IN THE MATTER OF *the Public Inquiries Act, 2009, S.O. 2009, c 33, Sch 6*

AND IN THE MATTER OF *the Resolution of the Council of the City of Hamilton dated April 24, 2019, establishing the Red Hill Valley Parkway Inquiry pursuant to section 274 of the Municipal Act, 2001, S.O. 2001, c 25*

CLOSING SUBMISSIONS OF GOLDER ASSOCIATES LTD.

March 13, 2023

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I. Table of Contents

Overview

1. Golder Associates Ltd.'s ("**Golder**") closing submissions are structured in two parts.

2. Part I focuses on Golder's involvement in the design and construction of the Red Hill Valley Parkway ("**RHVP**") in the period between 2005 and 2007; and secondly, Golder's engagement by the City of Hamilton ("**City**") between 2013 to 2018. This part of the submissions reviews Golder's factual findings and engineering reports, describes the recommendations and advice that Golder provided to improve frictional performance of the RHVP, and discusses the relevance of friction, a factor that may contribute to collisions on the RHVP.

3. Part II of Golder's submissions focusses on policy. This part of the submissions sets out Golder's policy recommendations and factors the Commission may wish to consider.

4. From the evidence relating to Golder's involvement with the RHVP, these main facts emerge:

   a. Dr. Uzarowski considered that theiction numbers on the RHVP reported by Tradewind Scientific Ltd. were relatively low, a finding with which the Inquiry's friction expert, Dr. Gerardo Flintsch, agrees.

   b. Dr. Uzarowski provided recommendations in the Golder Report in relation to the rehabilitation and preservation of the RHVP and how to improve the frictional characteristics of the asphalt surface of the RHVP.

   c. Dr. Uzarowski's findings, analysis and recommendations were reported to Mr. Moore, the Director, Engineering Services, Public Works for the City of Hamilton. Mr. Moore did not implement any part of the Golder Report, despite repeated recommendations by Golder.

   d. Further, Mr. Moore did not share the findings and recommendations made by Tradewind or Golder with others within Public Works.

   e. Although the frictional characteristics of the RHVP were relatively low, they were not by themselves a 'red flag'.

f. Dr. Uzarowski also provided further recommendations how to improve frictional characteristics of the RHVP to other employees of the City during several meetings related to other pavement and materials subjects. Again, his advice was not taken.

g. Frictional characteristics are a factor to be considered in relation to others such as excessive speed, design speed, geometry, including curvature and vertical alignment, distances between interchanges and weaving distances that may contribute to a high demand for friction.

h. The findings of the Tradewind Report and the Golder Report and the recommendations of these subject matter experts were relevant to any detailed safety analysis of the RHVP and should have been available to other staff within the City, and shared with the City's road safety consultant, CIMA, as part of a coordinated assessment of factors which contributed to collisions on the RHVP and could have been used in decision making to apply a treatment to improve the frictional characteristics of the pavement surface such as microsurfacing or shotblasting.

PART I – FACTS

5. Golder's submissions on the facts are structured around the following topics:

A. Background regarding Golder;

B. Summary of Golder's Investigation and Reports:

i. Perpetual Pavements Feasibility Study (the "**Feasibility Study**") – Decision to Use a Perpetual Pavement and SMA Asphalt;

ii. Perpetual Pavement Design Study, Phase 2 (the "**Design Study**");

iii. Construction of the Pavement Mainline and Ramps of the RHVP (the "**Project**") – Golder provided Quality Assurance;

iv. Pavement and Materials Technology Review ("**PMTR**") for the City of Hamilton;

v. Red Hill Valley Parkway – Performance Review after Six Years in Service (the "**2014 Golder Report**");

vi. The investigation and reporting for the Inertial Profiler Testing on the RHVP;

vii. Evaluation of Pavement Surface and Aggregates - Red Hill Valley Parkway (the "**2017 Pavement Evaluation**"); and

viii. Red Hill Valley Parkway HIR Suitability Study (the "**HIR Suitability**").

C. The surface frictional properties of the RHVP – 2007-2018: What does the data tell us and what do the experts say about it?

D. Findings, Analysis and Recommendations about Friction -- 'It would not have hurt and might have helped'

E. Techniques to improve Frictional Performance - Shotblasting/Skidabrading

F. Golder's Findings and Recommendations were received and understood

G. Friction and the Factors that may contribute to collisions on the RHVP.

A. Background Regarding Golder

6. Golder is an independent consulting, design and construction services engineering firm with specialist areas in earth, environment and energy. The Pavement and Materials Engineering Group operates within Golder's Environmental practice.

7. Dr. Ludomir Uzarowski, who has testified over seven days before this Inquiry, is a Principal and Senior Pavement and Materials Engineer in the Pavement and Materials Engineering Group within Golder, having joined Golder in 2003.[1] Dr. Uzarowski is a professional engineer licensed to practice engineering in Ontario and Alberta.[2] He holds a doctorate in civil engineering

[1] Exhibit 27 - CV of Dr. Uzarowski (GOL0001580); Transcript of Dr. Uzarowski, April 28, 2022, pg. 343-344, Lines 18-3
[2] Exhibit 27 - CV of Dr. Uzarowski (GOL0001580); Transcript of Dr. Uzarowski, April 28, 2022, pg. 342, Lines 3-13

with a specialty in pavement engineering from the University of Waterloo.[3] Dr. Uzarowski also holds master's degrees in civil engineering (Gdansk Technical University, 1974) and highway engineering (University of Nottingham, 1994) and is an Adjunct Professor at the University of Waterloo, Department of Civil and Environmental Engineering, where he taught infrastructure management and pavement design courses.[4] Prior to his employment at Golder, Dr. Uzarowski was a Principal Pavements and Quality Engineer at John Emery Geotechnical Engineering Limited ("**JEGEL**") and Head of the JEGEL Pavement Materials Research and Development Group.[5]

8. Dr. Uzarowski was awarded the CTAA Honorary Membership Award in 2021 for his lifetime of achievements and contributions to the asphalt industry. His practice includes the design of asphalt and concrete pavements, including the preparation of specifications and special provisions, pavement preservation and rehabilitation techniques and quality assurance reviews.[6] He acts for a wide range of private and public entities, including municipalities, federal and provincial agencies, airport authorities and also the Department of National Defence.[7] Dr. Uzarowski has published extensively in his field and presented technical papers throughout Canada, the United States, China and Japan on road and airport pavement design, life cycle costing, perpetual pavement design and construction, sustainability in pavement design, laboratory testing methods, laboratory and filed testing equipment, quality control/quality assurance, aggregates and granular materials, concrete pavement and materials technology, asphalt technology (cold in-place recycling, hot in-place recycling, foamed asphalt stabilization, emulsion stabilization, Superpave, SMA, asphalt specifications, new asphalt technologies in Ontario), crack sealants, pavement technology (asphalt and concrete pavements, airport pavements structural condition, pavement distresses, pavement condition evaluation, pavement mechanistic analysis, reflective cracking mitigation, perpetual pavements), deicing chemicals, winter maintenance, advanced road and runway weather information systems.[8] In 2009, Dr. Uzarowski was awarded the Willis Chipman

[3] Exhibit 27 - CV of Dr. Uzarowski (GOL0001580); Transcript of Dr. Uzarowski, April 28, 2022, pg. 342-343, Lines 24-6
[4] Exhibit 27 - CV of Dr. Uzarowski (GOL0001580); Transcript of Dr. Uzarowski, April 28, 2022, pg. 342, Lines 14-23
[5] Exhibit 27 - CV of Dr. Uzarowski (GOL0001580); Transcript of Dr. Uzarowski, April 28, 2022, pg. 344, Lines 4-8
[6] Exhibit 27 - CV of Dr. Uzarowski (GOL0001580); Transcript of Dr. Uzarowski, April 28, 2022, pg. 344, Lines 13-2
[7] Exhibit 27 - CV of Dr. Uzarowski (GOL0001580)
[8] *Ibid*

Award for Perpetual Pavement on Red Hill Valley Parkway in Hamilton by the Consulting Engineers of Ontario.[9]

9. Dr. Uzarowski was the principal contact at Golder in connection with the design of the perpetual pavement ultimately constructed on the RHVP and for four subsequent engagements relating to the RHVP: the Golder Report; the 2016 Inertial Profiler Testing; the 2017 Pavement Evaluation; and the HIR Suitability Study. Dr. Uzarowski was also the principal author of Pavement and Materials Technology Review which was completed in three phases and provided review and recommendations regarding the condition of asphalt on roads within Hamilton, revised quality control procedures for construction of asphalt pavements and the improvement of the specifications used in the design and construction of roads.

10. Dr. Uzarowski was assisted by Dr. Vimy Henderson (P.Eng. and Ph.D.) and Ms. Rabiah Rizvi (P.Eng.). Dr. Henderson was the Project Manager for the 2014 Golder Report, the 2016 Inertial Profiler Testing and for the initial stages of the 2017 Pavement Evaluation of the RHVP and HIR Suitability Study. Dr. Henderson is a licensed professional engineer in Ontario. She completed a doctorate in civil engineering in 2012 at the University of Waterloo.[10] Dr. Henderson is also a holder of a Bachelor of Applied Science in civil engineering from the University of Waterloo, where Dr. Henderson is now an adjunct professor in its Civil and Environmental Engineering Department.[11] Dr. Henderson left Golder in September of 2018 and continues her practice in pavement engineering.[12]

11. Ms. Rizvi took over as Project Manager for the 2017 Pavement Evaluation and the HIR Suitability Study. She is a licensed professional engineer in Ontario, Alberta, British Columbia, Nunavut, and Northwest Territories, and a Senior Pavement and Materials Engineer at Golder[13]

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[9] *Ibid*

[10] Exhibit 90 – CV of Dr. Henderson (GOL0007510); Transcript of Dr. Henderson, June 22, 2022, pg. 6213-6214, Lines 16-18

[11] Exhibit 90 – CV of Dr. Henderson (GOL0007510); Transcript of Dr. Henderson, June 22, 2022, pg. 6213, Lines 16-21

[12] Exhibit 90 – CV of Dr. Henderson (GOL0007510); Transcript of Dr. Henderson, June 22, 2022, pg. 6215-6216, Lines 21-18

[13] CV of Ms. Rizvi (GOL0007511); Transcript of Ms. Rizvi, June 23, 2022, pg. 6471-6472, Lines 11-5

Ms. Rizvi is the holder of a Bachelor of Applied Science with Honours, in Environmental Engineering, obtained at the University of Waterloo.[14] Ms. Rizvi's first involvement with the RHVP was in 2013 for the RHVP 2014 Golder Report where she was responsible for the Falling Weight Deflectometer ("**FWD**") testing analysis and the preparation of some components of the report of the FWD analysis.[15]

12. Mr. Andro Delos Reyes, a Certified Engineering Technologist, with a degree in engineering from the Philippines, provided construction review of the work during the paving of the RHVP as part of Golder's engagement to provide quality assurance.[16] Mr. Delos Reyes's title was Senior Inspector in the field and in the lab with duties including quality assurance review of materials and paving.[17] He worked closely with Dufferin and Trow on the testing of the aggregate for conformance with the project specifications.[18]

B. Golder's Investigation and Reports

i. 2005 Perpetual Pavements Feasibility Study – Decision to Use a Perpetual Pavement and SMA Asphalt

13. The detailed design of the RHVP was divided among three engineering firms: Stantec, Philips Engineering and McCormack Rankin. They were responsible for the civil design of the road and the alignment.

14. Consideration of the application of Stone Mastic Asphalt ("**SMA**") as a top course asphalt for the RHVP goes back at least to the early 2000s[19] and was expressly considered as a possible option for the RHVP in the 2003 revision to the Preliminary Design Report which described it as

[14] CV of Ms. Rizvi (GOL0007511); Transcript of Ms. Rizvi, June 23, 2022, pg. 6471, Lines 11-17

[15] Transcript of Ms. Rizvi, June 23, 2022, pg. 6472-6473, Lines 6-23

[16] Exhibit 28 – CV of Mr. Delos Ryes (GOL0005388); Transcript of Mr. Delos Reyes, May 02, 2022, pg. 693-694, Lines 10-25

[17] Transcript of Mr. Delos Reyes, May 02, 2022, pg. 697-698, Lines 16-10

[18] Transcript of Mr. Delos Reyes, May 02, 2022, pg. 710-712, Lines 11-6

[19] A 2002 CTAA paper co-authored by Mr. Gary Moore reviewed SMA placed in Hamilton on Burlington Street between Victoria Avenue and Wellington Street. The paper stated that the purpose of the placement was to evaluate the use of SMA to mitigate rutting in high traffic areas and to assess the potential of SMA for use on a proposed multi-lane expressway" (GOL0001567)

a "*a stone-on-stone, binder rich surface mix that provides quality rutting and cracking resistance*", was noise reducing and had been shown to have improved surface texture and skid resistance characteristics.[20] The City had also some experience with SMA placing it on Burlington Street and James Street in 2001.

15. In November of 2004, Dr. Uzarowski co-presented a paper titled "*Perpetual Asphalt Pavements*" at a conference hosted by the Canadian Technical Asphalt Association ("**CTAA**").[21] The paper explained the concept of perpetual pavements as a design intended to extend the effective service life of a road.[22] The design for a perpetual pavement included construction of a layer of what is described as 'rich bottom mix' ("**RBM**") which is a deep and flexible bottom layer to the pavement intended to provide better resistance to fatigue cracking. Mr. Gary Moore was interested in the potential application of perpetual pavement for the pavement on the RHVP. He met with Dr. Uzarowski on January 11, 2005, and they discussed the possibility of implementing a perpetual pavement on the RHVP. Dr. Uzarowski's evidence and notes of the meeting confirm Dr. Uzarowski's understanding that Mr. Moore intended to use SMA asphalt as the pavement surface. [23]

16. Golder was subsequently retained by Hamilton to prepare a feasibility study for the use of perpetual pavement on the RHVP in the 2005 Perpetual Pavements Feasibility Study (the "**Feasibility Study**"). [24] The Feasibility Study assessed the pros and cons of using a perpetual pavement in contrast to a conventional deep strength asphalt pavement option.[25] Mr. Moore provided the revised granular and asphalt quantities and prices, including for SMA[26] which was

[20] Overview Document ("**OD**") 3.1, image 7, para 15; Red Hill Creek Expressway Preliminary Design Report (HAM0031758_0001 at image 15)

[21] Perpetual Asphalt Pavements (GOL0003343)

[22] Correspondence of Dr. Uzarowski (GOL0003342) attaching the Perpetual Asphalt Pavements paper (GOL0003343)

[23] Exhibit 17 – Dr. Uzarowski notebook (RHV0000933 at image 2); Transcript of Dr. Uzarowski, April 28, 2022, pg. 359-360, Lines 2-25

[24] Correspondence of Golder re proposal and approval (GOL0003772 and HAM0050787_0001 attaching HAM0050788_0001); Purchase Order (GOL0004955); Transcript of Dr. Uzarowski, April 28, 2022, pg. 362, Lines 1-14; pg. 366, Lines 10-19

[25] Exhibit 18 – Feasibility Study (RHV0000935 at image 2); Transcript of Dr. Uzarowski, April 28, 2022, pg. 366, Lines 20-25; pg. 367, Lines 1-4

[26] OD3, image 17, para 32; Correspondence of Mr. Moore (HAM0050812_0001 attaching HAM0050813_0001 and HAM0050814_0001)

used by Dr. Uzarowski in his life cycle cost analysis and supported the cost advantage of the perpetual pavement design for use on the RHVP.[27]

17. The Feasibility Study[28] was prepared by Golder in tandem with a CTAA Paper titled "*Sustainable Pavements – Making the Case for Longer Design Lives for Flexible Pavements*",[29] which was essentially the same topic and discussed the benefits in terms of sustainability and value of a perpetual pavement.[30]

18. Dr. Uzarowski's notes of September 28, 2005, recorded a discussion with Mr. Moore about finishing Phase 1 and a possible Phase 2 of the perpetual pavement project for the review of the existing pavement designs, preparing a perpetual pavement design and the preparation of specifications for the asphalt.[31] Dr. Uzarowski's notes record a further discussion with Mr. Moore regarding Phase 2 of the perpetual pavement project, including mix requirement and specification development for "*Superpave, SMA, and RBL*".[32]

19. The signed and final Feasibility Study (dated "*August 2005*")[33] was delivered to Mr. Moore on or about October 12, 2005.[34] The Feasibility Study concluded that: "*A flexible pavement satisfying the requirements for perpetual pavement design is recommended for Red Hill Creek Expressway*".[35] The anticipated life expectancy of the pavement expressly anticipated that the

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[27] Exhibit 18 – Feasibility Study (RHV0000935 at image 4); Transcript of Dr. Uzarowski, April 28, 2022, pg. 369, Lines 3-12

[28] Exhibit 18 – Feasibility Study (RHV0000935); Correspondence of Dr. Uzarowski (GOL0003356)

[29] Sustainable Pavements paper (GOL0003367)

[30] OD 3, image 17-18, paras 31-34; Transcript of Dr. Uzarowski, April 28, 2022, pg. 368, Lines 8-25; pg. 369, Lines 1-2

[31] Exhibit 17 – Dr. Uzarowski notebook (RHV0000933 at image 20); Transcript of Dr. Uzarowski, April 28, 2022, pg. 376, Lines 14-25; pg. 377, Lines 1-22

[32] OD3, image 19, para 36; Exhibit 17 – Dr. Uzarowski notebook (RHV0000933 at image 23); Transcript of Dr. Uzarowski, April 28, 2022, pg. 377, Lines 7-22

[33] Exhibit 18 - RHV000935; Transcript of Dr. Uzarowski, April 28, 2022, p 371, lines 22-25; p 372, line 1

[34] Dr. Uzarowski emailed Donna Walsh (Facilities Manager, Golder) the "*Perpetual Pavements Feasibility Study*" for the RHVP (dated "*August 2005*") and appendices on October 12, 2005, to finalize the document for delivery (OD 3, image 19, para 37, also see GOL0003747). Transcript of Dr. Uzarowski, April 28, 2022, p 370, lines 19-25; p 371, lines 1-25

[35] Exhibit 18 – Feasibility Study (RHV0000935 at image 6); Transcript of Dr. Uzarowski, April 28, 2022, pg. 372, Lines 2-12

asphalt would receive regular maintenance in the form of routing and sealing of cracks on the surface, as well as periodic mill and patch, and mill and overlay.[36]

ii. Perpetual Pavement Design Study, Phase 2

20. On November 22, 2005, Dr. Uzarowski submitted a proposal[37] to Mr. Moore for the design of the perpetual pavement, and to update paving specifications and prepare special provisions for the tender and construction of the pavement, which was accepted by a purchase order issued by Hamilton on the same day.[38]

21. The Perpetual Pavement Design Study, Phase 2 (the "**Design Study**"), updated the original pavement design, prepared by Peto MacCallum and Soil Mat Engineers, to a perpetual pavement by altering the asphalt layers and adding a rich bottom mix layer.[39] The perpetual pavement design was forecasted to structurally support 93 million ESALs over 50 years.[40] The proposed specifications identified the applicable Ontario Provincial Standards Specification for aggregate and for the asphalt mixes as well as special provisions.

22. The design along with specifications were issued in a draft dated March 2006. The design for the perpetual pavement was revised several times.[41] The final design was as follows:[42]

[36] Exhibit 18 – Feasibility Study (RHV0000935, Tables 7 and 8 at images 25 and 26)

[37] Correspondence of Dr. Uzarowski (HAM0050819_0001) attaching Proposal (HAM0050820_0001)

[38] PO requisition form (HAM0000268_0001); Transcript of Dr. Uzarowski, April 28, 2022, pg. 381, Lines 12-25; pg. 382, Lines 1-6

[39] Design Study (GOL0003741 at image 2); Transcript of Dr. Uzarowski, April 28, 2022, pg. 382, Lines 7-23

[40] Design Study and Special Provisions (GOL0003741, GOL0003740, GOL0003742, GOL0003743, GOL0003744, GOL0003745 and GOL0003746)

[41] Design Study (GOL0003741 at image 2)

[42] Design Study (GOL0003741 at image 2)

	Perpetual Pavement design (mm)
SMA 12.5	40
SP 19.0	50
Superpave SP 25.0	70
SP 19.0 Rich Bottom Mix Layer	80
Granular A Base	150
Subbase, Granular B Type II	390
Total Pavement Thickness	780
Structural Number (S_N)	173

23. The pavement design and specifications and special provisions recommended in the report were incorporated in the tender for the pavement construction in early 2007.[43] The notice of tender for contract PW-06-243 and the tender document were released by the City on April 25, 2006, with a closing date of May 25, 2006.[44] An addendum to the original tender was issued by the City, requiring approval of a trial section prior to placement of SMA or RBM layers on the mainline.[45] Dr. Uzarowski's evidence was that he recommended trial sections, given that RBM was a new mix and production and placement of SMA could be challenging. Therefore, he recommended a trial section to verify that the contractor could produce and place both mixes to meet the project specification requirements.[46]

24. The mainline paving contract (the "**Project**") was ultimately awarded to Dufferin, on July 12, 2006.[47]

[43] Tender (DUF0002533.001 at images 91 and 92) Transcript of Dr. Uzarowski, April 28, 2022, pg. 384, Lines 11-25; pg. 385, Lines 1-7

[44] OD3, image 26, para 52; Notice of Tender (HAM0003013_0001); Tender (DUF0002533.001)

[45] OD3, image 27, para 55; Addendum No.1 (HAM0051398_0001 at images 1 and 2)

[46] Transcript of Dr. Uzarowski, April 28, 2022, pg. 385, Lines 9-25, pg. 386, Lines 1-25; pg. 387, Lines 1-3; Addendum No.1 (HAM0051398_0001 at images 1 and 2)

[47] OD3, image 29, para 58-59; Correspondence to Dufferin (HAM0007761_0001)

iii. Construction of the Pavement Mainline and Ramps of the RHVP – Golder provided Quality Assurance

25. Dufferin was the successful bidder for the construction of the pavement mainline and ramps of the RHVP.[48] Philips Engineering was the consultant retained by Hamilton to administer the project. In turn, Golder was retained by Philips to provide quality assurance, including material and mixture testing, sampling of asphalt materials, compaction testing of placed asphalt mat and review of field and laboratory test results to determine compliance with project specifications.[49] As contractor, Dufferin had the primary obligation to provide quality control.[50] Dufferin retained a geotechnical consultant, Trow, to provide quality control testing of materials from Dufferin's asphalt plant.[51]

26. Dufferin proposed to use aggregate from its Demix-Varennes (the "**Aggregates**") quarry for the Superpave 12.5 FC2 and SMA mixes for the Project.[52] At the time, the Demix Varennes quarry was not on the Ontario Designated Source Materials list ("**DSM**"), and it was first listed in 2009.[53] Dufferin noted that the Varennes aggregate had been used on Ministry of Transportation for Quebec projects and provided physical test data.[54] It was not a mandatory requirement of OPSS 1003 or OPSS 1151 for the aggregates to be on the DSM list.

27. Dr. Uzarowski's evidence was that he would have preferred that the aggregate be supplied from a quarry identified on the DSM list. That way the MTO effectively qualified the material confirming the laboratory characteristics and verifying the functional performance.[55] The contractual specifications and special provisions for the Project included that the aggregate meet

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[48] Notice to proceed with paving, July 13, 2006 (HAM0007761_0001)

[49] Golder's proposal for inspection and testing services, July 28, 2006 (GOL0000396 which revised an earlier proposal (GOL0000397)); Transcript of Dr. Uzarowski, April 28, 2022, pg. 388-389, Lines 10-12

[50] Transcript of Dr. Uzarowski, April 28, 2022, pg. 389, Lines 13-19

[51] Minutes of paving meeting #5, March 20, 2007 (HAM0007868_0001 at image 2)

[52] Letter from Philips re approval of Aggregates and attaching Demix test data, March 20, 2007 (GOL0004872, attaching GOL0004873, GOL0004874, GOL0004875, GOL0004876)

[53] The MTO issued a conditional approval of the Demix Varennes Quarry for SF12.5 FC1 and SF12.5 FC2 Coarse and fine aggregates, in a letter dated December 4, 2008 (MTO0000044 attaching MTO0000045)

[54] Fax to Golder enclosing Dufferin's approval of Aggregates letter, March 20, 2007 (GOL0004871, attaching GOL0004872, GOL0004873, GOL0004874, GOL0004875 and GOL0004876)

[55] Golder's fax re review of aggregate physical properties, March 23, 2007 (GOL0000248); Transcript of Dr. Uzarowski, April 28, 2022, pg. 407-410, Lines 13-18

Ontario Provincial Standard Specifications ("**OPSS**"), particularly OPSS 1003.[56] OPSS 1003 contained detailed physical requirements for aggregates.[57] Dufferin was obliged to supply aggregate that met the contractual specifications and did so by delivering the testing data for the aggregate to verify the Aggregate as compliant.[58]Dr. Uzarowski reviewed the test data to verify that it met the specifications for the Project.[59]

28. Dufferin provided physical test data submitted by the Demix quarry first on March 20, 2007.[60] Dr. Uzarowski responded on March 23, 2007, noting among other things that the laboratories conducting the aggregate physical property and consensus testing must hold valid CCIL TypeD certification and that the physical test data must be no older than 14 months at the time of submissions.[61] In his email to Philips, he stated that: "*The contractor would like to use these aggregates in the Superpave 12.5 FC2 and SMA mixes for the paving of the Red Hill Valley Project (RHVP). As the aggregate source is not listed on the MTO's Designated Source Material (DSM) list, the above aggregates to be approved for use in the RHVP must meet the aggregate requirements specified in the OPSS standards, including method of testing and specifications*."[62] Dr. Uzarowski required additional independent and more current test results for the aggregate.[63]

29. Dufferin provided updated laboratory test results for the physical properties of the aggregates from a CCIL certified laboratory on April 23, 2007.[64] The laboratory testing of the Aggregates included, among others, the following tests: Micro-Deval abrasion, Los Angeles impact and abrasion loss, petrographic examination, soundness and freeze-thaw resistance.[65]

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[56] Contract No. PW-06-243 (DUF0002533.001 at image 92)

[57] OPSS 1003 (GOL0003905 at image 5); Transcript of Dr. Uzarowski, April 28, 2022, pg. 411-413, Lines 1-16

[58] Fax to Golder enclosing Dufferin's approval of Aggregates letter, March 20, 2007 (GOL0004871, attaching GOL0004872, GOL0004873, GOL0004874, GOL0004875 and GOL0004876)

[59] Golder's fax re review of aggregate physical properties, March 23, 2007 (GOL0000248); Transcript of Dr. Uzarowski, April 28, 2022, pg. 407-410, Lines 13-18

[60] Fax to Golder enclosing Dufferin's approval of Aggregates letter, March 20, 2007 (GOL0004871, attaching GOL0004872, GOL0004873, GOL0004874, GOL0004875 and GOL0004876)

[61] Golder's fax re review of aggregate physical properties, March 23, 2007 (GOL0000248); Transcript of Dr. Uzarowski, April 28, 2022, pg. 407-410, Lines 13-18

[62] Golder's fax re review of aggregate physical properties, March 23, 2007 (GOL0000248)

[63] Golder's fax re mainline paving, March 23, 2007 (GOL0004868)

[64] Email and letter from Dufferin to Golder attaching lab test results, April 23, 2007 (GOL0001768, GOL0001769 and GOL0001770)

[65] Dufferin's lab test results, April 23, 2007 (GOL0001770)

Dr. Uzarowski considered that the physical properties of the Aggregates were excellent, a finding with which Mr. Chris Rogers who qualified the Aggregates for the DSM list in 2008 agreed.[66] Dufferin provided test results to establish the Aggregates' resistance to polishing in the form of a Coefficient of polishing by projection ("**Cpp**") test conducted by the Quebec Ministry of Transportation ("**MTQ**") in 2005 which exceeded the value required in Quebec.[67] Subsequent testing conducted by the MTO in 2008 using a polished stone value testing method ("**PSV**") resulted in a value of 52 (MTO require that the PSV for the aggregates to be placed on the DSM list should be at least 50).[68] Dr. Baaj noted that although "*the PSV was not part of the OPS Specifications and it was not a mandatory requirement for the aggregate to be part of the DSM list in 2007, the value of the PSV reported for the Aggregate was higher than the value required in the current specifications*."[69]

30. Subsequent review of the testing data provided by Dufferin in 2007 as well as the MTO testing conducted in 2008 by Dr. Hassan Baaj confirmed that the physical properties of the Aggregates in terms of their abrasion and attrition resistance, soundness and freeze-thaw resistance were all excellent.[70] Dr. Baaj confirmed: [71]

> *In summary, based on the Aggregates mechanical, physical, petrographic, and polishing properties as per the testing conducted in 2007 and 2008, I conclude that the Aggregate meets all the requirements for SMA 12.5 Mix and Traffic Category E in Ontario. Accordingly, the Aggregate could have been expected to be adequate for projects requiring good skid resistance. The Aggregate is, therefore, suitable for surface-course asphalt mixes used for high-volume, high-speed highways in Ontario.*

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[66] Exhibit 244 - Dr. Hassan Baaj, *Analysis of Aggregate Testing and Evaluation of the Coarse Aggregate used in the RHVP Pavement Surface Course*, February 2023 (GOL0007517 at image 19); Transcript of Dr. Uzarowski, April 28, 2022, pg. 418-419, Lines 22-5; pg. 422-423; Transcript of Mr. Rogers, May 19, 2022, pg. 2623-2626, Lines 20-11

[67] Exhibit 224 - Dr. Hassan Baaj, *Analysis of Aggregate Testing and Evaluation of the Coarse Aggregate used in the RHVP Pavement Surface Course*, February 2023, (GOL0007517 at image 19)

[68] *Ibid*

[69] *Ibid*

[70] *Ibid*

[71] *Ibid*

31. Dr. Gerardo Flintsch in his testimony considered Dr. Baaj's review very thorough and agreed with the finding, as did Mr. Hein.[72]

32. The Minutes of the RHVP Paving Construction Meeting No. 7 of May 8, 2007, recorded the finding that the physical properties of the Aggregates were all acceptable.[73] However, the asphalt mixes did not meet the volumetric requirements and were not accepted.[74]

33. Dufferin submitted its mix design including the Aggregates on June 22, 2007, along with a sample mix that was delivered to Golder's Whitby laboratory for testing.[75] Minutes from the RHVP Site Meeting No. 9 of July 10, 2007, record that Golder indicated that the SMA mix design appears to be satisfactory and that it would provide written confirmation of their analysis.[76] However, physical testing of the asphalt mix by Golder using an ignition oven resulted in some aggregate breakdown at very high temperatures. Dufferin responded by email of July 17, 2007, noting the breakdown discovered during the ignition oven testing and provided further laboratory testing of the Aggregate for micro-deval.[77] Golder verified the Dufferin testing by conducting its own additional laboratory testing of Micro-Deval as well as LA Abrasion to test the toughness of the aggregate and resistance to abrasion.[78] Dr. Uzarowski confirmed that the test results were excellent.[79]

34. Having verified that the laboratory test results established that the Aggregate had excellent physical characteristics, Dr. Uzarowski sought to confirm the field performance. He described the field performance as the missing element in the picture.[80] He contacted the MTQ on July 18,

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[72] Transcript of Dr. Flintsch, February 16, 2023, pg. 15542-15543, Lines 12-5; Transcript of Mr. Hein, February 24, 2023, pg. 16344, Lines 3-13

[73] Minutes of paving meeting #7, May 08, 2007 (HAM0007883_0001 at image 2)

[74] *Ibid*

[75] Email from Dufferin to Golder attaching mix design, June 22, 2007 (GOL0001630 attaching GOL0001631)

[76] Minutes of paving meeting #9, July 10, 2007 (GOL0001617 at image 2)

[77] Email from Dufferin to Golder, July 17, 2007 (DUF0001966.01)

[78] Exhibit 20 – Golder's LA Abrasion test, July 17, 2007 (GOL0000244); Exhibit 21 – Golder's Micro-Deval test, July 18, 2007 (GOL0000245); Transcript of Dr. Uzarowski, April 28, 2022, pg. 437-441, Lines 1-25

[79] Transcript of Dr. Uzarowski, April 28, 2022, pg. 441, Lines 5-25; pg. 442, Lines 1-25; pg443, Lines 1-2

[80] Transcript of Dr. Uzarowski, April 28, 2022, pg. 447, Lines 1-25

2007.[81] Dr. Uzarowski's notes record the information provided by Ms. Danielle Fleury: "*Very good aggregates used in HMA. One of the best aggregates. Used on high volume roads.*"[82]

35. Dufferin paved a test strip of the SMA mix on July 25, 2007.[83] SMA plant samples showed the mix used in the test strip paving did not meet the specified requirements[84] and the compaction testing of the strip were in the rejectable zone.[85] Dr. Uzarowski explained that the objective of the test strip was to check whether the contractor could produce the mix, place and compact it and meet the requirements of the specifications.[86] Dr. Uzarowski's evidence was that it was not uncommon for a test strip to fail[87], and that the test strip verifies that the contractor can do it but it also is so the contractor can learn. Dr. Uzarowski observed that it was very important for the contractor to learn how to modify the paving to do it in accordance with the specifications.[88] While the addendum to the tender specified that in case of failure of the test strip, Dufferin (the contractor) should do another one, Dufferin did not. Dr. Uzarowski's evidence was that as consultants, Golder only had the power to advise the contract administrator of the failure but could not force the contractor to perform another test. That was within the power of the contract administrator, Philips, and the owner.[89]

36. In response to a rumor that the MTO was not allowing Ontario Traprock (an aggregate supplier) to supply aggregate for SMA mixes, Dr. Uzarowski contacted Dr. Chris Raymond of the MTO on July 31, 2007. Dr. Raymond's email of August 1, 2007 recorded his recollection of the discussion and confirmed that he had informed Dr. Uzarowski that the Ministry had concerns with early life friction in some SMA pavements. [90] His email stated, among other things, that the

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[81] Dr. Uzarowski notebook (GOL0007410 at image 17); Transcript of Dr. Uzarowski, pg. 447-448, Lines 1-25

[82] Dr. Uzarowski notebook (GOL0007410 at image 17)

[83] Email of Golder, Jul 23, 2007 (GOL0001750) and Email of Golder, July 26, 2007 (GOL0001736 attaching GOL0001737, GOL0001738, GOL0001739, GOL0001740, GOL0001741, GOL0001742, and GOL0001743)

[84] Email of Golder, July 27, 2007 (GOL0001734); Dr. Uzarowski notebook (GOL0007410 at image 17)

[85] Email of Golder, July 26, 2007 (GOL0001736 attaching GOL0001737, GOL0001738, GOL0001739, GOL0001740, GOL0001741, GOL0001742, and GOL0001743); Transcript of Dr. Uzarowski, April 28, 2022, pg. 459-461, Lines 2-25

[86] Transcript of Dr. Uzarowski, April 28, 2022, pg. 458, Lines 17-25

[87] Transcript of Dr. Uzarowski, April 28, 2022, pg. 464, Lines 9-12

[88] Transcript of Dr. Uzarowski, April 28, 2022, pg. 464-465, Lines 13-7

[89] Addendum No. 1 to paving contract (HAM0051398_0001); Transcript of Dr. Uzarowski, April 28, 2022, pg. 467-468, Lines 1-3

[90] Internal MTO correspondence, August 1, 2007 (MTO0001265)

Ministry had developed a short list of acceptable SMA aggregates. Dr. Raymond's email says that Dr. Uzarowski expressed concern regarding the proposed use of SMA on a City of Hamilton project using an aggregate not on the Ministry's DSM list.[91] Dr. Raymond recorded that a possible outcome might be that the City of Hamilton could make a request for friction testing.[92]

37. Dr. Uzarowski's evidence was that he was not concerned about the use of SMA as he was convinced that SMA was the right application.[93] However, he would have preferred if the aggregate were on the DSM list and therefore that its performance had been verified. As a consequence of this discussion, Dr. Uzarowski recommended friction testing to determine if early age low friction was a problem.[94] Dr. Uzarowski explained that they would then know what they had and what action was required.[95]

38. On August 9, 2007, Mr. Oddi (Senior Project Manager, Engineering Services, City) wrote to Dufferin and confirmed: "*the Varennes DEMIx aggregates have been approved for use in the SMA and Superpave 12,5 FC2 surface course asphalt mixes on the Red Hill Valley Parkway mainline paving project. The trial batches for both mix designs met the specified requirements.*"[96] Golder did not receive and was not involved in Mr. Oddi's email of August 9, 2007, approving the aggregate.[97]

39. Dufferin proceeded to begin paving the mainline with the SMA mix on August 1, 2007. As part of its quality assurance role, Golder had developed a customized pavement compaction requirement for the RHVP, with compaction specifications that was more stringent than the OPSS 310.[98] Field testing results on the Northbound lanes of the mainline on August 1, 2007, showed some compaction tests that were rejectable at certain locations[99]. Dr. Uzarowski and Mr. Delos

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[91] *Ibid*

[92] *Ibid*

[93] Transcript of Dr. Uzarowski, April 28, 2022, pg. 478, lines 17-22

[94] Transcript of Dr. Uzarowski, April 28, 2022, pg. 479, lines 5-19

[95] Transcript of Dr. Uzarowski, April 28, 2022, pg. 480, lines 21-25 and pg. 481, lines 1-2

[96] Email confirming approval of Aggregates (DUF0002741.01)

[97] Email confirming approval of Aggregates (DUF0002741.01): Mr. Gamble then forwarded Mr. Oddi's email to Mr. Gangaram); Transcript of Dr. Uzarowski, April 28, 2022, pg. 502-503, lines 7-15

[98] Transcript of Dr. Uzarowski, April 28, 2022, pg. 491-498, lines 1-25

[99] Asphalt nuclear density test results (GOL0001718); Transcript of Dr. Uzarowski, April 28, 2022, pg. 496-498, lines 1-25

Reyes, who was on site and provided construction review of the work, both testified that they collaborated with the contractor and provided recommendations of compaction process improvements in order that Dufferin could improve the compaction operations.[100] As a result of these efforts, the compaction of the mainline conducted on August 11 and 13, 2007 met the OPSS 310 specifications, and substantially met the Golder specifications.[101] Both Dr. Uzarowski and Mr. Delos Reyes testified that the quality of the SMA asphalt mat on the RHVP was good and no fat spots or flushing was observed.[102]

40. Further, as part of its quality assurance role, Golder collected and reviewed the test results for the asphalt samples obtained during the RHVP paving. Dr. Uzarowski's evidence was that considered overall, the SMA test results were good.[103] In his affidavit of April 8, 2022, Dr. Uzarowski provided a detailed review of the test results. He concluded: [104]

> *In my opinion, the SMA test results are good overall. As it pertains to the 10 SMA results that were rejectable on a single sieve, I do not believe that I would have recommended rejection of the entire paved area that these samples represented, although I do not have a specific recollection of doing so. I base my present belief on two reasons: first, the impact of gradation outside the envelope on one sieve would not be significant and second, asphalt removal and replacement would create new cold joints that could have negative impact on pavement performance and could be technically difficult.*

41. In his evidence of the paving records, Dr. Flintsch found that the mix design was consistent with current mix design practices for SMA. He noted that there were some departures from the mix design values, none of them would be expected to have a significant negative impact on the frictional properties of the pavement surface. Dr. Flintsch also noted the low compaction on some sections paved in early August. He noted that the low compaction in some sections could have a

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[100] Transcript of Dr. Uzarowski, April 28, 2022, pg. 498, lines 21-25; pg. 499, lines 1-25; pg. 500, lines 1-6; Transcript of Mr. Delos Reyes, May 2, 2022, pg 808, lines 22-25 and pg 809, lines 1-7

[101] Transcript of Dr. Uzarowski, April 28, 2022, pg. 498-502, Lines 12 - 5

[102] Transcript of Mr. Delos Reyes, May 2, 2022, pg. 814, lines 8-17; pg. 815, lines 6-25; Transcript of Dr. Uzarowski, June 15, 2022, pg. 5536, lines 21-25; pg. 5537, lines 1-10

[103] Exhibit 23 - Affidavit of Dr. Uzarowski, April 8, 2022, (RHV0000928 at image 4, para 7)

[104] *Ibid*

negative impact on durability but that low compaction would not have contributed to low friction.[105]

42. Following his July 31, 2007 discussion with Mr. Raymond (MTO), Dr. Uzarowski recommended skid testing be conducted on the RHVP and had discussions with Mr. Moore, Mr. Delos Reyes, and Mr. Raymond about the MTO performing the testing.[106] Mr. Delos Reyes made the logistical arrangements for the testing with the MTO and the City.[107] Though the City consented to the MTO testing, it did not and was not prepared to make a request to the MTO directly.[108] Ms. Becca Lane of the MTO speculated: "*Maybe they are concerned about the results from a liability perspective*".[109]

43. Dr. Uzarowski received the October 16, 2007, MTO skid testing results from Mr. Raymond on October 18, 2007. The numbers were generally above FN (90)30. Mr. Raymond noted the values below 30 coincided with the presence of overhead structures.[110] Dr. Uzarowski considered that the results for newly paved SMA asphalt were generally good and acceptable.[111] Dr. Uzarowski understood that the MTO considered that acceptable early value for friction was FN 30 measured at highway speed.[112] Dr. Uzarowski expected the numbers to increase as the asphalt cement film on the pavement wore off with traffic.[113] Dr. Uzarowski forwarded the email to Mr. Moore and Mr. Oddi.[114] His evidence was that he discussed these results over the phone and advised that they were acceptable.[115]

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[105] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 26)

[106] Dr. Uzarowski notebook (GOL0007410 at image 35 and GOL0007408 at image 75); Internal MTO email (MTO0018696); Transcript of Dr. Uzarowski, April 28, 2022, pg. 511, lines 4-10. MTO0018696

[107] Transcript of Dr. Uzarowski, April 28, 2022, pg. 518, Lines 15-25; pg. 519, Lines 1-15

[108] Internal MTO correspondence (MTO0000005 and MTO0000007); LU, April 28, pg. 514, Lines 16-25

[109] Internal MTO correspondence (MTO0000007)

[110] Transcript of Dr. Uzarowski, April 28, 2022, pg. 520, Lines 16-23

[111] Transcript of Dr. Uzarowski, April 28, 2022, pg. 524, Lines 18-25, pg. 525, Line 1

[112] Transcript of Dr. Uzarowski, April 28, 2022, pg. 521, Lines 12-19; pg. 522, Lines 18-21

[113] Transcript of Dr. Uzarowski, April 28, 2022, pg. 523, Lines 1-13

[114] GOL0003513 attaching GOL0003514 and GOL0003515

[115] Transcript of Dr. Uzarowski, April 28, 2022, pg. 527, Lines 15-22; pg. 528, Lines 7-17

iv. Pavement And Materials Technology for the City of Hamilton

44. Between 2009 and 2013, Golder was retained to conduct the Pavement and Materials Technology Review ("**PMTR")** for the City.[116] The PMTR project, which was conducted in three phases, led to the delivery of three signed reports by Golder[117]: Phase I of Pavement and Materials Technology Review for the City of Hamilton, Ontario (November 2009)[118]; Pavement and Materials Technology Review – Phase II (April 2012)[119]; and Pavement and Materials Technology Review – Phase III (December 31, 2013)[120]. Dr. Uzarowski's evidence, which was corroborated by the content of the PMTR Phase I report, was that Mr. Moore and the City had concerns that the City's pavements were underperforming, and that the new or more advanced pavement and materials technology had not been fully implemented in the City.[121] As explained by Dr. Uzarowski, the City wanted to ensure that they were getting full value for their roads, in return for the high investments on them, so this project was a long-term objective to improve pavement performance.[122]

45. Golder's tasks for PMTR phase I included the visual inspection of the City's pavement conditions, a review of the City's maintenance, rehabilitation and construction specifications, a review of materials, and development of recommendations.[123] Following Golder's field inspection of large number of pavements in the City where major structural and pavement distresses were observed, Dr. Uzarowski's evidence was that he met with Mr. Moore to discuss Golder's observations, as detailed in his notebook entries of September 15, 2009, before finalizing the report after Golder incorporated the limited comments the City provided.[124] Golder's conclusion was that

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[116] Transcript of Dr. Uzarowski, June 15, 2022, pg. 5487, Lines 8-14

[117] Transcript of Dr. Uzarowski, June 23, 2022, pg. 6456-6460, Lines 8-11; Dr. Uzarowski provided evidence that these reports were finalized after comments on the draft were received from the City, and after the City agreed to the content of the reports. This evidence is in contrast with the Golder report where the City did not provide comments to Golder (see earlier transcript reference)

[118] PMTR I report (HAM0000723_0001)

[119] Exhibit 117 – PMTR II report (GOL0007440)

[120] PMTR III report (GOL0007504)

[121] Transcript of Dr. Uzarowski, June 15, 2022, pg. 5487-5488, Lines 21-10

[122] Transcript of Dr. Uzarowski, June 15, 2022, pg. 5488, Lines 3-10

[123] Transcript of Dr. Uzarowski, June 15, 2022, pg. 5488-5489, Lines 20-11

[124] OD 5, image 25, para 54; Dr. Uzarowski notebook (GOL0007396 at image 18); Transcript of Dr. Uzarowski, June 23, pg. 6456-6457, Lines 8-4

the City's processes for quality control were ineffective and required significant improvement.[125] Dr. Uzarowski's evidence was that the findings of this report were presented to a large number of City employees, including Mr. Moore.[126]

46. Notebook entries of Dr. Uzarowski indicated that Dr. Uzarowski and Mr. Moore met to discuss the PMTR phase II project on September 15 and December 15, 2009.[127] As noted in the PMTR phase II report, the objective of this phase was the "*development of specific recommendations for upgrading and improving the current City's Materials and Construction Specifications.*"[128] PMTR phase II records that it was delivered on December 19, 2011 and discussed at a presentation before.[129] Golder dedicated an entire section in the PMTR phase II report to Pavement Preservation and at the presentation to the City employees, described its strategy as one that "*enhances functional pavement performance by using an integrated, cost-effective set of practices that extend pavement life*".[130] Microsurfacing was specifically identified as a pavement preservation technique and the description noted the technique improved skid resistance.[131]

47. Dr. Uzarowski's evidence, and as described in the PMTR phase III report was that this report was to assist in the implementation of the recommendations in Phase I and II, to develop updated pavement design matrix, to provide recommendations for maintenance and rehabilitation alternatives and to provide recommendations for new paving technologies.[132] Golder repeated its description of the utility of microsurfacing as a pavement preservation method, including the minimal traffic disruption, the improvement of skid resistance, and a high life expectancy.[133] Golder recommended that the City consider microsurfacing due to the majority of City roads being

[125] PMTR I report (HAM0000723_0001 at image 18)
[126] PMTR I report (HAM0000723_0001 at image 5); Transcript of Dr. Uzarowski, June 23, 2022, pg. 6456-6457, Lines 8-10
[127] Dr. Uzarowski notebook (GOL0007396 at images 19 and 28)
[128] Exhibit 117 – PMTR II report (GOL0007440 at image 5)
[129] Exhibit 117 – PMTR II report (GOL0007440 at image 7); Transcript of Dr. Uzarowski, June 23, pg. 6455-6456
[130] Exhibit 117 – PMTR II report (GOL0007440 at images 9 and 49); Transcript of Dr. Uzarowski, June 23, pg. 6457-6458, lines 11-3
[131] Exhibit 117 – PMTR II report (GOL0007440 at image 51)
[132] PMTR III report (GOL0007504 at image 5); Transcript of Dr. Uzarowski, June 15, 2022, pg. 5491-5492, lines 16-10
[133] PMTR III report (GOL0007504 at images 32 and 33)

in good structural condition but exhibiting surface distresses.[134] Throughout all three phases of the PMTR, Dr. Uzarowski provided several recommendations for the City to get better value from their investment in their roads.

48. Notwithstanding the widespread presentation of Golder's investigation, analysis and reporting, the PMTR reports were not maintained as a resource and were apparently all but forgotten by 2018 when the City's auditor initiated the roads value for money audit.[135] In the event, the PMTR reports were extensively cited by the City's Auditor, duplicating Golder's work effort of the decade previous, repeating the analysis and recommendations Dr. Uzarowski had already provided in the PMTR reports.[136] The Pavement Preservation Management section in the Roads Value for Money Audit report appears to be a summary of the Pavement Preservation analysis contained in the PMTR Phase II report.[137] As well, the microsurfacing section contained in the audit report is almost identical to the section in the PMTR Phase II report.[138]

v. The 2014 Golder Report

49. RHVP developed "*low severity cracking*" following significant flooding episodes in July 2009 and July 2010.[139] Dr. Uzarowski's notes record a meeting with Mr. Moore on November 21, 2012[140] in which they discussed evaluating the condition of the RHVP pavement five years after construction.[141]

50. Mr. Moore requested that a proposal be submitted for the pavement evaluation by email of March 1, 2013.[142] Accordingly, Dr. Uzarowski submitted a proposal titled "*RHVP 5 Year*

[134] PMTR III report (GOL0007504 at image 33)

[135] OD9a, image 78, paras 190 – 192 – A back and forth between city staff Mr. Gord McGuire, Mr. Mike Becke and Ms. Susan Jacob indicated that nothing had been done with the PMTR reports and they had been forgotten after Dr. Uzarowski delivered them.

[136] Roads Value for Money Audit (RHV0000683)

[137] Exhibit 117 – PMTR II report (GOL0007440 at image 49); Roads Value for Money Audit (RHV0000683 at image 55)

[138] Exhibit 117 – PMTR II report (GOL0007440 at image 51); Roads Value for Money Audit (RHV0000683 at image 57)

[139] OD5, image 4, paras 4- 5; Transcript of Dr. Uzarowski, June 15, 2022, pg 5498, lines 1-5

[140] Dr. Uzarowski Notebook (GOL0007428 at image 2)

[141] Transcript of Dr. Uzarowski, June 15, 2022, pg 5494, lines 7-22

[142] OD 6, image 12 para 20; Transcript of Dr. Uzarowski, June 15, 2022, pg 5509, lines 1-5

Condition Evaluation" on March 1, 2013.[143] The proposal defined field investigation to include visual inspection, Inertial Profiler Testing, Falling Weight Deflectometer ("**FWD**") testing and rut measurement. Inertial Profiler Testing is used to calculate the roughness indices of the pavement or wheelpath elevation profiles, which provide information on the quality of the ride. FWD non-destructive testing is used to assess the structural condition of the pavement, including the stiffness of each pavement layer and to estimate the amount of structural damage in the existing asphalt. This investigation resulted in the report entitled Red Hill Valley Parkway – Performance Review after Six Years in Service (the "**Golder Report**").[144] Dr. Uzarowski's evidence was that he also proposed a paper publishing the results of the evaluation, but Mr. Moore was not interested.[145]

51. Although not known to Golder, the City had previously engaged CIMA to conduct a safety review of a section of the RHVP, which culminated in a report titled "*Red Hill Valley Parkway Safety Review*" (the "**2013 CIMA Report**").[146]

52. The visual inspection of the RHVP was completed on April 19, 2013, and Inertial Profiler Testing and FWD testing was conducted on May 9, 2013.[147] Dr. Uzarowski's evidence was that he likely shared a September 2013 draft of the report with Mr. Moore, as he wanted to discuss the findings from the field investigations.[148]

53. On September 30, 2013 Mr. Moore emailed Dr. Uzarowski writing: "*During the last couple of heavy rain events the Police have been attributing accidents to the "slipperiness of the pavement". Did we do any "Skid resistance" testing in our last outing? Can we do it? On both?*"[149] The following day, Mr. Moore emailed Dr. Uzarowski regarding the friction testing of some crosswalks in the City, forwarding an internal City email chain which included a note from Mr. Capostagno (District Supervisor Roads, Operations) relaying comments from the Police about the ramps and the RVP being "*very slippery…every time it rains heavily*" and Mr. McLennan's

[143] Golder's Proposal (GOL0003775 attaching GOL0003779)
[144] Golder Report (GOL0002981)
[145] Correspondence with Gary Moore re TAC abstract (GOL0003396 and GOL0003394)
[146] 2013 CIMA Report (HAM0041871_0001); Transcript of Dr. Uzarowski, June 15, 2022, pg 5514, lines 18-23
[147] Golder field notes (GOL0004438)
[148] Transcript of Dr. Uzarowski, June 15, 2022, pg 5529, para 9-25; pg 5530; Lines 1-18
[149] Correspondence from Mr. Moore (GOL0002643)

(Manager, Risk Management, Legal and Risk Management Services) observation that "*there was not a significant claims history for slippery conditions on the RHVP, certainly no more than any other mountain cut"*[150] The internal email exchanges also included an exchange in which Mr. Moore confirmed to his colleagues that he was having friction testing done and that he would share the results.[151]

54. CIMA delivered its 2013 CIMA Report to the City on September 16, 2013.[152] CIMA noted atypically high proportion of Single Motor Vehicle collisions ("**SMV**") wet road surface and non-daylight collisions on the southern segment of the RHVP, including the ramps for the Mud Street interchanges. CIMA's recommendations included to perform friction testing. The Report stated: "*Because of the high proportion of wet surface condition and SMV collisions, the City could consider undertaking pavement friction testing on the asphalt to get a baseline friction coefficient for which to compare to design specifications*".[153] Dr. Uzarowski's evidence was that it would have been valuable for Golder to have received the 2013 CIMA Report, in particular to understand the concerns and recommendations regarding wet accidents. In which case, Golder would have included macrotexture testing (given concerns of hydroplaning in wet weather collisions) and addressed any concerns about flushing and/or contamination, of which there were none.[154]

55. Dr. Henderson was Project Manager for Golder for the Golder Report. She contacted Stephen Lee (Head, Pavements and Foundations Section, MTO) on October 4, 2013 and requested that the MTO conduct friction testing.[155] The MTO declined on October 29, 2013, saying they would not be able to accommodate the request that season.[156] The MTO evidence was that their single locked wheel testing trailer was in use from the Spring to Fall but was put away for the winter and they did not test in freezing conditions.[157] By the end of October 2013, the choices among the limited options for friction testing were constrained by the approaching winter.

[150] Correspondence from Mr. Moore (GOL0002641 at image 4)
[151] Correspondence from Mr. Moore (GOL0002641 at image 2)
[152] Correspondence from CIMA sending the 2013 CIMA Report without appendices (CIM0008089 attaching CIM0008089.0001); 2013 CIMA Report with appendices (HAM0041871_0001)
[153] 2013 CIMA report (CIM0008089.001 at image 49)
[154] Transcript of Dr. Uzarowski, June 15, 2022, pg 5535, Lines 1-25; pg 5536, lines 1-25; and pg 5537, lines 1-10
[155] Friction request to MTO (GOL0004467); Transcript of Dr. Henderson, June 22, 2022, pg 6246-6247, lines 13-2
[156] Friction request to MTO (GOL0004467)
[157] Transcript of Chris Raymond, May 17, 2022, pg 2220, lines 1-18

Although, the MTO raised the possibility of using an ARA locked wheel testing device, the evidence of Mr. Hein was that the ARA device was located in the United States and was brought to Canada for testing every second year because of the cost and complexity of crossing the border.[158] On cross examination, Mr. Hein acknowledged that the ARA device would be brought to test in the Spring-Summer period and not likely in the country in November.[159] Neither Dr. Uzarowski nor Dr. Henderson recalled whether they had tried to contact ARA for assistance with friction testing.[160,161]

56. Ultimately, Golder retained, Tradewind Scientific Ltd. ("**Tradewind**") to perform the friction testing.[162] Dr. Uzarowski's evidence was that he considered that Tradewind were experts in pavement friction testing.[163] Dr. Uzarowski testified that the Grip Tester was "*well-established and described in the TAC guide*"[164] and in some technical presentations, for example, (*Frictional Characteristics of Pavements, 'Get a Grip*' by John Emery, dated November 2007 and presented at Canadian User Producer Group for Asphalt meeting)[165,166], and he was not concerned that Tradewind would be using different testing equipment from what the MTO had used in 2007.[167]

[158] Transcript of Mr. Hein, February 24, 2023, pg. 16281, lines 4-8

[159] Transcript of Mr. Hein, February 24, 2023, pg. 16353-16354, lines 4-7

[160] Transcript of Dr. Uzarowski, June 15, 2022, pg 5555-5556, lines 25-3; Transcript of Dr. Henderson, June 22, 2022, pg 6252, lines 15-17

[161] On December 11, 2017, Dr. Uzarowski emailed Mr. Stephen Lee (MTO) and requested him to provide contact information for MTO staff that could conduct PSV testing for "one of the large municipalities here". (GOL0002880) Mr. Lee replied, providing contact information for Mr. Joel Magnan. Mr. Magnan, copied to Mr. Lee's email, replied the same day, advised Dr. Uzarowski that the MTO could not perform the testing. (GOL0002902)

[162] Mr. Moore's approval of Tradewind (GOL0002647)

[163] Transcript of Dr. Uzarowski, June 15, 2022, pg 5557, lines 2-23

[164] Transcript of Dr. Uzarowski, June 15, 2022, pg 5559, lines 3-6

[165] Dr. Flintsch observed that the GripTester was used mostly on airports but has been used to test highway pavement in different countries and has the advantage over the locked wheel tester of providing continuous measurements and thus minimizing the chances of missing localized areas of low friction and was more reflective of the anti-lock braking systems in modern vehicles. See The Analysis of Friction on the RHVP, November 2022, EXP0000191, Exhibit 220, image 13. Note too that Craig White's evidence was that the Grip Tester device is used on the 407 (Transcript of Mr. White, June 22, 2022, pg 6176 lines 6-22).

[166] GOL0007392

[167] Transcript of Dr. Uzarowski, June 15, 2022, pg 5559, lines 1-6

57. Golder submitted a proposal to conduct friction testing and to "*prepare a short memo report*" for $8,000 plus HST, on November 19, 2013.[168] The same day, Mr. Moore directed City staff members, Marco Oddi, Rich Shebib and Martin White, to assist with traffic control while friction testing was performed on the RHVP.[169] The following day, Tradewind performed friction testing on the RHVP on November 20, 2013.[170]

58. Dr. Uzarowski understood that Mr. Moore needed the November 2013 friction testing results to present at a meeting with management on January 24, 2014.[171]

59. On January 24, 2014, Dr. Uzarowski sent a summary of the friction testing results of 2007 and 2013 to Mr. Moore along with a paper published by the CTAA in 2009 titled "*Early Age Low Friction Problem of SMA in Ontario*".[172] Dr. Uzarowski testified that the RHVP 2013 friction numbers he sent to Mr. Moore were likely provided to him over the phone by Mr. Rowan Taylor.[173] Although Dr. Uzarowski had understood that Mr. Moore required the friction data urgently because of a meeting with management, in fact Mr. Moore recompiled Dr. Uzarowski's email ("**Moore's Compiled Summary Friction Data Email**") and forwarded the data to Tom Dziedziejko (*General Manager of AME, Aecon Materials Engineering*). Mr. Dziedziejko was listed as an author of the paper attached to Dr. Uzarowski's email.[174] Dr. Uzarowski testified that he was not aware that the summary of results he had provided to Mr. Moore was in fact for the purposes of relaying them to Mr. Dziedziejko.[175]

60. Mr. Dziedziejko's presented at the Municipal Roads Technologies Workshop held on January 29 and 30, 2014, entitled "*SMA For Municipalities There and Back Again*". The

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[168] Golder's proposal (GOL0006542 at image 2)

[169] Correspondence from Mr. Moore (GOL0002647)

[170] OD6, image 77, para 196; Dr. Henderson notes (GOL0004441)

[171] OD 6, image 87, para 230-231; OD 6, image 89, para 234; Correspondence to Tradewind (TRW0000038); Correspondence from Tradewind (GOL0002656); Transcript of Dr. Uzarowski, June 15, 2022, pg 5574, lines 5-7; pg 5578, Lines 6-25

[172] Correspondence to Mr. Moore (GOL0002657 attaching GOL0002658 and GOL0002659)

[173] Correspondence to Tradewind (TRW0000038); Correspondence from Tradewind (GOL0002656)' Transcript of Dr. Uzarowski, June 15, 2022, pg 5577-5578; lines 1- 21

[174] Correspondence of Mr. Moore (HAM0052049_0001); Transcript of Dr. Uzarowski, June 15, 2022, pg 5595, lines 22-25

[175] Transcript of Dr. Uzarowski, June 15, 2022, pg 5595, lines 22-25

presentation included a slide containing a comparison between test results from MTO's 2007 friction testing and Tradewind's 2013 testing. This comparison was consistent and based on the information provided by Dr. Uzarowski to Mr. Moore on January 24, 2014.[176]

61. Golder received the Tradewind Report on January 26, 2014.[177] Tradewind found the friction on the RHVP: "*Nearly all areas of the road have friction values below or well below the relevant UK Investigatory Level 2 (GN of 48)*".[178] Dr. Uzarowski reviewed the reference guide identified by Tradewind and found Tradewind's use of the 'relevant UK Investigatory Level 2 (GN of 48)' as "*overly conservative*".[179] Dr. Uzarowski's analysis of the Tradewind friction data relied on the 1997 Transportation Association of Canada, *Pavement Design and Management Guide* which set out the Table reference standards using a UK standard for investigatory levels of road surfaces.[180] He then identified a correlation for SCRIM skid numbers to Grip tester numbers published by the United Kingdom Pavement Management System ("**UKPMS**").[181] Dr. Uzarowski considered that the applicable guide was GN 41 which he rounded to 40. He concluded that the friction values from the GripTester were "*relatively low*"[182,183], a finding with which Dr. Flintsch agreed.[184] Dr. Uzarowski's view that Tradewind's reference for investigatory levels was overly

[176] OD6, image 94, para 247; MTO0015946 and HAM0052049_0001

[177] Correspondence from Tradewind attaching report (GOL0001112 attaching GOL0001113)

[178] Golder Report appending the Tradewind Report (GOL0002981 at image 102) See Also OD3, Images 91-93.

[179] Transcript of Dr. Uzarowski, June 15, 2022, pg 5601, Lines 15-25; pg 5602, Lines 1-25; pg 5603, line 1

[180] TAC, Pavement Design and Management Guide, GOL0003936, images 2 and 3

[181] The chart showing the UK investigatory levels for SCRIM and GripTester was relied on by CIMA in their Memorandum of February 4, 2019 (in which they noted that the table was also referenced in the United States in the Guide to Pavement Friction), and cited by Dr. Flintsch in his Power Point presentation, the Primer (Exhibit 13, EXP0000189 at image 25) and the *Analysis of Friction on the RHVP* November 2022 (Exhibit 220, EXP0000191 at image 14) .

[182] GOL0001112, image 9 Section 5.0 Friction Testing and Section 6.0 Analysis and Recommendations

[183] Transcript of Dr. Uzarowski, June 15, 2022, pg 5619, Lines 10-25; pg 5620, Lines 1-25; pg 5621, lines 1-25; pg 5622, Lines 1-19

[184] '*Analysis of Friction on the RHVP*' November 2022 (Exhibit 220, EXP0000191 at image 15)

conservative was also subsequently confirmed by Tradewind itself[185], CIMA in its Memorandum of February 4, 2019[186] and Dr. Flintsch[187].

62. Dr. Uzarowski emailed Mr. Moore on January 31, 2014 enclosing the Golder Report.[188] The appendices to the report included the field investigations and the Tradewind Report.[189] Dr. Uzarowski noted in his covering email that the friction testing results have been included in the updated report.[190] Dr. Uzarowski wrote: "*If you have any questions or require more information, please do not hesitate to contact me*."[191]

63. Section 5 of the Golder Report summarized friction testing results, including a synopsis of the Tradewind Report, and Golder's analysis of the results:[192,193]

> *Friction testing was carried out on the RHVP in November 2013 by Tradewind Scientific using a GripTester. The testing was completed in both of the northbound and southbound thru lanes. Complete results of the friction testing are provided in Tradewind Scientific's report in Appendix E. This report also covers the results of friction testing on the Lincoln M. Alexander Parkway. Table 6 provides a summary of the average testing results on the RHVP.*

[185] Tradewind Scientific Memorandum to Commission Counsel, dated June 17, 2021 (RHV0000889)

[186] CIMA Memorandum of February 4, 2019 (HAM0054683 at image 4). Note CIMA's finding: Our conclusion of the review of the Golder report is that the friction values measured are in the range that the UKPMS would identify as 'investigatory' and would need additional review of the roadway as a whole. The Golder/Tradewinds report made a similar overall conclusion from the data, albeit using a different reference table", image 6

[187] Dr. Gerardo Flintsch, Analysis of Friction on the RHVP, November 2022, EXP 191, Exhibit 220, image 13

[188] Correspondence to Mr. Moore attaching the Golder Report with the appended Tradewind Report (GOL0002980 attaching GOL0002981)

[189] The Golder Report with the appendices (GOL0002980 attaching GOL0002981)

[190] The Golder Report (GOL0002981)

[191] Email from Dr. Uzarowski to Mr. Moore, dated Jan 31, 2014 (GOL0002980)

[192] The Golder Report (GOL0002981 at image 10); OD6, image 96, para 252

[193] It is Dr. Uzarowski's evidence that in his email to Mr. Moore on January 24, 2014, the test results were erroneously labelled as southbound lanes, wherein they were recorded as the northbound lanes in the Tradewind Report. The same error was repeated in the Golder Report. See RHV0000989 for a compilation of excerpts from the aforementioned emails and reports. (Transcript of Dr. Uzarowski, June 16, 2022, pg 5651, lines 10-25; pg 5652, lines 1-25; pg 5653, lines 1-25 and pg5654, lines 1-10)

Table 6: Friction Testing Results

Section	Average Friction Number
Lane 1 Southbound	34
Lane 2 Southbound	35
Lane 1 Northbound	39
Lane 2 Northbound	36

> *Although the Friction Number (FN) values are higher than when measured in 2007 immediately after construction (between 30 and 34), they are considered to be relatively low. Typically the FN values should be at least equal to or higher than 40 to be considered adequate. In the United Kingdom, for example, the FN values should be at least 48 for a motorway pavement.*

64. It is Dr. Uzarowski's evidence that the results were "*relatively low*".[194]

65. The appended Tradewind Report also discussed friction testing on certain access ramps and noted the "*overall average levels of 61 (on-ramp) and 54 (off-ramp) are comparable to or slightly higher than the UK Investigatory Level 3 (GN54), which applies to dual-carriageway roads near minor junctions*."[195] In other words, the ramps that were tested exhibited high frictional characteristics. The ramps (except for the ramp with the test strip done during construction) were paved with SP12.5 FC2, in contrast to the mainline that has a SMA surface course.[196]

66. Section 6 of the Golder Report included analysis and recommendations. Section 6 of the Golder Report stated:[197]

> *In order to remedy the longitudinal top down cracking, it is recommended that the surface course SMA be milled and a new surface course mix be placed at selected locations. At a minimum the milling and overlaying should be carried out on sections where the most frequent top down cracking is observed. Based on our pavement visual condition inspection, the minimum total length of the sections where mill and overlay is required would be about 2.5 km. The exact locations for the milling and overlaying should be determined on site. It is also recommended that if there is any debonding of the underlying SP 19.0 layer*

[194] Transcript of Dr. Uzarowski, June 16, 2022, pg 5623, lines 21-25 and pg 5624, lines 1-25; Transcript of Mr. Delos Reyes, May 2, 2022, pg 813, line 25 and pg 814, lines 1-7

[195] The Golder Report (GOL0002981 at image 106)

[196] Transcript of Dr. Uzarowski, June 23, pg 6412, lines 20-25 and pg 6413, lines 1-2

[197] OD6, image 97, para 253; The Golder Report (GOL0002981 at image 10)

> *observed during the milling and overlaying operation, the debonded SP 19.0 layer should also be removed.*
>
> *On the remaining portion of the RHVP, the existing cracks in the surface course should be routed and sealed to prevent the ingress of water and incompressible material into the pavement structure. Following the routing and sealing, it is recommended that a single layer of microsurfacing be applied. By carrying out the mill and overlay where required and applying microsurfacing, the issue of relatively low FN on the RHVP would also be addressed. The new surface course mix to be used on the RHVP Should incorporate aggregates that have good Polished Stone Value (PSV). It is recommended that the PSV of potential aggregate sources be tested in the laboratory.*

67. Dr. Uzarowski testified that due to an administrative error, the draft watermark was applied to the whole of the Golder Report including the appendices.[198] He acknowledged that the Tradewind Report had been delivered in final form and was not draft, and no further information was pending from Tradewind.[199]

68. Dr. Uzarowski's evidence is that it was common practice to send a draft report to the client for discussion and feedback. He explained that the report is finalized once the client had provided comments to be incorporated.[200] Golder's practice of delivering a report in draft for comments and delivering a final report when asked is consistent with the practice of other engineering consultants.[201] Mr. Moore echoed this norm that it was typical industry practice to send a draft report to the client for discussion before finalizing.[202] Dr. Uzarowski's evidence was that a client's input or comments into a report would not result in a change to his recommendations.[203] This practice is mirrored during the PMTR engagements, when reports were finalized once the City had provided comments.[204]

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[198] Transcript of June 15, 2022, pg 5614-5615, Lines 24-11

[199] Transcript of Dr. Uzarowski, June 16, 2022, pg 5697, Lines 15-21

[200] Transcript of Dr. Uzarowski, June 15, 2022, pg 5615-5616

[201] Mr. Soroush Salek (CIMA) echoed this practice and noted that it's common practice for CIMA to not sign its final reports, unless requested to do so by clients. (Transcript of Mr. Salek, September 29, 2022, pg 11244, Lines 6-16)

[202] Transcript of Mr. Moore, July 18, 2022, pg 8413, Lines 11-17;

[203] Transcript of Dr. Uzarowski, June 15, 2022, pg 5616, lines 4-23

[204] Transcript of Dr. Uzarowski, June 23, 2022, pg 6456, lines 18-25; pg 6457, lines 1-3

69. Dr. Uzarowski called Mr. Moore on February 4, 2014, to request a meeting to present the findings and recommendations in the Golder Report. Dr. Uzarowski's evidence was that his notes of the call document the topics he identified to be discussed during his proposed meeting with Mr. Moore.[205]

70. Mr. Moore and Dr. Uzarowski met at the City on February 7, 2014, and Dr. Uzarowski handed a bound copy of the Golder Report to Mr. Moore including the Tradewind Report.[206] Mr. Moore recalled they met but had no specific recollection of what was said.[207]

71. Dr. Uzarowski presented his analysis and findings from the Golder Report to Mr. Moore.[208] Dr. Uzarowski testified that he discussed the Tradewind friction findings, and that Mr. Moore asked no questions about the friction results or the standards for an investigatory level by which to assess the friction data. Dr. Uzarowki thought that Mr. Moore understood the findings and recommendations.[209] Dr. Uzarowski took notes of his discussion with Mr. Moore.

72. Although Mr. Moore's testimony is to the effect that he did not understand or agree with the reference standard for friction referred to by Tradewind and considered that it made no sense that friction improved from 2007 but was relatively low.[210] There is no note recording a question or statement by Mr. Moore about the friction data or the standard by which to assess it.[211] There was no evidence during the Inquiry to support Mr. Moore's assertion that he requested clarification on the UK standards when he first received the Golder Report or when Dr. Uzarowksi presented the findings and recommendations to him in early 2014.[212]

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[205] OD 6, para 259, pg 99; Dr. Uzarowski notebook (GOL0007407 at images 28-29); Transcript of Dr. Uzarowski, June 16, 2022, pg 5671, Lines 20-24; pg 5672, Lines 1-5

[206] Transcript of Dr. Uzarowski, June 16, 2022, pg 5674, Lines 6-15

[207] Transcript of Mr. Moore July 18, 2022, pg 8454, Lines 3-14

[208] Transcript of Dr. Uzarowski, June 16, 2022, pg 5678, lines 4-25; pg 5679, lines 1-25; and pg 5680, lines 1-23

[209] Transcript of Dr. Uzarowski, June 15, 2022, pg 5480, lines 9-25 and pg 5481, lines 1-2

[210] Transcript of Mr. Moore, July 18, 2022, pg 8643, lines 1-7

[211] Dr. Uzarowski notebook (GOL0007407 at image 30)

[212] Transcript of Mr. Moore July 18, 2022, pg 8643-8644, Lines 17-3

73. Mr. Moore's evidence was that he read the Golder Report before the February 7, 2014, meeting.[213] Dr. Uzarowski's evidence is that Mr. Moore did not describe the Tradewind test results as "inconclusive" at this meeting, nor did he express any concern about the clarity of either the Tradewind Report or Golder Report and its recommendations.[214]

74. Dr. Uzarowski's evidence was that he delivered brochures from Miller Paving about microsurfacing to Mr. Moore at the meeting of February 7, 2014 as additional information in support of the recommendation to conduct microsurfacing.[215] Dr. Uzarowski received brochures related to microsurfacing and slurry seal from Mr. Trevor Moore of Miller Paving on December 20, 2017.[216] Dr. Uzarowski's evidence was that Mr. Moore understood the findings and recommendations that he made to Mr. Moore and considered that Mr. Moore was familiar with microsurfacing as a type of preventative treatment.[217] Mr. Moore's evidence was that he did not have a problem with Golder's recommendation to mill and overlay in areas with the worst cracking but did not agree with the recommendation to use microsurfacing. He stated that microsurfacing was not something that we had a successful experience with on other roads, so while he did not recall specifically the discussion, he would have at some point made that clear that microsurfacing was not something that we would consider useful and good value for money.[218] Dr. Uzarwoski's evidence was that he also recommended shotblasting as a cost-effective alternative to improve frictional characteristics of the pavement.[219] Mr. Moore had no recollection of the recommendation to use shotblasting to improve the frictional performance of the asphalt.[220]

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[213] Transcript of Mr. Moore, July 18, 2022, pg 8417, Lines 13-20; pg 8418, Lines 4-12

[214] Transcript of Dr. Uzarowski, June 16, 2022, pg 5682, Lines 21-25; pg 5683, Lines 1-17

[215] Transcript of Dr. Uzarowski, June 16, 2022, pg 5674, Lines 6-15; pg 5688, Lines 17-25

[216] GOL0006503 attaching GOL0006504, GOL0006505, GOL0006506, GOL0006507, GOL0006508 and GOL0006509; OD 6, image 82, para 212; Transcript of Dr. Uzarowski pg 5690, lines 15-21

[217] The application of microsurfacing as a pavement preservation technique is described in the Golder PMTR reports as well as Stantec's 2007 Sustainability Plan, HAM0000320_0001

[218] Transcript of Mr. Moore July 18, 2022, page pg 8456, Lines 19-25

[219] Transcript of Dr. Uzarowski, June 16, 2022, pg 5689, Lines11-25; pg 5690, Lines 1-11

[220] Transcript of Mr. Moore, July 18, 2022, pg 8459-8460, Lines 25-11

75. Both Dr. Uzarowski and Dr. Henderson testified that the findings, analysis and recommendations contained in the Golder Report were complete.[221] The Golder Report was effectively final subject to the courtesy of inviting comments from the client before sending a signed report.[222] Mr. Moore's evidence acknowledged that the testing and data from the cores, the falling weight deflectometer and the inertial profiler testing were final.[223] Dr. Uzarowski's evidence was that in general, Mr. Moore was prompt about providing comments[224] and he typically responded swiftly if he wanted further steps to be taken or wanted more work or to finalize a draft report.[225] Dr. Uzarowski's evidence was that Mr. Moore was more interested in the results from investigations than he was in finalizing a report.[226] At least in this respect, Mr. Moore's evidence agreed with Dr. Uzarowski's: Mr. Moore's explained that they were looking for content and for the action that they needed to take. "*Making it pretty and putting it on the bookcase was, you know, something that usually followed as a matter of course but not something that I would chase for*."[227] Absent a request from the City to finalize the Golder Report, it remained unsigned.

76. Mr. Moore did not send a copy of the Golder Report or the Tradewind Report to anyone at the City after receiving it.[228] Mr. Moore justified not distributing the Golder Report and the Tradewind Report as because he had problems with the friction testing, specifically that he was looking for clarification about the reference from Dr. Uzarowski. However, as stated, Dr. Uzarowski did not receive any comments or questions from Mr. Moore about Tradewind's friction testing or requested clarification about the standard for an investigatory level until December 17, 2015.[229]

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[221] Transcript of Dr. Uzarowski, June 16, 2022, pg 5694, Lines 1-8; Transcript of Dr. Henderson, June 22, 2022, pg 6293-6294, Lines 18-5

[222] Transcript of Dr. Uzarowski, June 16, 2022, pg 5694-5695, Lines 1-13

[223] Transcript of Mr. Moore, July 18, 2022, pg 8465-8466, Lines 16-15

[224] Transcript of Dr. Uzarowski, June 15, 2022, pg 5617, Lines 1-7

[225] Transcript of Dr. Uzarowski, June 16, 2022, pg 5697, Lines 22-25; pg 5698, Lines 1-5

[226] Transcript of Dr. Uzarowski, June 16, 2022, pg 5696, Lines

[227] Gary Moore, July 18, pg 8467, Lines 2-7

[228] Gary Moore, July 18, pg 8457, Lines 9 -12

[229] Transcript of Mr. Moore, July 18, 2022, pg 8543-8544, Lines 24-3

77. Mr. Moore did not provide written comments on the draft Golder Report to Dr. Uzarowski and nor did he ask him to finalize it.[230] Because Dr. Uzarowski never received written comments or a direction to finalize the report, the Golder Report remained in draft form. It is Dr. Uzarowski's evidence that Mr. Moore did not "*care about finalizing. He just wanted the information. He wanted the numbers and move ahead. That was his attitude. And for me it was, the analysis were final, recommendations were final and there was no request. I ask[ed] him even in the e-mail if there was any comment to provide. Nothing was provided*." [231]

78. Mr. Moore did not raise any follow-up items or tasks related to the RHVP or Golder Report following this meeting.[232] Dr. Uzarowski testified that there were no action items or tasks related to the RHVP or Golder Report following the meeting.[233] Had there been, Dr. Uzarowski would have documented it in a note and actioned the task as he did every other task described throughout this narrative.

79. On March 18, 2014, Golder issued the final invoice for the Golder Report engagement.[234]

vi. The Investigation and Reporting for the Inertial Profiler Testing on the RHVP

80. Golder's engagement to provide inertial profiler testing of the RHVP in 2016 comes on the heels of the City's extensive investigation into collisions on the RHVP conducted in 2015. Golder had no knowledge of the CIMA investigation, but questions asked by CIMA in their investigation ripple into the questions asked of Dr. Uzarowski in Golder's engagement in 2016. CIMA's Red Hill Valley Parkway Detailed Safety Analysis was delivered by CIMA to the City unsigned in November 2015 (the "**2015 CIMA Report**").[235]

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[230] Transcript of Dr. Uzarowski, June 16, 2022, pg 5694, Lines 1-22

[231] Transcript of Dr. Uzarowski, June 16, 2022, pg 5694, Lines 23-25; pg 5695, Lines 1-8

[232] Transcript of Dr. Uzarowski, June 16, 2022, pg 5694, Lines 1-8

[233] Transcript of Dr. Uzarowski, June 16, 2022, pg 5694, Lines 1-8

[234] Exhibit 214 – Affidavit of Sherrie Charter, November 1, 2022, (RHV0001034 at image 3, para 12-13); Golder invoice (GOL0004359)

[235] 2015 CIMA report (HAM0000702_0001)

81. In the course of their investigation, Mr. Malone of CIMA consulted Mr. Moore about the asphalt surface of the RHVP. On August 7, 2005, Mr. Moore provided a summary of friction testing data to Mr. Malone noting in his correspondence that they were not for republication.[236] The instruction that the information was not for republication is consistent with the theme in Mr. Moore's evidence that friction data is not and should not be shared as it might be used in claims against the City. The data Mr. Moore sent to Mr. Malone was the same as provided by Dr. Uzarowski on January 24, 2014 that Mr. Moore cut and pasted into his email to Tom Dziedziejko and contained the 2007 friction data performed by MTO and a summary of the 2013 friction results performed by Tradewind, as well as the MTO paper on early age low friction on SMA.[237] Although Mr. Moore had the Tradewind Report including their opinion that the friction was below or well below the UK investigatory level that they applied and had the Golder Report which included Dr. Uzarowski's opinion that friction on the RHVP was relatively low, Mr. Moore deliberately sent neither to CIMA preferring the summary data which contained no assessment of the friction data[238]. In response to Mr. Moore's correspondence, Mr. Malone asked Mr. Moore if his assumption that "*FN numbers of less than 30 are below a desired level*" was correct, and if the 2007 and 2013 tests used the same methodology or were comparable.[239] Mr. Malone's evidence was that Mr. Moore did not advise him that Golder/Tradewind performed the friction testing on the RHVP in 2013 but instead, told him that "*the testing was done by MTO both times*" and that the data was comparable.[240] Having been in possession of the Tradewind Report since January 2014, and having set up the friction testing in November of 2013, Mr. Moore knew that Tradewind had performed the friction testing, and not MTO as misrepresented to CIMA. If one were to believe Mr. Moore's testimony of July 18, 2022, that the Tradewind data was totally inconsistent with the information he had been previously given and referred to a foreign standard that in his opinion

[236] Correspondence of Mr. Moore (CIM0010018 attaching CIM0010018.0001, CIM0010018.0002 and CIM0010018.0003)

[237] Correspondence of Mr. Moore (CIM0010018 attaching CIM0010018.0001, CIM0010018.0002 and CIM0010018.0003)

[238] Mr. Moore had the Tradewind Report and knew it had been delivered to him in 2014 as is clear from his correspondence with Shillingtons, legal counsel to the City on August 15, 2017, OD7, image 192, paragraph 568; HAM0062244_0001

[239] Correspondence of Mr. Malone (CIM0010017)

[240] Correspondence of Mr. Malone (CIM0010001); Transcript of Mr. Malone, May 31, 2022, pg 3473-3475, lines 11-4

made no sense,[241] he knew exactly that the Tradewind testing was not the same as MTO and not directly comparable.

82. In his review of a draft of the 2015 CIMA Report, Mr. Moore sought to delete the entire section recommending that the City conduct friction testing. He commented: "*There is no basis, nothing to compare to and no other agency in Ontario including the MTO doing this! It means absolutely nothing except proving potential exposure to legal actions and confusion!*"[242]

83. Mr. Moore attended the Public Works Committee ("**PWC**") meeting on December 7, 2015, where the content of the 2015 CIMA report was presented to council. At the meeting, Mr. Moore responded to a question about the quality of the asphalt used on the RHVP and informed the PWC that the MTO had performed initial friction testing and received results at or above what the MTO typically expected from high grade friction mixes. He went on to state that they had performed subsequent testing five years after in approximately 2012-2013 and found that the road was holding up exceptionally well. He added: "*We have no concerns about the surface mix*."[243] In his description, Mr. Moore contradicted Dr. Uzarowski's finding that friction on the RHVP was relatively low[244], and Golder's recommendation that the RHVP was in need of rehabilitation and preservation treatments[245].

84. On December 17, 2015, Mr. Moore sent Dr. Uzarowski of the same January 24, 2014, summary with the 2007 and 2013 friction testing data and the MTO paper on early age low friction on SMA.[246] Dr. Uzarowski's evidence is that he had a telephone call with Mr. Moore during which Mr. Moore requested a copy of the Tradewind report.[247] Dr. Uzarowski's evidence was also that during the call, Mr. Moore asked some follow-up questions about the Tradewind report such as the standards or anticipated values, and correlation between the different testing methods used in 2007 and 2013, echoing the questions Mr. Malone had asked Mr. Moore on August 7, 2015 when

[241] Transcript of Mr. Moore, July 18, 2022, pg. 8472, Lines 17 to 25
[242] Draft 2015 CIMA report with comments (HAM0000690_0001 at image 41)
[243] OD 7, image 74, paragraphs 233-234
[244] The Golder report (GOL0002981 at image 10)
[245] The Golder report (GOL0002981 at image 10 and 11)
[246] Correspondence from Mr. Moore (GOL0002681)
[247] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5710, Lines 4-23

he first received the 2007 and 2013 friction results.[248] Dr. Uzarowski's evidence was that that was the first time since the delivery of the Golder report and the appended Tradewind report in February 2014, that Mr. Moore made an inquiry about the findings in the Tradewind Report.[249]

85. In response to Mr. Moore's request, Dr. Uzarowski's sent a copy of the Tradewind Report to Mr. Moore, noting that he would "*look at some standards or anticipated values.*"[250] Dr. Uzarowski promptly contacted Mr. Taylor, asking the following: "*Do you know if there is any correlation between the GTN and FN? The GTN limits you gave in the report are from the UK. Do you know what limits are typically used in the US or in Canada?*"[251] In response to a follow up[252] from Dr. Uzarowski, Mr. Taylor sent a white paper comparing the GripTester and the Locked-wheel methods.[253] Dr. Uzarowski was familiar with that paper and his evidence was that while the paper sent by Mr. Taylor was academically good, it was not particularly useful because the correlation was made in consistent controlled conditions.[254] When Dr. Uzarowski made a further inquiry to Mr. Taylor asking if there were any values in Canada or the US for the Grip Tester, Mr. Taylor said he was not aware of any official values[255] which is consistent with the explanation at the beginning of the Tradewind Report.[256]

86. Dr. Uzarowski's evidence was that the content of his communication with Mr. Taylor was communicated to Mr. Moore on March 4, 2016, when he presented the results of the RHVP profile

[248] Correspondence of Mr. Malone (CIM0010001); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5711, Lines 7-12; pg. 5714, Lines 6-13

[249] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5715, Lines 1-7

[250] Correspondence of Dr. Uzarowski (GOL0003546); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5713-5714, lines 9-2

[251] Correspondence of Dr. Uzarowski (TRW0000030); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5716-5717, lines 18-4

[252] Correspondence of Dr. Uzarowski (TRW0000009); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5728, lines 1-17

[253] Correspondence of Mr. Taylor (GOL0002686 attaching GOL0002687); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5728-5729, Lines 22-6

[254] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5730-5731, Lines 1-21

[255] Correspondence of Mr. Taylor (GOL00002708); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5732-5734, Lines 12-3

[256] The Golder Report, Appendix E, Tradewind report (GOL0002981 at image 103)

testing.[257] Dr. Uzarowski's evidence was that there was not a good, direct, clear correlation between friction data taken using a locked wheel device and the Grip Tester and that there were not official values used in Canada or the US for a Grip Tester.[258]

87. Dr. Uzarowski's evidence was that during the telephone call on December 17, 2015, Mr. Moore also inquired about the measuring and fixing of dips on the RHVP.[259] Dr. Uzarowski then directed Golder team members to proceed with the Inertial Profiler Scan on the RHVP as requested by Mr. Moore.[260] The Golder employees involved in the Inertial Profiler scan of the RHVP engagement were Dr. Uzarowski, Dr. Henderson, Ms. Rizvi, Mr. Steven Jagdat and Mr. Joe Lin.[261] In his instructions, Dr. Uzarowski indicated to Golder staff that following a telephone call with Mr. Moore, Golder was to first proceed with the Inertial Profiler scan of the RHVP, then perform the roughness analysis, and finally advise the City on locations of the recommended repairs and provide recommendations on the appropriate methods of the repairs.[262] While the Inertial Profiler test had already been done as part of the Golder Report engagement, Dr. Uzarowski's evidence was that Mr. Moore wanted the exact locations of the dips and bumps on the RHVP plotted on a map for this project. [263]

88. The results of the profile testing were sent and presented to Mr. Moore at a meeting on March 4, 2016, in the form of an Excel spread sheet and a plan of the RHVP on which Dr. Uzarowski plotted the location of the bumps and dips.[264] There was no formal report for this

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[257] Dr. Uzarowski notebook (GOL0007409 at image 25); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5736-5637, Lines 8-8

[258] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5637, Lines 1-8

[259] Dr. Uzarowski notebook (GOL0007409 at image 13); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5710, Lines 1-3; pg. 5710, Lines 18-23; The Proposal and PO for this project were dealt with after the project was completed, at Mr. Moore's request. While this was not Golder's usual practice, an exception could be made if the project was approved by the client in writing or orally, and if the client indicated that it was urgent. (Transcript of Dr. Uzarowski, June 16, 2022, pg. 5727, Lines 12-20)

[260] Internal Golder correspondence (GOL0002679); Dr. Uzarowski notebook (RHV0000933 at image 705); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5719-5720, Lines 4-14

[261] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5719, Lines 4-25

[262] Internal Golder correspondence (GOL0002679); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5719, Lines 4-25

[263] Correspondence of Mr. Moore (GOL0002705); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5720, Lines 10-15; pg. 5723-5724, Lines 1-4; pg. 5725-5726, Lines 22-8

[264] Dr. Uzarowski notebook (GOL0007409 at image 25); Correspondence of Dr. Uzarowski (GOL0003552 attaching GOL0003553); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5737, Lines 9-23

engagement and Mr. Moore did not request one. Dr. Uzarowski recorded the topics discussed with Mr. Moore in his notes of the meeting of March 4, 2016[265]. At this meeting, Dr. Uzarowski's evidence was that he advised Mr. Moore the locations of the dips and repeated his recommendations to use microsurfacing to address pavement deficiencies.[266] The recommendations for microsurfacing was repeated from the 2014 Golder report and consistent with the advice on pavement preservation techniques presented in the PMTR reports[267]. Dr. Uzarowski's evidence was that in the March 4, 2016, meeting Mr. Moore referred to on-going anecdotal statements from the police about slipperiness on the RHVP.[268] Mr. Moore told Dr. Uzarowski that the "*police was expressing [the] opinion that the pavement was slippery.*"[269] Dr. Uzarowski's evidence was that as a consequence, he also recommended blasting, meaning shotblasting.[270]

89. Immediately following the meeting, Dr. Uzarowski contacted a number of companies offering shot blasting services.[271] Blastrac/Diamatic was one of the first companies Dr. Uzarowski contacted for shot blasting services.[272] Dr. Uzarowski obtained a quote of $301,888 from Skidabrader, a company in Louisiana in the US, for the entire surface of the RHVP that he communicated to Mr. Moore.[273] Dr. Uzarowski also obtained a quote from Groupe Lefebvre for Blastrac shot blasting.[274] Mr. Moore's response of March 15, 2016 suggests that Mr. Moore initially thought the quote was for further friction testing instead of a surface treatment to improve

[265] Dr. Uzarowski notebook (GOL0007409 at image 25)

[266] Dr. Uzarowski notebook (GOL0007409 at image 25); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5738, Lines 3-13; At this point, Dr. Uzarowski had suggested microsurfacing to the City several times. The recommendation and benefits were discussed in the PMTR and the Golder report, and reiterated to Mr. Moore at this March 4, 2016, meeting.

[267] It was also consistent with the advice provided by Stantec in its 2007 Sustainability Plan (HAM0000320_0001 at images 126)

[268] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5738, Line 14-23

[269] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5739, Line 16-22

[270] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5738, Line 3-25

[271] Correspondence of Dr. Uzarowski (GOL0002691, GOL0003549, GOL0002689 attaching GOL0002690, GOL0003551 and GOL0002699 attaching GOL0002700); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5740-5742, Lines 1-25

[272] OD7, image 115, para 367; Correspondence (GOL0002689)

[273]Correspondence of Skidabrader (GOL0002703 attaching GOL0002704); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5742, Lines 6-12; pg. 5743, Lines 9-12; 5744, Lines 14-16

[274] OD7, image 116-117, para 372; Correspondence of Mr. Lefebvre (GOL0002699 attaching GOL0002700)

frictional characteristics[275]. By further email exchange, Dr. Uzarowski clarified the benefits skidabrading and shot blasting while recommending further friction testing to find the worst locations for selective treatment.[276] Mr. Moore responded: "*I have never heard of this technology or what it does. Besides it doesn't address the cracking and need to address the surface distresses and deformations (humps and sumps), so I don't think we are interested.*"[277]

90. Dr. Uzarowski introduced Miller Paving to Mr. Andoga (Senior Project Manager, Infrastructure Programming, Asset Management for the City) as a large and sophisticated paving contractor with experience in using preventive treatments for pavement, including microsurfacing.[278] Dr. Uzarowski provided the plans for the plotted locations of the bumps and dips to be repaired to Mr. Andoga.[279] Mr. Andoga arranged for Miller Paving Limited, Miller Group to conduct a lunch seminar on March 21, 2016.[280] The topics included asset management basics, including microsurfacing. Mr. Nicholas Cifelli, Technical Services Manager for Miller Paving, wrote to Mr. Andoga by email exchange of May 2, 2016 stating that he drove the LINC and RHVP and commented that Micro is a good option, however "*we need to allow for some pre-construction repairs (potholes, crack sealing, base, etc.), and perhaps some crack sealing the year after the Micro in case some caracks return.*"[281] Mr. Andoga replied stating that they could "*discuss further details*" and that "*all maintenance repair areas (base repairs etc.) would be completed by others prior to the completion of any application.*"[282] Although not acknowledged, the rehabilitation strategy of repairing the bumps and dips, crack sealing and then using microsurfacing follows the recommendations in the Golder Report.[283]

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[275] Correspondence of Mr. Moore (GOL0002697); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5745-5746, Lines 13-10

[276] Correspondence of Dr. Uzarowski (GOL0003536); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5746, Lines 14-17

[277] Correspondence of Mr. Moore (GOL0002698); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5746, Lines 18-25; pg. 5747, Lines 1-19

[278] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5776, Lines12-16

[279] Correspondence of Dr. Uzarowski (HAM0034823_0001)

[280] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5770-5771, Lines 14-18

[281] OD7, image 122- 123, paragraph 391-392; Correspondence of Mr. Cifelli (HAM0025065_0001)

[282] OD7, image 122- 123, paragraph 391-392; Correspondence of Mr. Andoga (HAM0025065_0001)

[283] The Golder report (GOL0002981)

91. Mr. Becke, a Senior Project Manager within Engineering Services, also contacted Norjohn Contracting from Walker Industries, another paving contractor and obtained information about a scrub seal as part of their pavement preservation technology.[284]

92. In his testimony, Mr. Oddi, a Senior Project Manager within Engineering Services, described the RHVP as having top down cracking and understood that the cracking needed to be repaired before water got to the deeper layers within the perpetual pavement.[285] Although Mr. Oddi denied knowing anything of the Golder Report, he could only know that the cracking on the RHVP was top down from the cores taken by Golder and described in the Golder Report.

93. Although the decision-making process is not clear, it appears that the rehabilitation and preservation techniques discussed by Golder, Miller Paving and Norjohn were not pursued. By early 2017, if not earlier, it appears that the City has decided to repave the RHVP.[286]

vii. The 2017 Pavement Evaluation Report

94. By November of 2017, Public Works recorded that repaving of the RHVP and LINC had been scheduled between 2018-2019.[287] In November of 2017, both Dr. Uzarowski and Mr. Moore attended the 2017 CTAA conference in Halifax.[288] The conference included a presentation on a pavement resurfacing technique which recycled the existing pavement surface. Dr. Uzarowski organized a meeting between Mr. Moore and Mr. Pat Wiley from Ecopave, a British Columbia based paving company with experience using a Hot In-Place Recycling ("**HIR**") technique to resurface pavement. Mr. Moore expressed interest in the HIR technology and wanted to assess its feasibility for use on the RHVP.[289]

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[284] OD 7, images 118-122, para 379 - 389

[285] Transcript of Mr. Oddi, August 10, 2022, pg. 9232, Line 1-13; pg. 9366, Lines 2025; pg. 9367, Lines 1-6, pg. 9368, Lines 9-23

[286] OD 7, images 150 – 151, para 454-458; Internal City correspondence (HAM0000837_0001, HAM0044791_0001, HAM0044791_0001 and HAM0034635_0001)

[287] OD8, image 13, para 25; PWC draft report (HAM0026494_0001 at image 6)

[288] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5781, lines 24-25; pg. 5782, lines 1-7; Correspondence of Mr. Moore (GOL0002852)

[289] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5789, lines 12-19

95. In the HIR process, the existing surface of the pavement is scooped and placed in a mixing pugmill, with asphalt cement rejuvenator and a certain amount of a new, beneficiating mix to correct the HIR mix characteristics, and the HIR mix is paved using conventional asphalt pavers and compacted using rollers. In conventional dense graded mixes HIR requires only a relatively small amount of added beneficiating mix. The HIR mixes use mainly the existing material and very limited production and haulage of new material is needed with resulting cost efficiency and ecological benefits. However, if the character of the mix is to be changed, say from gap graded to dense graded, then the amount of the new, beneficiating mix must be significantly increased and the beneficiating mix must be customized so the final product will meet the project specifications.

96. By email of November 21, 2017, entitled "*Red Hill - testing for possible Hot in place*", Mr. Moore requested a proposal and timeframe for cores, BPT and PSV testing for Red Hill.[290] Dr. Uzarowski replied to Mr. Moore's email and attached a draft proposal for the pavement surface and aggregate evaluation of the RHVP. The attached proposal was revised from the draft version he had received earlier that day from Ms. Rizvi.[291] Dr. Uzarowski edited Ms. Rizvi's draft. Dr. Uzarowski's revised proposal provided for the investigation of the existing pavement surface on the RHVP; and described that the results of the field investigations and laboratory testing would be used to determine if the current material on the RHVP pavement can provide sufficient frictional characteristics; and to evaluate the potential of using the existing surface course SMA and underlying SP 19 mm binder course in HIR.[292] Both the original draft and the revised proposal provided for three tests: investigation of surface frictional properties using the British Pendulum tester; pavement macrotexture measurements using a sand patch test; and coring of asphalt surface layers, extraction of the aggregates and testing for Polished Stone Value ("**PSV**").[293] Of these three tests, only the PSV was necessary to an assessment of whether HIR was appropriate for the RHVP. Dr. Uzarowski explained that he understood that the evaluation for skid resistance "*was just for information*".[294]

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[290] Correspondence of Mr. Moore (GOL0002851)

[291] OD8, image 18, para 43

[292] Draft Proposal (HAM0052824_0001)

[293] Correspondence of Dr. Uzarowski (HAM0052823_0001 attaching HAM0052824_0001); Previous draft Proposal (GOL0005925). The version signed was the initial draft version See HAM0001073_0001.

[294] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5810, lines 4-25; pg. 5811, lines 1-13

97. On November 23, 2017, Dr. Uzarowski sent Mr. Moore the signed proposal for the engagement that resulted in the Evaluation of Pavement Surface and Aggregates, Red Hill Valley Parkway, City of Hamilton (the "**2017 Pavement Evaluation**").[295] However, due to a version control error, the signed proposal reverted to Ms. Rizvi's original draft.[296]

98. By late November 2017, there were few options available for measuring friction. Dr. Uzarowski's evidence was that the British Pendulum Tester ("**BPT**") testing device owned by the University of Waterloo was available to him.[297] Dr. Uzarowski generally understood from his previous experience what BPT test results corresponded to good and poor friction and therefore was not concerned about correlation of data from BPT testing to past testing results.[298]

99. All three tests required that lanes of the RHVP be closed to traffic. Testing was conducted over two nights on December 6 -7, 2017. Dr. Uzarowski's evidence was that the weather had been mild in the previous days but unfortunately fell to freezing on the nights the tests were conducted and there were light snow flurries. Field notes taken by Amelia Jewison recorded that Golder staff witnessed three collisions that occurred during testing.[299]

100. On December 11, 2017, Dr. Uzarowski contacted Stephen Lee *(Head of Pavements and Foundations, MTO)* to inquire whether MTO would be willing to conduct PSV testing for the City, as this would expedite the results given that samples are typically sent to Ireland or UK for testing.[300] MTO responded that it did not have the capacity to perform the PSV testing for the City and directed Golder to AMEC, another engineering consulting firm.[301] Dr. Uzarowski contacted AMEC who responded that they did not have the equipment to carry out PSV testing[302], which

[295] Correspondence of Dr. Uzarowski (HAM0001072_0001 attaching HAM0001073_0001)
[296] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5814, lines 19-25; pg. 5815, Lines 1-2
[297] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5796, lines 20-25; pg. 5797, lines 1-20
[298] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5798, lines 7-18
[299] OD 8, image 27, para 63; Ms. Jewison notes (GOL0001457; GOL0001458; GOL0001459; GOL0001460; GOL0001461; GOL0001462; GOL0001463; and GOL0001464)
[300] Correspondence of Dr. Uzarowski (GOL0002880); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5819, lines 2-8
[301] Correspondence of Mr. Magnan (GOL0002901)
[302] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5820, lines 7-13

confirmed to Golder that they would need the laboratory in Ireland or UK to carry out the sample testing.

101. Dr. Uzarowski's evidence was that he first learned of fatalities on the RHVP when Mr. Dave Hein, a principal at ARA, an engineering consulting firm, emailed him a link to the Hamilton Spectator article titled "*Scratching the surface for answers on Red Hill paving*" on January 22, 2018.[303] The article also repeated the anecdotal concern expressed by drivers that the RHVP was slippery.

102. On February 23, 2018, Dr. Uzarowski attended a meeting at the City and gave a presentation related to new asphalt specifications for the City.[304] Dr. Uzarowski's evidence is that after the presentation ended, a smaller group of attendees remained and discussed HIR, including Mike Becke, Marco Oddi and Tyler Renaud.[305] Mr. Renaud and Dr. Uzarowski agreed on the technical concerns of using HIR of SMA on the RHVP.[306] Dr. Uzarowski recommended "*using shotblasting as a quick and simple alternative for friction improvement of the RHVP*" in advance of resurfacing.[307] Dr. Uzarowski's evidence was that Mr. Oddi remarked that the City could not take any measures to improve friction as it would confirm to the public that there was a problem with the RHVP.[308] According to Dr. Uzarowski, this was the first of two occasions that Mr. Oddi repeated this explanation to Dr. Uzarowski as the reason why the City would not use a technique to improve the frictional performance of the surface pending the resurfacing.[309] Mr. Oddi testified that he did not recall being a part of this smaller discussion or making such a statement to Dr. Uzarowski.[310]

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[303] Correspondence of Mr. Hein (GOL0006770); Transcript of Dr. Uzarowski, June 20, 2020, pg. 5836, lines 11-21

[304] Calendar invite (HAM0001130_0001); Correspondence of Ms. Cameron (HAM0001131_0001)

[305] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5840, lines 15-25; pg. 5841, lines 1-6; Correspondence of Ms. Cameron (HAM0001131_0001)

[306] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5842, lines 5-25; pg. 5843 lines 1-17

[307] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5844, lines 20-25; pg. 5845 lines 1-8

[308] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5845, lines 11-25; pg. 5846, lines 1-10

[309] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5845, lines 11-23

[310] Transcript of Mr. Oddi, August 10, 2022, pg. 9284, lines 10-20; pg. 9286, lines 13-25; pg. 9287, lines 1-5; pg. 9288, lines 2-12

103. Following the February 23, 2018, meeting, Dr. Uzarowski contacted Mr. Pat Wiley from Ecopave to discuss the feasibility of HIR on SMA. Mr. Mike Becke, Senior Project Manager, Engineering Services, who was the City's Project Manager for the 2017 Pavement Evaluation, sent a calendar invitation including Mr. Oddi, Mr. Perusin, Mr. Andoga, Ms. Jacob, Mr. Leon, Mr. Vala, Mr. Renaud and Dr Uzarowski entitled "*Meeting to discuss rehab strategy for the RHVP, 2019*". The calendar invitation included the statement: "*Further to the presentation on Friday (thanks Ludomir), we had a side discussion afterwards regarding Hot-in-place on the RHVP. It sounds like there will be some challenges with this approach that we need to discuss moving forward*."[311] Dr. Uzarowski replied to Mr. Becke and reported his conversation with Mr. Wiley. Dr. Uzarowski wrote: "*Pat has never done HIR recycling of SMA and thinks that this is perhaps not feasible. He has referenced the MTO guidelines that do not allow HIR of SMA. I have included below the statements from thee MTO June 2015 guidelines on HIR for your information.*" The statements from the MTO included: "*The HIR process shall not be used to recycle SMA or composite pavements*".[312]

104. The meeting to "*discuss rehab strategy for the RHVP*" was scheduled for March 9, 2018.[313] The attendees of the March 9, 2018 meeting included Mr. Moore, Mr. Oddi, Mr. Becke, Ms. Jacob, Mr. Andoga and Mr. Perusin, among others.[314] In preparation for the meeting, Dr. Uzarowski created detailed notes[315] as he understood that Mr. Moore was keen on doing HIR of SMA and he had to deliver the likely unwelcome opinion that it might not be technically feasible.[316]

105. Dr. Uzarowski brought a hard copy of the results from the 2017 Pavement Evaluation and presented the results of the testing at the meeting. There is divergence in what people recall of this meeting. Of the attendees, Dr. Uzarowski and Mr. Becke took contemporaneous notes. Dr. Uzarowski also memorialized his recollection in an internal memorandum written on March 14, 2018.[317] The preparation notes set out the options of resurfacing using a Mill and Overlay or HIR

[311] Calendar invite from Mr. Becke (HAM0001132_0001)
[312] OD8, image 69, para 193; Correspondence of Dr. Uzarowski (GOL0002720)
[313] Calendar invite (GOL0002859)
[314] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5852, lines 20-25
[315] OD8, images 72-73, paras 204 -205; Dr. Uzarowski notebook (GOL0007414 at image 76)
[316] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5852, lines 4-17
[317] OD8, image 78, para 214; Correspondence of Dr. Uzarowski (GOL0005970 and GOL0003699)

with what Dr. Uzarowski noted as the attendant concerns. Dr. Uzarowski's evidence of his presentation and what was said in response is as follows:

a. The measured texture of the surface tested using the sand patch test showed that the macrotexture was good.

b. BPN was very variable, which Dr. Uzarowski considered was because of the weather conditions during the testing.[318] Mr. Moore's response recorded by Dr. Uzarowski were that the results were "inconclusive".[319] Mr. Moore's description of the test results being inconclusive at this meeting was then a repeated refrain for his description of all friction testing on the RHVP thereafter. Mr. Becke's evidence was that he did not receive the results but recalls hearing that the testing was inconclusive by Mr. Moore or possibly Mr. Oddi.[320] Mr. Oddi's evidence is consistent with Dr. Uzarowski in that he recalls Mr. Moore description of the friction numbers as inconclusive.[321]

c. Because he did not consider the BPT data to have been reliable, Dr. Uzarowski also presented the summary of the 2007 and 2013 friction testing results conducted by MTO and Tradewind, respectively.[322] Although none of the Hamilton witnesses recalled Tradewind being specifically identified by name during the meeting,[323] Mr. Becke recorded in his notes "*Concerns with friction #s*".[324] Neither Mr. Oddi nor Ms. Jacobs recall any discussion regarding frictional characteristics.[325]

d. Dr. Uzarowski presented the results of the PSV testing of the aggregate removed from the in-service asphalt which had a PSV value of 45 which he characterized as medium based on the paper written by Dr. Emery of JEGEL.[326] Dr. Uzarowski's notes record his view was that it was somewhat risky to reuse it in the surface

[318] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5857, lines 1-25, pg. 5858, lines 1-11

[319] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5864, lines 19-23

[320]Transcript of Mr. Becke, June 28, 2022, pg. 7055, lines 13-25; pg. 7056, lines 1-11

[321] Transcript of Mr. Oddi, August 10, 2022, pg. 9301, line24-25; pg. 9303, lines 10-20

[322] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5857, lines 20-25

[323] Transcript of Mr. Becke, June 28, 2022, pg. 7052, lines 19-25; pg. 7053, lines 1-25, pg. 7054, lines 1-9

[324] Mr. Becke notebook (HAM0061788_0001 at image 60)

[325] Transcript of Mr. Oddi, August 10, 2022, pg. 9304, lines 19-25, pg. 9305, lines 1-21; Transcript of Ms. Jacobs, September 06, 2022, pg. 10,115, lines 2-7

[326] Transcript of Dr. Uzarowski, June 20, 2022, pg5859, lines 15-23; pg. 5920, lines 1-25

course.[327] Dr. Uzarowski relayed that Mr. Wiley had not done HIR of SMA and did not want to do it on the RHVP which was a main road in Hamilton.[328] Dr. Uzarowski was also concerned that the MTO guidelines did not allow the HIR of SMA. Dr. Uzarowski's notes repeat his concerns with using HIR as a technique. He explained that HIR of SMA mix would no longer be SMA.[329] The Hamilton witnesses did not specifically recall the PSV testing but Mr. Becke's notes indicate that he understood (at least at that time) that the consequence of the PSV results meant that there would be a change and addition of aggregates to the mix – adding beneficiary mix and the HIR process would be to change the SMA and that the gradation of the aggregate will/may change.[330] Ms. Jacobs recalls that Mr. Moore wanted Dr. Uzarowski to look into what beneficiating mix can be utilized to make HIR feasible, although she does not recall a discussion of any test results.[331]

e. Dr. Uzarowski's notes record that he said that if HIR were to be used, he recommended microsurfacing to address the possible HIR related surface inconsistencies. Most of the witness evidence confirm that Mr. Moore said no to microsurfacing.[332] Mr. Oddi confirmed that Mr. Moore dismissed the idea of microsurfacing after HIR.[333] Ms. Jacobs recalls Dr. Uzarowski raising the idea of microsurfacing at the meeting but does not recall anyone rejecting the idea.[334]

106. At the time, Dr. Uzarowski was unaware that the 2014 Golder Report and the appended Tradewind Report had not been shared with other City Staff by Mr. Moore.[335]

107. Mr. Moore was displeased with Golder's advice that the HIR of SMA was technically not feasible. Dr. Uzarowski recalled that there was a heated discussion between Mr. Moore and Mr.

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[327] Dr. Uzarowski notebook (GOL0007414 at image 76)

[328] *Ibid*

[329] Dr. Uzarowski notebook (GOL0007414 at image 74)

[330] OD8, image 76, para 207; Notebook of Mr. Becke (HAM0061788_0001 at image 60)

[331] Transcript of Ms. Jacobs, September 06, 2022, pg. 10,110, lines 14-17; pg10,111 lines 24-25; pg. 10,112, lines 1-7

[332] Transcript of Mr. Becke, June 28, 2022, pg. 7050, lines 7-25; pg. 7051, lines 1-17

[333] Transcript of Mr. Oddi, August 10, 2022, pg. 9301, lines 24-25; pg. 9302, line 1

[334] Transcript Ms. Jacobs, September 06, 2022, pg. 10,116, lines 20-25; pg. 10,117, lines 1-10

[335] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5861, lines 5-9

Oddi, who was also doubtful of the choice of HIR on a key road asset. Mr. Becke and Mr. Oddi recalled Mr. Moore's ire being directed to Dr. Uzarowski.[336]

108. Mr. Moore left the meeting early, followed by Ms. Jacobs, leaving a smaller group of attendees at the meeting. In an effort to address all the items on his agenda, Dr. Uzarowski continued the discussion and recommended that the City conduct Skidabrading or shot blasting to improve the frictional characteristics of the RHVP pending the resurfacing.[337] It is Dr. Uzarowski's evidence that Mr. Oddi rejected this recommendation as it would confirm to the public that there was an issue with friction on the RHVP, was akin to admitting guilt and that the City would be blamed.[338] Mr. Becke echoed Mr. Oddi's position to Dr. Uzarowski.[339] This was the second occasion that Mr. Oddi repeated the City's explanation to Dr. Uzarowski as to why it would not take steps to improve surface frictional characteristics on the RHVP. Mr. Oddi's evidence does not deny that Dr. Uzarowski recommended a technique to improve the frictional characteristics or that the proposal was rejected but remembers the explanation of why it was rejected differently. Mr. Oddi explained that he didn't think that microsurfacing or any interim treatment made sense in advance of either HIR or resurfacing and therefore it "*seemed like a waste of taxpayer dollars*."[340]

109. The same day, Dr. Uzarowski had a follow-up discussion with Mr. Wiley regarding the HIR of SMA.[341]

110. Dr. Uzarowski described being "*shocked*"[342] by the March 9, 2018 meeting, which seemed to him to be an acknowledgement that the City knew that it had a concern with friction on the RHVP and was refusing to do anything about it. After meeting with the City, Dr. Uzarowski

[336] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5867, lines 12-25; pg. 5868, lines 1-25; pg. 5869, lines 1-20; pg. 5873, lines 7-22; Mike Becke, June 28, pg. 7045, lines 8-13
[337] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5880, lines 3-13
[338] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5881, lines 18-25; pg. 5882, lines 1-5
[339] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5881, lines 18-20
[340] Transcript of Mr. Oddi, August 10, 2022, pg. 9301, lines 6-9
[341] Correspondence of Dr. Uzarowski (GOL0003593 attaching GOL0003594)
[342] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5882, lines 22-25

recorded his recollection of the meeting in an email to his colleagues at Golder on March 14, 2018.[343] Dr. Uzarowski recorded:[344]

> *Frictional characteristics – I suggested applying microsurfacing on HIR recycled SMA, if they use HIR. This would make the surface uniform and offer good frictional characteristics. Gary rejected the idea. I then recommended using skid abrader or shot blasting, at least the worst areas indicated in Tradewind Scientific report, to improve friction of the current surface if they delay resurfacing. Marco rejected the idea for various reasons. For your information, I had recommended this treatment before when they let me know about friction concerns on the RHVP.*

111. Dr. Uzarowski's notes of March 9, 2018, record his question – "*what to do with the test results (PSV…)*".[345] Dr. Uzarowski sent an email to Mr. Becke on March 15, 2018, requesting a call relating to the RHVP.[346] Dr. Uzarowski's notes of the same day record details of the conversation with Mike Becke. The note includes the entry: "*Test results – leave them*."[347] Dr. Uzarowski's evidence was that his understanding of the outcome of the discussion was that Golder would not repeat the BPT testing, and that the City did not require a formal report on the 2017 Pavement Evaluation[348], recognizing that the PSV testing was to be incorporated into the analysis for what became the 2018 HIR Suitability Study.

112. Dr. Uzarowski's evidence was that he was first asked to prepare the final report for the 2017 Pavement Evaluation report by Mr. McGuire on November 29, 2018.[349] In his email, Mr. McGuire also noted an upcoming meeting with the City's legal team as they were looking for all files related to the RHVP.[350]

113. Dr. Uzarowski recalls that he requested a meeting with Mr. McGuire, who was the new Director of Engineering. Dr. Uzarowski explained that his reason for requesting the meeting was

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[343] Correspondence of Dr. Uzarowski (GOL0003699)
[344] OD8, image 78, para 214; Correspondence of Dr. Uzarowski (GOL0005970 and GOL0003699)
[345] Dr. Uzarowski notebook (GOL0007414 at image 74)
[346] Correspondence of Dr. Uzarowski (HAM0052952_0001)
[347] Dr. Uzarowski notebook (GOL0007414 at image 75)
[348] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5895, lines 4-11
[349] GOL0003026; LU, June 20, pg. 5924, lines 15-17
[350] OD9a, image 171, para 409; Correspondence of Mr. McGuire (GOL0003026)

rooted in his concern about the frictional characteristics of the pavement and the reports of accidents/fatalities on the RHVP, in combination with the City's reluctance to act on Golder's advice to implement pavement treatment technologies as interim measures because the City did not want to admit guilt and be blamed. At the same time, he was concerned that the City might try to blame Golder for what we advised and they decided not to follow. Dr. Uzarowski shared his concerns to senior colleagues at Golder who recommended that he meet with Mr. McGuire and explain the history of the work done by Golder and summarize the recommendations that had been repeatedly given.[351]

114. On December 18, 2018, Dr. Uzarowski met with Mr. McGuire and provided him with historic information regarding the paving, friction testing results, and the recommendations that Golder had provided.[352] Dr. Uzarowski delivered a hard copy of the draft 2017 Pavement Evaluation report to Mr. McGuire.[353] Dr. Uzarowski's evidence is that he was first made aware that the Golder Report and the appended Tradewind Report had not previously been shared internally at the City and that Mr. McGuire had found them recently.[354] It was also the first time he was informed of CIMA's engagement by the City to provide road safety consulting advice, and that CIMA had been advising the City about safety aspects and collision, including speed on the RHVP.[355] It is Dr. Uzarowski's evidence that Mr. McGuire "*made a clear impression to me that, you know, speed and volume was none of my business, that there was other consultant taking care of this, and then, you know, safety consultant who would take –who would look at safety aspects on the RHVP*."[356]

115. Dr. Uzarowski's notes document his conversation Mr. McGuire about various technologies that Golder had recommended to improve frictional characteristics of the RHVP pavement, including '*microsurfacing*' and '*shot blasting/skidabrading/blasting/blast tracking*'.[357] In this

[351] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5927, lines 23-25; pg. 5928; lines 1-25; pg. 5929, lines 1-18.
[352] OD9a, image 263, para 621
[353] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5941, lines 12-25; pg. 5942, lines 1-12; OD 9, para 526, para 214-215
[354] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5930, lines 22-25; pg. 5931, lines 1-3; pg. 5952, lines 7-16
[355] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5959, line 23-25; pg. 5960, line 1-25; pg. 5961, lines 1-4
[356] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5960, lines 5-23
[357] OD, 9a, image 263, para 621; Dr. Uzarowski notebook (GOL0003874_00004); Transcript of Dr. Uzarowski, June 20, 2020, pg 5952, lines 17-25; pg. 5953, lines 1-8

context, Dr. Uzarowski's note "*LU contacting contractors, final decision – no*" relates to his prior communication with pavement treatment technology contractors, including Skidabrader and Blastrac, but ultimately Mr. Moore was not interested in implementing this technology on the RHVP.[358]

116. Following this meeting, Dr. Uzarowski exchanged several emails with Mr. McGuire. Dr. Uzarowski's impression was that the tone of the emails pivoted to aggressive, following the December 18, 2018, meeting and that he was concerned that the City was trying to blame Golder.[359]

117. Dr. Uzarowski reported his recollection of the meeting in an email to his colleagues at Golder on Jan 14, 2019.[360] Dr. Uzarowski recorded the discussions with Mr. Moore regarding the Golder Report and the appended Tradewind Report[361]:

> *(…) Golder was requested by the City to investigate the skid resistance on the RHVP in 2013. Golder hired Tradewind Scientific, a company form Ottawa for skid testing. Tradewind Scientific submitted a report in early 2014. (…) At the end of January 2014, Golder submitted a report to the City on the performance of the pavement on the RHVP 6 years after construction. The Tradewind Scientific report was also attached to this report and it was mentioned in the Golder's report that the SN numbers should be addressed.*
>
> *The subject of friction results was also briefly discussed in a telephone conversation. Golder was requested not to send the report separately by email. A hard copy of the report was delivered on February 7, 2014 and the results were discussed. The possible solution of microsurfacing and shot blasting was also mentioned in this meeting with the City.*

118. Dr. Uzarowski also recorded the instances that he recommended various pavement treatment methods to improve the frictional characteristics of the pavement:[362]

> *In March 2016, Golder contacted contractors who can do shot blasting, one who can use a Skidabrader (large, high capacity machine) and another who uses Blastrac machine. (…) Golder received an email on March 15, 2016 that the City is not interested in this.*

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[358] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5957, lines 14-23

[359] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5870, lines 3-7

[360] Dr. Uzarowski first sent Ms. Rizvi a draft of the email to review and noted his intention to send the final email to her and other colleagues at Golder, including in-house counsel Mr. Linardi. Accordingly, the final email that was sent by Dr. Uzarowski is privileged and has not been produced.

[361] OD9a, image 306, para 716; Correspondence of Dr. Uzarowski (GOL0006440)

[362] OD9a, image 306, para 716; Correspondence of Dr. Uzarowski (GOL0006440)

> *There were a few discussions between 2016 and 2017 including friction on the RHVP when Golder mentioned the microsurfacing and shot blasting as the way of pavement frictional characteristics improvement. The answer from the City was no.*
>
> *In 2017, Golder was requested to carry out the investigation of PSV, surface texture and to do British Pendulum Testing on the RHVP. The testing was done at night on December 6/7 with temperatures below 0C and light snow fall. (…) The PSV of the aggregate from the SMA was 45 which is considered average/medium. The surface texture was good. BPN numbers – the average was medium; however, there were locations where the numbers were low. Because the testing was done while the temperature was below 0°C and there was light snow fall, the BPN numbers are considered not to be reliable. The results of the investigation were presented at the meeting with the City on March 9, 2018 where the possibility of doing Hot In-Place Recycling (HIR) on the RHVP was the main subject. The results of the testing were considered by the City to be inconclusive. Golder again mention in this meeting that the frictional characteristics can be improved by doing a low cost shot blasting. The City explained that they cannot do shot blasting because this would show the public that there was a problem with the pavement on the RHVP and by doing the blasting the City would admit the guilt and justify blame.*
>
> *At the end of the meeting with Gord McGuire on December 18, 2018, I mentioned that it is important to recognize that the frictional characteristics have not improved and the skid hazard in the RHVP may still be there. One of the main factors is the excessive speed on the RHVP. There is a traffic monitoring station on the RHVP. The data shows that a large percentage of the drivers does not follow the speed limit and the speed can be very high. Also, the traffic on the RHVP is much higher and heavier than it was designed for. This accelerates pavement deterioration including potential polishing. It is up to the City to decide what they want to do and if they want to do shot blasting before pavement rehabilitation likely in early 2019.*

119. Golder submitted the final version of the 2017 Pavement Evaluation report to the City on March 1, 2019.[363] The time from when it was requested on November 29, 2018, to the first draft on December 18, 2018 and when it was delivered on March 1, 2019 reflected Mr. McGuire's repeated follow up questions[364], the further research that was required, the involvement of Hamilton's auditor and Golder's own internal scrutiny and risk management as it became

[363] Correspondence of Dr. Uzarowski (GOL0006610 attaching GOL0006612)

[364] Correspondence of Mr. McGuire, December 19, 2018 (HAM0035745_0001); Correspondence of Mr. McGuire, January 13, 2019 (GOL0003045); Correspondence of Dr. Uzarowski, January 18, 2019 (HAM0054251_0001); Correspondence of Mr. McGuire, January 20, 2019 (GOL0003050), Correspondence of Golder, February 11, 2019 (also responding to Mr. Pellegrini (auditor) GOL0006720)

increasingly apparent that the City was looking for reasons to blame Golder for its own failure to action any of Golder and Tradewind's findings, analysis and recommendations.[365]

viii. Hot-in-Place Recycling Engagement

120. Immediately following the March 9, 2018, meeting with the City, Dr. Uzarowski had a follow-up discussion with Mr. Wiley regarding the feasibility of HIR of SMA.[366] Dr. Uzarowski reported his conversation to Mr. Moore on March 9, 2018, noting that he had a lengthy discussion with Mr. Wiley and that "*[h]e is much more optimistic now then a few days ago. We will work together to see how we can adjust the mix to make HIR feasible*." [367, 368]

121. On March 15, 2018, Dr. Uzarowski further reported to Mr. Moore (copying Mr. Becke and Mr. Oddi) on his discussions with Mr. Wiley, stating that Mr. Wiley is "*now in agreement to carry out this project*." Dr. Uzarowski broadly outlined Golder's proposed role in the HIR project as: obtaining field samples; laboratory testing; mix design; developing project specifications and Quality Assurance testing.[369] Mr. Moore responded to Dr. Uzarowski's email stating while he was agreeable to the proposed work, the contractor would be determined through the City's tender process.[370]

122. Golder's Project Risk Committee ("**Risk Committee**") became involved in this project in April 2018, after Dr. Henderson sent an internal email to her colleagues. She wrote: "*HIR is commonly used in BC but in different applications than the one the City is interested in. Ludomir has spoken with the HIR contractor (ECOPAVE) and they initially were very hesitant but are now*

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[365] Transcript of Dr. Uzarowski, June 23, 2022, pg. 6402, lines 10-25; pg. 6403, lines 1-25; pg. 6404, lines 1-4

[366] OD 8, image 76, para 208; Correspondence of Dr. Uzarowski (GOL0003593 attaching GOL0003594)

[367] OD 8, image 76, para 209

[368] The final HIR Suitability Study Report records that Dr. Uzarowski had also discussed the feasibility of HIR on SMA with the British Columbia Ministry of Transportation and Infrastructure ("BCMOTI"), who "has vast experience with HIR and has used it on a regular basis for over 25 years." The BCMOTI advised that it had never performed HIR on SMA, however, in their opinion it was theoretically possible. (see GOL0003877; section 4.0 Discussion and Recommendations)

[369] OD 8, image 80, para 220; Correspondence of Dr. Uzarowski (HAM0052969_0001)

[370] OD 8, image 81, para 222

on board with the idea. This idea has been driven by the City and not by Golder."[371] Dr. Henderson's evidence is that the HIR of SMA had a significant research component to it as HIR was not routinely implemented in Ontario and there was no experience of using HIR on SMA.[372] Further, a professional within the industry, who is a leader in HIR technology, Mr. Wiley, had identified that it would be challenging to do HIR of SMA.[373] Dr. Uzarowski's evidence was that the HIR of SMA was also contrary to OPSS guidelines.[374] Thus, this project merited a discussion with the Risk Committee, given all these considerations. Ultimately, the Risk Committee approved the project subject to Golder implementing technical controls and contractual terms that would act as a possible risk mitigation solution for a technology that was considered innovative.[375]

123. On May 14, 2018, Dr. Uzarowski attended a meeting at the City to discuss the feasibility of HIR on the RHVP.[376] Mr. Becke sent a calendar invitation to Mr. Andoga, Mr. Perusin, Mr. Oddi, Mr. Renaud and Dr. Uzarowski, titled "Red Hill Valley Repaving – HIP" and noted the reason for the meeting was "*to get the sampling going for the RHVP HIP resurfacing*".[377] Mr. Moore also attended the meeting.[378] Dr. Uzarowski's notes of the meeting record that amongst other things, sampling on the RHVP to assess the feasibility of HIR and PSV results was discussed.[379] The meeting also discussed Golder's findings from the 2017 Pavement Evaluation engagement.[380]

124. Mr. Moore left the meeting early. Afterwards, Dr. Uzarowski once again repeated his recommendation to conduct shotblasting as an interim measure and leading up to resurfacing of the RHVP in 2019, so as to improve frictional characteristics of the pavement.[381] Dr. Uzarowski's

[371] OD 8, image88, para 244; Correspondence of Dr. Henderson (GOL0005832)
[372] Transcript of Dr. Henderson, June 22, 2022, pg. 6321, line 1; pg. 6322, lines 1-9
[373] Transcript of Dr. Henderson, June 22, 2022, pg. 6321, lines 21-25; pg. 6322, lines 1-16
[374] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5898, lines 2-11
[375] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5897, lines 20-25; pg. 5898, lines 1-25; pg. 5899, lines 1-3
[376] OD 9a, image 10-11, para 11-13; Calendar invite (GOL0006444)
[377] OD 9a, image 10-11, para 11-13; Calendar invite from Mr. Becke (GOL0002860)
[378] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5900, lines 6-7; Transcript of Mr. Becke, June 28, 2022, pg. 7090, lines 18-22
[379] OD9a, image 10, para 13; Dr. Uzarowski notebook (GOL0003874 at image 2)
[380] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5904, lines 23-25; pg. 5905, lines 1-15
[381] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5905, lines 16-24

evidence was again that Mr. Oddi, followed by Mr. Becke dismissed this recommendation.[382] Dr. Uzarowski understood Mr. Oddi to mean that the City did not want to take any interim measure to address frictional characteristics of the pavement as it could be construed as an admission that there was a concern with friction on the RHVP. Mr. Oddi's evidence was that he does not recall attending the meeting.[383]

125. Golder submitted a proposal for the HIR Suitability on June 4, 2018. The proposal was divided into two phases: preliminary investigation and specification development (Phase 1); and mix design and QA testing, subject to Phase 1 results (Phase 2).[384] Mr. Becke was Project Manager for the engagement. His evidence was that the objective of this proposal was to get larger slab sections for testing as the HIR needed uncut aggregate.[385]

126. Golder supervised the collection of multiple asphalt samples from the RHVP on July 22, 2018.[386]

127. On August 27, 2018, Dr. Uzarowski emailed the Tradewind Report to Mr. Becke, noting "*as requested*".[387] Mr. Becke's evidence was that he raised with Dr. Henderson that "*all I had heard was that the results were inconclusive. Ms. Henderson asked, have you seen the report? I said no, She said, I'll send you the report*."[388] Dr. Henderson's evidence was that "*it is not a subject I would have brought up as it was work we had done for Gary Moore*", although she does not recall the conversation.[389] Mr. Becke did not clarify which results he was talking about, but does recall that the details of the report were not discussed.[390] It is Mr. Becke's evidence that at the time

[382] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5906, lines 1-12
[383] Transcript of Mr. Oddi, August 10, 2022, pg. 9327, lines 1-5
[384] Correspondence of Dr. Uzarowski (HAM0053447_0001) attaching Proposal (HAM0053448_0001)
[385] Transcript of Mr. Becke, June 28, 2002, pg7092, lines 22-25; pg. 7093, lines 1-2
[386] OD 9a, image 41, para 102; Dr. Henderson notes (GOL0001509)
[387] Correspondence of Dr. Uzarowski (GOL0006338 attaching GOL0006340, also HAM0053622_001 attaching HAM0053623_0001)
[388] Transcript of Mr. Becke, June 28, 2022, pg. 7109, lines 5-22
[389] Transcript of Dr. Henderson, June 22, 2022, pg. 6328, lines 15-25
[390] Transcript of Mr. Becke, June 28, 2022, pg. 7109, lines 18-22

he received Dr. Uzarowski's email, he did not appreciate that the Tradewind Report was appended to the 2014 Golder Report.[391]

128. On October 18, 2018, two HIR technology vendors, the Crupi Group and EnviroTech had organized a meeting with City Staff, including Mr. Becke, to promote HIR to the City. Dr. Uzarowski learnt about this meeting from Mr. Becke and requested that he be invited to this meeting.[392]

129. After the meeting with Crupi/EnviroTech, Dr. Uzarowski had an informal meeting with Mr. Becke and provided him with hardcopies of the initial gradation results from the HIR Suitability Study.[393] Dr. Uzarowski offered his preliminary opinion that although HIR of SMA was likely to be theoretically possible it would be extremely difficult and expensive to implement on the RHVP.[394] In response, Mr. Becke conveyed that the City had already decided not to use HIR to resurface the RHVP but to repave it. Mr. Becke instructed Golder to continue its evaluation of suitability of HIR and deliver its report.[395] After the Crupi/EnviroTech presentation had ended, Dr. Uzarowski was introduced to Mr. McGuire who left shortly before the informal meeting with Mr. Becke.[396]

130. On December 6, 2018, Mr. Becke requested Golder to submit a final report for the HIR engagement shortly.[397] At the time, Dr. Uzarowski understood from his October 18, 2018, meeting with Mr. Becke that the City would not be using HIR to resurface the RHVP and therefore the City was only interested in the "*evaluation or investigation [of HIR] and not implementation*".[398]

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[391] Transcript of Mr. Becke, June 28, 2002, pg. 7110, lines 24-25; pg. 7111, lines 1-3

[392] Calendar invite from Mr. Becke (HAM0011355_0001), Correspondence of Dr. Uzarowski (GOL0003672); Dr. Uzarowski notebook (GOL0007404 at images 30-31); Transcript of Dr. Uzarowski, June 20, 2022, pg. 5911, lines 15-25; pg. 5912, lines 1-25; pg. 5913, lines 1-4

[393] Exhibit 84 – Gradation results (GOL0007415); Transcript of Dr. Uzarowski, June 20, 2022, pg. 5913, lines 9-23

[394] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5914, lines 16-22

[395] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5915, lines 1-25; pg. 5916, lines 1-8

[396] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5914, lines 1-12

[397] Correspondence of Mr. Becke (HAM0035737_0001)

[398] Transcript of Dr. Uzarowski, June 20, 2022pg 5926, lines 9-17

131. Dr. Uzarowski emailed Mr. Becke attaching a draft copy of the HIR Suitability Study report, including laboratory results on December 21, 2018.[399] The same day, Mr. Becke forwarded the email from Dr. Uzarowski to Mr. McGuire (copying Ms. Jacob and Mr. Renaud).[400]

132. On January 17, 2019, Dr. Uzarowski logged notes from his telephone conversation with Mr. Becke. His notes indicate that they discussed "*SMA HIR on the RHVP*" and Golder was "*asked to continue testing*" and "*complete the report even if HIR is not feasible*".[401]

133. Golder submitted the final HIR Suitability Study Report to the City on March 11, 2019.[402] The report concluded that while HIR of SMA is theoretically possible, it necessitated the use of significant amount of beneficiating mix, which would result in substantial cost increase compared to a conventional resurfacing method. The recycled mix would have to meet the standard specification requirements of Superpave SP12.5 FC2 mix and the gradation would have to change from a gap graded SMA to dense graded SP12.5 FC2. The report also relied on the PSV testing results from the 2017 Pavement Evaluation Report for its analysis and recommendations, and stated:

> *(…) The benefit is that the addition of such a high percentage of the beneficiating mix would also allow an opportunity to improve friction characteristics, i.e., an increase in PSV for the combined aggregate. (…) The PSV of the aggregate in the SMA is about 45 and is considered to be average/medium as discussed on our report to the City dated February 28, 2019. If aggregates with a very high PSV, such as 55 or higher, is used in the beneficiating mix, then the average for the blend can be raised to approximately 50. However, it should be recognized that aggregate with a PSV of 55 may be expensive (…). Long haulage distances maybe required, and the aggregates would likely have to be custom produced to ensure the specific grading requirements are met.*

134. Golder found that HIR of SMA was theoretically possible but did not recommend its application on the RHVP.

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[399] OD 9a, image 269, para 630; Correspondence of Dr. Uzarowski (GOL0005768) attaching draft HIR Suitability Study (GOL0005769)

[400] OD 9a, image 269-70, para 630; Correspondence of Mr. Becke (HAM0054194_00 attaching HAM0054195_0001)

[401] Dr. Uzarowski notebook (RHV0000933 at image 873)

[402] OD10a, image 127, para 324; Correspondence of Dr Uzarowski (GOL0006581 attaching GOL0006583)

C. The surface frictional properties of the RHVP – 2007-2018: What does the data tell us and what do the experts say about it?

135. One of the objectives explicit in choosing to use SMA asphalt on the RHVP was the anticipation that it would provide good frictional performance.[403] Whether an asphalt does provide in fact good frictional performance largely depends on the characteristics of the aggregates within the asphalt mix.[404] To this end, much of the verification process for the review of the asphalt mix proposed by Dufferin was focused on the characteristics of the aggregate from Dufferin's Demix Varennes quarry (the "**Aggregates**"). The tests required by the specifications were intended to verify that the Aggregates were resistant to polishing and that they would retain their microtexture with the objective that the Aggregates within this aggregate dense mix would provide good frictional characteristics. In his review of the test results provided by Dufferin in 2007 as well as the MTO's testing of 2008, Dr. Hassan Baaj found that the Aggregates had excellent physical properties of hardness, resistance to attrition and abrasion, resistance to freeze thaw, Petrographic Number and resistance to polishing.[405] He concluded:[406]

> *In summary, based on the Aggregate's mechanical, physical, petrographic, and polishing properties, as per the testing conducted in 2007 and 2008, I conclude that the Aggregate meets all the requirements for SMA 12.5 Mix and Traffic Category E in Ontario. Accordingly, the Aggregate could have been expected to be adequate for projects requiring good skid resistance. The Aggregate is, therefore, suitable for surface-course asphalt mixes used for high-volume, high-speed highways in Ontario.*

[403] OD 3.1, image 7, para 15, 2003; Preliminary Design Report, Section 3.5.2 Pavement Design (HAM0031758_0001 at images 14 and 15); See also OD3, image 13, para 20; see also Exhibit 13 – Dr. Gerardo Flintsch, *Primer on Friction, Friction Management, and Stone Matrix Asphalt Mixtures*, April 2022 (EXP0000189 at image 37, section 3.1)

[404] Exhibit 13 – Dr. Gerardo Flintsch, *Primer on Friction, Friction Management, and Stone Matrix Asphalt Mixtures*, April 2022 (EXP0000189 at images 21 and 22, section 2.2)

[405] Exhibit 244 - Dr. Hassan Baaj, *Analysis of Aggregate Testing and Evaluation of the Coarse Aggregate used in the RHVP Pavement Surface Course*, February 2023 (GOL0007517 at image 18)

[406] Exhibit 244 - Dr. Hassan Baaj, *Analysis of Aggregate Testing and Evaluation of the Coarse Aggregate used in the RHVP Pavement Surface Course*, February 2023 (GOL0007517 at image 19)

136. Dr. Flintsch commented that he considered Dr. Baaj's review thorough and agreed with Dr. Baaj's findings.[407] Mr. Hein also agreed with Dr. Baaj's findings.[408]

137. In July of 2007, just before the surface paving was undertaken, Dr. Uzarowski was alerted by Mr. Chris Raymond of the MTO to the MTO's experience with early age low friction in some SMA mixes.[409] To verify that the asphalt on the RHVP did not exhibit a concerning low level of friction after paving, Dr. Uzarowski requested and MTO provided friction testing of the newly paved RHVP in October of 2007 before it was opened to traffic. Dr. Uzarowski considered that the results were good given the comparative experience of similar SMA asphalt mixes on MTO highways and that the surface friction would quickly increase significantly once the initial surface began to wear exposing the aggregate structure of the mix.[410]

138. The evidence from the MTO testing subsequently conducted on the RHVP in 2008 was that Dr. Uzarowski was correct: the results showed that the frictional characteristics significantly improved by 2008 showing friction averages of FN (90) 38-41.[411] As observed by Dr. Flintsch, the surface friction of the RHVP in September 2019 after resurfacing was slightly higher (between 40 and 44) than the friction values measured by the MTO in 2008.[412]

139. The MTO continued to conduct friction testing on the RHVP from 2008 to 2014 as part of its verification of the characteristics of the Aggregates, which was included in the MTO's DSM list for aggregate appropriate for high speed and high-volume roads using SP12.5FC and FC2 asphalt mixes in 2009.[413] The MTO evidence of its testing was that friction stabilized at averages

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[407] Transcript of Dr. Flintsch, February 16, 2023, pg. 15542-15543, lines 12-5

[408] Transcript of Mr. Hein, February 24, 2023, pg. 16344, lines 3-13

[409] OD3, image 55-56, para 113 – 114; Dr. Uzarowski notebook (GOL0007410 at image 21); Correspondence of Ms. Lane (MTO0001265)

[410] Correspondence of Dr. Uzarowski (GOL0002619 attaching GOL0002620 and GOL0002621); Transcript of Dr. Uzarowski, April 28, 2022, pg. 521, Lines 12-19; pg. 522, Lines 18-21, pg. 523, Lines 1-13 pg. 524, Lines 18-25, pg. 525, Line 1

[411] Internal MTO correspondence (MTO0024001 attaching MTO0024002, MTO0024003, MTO0024004 and MTO0024005); Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 10)

[412] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 10)

[413] OD4, image 96, para 229-232; Letter of the MTO re Conditional Approval (MTO0000046 enclosing MTO0000047); Consolidated friction testing by MTO (MTO0022942, MTO0022943, MTO0022944, MTO0022945 and MTO0022946)

around FN31 to FN33 and was therefore acceptable.[414] Ms. Becca Lane (Manager Materials Engineering and Research Office, Highway Standards Branch, MTO) did not consider the few deviations below FN(90)30 to be of concern.[415] Mr. Stephen Senior's (Head Soils and Aggregate Section, Materials Engineering and Research Office, MTO) evidence was that he looked at the trend in the data and observed that while there were high values in the beginning, "*to see them drop is not abnormal*", specifically for the trap rock category. He noted that the averages were "*sort of becoming more constant over time and levelling off at a value in the low 30s*" and therefore "*there was nothing alarming"* about these results given that the friction numbers were reasonably similar to other pavements in the trap rock category.[416]

140. Dr. Uzarowski's evidence was that he was not aware that the MTO had continued to test friction on the RHVP from 2008 to 2014 until 2018.[417] There is one odd piece of evidence in relation to the MTO's friction testing of the RHVP in 2010. The testing in 2010 was conducted at 100km/hr and not 90 km/hr and the results were therefore anomalous because of the test speed (which the MTO ultimately realized and then corrected). Ms. Lane said that she would contact Dr. Uzarowski to obtain a contact for the City to discuss the results.[418] Dr. Uzarowski's notes of November 15, 2010 record [419]: "*5) Becca Lane – 2007 friction on RHVP*." Dr. Uzarowski's evidence was that he would have given Ms. Lane Mr. Gary Moore's phone number had he been asked for a contact. Neither he nor Ms. Lane recalled any details of the telephone call and specifically, neither recalled discussing the MTO's on-going friction testing of the RHVP.[420] Dr. Uzarowski thought from his note that they likely discussed the early age low friction issue. Ms. Lane's evidence was that if she said she would contact the City, she would have but she has no record and no recollection of a conversation.[421] Mr. Moore had no recollection of being contacted

[414] Transcript of Ms. Lane, May 17, 2022, pg. 2244, lines 14-25; pg. 2245, lines 1-19; pg2247, lines 3-25; pg. 2248, lines 1-4

[415] Transcript of Ms. Lane, May 17, 2022, pg. 2162, lines 5-22

[416] Transcript of Mr. Senior, May 26, 2022, pg. 2824, lines 8-25; pg. 2825, lines 1-22

[417] Transcript of Dr. Uzarowski, June 15, 2020, pg. 5485, lines 18-22; pg. 5845 lines 1-8

[418] See Overview Document 4, image 90, paragraphs 212-213

[419] Exhibit 44 – Dr. Uzarowski's note (GOL0007502)

[420] Transcript of Dr. Uzarowski, June 15, 2022, pg. 5484, lines 4-25; pg. 5485, lines 1-12; Transcript of Ms. Lane, May 16, 2022, pg. 2125, lines 18-25; pg. 2126, lines 1-3; pg. 2127, lines 1-25; pg. 2128, line 1

[421] Transcript of Ms. Lane, May 17, 2022, pg. 2146, lines 11-18

by Ms. Lane.[422] Had Ms. Lane advised Dr. Uzarowski that the MTO had continued to conduct friction testing of the RHVP, he would have recorded the fact in his notes. There is not such a note and no evidence that Ms. Lane told Dr. Uzarowski that the MTO had continued to test friction on the RHVP after the post construction testing done in 2007.

141. The Tradewind Report was delivered by email to Golder on January 26, 2014.[423] Tradewind's finding was that the average GripTester Friction numbers were generally below or well below the UK reference investigatory level that it applied. Tradewind included the UK reference standard in Appendix 1 to its report. Tradewind also tested a number of ramps including the Greenhill on and off ramps. These were paved using the same aggregate but in a Superpave 12.5 FC2 asphalt mix. The results of the Greenhill off-ramp averaged GN61 and the on-ramp averaged GN54.[424] In relation to the mainline, Tradewind recommended: "*that a more detailed investigation be conducted and possible remedial action be considered to enhance the surface texture and friction characteristics of the Red Hill Valley Parkway, based on the friction measurements recorded in the current survey*."[425]

142. Dr. Uzarowski considered that the Tradewind finding that friction numbers were below or well below the relevant UK Investigatory Level 2 (GN of 48) to be overly conservative.[426] As he described in his testimony, his analysis of the Tradewind friction data relied on the 1997 Transportation Association of Canada, *Pavement Design and Management Guide* which set out the Table reference standards using a UK standard for investigatory levels of road surfaces.[427] He then identified a correlation for SCRIM skid numbers to Grip tester numbers published by the United Kingdom Pavement Management System ("**UKPMS**")[428] which showed a reference GN

[422] Transcript of Mr. Moore, July 15, 2022, pg. 8177, lines 23-25

[423] GOL0001112 attaching GOL0001113

[424] Tradewind Report (GOL0001113)

[425] The Golder Report (GOL0002981 at image 114)

[426] Transcript of Dr. Uzarowski, June 15, 2020, pg. 5601, lines 22-25

[427] TAC, Pavement Design and Management Guide (GOL0003936 at images 2 and 3)

[428] The chart showing the UK investigatory levels for SCRIM and GripTester and was relied on by Tradewind in their Memorandum of February 4, 2019 (in which they also noted that the table was also referenced in the United States in the Guide to Pavement Friction), and cited by Dr. Flintsch his Power Point presentation, the Primer and Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 14)

of 41 which he rounded to 40. Dr. Uzarowski concluded that the friction values from the GripTester were "relatively low"[429], a finding with which Dr. Flintsch agreed[430].

143. Tradewind subsequently acknowledged that it had not applied the correct UK reference standard and, without acknowledging that Dr. Uzarowski was correct, identified the same investigatory threshold that Dr. Uzarowski's applied and described its friction findings as less below the investigatory level than they had reported in 2014.[431] CIMA in its Memorandum of February 4, 2019[432] and Dr. Flintsch[433] applied the same UKPMS table used by Dr. Uzarowski. In effect, both agreed that the investigatory threshold value based on UK standard applied by Dr. Uzarowski was correct.

144. Friction testing of the RHVP was conducted by ARA in May of 2019 using a locked wheel tester and by Englobe using a Grip Testing device. In her testimony, Ms. Becca Lane specifically addressed the pre-resurfacing testing conducted by ARA and confirmed her view that the friction on the RHVP had leveled off by 2014 and did not decline further.[434] Ms. Lane's findings that the friction levelled off around 2014 was agreed by Dr. Flintsch as well as Mr. Hein.[435] Dr. Flintsch cross referenced the ARA data with the testing conducted by Englobe in May of 2019 using a GripTester. Dr. Flintsch remained of the view that the ARA and Englobe testing showed that the frictional characteristics of the road surface were 'relatively low".

145. Mr. Hein considered the MTO and ARA testing in reference to the MTO practice for further investigation of FN(90)30 measured at the posted speed limit for the road. He noted the deviations of specific friction readings below FN(90)30 but considered them minor and inconsequential. He

[429] The Golder Report, Section 5.0 Friction Testing and Section 6.0 Analysis and Recommendations (GOL0002981 at image 10)
[430] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 15)
[431] Exhibit 103 – Tradewind Letter (RHV0000889 at images 1 and 2)
[432] CIMA Memorandum of February 4, 2019 (HAM0054683_0001 at image 4); Note CIMA's finding: Our conclusion of the review of the Golder report is that the friction values measured are in the range that the UKPMS would identify as 'investigatory' and would need additional review of the roadway as a whole. The Golder/Tradewinds report made a similar overall conclusion from the data, albeit using a different reference table", image 6
[433] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 13)
[434] Transcript of Ms. Lane, May 17, 2022, pg. 2244, lines 14-25; pg. 2245, lines 1-19; and pg. 2247, lines 3-20
[435] Exhibit 222, David Hein "Phase 2 of the Red Hill Valley Parkway Inquiry – Response to the Report of Gerardo Flintsch dated November 2022", February 1, 2002 (HAM0064775_0001 at image 6)

stated: "*Finally, I have conducted friction testing results on various highways and have seen friction values for other highways in Ontario throughout my career. The RHVP friction test results are consistent on average for its age and are* consistent with friction results I have previously seen on other highways."[436] Dr. Hein did not agree with Dr. Uzarowski and Dr. Flintsch that the test results were 'relatively low' and considered that they were acceptable applying the MTO's practice for evaluation.[437]

146. Golder also conducted friction testing in early December of 2017 using a British Pendulum Tester method ("**BPT**") as part of the 2017 Pavement Evaluation. Golder's engagement arose as a consequence of Mr. Moore's interest in the potential application of HIR on the RHVP[438], instead of a more orthodox repaving contemplated in reporting to the Public Works Committee.[439] Dr. Uzarowski's evidence was that the British Pendulum equipment belonged to the University of Waterloo and was the equipment available so late in the season.[440] Testing was conducted by Golder on December 6 and 7, 2017.[441] Dr. Uzarowski considered that the results of the BPT results were very variable, and he did not consider them reliable.[442] Dr. Uzarowski cross referenced weather conditions on December 6 and 7 and stated that the variable results were likely explained by weather conditions (temperature below 0°C and light snow fall). Dr. Flintsch concurred with Dr. Uzarowski's finding that the results of the BPT testing were not reliable.[443]

147. Golder took cores of the surface on December 6 and 7, extracted the aggregate from the asphalt and had the aggregates sent to the James Fisher Testing Services in Ireland for Polished

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[436] David Hein "Phase 2 of the Red Hill Valley Parkway Inquiry – Response to the Report of Gerardo Flintsch dated November 2022, Exhibit 222A, image 9

[437] Exhibit 222, David Hein *"Phase 2 of the Red Hill Valley Parkway Inquiry – Response to the Report of Gerardo Flintsch dated November 2022*", February 1, 2002 (HAM0064775_0001 image 9); Also Exhibit 222A (HAM00064785_0001)

[438] Correspondence of Mr. Moore (GOL0002851) and Correspondence of Dr. Uzarowski attaching Proposal (HAM0052823_0001 attaching HAM0052824_0001)

[439] The Engineering Division has scheduled the repairing of the LINC and RHVP between 2018 to 2021. See Report to PWC 18008 HAM0026494 at image 6.

[440] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5796, lines 20-25; pg. 5797, lines 1-20

[441] Golder notes (GOL0001457, GOL0001458, GOL0001459, GOL0001460, GOL0001461, GOL0001462, GOL0001463 and GOL0001464)

[442] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5857, lines 1-25, pg. 5858, lines 1-11

[443] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 21)

Stone Value ("**PSV**") testing. Dr. Uzarowski's evidence was that the purpose of the PSV testing was to evaluate the anticipated long-term frictional performance of the aggregates for reuse as part of the application of Hot in Place recycling of the surface. The testing of the extracted aggregate resulted in a test value of 45 which Dr. Uzarowski found to be average/medium.[444] Dr. Baaj considered whether PSV of extracted aggregates could be used to evaluate the present state of polishing and his view was categorical that the testing could not be used for this purpose. While Dr. Flintsch noted the PSV of the extracted aggregates was in his view relatively low, he conceded to Dr. Baaj's opinion that the PSV testing of the extracted aggregates could not be used to evaluate their present condition.[445]

148. Lastly, the 2017 Pavement Evaluation also included the testing of the macrotexture of the pavement using a sand patch method. Dr. Uzarowski's finding was that the average texture depth was generally considered to be good.[446] Macrotexture was also tested by ARA in May of 2019 and although their results varied somewhat from those obtained by Golder in 2017, they too concluded that the macrotexture was good. Dr. Flintsch agreed with the findings that the macrotexture of the RHVP surface was acceptable.[447]

149. No one reviewing the results of the friction testing on the RHVP (not Dr. Uzarowski, Ms. Lane, Mr. Senior, Dr. Flintsch or Mr. Hein) identified them as alarming or a red flag. This is not a circumstance where friction by itself might be so low as to create its own hazard.

D. Findings, Analysis and Recommendations about Friction -- 'It would not have hurt and might have helped'

150. Dr. Uzarowski did not receive and was not aware of the extensive investigations and analysis conducted by Hamilton's road safety consultant, CIMA, about collisions on the RHVP. Dr. Uzarowski's evidence was that he was not aware of fatalities on the RHVP until Dave Hein

[444] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5859, lines 15-23; pg. 5920, lines 1-25
[445] Transcript of Dr. Flintsch, February 16, 2023, pg. 15544, lines 10-19
[446] Transcript of Dr. Uzarowski, June 20, 2022, pg. 5987, lines 15-23; pg. 5920, lines 12-19
[447] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 24)

(Principal Engineer and Vice-President of Transportation, ARA) emailed him on January 22, 2018, and provided a link to a Hamilton Spectator Article dated January 15, 2018 entitled "*Scratching the Surface for Answers on Red Hill Repaving*".[448] Mr. Moore could have shared the 2013 CIMA Report which found higher than expected rates of wet weather collisions on the RHVP and he did not. The context for Golder's engagement to have friction testing done on the RHVP were anecdotal reports about the ramps and mainline on the RHVP being slippery following City's internal discussions in late September 2013.[449]

151. Tradewind's analysis of the testing data using the Grip Tester was that nearly all areas of the road have friction values below or well below the relevant UK investigatory level 2. As described, Dr. Uzarowski considered that Tradewind's finding in relation to friction was overly conservation and he described the friction numbers on the RHVP as relatively low.

152. The Golder Report including the Tradewind Report, was delivered to Mr. Moore in early 2014 in writing twice: first, by email of January 31, 2014[450]; and secondly, on February 7, 2014, when Dr. Uzarowski delivered a printed bound copy to him. Dr. Uzarowski initially spoke with Mr. Moore on February 4, 2014, and outlined the report findings he wished to discuss with Mr. Moore. Dr. Uzarowski met with Mr. Moore on February 7, 2014, in a meeting at which Dr. Uzarowski presented his findings and recommendations contained in the Golder Report.[451] Mr. Moore's evidence was that he read the Tradewind Report and Golder Report before his meeting on February 7, 2014, with Dr. Uzarowski.[452] Dr. Uzarowski's evidence was that Mr. Moore understood the findings and recommendations.[453] Section 6.0 Analysis and Recommendations recommended:[454]

> *In order to remedy the longitudinal top down cracking, it is recommended that the surface course SMA be milled and a new surface course mix be placed at*

[448] The Article is referenced in OD8, image 62, para 169; Correspondence of Mr. Hein (GOL0006770).

[449] Although Mr. Moore shared email correspondence in September 2013 containing anecdotal reports of ramps and the mainline being slippery in rain, he did not share the 2013 CIMA reports which reports that CIMA had identified higher than expected rates of wet weather collisions.

[450] GOL0002980 attaching the Golder Report GOL0002981

[451] OD6, page 100, paragraph 260; and Notes GOL0007407 at image 30 and GOL0003530

[452] Transcript of Mr. Moore, July 18, 2022, pg. 8417, lines 13-20 and pg. 8418, lines 4-12

[453] Transcript of Dr. Uzarowski, June 16, 2020, pg. 5682, lines 2-6

[454] OD6, image 97, para 253; The Golder Report (GOL0002981 at image 11)

> *selected locations. At a minimum the milling and overlaying should be carried out on sections where the most frequent top down cracking is observed. Based on our pavement visual condition inspection, the minimum total length of the sections where mill and overlay is required would be about 2.5 km. The exact locations for the milling and overlaying should be determined on site. It is also recommended that if there is any debonding of the underlying SP 19.0 layer observed during the milling and overlaying operation, the debonded SP 19.0 layer should also be removed.*
>
> *On the remaining portion of the RHVP, the existing cracks in the surface course should be routed and sealed to prevent the ingress of water and incompressible material into the pavement structure. Following the routing and sealing, it is recommended that a single layer of microsurfacing be applied. By carrying out the mill and overlay where required and applying microsurfacing, the issue of relatively low FN on the RHVP would also be addressed. The new surface course mix to be used on the RHVP Should incorporate aggregates that have good Polished Stone Value (PSV). It is recommended that the PSV of potential aggregate sources be tested in the laboratory.*

153. Dr. Flintsch agreed with Dr. Uzarowski's finding that friction was relatively low. Dr. Flintsch made no comment on the cracking issues but agreed with Golder that "*the combination of resurfacing in some areas and microsurfacing on the rest of the RHVP would have addressed the low friction issue at that time.*"[455]

154. Golder's advice to use microsurfacing as a method to improve frictional characteristics was consistent its recommendations in the PMTR reports and also consistent with Stantec's recommendations in its utterly ignored 2007 Sustainability Plan. Appendix 5 to its Pavement Sustainability Plan described a Sample of Preventative Techniques which included a description of microsurfacing: "*Generally, microsurfacing has been used on moderate to heavy volume roads to improve surface frictional characteristics and to fill wheel ruts. It has also been used to address pavement distresses such as raveling and flushing, and to a certain extent to seal surface cracks*."[456]

[455] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 28)
[456] OD3, image 31-32, para 61-62; Sustainability Plan (HAM0000320_126)

155. Golder's advice to use microsurfacing to address the surface condition of the pavement was also agreed by Miller Paving. Although Miller Paving did not specifically address microsurfacing as a treatment to improve frictional characteristics, it was certainly their view that it would have been appropriate to address the pavement surface condition on the RHVP provided pre-construction repairs were made.[457]

156. Mr. Andoga's evidence was that he was not provided with the Golder Report. However, the pavement preservation and rehabilitation techniques he was contemplating with Miller Paving in 2016 would have substantially implemented the Golder Report recommendations.

157. Dr. Uzarowski's evidence was that he again recommended microsurfacing to Mr. Moore on March 4, 2016, as part of the pavement rehabilitation contemplated to address bumps and dips on the RHVP.[458]

E. Techniques to improve Frictional Performance - Shotblasting/Skidabrading

158. Dr. Uzarowski's notes record his discussion of Tradewind's friction testing with Mr. Moore on February 7, 2014. Dr. Uzarowski's evidence, corroborated in his Notes, was that if the City was not prepared to consider microsurfacing that it should consider the use of a blasting technique to the surface which would at least temporarily improve frictional characteristics.[459] This is the first instance in which Dr. Uzarowski recommended shotblasting as a technique to improve surface frictional characteristics.

159. The Tradewind Report was provided again to Mr. Moore on December 17, 2015.[460] The reason that it is resent is not clear; however, the context appears to be a consequence of the 2015 CIMA report which, among other things, recommended friction testing of the RHVP.[461] Dr.

[457] OD7, image 122, para 391; Correspondence of Mr. Andoga (HAM0025065_0001)

[458] Dr. Uzarowski notebook (GOL0007409 at image 25); Transcript of Dr. Uzarowski, June 16, 2022, pg. 5738, lines 3-13

[459] Transcript of Dr. Uzarowski, June 16, 2022, pg. 5674, lines 6-15 and pg. 5688, lines 17-25

[460] Correspondence of Dr. Uzarowski (GOL0003546 attaching GOL0003547); The Tradewind Report was provided as it had been sent by Tradewind as a Word document. There is no draft stamp on this copy of the Tradewind Report.

[461] 2015 CIMA report (HAM0000702_0001)

Uzarowski resent the Tradewind Report to Mr. Moore as a standalone document. This version did not contain the draft watermark stamp which was marked on it within the Golder Report.

160. On March 4, 2016, Dr. Uzarowski reported on Golder's engagement to assess the bumps and dips on the RHVP through inertial profiler testing. It appears that in the context of the inertial profile investigation, and Mr. Moore's questions about a correlation for the Grip Tester data and a local standard by which to evaluate it, Golder again provided information about how to improve surface frictional characteristics using microsurfacing and blasting technologies. This advice is corroborated in Dr. Uzarowski's notes recording the meeting with Mr. Moore on March 4, 2016.[462] Dr. Uzarowski's evidence is that immediately following the meeting, he inquired of contractors to obtain quotes for shotblasting or skidabrading.[463] The back and forth between Dr. Uzarowski and Mr. Moore is in an email exchange of March 15, 2016 in which in response to the quotation for skidabrading and using shotblasting to immediately increase friction numbers, Mr. Moore seems to have initially misunderstood the quotation as one for further friction testing.[464] In reply, Dr. Uzarowski clarified and suggested further friction testing could be done and then at least the worse locations could be selectively treated using skidabrader or Blastrac technology.[465] In response, Mr. Moore replied that he had never heard of the technology and that it did not address the surface distresses and wrote that he did not think that we are interested.[466] In other words, in response to Dr. Uzarowski's written correspondence providing a mechanism for how to improve the frictional characteristics of the RHVP, Hamilton was not interested.

161. In his report, Dr. Flintsch agreed with Dr. Uzarowski shot blasting could be a good short-term solution to address low friction.[467] Dr. Flintsch also considered that when the recommendation to use shotblasting was raised in 2018 that resurfacing which Hamilton had

[462] Dr. Uzarowski notebook (GOL0007409 at image 3)
[463] Correspondence of Skidabrader (GOL0002703); Correspondence of Blastrac (GOL0002691); Correspondence of Dr. Uzarowski (GOL0003543)
[464] Correspondence of Dr. Uzarowski (GOL0003536); Correspondence of Mr. Moore (GOL0002697); Correspondence of Mr. Moore (GOL0002698)
[465] Correspondence of Mr. Moore (GOL0002698)
[466] Correspondence of Mr. Moore (GOL0002698)
[467] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 28)

planned was probably a better and longer-term solution.[468] In cross examination, Dr. Flintsch acknowledged that it could have been used in 2016 and would have temporarily improved the frictional characteristics of the surface pending resurfacing.

162. On January 22, 2018, Dr. Uzarowski was first alerted by a link provided by Mr. Hein to an article in Hamilton Spectator to the fact that there had been fatalities on the RHVP[469], and further concern among road users that the RHVP was slippery. Before that time the only information in an email about pavement slipperiness and collisions was in Mr. Moore's emails of late September 2013 asking Golder for friction testing. At every meeting he had with City staff subsequently, Dr. Uzarowski recommended shotblasting or skidabrading to improve the frictional characteristics of the surface.

163. At a meeting at the City on February 23, 2018 at which he was discussing a new asphalt specification[470], Dr. Uzarowski's evidence was that after the formal presentation, there were a number of people from the City who lingered to talk (Tyler Renaud, Mike Becke and Marco Oddi) principally about the potential for the use of HIR on the RHVP.[471] Dr. Uzarowski recalled that he also raised the application of shot blasting to improve the surface frictional characteristics of the RHVP pending the resurfacing.[472] This is the first instance at which Dr. Uzarowski recalled that he was told that the City could not use a technique to improve friction because that would be taken to be an admission that friction was a concern.[473]

164. Dr. Uzarowski's findings of the 2017 Pavement Evaluation and his preliminary investigation into the use of HIR on the RHVP were presented to the City at a meeting of March 9, 2018, attended by Mr. Moore, Mr. Oddi, Mr. Becke, Mr. Dennis Perusin, Mr. Andoga, Ms. Jacob, Mr. Leon, Mr. Vala and Mr. Renaud.[474] Dr. Uzarowski prepared notes in advance of the

[468] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 28)
[469] GOL006770 and Uzarowski transcript
[470] HAM0001130_0001 and HAM0001131_0001
[471] Mr. Becke's calendar invitation of March 9, 2018, corroborates the discussion of February 23, 2018 about the challenges regarding HIR on the RHVP. See HAM0001132_0001
[472] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5844, lines 20-25; pg. 5845 lines 1-8
[473] Transcript of Dr. Uzarowski, June 20, 2020, pg. 5845, lines 11-23
[474] HAM0001132_0001. Mr. Moore and Mr. Becke were not identified in the Calendar invitation, but the evidence is that both attended. Mr. Becke's notes of the meeting are in evidence.

March 9 meeting and took notes during the meeting.[475] There is agreement that the discussion was heated but significant divergence of recollection of the details of the meeting. In relation to the condition of the pavement:

a. Dr. Uzarowski reported that the results of the BPT were very variable, and he considered them not reliable. Mr. Moore mischaracterized this finding saying that the testing was 'inconclusive', a refrain subsequently repeated by Mr. Moore and echoed by Mr. Becke and Mr. Oddi about all of the friction testing conducted on the RHVP.
b. Dr. Uzarowski's evidence was that since the BPT was not reliable, he reported on the findings from the Tradewind testing. The evidence from the City staff attending was that they did not recall that Tradewind was specifically mentioned, although Mr. Becke's notes specifically state: "*Concerns with Friction #s*".[476]
c. Dr. Uzarowski's notes reflect the concern with the application of HIR on the SMA. He recommended microsurfacing of the recycled surface to address anticipated surface inconsistences. Both Dr. Uzarowski and Mr. Becke's notes agree that Mr. Moore responded 'no' to the application of microsurfacing to a recycled surface.[477]
d. Dr. Uzarowski's evidence is that at the end of the meeting, he again proposed consideration of shotblasting or skidabrading for now, that is pending the resurfacing whatever mechanism might be used. Dr. Uzarowski's evidence is that Mr. Oddi and Mr. Becke both said that no because of the public.

165. Dr. Uzarowski's recollection of the meeting was memorialized in an internal email sent to his colleagues, Dr. Henderson, Ms. Rizvi and Dr. Maher on March 14, 2018.[478]

166. A further meeting was scheduled for May 14, 2018, to discuss repaving the RHVP using HIR.[479] The calendar invitation records that it was sent to Mr. Andoga, Mr. Perusin, Mr. Oddi,

[475] OD8, image 72-76, para 204-206; Also, note GOL0007414 at images 76-79, image 80 and image 74.
[476] OD8, image 76 para 207
[477] GOL0007414 at image 74 and HAM0061788_0001 at image 60. See OD 8, images 72 – 76, paras 204 - 207
[478] GOL0005970 and GOL0003699
[479] GOL0002860

Mr. Renaud as well as Dr. Uzarowski. Mr. Moore also attended the meeting. Dr. Uzarowski's notes of the meeting record discussion about sampling of the RHVP as large amounts of the surface asphalt were necessary to evaluate how the existing mix could be recycled and incorporated within the new asphalt mix. Dr. Uzarowski's notes include: "*pav. Condition – blasting no*". His evidence was that he again proposed shotblasting pending the resurfacing and was told no. Dr. Uzarowski understood this instruction to mean that the City refused to take an interim measure to specifically treat friction because it could be interpreted as an admission that friction was a concern.

167. On December 18, 2018, Dr. Uzarowski met with Mr. McGuire, who replaced Mr. Moore as the Director of Engineering Services, and delivered a draft of the 2017 Pavement Evaluation report to him and discussed Golder's work for the City in relation to the RHVP. This was the first time that Dr. Uzarowski was informed that Hamilton had retained CIMA as its road safety consultant. It was also when Dr. Uzarowski learned that the Golder Report and the Tradewind Report had been found. Dr. Uzarowski's discussion included the findings from the friction testing and the recommendations made by him to use microsurfacing and alternative methods to improve surface frictional characteristics by using shotblasting/ skidabrading.[480]

168. Golder's recommendation in writing to rehabilitate portions of the RHVP and use microsurfacing as a preservation technique and to improve the relatively low surface friction was not taken. Dr. Uzarowski's finding that friction on the RHVP was relatively low and the Tradewind Report finding that friction was below, or well below, the UK investigatory level that it applied were not shared within the City and not shared with the City's road safety consultant, CIMA.

169. Dr. Uzarowski's advice given in writing to Mr. Moore on March 15, 2016, to use shotblasting or skidabrading to improve the frictional characteristics of the surface was not taken. Dr. Uzarowski's advice to use shotblasting or skidabrading was repeated verbally on at least three occasions in 2018 and not taken.

170. Dr. Uzarowski is a pavement and materials engineer and not a road safety consultant. His opinion was that the friction numbers on the RHVP were relatively low and he provided solutions

[480] GOL0007404 image 40

as to how to improve the frictional performance. Certainly, reporting the friction findings internally within the City in 2014 would have focused scrutiny on friction and would have allowed for a more thoughtful response. We do not know what CIMA would have contemplated had they had the opportunity to review the Tradewind report in 2014[481], although some insight might be found in the CIMA Memorandum dated February 4, 2019. It records their view that the friction values obtained by Tradewind were above the design parameters that were used in the road design for stopping distance and horizontal curve design.[482] CIMA observed: "*But friction measurement that are at investigatory levels are in no way a definitive indication that a location is 'unsafe*'."[483] CIMA considered that further investigations of conditions were needed. What seems abundantly obvious is that they would not have ignored the Golder and the Tradewind Reports had they been provided.

171. In his conclusion to the Analysis of Friction on the RHVP, November 2022, Dr. Flintsch stated:[484]

> *In conclusion, it is my view that the very high percentage of collisions during wet conditions combined with the friction test results in the Tradewind report, as well as the MTO measurements was an indication that the relatively low friction contributed to those collisions, together with excessive speeds and the geometry of the freeway which give rise to elevated friction demand and thus collectively supported the previously stated need for a detailed safety analysis that could have resulted in a decision to apply a treatment to improve the frictional properties of the pavement surface, such as resurfacing or microsurfacing.*

172. What is painfully obvious in hindsight is that the Tradewind data and Dr. Uzarowski's recommendations for techniques that could be used to improve frictional characteristics should have been shared within the City and with CIMA. The City would have had far more information about frictional characteristics and a whole different set of tools to improve them. Among the many opportunities lost, the City and CIMA could have considered the selective application of a technique to improve frictional characteristics for at least the middle section of the RHVP locations where CIMA expressly knew by 2015 that there were a densely located and disproportionate

[481] See CIMA's February 4, 2019 Memorandum to the Mayor of Hamilton (HAM0054683_0001)
[482] CIMA memo (HAM0054683_0001 at image 5)
[483] *Ibid*
[484] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 30)

number of wet weather collisions. As Dr. Uzarowski stated: "*It would not have hurt and might have helped*."

F. Golder's Findings and Recommendations were received and understood

173. Until early 2018, Dr. Uzarowski reported primarily to Mr. Moore, the Director of Engineering Services, who oversaw design, construction and asset management of the City's road infrastructure.[485] Golder reported their findings and recommendations to a senior level within the City and reasonably expected that they would be assessed and implemented as the City considered appropriate. Reporting to the Head of Engineering Department in relation to the condition of a road is akin to reporting to the chief Building Official in relation to a building.[486] Golder could have had no possible expectation that their findings and recommendations would not be understood, considered and reported internally.

174. Dr. Uzarowski delivered the Golder Report and the Tradewind Report to Mr. Moore twice. Mr. Moore's evidence was that he believed that he read the Golder Report right away because he had been expecting it.[487] Mr. Moore did not recall giving the Golder Report or Tradewind Report to any City employee or discussing it with anyone[488, 489] Dr. Uzarowski's evidence was that Mr. Moore understood the findings and recommendations made in the Golder Report and did not have any questions when Dr. Uzarowski presented the findings, analysis and recommendations to him on February 7, 2014.

175. Mr. Moore's understood Golder's advice in relation to the rehabilitation and preservation of the asphalt. There were three aspects to that advice: to mill and overlay at selected location,

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[485] O2, Image 17, para 42-45

[486] The Honourable Paul Bélanger "*Report of the Elliot Lake Commission of Inquiry, Part I* (Recommendation 1.8, pg. 646)

[487] Transcript of Mr. Moore, July 18, 2022, pg. 8414, lines 19 -24

[488] Transcript of Dr. Uzarowski, June 15, 2022, pg. 5480, lines 9-25 and pg. 5481, lines 1-2

[489] Transcript of Mr. Moore, July 18, 2022, pg. 8467, lines 8-14, although later in his testimony Mr. Moore said he did not recall giving the Golder Report to anyone at asset management but that given the fact that the programming of the resurfacing proceeded and there was information in the report which would have supported that decision, it was very likely that they had it (See Transcript of Mr. Moore, July 18, 2022, pg. 8476, lines 5 -12)

routing and sealing cracks and microsurfacing. Mr. Moore did not recall specifically discussing Golder's recommendation to mill and overlay to addressing cracking and said that was not a surprising recommendation and it was consistent with what we anticipated.[490] Mr. Moore noted the importance of sealing the top so that you don't have to worry and rebuild the rich bottom mix layer.

176. Although it was not expressed in contemporaneous correspondence, Mr. Moore's evidence was that he disagreed with Golder's recommendation to use microsurfacing on the RHVP. In his testimony, Mr. Moore explained without specific reference, that the City had a poor experience with it. He said microsurfacing was "*not something that we had a successful experience with on other roads.*" He did not specifically recall the discussion but said that at some point in time he made clear that microsurfacing was not something that we would likely consider as a useful and good value for money type of treatment.[491] There is no ambiguity that Mr. Moore knew what microsurfacing was or what it did. Mr. Moore's evidence was emphatic that he did not agree with Golder's advice.[492]

177. Dr. Uzarowski's evidence was that he followed up on the written recommendation to rehabilitate the surface in presenting the Golder Report to Mr. Moore on February 7, 2014 and on March 4, 2016 (in the context of the inertial profiler testing engagement). Mr. Moore did not accept Golder's recommendation and did not follow it.

178. Mr. Moore agreed with Commission Counsel that there was no timeline to implement advice in the Golder Report and no urgency.[493] The Golder Report in the Analysis and Recommendations does reference anticipated necessary maintenance as part of the pavement life cycle in the form of milling and patching and routing and sealing over time given the estimated traffic volumes, concepts familiar to any engineer in charge of thousands of kilometers of roads.[494] Mr. Moore speculated that they (he and Dr. Uzarowski) likely had some discussion on timing for

[490] Transcript of Mr. Gary Moore, July 18, 2022, pg. 8457, lines 21-25

[491] Transcript of Mr. Gary Moore, July 18, 2022, pg. 8456, lines 19 - 25

[492] Microsurfacing is a well-established technique and included in the OPSS Muni 336, November 2018, including for high volume, high speed roads.

[493] Transcript of Mr. Moore, July 18, 2022, pg. 8465, lines 7 -16

[494] The Golder Report (GOL0002981 at image 9)

the recommendations because "*we'd gotten 14 years of traffic in six*."[495] Later, in his testimony, Mr. Moore noted that the RHVP had been programmed by Asset Management for resurfacing suggesting that Asset Management likely had the Golder Report as part of its decision making since there was information in the Golder Report which would have supported the decision to resurface.[496] As we heard from City witnesses, the decision making necessary for major capital expenditures involved consultation and managing many interests. The fact that the pavement rehabilitation and preservation recommendations did not have a specific timeline was not relevant to the fact that the recommendations in the Golder Report were not taken.

179. Similarly, nothing turns on the fact that the Golder Report was delivered in draft. The investigation, findings and analysis were all complete. As was evident in the testimony of the consulting engineers who gave evidence to the Inquiry, the practice of delivering a report in draft is standard among engineering consulting firms and reports are finalized as requested by clients. All of the CIMA reports delivered to the City were delivered in draft first. Not all of them were signed.[497] Mr. Moore did not ask for the Golder Report to be finalized. It was not. The draft watermark was not relevant to the fact that the recommendations were not implemented. Indeed Mr. Moore's evidence was that he was looking for content and the action that we needed to take. He was not concerned about making a report '*pretty and putting it on the bookcase*'.[498] In any event, the Tradewind Report was resent to Mr. Moore on December 17, 2015. Any after the fact effort to argue that the findings did not count because the report was marked draft cannot be applied to the Tradewind Report, at least after December 17, 2015.

180. Mr. Moore's evidence was that he did not understand the results from Tradewind's friction testing and Dr. Uzarowski's analysis of the Tradewind friction data. He said that he had no knowledge and had never heard of the UK reference standard for an investigatory level and did not know how it applied and he did not understand how the friction numbers on the RHVP could have been considered good in 2007 after paving but then they are not good. His evidence was that he thought it made no sense. Mr. Moore stated that until the friction results could be explained,

[495] Transcript of Mr. Moore, July 18, 2022, pg. 8466, lines 12 -14
[496] Transcript of Mr. Moore, July 18, 2022, pg. 8476, lines 5 - 12
[497] 2015 CIMA Report (HAM0000702_0001)
[498] Transcript of Mr. Moore, July 18, 2022, pg. 8467, lines 2 -7

he was not going to expend any funds or take any action.[499] Dr. Uzarowski's evidence was that Mr. Moore did not raise any questions about Tradewind's findings or his analysis of them when he sent the Golder Report or when they met on February 7, 2014. Further, in his comments of October 28, 2015 on the draft 2015 CIMA Report, Mr. Moore expressed his view of the futility of friction testing by deleting CIMA's recommendation to conduct friction testing, commenting "*there is no basis, nothing to compare to and no other agency in Ontario including the MTO doing this! It means absolutely nothing, except proving potential exposure to legal actions and confusion!*" [500] Dr. Uzarowski's evidence was that Mr. Moore did not raise any questions about Tradewind's findings or his analysis of them when he sent the Golder Report or when they met on February 7, 2014. There is no evidence in the two years that followed the delivery of the Golder Report and the Tradewind Report that Mr. Moore did not implement any recommendation in the Golder Report or the Tradewind Report because he was waiting for clarification of an applicable standard.

181. There is no record that Mr. Moore raised any question about the Tradewind data until December 17, 2015,[501] and then only after CIMA had recommended friction testing on the RHVP in its 2015 CIMA Report[502] and Mr. Malone of CIMA asked on August 7, 2015: "*do you have a performance specification for the FN value you strive for? And are the 2013 and 2007 testing values done using the same methodology and are they comparable?*".[503]

182. On December 17, 2015 Dr. Uzarowski asked two questions of Mr. Taylor of Tradewind: "*is there any correlation between a GTN and FN; and, are there GTN limits typically used in the US or Canada?*" Mr. Moore's testified that he never got an answer from Dr. Uzarowski. Dr. Uzarowski's evidence is that he investigated the questions and received input from Mr. Taylor in an email exchange on December 17, 2015, and again on February 20, 2016, and reported to Mr. Moore on March 4, 22016,in the context of the inertial profiler engagement. It is not credible to suggest that Dr. Uzarowski would have failed to report back findings he investigated to his client.

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[499] Transcript of Mr. Moore, July 18, 2022, pg. 8461 – 8464, Lines 1-25

[500] OD 7, image 51, para 157; HAM0000690.0001 at image 41

[501] Although curiously he did not want the Purchase Order for the work of the condition evaluation to be closed in March of 2014. See HAM0023740_0001

[502] HAM000690_0001

[503] OD7, image 36-39, para 107-118.

183. What is clear is that Mr. Moore did not accept Dr. Uzarowski's finding that the friction numbers on the RHVP were relatively low and did not agree that any treatment that addressed only friction was necessary. That is implicit in his conduct and flat out absolutely explicit in his response of March 15, 2016, when he says that he is not interested in a treatment for friction that he doesn't know about and that does not also address the surface cracking and dips and bumps.[504] In his testimony, Mr. Moore said he did not ask Dr. Uzarowski to investigate measures that would increase the skid numbers on the RHVP. He stated that he did not believe he ever asked for that. Mr. Moore explained: "*I don't believe I was looking in any way to address any frictional characteristics because I had no concerns with them.*"[505] In long and short, Mr. Moore had Golder's advice that friction was relatively low and did nothing with that advice; not because there was any uncertainty about the data or his was waiting for further information but because he himself had decided that he had no concerns with the frictional characteristics of the RHVP. He had the information, he understood it, and made his own determination, ignoring the advice of the City's pavement consultant.

184. Mr. Moore also did nothing with Golder's recommendation to conduct friction testing to locate the worst areas for treatment. If it were genuinely the case that Mr. Moore was not prepared to rely on the grip tester numbers, there was no reason that Hamilton could not have contacted the MTO and asked for further testing. One would have thought that would have at least unlocked the testing that the MTO had in any event conducted between 2008 and 2014.

185. Mr. Moore made his decision not to use microsurfacing and not to implement potential measures to improve the frictional characteristics without consulting anyone within the City. He deliberately siloed to himself alone the analysis and recommendations contained in the Tradewind and Golder Report. He knew that Traffic Engineering had been asking for friction data and he knew that CIMA had recommended friction testing and he chose not to share the Tradewind Report or the Golder Report with his colleagues or CIMA.[506] That strategy of not sharing the data or

[504] GOL0002698

[505] Transcript of Mr. Moore, July 19, 2022, pg. 8647, lines 1-10

[506] Mr. Moore clearly knew he had the Tradewind report and that he received it in 2014 as is clear from his email exchange of August 15, 2017 with external legal counsel for the City, Shillingtons. Overview Document 7, image 192, para 568; HAM0062244_0001

sharing it as minimally as possible is consistent with the theme within Mr. Moore's evidence that friction data should not be shared because it could be used in a claim against the municipality.[507] It most likely explains why Mr. Moore sent the compiled MTO and Tradewind data to CIMA on August 7, 2015, misrepresenting that the data had been in both cases conducted by MTO and was therefore comparable. CIMA might not have known what to do with the compiled friction results, but they were most unlikely to have ignored completely Tradewind's finding that friction numbers were below or well below the UK reference for an investigatory level or the finding of a pavement expert that friction on the RHVP was relatively low. In the result, the consequence of Mr. Moore's choice not to share the Golder and Tradewind reports with other City staff and with CIMA was that the opportunity to assess the potential relevance of the friction data in their analysis of collisions on the RHVP was lost.

186. As described, Dr. Uzarowski followed up his recommendation made to Mr. Moore to conduct shotblasting or skidabrading by repeating that recommendation to others within Public Works in 2018. Dr. Uzarowski recalled his advice clearly. He kept contemporaneous notes which recorded his advice and memorialized the March 9, 2018, meeting by an internal memorandum. Dr. Uzarowski was clear that he was told by Mr. Oddi and Mr. Becke that the City could not treat friction on the RHVP because it would be seen as a public acknowledgement that friction was a concern. Mr. Becke remembered virtually nothing. Mr. Oddi was the only City witness who acknowledged that Dr. Uzarowski recommended using shot blasting but he explained that it did not make sense to him at the time since they planned on resurfacing.[508] Mr. Oddi denied that he said that the City could not use shot blasting because it would be an admission of guilt.[509] One might speculate that amnesia is convenient cover for avoiding responsibility for decisions not taken.

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[507] See, for example Mr. Moore's response to Mr. Malone on August 10, 2015. They [MTO] keep this info very close to the vest so it can't be used against them in an action or suit. CIM 0010001, OD7, image 39, paragraph 116; also Mr. Moore's comments on the draft 2105 CIMA report in which he deleted the section on Friction writing: "There is no basis, nothing to compare to and no other agency in Ontario including the MTO doing this! It means absolutely nothing, except proving potential exposure to legal actions and confusion!" HAM000069_0001 at image 41, Overview Document 7, image 51-52, paragraphs 157-159

[508] Transcript of Mr. Oddi, pg. 9303 lines 22-25; pg. 9304 lines 1-25; pg. 9305 lines 1-22

[509] Transcript of Mr. Oddi, pg. 9306 lines 22-25; pg. 9306 lines 1-25; pg. 9307 lines 1-12

187. In all of the City's retrospective justifications for not implementing Golder's advice, the City cannot dispute that they had the Golder Report, they understood it and they did nothing with it.

G. Friction and the Factors that may contribute to collisions on the RHVP.

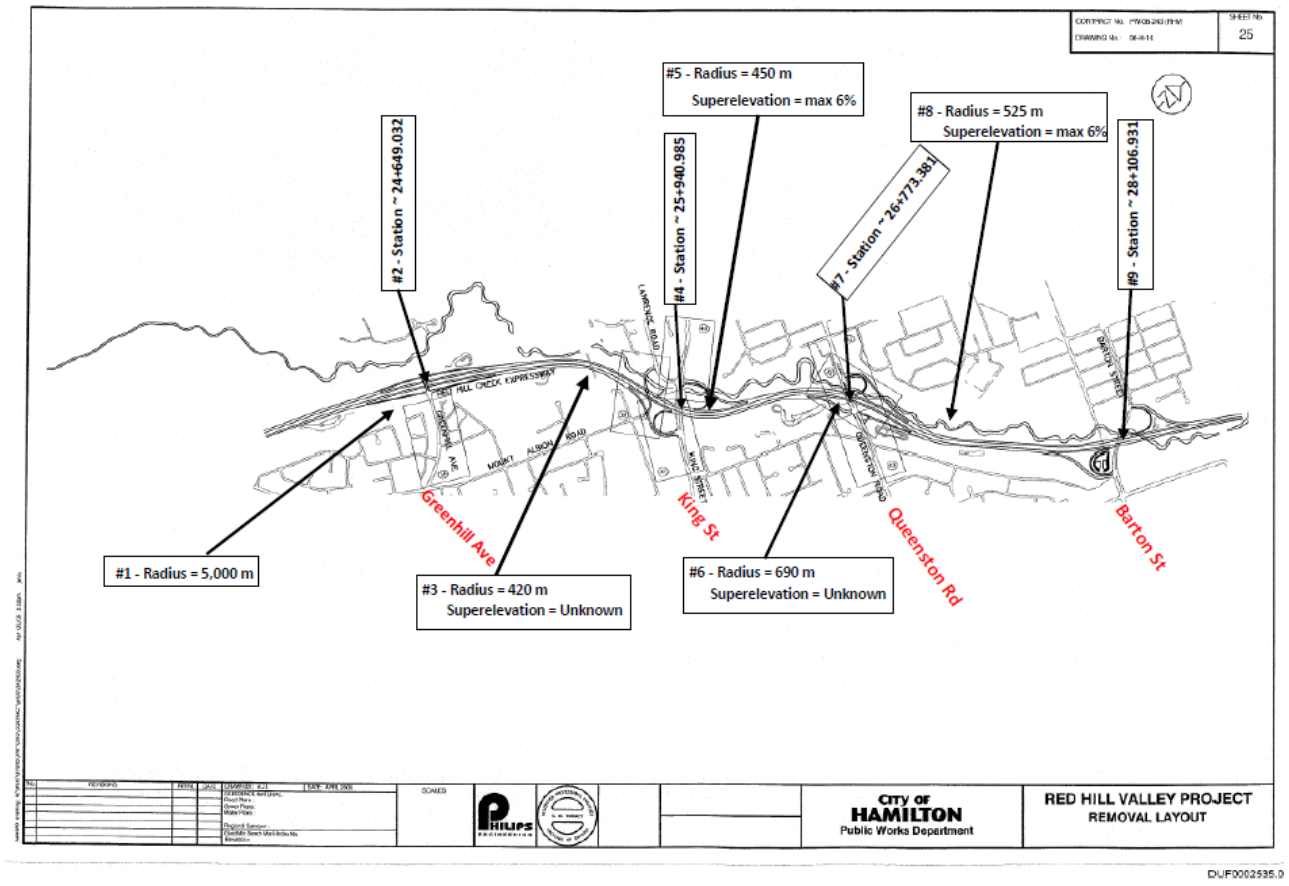
188. As described by Dr. Flintsch in the April 2022 Primer:[510]

> *Though deficient friction is seldom the main cause of a crash, there are situations where low friction can cause crashes in the presence of other contributing circumstances. For example, if human error makes an emergency maneuver necessary, a crash may occur if the friction demanded by the maneuver is greater than the friction that the road surface can provide in that location. If the available friction is exceeded, skidding or wheel slipping may lead to a loss of control or to a collision (Flintsch et al. 2012). On the other hand, if the friction is high, the collision may be avoided or its severity reduced.*

189. Section B of the RHVP was designed by Philips. The geometry of the alignment is most complicated in this section which comprises a change in vertical alignment, the tightest turns and the closest spacing of interchanges.

[510] Exhibit 13 – Dr. Gerardo Flintsch, *Primer on Friction, Friction Management, and Stone Matrix Asphalt Mixtures*, April 2022 (EXP0000189 at image 19)

Part B – Philips

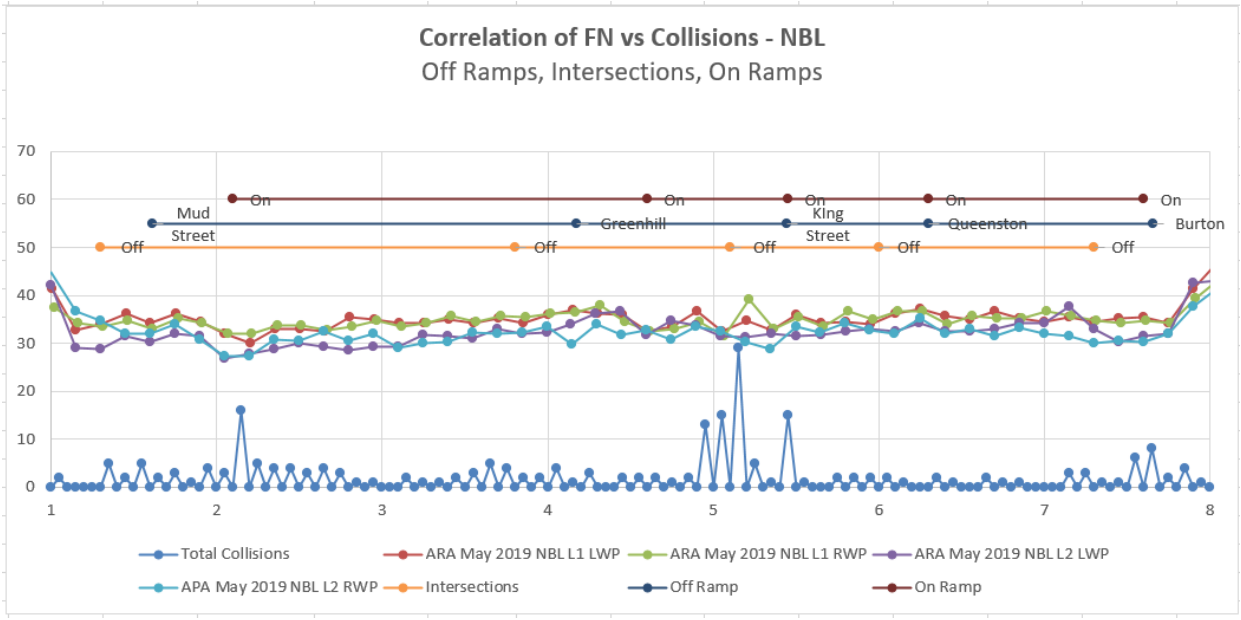


190. Mr. Russell Brownlee's *report, Red Hill Valley Parkway Inquiry, Highway Design and Assessment Report*, November 1, 2022, describes the expected violations to drivers, particularly driving Section B of the RHVP as including the design speed of 100 km/hr which is materially lower than would be usual on a 400 series highway; the horizontal curve design with the two mainline section curves in around the King Street interchange which were designed at or near the minimum values; and, the very close interchange spacing and tight weaving distances.

191. Friction numbers were 'relatively low' but not particularly variable on the mainline alignment. The graph of the ARA testing as below records relatively stable friction numbers recording an average FN(90) for the four lanes ranged from 31 to 35.[511] On the other hand, as is

[511] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 7)

clear from the CIMA reports, the collisions are clearly condensed in sections with the challenging geometric factors as shown in the example below:[512]



192. The role of friction cannot be ignored as a potential contributing factor to collisions on the RHVP. By the same measure, we submit that there is no evidence that it is the most significant factor. Mr. Malone resiled from his recorded view that friction was the most important contributing cause to wet weather collisions. He concluded ultimately that it was a factor. Mr. Brownlee's report recorded his view that reduced road surface friction would be the primary (i.e., highest ranking) contributory cause of an over-representation of wet road crashes.[513] Mr. Brownlee cited no authority in support of his assertion and in cross examination reframed his conclusion in reference to the high demand for friction in the Section B alignment.[514] Dr. Flintsch agreed that the proportion of RHVP collisions that occurred on a wet surface was high and agreed with the factors including slipperiness of the road surface, speeds exceeding the capability of the highway given the curvature of the road, curves in the road having design speeds just at 100km/hr and the close proximity of on/off ramps to each other leading to losses of control and/or driver errors –

[512] Source of Collision Data: CIM0015139.001
[513] Exhibit 221 - Russell Brownlee, *Red Hill Valley Parkway Inquiry, Highway Design and Assessment Report*, November 1, 2022 (EXP0000192 image 29)
[514] Transcript of Mr. Brownlee, February 21, 2023, pg. 15839, lines 9-11

probably contributed to the unusually high percentage of wet road collisions. Dr. Flintsch did not consider there was sufficient scientific evidence to comment on the order of greater contribution.[515]

PART II – POLICY RECOMMENDATIONS

193. Hamilton has not lacked for sophisticated consulting advice. The narrative of this Inquiry records a who's who of the preeminent engineering consulting firms practicing in Ontario. The City is demonstrably excellent at retaining sophisticated consulting engineering advice. It has been demonstrably not good at receiving, recording, actioning and archiving the advice it receives.

194. The omission at the center of this Inquiry is Hamilton's failure to internally report Golder and Tradewind's findings and recommendations so that they could be considered and actioned as the City considered appropriate. It may well be for any number of reasons that Hamilton might have decided not to implement Golder's advice; but it should not have been the case that advice was not taken because it simply was not known. Two consulting engineering firms were retained and investigating different aspects of the RHVP: CIMA, was investigating and making findings and recommendations in relation to road safety; and Golder had been retained to investigate the pavement condition, including friction, and Golder provided recommendations as to how to improve the pavement condition and how to improve the surface frictional characteristics. As owner, Hamilton should have been receiving, recording and coordinating the work of its consultants to best effect. Had CIMA known of Tradewind's friction findings, they could have been incorporated within a detailed safety analysis. Golder could have focused its recommendations on techniques to improve frictional characteristics had it known of the high number of wet surface collisions and their locations. Coordinating its experts and sharing information between different disciplines would have facilitated collaborative engagement and resulted in more thoughtful, more thorough and better solutions.

195. More generally, the lack of implementation, archiving and institutional consideration of reports addressing quality control, asset maintenance, rehabilitation and preservation is apparent,

[515] Exhibit 220 - Dr. Gerardo Flintsch, *Analysis of Friction on the RHVP*, November 2022, (EXP0000191 at image 27)

for example, in the utter neglect of the work done by Stantec in its 2007 Sustainability Plan and to a somewhat lesser extent the PMTR reports which were duplicated in part by the Auditor's report of 2021. The expense of the engagement of engineering guidance warrants better archival care with what is done with those reports. All should be summarized and archived in such a way that the City's employees would know what investigations had been conducted, what advice had been given and whether and to what extent those recommendations had been implemented. Even where a report contains information that the City might consider sensitive, it should be documented and recorded so that it can be used as the basis of informed decision making.

196. We understand that Hamilton has implemented changes to its internal process for recording and archiving reports delivered to it. Obviously, it should never the case that a consultant report is received and then not recorded and reported within the City.

197. Golder are not road safety consultants but have followed with interest the changes implemented by the City as a consequence of recommendations made within the CIMA reports. We note that the City has implemented a change in posted speed to 80 km/hr which more clearly communicates that the RHVP is not a 400 series highway and cannot be driven as one. It would appear from the findings made by Mr. Brownlee that the change in speed limit should materially assist in resolving the expectancy violations identified he identified and facilitate time for driving decisions given the tight geometry. Speed has been consistently identified as a key factor in contributing to collisions on the RHVP and the correction of the speed limit so that it is below and not at the design speed for the curvature is prudent and hopefully will materially contribute to reducing the number of collisions on the RHVP. The resurfacing has also resulted in improved frictional characteristics on the RHVP which may also have a positive effect in reducing the numbers of collisions, particularly in wet surface conditions.

198. Stantec's 2007 Sustainability Plan recommended friction testing every two years as part of the pavement condition assessment. Friction testing has not been consistently included in pavement condition assessments and Golder agrees with Stantec that they should be. As is clear in this case, friction fell off by 20% within the first six years of operation of the RHVP. That should have been internally noted. As is clear from CIMA's reporting and the findings of Mr.

Brownlee and Dr. Flintsch, the middle section of the RHVP has a number and overlapping features which increase the demands on drivers and have the consequence of creating a high demand on friction. Accordingly, prudent maintenance of the RHVP should include on-going friction assessment and may require the advice of pavement engineering expertise to recommend interim measures between resurfacing as to how to improve frictional characteristics, such as the use of microsurfacing and shotblasting and whatever other techniques as may be appropriate. These recommended technologies are well proven, and widely adopted including by the MTO. The application of a technology should be considered collaboratively by City staff and subject matter consultants and not ever be rejected out of hand on the basis of one decision-maker.

199. There is guidance provided by the Professional Engineers of Ontario in relation to identifying and responding to safety concerns[516]. The evidence before this Inquiry is that the relatively low friction on the RHVP in and of itself **did not** create a safety concern triggering consideration of the PEO's Guidance of their duty to report. Surface frictional characteristics are one factor to be assessed in connection with others, such as design speed, tight road geometry, vertical alignment change, spacing between interchanges and tight weaving distances that may create a high demand for friction. Whether there is a safety concern on a road requires the engagement of a road safety consultant who can investigate and assess all of the factors (one of which being friction) which may contribute to collisions.

ALL OF WHICH IS RESPECTFULLY SUBMITTED this 13th day of March, 2023

Jennifer Roberts

Nivedhya (Nivi) Ramaswamy

[516] Professional Engineering Practice Guideline, November 2020.

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