Agreed Summary of Pavement Friction Practices in Canada

1. Pavement Friction Practices in Canada

There are no published national standards or guidelines with respect to friction measurement or management in Canada. While Canadian regulations exist for airfield pavements, under the jurisdiction of Transport Canada, there are no policies or standards at the national level in Canada that require or encourage the measurement or management of pavement skid resistance and macrotexture on road networks or set friction investigatory or intervention levels.

This was noted in the 1997 Canadian Pavement Design and Management Guide, Transportation Association of Canada ("TAC"):[1] "The actual designation of surface friction standards (such as minimum skid number, SN) is not commonly practiced by provinces/states or local agencies in Canada and the United States" (page 64).

This absence of friction measurement and management guidelines is also reflected in Canada's Road Safety Strategy (RSS) 2025 "Towards Zero: The Safest Roads in the World", released by the CCMTA in 2016. This strategy (and its three predecessors in 2001, 2006 and 2011) outlines a vision for improving road safety collaboratively through an inventory of over two-hundred road safety measures that focus on road users, road infrastructure, vehicles and other initiatives. However, pavement friction measurement and management are absent from the identified safety measures.

2. Pavement Friction Practices in Ontario

Commission Counsel to the Red Hill Valley Parkway Inquiry have advised that a number of individuals from the Ontario Ministry of Transportation ("MTO") will be called as witnesses at the public hearings who will testify as to MTO practice and policy respecting highway friction management in Ontario, including but not limited to its use of approved aggregate sources, the standards applied in evaluating the characteristics of aggregates, and its maintenance of a publicly available aggregate source list. Commission Counsel advises that individuals from the MTO will also expand upon the content of this section including its approach to friction measurement and its use of the ASTM E274 locked wheel tester. The information below is not intended to be an all-encompassing account of Ontario's friction measurement and management regime.

Construction and upkeep of provincial road networks and associated civil infrastructure in the province of Ontario is one of the responsibilities of the MTO. Municipalities are responsible for the maintenance of municipal highways and bridges within their respective jurisdictions pursuant to the *Municipal Act, 2001*.

The MTO does not have friction management policies that establish numerical friction measurement standards or friction level action limits for highways in Ontario, and thus no such standards are published by MTO. With respect to friction measurement, Ontario follows ASTM E274 (Skid Resistance of Paved Surfaces Using a Full-Scale Tire) and uses a locked-wheel trailer to measure fiction on its highway network. The practice in Ontario is to conduct the test at the posted highway speed limit.

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[1] TAC is one of a number of not-for-profit associations in Canada that facilitates research, information gathering and consultation with stakeholders; the Canadian Council for Motor Transport Administrators ("CCMTA") is another. The membership of these associations includes all three levels of government, consulting engineers, industry, and other practitioners in related fields. In general, these associations strive to work collaboratively to provide leadership and to address the priorities and research needs of their member organizations, but they do not perform any regulatory or enforcement role.

The earliest friction measurements in Ontario occurred in 1962 and utilized a British portable skid tester. Ontario began using a locked wheel trailer in 1967. Early efforts in Ontario focused on selection of skid-resistant pavement surfaces, and on developing a wet pavement accident spot identification and treatment program (Kamel and Gartshore, 1982).

With respect to friction management, Kamel and Gartshore (1982) presented tentative guidelines for a friction classification system for the MTO that would assess friction values (SN) collected at the posted speed limit, Table 1, as well as other factors such as traffic volume, speed limit, congestion, alignment, grade and curvature, to determine what type of rehabilitation measure may be recommended for the treatment of wet-pavement accident locations. MTO has not published any information available to the public that suggests one particular system of friction measurement standards should apply across road networks generally, including that set out in the tentative guidelines.

Table 1. Tentative guidelines for a friction classification system for Ontario, Kamel and Gartshore (1982)

Facility Type	Speed Limit, km/h	Friction Level (*SN*) at Speed Limit		
		Good	Borderline	Low
Freeways and main highways	100	≥31	25 to 30	<25
2-lane and 4-lane	80	≥32	27 to 31	<27
Intersections	80	≥40	31 to 39	<31
	60	≥45	36 to 44	<36

Ontario conducted network-level friction testing in 2006 (Abd El Halim, 2010). The survey included approximately 1,800 km of the provincial road network across three regions and was completed to determine a baseline of the network friction levels (skid numbers) in preparation for a considered Long Term Area Maintenance Contract for these regions. The published data was anonymized to remove reference to the region or road being tested. Tests were conducted using a locked-wheel device that conformed to ASTM E274 and a ribbed tire that conformed to ASTM E501 (Standard Rib Tire for Pavement Skid Resistance Tests). Where possible, a test speed of 65 km/h was maintained for this survey, although, as noted above, the practice in Ontario is to conduct data collection at the posted highway speed limit on provincial highways, which is generally between 80 and 100 km/h. A summary of the 2006 network skid numbers is shown in Table 2.

Table 2. Summary of 2006 network-level skid numbers conducted at 65km/h for three regions in Ontario (Abd El Halim, 2010)

Region	Highway Number	Minimum SN	Maximum SN	Average SN	Standard Deviation	Coefficient of Variance
A & B	1	31.8	56.2	41.7	4.6	11%
	2	24.9	57.7	36.7	7.1	19%
	3	27.7	50.9	35.1	5.0	14%
	4	29	45.9	36.2	5.1	14%
	5	25.7	51.5	38.6	6.5	17%
	6	19.6	45.4	33.2	4.9	15%
	7	24.1	48	37.9	4.1	11%
	8	25.7	64.9	40.6	7.2	18%
	9	10.3	56.5	35.4	8.9	25%
	10	30	57.7	40.8	6.0	15%
C	11	45.3	64.8	53.7	2.8	5%
	12	35.1	60.4	49.2	5.8	12%
	13	22.3	67.6	55.0	7.0	13%
	14	41.1	55.5	46.6	3.8	8%
	15	39	68.6	55.0	4.2	8%
	16	35.9	55.6	48.4	4.8	10%
	17	34.4	52.5	46.8	4.0	9%
	18	46.4	60.4	53.6	3.0	6%
	19	49.2	58	54.1	4.5	8%
	20	43.1	66.1	54.7	4.7	9%
	21	37.3	58.2	50.6	4.4	9%
	22	44.2	57.8	50.3	3.3	7%
	23	32.8	63.3	54.3	8.4	15%
	24	26.1	62.6	43.0	14.6	34%
	25	46.7	53.3	49.9	2.1	4%
	26	46.1	62.8	56.7	3.7	7%

3. Pavement Friction Practices in Other Provinces

While several provinces are known to have friction measuring equipment or to contract consultants to collect friction data on their provincial roadways, published information and outcomes from these programs are limited.

4. References

TAC (1997), "Pavement Design and Management Guide", Transportation Association of Canada.

CCMTA (2016), Canada's Road Safety Strategy (RSS) 2025, "Towards Zero: The Safest Roads in the World", Canadian Council of Motor Transport Administrators.

N. Kamel and T. Gartshore (1982), "Ontario's Wet Pavement Accident Reduction Program," ASTM Special Technical Publication 763, American Society of Testing and Materials, (ASTM), Philadelphia, Pennsylvania.

Amir Omar Abd El Halim (2010), "Improvement to Highway Safety through Network Level Friction Testing and Cost Effective Pavement Maintenance", PhD thesis, University of Waterloo.