

# SKID RESISTANCE OF ASPHALT PAVEMENTS WITH DIFFERENT SURFACING MATERIALS IN THE CITY OF CALGARY

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## Background

- Pavement skid resistance or friction is one of the main safety considerations in pavement design and construction.
- Lower pavement friction increases the stopping distances and causes accidents.
- Although safety factors such as pavement friction should be considered in all pavement engineering projects, most of pavement projects are designed and constructed only based on life cycle cost analysis which does not take into account the indirect costs of accidents due to lack of friction.

## Scope and Objectives

- The City of Calgary is committed to improve the safety of its road network by monitoring pavement friction of its various surfacing materials. The City of Calgary conducted a study to evaluate its different paving materials.
- Several pavement sections in the City which were paved in 2010 and 2011 were tested in the Fall of 2011 to measure their skid resistance.

## Testing Locations and Pavement surfaces (Table 1)

No.	Road	Testing Location			Approximate Testing Length	Type of Pavement Surface and (Construction year)*
		From - to	Direction	Wheelpath		
1	144 <sup>th</sup> Avenue NW	West of Symons Valley Road to Rocky Ridge Road	WBL	Outer	5 km	City of Calgary Mix Type B-75 on top of cold-in-place recycling (2011)
2	16 <sup>th</sup> Avenue NE	100 m east and west of the intersection with 19 <sup>th</sup> Street	WBL	Outer wheelpath of 3 lanes	3 new paved lanes+100 m before and after	High Friction Surface (HFS) (2011)
3	18 <sup>th</sup> Street SE	Maynard Road to Centre Ave	NBL	Outer	0.5 km	Microsurface (2011)
4	20 <sup>th</sup> Avenue NW	19 <sup>th</sup> Street to Centre Street	EBL	Outer	2.2 km	City of Calgary Mix Type B-75 (2010)
5	16 <sup>th</sup> Avenue NW	14 <sup>th</sup> Street to 29 <sup>th</sup> Street	EBL and WBL	Outer wheelpath of outer lane	2.4 km in each direction	SMA (2011)
6	Crowchild Trail NW	Kensington Road to 5 <sup>th</sup> Avenue	NB and SB	Outer wheelpath of outer lane	0.5 km in each direction	SMA (2010)
7	Crowchild Trail SW	17 <sup>th</sup> Street to 33 <sup>rd</sup> Avenue	NB and SB	Outer wheelpath of outer lane	1.4 km in each direction	Superpave (2010)
8	Blackfoot Trail SE	19 <sup>th</sup> Street to 58 <sup>th</sup> Avenue	Both directions	Outer wheelpath of outer lane	4.5 km in each direction	Superpave (2011)

## Pavement Friction Factors

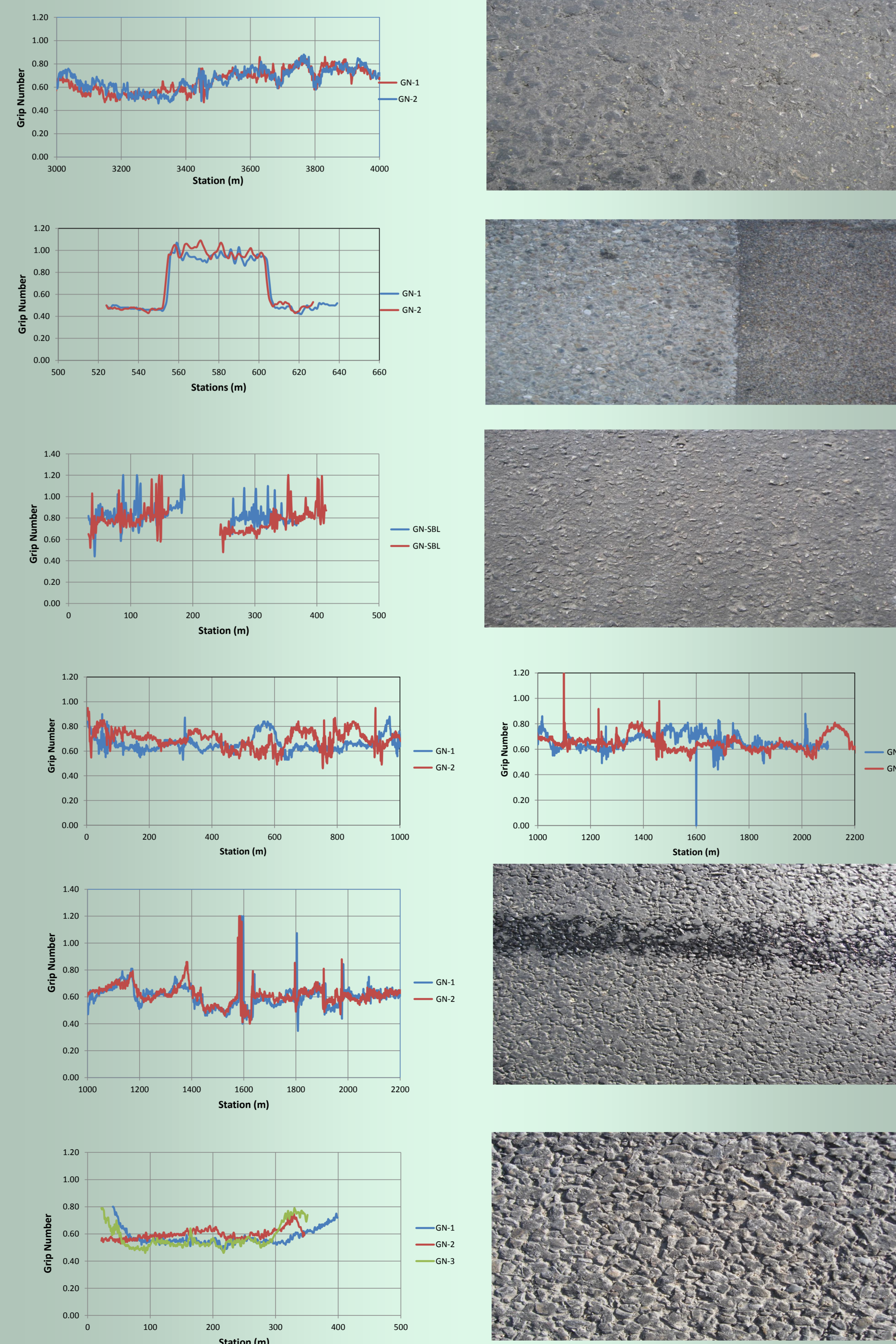
- Some important factors in pavement surface friction measurements are: aggregate type and its micro and macro-textures and source, asphalt mixture properties, water film thickness, air and pavement surface temperatures, speed of vehicle and slip, and friction testing equipment.

## Testing Equipment

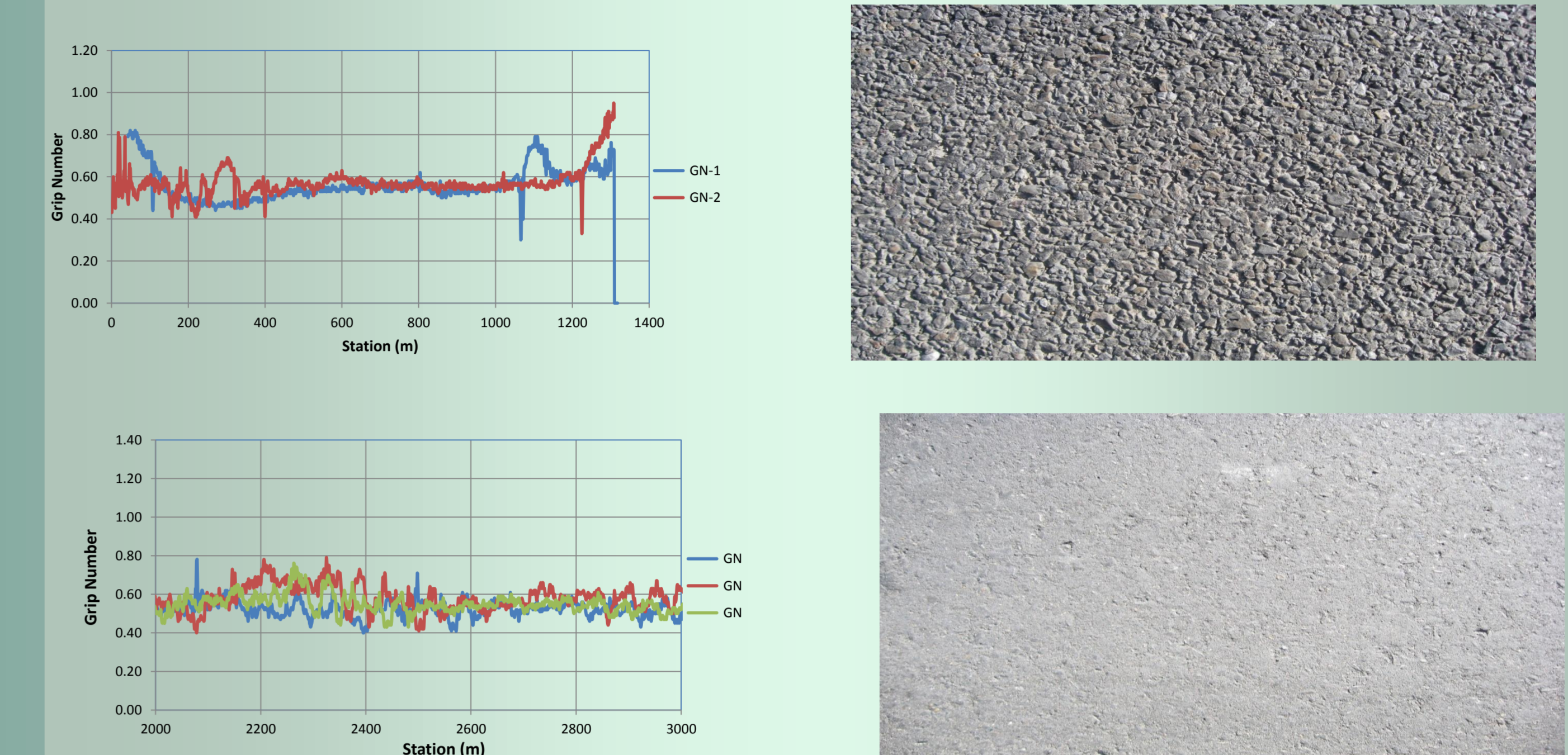


- A Findlay Irvine MK2-D Grip Tester (GT) was used.
- Testing did not need traffic accommodation.
- Testing was on wetted pavement with approximately 0.25 mm water film.
- It was not possible to keep testing speed uniform.
- GT measures pavement friction under a fixed slip (~15%). This simulates breaking of a vehicle with Antilock Brake System (ABS).

## Typical Testing Results (In the order as in Tables 1 and 2)



## Typical Testing Results (cont.)



## Summary of Results (Table 2)

No.	Road	Type of Pavement (Construction year)	Segmentation	Average GN	Standard Deviation
1	144 <sup>th</sup> Avenue NW	Mix Type B-75 on Cold-in-Place Recycling (2011)	Km 0.0 to ~km3.5	0.58	0.08
			~Km 3.5 to km 5.0	0.73	0.06
2	16 <sup>th</sup> Avenue NE	Old pavement and HFS (2011)	Old pavement	0.56	0.08
			HFS	0.96	0.05
3	18 <sup>th</sup> Street SE	Microsurface (2011)	Uniform	0.82 to 0.84	0.10 to 0.12
4	20 <sup>th</sup> Avenue NW	City of Calgary Mix Type B-75 (2010)	Uniform	0.66	0.06
5	16 <sup>th</sup> Avenue NW	SMA (2011)	Uniform	0.60 to 0.62	0.06 to 0.07
6	Crowchild Trail NW	SMA (2010)	Uniform	0.58 to 0.60	0.08 to 0.09
7	Crowchild Trail SW	Superpave (2010)	Uniform	0.57	0.06 to 0.08
8	Blackfoot Trail SE	Superpave (2011)	Non-uniform	0.40 to 0.55	0.09

## Conclusions

- The Grip Tester was able to differentiate between the pavement frictions values of different paving materials in the City of Calgary.
- HFS and micro-surface materials showed the highest friction values. Although HFS showed approximately 15% more surface friction than the micro-surface section, the effectiveness of these two high surface friction paving materials requires longer term monitoring in the future as well as life-cycle cost analysis.
- The surface friction of the SMA paving material was between 0.58 and 0.62, with an average of 0.60. SMA friction was approximately 10% lower than the City of Calgary Mix Type B-75. The difference in pavement friction of two SMA sections paved in 2010 and 2011 was not significant.
- Friction of a Superpave section, paved in 2011, indicated relatively lower friction numbers. This section needs to be monitored in the future.
- Friction of the same generic paving material (Superpave or SMA) can be different.