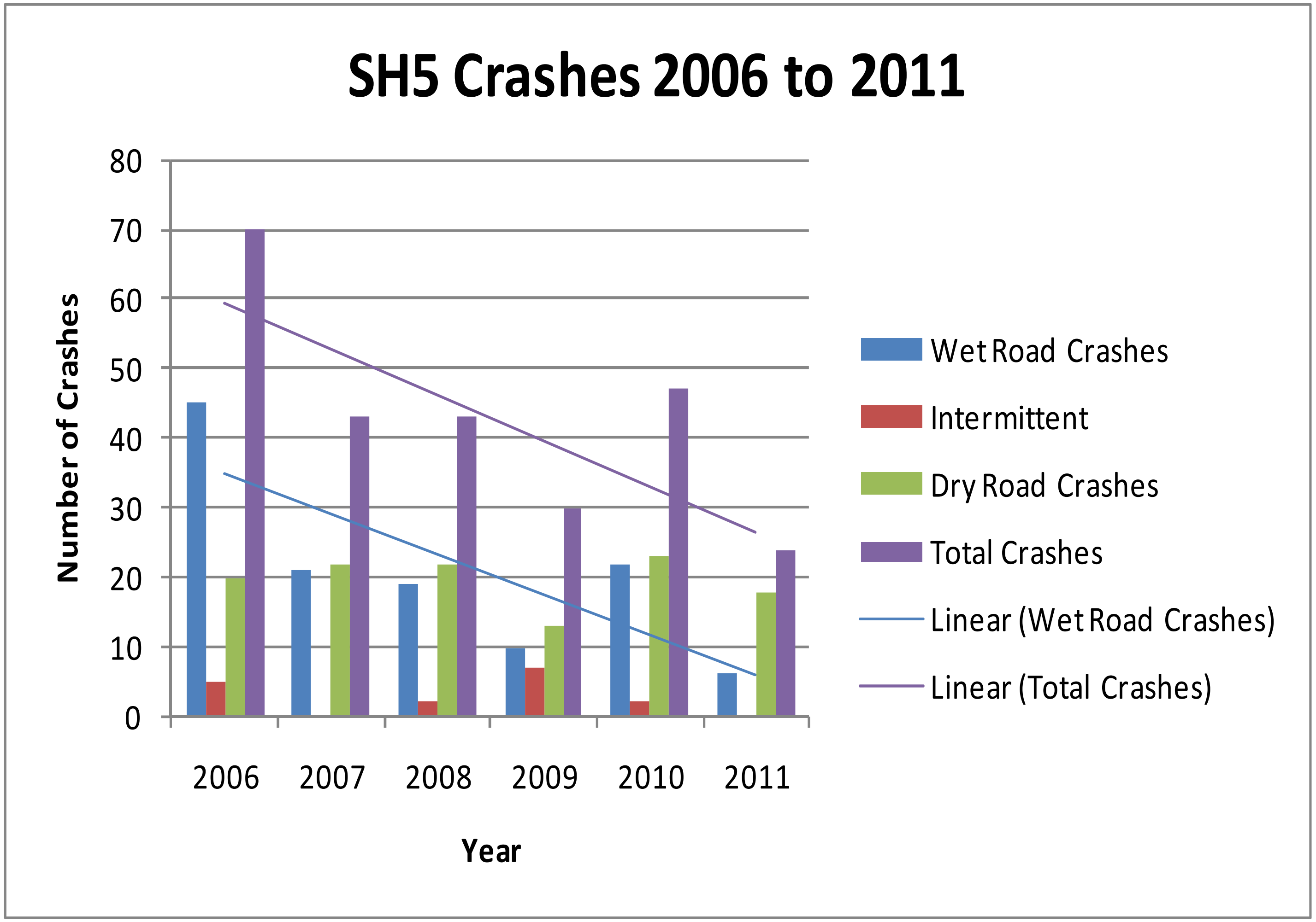


Plot of all data on Curves



GMS 0.50

Natural Aggregate 0.46


SH5 Crashes 2006 to 2011
Number of Crashes
80
70
60
50
40
30
20
10
0
2006
2007
2008
2009
2010
2011
Year
Wet Road Crashes
Intermittent
Dry Road Crashes
Total Crashes
Linear (Wet Road Crashes)
Linear (Total Crashes)

The Disadvantages of Using GMS

- GMS require up to 25% more binder than natural aggregate
- GMS denser so more expensive cartage
- GNS can react with road markings so the first application may need to be replaced quickly

Concluding Remarks

- GMS generally shows a steady decrease in skid resistance over time while the natural aggregate data is less consistent.
- Clear indication that reduction in skid resistance with age is greater on corners than on straights
- GMS shows improved skid resistance performance over natural aggregate particularly on curves.