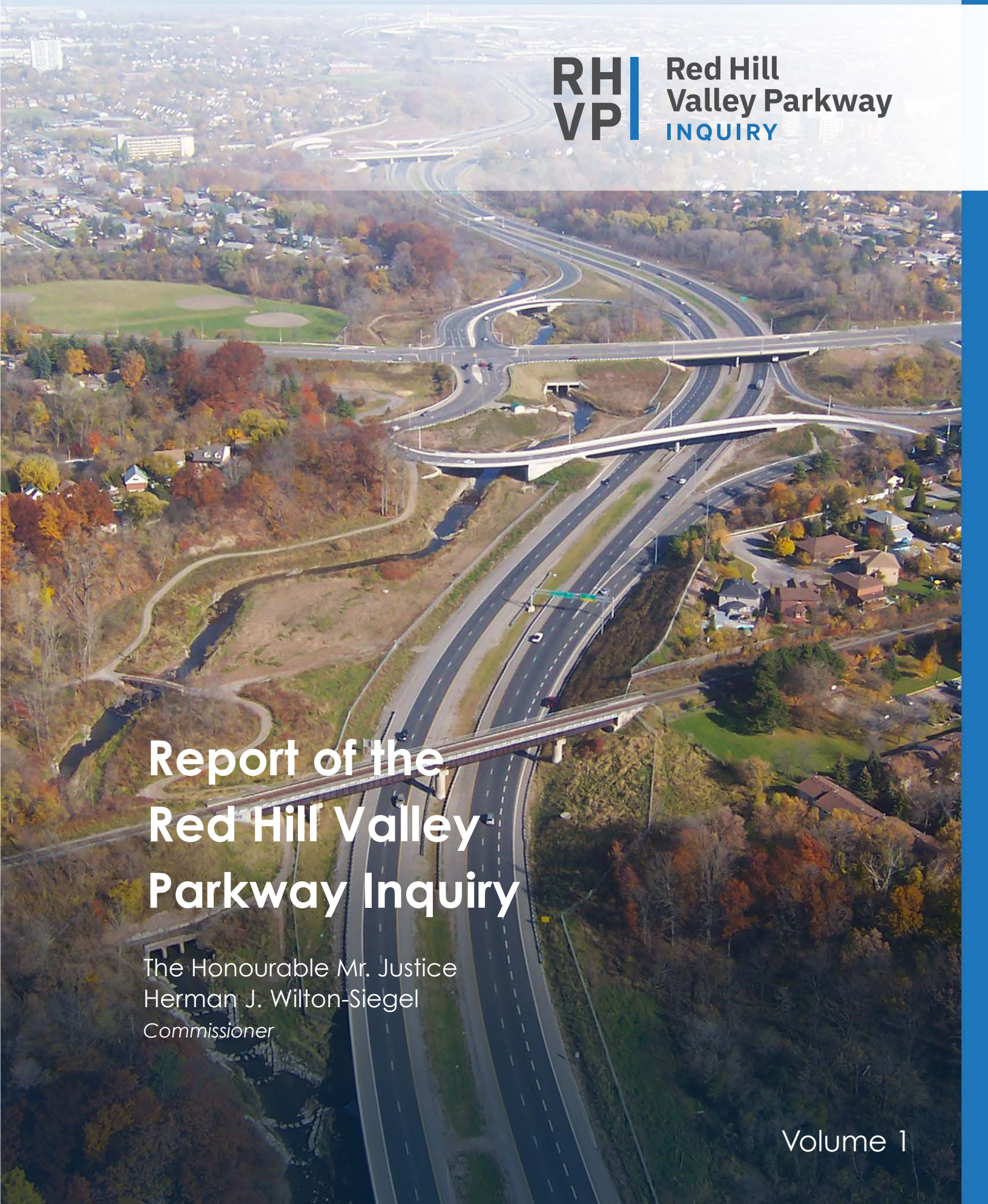
RH VP | Red Hill Valley Parkway INQUIRY



Report of the Red Hill Valley Parkway Inquiry

The Honourable Mr. Justice
Herman J. Wilton-Siegel
Commissioner

Volume 1

RH VP | Red Hill Valley Parkway INQUIRY

Report of the Red Hill Valley Parkway Inquiry

Volume 1

The Honourable Mr. Justice Herman J. Wilton-Siegel
Commissioner

Red Hill Valley Parkway Inquiry Report consists of two volumes:

Volume 1: Executive Summary and Chapters 1 - 8

Volume 2: Chapters 9 - 13 and Appendices

Volume 1: Executive Summary and Chapters 1 - 8

ISBN 978-1-7382112-2-7 (Print)

ISBN 978-1-7382112-0-3 (PDF)

RH VP | Red Hill Valley Parkway INQUIRY

November 29, 2023

Her Worship Mayor Andrea Horwath and Members of Hamilton City Council
Hamilton City Hall
71 Main Street West
Hamilton, ON L8P 4Y5

Dear Madam Mayor and Councillors:

With this letter, I respectfully submit my report on the Red Hill Valley Parkway Inquiry.

Yours very truly,

Mr. Justice Herman J. Wilton-Siegel
Commissioner

Table of Contents

Index List of Figures

Executive Summary

Introduction

The Red Hill Valley Parkway (the "RHVP") is a municipal urban freeway that runs through the Red Hill Valley, part of the Niagara Escarpment. The RHVP connects at the south end to the Lincoln M. Alexander Parkway (the "LINC"). The RHVP and the LINC were designed, constructed, and are owned by the City of Hamilton (the "City"). The RHVP and the LINC remain the only freeway infrastructure projects built by the City; together they form an approximately 19 km continuous connection between Highway 403 and the Queen Elizabeth Way ("QEW"), which are provincial highways owned and operated by the Ontario Ministry of Transportation (the "MTO").

Almost as soon as the RHVP opened in 2007, City councillors began receiving complaints about driving conditions on the RHVP. These complaints related principally to an inability to see pavement markings and roadway delineators, particularly in the dark or during inclement or snowy weather conditions, and a lack of lighting on certain portions of the RHVP. Some complaints also raised the issue of potential or perceived slipperiness of the road surface. The RHVP had its first fatal collision in 2012, and its second in 2015. By 2018, seven people had died in collisions on the RHVP.

As early as 2013, councillors pressed for measures to investigate and improve the driving experience on the RHVP. This included multiple directions from the City's Public Works Committee ("PWC"), a standing committee of the Hamilton City Council ("Council"), and the retainer of CIMA+ ("CIMA"), a traffic safety consultant, on several occasions to prepare a safety review of the RHVP, including by conducting a collision analysis. CIMA's reviews consistently revealed, among other things, a high proportion of wet surface collisions and single motor vehicle collisions. Beginning in 2013, CIMA identified various countermeasures to reduce the number and severity of accidents on the RHVP including changes to pavement markings, reflectors and signage, enhanced lighting, installing median barriers, and conducting friction testing, among others.

Between 2013 and 2018, the City, through its traffic safety staff (the "Traffic group" or "Traffic"[1] within the Public Works department), implemented the changes to the pavement markings, reflectors, and signage CIMA had recommended. There was also a significant push from staff in the Traffic group and the Hamilton Police Service to curb speeding, which the Traffic group presented as a principal explanation for the collision experience on the RHVP. Public Works staff recommended the deferral of larger, more expensive countermeasures, including increased lighting on the RHVP and the installation of median barriers. Throughout the period from 2014 to 2019, there was increasing public and media attention on the collisions and fatalities on the RHVP, including questions about whether the RHVP's pavement surface was a contributing factor to collisions on the parkway and requests from the media about friction testing results.

In 2016, the Engineering Services division of the Public Works department, under the Director of Engineering Services, Gary Moore, decided to complete surface treatment rehabilitation of the RHVP. In 2017, the surface treatment rehabilitation shifted to a more intensive resurfacing of the RHVP. In late 2017 and into 2018, Engineering Services considered the feasibility of a resurfacing method referred to as hot in-place recycling ("HIR"), instead of a more traditional mill and overlay resurfacing (which involves milling the top asphalt layer and replacing it with new asphalt material). Engineering Services was still assessing the method that would be used for the resurfacing when Mr. Moore retired in May 2018. By August 2018, the resurfacing was anticipated for 2019.

With this history as a background, in January and February 2019, City staff advised Council that, in September 2018, Gord McGuire, the new Director of Engineering, had found two reports, one prepared in January 2014 by Tradewind Scientific Ltd. ("Tradewind" and the "Tradewind Report") and a second report from Golder Associates

[1] The "Traffic group" or "Traffic" refers to the Traffic Operations & Engineering group. As set out in greater detail in Chapter 4, from late 2012 or early 2013 until 2017, the Traffic group was a group within the Energy, Fleet & Traffic section of the Corporate Assets & Strategic Planning division of Public Works. In 2017, the Traffic group became a section in the Transportation division and in 2018, it was transferred to the Roads & Traffic division. In February 2019, the Traffic section was renamed Transportation Operations in the Transportation Operations & Maintenance division. For purposes of the Executive Summary, I refer to the Traffic Operations & Engineering group (and, on occasion, the supervisors of this group) as "Traffic", "Traffic staff", or the "Traffic group".

Ltd. (“Golder”), who had acted as the City’s Quality Assurance consultant for the RHVP paving, on the state of the RHVP after six years of operation (the “2014 Golder Report”) to which the Tradewind Report was appended. Mr. Moore commissioned both reports in 2013 and received them in 2014.

The Tradewind Report reported the results of testing of the friction levels on the LINC and the RHVP conducted in 2013. The Tradewind Report found that, while the average friction levels on the LINC were generally comparable to or above an investigatory standard used in the United Kingdom, the friction levels on the RHVP were generally below or well below that standard. The Tradewind Report also recommended that a more detailed investigation be conducted, and possible remediation be considered to enhance the surface texture and friction characteristics of the RHVP. The 2014 Golder Report stated that, although the friction levels in 2013 were higher than when friction had been measured in 2007 immediately after construction of the RHVP, Golder considered them to be relatively low. The 2014 Golder Report recommended treatment methods to fix cracking on the RHVP, which would also address the low friction levels.

Two considerations motivated City staff to notify Council of the Tradewind Report in January and February 2019. First, Mr. Moore had not provided the Tradewind Report or the 2014 Golder Report to anyone else in Public Works after his receipt of them in early 2014, despite requests for information about friction testing from City staff and from the media. Significantly, during his tenure, Mr. Moore had made comments and representations to Council, staff in Public Works, and the media about the friction levels on the RHVP and friction testing results which were inconsistent with and/or contradicted by the findings and recommendations in the Tradewind Report. Second, in November 2018, the City received a freedom of information (“FOI”) request seeking documents relating to friction testing and asphalt testing to which these reports would be responsive. This development immediately elevated the priority to advise Council of the Tradewind Report before it was released to the FOI requestor.

Council was advised of the Tradewind Report at a closed session on January 23, 2019, and received a more comprehensive briefing on February 6, 2019. At the meeting on February 6, 2019, Council directed staff to release the Tradewind Report to the public that evening, together with a public apology to Council and the public regarding the Tradewind Report and the manner and timing of its disclosure.

Shortly after the Tradewind Report was disclosed publicly, City staff learned that the MTO had conducted friction testing on the RHVP between 2008 and 2014, in addition to friction testing the MTO had completed in 2007. At the time the Tradewind Report was discovered and disclosed, City staff were unaware that the MTO had conducted friction testing on the RHVP between 2008 and 2014, or of the test results.

The Inquiry Mandate

As a result of the disclosure to Council, Council initiated this Inquiry, established the Terms of Reference of the Inquiry consisting of 24 questions by a resolution passed on April 25, 2019,[2] and requested the appointment of a judge to conduct a judicial inquiry pursuant to section 274(1) of the *Municipal Act, 2001*.[3] I was subsequently appointed as the Commissioner of the Inquiry in May 2019.

Public inquiries serve a variety of important functions. As the name suggests, they are inquisitorial in nature, with a fact-finding mission, held in public, and run by an independent non-partisan commissioner. They aim to bring clarity about the precipitating event(s) to the entity that calls the inquiry, to the public, and in this case, to those who have been personally affected by accidents on the RHVP or who have questioned the safety of the RHVP for many years.

My mandate as Commissioner was strictly defined by the Inquiry's Terms of Reference and the questions that Council requested that I address. These questions can be distilled into five broad categories, which were undoubtedly in the minds of the public and City councillors when the Inquiry was called:

1) Why was the Tradewind Report not shared amongst City staff, Council, and the public prior to its discovery in the fall of 2018?

2) Were appropriate steps taken to disclose the Tradewind Report to Council and the public after its discovery in the fall of 2018?

[2] The full list of the questions set out in the Terms of Reference is contained in Appendix C.

[3] *Municipal Act, 2001*, SO 2001, c 25.

3) Why was the City not made aware of the prior friction testing of the RHVP conducted by the MTO in 2007?

4) What effect, if any, did the lack of awareness of the Tradewind Report and the MTO friction testing in 2007 on the part of City staff, Council, and the public, and the lack of prompt implementation of the recommendations contained in the Tradewind Report, have on the safety of the RHVP? Were drivers on the RHVP put at risk as a result of the non-disclosure? Did friction levels contribute to motor vehicle accidents on the RHVP, and what other factors, including driver behaviour, lighting, and weather conditions, contributed to such accidents?

5) What changes should the City make as a result of the answers to the questions above?

The Inquiry Process

To answer the 24 questions set out in the Terms of Reference, the Inquiry proceeded in several phases: an investigation phase involving document gathering, interviews, and the preparation of extensive Overview Documents; a public hearings phase over 78 hearing days for Phase 1 (which focused on fact evidence) and six days for Phase 2 (which focused on governance and technical expert evidence); and the preparation of this Report. Four entities — the City, Golder, Dufferin Construction Company ("Dufferin"), and the MTO — had formal participation status, and I encouraged non-participants, including those affected by collisions on the RHVP, to be involved in other ways.

Some of the specific 24 questions — regarding who had knowledge of the Tradewind Report and the 2007 MTO friction testing and when, and what reports concerning the RHVP were commissioned over time — were relatively straightforward. However, the answers to most of the questions posed in the Terms of Reference were complex, involved a broad timeframe to consider, and necessitated significant factual evidence.

As set out below, the question of why the Tradewind Report was not disclosed to Council until 2019 was not simply the result of one person's actions but had much to do with a culture within Public Works that did not require collaboration among its divisions

in respect of traffic safety on the RHVP. The Inquiry therefore dealt with the conduct of particular individuals, and with issues of interpersonal dynamics, workplace culture, and systemic gaps regarding the division of responsibility within Public Works as it related to traffic safety on the RHVP, and between Public Works and Legal Services following the discovery of the Tradewind Report in 2018[4]. On these issues, the Inquiry benefitted from the expertise of Janice Baker[5] on issues regarding the best practices for the management and governance of municipalities.

In addition, the Inquiry was tasked with answering questions of a highly technical nature regarding the construction of highways, traffic safety principles, and the role of friction as a potential contributor to accidents. These questions required a basic understanding of the science of pavement friction and friction measurement, traffic safety practices, the design and construction of the RHVP, and the recommendations of the City's consultants and the actions taken by Public Works staff between 2013 and 2018 to address the emerging collision patterns on the RHVP and pavement-related issues. In this regard, the Inquiry benefitted from the technical assistance of the experts retained by the Inquiry, Dr. Gerardo Flintsch[6] and Russell Brownlee,[7] and the experts of the participants, David Hein,[8] Dewan Karim,[9] and Dr. Hassan Baaj.[10] In addition, the Inquiry heard from several current or former CIMA staff as fact witnesses, regarding their involvement in a number of RHVP-related consulting reports for the City.

---

[4] A complete list of the individuals referenced in the Inquiry is contained at Appendix P.

[5] At the time of her opinion, Ms. Baker was the Chief Administrative Officer for the Region of Peel.

[6] Dr. Flintsch is the Director of the Center for Sustainable and Resilient Infrastructure at Virginia Tech Transportation Institute and the Dan Pletta Professor of Engineering in the Via Department of Civil and Environmental Engineering at Virginia Polytechnic Institute and State University.

[7] Mr. Brownlee is the President and Transportation Safety Engineer at True North Safety Group.

[8] Mr. Hein is the President and Principal Engineer at 2737493 Ontario Limited, and the City's expert in the Inquiry.

[9] Mr. Karim is the Practice Lead of the Transportation Engineering & Safety Group at 30 Forensic Engineering, and the City's expert in the Inquiry.

[10] Dr. Baaj is the Director of the University of Waterloo's Centre for Pavement & Transportation Technology, and Golder's expert in the Inquiry.

The Inquiry had the benefit of hindsight, and the experts who appeared before it had years of data to ground their opinions and analysis. Some information and technical findings were a product of the Inquiry's processes; City staff and consultants did not have this information prior to 2019. Although I relied on these experts to assist me in forming my conclusions below and in this Report, I have attempted to avoid imposing the expertise of the technical experts on individual members of the Public Works department where it was not warranted or importing hindsight knowledge onto those who had responsibility for the safety of the RHVP over time.

A judicial inquiry cannot make findings of civil or criminal liability, nor conclusions that any individual has breached any legal standard that would entail civil or criminal liability or professional discipline. Determining conclusions of civil or criminal liability is a matter for the courts in the context of specific civil or criminal proceedings. For this reason, I have not determined whether any conduct constitutes "negligence", as posed in two of the questions in the Terms of Reference, which would require conclusions in law. Similarly, to the extent "malfeasance" involves a legal conclusion, I have not addressed that term. Where terms such as "responsible", "failure", or "standards" are used in this Report, I intend their plain non-legal meaning rather than to give these words the meaning they would have in a civil or criminal proceeding or to imply any conclusions in law. As Justice Bélanger aptly stated in the *Report of the Elliot Lake Commission of Inquiry*, an inquiry's "dissection and analysis of past events, its quest for expert opinion, and its examination of best practices have only one purpose: to put forward an opinion, in the form of recommendations, on how best to improve the current situation."[11]

The Content of the Report

To answer the questions set out in the Terms of Reference, this Report is necessarily lengthy and detailed. This Executive Summary does not capture all of the findings contained within my Report, much less all of the evidence behind those findings, nor the totality and nuances of my conclusions or rationale for my recommendations, which are both set out in Chapter 12. I encourage readers to review the full report, which is organized as follows.

[11] *Report of the Elliot Lake Commission of Inquiry*, *Executive Summary* (Queen's Printer for Ontario: Ministry of the Attorney General, 2014) (Paul R. Bélanger) at 4.

The first four chapters set out important background information. Chapter 1 sets out a basic introduction to a number of technical topics, including the surface course used on the RHVP, the science of pavement-tire friction and how it is measured on highways in Ontario including by the MTO, and certain traffic safety concepts and highway design considerations relevant to traffic safety on the RHVP. This was necessary given the breadth of the Terms of Reference regarding the factors that cause collisions. Chapter 2 addresses the design and construction of the RHVP and provides an overview of the design and geometric features on the RHVP mainline that are significant for traffic safety purposes. Chapter 3 describes the friction testing that the MTO conducted on the RHVP in 2007 and between 2008 and 2014. Chapter 4 provides an overview of the City's governance structure and operational organization, with particular attention to the departments, divisions, sections, and key staff thereof, and external consultants retained by the City, who had a role in managing and maintaining the RHVP or who were otherwise the subject of this Inquiry's mandate.

Chapters 5 through 10 review, in chronological order, the actions taken by City staff, principally members of the Traffic group and the Engineering Services division regarding RHVP-related matters, including Public Works' retainers of Golder to assess the pavement condition and of CIMA to address traffic safety, and discussions regarding rehabilitation and resurfacing of the RHVP. Chapters 9 and 10 also describe the circumstances under which Mr. McGuire found the Tradewind Report. Chapter 11 describes the actions of staff from Public Works, Legal Services, and Communications to bring the Tradewind Report and other RHVP-related matters to Council in January and February 2019.

Chapter 12 sets out certain findings and my overall conclusions relevant for the Terms of Reference and the Recommendations. It then sets out my answers to the specific questions posed in the Terms of Reference and is followed by my Recommendations. Chapter 13 concludes the Report with an overview of the Inquiry process.

Significant Findings and Conclusions of the Report

The following findings and observations are important for understanding the City's approach to traffic safety on the RHVP, particularly from 2013 to 2019. They also inform the answers to the Terms of Reference and the Recommendations that are set out in Chapter 12.

Design of the RHVP[12]

There are no mandatory requirements for the design and construction of limited access municipal freeways in Ontario. There are instead guidelines and best practices, and requirements that municipalities can adopt if they choose to do so. The applicable design manuals provide the starting points of any design, but there is always latitude to deviate from the guidance in specific situations and combinations of situations. In some cases, it may also be necessary to depart from a particular guideline in order to meet other project objectives and constraints.

Compliance with the prevailing design standards does not ensure that a roadway will be safe. Nor does the need to apply exceptions to those standards imply that a roadway will be unsafe. The safety of a highway must be monitored and assessed on a continuous basis with its collision experience measured over a long enough time period to provide a high level of confidence that the observed collision experience is a true representation of the expected safety characteristics of that location or highway. As addressed below this is the concept of a "substantive safety" approach, as distinct from a "nominal safety" approach, which simply assesses compliance with minimum standards and/or guidelines. The substantive or long term safety performance of a roadway does not always directly correspond to its level of nominal safety, even if all geometric design criteria are met.

The RHVP was designed to follow the contours of the Red Hill Valley and constructed to accommodate the existing arterial roads crossing the Red Hill Valley. The RHVP

[12] The design and construction of the RHVP, its challenging geometry, and the impact on traffic safety are described in Chapters 1, 2, and 12.

was designed and constructed in accordance with prevailing design guidelines in Ontario (with one qualification regarding a feature of one curve that it is not possible to assess, and with certain permitted design exceptions described below). However, the design of the RHVP has features that make some sections particularly challenging to drive. These include:

- The RHVP design speed is 100 km/h and, until 2019, the entire RHVP mainline had a posted speed limit of 90 km/h. Both of these speeds were within the permissible range of the design guidelines, but the 10 km/h differential between them was less than the desirable 20 km/h difference recommended by the design guidelines.

- There are three sequential curves in the section between the Greenhill Avenue and Queenston Road interchanges, two of which are at or close to the minimum curve radii permitted under the design guidelines.

- The design guidelines permit deviations from the recommended interchange spacing, which is not uncommon with urban freeways due to existing arterial roads. In this regard, the spacing of all but one of the six RHVP interchanges, including between the Greenhill Avenue, King Street, and Queenston Road interchanges, reflects the application of such exceptions.

- Similarly, three of the “weaving distances” on the RHVP (the spacing between on ramps and off ramps) are below the recommended minimum in the design guidelines and correspond with the two most closely spaced interchanges and the three sequential curves between the Greenhill Avenue and Queenston Road interchanges described above.

- The RHVP has non-continuous decision point lighting, which is located at the exit ramp of each interchange. Accordingly, each RHVP exit ramp and their surrounding area(s) are lit, but ramps entering onto the RHVP and the RHVP mainline itself are not lit. The RHVP’s lighting configuration is identical to the LINC’s.

In summary, the section from Greenhill Avenue to Queenston Road brings together closely spaced interchanges and weaving sections in succession with tight curves

that motorists need to navigate and, prior to the speed reduction, an atypical but permissible difference between the posted and design speeds. Individually and collectively, these elements of the RHVP design may result in what are known as "expectancy violations" for some drivers leading to poor decision making. There is a correlatively higher friction demand required for execution of maneuvers in that area.

Construction of the RHVP

Two features of the RHVP's pavement were innovative in a municipal context. Both were relevant to the Inquiry's mandate.

First, the RHVP was constructed using a perpetual pavement structure, which is intended to last longer than traditional pavement structures. The choice of a perpetual pavement structure was a reasonable one.

Second, the RHVP surface was paved with a stone mastic asphalt ("SMA") layer which differed from more traditional surface courses. Gary Moore, then working within the Red Hill Valley Project Office, and the City's Quality Assurance consultant, Golder, and Mr. Moore's primary contact at Golder, Dr. Ludomir Uzarowski, were involved in the selection and assessment of the RHVP SMA during design and construction.

The paving contractor, Dufferin, sourced the coarse and fine aggregate used in the SMA surface course from the quarry of its affiliate, Demix Agrégats, located just outside of Montreal, Quebec. This was the first time the Demix aggregate had been used in Ontario. The MTO requires aggregates used in the construction of roads to be tested and pre-qualified for their frictional qualities before use in provincial highways. Prior to the RHVP's construction, the Demix aggregate was not on the MTO's Designated Sources for Materials list of pre-qualified aggregates. However, based on the testing information pertaining to this aggregate, the Demix aggregate was expected to provide a good frictional performance and was suitable for use in the SMA surface course of the RHVP.

The Inquiry did not receive any evidence that indicated that the frictional or other characteristics of the Demix aggregate were inadequate at the time of construction of the RHVP. In addition, although there were some construction deficiencies disclosed

by the various asphalt test results taken at the time of paving relating to the mix design, compaction, and gradation, the evidence established that these were unlikely to have adversely affected the frictional qualities of the RHVP. The use of SMA, in itself, did not give rise to any friction issues on the RHVP.

A Comparison of the MTO and City Approaches[13]

Traffic safety is one of the highest responsibilities of a traffic authority, municipal or otherwise. Before the mid-1990s, a "nominal safety" approach, described above, assumed that a "road designed to meet minimum standards would be 'safe'." This is no longer an acceptable road safety assumption within the traffic safety community. Traffic safety on an urban expressway is not determined solely by compliance with the design standards and guidance in effect at the time of design of that expressway.

Rather, traffic safety requires a "substantive safety" approach. Even a roadway that is nominally safe (that is, all design elements meet design criteria) is not automatically substantively safe or vice versa. Despite complying with geometric design guidelines or standards, specific sections of a highway could still experience higher collision volumes due to various local constraints or conditions that were not included in the typical condition or geometric design details developed in industry documents. It is necessary to monitor traffic safety on an ongoing basis as usage on an expressway is a dynamic factor changing over time. A comprehensive traffic safety approach requires ongoing data collection and analysis and routine consideration of all factors that may contribute to collisions on a roadway to assess and reduce collisions. These factors include highway geometry, the location of interchanges and ramps, driver expectations, design and posted speeds, illumination, signage and roadside devices, pavement markings and other retroreflective safety devices, and the physical structure of the roadway, including the pavement structure, design, and materials.

The Inquiry heard evidence about the MTO's approach to assessing collision issues on provincial roads and to identifying when friction could be involved as a contributing factor. This evidence was instructive. As noted above, the MTO requires that the aggregate used in the construction of MTO roads be pre-qualified for its frictional

[13] The MTO's approach is set out in Chapter 1 and referenced in Chapter 12. Traffic safety principles are set out in Chapter 1 and both approaches are referenced in Chapter 12.

qualities, that is, tested before inclusion on the MTO list of Designated Sources for Materials. In addition, and more importantly for the purposes of this Inquiry, the regional offices of the MTO regularly monitor accident statistics to identify issues such as abnormal collision experiences in the provincial road system. They then conduct a detailed investigation to isolate the potential contributing factors to any such experience, which may include friction testing. Based on this investigation, the MTO then determines whether to apply countermeasures that respond to the identified contributing factors.

The City's approach to traffic safety on the RHVP during the relevant period for the Inquiry, being 2008 to 2019, did not follow the MTO's proactive approach. Instead, it was primarily reactive. Between 2011 and 2017, the City did not have a regularized system for analyzing collisions and identifying potential contributing factors to accidents in high collision areas on a comprehensive basis. Rather than proactively identifying areas of concern, traffic safety on the RHVP was generally addressed as an *ad hoc* response to particular issues raised by Council, the PWC, or public complaints.

Moreover, there does not appear to have been an understanding within Public Works that traffic safety was a shared responsibility of several divisions of Public Works. Although Gerry Davis, the General Manager of Public Works until the spring of 2016, testified that Public Works practised cooperation and collaboration between the divisions during his tenure, the evidence indicated otherwise in respect of the approach to traffic safety on the RHVP. The absence of a sense of a shared responsibility and a comprehensive approach to traffic safety presented itself in two related ways.

First, there was no Public Works division, staff, or director responsible for the overall safety of the RHVP, and this continued over the course of various organizational changes within Public Works. The responsibility for maintenance, operation, and traffic safety on the RHVP was allocated amongst divisions, sections, or groups within Public Works, with clear "siloed" delineation. Engineering Services was generally responsible for the physical roadway, which included the pavement surface except roadside structures, its Street Lighting & Electrical group was responsible for illumination, and its Asset Management section was responsible for assessing road infrastructure. The Roads & Maintenance division was responsible for more routine maintenance of the parkway. Traffic safety — principally matters that affected driver

behaviour such as pavement markings, signage, and posted speed limits, rather than the physical structure of the roadway — was the responsibility of the Traffic group, which fell under a different division. The Traffic group was required to assume responsibility for matters beyond the usual expertise and experience of those with traffic safety responsibility for the local roads and arterial roadways of the City. Traffic did, however, engage an external consultant, CIMA, to complete various traffic safety reports.

In order for a municipality to function and appropriately manage a major infrastructure asset, there needs to be an allocation of responsibilities amongst divisions and staff who have the requisite expertise. The City's allocation within Public Works for the RHVP and LINC reflected a delineation of responsibility in roadway infrastructure between the physical structure of the roadway and the traffic safety elements that principally affect driver behaviour that is, in part, structural. There is a division of skills, training, and expertise in traffic safety and in pavement materials, including within the consultant community. Generally speaking, for matters pertaining to surface friction, while traffic safety experts are aware that low friction can in some circumstances present a safety issue, they do not have a deep understanding of the science of friction or of how to interpret friction test results. Also generally speaking, if pavement and materials experts (who specialize in asphalt mixes, aggregates, and pavement design), like Golder, are conversant in friction testing and the interpretation of friction testing results, they do not necessarily know how to apply those results to the traffic safety context.

Second, and related to the first, the Traffic group and the Engineering Services division each viewed themselves as responsible only for the specific matters within their own areas of allocated responsibility. While a division of responsibilities may be appropriate for other arterial roads and residential streets, it is not effective for an urban expressway, especially in the absence of an individual who was designated to address issues of collective responsibility where there was a lack of information sharing between divisions.

The absence of a sense of a shared responsibility and of a comprehensive approach to traffic safety was further constrained by the approach of Mr. Moore to traffic safety on the RHVP. During his tenure as Director of Engineering Services, Mr. Moore did

not view traffic safety as being included within the mandate of Engineering Services. In addition, having been directly involved in the design and construction of the RHVP, Mr. Moore had the strongly held view that the RHVP was at least as safe as any comparable roadway because it had been designed according to the prevailing design standards using a quality aggregate and a premium surface course. In his view, any abnormal accident experience was attributable to driver behaviour, especially excessive speeding. Thus, from his perspective, there was no need for significant changes to the RHVP to respond to traffic safety concerns, especially in respect of the pavement, illumination, or other changes that would fall to Engineering Services to investigate, program, or implement. Indeed, he believed that doing so could have liability consequences for the City. Mr. Moore expressed these views, aggressively at times, to staff in the Traffic group in respect of friction testing, including challenging the utility or need for traffic safety countermeasures relating to friction testing, median barriers, and changes to lighting.

Friction and Friction Standards (Answers to Terms of Reference Questions 22 and 23)[14]

It is important not to place inordinate emphasis on friction as a potential contributing factor to accidents on the RHVP. However, an understanding of friction demand and its possible contribution to collisions is necessary for the purposes of this Report, as the Inquiry was triggered by the disclosure of the Tradewind Report which dealt specifically with friction levels on the RHVP.

The friction level and texture of a pavement surface are important components of the highway-related conditions that influence traffic safety. Deficient friction is seldom the main cause of a collision, but low friction levels can be a contributing factor in the presence of other contributing circumstances in particular situations. Studies over the years have repeatedly shown that sites with low friction have more collisions than sites with high friction. Recent studies have found that both dry and wet collision rates increase with decreasing friction levels, though the impact is higher on wet road collisions than on dry road collisions.

[14] See Chapter 1 for more information on friction standards and the relationship to traffic safety.

What constitutes adequate friction in practice varies from roadway to roadway and from section to section within an individual roadway. Whether a road has adequate friction (skid resistance) and whether friction levels contribute to collisions are therefore questions to which there are no simple answers. In broad terms, an effective approach to ensuring adequate pavement friction requires policies and practices in the design and construction of a highway, a management program involving the monitoring of the collision experience of the highway, and a policy to identify and respond to potentially unsafe roadway surfaces in a timely fashion if low friction is determined to be a contributing factor to the collision experience.

Questions 22 and 23 of the Terms of Reference ask specifically about roadway friction standards in Ontario and their public availability.[15] There is no formal standard for acceptable levels of friction on a roadway in Ontario. The MTO does not publish any friction measurement standards or friction level investigatory limits in respect of highways in Ontario. The MTO also does not broadly share its friction data externally as a rule, although on occasion MTO friction data may be published or shared in technical papers and industry presentations. While there is no formal MTO directive governing responses to friction-related inquiries, in practice MTO staff appear to have limited their responses to generic, high-level information, avoiding the provision of specific information regarding friction results on specific MTO highways, any MTO views regarding appropriate threshold levels, and any interpretation of friction results.

The MTO locked-wheel friction testing generates friction levels referred to as friction numbers ("FN") on a scale of 100. There are other devices to test friction which use different measurement scales, including the GripTester which was used by Tradewind when it conducted its testing in 2013.

[15] Questions 22 and 23 ask: ***22)*** *What is the standard in Ontario, if any, with respect to the acceptable levels of friction on a roadway?* ***23)*** *Is information with respect to the friction levels of the roadways in Ontario publicly available?* See Chapter 1 for a further explanation of the MTO's uses of FN30, and Chapter 12 for a complete answer to Questions 22 and 23.

When testing is conducted for the purposes of qualifying an aggregate for the MTO's Designated Sources for Materials list, the MTO uses a guideline of FN30 as a performance measure for the aggregate under review. Aggregates used in pavements with friction results of FN30 or above are generally considered satisfactory for initial and continued listing on the MTO's list, provided the aggregates also satisfy all of the other requirements. However, in this context, the MTO does not look at friction demand issues that might render otherwise acceptable friction levels insufficient for the demand in certain locations. It looks only to the overall average FN of the segment tested or, in some cases, the results for a comparator control strip, in which event, it is the relative rather than the absolute result that is meaningful.

For traffic safety purposes, where an MTO regional office has requested friction testing after conducting an investigation to isolate the potential contributing factors to abnormal collision experiences, the MTO uses a tested friction level of FN30 (measured at the posted speed) as an informal investigatory level guideline for assessing roadway friction based on testing using its locked-wheel trailer testing equipment.

FN30 is used as a starting point for MTO staff to determine whether the friction demand required of the roadway is met and/or whether any friction-related issues exist and, in that context, whether surface friction conditions are a possible contributing factor to the collision experience being analyzed. It is not regarded as an indication, in itself, of either a safe road if a friction level exceeds the threshold or an unsafe road if a friction level falls below the threshold. Depending on the presence or absence of other possible contributing factors, a friction level above FN30 may be inadequate and conversely a friction level below FN30 may be sufficient.

While this guideline is not published, the MTO's use of this informal guideline was not a secret within the asphalt or paving industries in Ontario, although it was not universally known during the relevant period for the Inquiry. While Dr. Uzarowski of Golder was aware of the MTO's use of this guideline, witnesses for the City and Dufferin, who are part of that community, testified that it was not known to them.

MTO Friction Testing of the RHVP (Answers to Terms of Reference Questions 17, 18, 19, 20, and 21)[16]

Questions 17 to 21 of the Terms of Reference ask about the circumstances and consequences of the non-disclosure of the friction testing which the MTO conducted on the RHVP in 2007.[17]

The MTO completed friction testing on a 4 km section of the southbound lanes of the RHVP on October 16, 2007, shortly before the RHVP opened to the public, on November 17, 2007. The 2007 testing was performed with the City's knowledge and agreement. Dr. Uzarowski requested it on behalf of the City to confirm the acceptability of the Demix aggregate used in the RHVP SMA surface course. The MTO was also interested in determining whether the RHVP SMA revealed any early age low friction issues, which the MTO had seen with its own SMA pavements, in which new SMA pavement exhibited low friction levels which improved over a relatively short period as traffic wore off an asphalt film on the surface.

The October 2007 test results obtained on the RHVP were better than typically achieved on MTO highways for brand new SMA pavements and were therefore considered acceptable by the MTO, particularly as the friction levels were expected to increase with traffic (results for Southbound Lane 1 averaged FN33.9, and ranged from FN28.1 to FN36.5; results for Southbound Lane 2 averaged FN33.8, and ranged from FN28.4 to FN37.4). Over time, several MTO staff received a copy of these results. The MTO provided the results to Golder who in turn provided them to Mr. Moore and Marco Oddi (then the Senior Project Manager, Red Hill Valley Project, Public Works,

---

[16] The MTO's friction testing of the RHVP is addressed in Chapter 3.

[17] Questions 17 to 21 ask: ***17)*** *Why was the MTO Report not provided to Council or made publicly available?* ***18)*** *Who was briefed within the MTO's office about the MTO Report?* ***19)*** *Did the MTO Report contain findings or information that would have triggered Council to make safety changes to the roads or order further studies?* ***20)*** *Did the failure to disclose the MTO Report, or the information and recommendations contained therein, contribute to accidents, injuries or fatalities on the RHVP since January, 2014?* ***21)*** *Did the MTO request, direct or conduct any friction tests, asphalt assessments, or general road safety reviews or assessments on the RHVP other than the MTO Report?* See Chapter 12 for the answers to these questions.

Hamilton). Mr. Moore expressed his understanding of the results as indicating that the RHVP was “good to go”.

Mr. Moore made an operational decision not to share the 2007 results with anyone within Public Works. At the time he received the results, the RHVP project was near completion and with Chris Murray (former Director, Red Hill Valley Project, Public Works, Hamilton) having changed jobs, there was no director of the Red Hill Valley Project to provide the information to. Having received satisfactory results for newly placed SMA pavement that disclosed no issues, there was nothing to report to Council. Mr. Moore’s decision not to share the results was not inappropriate in the circumstances.

Even if the 2007 friction test results had been provided to Council in 2007, they would not have triggered any safety changes to the RHVP or prompted any further friction-related studies of the parkway, and the lack of such disclosure did not contribute to accidents, injuries, or fatalities on the RHVP. The uncontroverted evidence before the Inquiry was that no further assessment, remediation, or action was warranted in 2007 because the results were acceptable for newly paved SMA pavement and friction levels were expected to increase shortly after the RHVP opened.

In short, in answer to Questions 17 to 20, the results of the MTO friction testing in 2007 were circulated amongst MTO staff over time and were provided to Dr. Uzarowski of Golder on behalf of the City, there was no obligation on the part of the MTO to provide the results to Council or the public, the MTO Report did not contain findings or information that would have triggered Council to make safety changes to the road or order further studies, and the non-disclosure of the results of the MTO friction testing in 2007, or the information and recommendations contained therein, did not contribute to accidents, injuries, or fatalities on the RHVP since January 2014.

In answer to Question 21, the MTO subsequently performed friction testing on the RHVP for the purpose of evaluating the suitability of the Demix aggregate to be placed on the MTO’s Designated Sources for Materials list (in 2008 and 2009) and to remain on the Designated Sources for Materials list (in 2010, 2011, 2012, and 2014). All of this testing was conducted pursuant to the MTO’s standard procedures for assessing applications for listing on the Designated Sources for Materials list and for maintenance of an existing listing and distributed to the standard distribution group

for Designated Sources for Materials-related friction test results within the MTO. It was not performed or analyzed for traffic safety purposes. The MTO did not conduct or direct any other asphalt and/or road safety reviews or assessments, aside from the aforementioned Designated Sources for Materials-related friction testing, in respect of the RHVP. The fact of this friction testing and the results remained unknown to City staff and Dr. Uzarowski until after the Tradewind Report was disclosed to the public. The City received the MTO's 2008 to 2014 RHVP friction test results from the MTO on February 12, 2019. These results are discussed below.

The Tradewind Report and the 2014 Golder Report

After heavy rainstorms in September 2013, the City's roads maintenance staff, who were on-site on the RHVP for their maintenance and operations work, raised concerns within Public Works that they, the police, and the public believed that the RHVP was unduly "slippery when wet". Mr. Moore told his colleagues that the SMA surface course exceeded all MTO criteria, but he volunteered to obtain friction testing for the express purpose of using the results to defeat any litigation claim that might arise in the future. He also volunteered to let his colleagues, including staff in the Traffic group, know when he received the results.

Mr. Moore asked Golder to arrange to have friction testing conducted on the roadway surface. Golder in turn engaged Tradewind, which conducted such testing on November 20, 2013. Tradewind used a GripTester to conduct the testing, which is a different type of friction testing equipment from the MTO's locked-wheel friction tester. The GripTester produces GripNumber ("GN") values which are not equivalent to the MTO's locked-wheel testing equipment and resulting FN values. For this reason, the Tradewind results cannot be compared directly to the MTO results or against the FN30 threshold that the MTO uses.

At the time, Mr. Moore had already engaged Golder to conduct a review of the RHVP pavement after six years of in-service operation, and after two flooding events. This project was led by Dr. Uzarowski and became the 2014 Golder Report. Mr. Moore's focus for this project was the preservation of the perpetual pavement structure.

In part because of Mr. Moore's past involvement in the design and construction of the RHVP and his preeminent knowledge of pavement-related matters within the

City, as well as his management style, Mr. Moore maintained personal involvement, supervision, and decision making relating to the RHVP within Engineering Services. Although he was a director, he acted as the project manager on RHVP projects that involved retaining Golder, including the 2014 Golder Report project and the related Tradewind friction testing, without input, involvement, or awareness of other colleagues in Engineering Services.

Mr. Moore received the Tradewind Report on January 31, 2014, as an appendix to the 2014 Golder Report, which was sent electronically. Dr. Uzarowski also provided Mr. Moore with a hard copy of the complete 2014 Golder Report at an in-person meeting on February 7, 2014. In each case, Golder had applied a "draft" watermark on the entire 2014 Golder Report, including the appendices, despite the Tradewind Report being final. Mr. Moore had no comments on either report and both he and Dr. Uzarowski treated the 2014 Golder Report, including the appendices, as final. Golder and Tradewind also both viewed their reports as final. The "draft" watermark did, however, result in confusion later when Mr. McGuire found the Tradewind Report in 2018.

In the "Conclusion and Recommendations" section of the Tradewind Report, Tradewind found the LINC results to "indicate a generally uniform pavement surface texture and composition, with limited variation due to vehicular traffic wear." However, Tradewind noted that "the overall friction averages as measured by the GripTester on the designated lanes and sections of the Red Hill Valley Parkway were below or well below the same UK Investigatory Level 2" and concluded that:

> [t]he overall low levels and the variability of friction values along the length of the Parkway indicate the need for a further examination of the pavement surface, composition and wear performance. It should be noted that, in addition to the overall low average Grip Number levels on this facility, there are some localized sections with quite low friction values, reaching 27-30 in several areas. We recommend 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.

The 2014 Golder Report addressed the Tradewind friction testing in one section and in its recommendations. While there are certain problems with Golder's interpretation of these results as Dr. Uzarowski was not familiar with the UK standard referenced by Tradewind, his conclusion after conducting some personal research was clear. After describing the testing and noting that the complete results of the friction testing were provided in the Tradewind Report in Appendix E, he set out the average friction numbers for each of the lanes tested, which ranged from 34 to 39. The 2014 Golder Report then set out Dr. Uzarowski's conclusion as follows:

> 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.

The 2014 Golder Report recommended a mill and overlay resurfacing on sections where Golder had observed the most frequent top-down cracking of the pavement surface and routing and sealing of cracks followed by the application of a single layer of microsurfacing on the remainder of the RHVP. It noted that the effect of these treatments would be to remedy the top-down cracking and also address the issue of the relatively low friction levels on the RHVP.

The Tradewind Report was credible and reliable when it was delivered to Mr. Moore in 2014. It contained a clear recommendation. It was unambiguous. It was not, as suggested by Mr. Moore and later repeated by others, inconclusive. Although the Tradewind Report applied an outdated UK standard, the results were still below the UK investigatory level applying the correct UK standard.

The Inquiry heard from two pavement experts, Mr. Hein and Dr. Flintsch, who both testified that one cannot simply import friction standards from foreign jurisdictions to form the basis of a friction management program in Ontario. However, Dr. Flintsch was also of the opinion that the standard in the Tradewind Report could still be applied as a "good reference" in this individual case. Dr. Flintsch opined that the Tradewind Report ought to have sparked further investigation, including investigation to determine whether the friction demand may be exceeding the available friction by

reviewing the geometry, speeds, traffic, and the collision history and, if necessary, further testing with a different device if the recipient was unfamiliar with the GripTester or unsure about applying the UK standard. Mr. Hein, in turn, acknowledged that, had he received the Tradewind Report in early 2014, he would have recommended a further investigation as Tradewind had. He also would have recommended locked-wheel friction testing be conducted because he was more familiar with that device and how to interpret its results.

I return to these reports below.

RHVP Traffic-Safety Initiatives and Pavement-Related Studies and Events From 2013 to 2015[18]

Several questions in the Terms of Reference relate to the circumstances and the consequences of non-disclosure of the Tradewind Report after it was provided to the Department of Engineering Services in January 2014. Answering these questions requires an understanding of the various initiatives and studies undertaken by the Traffic group and Engineering Services regarding traffic safety on the RHVP and the maintenance of the RHVP pavement structure, respectively.

As noted above, during this period, there was an absence of a shared sense of responsibility within Public Works for addressing the collision experience on the RHVP and LINC. The resulting siloed approach to issues relating to the RHVP was exacerbated by the absence of a clear understanding of responsibility for matters that crossed divisional lines and personality issues that had the result of deferring, rather than resolving, certain recommendations that were opposed.

The 2013 CIMA Report[19]

Following public complaints, and the first fatal collision involving two people on the RHVP in September 2012, the PWC passed a motion in January 2013 directing staff to investigate upgrading the lighting in the vicinity of the Mud Street/Stone Church

[18] These initiatives and studies are addressed in Chapters 6 through 9.

[19] The 2013 CIMA Report is described in Chapter 6.

Road interchanges (the “study area”) as well as better signage and lane markings or other safety initiatives in that area.

At first, Traffic proposed that Traffic and Engineering Services address signage and lighting separately, which was consistent with the allocation of RHVP-tasks referenced above. In the end, Traffic led the 2013 CIMA project, and a project manager from Engineering Services’ Street Lighting & Electrical Engineering group was assigned to the 2013 CIMA project team. The project team did not appear to have a staff member to give input on behalf of other divisions of Engineering Services. There was no project charter in place that would have clarified individual roles and the respective responsibilities of the Traffic group and Engineering Services. There was also a lack of standards and/or processes for clear communication internally or with CIMA.

The 2013 CIMA Report included a collision analysis within the study area which revealed that single motor vehicle accidents were the most common accident type. In addition, non-daylight collisions on the mainline and on a particular ramp were at levels significantly higher than the provincial average, as were wet surface collisions on a particular stretch of the mainline and the same ramp.

CIMA recommended a number of countermeasures to address the collision patterns identified on the ramps and various sections within the study area. These recommendations included changes to signage and pavement markings including “slippery when wet” signs, applying a high friction surface course to the Mud Street ramp, and conducting friction testing across the entire RHVP study area. The application of a high friction surface course and friction testing recommendations were intended to improve friction on the ramp and assess whether friction was contributing to the collision experience, respectively. CIMA also determined that illumination was warranted on the ramps of the Mud Street interchange, although CIMA noted that illumination did not need to be implemented simply because a warrant had been achieved. CIMA did not assess the geometry and received direction from City staff not to consider recommendations for pavement treatment on the RHVP mainline.

The PWC motion had contemplated an investigation of illumination on the mainline of the RHVP in the study area. CIMA included in its report its assessment and recommendation regarding illumination on certain interchanges but did not include its assessment of continuous mainline illumination, which it had conducted. CIMA’s self-

imposed reduction in its scope occurred as a result of a conversation between Brian Malone (Partner, Vice-President, Transportation, CIMA) and Mr. Moore, about which neither advised other City staff nor CIMA staff. Mr. Moore told Mr. Malone that lighting was prohibited on the mainline RHVP because of environmental constraints identified in the environmental assessment ("EA") process required to approve construction of the RHVP.

Traffic staff recommended a "phased approach" that focused on implementing lower cost countermeasures first and deferred the implementation of CIMA's recommendation to install lighting at certain interchanges. Traffic staff asked CIMA to include the City's timeline for implementation in the 2013 CIMA Report, which had been finalized, and CIMA did so. Traffic staff prepared a staff report to the PWC containing these recommendations. Traffic staff did not discuss CIMA's recommendations for friction testing or the application of the high friction pavement surface with Engineering Services at any point during the project or, it appears, after the PWC approved these recommendations. The staff report referenced only vague commitments that Traffic would consult with Engineering Services regarding these countermeasures.

While the PWC accepted the proposed phased approach in November 2013, the PWC did not agree to remove an assessment of illumination from its outstanding business list. Instead, the PWC directed that staff report back respecting the lighting issue one year later, following an assessment of the effectiveness of the other countermeasures.

Mr. Moore displayed significant frustration to his colleagues about this direction regarding lighting. This tension between Mr. Moore, who did not believe lighting to be practical, affordable, or permissible under the EA for the RHVP, and the PWC, who sought a meaningful investigation of the lighting on the RHVP, continued throughout the relevant period for this Inquiry. Regardless of the merits of Mr. Moore's views regarding the feasibility of illumination of the mainline RHVP, he should have provided his views to the PWC in advance of the completion of the 2013 CIMA Report, so that the PWC could determine how, or if, they wanted staff to continue to address the issue of lighting on the RHVP, as it was a central issue in the PWC's motion. As described below, much later, in 2018, CIMA completed a study regarding lighting, and found that lighting was not prohibited but would require a fresh EA process and further studies.

Traffic and Engineering Services did not coordinate on the implementation of the countermeasures recommended in the 2013 CIMA Report. Traffic started implementing the signage and marking measures within its authority in 2014 and installed temporary "cat's eyes" illuminators and curve warning and "slippery when wet" signs around the Mud Street ramp by November 2015. Traffic and Engineering Services did not discuss the friction testing or the application of the high friction pavement surface. Public Works did not appear to have a tracking process for the recommendations. Engineering Services never took responsibility for these items within the project team or before the PWC, and Traffic never viewed them as falling within their scope of responsibility. Without a clear project team with senior staff from both sections, no division in Public Works took responsibility for completing and updating the PWC about friction testing or the high friction pavement application. Effectively, Traffic deferred countermeasures that fell under Engineering Services to Engineering Services, until Engineering Services was prepared to implement them.

The Commission of the Tradewind Report and the 2014 Golder Report[20]

Concurrently but independently of CIMA's mandate that produced the 2013 CIMA Report, Mr. Moore engaged Golder to conduct a review of the RHVP after six years of in-service operation which, in September 2013, expanded to include having friction testing conducted on the roadway surface, as noted above.

In advance of receiving the Tradewind Report in January 2014, on January 24, 2014, Dr. Uzarowski sent Mr. Moore a summary of the average friction values from the 2007 MTO testing and the average friction values from the Tradewind Report (the "January 2014 Uzarowski Email"). The MTO results for Southbound Lane 1 averaged FN33.9, while the MTO results for Southbound Lane 2 averaged FN33.8. The January 2014 Uzarowski Email stated that the average FN numbers by lane from the Tradewind Report were 35 for the southbound right lane, 34 for the southbound left lane, 36 for the northbound right lane, and 39 for the northbound left lane. Mr. Moore provided that information to an industry colleague for use in a presentation.

[20] The Tradewind Report and the 2014 Golder Report are described in Chapter 6. My conclusions in respect of these reports are set out in Chapter 12.

Until 2016, this email summary formed the basis of Mr. Moore's understanding that the Tradewind friction results were comparable and were "better" than the 2007 MTO testing results. This was incorrect because, as noted above, as a result of the different testing equipment that Tradewind and the MTO used, the Tradewind GripNumber values cannot be compared to the MTO results or assessed based on the MTO's informal FN30 investigatory threshold.

Notwithstanding that Mr. Moore was not aware of this, Mr. Moore should have understood from the words in the body of the 2014 Golder Report, which he read in January or February 2014, that Golder was of the view that the friction levels for at least some sections of the RHVP were relatively low. From the Tradewind Report, if he had read it, he would also have understood that Tradewind was of the view that these levels warranted further investigation and potentially remediation.

However, based on Mr. Moore's actions over time, I have concluded that Mr. Moore did not read the Tradewind Report when he received it in January 2014 and did not do so in any detail until December 2015. During that two-year period, and despite his discussion with Dr. Uzarowski in February 2014, Mr. Moore's understanding of the friction test results on the RHVP was limited to the content of the January 2014 Uzarowski Email.

I cannot make any definite findings as to why Mr. Moore did not act on Golder's recommendations in the 2014 Golder Report, which he had read, after January 2014. However, Mr. Moore viewed that advice through the lens of what he cared about: the surface of the pavement. He was unconcerned with improving friction on its own, rather than as a side benefit of any action to maintain the integrity of the pavement. He understood Golder's recommendation to undertake a mill and overlay on a portion of the RHVP and routing and sealing followed by microsurfacing on the balance as part of Golder's analysis that the RHVP pavement had some cracking. He did not think this pavement surface recommendation was urgent. His failure to consider the traffic safety implications of "relatively low" friction values reveals how narrowly he viewed his role.

Mr. Moore's failure to carefully review the Tradewind Report from January 2014 to December 2015 was a significant lapse of his duty as Director of Engineering Services and as the *de facto* project manager on the 2014 Golder Report project, in light of the

statements he made during this period to the PWC, his colleagues, and Mr. Malone, described below.

The 2015 CIMA Report[21]

In October 2014, a young man and woman were killed on the LINC when their vehicle crossed the median and collided with vehicles travelling westbound. The Traffic group subsequently engaged CIMA to complete a safety review of the LINC, which resulted in what was referred to as the "2015 CIMA LINC Report".

On May 5, 2015, two young women travelling northbound on the RHVP at night were killed in a crossover collision when their vehicle crossed the median barrier and collided with a vehicle travelling in the southbound lanes near Greenhill Avenue. As a result of this collision, the PWC directed staff to investigate additional safety measures for the RHVP and LINC, such as guardrails, lighting, and lane markings, to prevent further fatalities and serious injuries. Another fatal collision on the RHVP occurred in July 2015.

The Traffic group engaged CIMA to complete a safety review of the entirety of the RHVP, which included the most challenging area between the Greenhill Avenue and Queenston Road interchanges. This assignment resulted in what was referred to as the "2015 CIMA Report". The City's internal team for this project did not include anyone from Engineering Services. However, Mr. Moore had some involvement, described below.

The 2015 CIMA Report included a collision analysis that reflected a similar collision experience as CIMA had found in the study area in 2013, but this time for the entire RHVP. CIMA found in 2015 that the highest concentration of collisions occurred at specific locations that broadly fell between the Greenhill Avenue and Queenston Road interchanges and near the Mud Street on ramps. Of significance, all locations mentioned in the 2015 CIMA Report were "within, on approach to, or leaving a horizontal curve." CIMA also found that illumination on the RHVP mainline was warranted using warrants from the Transportation Association of Canada Roadway Lighting Guide and MTO Policy for Highway Illumination, subject to a cost-benefit analysis.

[21] The 2015 CIMA Report is discussed in detail in Chapter 7.

CIMA concluded, based on its collision review, that it appeared that the combination of high vehicle speeds and wet surface conditions might have been the primary contributing factors to collisions on the RHVP, particularly in the vicinity of the King Street and Queenston Road interchanges where vehicles must travel small-radius horizontal curves.

During the preparation of the 2015 CIMA Report, Mr. Malone of CIMA contacted Mr. Moore directly to obtain information on RHVP friction testing, rather than going through the Traffic group or the members of the project team. Mr. Moore provided Mr. Malone with a copy of the January 2014 Uzarowski Email which contained the summary results of the MTO 2007 and Tradewind 2013 friction testing. Mr. Moore advised that these results were not for republication, without explanation. In response to Mr. Malone's questions regarding this testing, Mr. Moore provided incorrect information suggesting, among other things, that both tests had been conducted by the MTO, that the results were comparable and, therefore, by inference, that the 2013 results were better than the 2007 results. In my view, this delivery of incorrect information was the result of Mr. Moore's lack of interest in friction testing, rather than an intention to mislead. Regardless, his failure to provide accurate and complete information, including locating and providing a copy of the Tradewind Report itself, was careless and fell below his responsibilities as Director of Engineering Services. This error was compounded by the fact that neither Mr. Malone nor Mr. Moore told anyone in Traffic or on the project team about their discussion.

After CIMA sent the Traffic group a draft of the 2015 CIMA Report, David Ferguson (Superintendent, Traffic Engineering, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning; Public Works, Hamilton) sought buy-in from Engineering Services and other divisional directors in Public Works. Mr. Moore applied a nominal safety lens. He challenged the CIMA recommendations that Engineering Services would be responsible to implement (illumination, friction testing, median barriers), and asserted that Engineering Services was not required to investigate or fund the implementation of these countermeasures.

CIMA delivered the 2015 CIMA Report in November 2015. In the report, CIMA proposed a number of countermeasures, including targeted police enforcement for speeding and installation of speed feedback signs, oversized speed limit signs, continuous

illumination, and “slippery when wet” signs. To mitigate median-related collisions, CIMA recommended that the City install a high-tension cable median barrier.

CIMA also recommended that the City conduct friction testing under normal conditions and under typical wet pavement conditions, near locations with the highest frequencies of wet surface collisions, especially the curves, with a special focus on the curves near the King Street and Queenston Road interchanges. Mr. Moore told CIMA and Traffic staff in October 2015, likely for the first time, that he had friction testing conducted and that the results were satisfactory, in reliance on the January 2014 Uzarowski Email and not having reviewed the Tradewind Report. In November 2015, after review of the 2015 CIMA Report, Mr. Moore nevertheless continued to express the view that CIMA’s recommended friction testing would be of no value. Traffic staff did not take any steps to obtain the results Mr. Moore referenced in October, which in my view, reflected the view of Traffic staff that Engineering Services was responsible for friction testing, and a desire not to engage with Mr. Moore on this issue.

Staff were responsible for adequately summarizing CIMA’s report in their staff report to the PWC. The staff recommendation report, prepared by Traffic staff, that ultimately went to the PWC was not clear or complete. It did not set out that a high proportion of collisions were occurring under wet conditions on the RHVP or explain in plain language that CIMA had found that a combination of high vehicle speeds and wet surface conditions, exacerbated by the geometry of the parkway in certain locations, might be the primary contributing factors to collisions on the RHVP, or that in the four tight curves in the vicinity of King Street and Queenston Road, vehicles “slightly exceeding the design speed could run off the road while negotiating these curves.” Instead, the emphasis was very much on excessive speeding.

The 2015 CIMA Report categorized its recommendations as short term, medium term, and long term without including set timeframes. Friction testing was listed as a short term recommendation. The short term recommendations all fell within the scope of Traffic, except the recommendation to conduct friction testing. The long term recommendations included rumble strips, median barriers, and end-to-end illumination, all matters that were within the scope of Engineering Services.

In the staff report, Traffic staff characterized friction testing as a medium term recommendation (2 to 5 years). The staff report sought PWC approval to defer the

countermeasures staff had identified as medium term and long term pending the outcome of the Transportation Master Plan ("TMP") update. The TMP update was to address the potential widening of the RHVP and the LINC. There was no basis to list friction testing as a medium term countermeasure or to defer it; friction testing had no connection to the widening and CIMA was clear that friction testing was intended to assess whether current friction levels were a contributory factor to the wet surface collisions and to establish a baseline friction level for comparison purposes.

Subsequent to the finalization of the recommendation report and before it was presented to the PWC, the Traffic group asked CIMA to conform its report to the staff report by moving friction testing to a medium term recommendation. CIMA declined to change its listing of friction testing as short-term, although CIMA and the Traffic group did not discuss why CIMA had done so, and the Traffic group did not change its characterization of friction testing as a medium term recommendation in the staff report presented to the PWC.

As a result of the division of responsibility for, and deferral of, the countermeasures identified as medium and long term, none of the work that would be the responsibility of Engineering Services had to be completed (or even considered) pending the outcome of the TMP, which was on an unknown timeline. This included the specific friction testing CIMA had recommended. In my view, this approach, which involved deferring these items, was adopted by one or more of those in the Traffic group — being Mr. Ferguson; Martin White, the Manager of Traffic Operations & Engineering; their superior, Geoff Lupton, the Director of Energy, Fleet & Traffic; or Mr. Lupton's superior, John Mater, the Director of Corporate Assets & Strategic Planning[22] — to avoid a confrontation with Mr. Moore regarding the merits of these countermeasures.

The staff report on the 2015 CIMA Report (and the companion 2015 CIMA LINC Report) was presented to the PWC on December 7, 2015. After some internal discussion, Traffic staff provided both of CIMA's reports to the PWC members in advance of this meeting.

[22] As noted above and in more detail in Chapter 4, from late 2012 or early 2013 until 2017, Traffic Operations & Engineering was within the Energy, Fleet & Traffic section of the Corporate Assets & Strategic Planning division of Public Works.

The PWC approved the recommendation report and directed that staff install signs at appropriate locations on the LINC and the RHVP stating the penalties and costs associated with speeding. The PWC also directed staff to report to the PWC on the costs and process of investigating an improved lighting system on the RHVP and the LINC, which had not been done despite the PWC's direction in November 2013 that staff provide an update on lighting after one year of the other countermeasures being implemented. Staff were also directed to investigate installing rumble strips on the sides of the LINC and seek out provincial approval from the MTO to allow the City to implement photo radar on the RHVP and the LINC, and assess the feasibility of implementing photo radar.

Mr. Moore Returns to the Tradewind Report in Late 2015/Early 2016[23]

Mr. Moore attended the PWC meeting on December 7, 2015, at which Traffic staff presented the recommendation report on the 2015 CIMA Report. In response to a question from a councillor reflecting public concern with the quality of the asphalt surface, Mr. Moore stated that the MTO had done testing on the RHVP initially and found it was "at or above what they would normally find with their high grade friction mixes", and that he had friction testing performed in approximately 2012/2013, which found that the road was holding up "exceptionally well", that staff had no concerns about the performance of the surface mix, and that the quality of the RHVP was above the grade of 400-series highways in Ontario.

As a result of the focus on speeding and the comfort Mr. Moore provided that the pavement was not contributing to collisions, the PWC was left with the impression that speeding was the principal cause of collisions on the RHVP. This explanation of collisions downplayed the significance of the high proportion of wet surface collisions and the factors which CIMA had identified as contributing to such collisions, in addition to "excessive speed". Given their familiarity with the 2015 CIMA Report, Traffic staff should have better explained to the PWC, both in their staff report and at the PWC meeting, the multiple possible contributing factors identified by CIMA that affect the speed at which the RHVP becomes more challenging to drive.

[23] See Chapter 7 and my conclusions on these issues in Chapter 12.

Shortly after the PWC meeting, prompted by an email from Mr. Moore, Dr. Uzarowski sent Mr. Moore a second copy of the Tradewind Report by email (the "December 2015 Uzarowski Email"). I am satisfied that Mr. Moore read the Tradewind Report, likely for the first time, at or around this time. Mr. Moore had questions about the applicability and utility of the Tradewind results because the Tradewind Report referenced the UK standard, which he directed Dr. Uzarowski to answer.

Before he received this information from Dr. Uzarowski in March 2016, Mr. Moore discussed friction testing with his colleagues twice. First, on February 16, 2016, he instructed Mr. Ferguson to advise the Mayor's Office, certain councillors,[24] and a local community group that Engineering Services would complete friction testing in 2016, which Mr. Ferguson did. This was in response to the community group's request to Council that friction testing be treated as a short term safety option consistent with the 2015 CIMA Report, rather than a medium term safety option as recommended in the staff report. However, Engineering Services had not planned any friction testing in 2016 and none was completed after this commitment.

Second, on February 25, 2016, Mr. Moore sent an email to Mr. Lupton and Mr. Ferguson (which Mr. Lupton later forwarded to Mr. White), in which he stated:

> FYI – Some roughness/skid resistance/friction testing has been done. However I'm still trying to get the analysis for it and to put it into context (like how does this compare to other highways of similar type) MTO is very guarded of this information and does not share numbers due to liability and concerns they will form part of a legal action. We should be similarly wary!

Mr. Moore did not provide his colleagues with an update to this email. Although their requests were not in writing, I accept that one or more Traffic staff made at least one verbal request for these results to Mr. Moore between the December 2015 PWC meeting and the end of 2017. The Traffic group manager, Martin White, testified that, by the summer of 2017, he thought that the intervention of someone at the director level or even the General Manager of Public Works would be required to get this information from Mr. Moore, but there is no evidence that Mr. White made a direct

[24] See Chapter 7 for a full list of councillors copied on this email.

request to his superiors — Mr. Lupton (during his tenure until 2017) or Mr. Mater — to do so. Within the Traffic group, Mr. White and Mr. Ferguson testified that they had no expertise in evaluating friction testing results. They viewed friction testing as Mr. Moore's responsibility, consistent with the siloed approach to responsibilities, and Mr. Lupton and Mr. Mater were content to do the same. However, Traffic staff should have pressed to receive a copy of the friction testing results, and if, upon receipt, they felt unable to evaluate the friction testing results, they should have taken steps to understand their significance, including retaining CIMA or another expert.

At a meeting on March 14, 2016, after he had researched the answers to Mr. Moore's questions, Dr. Uzarowski told Mr. Moore there was no clear correlation between results from a GripTester and results from a locked-wheel tester, and indicated that the Tradewind GripNumbers, although numerically higher than the 2007 MTO locked-wheel numbers, were not indicative of the Tradewind results being either "better" than the MTO's prior results, or satisfactory. Dr. Uzarowski also made recommendations to Mr. Moore for pavement remediation techniques that could address low friction — microsurfacing and shotblasting — although their subsequent discussions revealed some talking at cross purposes on this point and Mr. Moore ultimately declined to consider those techniques.

As such, by March 14, 2016, Mr. Moore had no basis to discount the findings and recommendations in the Tradewind Report. Despite this, Mr. Moore dismissed the information that Dr. Uzarowski gave him.

There were no City by-laws that required disclosure of the 2014 Golder Report or the Tradewind Report to Council or the PWC in 2014 or 2016. Not all consultant reports had to be reported. However, in light of the circumstances and the evidence at the Inquiry of both Dr. Flintsch and Mr. Hein, at a minimum Mr. Moore should have ensured that a further investigation into the pavement condition was completed to understand the circumstances resulting in the low friction levels. Even if Mr. Moore had remaining questions about the applicability in Ontario of the UK standard referenced in the Tradewind Report, there were options for further investigation, including further locked-wheel testing, that would have addressed those questions.

In any event, Mr. Moore should have provided the Tradewind Report and any information he had about how to interpret the results to his colleagues in the Traffic group, at the very latest, by March 2016 in order that they could determine whether the friction levels were of significance for traffic safety on the RHVP. There was no justification for Mr. Moore's failure to provide a copy to his colleagues in the Traffic group.

In April or May 2016, the Asset Management section of Engineering Services decided to consider surface treatment rehabilitation of the RHVP in 2017. Mr. Moore testified that he considered that rehabilitation would automatically improve friction levels on the RHVP, although he did not think the levels needed to be improved in 2016. Rehabilitation likely would have improved friction levels on the RHVP, if the right materials and treatment were used. However, this did not relieve Mr. Moore of his obligation to provide the Tradewind Report to the Traffic group.

Resurfacing and Other Traffic Safety and RHVP-Related Activity From 2016 to 2018[25]

During the period between 2016 and mid-2018, there were continued collisions and fatalities on the RHVP and commensurate calls for action from councillors and the public. The Public Works department, in particular the Engineering Services division and the Traffic group, were involved in a number of RHVP-related projects, studies, and reports. Throughout this period, Traffic staff implemented some, but not all, of the approved countermeasures from the 2015 CIMA Report. Implementation of at least some of these countermeasures was tied to the planned resurfacing and was thus delayed.

I note that while the work of Engineering Services and Traffic during this period largely proceeded independently in a continuing siloed fashion, the new General Manager of Public Works, Dan McKinnon, who assumed the role in September 2016, made efforts to coordinate staff's activities on outstanding RHVP-related matters in a more coherent manner.

[25] Chapters 7, 8, and 9 address this time period and the initiatives that occurred throughout it.

RHVP Resurfacing[26]

The most significant of the RHVP-related activities during this period was the decision to resurface the RHVP. At the time the RHVP was built, the first resurfacing of the SMA pavement was anticipated to occur in year 21 of the parkway's operation (that is, 2028), based on expected traffic volumes. Ultimately, the first resurfacing occurred in the spring/summer of 2019, much earlier than originally anticipated, as a consequence of, among other things, higher than anticipated traffic volumes on the RHVP.

In May 2015, Mr. Moore advised the PWC that the first "wholesale resurfacing" was anticipated in 2021. As noted above, Engineering Services first began actively considering surface treatment rehabilitation of the RHVP in the spring of 2016. By early 2017, the plan had shifted to a complete resurfacing of the RHVP. The decision to resurface the RHVP on this accelerated timeline was made entirely by staff of Engineering Services. The Inquiry did not receive evidence to clarify what triggered the decision in 2016 to consider rehabilitation of the RHVP, nor clear evidence to clarify the reason for the shift to resurfacing, except that resurfacing would be more cost-effective than surface treatment rehabilitation in the long term.

Of note, Mr. Moore was the only Public Works staff member who was aware of the Tradewind friction testing results at the time the rehabilitation and resurfacing decisions were made. Although Traffic staff deferred certain traffic-related pavement work on Mr. Moore's advice in order that the pavement work would be coordinated with future rehabilitation works, Mr. Moore made no mention of the Tradewind Report or the 2014 Golder Report to any of his colleagues. One such countermeasure that was delayed was the short term countermeasure of raised pavement markings, which were intended to assist drivers in seeing and navigating the lanes of the RHVP. City staff had continued to receive complaints about lane visibility on the RHVP during this period, including from Mayor Fred Eisenberger and one councillor.

Staff in Traffic and Engineering Services discussed the scope for the RHVP resurfacing project throughout 2017. Although Traffic staff initially requested that the project scope include installation of median barriers (which, as noted above, was a long term recommendation from the 2015 CIMA Report that had been deferred pending further

[26] The resurfacing of the RHVP is discussed in Chapters 7, 8, 9, 10, and 11.

assessment of widening the RHVP and the LINC), Mr. Moore and his staff objected to the inclusion of this work in the scope for the resurfacing project. When Mr. White and Mr. Ferguson escalated this disagreement to Mr. Mater, Mr. Mater advised his staff to remove their request for the installation of median barriers because that issue had been deferred. At that time, the resurfacing, using a traditional mill and overlay method was anticipated to occur in two stages, with one direction of the RHVP to be resurfaced in 2018 and the other direction in 2019.

The RHVP resurfacing, originally anticipated to begin in 2018, did not occur until 2019 as a result of Engineering Services' consideration of a different resurfacing method for the RHVP – namely, hot in-place recycling or HIR. HIR involves, as its name suggests, recycling of the existing asphalt surface course in a new pavement surface which, because of these recycling benefits, is potentially less expensive and more environmentally friendly than a traditional mill and overlay, in which the top asphalt layer is milled and replaced with new asphalt material.

Mr. Moore began to consider HIR in November 2017, following a discussion he and Dr. Uzarowski had with a British Columbia-based contractor at that time. In connection with this, Mr. Moore retained Dr. Uzarowski and Golder to conduct three field tests on the RHVP: British Pendulum Testing ("BPT"), Polished Stone Value ("PSV") testing, and pavement texture measurements. The focus of Golder's engagement (referred to as the "Golder Pavement Evaluation") was HIR. Although BPT is a type of friction test and an aggregate's PSV is an indication of its resistance to polishing, the purpose of the Golder Pavement Evaluation testing was to evaluate the suitability of the aggregate in the RHVP's SMA surface course for use in HIR. It was not testing to satisfy the friction testing recommended by CIMA in the 2015 CIMA Report, nor testing that would have been responsive to Tradewind's recommendation for additional testing, which Mr. Moore did not think was necessary in light of the resurfacing. Either way, Mr. Moore did not approve the Golder Pavement Evaluation testing with any intention that it would be used for any traffic safety purpose.

The results of the Golder Pavement Evaluation testing left Dr. Uzarowski with significant reservations about the feasibility of recycling the SMA in an HIR resurfacing and its economic benefits. Dr. Uzarowski's views that HIR was not feasible were met with resistance from City staff, especially Mr. Moore, in a meeting on March 9, 2018. At that meeting, Dr. Uzarowski recommended against using HIR, instead recommending

either a mill and overlay or using hot-in-place recycling of the SMA in combination with a microsurfacing treatment. Although Dr. Uzarowski testified that he raised the prior Tradewind friction testing and the possibility of shotblasting or other remediation for the RHVP at this meeting, none of the City witnesses who attended the meeting had a specific recollection of prior friction testing results being discussed or of Dr. Uzarowski using the name "Tradewind".

Notwithstanding Dr. Uzarowski's initial reservations, he agreed to reconsider and see whether an asphalt mix using SMA in an HIR resurfacing was feasible and suitable. This resulted in a further mandate of Golder for a study referred to as the "HIR Suitability Study". Golder's work on the HIR Suitability Study overlapped with Mr. Moore's retirement as Director of Engineering Services and Mr. McGuire's appointment as his successor, discussed further below. Mike Becke (Senior Project Manager, Design, Engineering Services, Public Works, Hamilton) became the City's lead on the HIR Suitability Study following Mr. Moore's retirement in May 2018. As a result of discussions with Golder staff in this context, Mr. Becke received a copy of the Tradewind Report in late August 2018, which he did not read until mid-September 2018, shortly before Mr. McGuire discovered the Tradewind Report. This was the first time any Engineering Services staff aside from Mr. Moore received a copy of the Tradewind Report. Eventually, as set out below, the consideration of HIR was abandoned in favour of the mill and overlay resurfacing method.

The Lighting Study[27]

In September 2016, Mr. Moore submitted a staff report to the PWC in response to the PWC's December 2015 direction to provide information regarding the costs and process to investigate an improved lighting system on the RHVP and the LINC. In my view, the intention in this staff report was to discourage further consideration of lighting on the RHVP mainline, at least until a decision was made on the possible widening of the RHVP. However, the PWC remained engaged with the issue. In September 2016 and December 2017, the PWC issued further directions to staff to study lighting enhancements, the costs thereof, and to advise what impact, if any, brighter lights could have on the RHVP EA. Ultimately, CIMA was retained in the spring of 2018 by Engineering Services staff to complete this study, referred to as the "Lighting Study".

[27] The Lighting Study is discussed in Chapters 8, 9, 10, and 11.

Of significance, the Lighting Study revealed that pre-construction environmental approvals had not precluded continuous lighting on the RHVP, a finding which contradicted a long-held assumption or understanding amongst City staff and councillors that such lighting had been prohibited by the RHVP EA. CIMA's collision analysis in the Lighting Study also confirmed CIMA's past findings that there was a "significantly higher" proportion of wet road collisions on the RHVP compared to the provincial average. It found, however, that non-daylight collision rates were in line with provincial rates.

The Speed Limit Study[28]

Traffic staff also retained CIMA in March 2018 to study the feasibility and safety benefits of reducing the existing posted speed limit on the RHVP and the LINC from 90 km/h to 80 km/h. This study, referred to as the "Speed Limit Study", was the result of an August 2017 direction of the PWC, spurred by ongoing concerns with speeding on the parkways and the injuries and two fatalities caused by speed-related accidents. Two young men had been killed in separate crossover collisions on the RHVP earlier that year, on January 26, 2017 and February 21, 2017, respectively.

Report PW18008[29]

In May 2017, senior Public Works staff met to brief Mr. McKinnon (then nine months into his role as General Manager of Public Works) on the numerous outstanding RHVP-related PWC directions. According to Mr. Mater, who organized the meeting, the RHVP was a "big topic of conversation, both in the public and within [Public Works]" at that time. Friction test results which, as Mr. Mater described, were "part of the Red Hill Valley" story, were listed as an agenda item for this meeting. I am unable to reach any findings about what, if anything, was discussed at this meeting about RHVP friction testing results. I am, however, satisfied that Mr. Moore neither discussed the existence of the 2014 Golder Report or the Tradewind Report by name nor provided a copy of either report to his colleagues.

[28] The Speed Limit Study is discussed in Chapters 8, 9, 10, and 11.

[29] Report PW18008 is discussed in Chapters 8, 9, 10, and 11.

Out of this meeting, the Traffic group prepared and submitted an omnibus recommendation report to the PWC — Report PW18008: Red Hill Valley Parkway and Lincoln Alexander Parkway Transportation and Safety Update — in January 2018, which consolidated the outstanding PWC directions to staff in respect of the RHVP and the LINC. This staff report recommended that the PWC direct staff to implement a broad range of safety and traffic initiatives, including the continued implementation of the approved short and medium term countermeasures from the 2015 CIMA Report. Appendix A to Report PW18008 identified the implementation status of these countermeasures since 2015. A line item of "Conduct Pavement Friction Testing" was marked as complete. Traffic staff had made the same representation about completed friction testing in an earlier information update submitted to Council in March 2017. When Traffic staff listed friction testing as complete, they relied on the statements Mr. Moore had made in the meeting with CIMA in October 2015, at the December 2015 PWC meeting, and in his emails in February 2016, and on the one or more verbal requests that one or more Traffic staff made for these results to Mr. Moore between December 2015 and the end of 2017.

Report PW18008 also recommended, and the PWC approved, that staff conduct an annual detailed collision analysis on the RHVP and the LINC. In 2018, Traffic staff prepared the 2017 Annual Collision Report, which reported on City collision data, including data specific to the RHVP, from 2013 to 2017. The 2017 Annual Collision Report, which was presented to Council at the meeting of the General Issues Committee ("GIC") on February 6, 2019, was the first network-wide collision data published by the City since 2010.

Requests for Friction Testing and Friction Testing-Related Discussions[30]

Friction testing on the RHVP was the subject of several discussions amongst City staff and with the media in the late spring and early summer of 2017.

In late May 2017, a reporter for the Hamilton Spectator and a councillor (prompted by a request from the reporter) asked to receive a copy of RHVP friction testing results.

[30] Requests for friction testing results are described in Chapters 6, 7, 8, and 12.

The councillor's requests bounced around by email amongst numerous Engineering Services staff, including directly to Mr. Moore (who was out of the office on vacation) and to staff in the Asset Management, Construction, and Design sections of Engineering Services, as well as to Mr. White and Mr. Ferguson in Traffic. Ultimately, the councillor's requests proved unsuccessful; despite several requests over the course of a month, the councillor did not receive the Tradewind friction test results or the Tradewind Report from Mr. Moore.

The Hamilton Spectator reporter was also unable to obtain a copy of the Tradewind results or the Tradewind Report from Mr. Moore. The two did, however, speak about RHVP friction testing in connection with an article the reporter published in the Hamilton Spectator on July 15, 2017. In their discussions, Mr. Moore inaccurately described the results of the Tradewind testing as "inconclusive" and stated that there was no formal report of the friction testing, only an "informal chart sent in an email in December 2015", among other things. Mr. Moore also told the reporter that "instead of doing further testing, as was recommended, the city decided to repave". At the time of this article, Mr. Moore had not conveyed to his colleagues some of the information he told the reporter, including the inaccurate information. Variations on these statements appeared in subsequent media articles over time and Mr. Moore later made similar comments to his colleagues.

The publication of the article prompted a law clerk from Shillingtons LLP, the City's external legal counsel on a claim arising from a collision on the LINC, to request a copy of the friction testing results referenced in the article. She initially asked Mr. Ferguson, who had also been quoted in the July 2017 article. Mr. Ferguson directed the law clerk to Mr. Moore (whom she contacted), but he did not otherwise follow up, despite Traffic's past requests for these results and Mr. Ferguson's knowledge of the councillor's recent requests for them. On a call in August 2017, Mr. Moore gave information about the MTO testing, the SMA early age low friction issue, the Tradewind testing, and the proposed resurfacing of the RHVP in 2018/2019 to the Shillingtons law clerk and a partner at Shillingtons. He also sent her a standalone copy of the Tradewind Report, marking the only time Mr. Moore distributed a copy of the Tradewind Report to anyone.

The Hamilton Spectator article was also discussed internally in the City's Dispute Resolution group within its Legal Services division around this time, which prompted

a request for the study referred to in the article. The request was made to Diana Swaby (Claims Supervisor, Risk Management, Finance & Corporate Services, Hamilton), who directed the request to Mr. Oddi (Manager, Construction, Engineering Services, Public Works, Hamilton). The Inquiry did not receive evidence of further correspondence with Mr. Oddi. The Inquiry also did not receive evidence that City staff from Legal Services obtained the Tradewind Report before at least late 2018 or early 2019. However, Ms. Swaby received a reporting letter from Shillingtons that contained a four-paragraph summary of the Tradewind Report in January 2018 and received a copy of the Tradewind Report from Shillingtons in May 2018, the latter of which she testified that she would not have reviewed in detail due to its technical nature.

In a follow up Hamilton Spectator article published in January 2018, Mr. Moore was quoted as stating "[w]e don't know why they feel that [the pavement on the RHVP is] slippery... That's all part of (why the city is doing) the testing." Mr. Moore referenced the Golder Pavement Evaluation to foreclose the persistent questions from the media about friction testing, in a manner that misrepresented the purpose of that project.

Personnel Changes and Restructuring in Public Works

The Public Works department, under Mr. McKinnon as General Manager, was restructured in January 2018. For purposes of this Inquiry, the two significant outcomes of this restructuring were: (1) the creation of a new division called Roads & Traffic, to which the Traffic group was transferred; and (2) the mandate and oversight responsibilities of the position of Director of Engineering Services being split between Mr. Moore and Mr. McGuire (then Manager, Geomatics & Corridor Management, Engineering Services, Public Works, Hamilton).

The result of the latter was that Mr. Moore's involvement in Engineering Services' projects reduced in the months before his retirement in May 2018. However, during 2018, he continued to play an active role in respect of the RHVP resurfacing project and was a driving force in Engineering Services' consideration of HIR, including the retainer of Golder to complete the Golder Pavement Evaluation in 2017 and the HIR Suitability Study in 2018, described above.

Mr. Moore and Mr. McGuire shared the portfolio of Director of Engineering Services until Mr. Moore's retirement in May 2018. Ultimately, Mr. McGuire succeeded Mr. Moore as the Director of Engineering Services in June 2018.

Mr. Moore's Transition Out of the Director of Engineering Services Role[31]

Mr. Moore's transition out of the role of Director of Engineering Services in the spring of 2018 was informal and haphazard. He prepared no transition memos or briefing documents and provided Mr. McGuire with only a "few" emails that Mr. Moore thought might be of value. Beyond this, Mr. Moore's transition process involved distributing certain hard copy documents to colleagues or filing them on a reference library shelf in Engineering Services' offices and uploading certain documents to ProjectWise, a software program used by Engineering Services staff.

Mr. Moore gave a hard copy of the 2014 Golder Report to his assistant, Diana Cameron, in a pile of hard copy documents. Mr. Moore also uploaded two emails into a folder in ProjectWise called "Director's Office (Engineering Services)" (the "Director's Office Folder"), accessible only to the Director of Engineering Services and his assistant. These emails were: (1) the January 2014 Uzarowski Email (that summarized the averages of the 2007 MTO and 2013 Tradewind friction test results) and (2) the December 2015 Uzarowski Email (which attached a standalone copy of the Tradewind Report). The latter was the copy of the Tradewind Report that Mr. McGuire ultimately "discovered" later in 2018.

The manner and location of Mr. Moore's uploading of the Tradewind Report to ProjectWise, in the absence of any other steps to alert his colleagues to the existence of this report, reveals, at a minimum, a disregard for maintaining any institutional knowledge about the RHVP after his departure from the City. A clear consequence of Mr. Moore's monopoly of RHVP-related information, as well as the lack of a repository for RHVP-related information, was that other members of the Public Works department, including Mr. McGuire, operated at an information deficit. That said, Mr. Moore clearly did not have an intention to "disappear" the Tradewind Report – if he had, he would not have uploaded it at all, nor would he have provided it to Shillingtons several months earlier.

[31] Mr. Moore's pre-retirement conduct is described in Chapter 9.

Mr. McGuire's Transition Into the Director of Engineering Services Role[32]

Mr. McGuire got up to speed in his new role in the spring and summer of 2018, having succeeded Mr. Moore as Director of Engineering Services after his retirement in May 2018.

This was a busy time in the Public Works department, particularly in respect of the RHVP. The Lighting Study, the Speed Limit Study, and the City's 2017 Annual Collision Report, overseen by staff in either Traffic or Engineering Services, were all in progress and the use of HIR as the method for the RHVP resurfacing was under continued consideration with Golder. In addition, the City's Office of the Auditor General (also called "Audit Services" or the Audit Services division) began a Value For Money audit (the "VFM Audit") looking into how the City tracked and managed pavement performance.

During the same period, the City's long-standing City Manager retired and was replaced by an Interim City Manager, Mike Zegarac, and Edward Soldo joined the City as the new Director of Roads & Traffic in the Public Works department and became responsible for traffic safety and the Traffic group.

In the spring and summer of 2018, Mr. McGuire had learned or come across several significant pieces of information about the RHVP, including historical information not shared with him by Mr. Moore. Among other things, Mr. McGuire learned about the collision experience on the RHVP from updated RHVP collision analyses, including some of Traffic's findings in the 2017 Annual Collision Report and CIMA's findings in the Lighting Study. He had also learned and requested further information about the "asphalt" testing that Golder was completing as part of the Golder Pavement Evaluation. Mr. McGuire was interviewed by the Hamilton Spectator for an article about RHVP asphalt testing and the resurfacing of the RHVP in July 2018. He spoke to Mr. Moore to prepare for this interview. Mr. McGuire also reviewed Mr. Moore's earlier statements in the July 2017 Hamilton Spectator article.

In the evening of August 30, 2018, Mr. McGuire looked through the ProjectWise database and came across the two emails that Mr. Moore had uploaded to the Director's Office Folder. Mr. McGuire forwarded the December 2015 Uzarowski

[32] Mr. McGuire's transition into his new role is described in Chapter 9.

Email to someone (the identity of whom is not established on the evidence) without reading the email or the appended Tradewind Report. He also forwarded the January 2014 Uzarowski Email to Mr. Malone of CIMA who, as noted above, had previously received a version of this information from Mr. Moore in August 2015. Although Mr. Malone understood Mr. McGuire's email to be a request for assistance in interpreting the results, my view is that Mr. McGuire wanted a second set of eyes on the subject as he tried to pull the pieces of the collision history and the upcoming resurfacing together. After a high-level discussion with Mr. Malone, Mr. McGuire did not pursue any issues related to RHVP friction for nearly one month, until he came across the December 2015 Uzarowski Email in the Director's Office folder for a second time on September 26, 2018.

Answers to Terms of Reference Questions 1, 2, 3, 4, 5, and 13

Questions 1, 2, 3, 4, 5, and 13 of the Terms of Reference relate to the circumstances and the non-disclosure of the Tradewind Report after it was provided to Engineering Services in January 2014.[33] My detailed conclusions and answers to these questions are set out in Chapter 12.

[33] Questions 1 to 5 and 13 ask: ***1)*** *Identify all individuals who received a copy of the Tradewind Report or were advised of the Tradewind Report or the information and recommendations contained therein after it was provided to the City's Department of Engineering Services in January, 2014.* ***2)*** *Based on the City's by-laws, policies and procedures, as they were in 2014, should Council have been made aware of the Report, or the information and recommendations contained therein, once the Report was submitted to the Department of Engineering Services in 2014?* ***3)*** *Why was the information in the Tradewind Report, or the information and recommendations contained therein, not provided to Council or the public once the Tradewind Report was submitted to the Department of Engineering Services in 2014?* ***4)*** *Who, if anyone, was responsible for the failure to disclose a copy of the Tradewind Report, or the information and recommendations contained therein, to Council in 2014?* ***5)*** *Was there any negligence, malfeasance or misconduct in failing to provide the Report, or the information and recommendations contained therein, to Council or the public?* ***13)*** *Did anyone in the Public Works Office or Roads Department request, direct or conduct any other friction test, asphalt assessment, or general road safety reviews or assessments on the RHVP?* See Chapter 12 for the answers to these questions.

In response to Question 1, all of the individuals who received a copy of the Tradewind Report, and/or were advised of the Tradewind Report or its contents, after Mr. Moore received it in January 2014 until September 26, 2018, when Mr. McGuire located it, are listed in Chapter 12.

Questions 2, 3, and 4 address whether Council should have been made aware of the Tradewind Report when it was submitted to Engineering Services, why it was not provided to Council or the public, and who was responsible for the failure to disclose the Report to Council. There was no requirement in 2014 under the City's by-laws or policies to bring all consultant reports to Council. As the Tradewind Report did not indicate a matter of imminent concern but rather recommended a further investigation, there was no other obligation or best practice that required that Council be made aware of the Tradewind Report. As the sole recipient of the Tradewind Report, Mr. Moore was responsible for the non-disclosure of the Tradewind Report and its contents to Council as a result of his decision not to provide it to anyone other than Shillingtons.

The reasons why the Tradewind Report was not made known to Council during the period between Mr. Moore's receipt in 2014 and 2019 are more complicated. The reasons turn on why Mr. Moore did not provide a copy of the Tradewind Report to the Traffic group, which might have resulted in disclosure to Council in connection with recommendations of the Traffic group regarding traffic safety of the RHVP. Briefly summarized, Mr. Moore kept the Tradewind Report to himself for a number of reasons, which involve the interplay of the siloed structure of the Public Works department in respect of matters pertaining to the RHVP, in particular between Engineering Services and the Traffic group, and Mr. Moore's strongly held views regarding the state of the roadway, the role of Engineering Services in respect of traffic safety, and the merits of friction testing. In addition, while members of the Traffic group and their superiors either requested the results of the friction testing or spoke to Mr. Moore about the friction test results, the Traffic group did not press for a copy of the Tradewind Report and instead relied on Mr. Moore for an assessment of the friction testing results because they viewed pavement-related issues as falling within the purview of Engineering Services. If the Traffic group had pursued a copy of the Tradewind Report, the Tradewind results would have been available to Traffic and thus available to provide to CIMA and might have been disclosed to Council at some point prior to 2019 in connection with Traffic's recommendations for traffic safety.

The reader is directed to the answer to Question 3 in Chapter 12 for a more complete response to this question.

Question 5 asks whether there was any misconduct on the part of City staff in regard to the non-disclosure of the Tradewind Report. I conclude that Mr. Moore's failure to provide the Tradewind Report to the Traffic group for the purposes of its traffic safety mandate constituted misconduct as that term is understood for the purposes of this Inquiry, as set out above. Although it would have been preferable for staff in the Traffic group to have pressed Mr. Moore for a copy of the Tradewind Report, I have concluded that the failure of Traffic staff to do so does not rise to the level of misconduct for the reasons set out in Chapter 12. In addition, Mr. Moore provided inadequate, incomplete, or inaccurate information about the Tradewind Report and/or Tradewind's friction testing and the results thereof on three occasions to the PWC, Mr. Malone, and the media, as described in Chapter 12. I have further concluded that these actions also constituted misconduct.

For the purposes of Question 13, a complete listing of the friction tests (other than the MTO friction tests, the Tradewind Report, and the Golder Report), asphalt assessments, general road safety reviews, and other assessments of the RHVP prepared by Golder and CIMA from 2005 to 2020 is set out in Chapter 4 under the headings 4.6.3. and 4.6.4.

The "Discovery" and Disclosure of the Tradewind Report

On September 26, 2018, Gord McGuire located an electronic copy of the Tradewind Report in the restricted Director's Office Folder in ProjectWise. The copy Mr. McGuire found was attached to the December 2015 Uzarowski Email that Mr. Moore had saved into this folder in May 2018. On September 26 or 27, either Mr. McGuire or his assistant Ms. Cameron subsequently located the 2014 Golder Report in the pile of documents that Mr. Moore had left while cleaning out his office in the lead-up to his retirement, as described above.

Questions 6, 7, 8, and 9 of the Terms of Reference address how the Tradewind Report was discovered and whether appropriate steps were taken to disclose the Tradewind Report and its contents once it was discovered.

The actions of the City staff can be divided into two periods:

- the period from September 26, 2018, when Mr. McGuire located the Tradewind Report and the 2014 Golder Report, until the City's receipt of a municipal FOI request for friction testing records (referred to in this Inquiry as "FOI 18-189" or the "FOI request") on November 8, 2018; and

- the period between the City's receipt of FOI 18-189 on November 8, 2018, and the presentations to Council at the Council meeting on January 23, 2019, and the GIC meeting on February 6, 2019, regarding the existence of the Tradewind Report and updates on various RHVP-related initiatives.

Actions of City Staff Prior to Receipt of FOI 18-189[34]

Between September 26, 2018 and November 8, 2018, only a very limited number of individuals at the City knew about the existence of the Tradewind Report and the 2014 Golder Report. During that time, those aware of and responsible for considering its significance — Mr. McGuire for Engineering Services, Mr. Soldo for Roads & Traffic, and Mr. McKinnon as General Manager of Public Works — did little to progress their understanding of the content or significance of the Tradewind Report or the 2014 Golder Report.

When Mr. McGuire found the Tradewind Report and the 2014 Golder Report, he recognized that they were significant, insofar as the Tradewind Report contradicted Mr. Moore's past statements about friction testing on the RHVP. In particular, Mr. McGuire's takeaway was that the Tradewind Report was a report, not an "informal chart" as Mr. Moore had represented to the Hamilton Spectator.

Mr. McGuire asked Susan Jacob, the long-tenured Manager of Design (within Engineering Services) and a professional engineer, for her views. He also alerted Mr. McKinnon, who had a short conversation with Mr. Moore in early October from which Mr. McKinnon understood that Mr. Moore had not shared the Tradewind Report internally and that no further investigation had been completed. Mr. McGuire spoke to the City's Deputy City Solicitors, Debbie Edwards and Ron Sabo, in early October.

[34] These actions are described in Chapter 9.

They suggested that Mr. McGuire contact Mr. Moore for a better understanding of the circumstances pertaining to the Tradewind Report. Mr. McGuire did not do so until after receipt of the FOI request. Mr. McGuire also advised Mr. Soldo about his discovery of the reports and provided Mr. Soldo with a copy of the 2014 Golder Report with appendices, including the Tradewind Report, some time around October 10 to 15, 2018.

At some time prior to October 18, 2018, Mr. McGuire made the decision to abandon the HIR assessment and use a traditional mill and overlay method for the RHVP resurfacing. Although it is possible that the discovery of the Tradewind Report provided additional support for this decision, I do not find that this was the sole, or even primary, purpose for the decision. Rather, there was increasing evidence that HIR would not be feasible from a cost-benefit perspective. Mr. McGuire's decision meant the City could proceed to tendering and completing the RHVP resurfacing project in 2019.

The Tradewind Report raised questions that should have been obvious to City staff who read it, specifically whether the collision history of the RHVP — particularly the wet surface collision history — and the years of public and Council complaints could be attributable, at least in part, to the friction levels on the RHVP and whether the friction levels in 2018 posed a safety concern. The expert evidence provided to the Inquiry was that, in fact, friction levels on the RHVP had levelled off as of 2014. However, no one among City staff or its consultants knew this in the fall of 2018.

Prior to the receipt of FOI 18-189, Mr. McGuire and Mr. Soldo did not ask their staff about any prior knowledge of these reports or of any friction testing conducted on the RHVP. Nor did they seek any expert advice regarding the significance of the Tradewind Report and/or the need for any potential interim safety measures, including discussing the reports with Golder and CIMA, both of whom were already retained by the City in respect of several projects at that time. There are several reasons for this lack of action.

First, both Mr. McGuire and Mr. Soldo came to a quick conclusion that there were no immediate safety concerns raised in the Tradewind Report, and that the planned resurfacing on the RHVP satisfied the recommendation of remedial action and therefore addressed any traffic safety concerns raised by the Tradewind Report and the 2014 Golder Report. For his part, Mr. McKinnon relied on his directors' assessment.

Second, it appears that both viewed the other (and the other's division in Public Works) as responsible for considering the interplay of friction/pavement surface and roadway/traffic safety. Neither Mr. McGuire nor Mr. Soldo nor anyone else at the City had any expertise in friction testing methodologies and evaluation.

Third, Mr. McGuire and Mr. Soldo each had competing priorities in October and November 2018, relating to the RHVP and otherwise. Both had ongoing RHVP-related projects, some of which were anticipated to be reported to the PWC. Mr. McGuire was dealing with a response to Audit Services' VFM Audit, preparing to report to the PWC on the CIMA Lighting Study, and obtaining final reports on Golder projects related to the anticipated RHVP resurfacing (being the Golder Pavement Evaluation and the HIR Suitability Study). Mr. Soldo was preparing to report to the PWC on the results of the 2017 Annual Collision Report and the CIMA Speed Limit Study. His division was also working with CIMA on a project referred to as the "RHVP Roadside Safety Assessment", which had commenced in October 2018 (before Mr. Soldo received the Tradewind Report) to assess any upgrades for roadside devices to be implemented during resurfacing. Mr. McGuire and Mr. Soldo had also discussed preparing a joint report to the PWC requesting a functional assessment of the RHVP.

Actions of City Staff After the Receipt of FOI 18-189[35]

FOI 18-189 requested any reports, memos, drafts, and correspondence about friction testing on the RHVP in the last five years and any reports, memos (including drafts), or correspondence about asphalt and/or pavement testing, assessments or plans on the RHVP in the last two years.

Both Mr. McGuire and Mr. McKinnon testified that they believed that the Tradewind Report would have to be presented to Council. However, it is not clear if, or in what form or detail, notification to Council would have occurred had Public Works not received FOI 18-189. However, as of November 8, 2018, receipt of the FOI request immediately forced the issue of whether, when, and how to disclose the existence of the Tradewind Report. Thereafter, it became an important priority of City staff to bring the Tradewind Report to Council's attention before the Tradewind Report was released to the FOI requestor and potentially made public.

[35] These actions are described in Chapter 10.

Between mid-November 2018 and early February 2019, the small circle of City staff who knew about and/or had a copy of the Tradewind Report expanded for this purpose. City staff in several departments and divisions — including Public Works, Legal Services, Communications, and the City Manager — devoted significant time to developing a collective presentation to Council regarding matters relating to the RHVP, including messaging pertaining to the Tradewind Report.

In mid-November and December 2018, Legal Services was engaged to assist with the FOI response, which was initially due in November 2018. In addition, upon learning of the Tradewind Report, Nicole Auty (City Solicitor, Legal Services, Finance & Corporate Services, Hamilton) and Mr. Sabo recognized, quite appropriately, that the existence of the Tradewind Report and its likely release in response to FOI 18-189 could have legal consequences for the City and retained David Boghosian (Managing Partner, Boghosian & Allen LLP) to complete "a general liability and risk assessment".

In preparation for the presentation to Council, each department or division concentrated on the matters that the leaders of those departments/divisions perceived to be within their mandate. The Inquiry's fact-finding mandate was challenged by the inability of many witnesses who testified before the Inquiry to describe the specific actions, decision-making, and discussions during this period. However, the evidence suggests that, although there were a number of meetings to jointly review the progress of the various presentations being put together, there was little actual collaboration in developing the content of these presentations.

From November 2018 to January 2019, Mr. McGuire and Mr. Soldo worked to prepare an update to the omnibus report regarding the RHVP and the LINC that the Traffic group had submitted in January 2018 (being Report PW18008), to be presented to the PWC, along with updates regarding other RHVP-related initiatives. Ultimately, this work was presented to Council in three public reports at the meeting of the GIC on February 6, 2019, which was the same meeting at which Council received its second briefing on the Tradewind Report.

To prepare these reports, Mr. McGuire and his staff were engaged in finalizing CIMA's Lighting Study report. Mr. McGuire also had discussions with Dr. Uzarowski about the results of the Golder Pavement Evaluation and the status of Golder's report, as well as certain aspects of the Tradewind Report (during which Mr. McGuire characterized

of the results as inconclusive", which Dr. Uzarowski challenged) and RHVP friction testing. Mr. Soldo focused on the RHVP Roadside Safety Assessment, the CIMA Speed Limit Study, the 2017 Annual Collision Report, and the preparation of staff reports on these items. Mr. McGuire and Mr. Soldo also gathered historic and current information regarding the RHVP from their staff.

Mr. McGuire and Mr. Soldo also attended meetings with Mr. McKinnon, Legal Services staff, Communications staff, and the City Manager regarding notification to Council about the Tradewind Report. To this end, Mr. McGuire and Mr. McKinnon obtained information from Mr. Moore in November 2018, which included Mr. Moore's view that the Tradewind Report was "inconclusive" because it applied a standard from the UK, that Mr. Moore had sought further interpretation of the results from Golder which was never provided, and/or that Mr. Moore had retained Golder to do the Golder Pavement Evaluation in 2017 in response to the Tradewind Report. Mr. McGuire and his staff also worked in this period to respond to the ongoing VFM Audit, including requests for RHVP-related documents.

In connection with the VFM Audit, Audit Services initially received a copy of the 2014 Golder Report that redacted all references to the Tradewind Report in the body of the 2014 Golder Report. The report was redacted at Mr. McGuire's direction on the advice of Legal Services due to concerns about the potential release of the document by Audit Services before staff had briefed Council. Audit Services ultimately obtained an unredacted copy of the 2014 Golder Report and the Tradewind Report on December 4, 2018. This reinforced the need to bring the Tradewind Report to Council's attention as quickly as possible.

However, as with the period prior to the receipt of FOI 18-189, Mr. McGuire and Mr. Soldo did not tell their staff about the Tradewind Report, retain the City's existing consultants or any new consultants for input, or otherwise conduct any analysis of the significance of the Tradewind Report for the traffic safety advice upon which the City had been acting, for the same reasons as during the September to November 2018 period set out above. In addition, they knew in December 2018 that Legal Services was obtaining a legal opinion regarding the Tradewind Report and was considering contacting CIMA. While Mr. McGuire apparently wanted to speak to Mr. Malone about the Tradewind Report in early December, a member of Legal Services advised him not to do so until the relationship between the City and CIMA had been finalised for

the purposes of the legal opinion. For his part, Mr. Soldo was of the view that if Legal Services was dealing with CIMA in respect of the Tradewind Report, he would not duplicate the effort, and he incorrectly understood that Mr. Malone was already aware of the Tradewind Report.

Legal Services had retained Mr. Boghosian for a general liability assessment and to identify countermeasures in his liability assessment that could be used as potential mitigating actions. At the outset of their discussions, Ms. Auty and Mr. Boghosian agreed that Mr. Boghosian would contact Mr. Malone of CIMA for background information. Contacting Golder was not discussed. Although Ms. Auty intended to maintain privilege over CIMA's opinion using Mr. Boghosian as an intermediary, Ms. Auty did not intend that this legal strategy would prevent or restrict communications between CIMA and Public Works staff. She expected, and incorrectly assumed, that CIMA was sharing the same information with Public Works. However, in reality, there were no meaningful discussions that occurred between Public Works staff and CIMA about the Tradewind Report.

Mr. Boghosian spoke to Mr. Malone on December 11, 2018, but did not provide a copy of the Tradewind Report to him. From this conversation, Mr. Boghosian understood that CIMA had already determined that the RHVP had a wet road friction problem, that the friction values "added nothing", and that the RHVP would be a safe road if the City implemented all the recommendations from the 2015 CIMA Report. As a result, Mr. Boghosian's legal opinion focused on mitigation of the City's liability to the extent that the City had not implemented all of CIMA's past recommendations, rather than on the recommendations of Tradewind and Golder for further investigation and/or remediation and the possible liability that could have flowed from a failure to follow Tradewind's or Golder's recommendations.

Ms. Auty and Mr. Sabo did not share Mr. Boghosian's written draft legal opinion with Public Works staff upon their receipt of it on December 13, 2018. Ms. Auty did, however, pass on Mr. Boghosian's advice to implement all of CIMA's outstanding recommendations immediately.

The Briefing of Council[36]

After alerting Mayor Fred Eisenberger about the Tradewind Report on December 18, 2018, City staff worked to gather information to bring to Council, which would subsequently be made available to the public, as Mayor Eisenberger had advised. Mayor Eisenberger's advice was premised on his understanding from staff that there were no safety issues on the RHVP.

The January 23, 2019 Council Meeting

On January 23, 2019, Ms. Auty briefed the Mayor and members of Council about the existence of the Tradewind Report during a closed session of Council. This briefing occurred nine days after Mr. McGuire submitted Engineering Services' response for FOI 18-189 to the City's Access & Privacy Office on January 14, 2019. Once delivered, City staff no longer had control over the possible disclosure of the Tradewind Report or the 2014 Golder Report, or the timing thereof.

The briefing on January 23 was intended to be a "heads up" notice to Council. Staff were also planning a more comprehensive presentation on the Tradewind Report for Council and had several topics to report to the PWC regarding outstanding RHVP-related matters, all of which were ultimately consolidated into a presentation to the GIC on February 6, 2019.

Ms. Auty's confidential briefing report for the January 23 Council meeting contained a brief historical background of the RHVP and the Tradewind Report, a brief summary of Mr. McGuire's "discovery" of the Tradewind Report (which was described as "draft"), and the 2013 friction testing, as well as a brief summary of its results, including that the RHVP results fell "below or well below the relevant UK standard". The report identified several concerns associated with the Tradewind Report, including the lack of any prior distribution to City staff and inconsistent media statements made in the past, as well as the related reputational impact. It did not summarize Tradewind's recommendations, attach a copy of the Tradewind Report, or reference the 2014 Golder Report.

[36] These actions are described in Chapter 11.

The Inquiry received limited evidence regarding what, if anything, was reported or discussed during the closed session on January 23, beyond the content of Ms. Auty's written report. However, the Inquiry received evidence that Mr. McKinnon provided assurances to Council during the closed session that the RHVP was safe.

The evidence before the Inquiry suggested that Council had several questions and action items for staff to address that involved the obvious questions arising from the "discovery" of the Tradewind Report. Broadly speaking, these were: (1) whether CIMA or Mr. Malone had a copy of the Tradewind Report; (2) whether or how CIMA's recommendations would have changed with the benefit of the Tradewind Report; and (3) whether CIMA recommended any interim measures to address safety on the RHVP pending resurfacing. The issue of the implications of the Tradewind test results for the safety on the RHVP, both in and of themselves and as part of a larger assessment of the factors contributing to the accident experience on the RHVP, should have been addressed by Public Works before this time, but had not been.

Preparation for the February 6, 2019 GIC Meeting

The next briefing of Council occurred at a meeting of the GIC on February 6, 2019. In the period between January 23 and February 6, City staff took several steps to respond to Council's questions and prepare for the subsequent briefing, including finalizing the presentation materials and the preparation of a further report by Ms. Auty, which became Report LS19010: Roads Infrastructure Litigation Review and Assessment. In addition, on January 31, 2019, Mr. McKinnon, the City Manager and the Executive Director of Human Resources met with Mr. Moore to obtain further information about the RHVP and various matters pertaining to friction testing on the RHVP. The information Mr. Moore provided in response was vague and self-serving, perhaps not surprisingly in the circumstances.

More significantly, following the January 23 Council meeting, Ms. Auty, through Mr. Boghosian, retained CIMA to advise on Council's questions. Although Mr. Malone of CIMA had discussed RHVP friction testing in varying degrees of detail and in varying contexts with Mr. Moore, Mr. McGuire, Mr. Soldo, and Mr. Boghosian in the past, he did not actually learn with clarity about the existence of the Tradewind Report until he participated in a telephone call between several City staff members of Legal Services, Public Works, and Communications, and Mr. Boghosian on January 30, 2019.

Following this call, Mr. Malone agreed to prepare a memorandum response to three questions (the "February 4 CIMA Memorandum"). Mr. Boghosian provided Mr. Malone with a copy of the Tradewind Report and the 2014 Golder Report. In the days that followed, and on a compressed timeframe and in circumstances of considerable pressure, Mr. Malone prepared the February 4 CIMA Memorandum. The February 4 CIMA Memorandum was provided to the GIC on February 6, 2019, as an appendix to Legal Services' Report LS19010.

The February 4 CIMA Memorandum summarized CIMA's review of the 2014 Golder Report and the Tradewind Report. CIMA did not recommend closure of the RHVP prior to the completion of the RHVP resurfacing. It concluded that the information in the 2014 Golder Report (including the Tradewind Report) did not require any changes to CIMA's recommendations in CIMA's previous reports to the City regarding safety on the RHVP. It noted, however, that if CIMA had the Tradewind Report prior to completing the 2015 CIMA Report, CIMA would have adjusted its friction testing recommendation to urge "further investigation of the friction findings in the 2014 Golder Report, relating to road design and operations" and modified its past recommendation to conduct speed enforcement to "increased" or "enhanced" speed enforcement until the resurfacing. The February 4 CIMA Memorandum was not a comprehensive review of traffic safety on the RHVP in light of the Tradewind test results nor could it have been in the time that was available to CIMA to complete this assignment. As described in detail in Chapter 12, in my view, the CIMA February 4 Memorandum had some limitations that diminished its usefulness.

The February 6, 2019 GIC Meeting

Council received a second, much lengthier and more detailed briefing from staff about the Tradewind Report, the state of the RHVP, and the City's proposed communications strategy in respect of the Tradewind Report at an over 13-hour long meeting of the GIC on February 6, 2019. The meeting began with an open session and then moved into an in camera closed session that lasted for nearly six hours, during which staff presented a four-part presentation related to the Tradewind Report. The GIC meeting moved back into open session at the end of the closed session. At the end of the second open session, the Tradewind Report was released publicly.

Staff presented a significant amount of information about or related to the RHVP and the Tradewind Report at the GIC meeting on February 6. During the lengthy closed session, staff presented two confidential reports: Legal Services' Report LS19010, which appended the February 4 CIMA Memorandum and Audit Services' Report AUD19002: Roads Audit Update. Staff also provided Council with copies of two confidential documents: a communications plan summary and a preliminary reconstructed timeline of RHVP-related events between July 2006 and mid-January 2019. Staff's four-part presentation in the closed session, which was accompanied by a confidential slide deck presentation, was as follows:

1) A presentation by Mr. McKinnon on the timeline and technical concerns;

2) A presentation by Charles Brown (Auditor General, Office of the City Auditor (Audit Services), City Manager's Office, Hamilton) on Audit Services' investigation, which included information about how the Tradewind Report came to Audit Services' attention during the VFM Audit;

3) A presentation by Ms. Auty and Mr. Boghosian on the legal considerations, understood to have been divided into a claims review presented by Ms. Auty and a liability review presented by Mr. Boghosian. Mr. Boghosian's written legal opinion was not given to Council, but I understand that Council was orally walked through that opinion; and

4) A presentation by John Hertel (Director, Strategic Partnerships & Communications, City Manager's Office, Hamilton) setting out staff's recommended internal and external communications strategy related to the Tradewind Report.

The information that the GIC received in the materials ranged from the historical context of the RHVP's construction, prior safety improvements implemented by staff, plans for future improvements to the RHVP (including resurfacing), technical information about roadway friction, and the existence of the Tradewind Report.

Although the Inquiry received evidence from many attendees at this meeting, most witnesses had limited recollections about the substance of staff's presentation (beyond what was set out in the slide deck), what questions members of Council asked, and/or staff's answers. Some witnesses also had difficulty distinguishing this meeting from

prior and subsequent Council meetings. Consequently, the Inquiry had limited insight into the substance of the discussions during the closed session on February 6.

In the second open session, which followed the lengthy closed session, Mr. Soldo and/or Mr. McGuire presented three Public Works reports in under 15 minutes, with little discussion:

- Report PW19012: City of Hamilton Annual Collision Report - 2017, which reported on City collision data, including data specific to the RHVP, from 2013 to 2017. The 2017 Annual Collision Report, which Mr. Soldo submitted, was the first network-wide collision data published by the City since 2010;

- Report PW19014: Speed Limit Reduction Feasibility Study on the Lincoln M. Alexander and the Red Hill Valley Parkways, which Mr. Soldo also submitted, and which recommended a reduction in the speed limit (from 90 km/h to 80 km/h) for a portion of the RHVP between the Greenhill Avenue interchange and the QEW, contrary to CIMA's recommendation to maintain the existing posted speed in the Speed Limit Study; and

- Report PW18008A: Lincoln M. Alexander Parkway (LINC) and Red Hill Valley Parkway (RHVP) Transportation and Safety Update, submitted jointly by Mr. McGuire and Mr. Soldo, which addressed, among other topics, the RHVP Roadside Safety Assessment, the Lighting Study, the testing performed by Golder in the Golder Pavement Evaluation, the upcoming RHVP and LINC resurfacing, and the implementation status of countermeasures on the RHVP since 2015.

In my view, there were several issues in the written presentation and the related materials that deserve comment, which I provide with the caveat that I could not confirm whether staff provided additional information during the oral presentations provided in the closed session. In summary:

- Read collectively, the core message in the three Public Works reports presented in the open session was that driver behaviour was the primary cause of collisions on the RHVP. In my view, the Public Works materials before the GIC which, unlike the other confidential materials, were accessible to the public did not provide a full and complete picture of the factors contributing to

collisions on the RHVP, particularly under wet surface conditions, or the role that these factors, including inadequate skid resistance, played regarding the collision experience on the RHVP. In this respect, it was noteworthy that the three staff reports submitted by Public Works did not provide any information at all regarding the wet surface collision history on the RHVP identified by CIMA in CIMA's recent reports (which were referenced in Reports PW19014 and Report PW18008A) and only included a short reference in Report PW19014 to the significance of the geometry of the parkway.

- The confidential materials provided by Legal Services and Communications staff, including the four-part slide deck presentation, appear to have focused primarily on the legal and reputational concerns posed by the release of the Tradewind Report through the FOI process and Mr. Moore's failure to distribute it, rather than the Tradewind Report's contents and/or the existence of any safety concerns. In this regard, it is also noteworthy that the only staff reports to Council that dealt specifically with the Tradewind Report were the two reports of Legal Services (presented on January 23 and February 6).

The restriction of the discussion regarding the Tradewind Report to the closed session reflected the fact that Public Works and Legal Services continued to approach the issues regarding the Tradewind Report narrowly as confidential legal issues.

Contrary to staff's recommended communications strategy to release the Tradewind Report one week later, after a subsequent Council meeting, Council directed staff to release the Tradewind Report to the public in the evening of February 6, 2019, together with a public apology to Council and the public regarding the Tradewind Report and the manner and timing of its disclosure. The City media release included staff's apology and provided a high-level overview of the information that had been presented to the GIC that day. The media release appended the Tradewind Report and the February 4 CIMA Memorandum. In addition, Council passed several resolutions on February 6, including a by-law to implement the reduction of the posted speed limit to 80 km/h on the portion of the RHVP between the Greenhill Avenue interchange and the QEW.

Shortly after the Tradewind Report was disclosed publicly, City staff learned for the first time of the MTO friction testing on the RHVP between 2008 and 2014. At the time

the Tradewind Report was discovered and disclosed, City staff were unaware of this post-2007 MTO friction testing or the test results.

The RHVP was resurfaced in the spring/summer of 2019. Further friction testing using a locked-wheel tester (the same type of equipment used by the MTO) was conducted by Applied Research Associates, Inc. ("ARA") prior to, and after, the RHVP was resurfaced. Englobe Corp. ("Englobe") also conducted further friction testing on the RHVP using a GripTester (the same type of equipment used by Tradewind) prior to the resurfacing.

In addition, the City made changes to its processes and policies following the public disclosure of the Tradewind Report in February 2019 and during the period of the Inquiry's work. These changes relate to, among other things, document control and retention, the working relationship between City staff and councillors, the City's Code of Conduct for staff, and a committee of senior Public Works leadership to coordinate staff's work on the RHVP and the LINC.

Answers to Terms of Reference Questions 6, 7, 8, and 9

My detailed conclusions and answers to Questions 6, 7, 8, and 9 of the Terms of Reference are set out in Chapter 12.[37]

Question 6 asks how the Tradewind Report was discovered in 2018. The circumstances under which Mr. McGuire located the Tradewind Report in a ProjectWise folder on September 26, 2018 are set out above.

In response to Question 7, all of the individuals who received a copy of the Tradewind Report and/or were advised of the Tradewind Report or the information and

[37] Questions 6 to 9 ask: ***6)*** *How was the Tradewind Report discovered in 2018?* ***7)*** *Identify all individuals who received a copy of the Tradewind Report or were advised of the Tradewind Report or the information and recommendations contained therein, in 2018.* ***8)*** *Were appropriate steps taken to disclose the Tradewind Report, or the information and recommendations contained therein, once it was discovered in 2018?* ***9)*** *Was there any negligence, malfeasance or misconduct in failing to disclose the Tradewind Report, or the information and recommendations contained therein, once the Tradewind Report was discovered in 2018?*

recommendations contained therein in 2018 after Mr. McGuire located the Tradewind Report are listed in Chapter 12.

Questions 8 and 9 ask whether appropriate steps were taken to disclose the Tradewind Report to Council after it was discovered in 2018 and whether there was any misconduct in failing to disclose the Tradewind Report after such discovery.

I find that none of the City staff involved in the preparation of the notification to Council about the Tradewind Report engaged in misconduct, as that term is understood for the purposes of this Inquiry, or in improper or unprofessional behaviour. Nor do I think that the actions of any of the individuals involved in the presentations to Council constituted bad management.

However, the absence of a joint effort to respond collectively to all of the possible implications of discovery of the Tradewind Report, ineffective communication among those involved, and the compressed timeframe had the result that there was no analysis of any significance on a central issue — the implications, if any, of the Tradewind Report for the present and future operating conditions on the RHVP and, more specifically, whether the traffic safety measures put in place over time were appropriate and sufficient — apart from the observation that the resurfacing would cure any deficient friction levels.

This issue was not addressed until Council raised its questions at the Council meeting on January 23, with the result that CIMA could not comprehensively address the issue in the February 4 CIMA Memorandum in the limited time available to it. In addition, while I accept that the staff involved in the written presentations to Council legitimately sought to be open and transparent with Council and the public, Council could have been provided with more information in the written materials to understand more comprehensively the factors contributing to accidents on the RHVP. This conclusion is, however, based solely on the written presentations as the Inquiry received only limited testimony regarding the content of the discussions in the closed sessions of Council and the GIC. The reader is referred to the full answer in Chapter 12, and the facts in Chapters 10 and 11, for a more complete understanding of my answers and of the limitations attached to them based on the evidence before the Inquiry.

What We Know About the RHVP as a Result of the Inquiry

This section summarizes my findings and conclusions in Chapter 12 regarding the technical issues around RHVP pavement friction and safety based on the information that was available to the Inquiry. It is important for the reader to review the detailed findings in Chapter 12 to understand and appreciate the many nuances underpinning this summary.

The RHVP's Overall Collision Rates Were Higher Than Provincial Averages

The RHVP average weighted collision rate, counting all collisions (police reported and self-reported), was significantly higher than the collision rates on comparator provincial highways. In January 2019, CIMA concluded that the RHVP's average weighed collision rate was 1.01 collisions per million vehicle-kilometres travelled, whereas the rates were lower on the four provincial freeways CIMA selected as comparators: Highway 403 (0.81); Highway 406 (0.78); Highway 7/8 (0.66); and Highway 8 (0.70).

The RHVP Had "Hot Spot" Sections

Elements of the RHVP geometry make the roadway challenging to drive, particularly in the area between the Greenhill Avenue and Queenston Road interchanges, which requires a higher friction supply in order to execute maneuvers in that area. Consistent with that evidence, the locations with the highest collision frequencies were located within, on approach to, or leaving horizontal curves, particularly in that segment of the RHVP.

The RHVP Had An Abnormally High Proportion of Wet Road Collisions

The various experts who gave evidence before the Inquiry differed somewhat on what constitutes a "typical" wet road collision proportion, but there is no question that

the proportion of wet road collisions on the RHVP compared to total collisions was abnormally or disproportionately high compared to the expected norms.

RHVP Friction Levels Declined from 2007 to 2014, Then Levelled Off (Answers to Terms of Reference Questions 14 and 16)

As discussed above, the MTO October 2007 friction test results were good for new SMA prior to opening to traffic, where it was predictable that friction would be low initially and increase in a matter of weeks or months after opening to traffic. In addition, while the results were not high, objectively speaking, they were much better than other brand new SMA pavements that the MTO had tested which had had early low age friction issues that resolved quickly.

Question 16 asks whether the 2007 MTO testing provided additional support or rebuttal to the conclusions of the Tradewind Report.[38] It provided neither. The condition of the RHVP pavement surface at the time of the Tradewind testing in 2013 was different from that at the time of the 2007 MTO testing. The frictional performance in October 2007 prior to opening was distinct from, and cannot be compared to, the parkway's frictional performance six years later in 2013 when tested by Tradewind.

Question 14 asks whether any consultant reports prepared after the Tradewind Report provided additional support or rebuttal to the conclusions contained in the Tradewind Report.[39]

The MTO 2008 results disclosed that the friction levels had increased following the October 2007 MTO testing, and after exposure to traffic.

However, the MTO results from 2009 to 2014 (excluding 2013 when testing did not occur) disclosed a decrease in the friction levels in each year thereafter. By 2014, the MTO results were approximately 20% lower than measured in 2008. The Tradewind

[38] Question 16 asks: ***16)*** *Did the MTO Report provide additional support or rebuttal to the conclusions contained in the Tradewind Report?*

[39] Question 14 asks: ***14)*** *Did subsequent consultant reports provide additional support or rebuttal to the conclusions contained in the Tradewind Report?*

friction test results, obtained in November 2013, along with the ARA and Englobe pre-resurfacing friction test results in May 2019, each confirm that the reduction in friction had levelled off after 2013/2014.

The 20% decline in friction disclosed by the MTO results was not unusual over a period of six years and was consistent with an expected amount of polishing of the aggregate used in the SMA surface course due to wearing from traffic. However, the reduction, while not unexpected, was "significant" because the starting point friction levels in 2008 were not particularly high to begin with.

I note as well that the various CIMA reports prepared after the Tradewind Report, even though prepared in ignorance of the Tradewind Report, contained collision history statistics and analysis suggesting that low friction might be a contributing factor to the accident experience on the RHVP, all of which provided additional support for the Tradewind Report test results and its conclusion that further investigation was necessary.

"Relatively Low" RHVP Friction Levels Were a Likely Contributor to Collisions

As a general matter, as mentioned above, deficient friction is seldom the sole or principal cause of accidents on an expressway. In any event, the Inquiry has seen nothing to suggest that the friction levels on the RHVP were so low that friction in and of itself was a cause of accidents in the absence of other contributing factors.

However, by 2013/2014, the skid resistance levels on the RHVP were "relatively low". The fact that parts of the roadway are challenging to drive makes the friction supply required to meet that friction demand more important than in other situations. In that context, the RHVP's "relatively low" friction presented a problem that might not be present on other less challenging highway segments, particularly, but not exclusively, when the pavement surface was wet. As Dr. Flintsch testified, while the friction supplied by the SMA pavement was not inordinately low, it was low relative to the friction demanded by the geometric features of the RHVP.

The evidence before the Inquiry established that, at least with respect to accidents under wet surface conditions, inadequate skid resistance or friction was a contributing factor to accidents on the RHVP, in concert with other factors.

Ultimately, the extent that friction levels on the RHVP might have been a possible contributing factor to collisions even under dry surface conditions prior to 2019 cannot be definitively established. However, in general, skid resistance affects both wet and dry road collision rates, with both rates increasing as friction decreases, although the effect is greater on wet surfaces. In my view, the preponderance of the evidence regarding the other contributing factors to the accident experience on the RHVP, including not only the geometric features but also the location of the interchanges and ramps, as well as the relationship between the design speed and the posted speed, supports this conclusion.

None of this is to say that low friction was a contributor to any individual collision. A full collision reconstruction is necessary to reach a conclusion as to the cause(s) of any individual collision.

Many Factors Contributed to Collisions on the RHVP (Answer to Terms of Reference Question 24)

Question 24 raises the question of the universe of factors that contribute to accidents on the RHVP.[40]

As noted above, there is ample evidence that friction levels were a contributing factor generally to collisions on the RHVP, and especially on wet pavement. However, there are many potential contributing factors to collisions and other accidents on a roadway which, in general, can be broken down into three categories: factors related to the highway conditions, factors related to the vehicles involved, and factors related to the driver(s) involved.

[40] Question 24 asks: ***24)*** *To what extent do other factors, including, but not limited to, driver behaviour, lighting and weather conditions, contribute to motor vehicle accidents when compared to the impact of friction levels on motor vehicle accidents on the RHVP?*

It is well documented in the transportation industry that the motorist is the primary contributor to collisions in the road-vehicle-motorist system, while it is estimated that road design, operations, and maintenance are a contributing factor in approximately one quarter of motor vehicle collisions. Road users operate within an environment, and they operate better and make better or error-free decisions when the roadway in front of them is consistent with what they expect for that type of facility. Within a particular road section, the design, the operations, the line markings, and the signage, among other factors, ought to be relatively consistent for like situations. Roadway infrastructure must be designed, operated, and maintained so that motorists understand the system they are using and will make rapid and appropriate decisions in selecting speed and path. Consistency and uniformity of design standards is a primary means of facilitating motorist comprehension, expectancy, and prudent decision making.

As noted above, on the RHVP, several interrelated factors contributed to collisions in addition to the friction levels. These included the geometry (tight sequential curves, short weaving areas, and closely spaced interchanges) and operating speeds that regularly exceeded the design speed of 100 km/h, given that the posted speed was 90 km/h until the partial reduction approved by Council in 2019. Essentially, the relatively low friction reduced the margin of error that drivers had in challenging areas of the RHVP, which made the roadway less forgiving of driver speed and error, particularly under wet surface conditions. This evidence was supported by the opinions of CIMA expressed in the 2015 CIMA Report, the Lighting Study, the RHVP Roadside Safety Assessment, and the February 4 CIMA Memorandum.

The evidence before the Inquiry did not, however, support a ranking among these factors. With the breadth of evidence the Inquiry heard, the primary point that bears repeating is that none of the factors that contribute to collisions can be taken in isolation. Rather, the combination of geometry, the posted speed, road surface conditions, friction levels, and driver expectations that the RHVP functions like a 400-series highway are all potential contributing factors to collisions on the RHVP.

The Impact of The Non-Disclosure of The Tradewind Report on RHVP Safety (Answers to Terms of Reference Questions 10, 11, and 12)

Questions 10, 11, and 12 of the Terms of Reference address the impact of the non-disclosure of the Tradewind Report.[41] These questions require consideration of the consequences of the non-disclosure of the Tradewind Report at the time of its receipt in January 2014.

The principal significance of Mr. Moore's retention of the Tradewind Report was that the Traffic group and its consultant, CIMA, did not have the benefit of the findings and recommendations in the Tradewind Report after 2014. The question is therefore what could reasonably have been expected to happen if Traffic had in fact received the Tradewind Report and the 2014 Golder Report in 2014. The answers to these questions are therefore, by their nature, speculative. I address these questions based on the following framework.

The Tradewind Report was credible; its contents and its recommendation for further investigation should have been taken seriously. The Tradewind Report did not identify an urgent concern, whether relating to pavement condition or traffic safety, but it did identify a condition that could, under some circumstances, be a contributing factor to collisions, particularly under wet surface conditions. Its findings not only required a further investigation but also called into question the simple explanation of bad driver behaviour that was provided to the PWC and Council as the reason for the abnormal accident experience on the RHVP.

Significantly, both the Tradewind results and the CIMA analysis in the 2015 CIMA Report suggested that friction levels on the roadway could have been a contributing

[41] Questions 10 to 12 ask: ***10)*** *Did the Tradewind Report contain findings or information that would have triggered Council to make safety changes to the roads or order further studies?* ***11)*** *Were users of the RHVP put at risk as a result of the failure to disclose the Tradewind Report's findings?* ***12)*** *Did the failure to disclose the Tradewind Report, or the information and recommendations contained therein, contribute to accidents, injuries or fatalities on the RHVP since January, 2014?*

factor to the accident experience on the RHVP. If Traffic had received the Tradewind Report, it would not have been possible to attribute that collision experience exclusively to bad driver behaviour, even if the friction levels that it revealed were not, in and of themselves, the cause of collisions. Recognition of this possibility would have prompted the Traffic group to look more broadly at the issue and to develop a more comprehensive view of the factors that were contributing to the collision experience on the RHVP in 2014. Given the pre-existing elements of the geometry of the RHVP, the weaving distances associated with the location of the ramps and interchanges, and the separation between the posted speed and the design speed, among other factors, Traffic would have had to address the question of whether the interaction of the friction levels on the RHVP with these other factors could have been an explanation for the wet surface accident experience in particular.

It is reasonable to conclude that, if the Traffic group had received the Tradewind Report, this group would have conducted a further investigation of the roadway surface including the friction levels on the RHVP as recommended by Tradewind. This would have provided a clearer assessment as to whether the pavement surface friction levels were a contributing factor to collisions on the RHVP. It may have included further friction testing, or more targeted testing on the RHVP's hot spots. I have no doubt that Council would have authorized any study or investigation that staff recommended given the ongoing engagement of the PWC on RHVP traffic safety matters, and the public attention paid to the collision experience on the RHVP.

The City's consultants — Golder and CIMA — canvassed many types of possible countermeasures with their staff contacts in Public Works over time, some of which were implemented, and others which were not, for various reasons. If the Traffic group had received the Tradewind Report and the 2014 Golder Report and had conducted further investigation, they would have been more fully informed about all the countermeasures available to the City and would have been in a position to consider them meaningfully.

However, I cannot speculate on whether City staff would have recommended adoption of specific countermeasures recommended by CIMA that were not implemented between 2014 and 2019, or any of Golder's recommendations. Many of these options would have been costly, and would have taken time, to implement (for example, rehabilitation of the surface and installation of median barriers). It is impossible to

assess in hindsight the factors that would have gone into a decision on any of such options including the results of the necessary cost-benefit analysis.

However, with respect to the countermeasures recommended by CIMA that were actually implemented in the period between 2014 and 2019, I think it is reasonable to assume that if Traffic had adopted a more comprehensive approach to traffic safety, Traffic would have recommended to Council that those countermeasures be implemented earlier than actually occurred. In particular, I think that it is reasonable to assume that Traffic would have recommended a reduction in the posted speed limit on the RHVP and enhanced speed enforcement earlier than 2019. I also think that it is reasonable to assume that Traffic would have recommended implementation of those countermeasures that were tied to the resurfacing schedule of Engineering Services, in particular the installation of permanent raised reflective markings, on an independent and earlier basis.

Due to the COVID-19 pandemic and its effects on traffic patterns, it was not possible to draw reliable conclusions regarding collision trends after 2019 following the reduction of the posted speed limit, the commencement of enhanced speed enforcement, and the resurfacing of the RHVP, which otherwise could have demonstrated whether these actions did, in fact, result in a reduction in collisions. This will only be possible when the City has an appropriate data set of post-2021 collision statistics available for expert analysis. In addition, dealing specifically with respect to fatalities, the limited number of such incidents makes it impossible to draw statistically meaningful conclusions.

However, to the extent that the earlier implementation of the countermeasures described above would have decreased the demand for friction on the RHVP, the expert evidence established that decreasing the demand for friction will decrease the number of collisions, injuries, and deaths, even if it is not possible to quantify the effect. Accordingly, it is logical to assume that the failure to disclose the Tradewind Report, or the information and recommendations contained in the Report, resulted in users of the RHVP being exposed to more risk than would have been the case if those countermeasures had been implemented earlier. For the same reason, it is also logical to assume that the failure to disclose the Tradewind Report contributed to accidents and injuries on the RHVP since January 2014.

Summary of Recommendations

In Chapter 12, I set out Recommendations in response to the questions I was directed to answer in the Terms of Reference. These Recommendations are informed by my findings, overall conclusions, and the answers to the Terms of Reference set out in Chapter 12 and in earlier chapters.

The City's resolution directing this Inquiry included a direction to make recommendations appropriate and in the public interest as a result of the Inquiry, including in Question 15 of the Terms of Reference, to identify any changes to the City's by-laws, policies, and procedures to prevent any future incidents of non-disclosure of significant information to Council. The Recommendations focus on the structural and systemic issues that are identified in this Report.

My recommendations are directed to the City of Hamilton, but many of the matters raised in the Terms of Reference are relevant to municipal governance generally and maintenance of municipal expressways specifically.

Many of the matters addressed in my Recommendations have been addressed in the reports and recommendations of previous inquiries. Where appropriate, I repeat and reiterate guidance from previous inquiries in my Recommendations. In particular, I have emphasized the need for leadership and education in establishing and maintaining a culture of collaboration, cooperation, transparency, and accountability for Council, staff, and the public. Such a culture is fundamental to good government at the local level.

I am aware that the City has made changes to its practices, policies, and procedures since 2019, and that some of these changes may address issues discussed in this Report and highlighted in the Recommendations. My Recommendations, however, are rooted in the Terms of Reference and respond to the policies, procedures, and events set out in the Terms of Reference that were in effect prior to and as of 2019. Nothing in this Report should be viewed as an express or implied criticism of the City's subsequent efforts to improve its policies, practices, and procedures.

The Recommendations are set out in full in Chapter 12 and cover several different matters. As a summary, the principal categories of Recommendations are as follows.

First, the Public Works department should treat traffic safety on the RHVP and the LINC as a shared responsibility of all members of the department. The Recommendations suggest certain mechanisms to reinforce this joint responsibility.

Second, given the collision history on the RHVP, and the fact that the collision experience will necessarily change over time, Public Works should adopt processes for a comprehensive safety approach similar to the approach of the regional offices of the MTO to monitor and address traffic safety issues that arise on the RHVP and the LINC. My Recommendations relate to both expressways as they form one continuous roadway that should be managed as a whole. The Recommendations identify certain elements of such an approach to traffic safety.

Third, the Recommendations address the need to develop a real culture of collaboration and cooperation between departments and divisions of Public Works that have overlapping responsibilities.

Fourth, the Recommendations address the need for the Public Works department to enable information sharing among members of the department, including the establishment of a library of all consultant and third-party reports, staff reports, collision statistics, and analyses, among other things, and a formal project tracking system for any matter involving multiple divisions within Public Works.

Fifth, in view of the issues raised in respect of staff reports to Council, it is recommended that certain actions be taken to ensure better and more consistent reporting to Council. The recommendations also suggest policies regarding the preparation of staff reports to ensure objective and comprehensive reports to Council and its committees.

Similarly, in view of the issues raised regarding statements to the media and the public, it is recommended that certain steps be taken to ensure accurate disclosure to the media and the public and the correction of any inaccurate disclosure.

Lastly, the Recommendations address a number of issues respecting third-party consultant engagements and the preparation of consultant reports and the companion staff reports to ensure that the respective roles of consultants and City staff are respected.

Conclusion

This Inquiry effectively began in the late spring of 2019. Its Terms of Reference required an investigation of the relevant facts pertaining to the design and construction of the RHVP, traffic safety reviews and friction testing conducted since the opening of the RHVP in November 2007, the manner in which the Public Works department oversaw roadway and traffic safety on the RHVP during that period, and the actions of City staff in respect of, and following, discovery of the Tradewind Report in September 2018.

As set out in Chapter 13, the investigation phase, which went to April 2022, took longer than anyone anticipated or wanted. Broadly drafted terms of reference have significant consequences for the scope and process of an inquiry, as was the case in this Inquiry. This, in turn, affected the length and cost of the Inquiry, as did the City's approach on issues of document production and privilege assertions which are detailed in Chapter 13. In addition, the occurrence of the COVID-19 pandemic created challenges for the participants, especially the City.

The public hearings provided a comprehensive airing of the issues relevant to the Terms of Reference, which is the goal of public inquiries. It is my hope that the technical and expert evidence and my overall findings in this Report will contribute to a better understanding of the design, construction, and operating history of the RHVP and thereby provide some clarity to the City, those who have been personally affected by accidents on the RHVP, and the Hamilton public generally.

As noted above, as an investigation completed in a public forum, a public inquiry requires flexibility, creativity, and adaptiveness to achieve a fair process that is transparent and balances thoroughness with efficiency. Through the commitment of Commission Counsel, the participants, and the participants' counsel, and all those involved in the Inquiry process, I trust we have met these goals.

CHAPTER 1

Technical Concepts and Background

1.1. Overview

This chapter provides a basic introduction to a number of topics necessary for an understanding of the evidence, conclusions, and recommendations discussed later in this Report – certain guidelines applicable to the design of highways in Ontario, different pavement structures, the stone mastic asphalt ("SMA") surface course of the Red Hill Valley Parkway ("RHVP"), the science of pavement-tire friction, the measurement and management of friction levels on highways in Ontario and internationally, the approach of the Ontario Ministry of Transportation ("MTO") to ensuring adequate friction on Ontario highways, and certain traffic safety concepts and highway design considerations relevant to traffic safety on the RHVP.

These topics are technical, as is much of the subject matter of the Inquiry's Terms of Reference. Accordingly, much of the evidence before the Inquiry was technical and a large number of the individuals involved, including those who testified, were engineers or had other technical roles and/or backgrounds. It was therefore necessary for the Inquiry to have independent expert advice on technical matters. In this regard, the Inquiry has benefitted from the technical assistance of Dr. Gerardo Flintsch[1] and Russell Brownlee,[2] each of whom provided expert reports and oral testimony on two occasions.

Dr. Flintsch's first report, dated April 2022, entitled "Primer on Friction, Friction Management, and Stone Matrix Asphalt Mixtures" (the "Flintsch Primer"), and his oral testimony in connection with this report also at the outset of the Phase 1 public hearings provided a technical overview of the friction-related matters relevant for this Inquiry. His second report, dated November 2022, and testimony in Phase 2 of the Inquiry hearings applied these concepts to the RHVP.

Mr. Brownlee's March 2022 report and his oral testimony in connection with this report at the outset of the Phase 1 public hearings introduced general concepts of highway

[1] Dr. Flintsch is the Director of the Center for Sustainable and Resilient Infrastructure at Virginia Tech Transportation Institute.

[2] Mr. Brownlee is the President and Transportation Safety Engineer at True North Safety Group.

design. His second report, dated November 2022, and testimony in Phase 2 discussed the applicability of those concepts and traffic safety principles to the RHVP.

For brevity and clarity, some portions of this chapter pertaining to friction, SMA, design guidelines, and traffic safety concepts are adopted verbatim or substantially verbatim from the Flintsch Primer or from Mr. Brownlee's reports and evidence, without specific attribution or quotation marks. No participant in the Inquiry took issue with the Flintsch Primer, and in this chapter I rely only on aspects of Mr. Brownlee's reports and evidence that were not contentious.

1.2. Requirements, Best Practices, and/or Guidelines for Municipalities Constructing Expressways

There are no mandatory requirements for the design and construction of limited access municipal freeways in Ontario. There are instead guidelines and best practices, and requirements that municipalities can adopt if they choose to do so. Industry good practice is to apply these, with any design exceptions the municipality has formally adopted (called "jurisdictional" design exceptions). These jurisdictional exceptions may be location specific (a design exception), project specific (a special provision in a contract or tender), or network wide (a standard drawing or table of acceptable design criteria).

1.2.1. Ontario Highway Design Standards

The principal design standards or guidelines for the design of highways in Ontario are:

- the 1985 Geometric Design Standards for Ontario Highways published by the MTO (the "1985 MTO Design Guide"). The 1985 MTO Design Guide was developed for use on provincial highways and roadways. Some municipal entities adopted it for the design and contract specifications of their roadways; and

- the 1999 Geometric Design Guide for Canadian Roads published by the Transportation Association of Canada (the "1999 TAC Guide") and the 2017 update (as updated, the "2017 TAC Guide"). The 1999 TAC Guide and 2017

TAC Guide were developed to achieve design consistency amongst Canadian federal, provincial, territorial, and municipal road authorities.

Most major Ontario cities and towns, and many counties, have applied the 1999 and 2017 TAC guides, unless they were making modifications to a provincial highway within their jurisdiction that was the subject of a connecting link agreement with the MTO. In these latter instances, MTO practices would be specified. In 2017, the MTO itself adopted the entirety of the 2017 TAC Guide, except the roadside design chapter.

The RHVP design was based on the 1985 MTO Design Guide. Although the RHVP was not actually constructed until the mid-2000's, the main RHVP design phase took place before the 1999 TAC Guide came into existence, as described in detail in Chapter 2. While there are differences between the 1985 MTO Design Guide and the 1999 TAC Guide, they are not material for the purposes of the Inquiry.

Whichever guide is applied, the design parameters therein are not hard and fast rules that must be applied in all circumstances. The design manuals provide the starting points of any design, but there is always latitude to deviate from the guidance in specific situations and combinations of situations. In some cases, it may also be necessary to depart from a particular guideline in order to meet other project objectives and constraints.

Engineering design manuals set out industry good practice, but also the understanding that there will be trade-offs, design exceptions, and engineering judgment to be applied in all those situations to meet project goals, funding arrangements, and project constraints. Such constraints could include property impact, funding sources, topography, environmental concerns, or the requirements for environmental approvals.

Meeting design requirements (whether they are termed "guidelines" or "standards" as they are sometimes called) does not guarantee that the as-built road will be safe, and a departure from the guidelines to address particular constraints does not mean that the as-built road will be unsafe. Accordingly, in all cases, professional judgment must be applied to ensure that an as-built road operates as safely as reasonably possible.

The principal standards/guidelines relevant to this Inquiry pertain to the following elements of highway design, which are listed along with a brief summary of how they apply to the RHVP:

1) **Design speed**: The RHVP design speed is 100 km/h. The selection of design speed affects a number of other highway features, such as horizontal and vertical curves, sight stopping distances, and road/shoulder widths. The 1985 MTO Design Guide allows for a design speed range of 90 to 120 km/h, with 90 km/h only to be considered in the instance of urban freeways (the RHVP is an urban freeway).

2) **Posted speed:** The design speed should ideally be 20 km/h over the posted speed limit. Every effort should be made to meet this desirable standard on a freeway, but the 1985 MTO Design Guide provides that urban environments and challenging topography are two of the reasons for which it may not be met. From the time it was constructed until February 2019, the RHVP had a posted speed of 90 km/h, which was only 10 km/h less than the design speed. By contrast, the majority of Ontario freeways have posted speeds of 100 km/h and design speeds of 120 km/h.

3) **Horizontal circular curve radius:** A 100 km/h design speed results in a minimum recommended circular curve radius of 420 m under the 1985 MTO Design Guide. Sequential curves on the RHVP south of King Street and traversing the King Street interchange have radii of 420 m and 450 m, respectively. These two curves are immediately adjacent to a third much larger radius curve south of Queenston Road.

4) **Superelevation:** Superelevation is a feature of curve design, with the outside road edge higher than the inside road edge to counteract the horizontal forces on a vehicle as it goes around the curve. The designed superelevations of the RHVP are mostly compliant with the guidelines in the 1985 MTO Design Guide, but it is unknown whether or not the 420 m radius curve south of King Street on the RHVP meets the minimum required 6% superelevation for that curve specified by the 1985 MTO Design Guide.

5) **Interchange spacing:** The 1985 MTO Design Guide recommends that freeway interchanges be spaced not less than 2 km apart. While deviations from this are not uncommon with urban freeways due to existing arterial roads and neighbourhoods, all but one of the six RHVP interchanges are spaced

closer than 2 km apart. Two of the three most closely spaced interchanges on the RHVP (Greenhill Avenue to King Street and King Street to Queenston Road) are located in the area of the three sequential curves described above.

6) **Ramp spacing (weaving distances):** The 1985 MTO Design Guide also recommends a minimum distance of 600 m between ramps on a freeway (also called "weaving distance"). Three of the weaving distances on the RHVP are below that recommended minimum, and correspond with the two most closely spaced interchanges and the three sequential curves described above.

7) **Vertical curves:** The 1985 MTO Design Guide sets guidelines for the maximum grade (slope) of vertical curves (crests and valleys), and for the permissible rate of change in grade. While the RHVP is compliant with those guidelines, the challenging geometric elements described above generally coincide with the downhill grade of the Niagara Escarpment when driving northbound on the RHVP and the uphill grade when driving southbound.

These issues are discussed in greater detail later in this chapter and in Chapter 2.

1.2.2. Ontario Paving Standards

There are also no mandatory requirements respecting the materials municipalities use to pave limited access freeways that they construct.

The Ontario Provincial Standards ("OPS") organization publishes and maintains a comprehensive set of Ontario Provincial Standard Specifications ("OPSS") for use by road and public works owners, contractors, and consultants in Ontario. The OPS organization consists of various specialty committees, the majority of whose members are municipal representatives.

The MTO has developed specifications that reflect the MTO's own administration, testing, pavement policies, procedures, and practices. These specifications are not legally binding on municipalities. However, OPS specialty committees update and revise some of those specifications for municipal use by ensuring they reflect the comparable procedures, and practices of municipalities in Ontario. The OPS Pavements Committee is one such committee. It consists of a majority of municipal

representatives in addition to industry and consulting representatives and an MTO representative (whose role is to speak to the nature of the MTO specifications). While municipalities may use the specifications developed by the OPS Pavements Committee, they are not required to do so.

As described below and in Chapter 3, the MTO maintains a Designated Source of Materials ("DSM") list. The DSM lists the products and their sources that the MTO will accept as suitable for use in MTO contracts. Among the products and sources included on the DSM are the premium aggregates the MTO requires be used in certain surface course pavements, including but not limited to, SMA and Superpave 12.5 FC2 (or SP12.5 FC), which have been used on the RHVP. There is no comparable list maintained for municipalities and they are not bound to use DSM listed aggregates in the pavements used in the construction of a municipal freeway.

1.3. Perpetual Pavement and Stone Mastic Asphalt

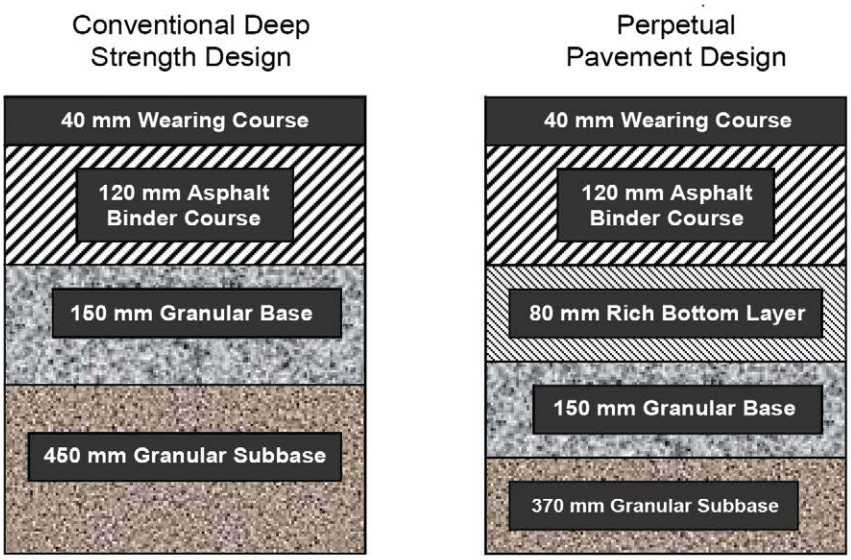
The RHVP mainline was constructed using a perpetual pavement design structure with an SMA surface course. This section provides a brief description of perpetual pavements and SMA, and an overview of their use in Ontario.

1.3.1. Perpetual Pavement Structure

Any roadway paved with hot mix asphalt ("HMA") has one or more granular and asphalt layers. The composition of these layers and their thickness comprise the pavement structure. For a freeway, there are typically multiple layers. **Figure 1a** is a visual representation of two types of pavement structure design: conventional deep strength pavement and perpetual pavement.[3]

[3] **Figure 1a** is from a paper specifically about the RHVP, but it provides a general visual representation of the two types of pavement structures depicted.

Figure 1a: Conventional Deep Strength and Perpetual Pavement Designs



A perpetual pavement (also called “permanent pavement” or “long-life pavement”) is one type of overall pavement structure design comprising multiple granular and asphalt layers. As these names suggest, longevity is a defining feature.

Each pavement structure contemplates a surface course (also called the “wearing course”) of HMA. Two such surface courses are SMA, which is typically used for high volume freeways, and Superpave 12.5 FC2. For example, in the diagrams above, either SMA or Superpave 12.5 FC2 could form the top “40 mm Wearing Course” in either pavement structure.

The intended lifespan of a perpetual pavement is 50 years or more. Only periodic replacement of the perpetual pavement’s thin surface layer (resurfacing or repaving) is required during this 50-year period. Major rehabilitation or reconstruction is not anticipated until the pavement has been in service for 50 years or more, although routine maintenance and minor rehabilitation is anticipated throughout the pavement life cycle.

By contrast, the life cycle of a conventional deep strength asphalt pavement is approximately 20 years. The typical life cycle involves routine maintenance on the pavement throughout and major rehabilitation work every 18 to 25 years.

Perpetual pavements are designed from the bottom up. The key design principles of the perpetual pavement structure are:

- A competent pavement foundation consisting of subgrade and granular layers;
- A “rich bottom” or fatigue resistant layer of asphalt that has increased asphalt content and reduced air voids, and is highly resistant to fatigue cracking;
- An intermediate asphalt binder course layer that is structurally sound and rut-resistant;
- A renewable 40 mm surface layer that is rut, wear, and skid resistant; and
- A total asphalt thickness of more than 200 mm (comprised of the surface course, asphalt binder course, and rich bottom layers) to reduce and resist fatigue cracking.

Perpetual pavements are designed to avoid deep-seated structural failure and resist fatigue cracking in the lower asphalt layers. Generally, with appropriate maintenance procedures, perpetual pavements are intended to experience wear and tear only on the 40 mm surface course. Because wearing is confined to the top layer, pavement distresses can be remedied through milling and replacement of the 40 mm surface course. Mill and overlay (colloquially known as “shave and pave”) resurfacing (a type of pavement rehabilitation) is faster, lower cost, and more resource-efficient than the major rehabilitation (reconstruction) required for conventional asphalt pavements that tend to fail from the bottom layers up.

The most notable claimed benefit of the perpetual pavement structure is the lower overall costs over the 50-year pavement life, as compared to conventional pavement structures, notwithstanding the higher upfront construction costs to build a perpetual pavement.

Other benefits of perpetual pavement are said to include conservation of aggregate and bituminous resources, lower energy consumption, and reduced vehicle emissions. These benefits flow from the reduced rehabilitation and major reconstruction needs of perpetual pavements over the life of the pavement structure and a corresponding reduction in the frequency of rehabilitation-related traffic disruption and lane closure.

Higher ride quality associated with the increased rut resistance of perpetual pavements also reduces potential vehicle damage.

The MTO conducted its first perpetual pavement trial in 2007 on a 2.2 km test section of Highway 406 near Thorold, Ontario. The Highway 406 perpetual pavement was paved concurrently with a 3.1 km control section of typical deep strength pavement to allow the MTO to monitor performance of the perpetual pavement. As of 2009, the MTO had two additional perpetual pavement projects under construction.

The decision of the City of Hamilton (the "City") to use a perpetual pavement structure on the RHVP, including the feasibility study prepared in respect of this decision, is discussed in Chapter 2.

1.3.2. Stone Mastic Asphalt

1.3.2.1. Technical Background

SMA is an asphalt concrete mixture developed in Germany in the 1960s. It was developed to provide heavily trafficked roads with a durable, rut-resistant wearing course. The SMA technology was introduced in North America in the early 1990s, and it has been used mostly as a surface layer on high traffic freeways.

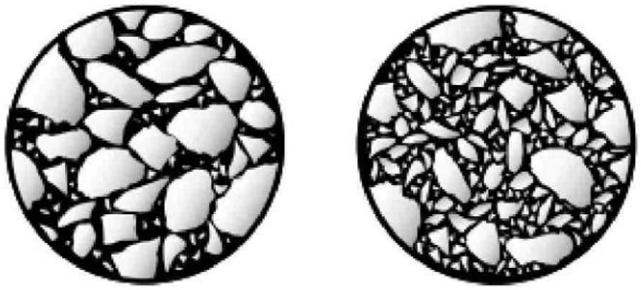
The most commonly used HMA mixes in North America are dense-graded mixes. These mixes use a well-graded aggregate (even distribution of aggregate particles from coarse to fine) and asphalt binder. Dense-graded mixes are considered the workhorse of HMA since they may be used effectively in all pavement layers, for all traffic conditions. Superpave 12.5 FC2 is a dense-graded HMA mix. A Superpave 12.5 FC2 mix was placed on the RHVP mainline and ramps when it was resurfaced in 2019; it was also used for the original surface course on the RHVP ramps.

In contrast, SMA is a gap-graded HMA, by which is meant an asphalt that uses coarse and fine aggregates without an even distribution of aggregate particles, and that uses a modified asphalt binder with higher asphalt content than other mixes. SMA is often considered a premium mix because of higher initial costs due to increased asphalt contents and the use of more durable aggregates. Cubical, low abrasion, crushed stone and manufactured sands are recommended because the SMA mixture gains most of its strength from the stone-on-stone aggregate skeleton. The skeleton is held together by a

mixture of manufactured sands, mineral fillers, and additives (fibers and polymers) that make a stiff matrix. Mineral fillers and additives also reduce the amount of asphalt drain-down in the mix during construction, which increases the amount of asphalt used in the mix and improves its durability.

Figure 1b is an illustration of the aggregate structure of an SMA mix compared with a conventional dense-graded mixture.

Figure 1b: Aggregate Structure of SMA and Conventional Dense-Graded HMA



As mentioned, SMA is designed to improve rut resistance and durability. The primary advantage of SMA is an extended life with improved pavement performance compared to conventional dense-graded HMA. SMA was an attractive choice for the RHVP because of its pavement performance and alleged noise reduction which was significant given the adjacent residential areas.

SMA mixes are typically 20 to 25% more expensive than the traditional HMA mixes. The extra cost comes from the use of higher quality aggregates, more (and typically more expensive) polymer-modified binder, and more mineral filler than conventional mixtures. SMA mixtures also require adding fibers to stabilize the high quantities of binder and require higher mixing temperatures (because of the polymer-modified binders), which increases energy use during production. However, for high traffic highways, the extra service life obtained because of the enhanced durability typically compensates for the extra cost.

Dr. Flintsch described the evidence respecting the frictional qualities of SMA as being equivocal, when considered as a category. Some studies indicate SMA has slightly better frictional qualities than traditional dense-graded mixes, while others do not. In Dr.

Flintsch's opinion, the frictional qualities of a pavement are not dependent on the asphalt type per se, but instead, on the type and quality of the aggregate used in a mix whether SMA or otherwise. I accept this opinion.

One potential concern with SMA surfaces is low friction when the surface is new. This was a major issue for the MTO beginning in 2005 and resulted in a pause in MTO placement of SMA on provincial highways from late 2007 until 2014, as described in detail below.

It is understood that sand (often precoated with asphalt binder) is sometimes added to the surface of SMA in Germany and rolled in while it is hot. This construction practice has also been used in the UK and New Zealand and, as described below, is similar to the approach the MTO ultimately took to address this early age low friction issue.

1.3.2.2. Early Age Low Friction Issues with SMA in Ontario

After a trial on a section of Highway 401, the MTO adopted the use of SMA as a premium surface course mix on MTO highways beginning in the early 2000s. As of 2003, the MTO's Surface Course Directive (PLNG-C-003), which provides direction on the use of surface course types on provincial highways, recommended that SMA be used for high volume freeways, in particular 400-series highways and the Queen Elizabeth Way ("QEW").[4] The MTO completed an additional eight SMA paving contracts in 2004 and 2005.

Ontario's asphalt paving industry organizations — the Ontario Hot Mix Producers' Association ("OHMPA") and the Ontario Road Builders' Association — strongly supported the use of SMA in Ontario.

By 2005, however, the MTO began identifying issues of low initial pavement friction on its newly placed SMA pavements. A November 2005 MTO presentation reflected that initial friction values for MTO's pavements were in the 20s, with a range of values between 25 and 45.[5] Initial pavement values in the 20s were below the desired MTO value of FN30.

---

[4] High volume freeways are roads with equivalent single axle loads ("ESALs") greater than 3 million per design lane.

[5] The November 2005 MTO presentation describes the values as SN (skid number), rather than FN (friction number). SN and FN are different ways of reporting friction values that result from testing using an ASTM E274 locked-wheel friction tester. For consistency, FN is used throughout this chapter.

The MTO approach to testing the friction values of pavement is discussed later in this chapter.

MTO staff also identified that SMA surface friction tended to improve relatively quickly over time as traffic wore off the asphalt cement film. The MTO's experience with early age SMA low friction was consistent with issues experienced by road agencies in other jurisdictions that used SMA.

The low initial friction values were a public safety concern for the MTO. In response, the MTO undertook an extensive multi-year investigation to address SMA early age low friction. The MTO's investigation, and its related initiatives and trials, began in 2006 and continued until 2014. As part of that, in November 2005, a joint MTO-industry task group was formed in response to the SMA early age friction problem and other issues related to construction of SMA mixes. The SMA task group was made up of MTO and OHMPA representatives.

Various iterations of the SMA task group and its membership existed for nearly 10 years, until 2014.[6] The Inquiry received a great deal of documentary evidence regarding the SMA task group, as well as some oral evidence on the topic. However, a short summary of its activities as they aligned with issues pertaining to the RHVP will suffice for the purposes of this Report.

In May 2007, the MTO revised the list of premium aggregates allowed for use in SMA on the recommendation of the SMA task group. Seven DSM-approved quarry sources were permitted for use in SMA. Some aggregate sources, including aggregate from Ontario Trap Rock,[7] were excluded from use in SMA because of poor or insufficient frictional performance data. As of August 2007, the MTO's "short-list" of acceptable SMA aggregates was communicated via two Special Provisions (SSP 313S45 and SSP 110F12).

The MTO's prohibition on the use of Ontario Trap Rock prompted a telephone call from Dr. Ludomir Uzarowski (Principal, Pavement & Materials Engineering, Golder) of Golder Associates Ltd. ("Golder") to Dr. Chris Raymond (Senior Pavement Design Engineer,

---

[6] Three former MTO representatives on the SMA task group testified at the public hearings: Dr. Chris Raymond, Chris Rogers, and Tom Kazmierowski.

[7] "Ontario Trap Rock" is the name of a company that is an aggregate supplier in Ontario. However, "trap rock" is also a type of aggregate used in highway pavements.

Pavements & Foundations, Materials Engineering & Research Office, Highway Standards Branch, Provincial Highways Management Division, MTO)[8] on July 31, 2007, regarding the aggregate used by Dufferin Construction Company ("Dufferin") in the SMA surface course on the RHVP, as discussed in Chapters 2 and 3.

Frank Marciello (Pavement Evaluation Supervisor, Pavements & Foundations Section, MTO) conducted pavement friction testing on the MTO's SMA pavements throughout 2007 for the purposes of evaluating early and yearly SMA performance and the various initiatives recommended by the SMA task group.

On November 6, 2007, as a consequence of the MTO's experience with early age low friction of SMA, the MTO implemented a pause on the use of SMA on provincial roads.

An MTO Information Note issued that day indicated that the pause was related in part to low pavement friction on a construction contract on Highway 401 at Woodstock (Contract 2005-2030), which had friction numbers ranging from the low to high 20s. Because Contract 2005-2030 was paved with approved aggregates on the MTO short-list, the MTO concluded that restrictions on the use of SMA aggregates was not a successful means of addressing early age low friction problems.

This pause was instituted after paving of the RHVP was completed. Friction testing on the RHVP took place in October 2007 and is discussed in detail in Chapter 3. The MTO's October 2007 RHVP friction test results, although obtained only two weeks before the SMA pause was implemented, did not factor at all in the MTO's decision to pause the use of SMA. To the contrary, the MTO considered the results of the testing on the RHVP to be good for a newly placed SMA pavement.

In this regard, in the course of discussions between Dr. Uzarowski and Dr. Raymond regarding early age SMA friction issues in October and November 2007, Dr. Uzarowski suggested that the MTO consider shotblasting (which involves steel pellets being fired at the pavement surface) as a method to remove the asphalt film in freshly paved SMAs. These discussions, while close in time to the MTO's October 2007 RHVP friction testing, did not contemplate shotblasting on the RHVP. All communication was in furtherance of

[8] In this chapter, unless stated otherwise, all MTO staff referenced by name were in the Materials Engineering & Research Office (MERO) in the Highway Standards Branch of the MTO's Provincial Highways Management Division.

the joint MTO/industry SMA task group's efforts at addressing the MTO's early age friction issues.

Around the same time, Dr. Raymond and Dr. Uzarowski also discussed the possibility of the MTO conducting British Pendulum Testing ("BPT") on the RHVP. The mechanics of BPT, a form of friction testing, are described below in this chapter. The reason for this testing, had it occurred, would have been for the MTO to use the BPT results in an attempt to correlate them with its October 2007 friction test results on the RHVP. However, for reasons that remain unclear, the MTO did not conduct any such testing on the RHVP. In any event, the purpose of the proposed testing was not related to concerns about RHVP friction levels at the time.

The MTO continued to allow limited placement of SMA following implementation of the pause in November 2007, generally restricted to already-awarded SMA contracts and contracts that acted as trials for initiatives recommended by the SMA task group. For example, the MTO used a revised SMA mix design on a QEW trial at Red Hill Creek (near the RHVP) in 2009.

Work of the SMA task group continued until 2014. Various trials and treatments were investigated during this time. A successful solution to the SMA early age low friction issues was ultimately achieved using a coated "hot grit" application. This process involves coating hot grit (fine aggregate) using 1% asphalt cement and applying it to the SMA surface when it is placed.

On October 31, 2014, the MTO lifted its pause. The MTO's Surface Course Directive (PLNG-C-003) was revised to reinstate the use of SMA for high volume provincial freeways. Since 2014, the revised Surface Course Directive has required application of a hot grit coated with asphalt cement on all SMA pavements during paving to address the early age low friction issue. At the time of writing this Report, SMA continues to be used by the MTO as a premium surface course mix for high traffic, high volume provincial roads.

The lifting of the MTO's pause on SMA placement coincided with the last MTO friction test of the RHVP in 2014. However, this timing was coincidental, particularly as the MTO friction testing of the RHVP after 2007 was unrelated to the early age low friction issue as described in Chapter 3.

1.4. Overview of Friction, Friction Measurement, and Friction Management

1.4.1. Relationship Between Crashes and Friction

As this Inquiry was prompted by disclosure of the Tradewind Report which addressed friction levels on the RHVP, the significance of friction levels for collisions on an expressway is a fundamental issue.

Evidence clearly establishes that deficient friction is seldom the main cause of a collision, but low friction levels can be a contributing factor in the presence of other contributing circumstances in particular situations. Road sections with poor friction levels, or skid resistance, because of the materials of which they are made and/or the extent to which they have been polished by traffic, may contribute to collisions. 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 and/or to a collision. On the other hand, if the friction level provided by the road surface is high, a collision may be avoided or its severity reduced.

Studies over the years have repeatedly shown that sites with low friction have more collisions than sites with high friction. Because a large percentage of the skidding problems occur when a road surface is wet, research has tended to focus on the link between wet road collisions and friction. However, recent studies have found that both dry and wet collision rates increase with decreasing friction levels, though the impact is higher on wet road collisions than on dry road collisions.

While the basic science of pavement-tire friction is itself not particularly complicated or inaccessible to the layperson, applying it to a particular roadway or segment thereof is neither exact nor “one size fits all”. Clear determinations are hard to arrive at because the adequacy of friction levels is contextual. What constitutes adequate friction in practice varies from roadway to roadway and from section to section within a single roadway. Whether or not a road has adequate friction (skid resistance), and whether or not friction levels contribute to collisions, are therefore questions to which there are no simple answers.

1.4.2. Basic Science of Tire-Pavement Friction

When a tire free rolls in a straight line, the contact patch is instantaneously stationary with little to no friction developed at the tire/road interface, although there are some interactions that contribute to rolling resistance. However, when a driver begins to execute a maneuver that involves a change of speed or direction, forces develop at the interface in response to acceleration, braking, and/or steering that cause a friction reaction between the tire and the road. Friction enables the vehicle to speed up, slow down, or track around a curve. The reaction forces are limited by the dynamic friction available.

According to the American Association of State Highway Transportation Officials ("AASHTO") "Guide for Pavement Friction", an authoritative industry publication, "Pavement friction is the force that resists the relative motion between a vehicle tire and a pavement surface". The friction force between tire and pavement is generally characterized by a dimensionless coefficient, known as the "coefficient of friction", which is the ratio of the tangential force at the contact interface to the longitudinal force on the wheel.

The friction that can develop between a vehicle tire and the pavement is the result of the interaction between the tire, the pavement, and the condition of the road surface, so it is not a property of the tire or the road surface individually. Tire-pavement friction also depends on the amount of water and other contaminants present between the tire and the pavement, the vehicle's maneuver, and the environmental conditions.

The properties or characteristics of the pavement surface that affect friction are defined by the texture in the surface. Pavement texture is defined by AASHTO as "the deviations of the pavement surface from a true planar surface". These deviations vary from microscopic asperities on the aggregate surface, to valleys and crests in between the aggregates that form the surface of the pavement, to bumps in the road that affect the vehicle dynamics and driver comfort (referred to as roughness or smoothness in the highway industry).

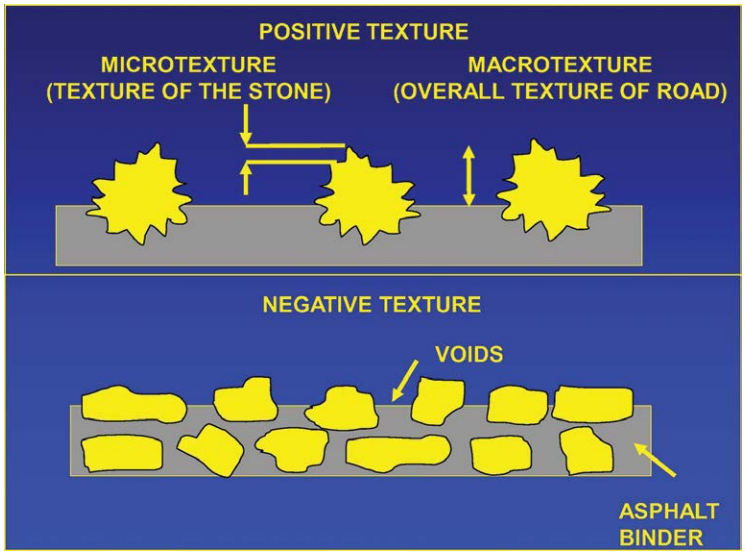
There are two main components of the texture spectrum that affect tire-pavement friction: microtexture and macrotexture:

1) **Microtexture** is the fine-scale texture on the surface of the coarse aggregate in asphalt or the sand in concrete pavements that interacts directly with the tire rubber on a molecular scale and provides adhesion.

2) **Macrotexture** represents slightly bigger surface irregularities. As water film thickness increases, the pavement's macrotexture provides water drainage paths beneath the tire, reducing hydroplaning potential and allowing for greater tire/pavement adhesion (a function of the pavement's microtexture).

A visual representation of microtexture and macrotexture is set out in **Figure 1c.**

Figure 1c: Visual Representation of Microtexture and Macrotexture



While microtexture is primarily affected by the type of aggregate used, mostly the aggregate's surface asperities and polishing characteristics, macrotexture is the result of the type and properties of the asphalt mixture used in the surface of asphalt pavements.

The coarse aggregates in the surface of the pavement (which provide the microtexture) are in contact with the tire and thus, are subject to the adhesion forces that contribute to the friction and grip needed to safely operate vehicles. These adhesion forces generated between the rubber and aggregates abrade or polish the aggregate particles by eliminating some of the asperities. This lowers the microtexture and produces a reduction in friction over time. Some aggregates have better resistance to polishing

than others. Therefore, the polishing characteristics of an aggregate used in a surface course of an expressway are important for maintaining long-term friction.

1.4.3. Types of Friction Measuring Equipment and Testing

Many different devices have been developed over the years to measure pavement friction. However, they all rely on the broad principle of sliding rubber over a wet road surface and measuring the reaction forces developed. These forces are used to compute a coefficient of friction expressed against a scale of 100 and referred to variously as a Friction Number ("FN"), a Skid Number ("SN"), or a Grip Number ("GN"), depending upon the test equipment employed.

Friction testing and interpretation are done according to standard procedures, which are normalized by national and/or international bodies. The most commonly used standards in North America are those established by AASHTO and ASTM International (formerly the American Society for Testing and Materials).

However, the various friction-measuring technologies available use different types of tires, water film thicknesses, and operating principles, with the result that they do not produce a common, standardized measurement of friction.

1.4.3.1. Locked-Wheel Testers

Most highway agencies in North America (including the MTO) have traditionally used locked-wheel friction testers or "skid trailers" to measure friction. These tests are normalized by a standard designated as ASTM E274-15, "Standard Test Method for Skid Resistance of Pavement Surfaces Using a Full-Scale Tire".

In this test, one of the wheels of a trailer is fully locked (generating 100% slip) to simulate emergency braking without anti-lock brakes, which were uncommon at the time the technology was developed. The measurements can be done using a ribbed tire (ASTM E501-08) or a smooth tire (ASTM E524-08).

ASTM E274-15 reports friction as a skid resistance number that includes the speed of testing and the type of tire: R or S, for ribbed or smooth, respectively. For example, SN40R indicates that the test was run at a test speed of 40 mph (64 km/h) with a standard ribbed tire. When the standard international metric system is used, the

test speed is placed in parentheses, for example, SN(65)R. AASHTO uses a similar notation but refers to the number as a friction number or FN.

While measurements using the smooth tire are sensitive to both microtexture and macrotexture, measurements using the ribbed tire are impacted mostly by the microtexture of the pavement. Ribbed tire measurements are not very sensitive to the surface macrotexture and some agencies have added macrotexture measurements to capture the full friction characteristics (for example, the sand patch test described below). In addition, friction measurements with the ribbed tire are also less susceptible to the testing speed and are typically higher than those produced by smooth tires at high speeds.

A key limitation of locked-wheel testers is that they can only sample the pavement surface by repeatedly collecting data on short, localized segments of road and do not effectively differentiate the changes in friction along the route corridor. Put another way, locked-wheel testers only provide measurements for the locations along the roadway where the brake is applied and, accordingly, it is difficult to repeat the measurements taken from a testing run along the same roadway because the brake cannot be applied in precisely the same location on each testing run.

As described more fully below, the MTO uses a locked-wheel skid trailer with a ribbed tire, but tests at the posted speed of the roadway in question rather than at the standard test speed of 65 km/h. It is this device and testing method that the MTO used in its testing of the RHVP, conducted at the then posted speed of 90 km/h. As described in Chapters 11 and 12, Applied Research Associates (“ARA”) used the same method to test the RHVP just prior to and after the RHVP resurfacing in 2019.

1.4.3.2. GripTester

Certain test devices measure friction with a tire partially slipping continuously with respect to the pavement surface and are known as continuous friction measuring equipment (“CFME”). One common type of CFME is a GripTester. Generally speaking, and all other things being equal, a GripTester will return higher friction measurements (expressed as GN) than a locked-wheel tester (expressed as FN or SN).

Tradewind Scientific Ltd. (“Tradewind”) used a GripTester for its friction testing on the RHVP in November 2013, as described in Chapter 6. Englobe also used a GripTester

to test the RVHP in May 2019 just prior to resurfacing, as described in Chapters 11 and 12. As discussed below, the 407 ETR Concession Company Limited (the "407 Company") purchased a GripTester from Tradewind, which it received in 2011. Although the 407 Company was unable to convince the MTO to allow it to use the GripTester for the purpose of satisfying its contractual friction testing obligations, the 407 Company found the GripTester to be a useful and reliable tool, especially on asphalt.

Different types of CFME use different operational principles and measuring modes. Because of that, the various CFME technologies produce different friction measurements from each other, as well as different measurements from those obtained with the locked-wheel skid trailers. CFME (including the GripTester) are impacted mostly by the microtexture of the pavement and are not very sensitive to the surface macrotexture. Their measurements are often complemented by macrotexture measurements, as discussed further below.

1.4.3.3. British Pendulum Test

An older category of friction measuring devices are known as "sliders". A slider is attached either to the foot of a pendulum arm or to a rotating head, which slow down on contact with the road surface. The rate of deceleration is used to derive a value representing the skid resistance of the road. The most commonly used of this type of test is the British Pendulum Test or BPT (ASTM E303-93).

While the BPT is still used, it is a static test, only measuring friction values in the specific locations tested, and because it tests at the lowest sliding speed, it is only sensitive to microtexture. In addition, the road being tested has to be shut to traffic while the testing is performed.

As described in Chapter 8, Golder used the BPT to measure RHVP friction in December 2017. However, the results of that test were considered to be unreliable because of the weather conditions and, in any event, cannot be correlated with the testing conducted by the MTO, ARA, Tradewind, or Englobe.

1.4.3.4. Sand Patch Test

Relatively high macrotexture is critical to maintaining an appropriate level of friction at high speed (for example, higher that 80 km/h). This is especially critical in areas of high friction demands, such as curves in high speed freeways. In particular, on wet pavements, as the vehicle speed increases, skid resistance decreases to an extent that depends on the macrotexture. The pavement's macrotexture provides water drainage paths beneath the tire, reducing hydroplaning potential, and allowing for greater tire/pavement adhesion (a function of the pavement's microtexture). Generally, surfaces with greater macrotexture have greater friction at high speeds, although this is not always the case.

For this reason, tests of macrotexture are often taken to complement friction measurements in order to obtain a fuller spectrum of pavement surface frictional properties at various slipping speeds.

Macrotexture measurements can be measured using both highway speed profilers and static methods. The oldest method is the volumetric patch test. In this test, a known volume of sand, glass beads, or grease is spread evenly into a circular patch on the road surface. Where sand is used, this test is commonly called a "sand patch test". The area is measured, and the average depth below the peaks in the surface is calculated to give a value known as "mean texture depth" ("MTD").

As described in Chapter 8, Golder used the sand patch test to measure RHVP macrotexture in December 2017, and ARA used the same method in May 2019 just prior to the RHVP resurfacing as described in Chapter 11.

1.4.3.5. Polished Stone Value Test

Aggregates are the primary contact medium with vehicle tires. Aggregate properties are also the predominant factor that determine frictional performance of asphalt surfaces. Aggregate is generally characterized into two distinct sizes — coarse aggregate and fine aggregate.

To minimize the use of coarse aggregates that are susceptible to polishing, which results in loss of friction over time, some highway agencies require the use of tests that

measure the resistance of an aggregate to abrasion, wear, and/or polishing. Common tests used for this purpose include the Micro-Deval test for coarse aggregates (which is governed by AASHTO T 327, "Standard Method of Test for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus"), and the Polished Stone Value ("PSV") test (which is governed by AASHTO T 279, "Standard Method of Test for Accelerated Polishing of Aggregates Using the British Wheel").[9]

As described later in this chapter, the MTO uses PSV testing (along with numerous other tests) in order to determine whether aggregates are suitable for inclusion in the DSM. As described in Chapter 3, in 2008, the MTO performed PSV testing on the Demix aggregate used in the RHVP surface course pavement for DSM inclusion purposes, and found it to be acceptable.

PSV testing, including by the MTO for DSM assessment purposes, is typically conducted on virgin aggregate (meaning aggregate from a quarry which has not been used). However, as described in Chapter 8, Golder also had PSV testing conducted on the aggregate in core samples extracted from the in-service RHVP in December 2017 in connection with Golder's review of the possibility of hot in-place recycling of the SMA surface course.

1.4.4. Difficulty with Interconversion of Friction Measurements

The Flintsch Primer describes a number of attempts to compare measurements taken by different types of equipment, such as the GripTester, SCRIM,[10] and locked-wheel tester.

It is not necessary to go into depth on this topic. The Flintsch Primer concluded that attempts to convert results from one device to another, including between GripTester and locked-wheel tester measurements, "are not very accurate".

---

[9] A detailed discussion of the Micro-Deval and PSV tests, along with a number of other aggregate durability and polishing tests, can be found in the February 2023 report of Dr. Hassan Baaj (Director of the University of Waterloo's Centre for Pavement & Transportation Technology, and Golder's expert in the Inquiry), titled "Analysis of Aggregate Testing and Evaluation of the Coarse Aggregate used in RHVP Pavement Surface Course".

[10] "SCRIM" stands for Sideway-force Coefficient Routine Investigation Machine.

Part of the difficulty in harmonizing friction measurements taken by different types of devices (and even those taken at different times by the same type of device) arises from operational factors that affect the friction measurement. These include:

1) **Water film thickness:** The water on the pavement surface decreases the tire-pavement contact area and so reduces the available friction force. Thicker films of water produce lower friction measurements.

2) **Type and condition of the tire:** Worn tires are known to be more sensitive to water film thickness and provide less friction than tires in good condition, especially on wet surfaces. Pavement macrotexture and tire treads can provide channels for water to escape through the tire pavement contact area, which results in increasing the friction forces between tire and pavement surface.

3) **Vehicle and sliding speeds:** Friction decreases as the vehicle and slipping speeds increase. Testing at a higher speed will, generally, result in lower friction readings.

4) **Temperature:** Tire-pavement friction decreases if the tire temperature increases. Testing at lower temperatures will generally result in higher friction readings than testing at higher temperatures.

5) **Contaminant:** Contaminants such as oily liquids, dust, rubber accumulation, and other substances on a highway surface also affect the available friction and can cause localized areas of low friction.

However, it is relevant for an understanding of the Tradewind Report that, all other things being equal, a GripTester (used by Tradewind) will generally measure higher friction (expressed as a GN) than a locked-wheel tester (used by the MTO and expressed as an FN or SN).

1.4.5. The Concept of Friction Demand

As mentioned, there are a number of different factors that contribute to highway crashes, including those related to drivers, to vehicles, and to highway conditions. Of these three categories, highway agencies can only control highway conditions,

and then only partially, through design, construction, maintenance, and management practices and policies. As discussed, the friction level and texture of a pavement surface are important components of the highway-related conditions that influence traffic safety. If deficient, they can be a contributing factor to the collision experience of a highway. This section discusses the various approaches that highway agencies use to ensure the frictional properties of a highway's pavement surface.

Friction demand is the level of friction needed to safely accelerate, brake, and steer a vehicle on a particular roadway. Adequate friction at any location on a roadway depends on how much friction is required in the particular circumstances of the roadway. Factors such as traffic volume, posted speed and driver practices respecting operational speed, geometrics (horizontal and vertical curves, grades, cross-slope, sight distance, shoulder and lane width, etc.), the potential for conflicting vehicle movements, roadway hazards, and the location of intersections or interchanges will impact how much friction is needed.

Highway agencies seek to ensure that pavement surface friction supply (the maximum friction that the surface can provide) meets or exceeds friction demand at all times. They do so using a number of different approaches discussed in this section.

1.4.6. Approaches to Ensuring Adequate Pavement Friction of a Highway

In broad terms, an effective approach to ensuring adequate pavement friction requires policies and practices in the design and construction of a highway, a management program involving the monitoring of the accident experience of the highway, and a policy to identify and respond to potentially unsafe roadway surfaces in a timely fashion. Each of these components of friction management will be addressed below in turn.

The aim of such practices is to enable appropriate judgments regarding the treatment or resurfacing of a roadway where required based on objective evidence and criteria. These judgments balance the risk of a crash occurring with the costs and practicalities of providing adequate friction which may prevent a crash or reduce its consequences in terms of death or severity of injury.

1.4.6.1. Design for Friction

Pavement friction design involves utilizing appropriate materials and construction techniques to achieve high levels of microtexture and macrotexture on the pavement surface. The type of aggregates used in the surface mix directly affects the microtexture while the gradation and size of the aggregate contribute to the macro-texture properties of the pavement surface.

In asphalt mixtures, the large aggregates govern the frictional properties of the pavement surface. The wear characteristics of aggregates are also important in maintaining friction levels. The aggregate mineralogy and hardness directly affect the durability and resistance to polishing of the aggregates.

As discussed below, the MTO places considerable reliance on this approach through its DSM list. In the case of the RHVP, as discussed in Chapter 2, the surface pavement selected was an SMA asphalt using an aggregate that was not on the DSM supplied from the Varennes quarry of an affiliate of Dufferin in Quebec (Demix Agrégats). The tests conducted with respect to the quality of this aggregate's characteristics, and the conclusions reached, in particular regarding its suitability from a friction perspective, are discussed in Chapter 3.

As well, assumptions about the available coefficient of friction on a highway are "built into" the highway design guidelines. The friction values assumed in design do not represent the actual available friction between tires and road, but the highway design does account for intermittent reduced friction conditions due to snow, slush, or icy road surface conditions. This is discussed below.

1.4.6.2. Investigate and/or Monitor Friction Levels

The Inquiry heard evidence of two different approaches to the ongoing management of friction levels on an in-service highway.

Certain highway agencies proactively monitor friction levels pursuant to a friction management program that involves regular testing. Alternatively, other highway agencies test friction levels as a possible contributing factor to an abnormal collision history on a highway or a segment of a highway. Both of these approaches are

addressed below. However, it should be noted that, in either case, an effective program requires and presupposes the systematic and regular collection and analysis of accident statistics that enable identification of high collision areas or other “hot spots” on a highway.

The Inquiry heard evidence that certain countries including the UK, Australia, New Zealand, and Germany have established pavement friction management programs or policies that provide a framework by which highway agencies can monitor the condition of their road networks and, based on objective evidence including regular testing, make appropriate judgments regarding rehabilitation or resurfacing of a roadway where required.

For this purpose, the applicable highway agencies have established friction demand categories for individual highway classes, facility types, and access types. These friction demand categories reflect the fact there will be significant sections of a road network where the friction demand will be reduced because situations likely to involve skidding are generally rare and other situations in which the required friction level is required to be higher. In the former category are lightly travelled highways; in the latter category are sections where it is observed that drivers frequently need to brake or turn at speed.

Consistent with this approach of different friction demand categories, highway agencies establish different investigatory levels for each friction demand category rather than using a single investigatory level. In this context, an investigatory level is understood to be a threshold friction level of an ordinary surface, as established by the particular highway authority, at which an investigation must (or ought to) occur to determine whether the friction level of the roadway surface is contributing to collisions to the extent that it requires remediation in some form. An “investigatory level” should be distinguished from an “intervention level” which is established in more limited circumstances by certain highway agencies as a threshold friction level at which friction remedial measures are mandated.

1.5. Friction Management Internationally

The following discussion summarizes the evidence reviewed by the Inquiry regarding the friction management programs of highway agencies in the United Kingdom, Australia, and New Zealand. It is followed by a summary of certain evidence received by the Inquiry regarding the approaches to friction management taken by certain state highway agencies in the United States.

1.5.1. The United Kingdom, Australia, and New Zealand

Countries that have focused on improving friction proactively to reduce crashes, led by the United Kingdom, have defined friction demand categories that reflect the risk associated with driving along each demand category. The UK has defined 10 highway demand categories which divide the roads based on their design standard (high level highways, divided highways, and two-lane roads) and whether or not the sections include an "event." A non-event roadway section is a tangent (straight) section of a roadway with a gradient less than 5% having no intersection, ramp, or crossings. Events include sharp curves, intersections, ramps, crossings, and sections with a gradient greater than 5%.

The UK investigatory levels (converted to GripTester results) that were in place at the time of the Tradewind testing of the RHVP in November 2013 are set out in **Figure 1d.** The applicable investigatory level for an expressway comparable to the RHVP is indicated on the chart as a GN of 0.41, shown in the second box in the "Motorway" demand category shaded in dark grey (the rest of the table is not relevant for an understanding of the Tradewind Report).

Figure 1d: UK Investigatory Levels in Place as of November 2013

Table 2. Adaptations of the UK Investigatory Levels for a Mark 2 GripTester using a conversion factor of 0.85 (after UKPMS 2005).

Site category and definition			Investigatory level (IL) at 50 km/h							
		SFC	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
		GN	0.35	0.41	0.47	0.53	0.59	0.65	0.71	0.76
A	Motorway									
B	Non-event carriageway with one-way traffic									
C	Non-event carriageway with two-way traffic									
Q	Approaches to and across minor and major junctions, Approaches to roundabouts and traffic signals									
K	Approaches to pedestrian crossings and other high risk signal									
R	Roundabouts									
G1	Gradient 5-10% longer than 50 m (see note 6)									
G2	Gradient >10% longer than 50 m (see note 6)									
S1	Bend radius < 500 m – carriageway with one-way traffic									
S2	Bend radius < 500 m – carriageway with two-way traffic									

Notes: Reference should be made to Chapter 4 of HD 28/04 and in particular, the notes to Table 4.1 (of HD 28/04) for guidance on interpretation.

Dark Grey indicates the range of ILs that should generally be used for roads carrying significant levels of traffic.

Light Grey in cells indicates a lower IL that may be appropriate in lower risk situations, such as low traffic levels or where the risks present are mitigated by other means, providing this has been confirmed by the crash history.

While the rest of the boxes are not pertinent to understanding the Tradewind Report, the table above illustrates the UK approach to using demand categories based on both the facility type and particular roadway geometry, with different investigatory levels for each.

Similar though not identical approaches are taken in Australia and New Zealand. In Australia, “Austroads” is the agency responsible for developing “national guidance documents” for, amongst other things, skid resistance policies. Australian state and local road authorities are encouraged, but not required, to develop strategies for managing skid resistance across their networks. In New Zealand, a national policy governs skid resistance management on the state highway network, including governing macrotexture levels, and sets both investigatory and intervention levels.

As described in Chapter 6, the Tradewind Report applied a UK investigatory level to its November 2013 GripTester RHVP test results. Although Tradewind applied an older version of the UK investigatory levels chart than the one in place at the time

of its testing, the Tradewind results were below the investigatory level of whichever version of the UK standard was applied. That fact is not challenged. Rather, an issue in this Inquiry is the significance to be attached to the UK investigatory levels as applied to the RHVP.

1.5.2. American Jurisdictions

In the United States, the traditional approach to solving friction problems has been to focus on friction testing of specific roadway locations identified as having "high crash counts" or "hot spots" rather than to test highway friction levels on a proactive basis. The values selected to define high crash counts (typically wet-pavement crashes) have been chosen by various methods and are not uniform. Agencies then use a friction threshold value to decide if a section should be investigated for a friction-improving treatment. I would note that, although the AASHTO Guide for Pavement Friction provides guidelines and recommendations for friction design and aggregate testing, the Inquiry did not receive any evidence on the specific approach or approaches, if any, of state highway authorities to ensuring acceptable pavement surfaces at the design and construction stage of a highway.

Unlike in the UK, Australia, and New Zealand, the majority of agencies in the US use only one published investigatory or intervention level friction threshold, which does not discriminate according to the roadway type or site type (for example, whether it is located on a tangent, curve, vertical curve, etc.).

Figure 1e, produced in the report of David Hein,[11] the City's friction expert in this Inquiry, sets out the single investigatory or intervention levels set by eight US states (without distinguishing whether they are investigatory or intervention levels). In all instances, those states use the ASTM E274 locked-wheel tester at a standard speed of 65 km/h with a ribbed tire. The relevant column for roadways comparable to the RHVP is understood to be the "Interstate" column, which pertains to limited access freeways.

[11] Mr. Hein is the President and Principal Engineer at 2737493 Ontario Limited.

Figure 1e: US State Investigatory or Intervention Levels

Agency	Interstate	Primary	Secondary	Local
Illinois	FN65R > 30			N/A
Kentucky	FN65R > 28	FN65R > 25		
New York	FN65R > 32			
South Carolina	FN65R > 41	FN65R > 37		N/A
Texas	FN65R > 30	FN65R > 26	FN65R > 22	N/A
Utah	FN65R > 30-35	FN65R > 35		N/A
Washington	FN65R > 30			
Wyoming	FN65R > 35			N/A

By way of a more detailed example, one of the eight jurisdictions in the above table, New York uses locked-wheel friction testing at each 0.16 km (0.1 mi) segment of an identified location in each direction. If a section has one or more readings of FN65R less than 32, it is recommended for treatment.

I note that this general approach in the US differs from the current recommendation in the AASHTO Guide for Pavement Friction, which recommends friction demand categories and uses the UK Investigatory Level approach as an example. Recent revisions to the AASHTO Guide for Pavement Friction that were released in December 2022 also recommend elimination of the use of intervention levels altogether because agencies are unlikely to trigger treatments without a detailed project investigation.

1.6. MTO Friction Management and Testing

1.6.1. Overview of the MTO's Practices

Nine current or former employees of the MTO testified at the public hearings. In addition to testifying regarding the MTO's specific involvement in friction testing on the RHVP (described in Chapter 3), they also testified as to MTO practices and policies respecting highway friction management and testing in Ontario more generally.

The MTO relies on two principal approaches to ensuring adequate levels of friction on its asphalt pavement highways:

1) Ensuring that the aggregates used in asphalt surface layers have adequate frictional qualities by prequalifying them for use; and

2) Friction testing at the instance of MTO regional offices seeking to identify whether low friction is a contributing cause to an abnormal collision experience on a particular highway segment.

Both of these components of the MTO approach to ensuring adequate friction levels on MTO highways will be discussed below.

Of note, unlike the US jurisdictions described above, while the MTO has an informal threshold friction level which it applies with qualifications for investigatory purposes and as part of the process for pre-qualifying aggregates for use, the MTO does not publish numerical friction measurement standards or friction level action limits for its highways.

1.6.2. MTO Approach to Ensuring Adequate Friction

1.6.2.1. Internal Requests for DSM-Related Testing from the Soils & Aggregates Section

Since the mid-1980s the MTO has maintained its DSM list that sets out various categories of material that are pre-screened and pre-approved for use on MTO highway projects. Friction testing is conducted for DSM listing and maintenance purposes.

DSM listing is, in most instances, a prerequisite to a product being used on the provincial highway system. The DSM is the core of the MTO's front-end approach to friction management, which relies on the use of good quality aggregates and high quality mixes in MTO roads to ensure adequate friction levels on provincial highways.

Section 3.05.25 of the DSM sets out the application-specific requirements necessary to achieve DSM status for premium surface course aggregates, including the coarse and fine aggregates used in SMA pavements. The Soils & Aggregates section in the

MTO's Materials Engineering and Research Office ("MERO") supervises the DSM system.

Section 3.05.25 provides that, to obtain a listing on the DSM, an applicant supplier and/or aggregate must satisfy the following preconditions:

1) Submission of a letter of consideration to the Head of the Soils & Aggregates section (this requirement commences the DSM approval process);

2) Demonstration of satisfactory nature and consistency of the source, as determined by geological examination of Soils & Aggregates staff during a quarry visit;

3) Demonstration of satisfactory production facilities, as determined by inspection of Soils & Aggregates staff during a quarry visit;

4) Sampling by Soils & Aggregates staff of 1,000-tonne coarse and fine aggregate stockpiles meeting the relevant grading requirements;

5) Demonstration of satisfactory quality of the aggregate, including meeting OPSS 1001 and 1003 criteria, an average PSV of 50 (with no value less than 48),[12] and an average Aggregate Abrasion Value ("AAV") of no more than 6.0. The MTO uses PSV and AAV testing to measure the frictional characteristics of the applicant aggregate, specifically its resistance to polishing and abrasion. It is generally thought that pavement(s) paved with an aggregate that meets the specified criteria will have satisfactory friction;

6) Submission of a quality control plan detailing procedures and processes followed to ensure product quality;

7) Construction of a 500 m test strip containing the applicant aggregate source in Superpave 12.5 FC 1 or 2, HL1, or Dense Friction Course ("DFC") pavement on an 100 km/h highway. The 500 m test section is typically arranged and paved by the contractor on an existing MTO contract next to an adjacent DSM-

[12] The requirement of an average PSV of 50 applies to most aggregates, except quartzite aggregates.

approved aggregate source. The adjacent section acts as a de facto control section;

8) Satisfactory performance of the aggregate in the test strip during an initial two-year period, based on visual inspection by Soils & Aggregates staff and friction testing using the ASTM E274 skid trailer. Friction testing is conducted on the test section (and the adjacent control section) for at least two years before the aggregate can be considered for inclusion on the DSM. The control data can be useful to rule out any non-aggregate factors in the friction results;

9) Registration with The Road Authority; and

10) Payment of a registration fee to the Minister of Finance.

Although normal procedure requires a control section for friction testing in addition to a test strip, there have been instances where an aggregate is evaluated in the absence of an adjacent control section. Evaluation of the Demix aggregate, discussed in Chapter 3, is one such example.

All DSM approvals are conditional. To remain on the DSM, an aggregate must continue to exhibit satisfactory aggregate performance, including in-service frictional performance, and production quality. Inspection, laboratory testing, and skid testing take place over the life of the test section, although the frequency of inspection and laboratory testing has diminished in recent years due to staffing constraints.

An aggregate is not automatically removed from the DSM if it exhibits unsatisfactory frictional performance (that is, results less than FN30), although the MTO has jurisdiction to delist an aggregate if it so chooses. In lieu of delisting, other remedial action may include placing conditions on the aggregate's use, additional monitoring and assessment, and/or working with the supplier to identify and resolve the problem.

From 2001 to 2015, Bob Gorman (Senior Aggregate Engineering Officer, Soils & Aggregates Section, MTO) was the primary person responsible for managing and overseeing the DSM within the MTO, in consultation with the Head of the Soils & Aggregates section, who was Chris Rogers (Manager, Soils and Aggregate Section, MTO) from 1990 until April 2008 and thereafter Stephen Senior (Head, Soils &

Aggregate Section, MTO) until November 2016. As described in Chapter 3, all three individuals were involved in the DSM application and approval process for the Demix aggregate and related friction testing on the RHVP in 2008 to 2012, and in 2014.

DSM-related friction results are typically sent to the Head of Soils & Aggregates, the responsible geologist in Soils & Aggregates, and the Head of Pavements & Foundations in MERO.[13] DSM list applicants are only advised whether their aggregate has satisfactory or unsatisfactory frictional performance, and do not receive raw test data or friction results for friction testing conducted on the aggregate test strip.

In the context of requests for friction testing of a section of a roadway to assess an aggregate for DSM-related purposes, the MTO uses a guideline of FN30 as a performance measure for the aggregate under review. Aggregates used in pavements with friction results of FN30 or above are generally considered satisfactory for initial and continued listing on the MTO's DSM list, provided the aggregates also satisfy all of the other requirements set out above. However, in this context, the MTO does not look at friction demand issues that might render otherwise acceptable friction levels insufficient for the demand in certain locations as the MTO would do if it performed friction testing for a regional office as discussed below. It looks only to the overall average FN of the segment tested or, in some cases, the results for a comparator control strip in which event it is the relative rather than the absolute result that is meaningful.

On the other hand, mere attainment of the threshold of FN30, although considered acceptable for DSM-purposes, is not treated by the Soils & Aggregates section as desirable. The MTO preference is to have results significantly above FN30 and, generally speaking, as high as possible. Further, the trend of declining friction values may be relevant even if, at any given time, an aggregate satisfied the MTO guideline, i.e., tests above the friction level of FN30.

[13] In recent years, the name of the Pavements & Foundations Section was changed to the Pavement Section and the office name was changed from MERO to the Engineering Materials Office. For purposes of this Report, I use Pavements & Foundations Section and MERO.

1.6.2.2. Internal Regional Requests

The MTO does not test the friction levels of MTO highways on a regular proactive basis. However, on an annual basis, staff in each of the MTO's regional offices assess and evaluate the regional road network for maintenance purposes and issue monitoring. Issue monitoring may include, for example, identification of areas with high accident rates, aggregate polishing, pavement flushing, and/or police concerns. If a regional office identifies friction concerns as a potential contributing factor to the issue of concern, the regional staff will make a request for friction testing to the Pavements & Foundations section. Upon completion of testing in the area(s) of the identified "spot hazard", results are provided to regional staff in the standard spreadsheet format. The MTO's five regional offices are therefore a significant source of internal requests for friction testing.

Regional personnel assess testing results with the region's engineers having knowledge of the roadway characteristics and underlying concerns and determine whether and how to continue the investigatory efforts, including whether to budget for (or immediately pursue) remedial measures.

In this context, although the MTO uses FN30 as an informal investigatory level, FN30 is not a "magic" number at which point the friction on a roadway transforms from good to bad (or vice versa). Instead, FN30 is used as a starting point for MTO staff to permit a determination as to whether the friction demand required of the roadway is met and/or whether any friction-related issues exist and, in that context, whether surface friction conditions are a possible contributing factor to the accident experience being analyzed.

Accordingly, for the purposes of issue monitoring, the MTO effectively uses a three-tiered system to review friction test results:

1) **Results of FN30 or above** are generally used as an indication that the friction levels are satisfactory and that the region may want to focus on identifying (and responding to) different cause(s) for the issue. However, in some cases, friction levels above this threshold may require further investigation or remediation if the friction demand of the roadway as a result of other roadway features does not appear to be satisfied.

2) **Results between FN29 and FN25** generally serve as an investigatory level or threshold, prompting further monitoring and/or investigation by regional staff to determine if friction issues exist. Within this range, friction is generally not ruled out as a possible factor contributing to the identified roadway issue, and often the regional investigation continues. Continued investigation might include additional friction monitoring (such as annual or more regular friction testing), collision assessments (including collision location), and/or an on-site engineering assessment to determine the friction demand and/or identify (or rule out) other factors that may impact friction levels, such as surface distresses or deformities.

3) **Results below FN25**, which tend to be reviewed as individual results (rather than an overall average FN), generally warrant some kind of investigation, action, and/or remediation to address surface friction, such as resurfacing. Generally, results below FN20 are concerning in and of themselves.

While the MTO generally reviews the average FN (comprised of each measured FN) for each tested road segment on a per-lane basis, in some circumstances, the MTO reviews and assesses individual segments that fall below FN30. For instance, if there is an issue with the safety performance on a road and there are many consecutive low friction values on a specific roadway section, this may indicate a need for remedial work on the specific roadway section regardless of an overall acceptable average based on all collected measurements. Although the MTO generally does not share friction test results externally, on occasion regional staff may share the results, for example, to support a demand by the MTO for a contractor to perform remedial work on an area with identified pavement friction deficiencies.

In summary, the MTO applies a flexible approach to the application of its informal threshold of FN30. I note that Mr. Hein, the City's own friction expert in this Inquiry, explained and endorsed such a flexible approach for the reason that, irrespective of the specific investigatory level applied, there is no absolute friction number at which a pavement can be characterized as safe or unsafe.

1.6.2.3. Other Purposes for which MTO Tests Friction

In addition to testing friction for the two purposes described above, the MTO also conducts friction testing under two other general circumstances.

1.6.2.3.1. Other Internal Requests

The MTO periodically conducts network-level friction testing on an entire road network basis or a representative sampling of the network's roads. The MTO conducted network-level testing in 2006 on approximately 1,800 km of provincial roads in three regions in preparation for consideration of long term area maintenance contracts for these regions. The MTO also conducted network-level testing in 2013 on over 150 test pavements as part of the MTO's consideration of contractual friction performance specifications.

From as early as 2005 through to 2015, the MTO considered various approaches to the use of and development of a friction number value as a performance requirement and/or a repair requirement in its pavement contracts, in addition to or in lieu of the use of pre-approved aggregate sources from the DSM. The underlying issue under consideration was whether the front-end DSM approach should either be replaced by, or supplemented with, back-end quality control measures. The MTO conducted the network-level friction testing in 2013 to understand existing friction levels on provincial highways with a view to developing an appropriate metric. Ultimately, the MTO decided to continue using the front-end DSM approach to friction management, described above, instead of a contractual friction number performance specification, with the result that friction targets are no longer set out in new contracts.

The MTO also performs internal "special request" friction testing as part of research or experimental projects. MTO friction testing arising from the SMA early age low friction issues, discussed earlier in this chapter, was one such project.

1.6.2.3.2. Requests from External Entities

On occasion, the MTO also receives requests for friction testing from external entities, such as police forces and municipalities. For the purposes of this Report, I focus on the latter.

Municipal requests are not part of the MTO's formal friction testing program and are considered "special request" testing. In the experience of Mr. Marciello, the MTO's Pavement Evaluation Supervisor until 2015, municipal requests were rare. Unlike internal requests, there is no clear or established process for receipt of and response to external requests. Requests typically come to whomever is the external requestor's contact at the MTO, which may be either staff in a regional office or a member of MERO.

Internal provincial friction test needs are prioritized over external testing. Where resources and capacity allow, the MTO generally conducts the requested testing as a courtesy. The Inquiry received evidence that municipal friction test requests are considered the "last priority". Mr. Marciello recalled municipal friction testing requests being declined on occasion. As described in Chapter 3, in 2013, a request by Dr. Vimy Henderson (Pavement & Materials Engineer, Golder) to the MTO for friction testing of the RHVP and LINC was denied due to the lack of availability of the testing capacity at that time.

When testing is conducted, the MTO generally provides the municipal requestor with the raw friction test data in the standard spreadsheet format. Municipal test results are also provided to the Head of Pavements & Foundations. MTO staff do not, however, provide any assessment, interpretation, or analysis of the friction results. As one MTO witness testified, MTO staff are not consultants and so no consultant assessment is provided.

1.6.2.4. How the MTO Tests Friction

Since 1967 the MTO has performed friction testing on the provincial road network using a locked-wheel friction tester (also referred to as a "skid trailer" or "brakeforce trailer") with a ribbed tire, in accordance with the ASTM E274 and ASTM E501-08 standards, subject to one qualification described below.

The MTO owns one skid trailer which was purchased sometime prior to 2007. All MTO skid testing of the RHVP has been performed using this trailer. A GPS unit was acquired for the skid trailer in April 2014; this allowed for more precise geolocation of tested areas and friction results thereof. Prior to 2014, the MTO's skid trailer did not have GPS capabilities.

A Pavement Evaluation Supervisor performs all the MTO's pavement friction testing throughout the province. The Pavement Evaluation Supervisor position reports to the Head of the Pavements & Foundations section in MERO. In all instances, the results of the pavement friction testing are sent to the Head of the Pavements & Foundations section.

From the mid-1990s until March 2015, Mr. Marciello was the Pavement Evaluation Supervisor. He performed all MTO friction testing during this period, including the friction testing conducted on the RHVP in 2007, 2008, 2009, 2010, 2011, 2012, and 2014, discussed in Chapter 3. Mr. Marciello performed thousands of friction tests province-wide throughout his tenure.

The MTO conducts its testing in spring, summer, and early fall when temperatures are warmer. The MTO practice is to perform friction testing at ambient air temperatures above 3°C or 4°C.

The MTO performs its testing at the roadway posted speed, rather than the standard test speed of 65 km/h specified in ASTM E274. Typically, the testing is performed on open roads in mixed traffic. On occasion, in instances of high traffic, the testing may be performed at a speed below the posted speed.

The duration of one test cycle of the MTO's skid trailer is up to a maximum of four seconds. Test cycles can be performed manually by the test operator (who applies the wheel brake each time), or automatically with the brake applied at pre-set intervals. Mr. Marciello's practice was to manually perform the testing for short test sections or if there were pavement surface concerns such as flushing or bleeding. For longer test sections, Mr. Marciello typically conducted the testing automatically based on a pre-set distance.

The frequency of friction measurements within a given test section is based on the purpose for which the testing was conducted. A 2013 MTO presentation reflected a frequency of 30 m or less for testing pursuant to an accident inquiry or friction concern, and a frequency of 200 m for aggregate source selection purposes. The latter includes DSM-related testing.

Test data is recorded using an on-board computer system in the skid trailer. The on-board computer calculates the dynamic FN for each test cycle. After testing is

complete, the test data is recorded on a disc. Mr. Marciello processed the data, compiled the results at his office, and distributed them as required.

MTO friction test results are recorded in an Excel document containing two spreadsheets: one spreadsheet lists the detailed test results, and the other plots the recorded FNs for the tested years (and any prior year(s) of testing on the same road segment, where applicable). Examples of the two spreadsheets are included as **Figures 3b, 3k, 3l, 3m,** and **3n** in Chapter 3.

In the detailed test results spreadsheet, the distance, speed, and average FN of each test is reported, as is the overall average speed, average FN, minimum and maximum FN, and standard deviation. The results also include the date, air temperature, and various details about the test location, such as the tested lane, the start and end points for testing, the distance from the starting point for each result, key landmark distance, and GPS locations for results (where applicable). Comments about the test site may also be included by the test operator. All listed information is either manually inputted or automatically generated in the field at the time of testing, and subsequently processed into the spreadsheet using a software program.

1.7. The 407 ETR: Friction Management and Testing

The Highway 407 Express Toll Road (the “407 ETR”) is a limited access tolled freeway that runs east-west for 108 km through the “905” area of Greater Toronto, from Burlington in the west to Pickering in the east. The 407 ETR is operated by the 407 Company under a concession agreement between the 407 Company and the MTO. Craig White (Vice-President, Highway Operations, 407 ETR Concession Company, since 2010), testified before the Inquiry respecting the 407 Company’s friction management obligations and practices. In broad terms, the 407 Company has established a hybrid friction management program which combines contractually mandated testing every other year with ongoing monitoring of the accident experience on the 407 ETR.

The portion of the 407 ETR between the Highway 403 interchange in Oakville in the west and Markham Road in the east has a concrete surface. The extensions at both ends (westerly to the QEW/403/407 interchange in Burlington and easterly to Brock Road in Pickering) have an asphalt surface. The asphalt sections are generally three

lanes wide in each direction, whereas the concrete section is mostly five lanes in each direction, although there are areas with entering ramp lanes where it is up to seven lanes wide in each direction.

Generally speaking, the 407 ETR is not a comparable roadway to the RHVP. It is straighter, wider, and its interchanges are more widely spaced. The topography on which it is built is less constrained than that of the RHVP. It also has a posted speed of 100 km/h.

The concession agreement between the 407 Company and the MTO includes a requirement in Schedule 20 that the 407 Company test highway pavement friction every two years using a brakeforce (locked-wheel) trailer in accordance with the ASTM E274 standard. The relevant paragraph in the concession agreement also requires investigation and remediation of pavement surface under certain conditions:

> For freeway pavements, when the surface friction skid number reaches SN 100=30 as measured by a breakforce [*sic*] trailer, conforming to ASTM Standard E-274 and E-501, the Concessionaire shall undertake immediate investigation, and if appropriate, establish and implement a schedule for immediate mitigation. Remedial action is also to be undertaken whenever a surface friction problem is thought to exist irrespective of the surface friction skid number.

Accordingly, the 407 Company is required to test at the 407 ETR posted speed of 100 km/h and is subject to an investigatory level of SN30 (which is the same as FN30). In addition, regardless of whether or not the friction investigatory level is actually reached, action must be taken if it is thought that a surface friction problem exists.

The 407 Company engages ARA to conduct testing of the entire 407 ETR every second year, which they have done since the early 2000's using a brakeforce trailer from the US. As discussed in Chapters 11 and 12, ARA was also engaged by the City of Hamilton to conduct friction testing on the RHVP in May and September 2019.

The 407 Company also conducts a collision analysis every year for the entire facility. The 407 Company ties these two data elements together – friction testing and collision analysis – to consider whether an area of the highway having low friction numbers

is also generating a higher rate of collisions, as well as analyzing other potential contributing factors to that experience.

When friction under FN30 is measured in a given segment but the collision experience in that area is not unusual, no action is typically taken. This recognizes the fact that relatively low friction levels do not necessarily have an adverse effect on road safety. Conversely, there are occasions, including but not limited to wet surface conditions, where the collision rate analysis gives rise to concerns about friction levels even though the skid test results do not fall below the investigatory level of FN30. In those instances, an investigation ensues even though the investigatory level has not been triggered.

Additionally, the 407 Company says that it will take friction remediation action when it is prudent to do so because there is a reasonable probability that enhancing friction will reduce collisions. Remediation does not wait until it can be said that there is absolute certainty that friction levels are contributing to collisions. Essentially, the 407 Company evaluates the friction and collision data and undertakes remediation if it concludes there is a probability that something can be done to improve the frictional characteristics that will reduce collisions.

1.8. Overview of Traffic Safety Concepts and Highway Design Considerations

This section provides an overview of certain traffic safety concepts and highway design considerations relevant to the RHVP traffic safety issues addressed in this Report.

1.8.1. Traffic Safety Concepts

1.8.1.1. Nominal Versus Substantive Safety

As noted earlier, engineering design manuals set out industry good practice for highway design, but also the understanding that there will be trade-offs, design exceptions, and engineering judgment that needs to be applied in all situations to meet project goals, funding, and constraints that are dealt with on each project.

Design dimensions that do not meet the design guidelines do not necessarily result in an unsafe design, and dimensions that meet the design guidelines do not ensure a safe roadway. As Mr. Brownlee put it, a roadway is not just on a piece of paper but rather, it is built within the real world and designers need to deal with those real-world realities in their designs. This raises the concepts of “nominal” versus “substantive” safety.

“Nominal safety” is defined by the US Federal Highway Administration as “a consideration of whether a roadway, design alternative, or design element meets minimum design criteria”.

In contrast, “substantive safety” is defined as

> the actual long term or expected safety performance of a roadway [or section of a roadway]. This would be determined by its collision experience measured over a long enough time period to provide a high level of confidence that the observed collision experience is a true representation of the expected safety characteristics of that location or highway.

The substantive or long term safety performance of a roadway does not always directly correspond to its level of nominal safety, even if all geometric design criteria are met.

Before the mid-1990s, a nominal safety approach assumed that a “road designed to meet minimum standards would be ‘safe’.” Safety assessment practices began to change after major guidelines were published, such as the Highway Safety Manual (2009) published by the US Federal Highway Administration. To appropriately monitor highway safety conditions, industry professionals have developed continuous monitoring through data collection, maintenance, and inspection processes. Typically, a roadway or highway authority performs major safety reviews every five years and publishes or analyzes annual crash experiences.

1.8.1.2. Design Consistency and Motorist Expectations

It is well documented in the transportation industry that the motorist is the primary contributor to collisions with the road-vehicle-motorist system. It is also a well-established fact in transportation research that individuals react faster and more

accurately to events, conditions, and hazards that are “expected” compared to those that are unexpected or a surprise. Motorists have longer term expectations that are primarily based on education, training, and past driving experiences, and shorter term expectations based on conditions experienced on a particular trip or along a specific road section.

Road users operate within an environment, and they operate better and make better or error-free decisions when the roadway in front of them is consistent with what they expect for that type of facility. The design, operations, line markings, and signage, among other elements, ought to be relatively consistent within a particular road section for like situations. Motorists expect this, and with that consistency, they can focus on understanding the roadway environment and can turn their attention more to identifying hazards and other vehicles on the roadway. When the environment deviates from expectations, drivers take longer to make decisions, and longer to perceive and react to new situations, with the result that, all else being equal, the potential for collisions and conflicts increases.

It is estimated that road design, operations, and maintenance is a contributing factor in approximately one quarter of motor vehicle collisions. This significant contribution suggests that, in particular, the infrastructure must be designed, operated, and maintained so that motorists understand the system they are using and will make rapid and appropriate decisions in selecting speed and path. Consistency and uniformity of design standards is a primary means of facilitating motorist comprehension, expectancy, and prudent decision making.

1.8.2. Design Considerations

1.8.2.1. Design Speed, Posted Speed, Sight Distances, and Curves

Common practice is to select a design speed of 10 to 20 km/h over the posted speed limit for a paved roadway. As mentioned above, design speed is one of the fundamental aspects of highway design from which other design parameters flow. The design speed is applied in decision making regarding the appropriate road design features (that is, road/shoulder widths, horizontal curves and vertical curves, and roadside design and protection) and traffic control devices.

There is, however, no commonly applied standard or guideline establishing posted speed limits on freeways in Ontario, beyond the statutory speed outlined by the *Highway Traffic Act.*[14] There are also no legal or regulatory requirements for establishing the appropriate design speed or posted speed on Ontario roadways, or of the relationship between them.

The 1985 MTO Design Guide indicates that:

- Design speed should desirably be set at 20 km/h over the posted limit.
- There may be instances on lower functioning classes of highways (that is, secondary highways) with lower volumes, where it is acceptable to apply a design speed equal to the posted speed.
- Every effort should be made to provide the desirable standard on freeways as they are generally the important links and more heavily travelled components in the highway system.
- Urban environments and challenging topography are two of the reasons provided in which desirable design speeds may not be accommodated.
- Consistency and uniformity of design standards place the driver in an environment which is fundamentally safer because it is more likely to compensate for the driving errors that unfortunately are inevitably made.

The design speed of a highway is generally selected as a function of the roadway classification and the intended posted speed. The 1985 MTO Design Guide allows a design speed range of 90 to 120 km/h to be selected for freeways, with a 90 km/h design speed to be considered only in the instance of urban freeways such as the RHVP. The majority of Ontario freeway facilities are posted with 100 km/h maximum speed limits and have mainline design speeds of 120km/h.

Generally, the overall design criteria, including the design speed, are specified at the outset of the design process. Once the design speed is selected, the highway features are designed, at a minimum, to the prevailing guidance. Where specific highway

[14] *Highway Traffic Act*, RSO 1990, c H.8

features or operations cannot be provided to meet the design speed criteria and/or motorist expectations of the posted speed, regulatory and warning traffic control devices are used to set expectations for appropriate operating speeds.

A number of road design features flow directly from the design speed choice. For the purposes of the Inquiry the relevant ones are:

1) **Stopping sight distance:** to allow motorists to perceive, react, and stop for an object in their path at the design speed; that is, sufficient sight distance over a vertical curve or around a horizontal curve to observe and react to an object or stopped vehicle in the travel lane.

2) **Decision sight distance:** to allow motorists sufficient time to make a decision regarding maneuvering their vehicle or adjusting their speed in complex situations where information may be perceived incorrectly, decisions are required, or control actions are required (as opposed to stopping sight distance which involves a complete stop for an obstacle). Examples of complex situations include complex intersections or interchanges, unusual or unexpected changes in the roadway environment, construction zones, and demanding driver workload areas due to heavy traffic, advertising, and/or traffic control devices.

3) **Horizontal curves including:**

    a) **Circular curves:** with a design speed related to the curve radius, wet weather friction values, and superelevation;

    b) **Spiral curves:** a curve with a constantly varying radius, to provide a smooth transition between a tangent road section and the circular curve; and

    c) **Superelevation:** design with the outside road edge to be higher than the inside road edge to counteract the horizontal forces on a vehicle around a curve.

4) **Vertical curves:** representing the hills and valleys experienced as one travels along the highway alignment.

As an example, the 1985 MTO Design Guide specifies the minimum horizontal circular curve radius based on the selected design speed. As **Figure 1f** reflects, the minimum specified horizontal curve radius increases as the design speed increases.

Figure 1f: Excerpt from 1985 MTO Design Guide, Minimum Curve Radius

Table C3-2
MINIMUM RADIUS DETERMINED FOR LIMITING VALUES OF e AND f

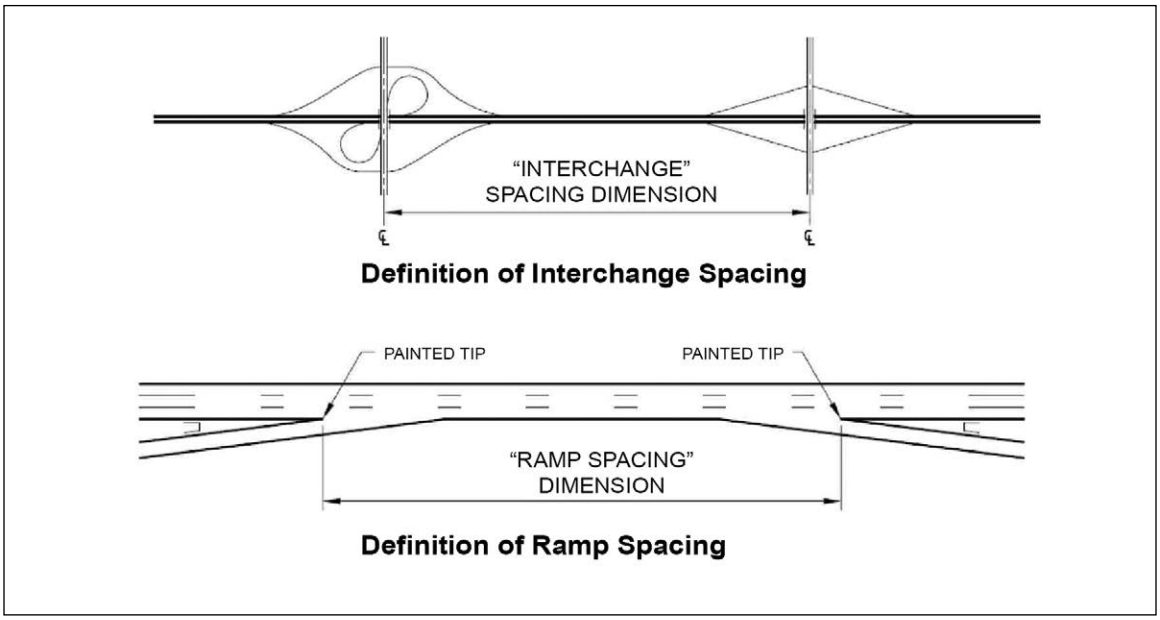
Design speed km/h	*max m/m	Max. *f*	Total *e + f*	Min. Radius (calculated) m	Min. Radius (rounded) m
40	0.06	0.165	0.225	55.99	55
50		0.159	0.219	89.89	90
60		0.153	0.213	133.08	130
70		0.147	0.207	186.39	190
80		0.140	0.200	251.97	250
90		0.134	0.194	328.76	340
100		0.128	0.188	418.83	420
110		0.122	0.182	523.49	525
120		0.115	0.175	647.92	650
130*		0.109	0.169	787.40	800
140*		0.103	0.163	946.81	1000
150*		0.098	0.158	1121.30	1150
160*		0.091	0.151	1334.93	1350

As can be seen in **Figure 1f**, the minimum recommended curve radius for a 100 km/h design speed (the RHVP design speed) is 420 m.

1.8.2.2. Interchange and Ramp Spacing

Freeway interchange spacing and interchange ramp spacing are both subject to guidance in the 1985 MTO Design Guide. A visual depiction of how interchange and ramp spacing are defined is set out in the **Figure 1g.**

Figure 1g: Interchange and Ramp Spacing Definitions



Interchanges on urban freeways are recommended to be between 2 and 3 km apart (measured from the centre line of the road crossing the freeway for which the interchange is constructed). As with other design guidelines, this is not a hard and fast rule. Interchanges can and often are located closer together given a pre-existing urban arterial road network to which the freeway is to be connected. For these situations, the 1985 MTO Design Guide recommends measures to avoid closely spaced interchanges such as aggregating interchanges from more than one arterial road into one interchange.

Similarly, the 1985 MTO Design Guide recommends freeway interchange ramps be spaced a minimum of 600 m from one another (measured from the painted tips of the areas at the terminus of each ramp where it is permissible for traffic to travel on or off the freeway). This area between ramps is also known as "weaving distance".

The application of these design guidelines to the RHVP is described in Chapter 2.

1.8.2.3. Pavement Friction Design

Friction values used in highway design are measured either longitudinally (that is, the design friction value assumed between the road and tire for a vehicle to stop

within the stopping sight distance) or laterally (that is, the lateral friction required for a vehicle to travel around a curve in the roadway).

The 1999/2017 TAC Guide and the 1985 MTO Design Guide recommend conservative design values for available friction based on worn pavement, worn tires, and wet pavement conditions. The friction values assumed in design do not represent the actual available friction between tires and road. The highway design does account for intermittent reduced friction conditions due to snow, slush, or icy road surface conditions. Pavement friction is required to maintain traction around curves and allow for acceptable braking, as required for stopping sight distance.

In other words, assumptions about the available coefficient of friction on a highway are “built into” the highway design guidelines. Stopping sight distances are calculated using the assumed coefficient of friction required for braking to a complete stop at a given speed. However, as set out earlier in this chapter, in practice the adequacy of friction on a particular roadway is contextual. This engages the concept of “friction demand”.

Generally speaking, the tighter the horizontal curve radii, the closer together those curves are, the closer interchanges and ramps are spaced, the steeper are vertical curves and grades, the faster are the driving speeds, and the greater are the traffic volumes, the greater the likely number of collisions and the higher the friction demand of the roadway. That is the case whether or not the design guidelines are strictly adhered to. The available friction is something that may reduce the number of collisions and their severity, or contribute to them.

CHAPTER 2

Design and Construction of the RHVP from the 1950s to 2007

2.1. Overview

This chapter is about the design and construction of the Red Hill Valley Parkway (the "RHVP").

The RHVP is a (mostly) four lane, 7 km municipal freeway owned and maintained by the City of Hamilton (the "City"). The RHVP connects at the south end to the Lincoln M. Alexander Parkway ("the "LINC"), and at the north end to the Queen Elizabeth Way ("QEW"). Together, the RHVP and the LINC form an approximately 19 km continuous connection between Highway 403 and the QEW. Highway 403 and the QEW are provincial highways owned and operated by the Ontario Ministry of Transportation (the "MTO").

The RHVP was designed by the City and its predecessor entity the Regional Municipality of Hamilton-Wentworth (the "Region") and their consultants. For design purposes, the RHVP is an urban expressway. As built, the RHVP is a winding, curvy road. The physical setting of the RHVP in the Niagara Escarpment and environmental concerns significantly affected the design. The resulting geometry of the RHVP is challenging for drivers in some locations as it follows the course of the Red Hill Valley through a series of horizontal curves and relatively closely spaced interchanges and ramps in the same area.

Russell Brownlee's[1] November 2022 report provides an instructive review of the mainline design and geometric features that are significant for traffic safety purposes. In addition, the RHVP mainline is not illuminated; environmental and other concerns influenced the decision not to illuminate the mainline, although illumination was not expressly prohibited by any environmental assessment.

The RHVP pavement structure is a "perpetual" or "permanent" pavement and has a surface layer of stone mastic asphalt ("SMA"). The perpetual pavement structure is intended to last longer than traditional pavement structures. The choice of a perpetual pavement structure with a SMA surface layer was a reasonable one and that choice did not, in itself, give rise to any friction issues on the RHVP.

[1] Mr. Brownlee is the President and Transportation Safety Engineer at True North Safety Group.

Dufferin Construction Company ("Dufferin") was awarded the contract to pave the RHVP in July 2006. Paving of the mainline began in May 2007 and was completed in August 2007. The roadway was opened to the public on November 17, 2007. The grading and paving process, and the parties involved are described in this chapter.

A number of issues arose with respect to the SMA prior to and during paving of the surface course. These involved the aggregate to be used, the mix design, compaction, and gradation. In the plainest terms, the mix design is the ingredient list and recipe used to create an asphalt mix. In the end, however, it is unlikely that any of these issues adversely affected the frictional qualities of the SMA pavement surface on the RHVP. The aggregate and the mix design met the contractual requirements, and issues related to the pavement compaction and aggregate gradation were dealt with on site. However, lingering concerns with respect to the suitability of the aggregate and its frictional qualities on the part of Dr. Ludomir Uzarowski of Golder Associates Ltd. ("Golder") were factors that initiated the friction testing performed by the MTO on October 16, 2007, shortly before the RHVP opened to the public, on November 17, 2007.

2.2. The Long Road to RHVP Construction

2.2.1. Situating the RHVP

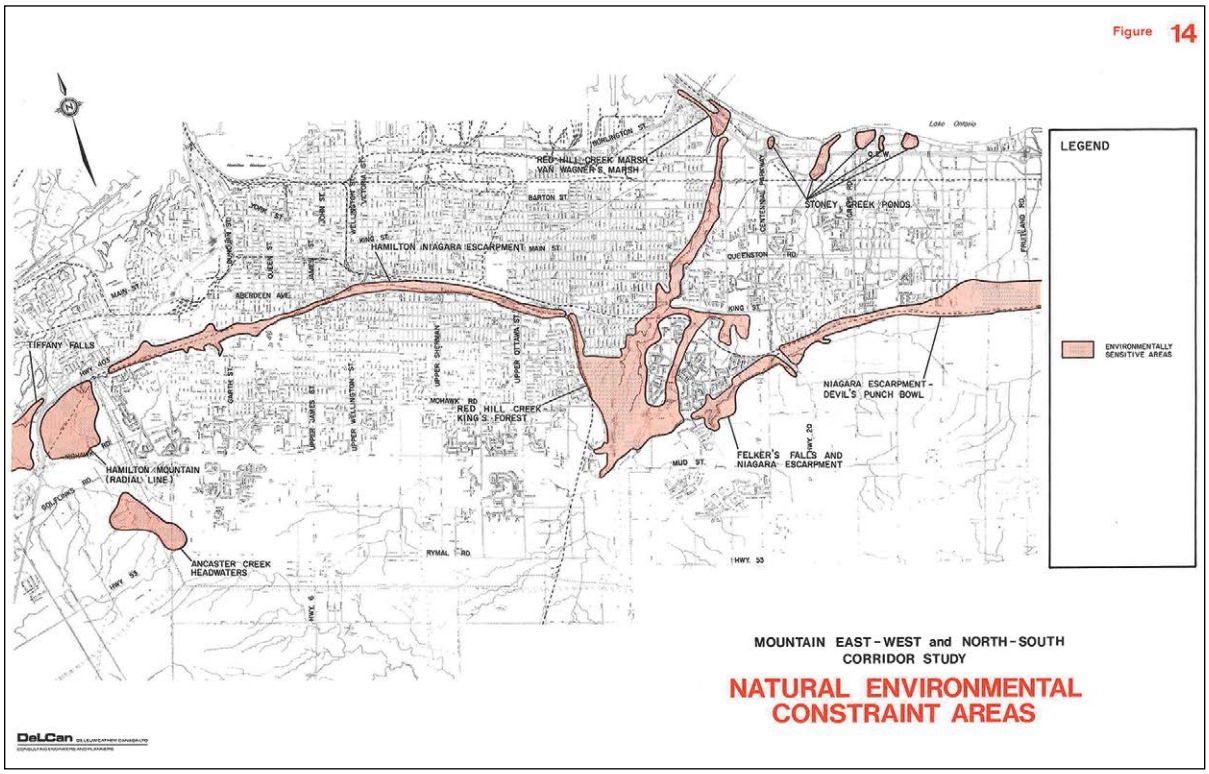
The RHVP is named for the geographic area it traverses: the Red Hill Valley (the "Valley"). The RHVP path closely follows that of the Valley, which is situated within the Niagara Escarpment. The Valley is an environmentally sensitive area that is home to numerous plant and animal species, woodlands, the Red Hill Creek, and recreational and scenic areas. Today, the RHVP is surrounded by forested areas, parks, and recreational hiking and walking trails. Much of the RHVP is contained in the open public space of the Valley, although the parkway also borders residential areas in Hamilton.

From the time of its conception, the RHVP was seen to have the potential to cause significant environmental effects. Protection and preservation of the Valley and the surrounding natural environment was an important factor during the planning, design, and construction phases of the Red Hill Valley Project (the "RHV Project" or the

"Project"). Environmental considerations and concerns extended across all levels of government.

Figure 2a was prepared as part of the 1982 "Mountain East-West and North-South Transportation Corridor Environmental Assessment Submission", and illustrates the environmentally sensitive areas in which the RHVP and the LINC were eventually constructed. Environmental constraint areas included areas that were deemed to be particularly sensitive to the impacts of construction and areas of significance relating to geological or topographical formations, vegetation communities, and wildlife populations.

Figure 2a: 1982 Map for the Mountain East-West and North-South Transportation Corridors



It is also important to highlight that the City is situated upon the traditional territories of the Erie, Neutral, Huron-Wendat, Haudenosaunee, and Mississaugas. A joint stewardship board ("JSB") between the City and the Haudenosaunee was established in 2005, during the construction of the RHVP, and remains in existence today. The JSB is comprised of six members: three City representatives and three Haudenosaunee representatives.

In its early days, the JSB's purpose was to implement various agreements related to the Valley signed by the City and the Haudenosaunee during the pre-construction period. Today, the JSB's goal and overarching purposes are joint stewardship and environmental guardianship of the Valley.

2.2.2. Major Events in the Pre-Construction Era

Over 50 years passed between the time of the RHVP's conception and its opening to the driving public in November 2007. A consultation report prepared during the planning stage described the freeway as "one of the most controversial development projects in Hamilton's history."

The idea of constructing a transportation corridor within Wentworth County (later the Region) to connect the road system south of the Niagara Escarpment (the QEW) to the road system north of the Escarpment (now Highway 403) dates to the mid-1950s. Proponents of the transportation corridor considered it a vitally important component to the continued economic and social growth of the region. However, support for the transportation corridor was not unanimous and opposition to the roadway project existed from the outset.

Initial planning for the transportation corridor contemplated a single roadway system comprised of two sections: an east-west roadway (which became the LINC) and a north-south roadway (which became the RHVP). The east-west and north-south sections largely existed as a single project until 1990, when, as addressed below, the parkways' paths diverged.

In December 1982, the Region filed a two-volume Environmental Assessment ("EA") submission for the transportation corridor. The EA submission documented the findings and conclusions of the need for the expansion of the Region's road system, the scope and timing of the work, and the potential social, economic, and environmental impacts of roadway expansion (among other considerations). As part of the EA submission, the Region sought approval to build the continuous roadway east-west and north-south to connect the QEW and Highway 403, which was the preferred option over alternatives set out in the EA.

In October 1985, the EA was approved by a joint panel of the Ontario Environmental Assessment Board and the Ontario Municipal Board. The panel ordered the various provincial agencies to issue all relevant and necessary approvals and permits for the road's construction.

In 1987, the Ontario provincial government endorsed the approval of the transportation corridor. Provincial funding for the project was granted the same year.

After the project was approved, a Preliminary Design Report ("PDR") was prepared in 1990. The 1990 PDR covered the entire transportation corridor and addressed anticipated design elements for both the east-west and the north-south sections. Design elements for the north-south section are discussed later in this chapter.

Also in 1990, project construction was initiated at various locations in the Valley. However, construction activities for the north-south section did not last long. Construction was halted later in 1990, after the newly elected provincial government withdrew funding for that section of the road. Funding was not withdrawn for the east-west section; this was the point at which the paths for the east-west LINC and the north-south RHVP diverged.

The LINC is a four lane, 12 km roadway, which has a relatively straight and flat geometry. Construction of the LINC was completed in October 1997, and the road opened to the driving public on October 15, 1997. The LINC was subsequently extended, from Dartnall Road to Mud Street, by construction which was completed in July 1999.

In 1995, a new provincial government reinstated funding for the north-south section. Around this time, the Region undertook an extensive redesign of the north-south section and engaged in extensive consultations with technical experts and the public.

In 1999, the federal government subjected the north-south portion to a panel review under the *Canadian Environmental Assessment Act* ("CEAA"). The Region commenced litigation in response in the Federal Court of Canada, and was ultimately successful in arguing that it was too late for the CEAA to be applied. The litigation related to the panel review ended in 2002.

The City restarted work on the north-south section the same year. Major tasks at that time included preparing an updated roadway design, completing the various assessments of roadway impacts (in consultation with the design team and related consultants), and finalizing several technical studies and reports, many of which related to environmental and ecological considerations. In 2003, after 13 years of delay, construction activities restarted on the RHVP. Another four years passed before the RHVP opened to the public in November 2007.

The revised design of the RHVP and events related to its construction between 2003 and November 2007 are described in detail later in this chapter.

2.2.3. The MTO: A Neighbour and a Funding Partner

The RHVP and the MTO-owned and maintained QEW are joined by an interchange at the northern end of the RHVP, toward Lake Ontario. Vehicles travelling northbound on the RHVP exit onto the QEW via the RHVP/QEW interchange to travel either eastbound or westbound. Similarly, vehicles travelling on the QEW use the RHVP/QEW interchange to exit onto the RHVP to travel southbound.

Various agreements existed between the MTO and the Region, later the City, regarding the division of responsibility and costs for the RHVP and the RHVP/QEW interchange projects.

In October 1998, the MTO and the Region signed a funding agreement in which the MTO agreed to contribute 60% of the total project costs for the RHVP project, up to a maximum of $106.75 million. The October 1998 funding agreement also established that the MTO was financially responsible for the design and construction of the RHVP/QEW interchange.

Pursuant to this agreement and a supplemental agreement executed in 2005, the MTO issued and oversaw all contracts and the related work for the design and construction of the RHVP/QEW interchange. The MTO's work occurred concurrently with the City's construction of the RHVP. Dufferin was the paving contractor for both projects. The RHVP/QEW interchange was also paved with SMA as the surface course. The interchange opened to traffic sometime in or about late 2008 or early 2009, approximately one year after the RHVP opened.

By March 2005, the MTO had fulfilled its $106.75 million funding commitment to the City. It is important to note that, although the MTO and the City worked collaboratively toward the shared goals of opening the RHVP and the RHVP/QEW interchange, the MTO's involvement in the RHVP was solely financial. The City retained full control over, and responsibility for, the design and construction of the RHVP. The RHVP is, and remains, a municipal freeway, not a provincial freeway.

I pause to note that neither the City nor its predecessor, the Region, had other experience in designing and building high speed, high volume freeways. The RHVP and the LINC remain the only freeway infrastructure projects built by the City. This contrasts with the MTO, which has constructed a provincial highway network that spans the entire province of Ontario.

2.3. Oversight of and Involvement in the RHVP Project

2.3.1. Special Projects Office

In the 1980s, the Region established a Special Projects Office to oversee major projects, including the north-south and east-west transportation corridor project. The Special Projects Office was an office of the Region. It was disbanded in 2001 upon amalgamation.

The Special Projects Office oversaw the planning, design, and construction of the LINC and the LINC extension, completed in 1997 and 1999, respectively. The Special Projects Office also oversaw the planning and design in the 1980s and 1990s of what became the RHVP.

The Inquiry received limited evidence about the day to day functions of the Special Projects Office and the roles and responsibilities of its staff, apart from the evidence of Gary Moore.

Mr. Moore joined the Region as a project engineer in May 1988. He was subsequently promoted to Senior Project Engineer for the transportation corridor project. From 1993 to 2001, Mr. Moore was the Manager of the Special Projects Office. Beginning in 2002, Mr. Moore served as the Manager of Design for the RHV Project Office. In

all, by the time the RHVP opened to the public in November 2007, Mr. Moore had therefore been involved with the RHVP for almost 20 years.

At the Inquiry hearings, Mr. Moore testified that staff in the Special Projects Office worked as a team, both internally and with technical consultants retained by the Office. Other key staff in the Special Projects Office were:[2] John van der Mark (Director in Charge of Special Projects, Special Projects Office, Regional Municipality of Hamilton-Wentworth); Chris Murray (Environmental Planner, Special Projects Office, Regional Municipality of Hamilton-Wentworth, beginning in 1995); and Marco Oddi (Project Manager, Special Projects Office, Regional Municipality of Hamilton-Wentworth, 1991 to 2001). Mr. Oddi reported to Mr. Moore who, in turn, reported to Mr. van der Mark.

2.3.2. RHV Project and RHV Project Office

The City adopted the motto “More than a Road” for the RHV Project. The intent of the motto was to encapsulate all the work undertaken in the Valley as part of the RHV Project. According to a 2010 City presentation, the major elements were:

- construction of the RHVP;
- a 7 km realignment project for the Valley;
- construction of a stormwater management system;
- installation of a 2.9 km combined sewer overflow pipe; and
- establishment of an Environmental Management Plan and a Landscape Management Plan.

Only the first element — the construction of the RHVP — is pertinent for the Inquiry’s purposes. It is, however, important to remember the broader context in which the RHVP came to be. The RHVP was only one piece of the City’s overall RHV Project, albeit a very large piece.

[2] This is not a comprehensive list of all staff in the Special Projects Office. The above-listed staff are those who the Inquiry understands to have been centrally involved in RHVP design and construction from the early 1990s onwards.

In late 2002, when the work restarted on the north-south roadway, the City established an RHV Project Office to oversee the RHV Project. Initially, from 2002 to 2003, the RHV Project Office was a division within the City's Transportation, Operations & Environment department, and in 2003, became a division within the Public Works department. The RHV Project Office's responsibilities included design and construction of the various infrastructure aspects of the project (road, water, and wastewater), project-related communications, project finance, and administration.

Members of the RHV Project Office included Mr. Murray, the Project Director; Mr. Moore, the Manager of Design; and Mr. Oddi, the Senior Project Manager. Their respective roles and responsibilities, as well as key details pertaining to the project scope, objectives, and strategy, were set out in a RHV Project Charter prepared in early 2003, and are summarized below:

- **Mr. Murray, Project Director:** In this role, Mr. Murray was the RHV Project leader. He was responsible for "the initiation, planning, execution and control of the total Project effort", and held the authority for day-to-day decision-making for the Project's operations. Mr. Murray was also the liaison between the Project team and Hamilton City Council ("Council"), the media, and external stakeholders. As noted below, Mr. Murray left the Project Director position in June 2007, shortly after paving of the RHVP began.

- **Mr. Moore, Manager of Design:** In this role, Mr. Moore was the head of the RHV Project team's technical arm. Among other responsibilities, commencing in 1990, Mr. Moore (in conjunction with other members of the RHV Project team and Project consultants) was involved in developing the RHVP preliminary design. In addition, Mr. Moore oversaw the preparation of the detailed design drawings by the City's consultants. He held a similar role for the design and construction of the LINC mainline and the LINC extension. Between 2002 and 2007, Mr. Moore held the Manager of Design position in the RHV Project Office concurrently with his home position as Manager of Design in the Capital Planning and Implementation division of the Public Works department of the City. Mr. Moore split his time between these roles on a variable basis, depending on the work ongoing at the time. In his testimony, Mr. Moore estimated that in some years, he spent 30% to 40% of his time on the RHV Project; in other

years, likely in earlier phases, Mr. Moore spent over 50% of his time on the Project.

- **Mr. Oddi, Senior Project Manager:** In this role, Mr. Oddi reported to Mr. Moore, and assisted Mr. Moore in managing and administering the design and construction of various infrastructure components. Mr. Oddi's involvement spanned all stages of the RHV Project, from the preliminary engineering and detailed design stages through to putting contracts out for tender and construction administration.

Both Mr. Moore and Mr. Oddi were licenced professional engineers with backgrounds in civil engineering. Mr. Murray's background was in urban and environmental planning, rather than engineering. Accordingly, Mr. Murray relied on Mr. Moore and Mr. Oddi, as well as consultants the City retained, to make technical civil engineering decisions on the Project, including the decisions pertaining to the RHVP pavement design and the related specifications discussed later in this chapter.

2.3.3. Council Oversight

Council had oversight responsibilities for the RHV Project, including on matters related to the overall project budget and cost. However, it is apparent that City staff made all of the day to day and technical decisions related to the Project. Councillor Sam Merulla (Ward 4, Hamilton), a former Councillor and member of the Public Works Committee ("PWC") and Parkway Implementation Committee ("PIC"), testified that Council gave staff a significant amount of discretion to make decisions pertaining to the Project. This is consistent with the evidence of Mr. Murray, Mr. Moore, and Mr. Oddi.

The RHV Project Office provided updates, provided recommendations, and made requests to Council via staff reports submitted to the PWC.[3] The PWC was at the time, and remains today, a standing subcommittee of Council. On occasion, the RHV Project Office and the Budget & Finance division (of the City's Corporate Services department) submitted joint reports to the PWC related to procurement or budget.

[3] Between 2004 and 2006, the Public Works Committee was named the Public Works, Infrastructure & Environment Committee. The renamed Public Works Committee was established in 2006.

As of at least February 2005, Mr. Murray submitted monthly information update reports about the RHV Project to the Mayor and Council. In his testimony, Mr. Murray clarified that, although the reports were written and submitted under his name, they were a collective effort of the various members of the RHV Project Office. Topics covered in the information updates ranged from contract award details, the progress of the construction, and updates on the construction and paving scheduling. The reports were purely informational and did not contain requests or recommendations requiring Council decisions.

2.3.4. Expressway/Parkway Implementation Committee

In April 2002, Council established the Expressway Implementation Committee, which, in June 2005, was renamed the Parkway Implementation Committee to coincide with the renaming of the north-south roadway from the Red Hill Creek Expressway to the Red Hill Valley Parkway.

The PIC was a sub-committee of the PWC; the PIC reported to the PWC, which in turn, reported to Council. A March 2002 staff report to the Mayor and Council described the intended purpose of the PIC as:

> to address community issues and provide overall guidance and advice to staff on the implementation of the detailed design and construction phases of the Expressway. The composition of the Committee may consist of Councillors whose wards are directly impacted by roadway construction (i.e., Wards 4, 5, 6 and 9) and those that are indirectly affected.

The PIC met periodically from 2002 until it was disbanded in 2014. PIC meeting records reflect that PIC meetings were a forum for staff, including RHV Project staff, to give presentations and provide project updates, for PIC members to ask questions, and to engage with members of the public. At the Inquiry, Mr. Murray testified that his interactions with the PIC were largely to provide updates on the progress of the project. According to Mr. Murray, PIC meetings:

> afforded the project office an opportunity to understand any specific issues or concerns that individuals had based in conversations that were being held with the constituents…It was an effective way to

> communicate with those…directly and somewhat indirectly affected by the project.

The evidence before the Inquiry is that the PIC did not exercise any decision making role with respect to the RHV Project. PIC members were not involved in any decisions about technical or engineering aspects of RHVP design and construction. While that is somewhat at odds with the PIC's intended purpose set out in the March 2002 staff report, in practice, the PIC's main function was responding to public concerns and complaints related to or arising from RHVP construction and use. Many of these concerns and complaints pertained to noise and air pollution arising from the construction and ongoing operation of the RHVP. The PIC continued to serve this function after the RHVP opened to the public in November 2007, and did not address operational safety issues.

2.4. RHVP Design and Geometry

2.4.1. Preliminary RHVP Design

As noted above, preliminary design for the RHVP (and the LINC) began in the late 1980s and early 1990s. The original PDR, prepared in January 1990, included the design for both the north-south RHVP and the east-west LINC. The design was based on the MTO's 1985 Geometric Design Standards for Ontario Highways (the "MTO Design Guide"), as described in detail in Chapter 1.[4]

The Region made significant changes to the north-south roadway design during the 1990s. This was also the period when provincial funding was withdrawn and then subsequently reinstated. A 2010 City presentation described these changes as "an extensive re-design…to lessen its environmental impacts and to look for ways to maintain and enhance the natural environmental in the Red Hill Valley." The redesign was completed some time before 1999, but was put on hold pending the above-noted CEAA panel review.

[4] As discussed in Chapter 1, the 1985 MTO Design Guide is instructive for, but not binding on, Ontario municipalities.

Subsequent drafts of the RHVP PDR were prepared once the RHV Project work restarted in 2002. The Inquiry received draft PDRs dated February 2003 and November 2003 and two sections of a draft Design Report dated January 31, 2006.[5] [6] Mr. Moore and Mr. Oddi testified that the subsequent PDR drafts, which do not list authors, were compiled through joint efforts of City staff and the City's consultants. They were intended to be read in conjunction with the January 1990 PDR. Neither a final PDR, nor a complete or final Design Report were produced to the Inquiry.

Figure 2b summarized and compares certain design elements and features of the RHVP set out in the various PDRs (January 1990, February 2003, November 2003) and the January 2006 draft Design Report. There were changes and revisions as between the February 2003 and November 2003 PDR drafts; however, the documents are identical as they pertain to the features below. The draft Design Report also incorporated many of these design elements, although some elements were not included in the sections the Inquiry received. The design features not included in the draft Design Report are identified in the footnotes. The below-listed design features are also discussed in more detail in the sections that follow.

Figure 2b: Red Hill Valley Parkway Preliminary and Design Reports: 1990, 2003, and 2006

Design Feature	January 1990 PDR	February/November 2003 PDRs and January 2006 Design Report
Applicable Design Guidelines	"Roadway design criteria conforming to those in the M.T.O. Geometric Design	"Roadway design criteria conforming to those in the MTO Geometric Design

[5] The produced sections of the January 2006 draft Design Report were the "Introduction" and "Engineering Design" sections.

[6] A document prepared by Gord McGuire (then Director, Engineering Services, Public Works, Hamilton) in January 2019 refers to a "2008 final Engineering Design document authored by Pam Hubbard" and excerpts content related to the RHVP perpetual pavement design and SMA surface course. The document Mr. McGuire referred to was not in evidence before the Inquiry, nor is it clear that this document was produced to the Inquiry.

Design Feature	January 1990 PDR	February/November 2003 PDRs and January 2006 Design Report
Applicable Design Guidelines	Manual have been adopted for this Project. The Ontario Provincial Standard Drawings (OPSD) and Specifications (OPSS) will be used for the design of roadways and structures."	Manual have been adopted for this Project. The Ontario Provincial Standard Drawings (OPSD) and Specifications (OPSS) will be used as a guide for the design of roadways and structures."
Number of Lanes	6 lane roadway	Basic 4 lane roadway, with grading for future expansion to basic 6-lane roadway[7]
Interchange Spacing	"The spacing of interchanges in the north-south corridor was based on optimizing traffic distribution. Since the major east-west arterials in the Lower Mountain Area are located much closer than 3 km, appropriate design measures have to be taken to provide adequate weaving distances between ramps."	"As per the original plan interchanges will be located at Mud Street/Trinity Church Road, Greenhill Avenue, King Street, Queenston Road and Barton Street. The design of these interchanges has been changed to improve traffic operations or environmental features and/or to accommodate the relocation of the Red Hill Creek and Red Hill Valley trail."[8]

[7] The January 2006 draft Design Report produced to the Inquiry does not include a section related specifically to roadway lanes. As it pertains to the number of lanes, the draft states: "roadway will be marked as four lanes plus auxiliary lanes".

[8] The January 2006 draft Design Report produced to the Inquiry does not include a section related to interchange spacing.

Design Feature	January 1990 PDR	February/November 2003 PDRs and January 2006 Design Report
Pavement Design	Use of Dense Friction Course was "preferred"	"Modified HL1 or an SMA…. are being considered for the surface or wearing course asphalt mixes."
Illumination	"Full illumination is warranted for the North-South Freeway, except for the section between Mud Street and Greenhill Avenue. However, full illumination in this section would improve safety related to: – the truck climbing lane; – the high embankments; and – the section between two illuminated interchanges. High mast lighting is considered appropriate along the North-South Freeway for economic reasons. This lighting might cover part of the cross streets with the remainder to be illuminated by conventional lighting."	"Only partial illumination with be provided, i.e. at interchange ramps and City streets only." "Only partial illumination will be provided, i.e. decision noses at interchange ramps and City streets only. The illumination will be designed according to IESNA and Provincial standards, and City of Hamilton requirements. The four pole arrangement successfully used on the LINC will be used on the North-South."

Design Feature	January 1990 PDR	February/November 2003 PDRs and January 2006 Design Report
Maximum Superelevation	6%	6%
Grades	Minimum (desirable): 0.5% Maximum upgrade: 5% Maximum down grade: 7.0%	Minimum (desirable): 0.5% Maximum upgrade & downgrade: 4.0%
Minimum Curve Radius	420 m	420 m
Posted Speed	90 km/h	90 km/h
Design Speed	Not referenced	100 km/h

2.4.2. Detailed RHVP Design

The preliminary design phase is typically followed by the detailed design phase. For the RHV Project, this occurred in the period of 2006 to 2007. Detailed design can colloquially be considered the refinement phase of a project; it is at this stage that the project's preliminary design is refined, construction plans and design specifications are established, and a list of materials and their associated cost(s) are prepared.

Detailed design work for the RHVP was split into four parts: Parts A, B, C, and D. Detailed design drawings were prepared for each part. The detailed design drawings for the RHVP and the design elements depicted on them — such as the radius and superelevation of curves — were based on parameters considered during the preliminary design phase.

Parts A, B, and C pertained to roadway and ramp design, and Part D set the parameters for other roadway and roadside features. Three consulting engineering firms prepared the four detailed designs, as follows:

A. Stantec designed Part A, which extended from the Mud Street interchange to south of Greenhill Avenue;

B. Philips Engineering ("Philips") designed Part B, which extended from south of Greenhill Avenue to Queenston Road;

C. McCormick Rankin designed Part C, which extended from Queenston Road to the RHVP/QEW interchange; and

D. Stantec designed Part D, which included design details for signage and pavement markings, stormwater management, and landscaping details for the entire length of the RHVP.

The City issued "for tender" and "for construction" versions of detailed design drawings. The drawings marked "for tender" were not dated but would have been prepared sometime prior to the issuance of the tender in May 2006. The drawings marked "for construction" were stamped in June 2006, shortly after the RHVP tender closed. The City issued only a partial set of "as-constructed" (or "as-built") drawings. As-constructed drawings are intended to show the details of the built infrastructure and conditions on a roadway. The evidence before the Inquiry is that neither the City nor Dufferin (the RHVP paving contractor) prepared comprehensive as-constructed RHVP drawings. This is relevant for the issue of the superelevation of one RHVP mainline curve, discussed below.

It is not necessary to make any findings about the reasons for the City's not issuing as-constructed drawings. I do, however, observe that the challenge of not having such drawings is that there is no representation of, or insight into, the actual conditions and features on the RHVP, including in particular any deviations from the contractual design elements, or of any irregularities that may have occurred during construction and paving.[9] I note, however, that there was no evidence of any such deviations or

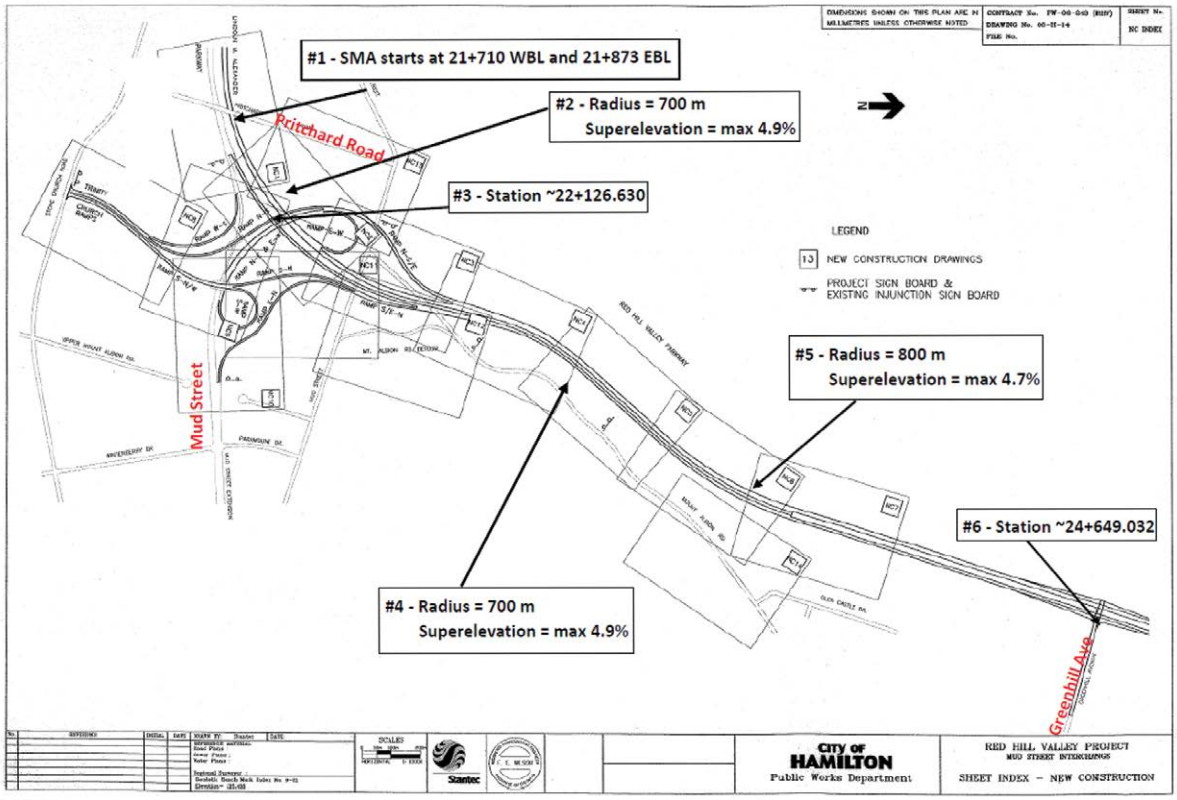
[9] The existence of an observed "kink" in the pavement markings on the curve that joined the LINC and the RHVP is an example of the type of construction irregularity described above, which is not reflected in any post-construction drawings. The "kink" was observed by City staff as a flat spot in the RHVP where there should be a pure circular curve. City staff discussed the kink in/around 2010 and it was also reviewed by CIMA in CIMA's 2013 safety review of a portion of the RHVP.

irregularities before the Inquiry apart from one matter discussed in the footnote above, a “kink” in the pavement markings on the curve where the RHVP and LINC joined.

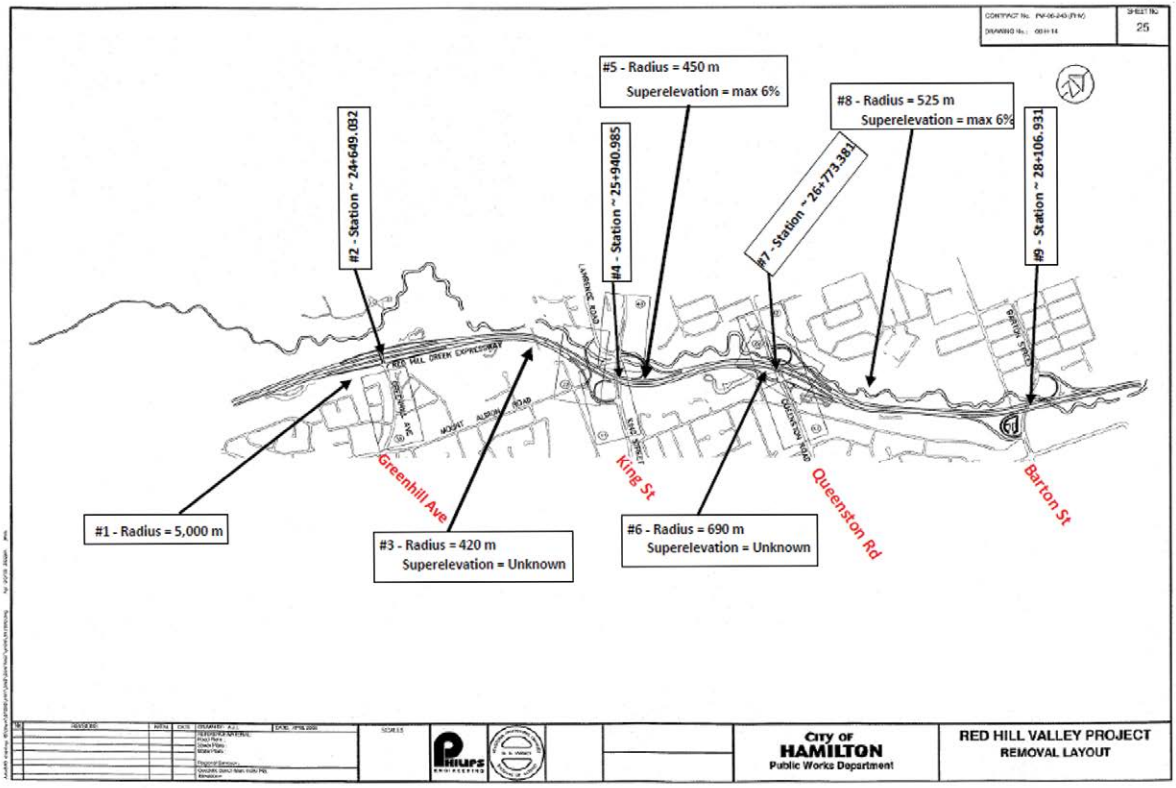
Annotated design drawings for Parts A, B, and C, set out in **Figure 2c**, were prepared during the Inquiry using the “for tender” versions. The only additions to the “for tender” drawings were the numbered boxes with arrows and the road names in red text. Taken collectively, Parts A, B, and C set out the detailed design for the entire 7 km length of the RHVP mainline, ramps, and interchanges. Certain geometric design elements depicted in these drawings are described further in the section that follows.

Figure 2c: Annotated RHVP Detailed Design Drawings, Parts A, B, C

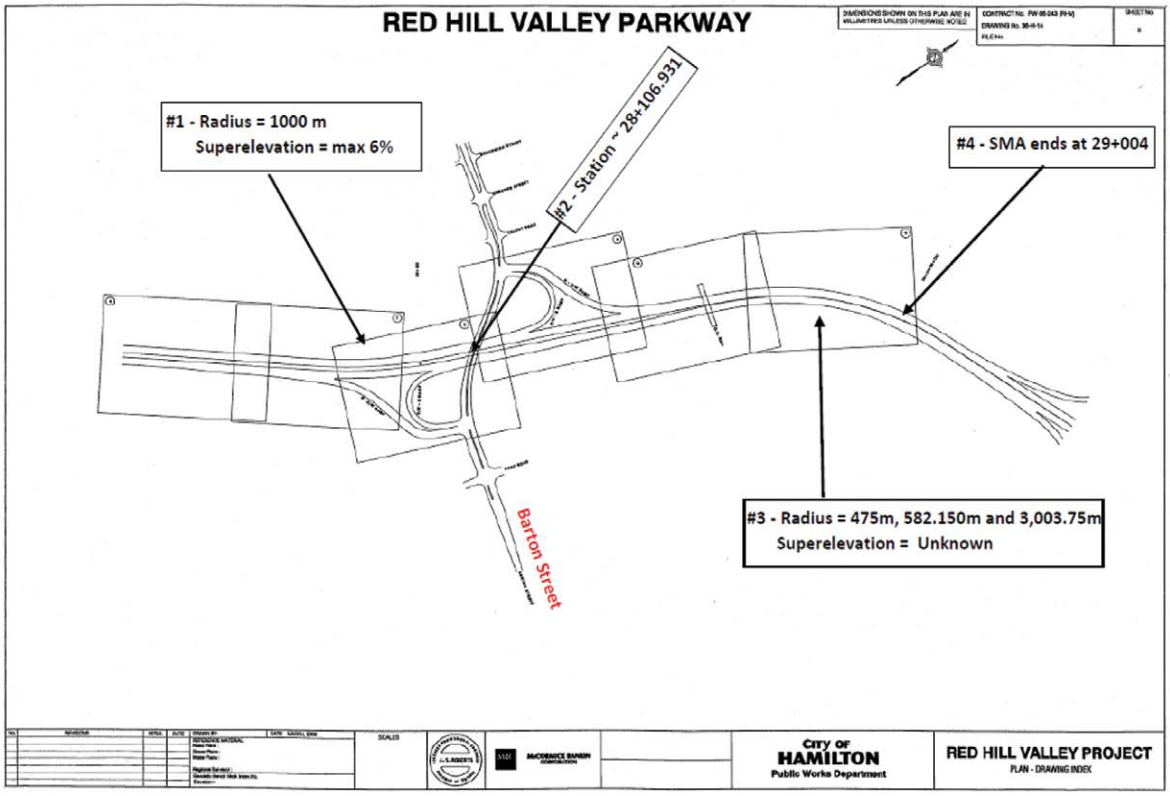
Part A - Stantec



Part B - Phillips



Part C - McCormick Rankin



2.4.3. Key Features of the RHVP's Design and Geometry

Certain design elements and geometric features on the RHVP can, in and of themselves, be challenging for motorists to navigate. Potential challenges for motorists are compounded when the various roadway features are experienced in combination. This is particularly so in the tighter, more constrained sections of the RHVP and in inclement weather and under non-daylight lighting conditions.

Key elements of the RHVP design — illumination, design and posted speeds, horizontal alignment and curvature, superelevation, and interchange spacing — are discussed below.[10] A detailed overview of general road and traffic safety considerations, including principles of and guidelines for highway design, is provided in Chapter 1. The significance of these design features and the RHVP's geometry for motorists who drive it is discussed in Chapter 12.

2.4.3.1. Illumination

The RHVP has non-continuous decision point lighting located at the exit ramp of each interchange. Accordingly, each RHVP exit ramp and their surrounding area(s) are lit, but ramps entering onto the RHVP and the RHVP mainline itself are not lit. The RHVP's lighting configuration is identical to the LINC's.

Non-continuous decision point illumination is consistent with what was contemplated in the 2003 PDRs and 2006 Design Report, which provided for partial illumination at interchanges. However, the non-continuous decision point illumination differs significantly from what was originally contemplated in the 1990 PDR, which found full illumination to be warranted for most of the north-south roadway. The 1990 PDR contemplated the use of high-mast lighting.[11]

---

[10] Russell Brownlee's expert reports, and the report of Dewan Karim (who is the Practice Lead of the Transportation Engineering & Safety Group at 30 Forensic Engineering), address additional elements of the RHVP design, in addition to those listed. The elements discussed in this chapter are, in my view, those that are central to the motorist experience. These expert reports are also discussed in Chapters 1 and 12.

[11] High-mast lighting consists of a tall pole with lighting attached to the top and pointing toward the ground.

During the period relevant to the Inquiry, Council was advised by City staff on various occasions that illumination on the RHVP mainline was prohibited or restricted by an EA conducted at the time provincial approvals were granted for construction of the RHVP. However, in 2019, as part of a lighting study conducted on the RHVP and the LINC (the "Lighting Study") described in Chapters 8, 9, and 11, CIMA identified that there was, in fact, no environmental assessment prohibition on RHVP lighting. CIMA stated the following in the Lighting Study report:

> [t]he review of the previous environmental studies found that there is no documentation, previous findings or recommendations in those reports that would preclude the implementation of continuous lighting along the facilities.

Environmental considerations and concerns inevitably shaped decisions regarding illumination on the RHVP during the design and approval phases. There is, however, an important distinction between an approval of a design that did not provide for mainline lighting, and an approval of a design that was based on an express prohibition or restriction of mainline lighting. The RHVP falls into the first category. In the circumstances of the RHVP, the omission of lighting from the various RHVP approvals did not amount to or arise from an outright prohibition. However, as CIMA found in the Lighting Study, a new Municipal Class EA would be required if the City wanted to implement lighting improvements, including the installation of continuous illumination, on the RHVP.

2.4.3.2. Design and Posted Speed

As discussed in Chapter 1, selecting a roadway design speed is a very significant decision in the roadway design process. The decision about design speed has an impact on other design features including the road and shoulder widths, horizontal and vertical curves, roadside design and protection, and traffic control devices, as set out in the industry design guidelines.

The RHVP has a design speed of 100 km/h. Until 2019, the entire RHVP mainline had a posted speed of 90 km/h and a 10 km/h differential in the design and posted speed of the RHVP. On February 16, 2019, Council reduced the posted speed limit from 90 km/h to 80 km/h on a portion of the RHVP, between Greenhill Avenue and the QEW. The posted speed limit remained at 90 km/h on the remainder of the RHVP (from Greenhill Avenue to Dartnall) until May 17, 2021, when Council reduced the speed

limit on the entire length of the RHVP to 80 km/h. This change aligned the difference between the RHVP's design and posted speeds to the desirable 20 km/h difference recommended by the 1985 MTO Design Guide as discussed in Chapter 1. The speed limit reductions are discussed in Chapter 11.

2.4.3.3. Curve Radii

The RHVP is a winding, curvy road. This will be evident to anyone who observes a map of the RHVP, and even more so to drivers on it. The RHVP curves uphill (when travelling southbound) and curves downhill (when travelling northbound) as it traverses the Niagara Escarpment and weaves through the Valley and the already-built surrounding urban areas and infrastructure.

For roads with a 100 km/h design speed, the 1985 MTO Design Guide specifies a 420 m minimum curve radius for horizontal curves and a maximum superelevation of 6%. All nine horizontal (side-to-side) curves on the RHVP mainline (depicted above in **Figure 2c**) meet the prescribed 420 m minimum curve radius in the 1985 MTO Design Guide. Eight curves exceed this minimum. **Figure 2d** below sets out the approximate location of each curve on the RHVP mainline and the radius of each.

Figure 2d: Curve Radii of RHVP Mainline Curves

RHVP Mainline Curves	Curve Radius
South of the Mud Street interchange	700 m
North of the Mud Street interchange	700 m
South of the Greenhill Avenue interchange	800 m
South of the King Street interchange	420 m
North of the King Street interchange	450 m
South of the Queenston Road interchange	690 m
North of the Queenston Road interchange	525 m
South of the Barton Road interchange	1000 m
North of the Barton Road interchange	575 m

It is important to note that the section near the King Street interchange has the two tightest curves: the 420 m curve south of the King Street interchange and the 450 m curve that runs through and north of the King Street interchange. These curves are at (420 m) and only slightly above (450 m) the 1985 MTO Design Guide minimum, and they follow one after the other, without a tangent (straight) section between them. The 450 m curve runs directly into a third much larger 690 m radius curve immediately to its north.

2.4.3.4. Superelevation

Superelevation specifications for the RHVP curves were included in the Parts A, B, and C detailed design drawings at **Figure 2c**, above.

Stantec's Part A drawing included maximum superelevation information for each of the three curves included in Part A (from Pritchard Road to Greenhill Avenue). The superelevation for the three curves north and south of the Mud Street interchange and south of the Greenhill Avenue interchange were either 4.7% or 4.9%.

Philips' Part B drawing and McCormick Rankin's Part C drawing specify a maximum superelevation of 6% for curves to the left (when travelling northbound). The 6% maximum superelevation is consistent with the maximum contemplated in the RHVP preliminary design documents. However, the Parts B and C drawings do not include information about the superelevation for right curves (right when travelling northbound).

The absence of certain superelevation information was also raised with witnesses during the Inquiry's public hearings. David Hainer (Site Supervisor, Dufferin), who was Dufferin's Senior Project Superintendent on the RHVP paving project, testified about his experience with specifications for superelevation. In Mr. Hainer's experience, superelevation information is typically included in grading templates, rather than in design drawings. Contractors use the grading template specifications, including the various superelevations, to construct the roadway.

Mr. Hainer's experience provides useful context. However, I am unable to reach any conclusions on whether the Part B and C right curve superelevations were included in the grading templates because no RHVP grading templates were produced to the Inquiry. Accordingly, there is an evidentiary gap as it relates to the superelevation of some right curves on the RHVP.

There is a potential significance to the absence of the superelevation information. As described in Chapter 1, the 1985 MTO Design Guide specifies a minimum curve radius of 420 m and a maximum superelevation of 6% for roads with a 100 km/h design speed. In the northbound direction, there is no superelevation provided for the 420 m radius right curve south of the King Street interchange. This curve meets the 1985 MTO Design Guide standards only if the superelevation is 6%; if the superelevation is less than 6%, the curve does not meet the minimum design requirements of the MTO Design Guide.

2.4.3.5. Interchange and Ramp Spacing

The RHVP includes six interchanges, which are as follows, from south to north: Dartnall Road, Mud Street, Greenhill Avenue, King Street, Queenston Road, and Barton Street. The 1990 PDR indicates that the interchanges and their respective spacing were determined based on “optimizing traffic distribution” and on existing arterial roads in the Lower Mountain area.

All but one of the RHVP interchanges are spaced closer than the 2 km minimum recommended in the 1985 MTO Design Guide. While such deviations are not uncommon with urban freeways where there are existing arterial roads and traffic patterns to be accommodated, the only exception on the RHVP is the spacing between the Mud Street and Greenhill Avenue interchanges, which is 2.5 km. RHVP interchange spacing is illustrated in **Figure 2e**.

Figure 2e: RHVP Interchange Spacing

RHVP Interchanges	Distance Between Interchanges
Dartnall Road to Mud Street	1.152 km
Mud Street to Greenhill Avenue	2.522 km
Greenhill Avenue to King Street	1.292 km
King Street to Queenston Road	0.832 km
Queenston Road to Barton Street	1.334 km

The 1985 MTO Design Guide also recommends a minimum distance of 600 m between ramps on a freeway (also called “weaving distance”). Most of the ramps on the RHVP are spaced farther apart than the minimum recommended (600 m), but three of them are less than the recommended minimum:

- 500 m between Greenhill Avenue and King Street, travelling northbound;
- 550 m between King Street and Queenston Road, travelling northbound; and
- 415 m between King Street and Queenston Road, travelling southbound.

These locations correspond with the two curves with the tightest radii (described above) and with two of the three closest spaced interchanges – between Greenhill Avenue to King Street and King Street to Queenston Road, which at 0.832 km, are spaced less than half of the minimum recommended distance.

The 1985 MTO Design Guide requires that measures be taken to address the effects of closely spaced interchanges. One measure is to simply exclude an interchange (which is more a matter of eliminating the issue than addressing it). Others involve combining interchanges or configuring them in something other than the typical partial cloverleaf fashion seen on the LINC interchanges (consisting of six ramps with, in each direction, one off ramp, followed by one circular on ramp and a second non-circular on ramp).

In the case of the King Street and Queenston Road interchanges, a measure taken appears to have been to use one non-circular off ramp and one circular on ramp in each direction rather than the typical two on ramps, resulting in longer spacing between those ramps themselves as well as between those ramps and the ramps of the adjacent interchanges.

In the case of the Greenhill Avenue interchange, an entirely different interchange design was used because of geographic constraints. The Greenhill Avenue interchange has no circular ramps at all and only one on and off ramp in each direction. This produced the short 500 m weaving distance between the Greenhill Road northbound on ramp and the King Street northbound off ramp.

2.4.4. Bringing the Design and Geometry Elements Together: High RHVP Friction Demand and Potential Driver Expectancy Violations

A number of the elements discussed above contribute to elevated friction demand in the area that includes the 420 m radius curve between Greenhill Avenue and King Street, the 450 m radius curve that traverses the King Street interchange, and the 690 m radius curve that traverses the Queenston Road interchange. The concept of friction demand is discussed in Chapter 1.

These three sequential curves interact with other challenging design elements. They traverse the most closely spaced interchanges and ramps, and the 420 m radius curve south of the King Street interchange has undetermined superelevation (which could be significant). At the same time, the 90 km/h posted speed on a road with a 100 km/h design speed was less than the desirable 20 km/h recommended speed differential.

The following describes the journey through the Greenhill Avenue to Queenston Road area, going both northbound and southbound:

Northbound

After a driver passes the Greenhill Avenue interchange, they enter the 420 m radius right curve (the tightest on the RHVP, with undetermined superelevation) within which is the 500 m weaving area between the Greenhill Avenue and King Street ramps (the second shortest on the RHVP). While navigating the curve and weaving area, the driver passes under the CP railway bridge immediately before reaching the King Street off ramp.

After passing the King Street off ramp, the driver leaves the 420 m radius right curve and enters the 450 m radius left curve (second tightest on the RHVP) as they pass under the Mt. Albion Road bridge. Immediately after that, before the midway point of the curve, the driver passes underneath the King Street overpass and encounters the traffic entering from the King Street on ramp. The weaving section begins immediately after the King Street overpass. The distance between the Greenhill Avenue interchange, where this journey started, and this point at

the King Street interchange is 1,292 m (708 m shorter than the recommended minimum 2 km interchange spacing).

The next stage of the journey is between the closest spaced interchanges on the RHVP — King Street to Queenston Road — which are 832 m apart (1,168 m closer than the recommended minimum). After the King Street overpass and on ramp, the driver continues through the 450 m left curve (described above) and at its conclusion immediately enters the 690 m right curve while navigating the 550 m weaving distance between the King Street on ramp and Queenston Road off ramp (the third shortest on the RHVP). After the Queenston Road off ramp, the right curve crosses under the Queenston Road overpass before transitioning to its north into a 525 m radius left curve.

Southbound

The driver passes the Queenston Road overpass and on ramp at the same time they are in the midst of navigating the 690 m left curve. Traffic enters the mainline from the Queenston Road on ramp, and the weaving section begins underneath the overpass. The 690 m curve itself is much larger than the minimum recommended radius, but the distance between the Queenston Road and King Street interchanges (832 m) and the weaving distance between their ramps (415 m) are both the shortest on the RHVP.

Between Queenston Road and King Street, at approximately the location of the King Street off ramp, the driver exits the 690 m radius left curve and enters the 450 m radius right curve (second tightest on the RHVP). The driver continues through that right curve as they pass underneath the King Street overpass and encounters the traffic entering from the King Street on ramp. The weaving section begins underneath the King Street overpass.

Shortly after that, the driver passes under the Mt. Albion Road bridge, exits the 450 m radius right curve and enters the 420 m radius left curve (the tightest on the RHVP, with undetermined superelevation). Although the weaving distance between the King Street on ramp and the Greenhill Avenue off ramp is far above the minimum recommended 600 m, the distance between the King Street and Greenhill Avenue interchanges themselves is 1,292 m (708 m shorter than the

recommended minimum 2 km spacing between interchanges). While navigating the curve, midway through the weaving area, the driver passes under the CP railway bridge. After that, the driver reaches the Greenhill Avenue off ramp and then the Greenhill Avenue overpass itself.

Considering these features together as a driver would experience them, it is evident that the design of the RHVP section from Greenhill Avenue to Queenston Road is particularly challenging; this area brings together closely spaced interchanges and weaving sections in succession with tight curves that motorists need to navigate and, prior to the speed reduction, an atypical but permissible difference between posted and design speed. Individually and collectively, these elements of the RHVP design may result in expectancy violations for some drivers leading to poor decision making, and there is a correlatively higher friction demand required for execution of maneuvers in the area between Greenhill Avenue and Queenston Road.[12]

As discussed in more detail in Chapter 12, this area exhibited a high number of collisions and an abnormally high proportion of wet surface collisions.

2.5. Laying the Foundation: Pre-Paving Stages of RHVP Construction

2.5.1. Decision to Use SMA for the Surface Course

The surface course of the RHVP mainline is SMA. At the time of RHVP construction, SMA was not a new technology, having been developed in Germany in the 1960's and introduced into North America in the early 1990's. However, SMA was still a relatively new pavement technology in Ontario, having only been introduced by the MTO as a premium surface course mix in 2002, following a test placement on Highway 401 in 1996. The technical features of SMA generally and its use in Ontario specifically are discussed in Chapter 1.

The evidence the Inquiry received suggests that a preliminary decision to use SMA for the RHVP surface course was made no later than 1999. That decision could have

[12] The geometry of the area is reflected in the annotated Part B drawing excerpted earlier in **Figure 2c**.

been revisited subsequently, but by 1999, the clear intention was to use SMA. Notes from a June 1999 meeting attended by Mr. Moore, then the Manager of the Special Projects Office, reflect discussion of certain RHVP design criteria, including that the pavement was to be SMA. Also in 1999, at Mr. Moore's direction, the City placed an SMA trial section on Burlington Street (an arterial road). One of the purposes of the Burlington Street SMA trial was to assess the potential use of SMA on the RHVP.

Subsequently, the draft 2003 PDR also contemplated use of SMA for the surface course with an HL-1 mix as the alternative surface course. The draft 2003 PDR noted various benefits of SMA, including resistance to rutting and cracking, lower noise generation, improved surface texture, and improved skid resistance. The draft 2003 PDR also noted the 5% to 8% premium cost for SMA over HL-1.

While the intention to use SMA went back to 1999, the City's definitive decision to use SMA appears to have been made some time in 2005. This conclusion is supported by three events that occurred in 2005:

- At the direction of Mr. Moore, Dr. Uzarowski of Golder prepared a Perpetual Pavement Feasibility Study for the RHVP. Both pavement designs used in the study (perpetual pavement and conventional deep strength pavement) contemplated the use of SMA as the surface course. The study did not consider the use of any other surface courses;

- At the same time as the feasibility study, Dr. Uzarowski authored a paper (with Mr. Moore, Dr. Michael Maher (Principal, Pavement & Materials Engineering, Golder), and Vince Aurilio (Technical Director - Field Engineer, OHMPA) given credit as co-authors) about the RHVP pavement design for the Canadian Technical Asphalt Association ("CTAA"). The paper, titled "Sustainable Pavements – Making the Case for Longer Design Lives for Flexible Pavements", also compared the RHVP perpetual pavement and conventional deep strength pavement designs using SMA as the surface course; and

- In July 2005, the City submitted an external award application for the RHVP that listed the pavement type as "[f]lexible-perpetual pavement design with SMA surface".

While the potential use of SMA as the RHVP surface course was likely discussed amongst staff in the Special Projects Office and the RHV Project Office, including Mr. Moore and Mr. van der Mark, going back to at least 1999, the evidence before the Inquiry suggests that Mr. Moore was the primary driver of this decision.

The choice to use SMA for the RHVP surface course was entirely an operational decision made by the RHV Project Office, including Mr. Moore. Members of Council, including the PIC, were not involved in selecting the RHVP surface course. Council was first advised formally about the use of SMA in an information update that Mr. Murray circulated on June 5, 2007, in which they were told about the RHVP paving operations (which were underway by that time). Mr. Murray's update stated that "the surface asphalt will be a Stone Mastic Asphalt that will improve skid resistance and lower noise generation."[13]

The noise attenuation benefits of SMA pavements were almost certainly an important consideration in staff's decision, given the RHV Project's aim to reduce environmental consequences from RHVP construction and the City's concern with reducing noise pollution for surrounding property owners.[14]

City staff, including Mr. Moore, were also aware of what, at the time, were understood to be superior skid resistance characteristics of SMA. This is evidenced by the benefits of SMA listed in the 2003 PDRs. However, there is no evidence to suggest that the stated frictional benefits of SMA were of material significance to City staff when selecting SMA, although staff did rely on this ostensible benefit on occasion when justifying its use, such as in the June 5, 2007 information update.

As discussed in Chapter 3, while the MTO began identifying an early age friction issue with the MTO SMA pavements in 2005, neither Mr. Moore nor Mr. Oddi were aware of the issue until mid- to late-2007. In any event, the SMA early age friction issue was not one that affected the long-term frictional performance of the RHVP.

---

[13] The June 5, 2007 information update was not written by Mr. Murray. It was prepared collaboratively by various members of the RHV Project team for Mr. Murray, who submitted and circulated the report to Council.

[14] An example of the City's noise mitigation efforts was that the City, in consultation with the PIC, undertook a noise mitigation program in which property owners were offered noise walls and/or other noise screening options.

2.5.2. Decision to Use a Perpetual Pavement Design

The RHVP pavement is designed as a "perpetual pavement" structure rather than a conventional "deep strength" pavement design, as had been used on the LINC. The attributes and differences between the two are discussed in Chapter 1.

The original RHVP design contemplated a conventional deep strength pavement, the same structure used for the LINC years before. Mr. Moore began considering the use of a perpetual pavement structure for the RHVP in late 2004 or early 2005. According to Mr. Moore, the genesis of the design change was a paper and related presentation on perpetual pavement written by Dr. Uzarowski and Mr. Aurilio (titled "Perpetual Asphalt Pavements") for the November 2004 CTAA conference, which Mr. Moore attended.

At Mr. Moore's instigation, Mr. Moore and Dr. Uzarowski began discussing the possible use of a perpetual pavement design on the RHVP in January 2005. On January 11, 2005, Dr. Uzarowski attended a meeting with Mr. Moore. Mr. Moore testified that, at the time of the meeting, he was actively considering how the perpetual pavement structure might apply to the RHVP project and the possible benefits of using it. Dr. Uzarowski's notes from the January 11 meeting reflect discussion of various RHVP design components, including an SMA surface course and a possible perpetual pavement structure.

Dr. Uzarowski, on behalf of Golder, began working on a feasibility study for the use of perpetual pavement on the RHVP shortly after the January 11 meeting. The feasibility study was the first phase of Golder's two part assignment; in the second phase, discussed below, Golder developed the design and specifications for the RHVP perpetual pavement.

The feasibility study compared the conventional deep strength pavement design originally contemplated for the RHVP with a perpetual pavement design. As noted, Golder's study assumed an SMA surface course for both pavement design options.

Golder's study was finalized and its content and conclusions were conveyed to the City by August 2005. Golder recommended that the City use a perpetual pavement design for the RHVP. The feasibility study described the following benefits of the perpetual structure, compared to the conventional deep strength pavement:

- lower life cycle costs ($12,691,853 using a perpetual pavement compared to $13,804,675 using a conventional deep strength pavement, both over a 50-year life cycle);
- lower maintenance and rehabilitation costs ($870,890 compared to $1,383,013, over the 50-year life cycle);
- avoidance of a detour route for use during pavement rehabilitation (at an estimated cost of $344,240), which would be required for a conventional deep strength pavement;
- reduced time required for maintenance activities, resulting in less public inconvenience and lower user delay costs (estimated user delay costs for a perpetual pavement were $453,056, compared to $1,279,545 for a conventional deep strength pavement); and
- better resistance to fatigue cracking and less susceptibility to rutting, and consequently, reduced rehabilitation needs and associated reductions in rehabilitation and user delay costs.

The only drawback to perpetual pavement noted in the feasibility study was higher initial construction costs. Estimated construction costs for a perpetual pavement design were $11,425,914, compared to $10,850,079 for a conventional deep strength design. Notwithstanding the higher initial costs, the study concluded that the overall lifetime costs for the perpetual pavement structure were over $1.1 million lower than the lifetime costs for the conventional deep strength pavement structure.

The feasibility study indicated that resurfacing of the SMA surface layer was anticipated in years 21, 34, and 46 using a perpetual pavement structure. The anticipated resurfacing timeline was based on the annual average daily travel anticipated for the RHVP at that time. Accordingly, when the RHVP opened in 2007, the City anticipated mill and overlay resurfacing (also known as a “shave and pave”) in 2028, 2041, and 2053 and regular maintenance in the form of crack routing and sealing and mill and patch. Ultimately, the first resurfacing occurred much earlier as a consequence of, among other factors, much higher than anticipated traffic volume on the RHVP after its opening.

As with the decision to use SMA, the decision to use a perpetual pavement design was entirely an operational decision made by staff. Members of Council were not involved in the decision. Indeed, it appears that members of Council were advised about this design choice many months later at a PIC meeting on March 7, 2006.

For all the reasons described above, the City's decision — which was effectively made by Mr. Moore — made good economic sense.

Mr. Moore's motivations, as set out in a 2006 CTAA paper co-authored with Dr. Uzarowski, provide insight into his rationale for selecting a perpetual pavement design:

> The objective of the approach used on the Red Hill Creek Expressway was to design a pavement that is safe, cost effective and has less impact on the environment in terms of the quantity of used materials, less impact on the traveling public and road neighborhood, and less energy consumption and greenhouse gas emission.

The exact date that Mr. Moore made his decision is not established in the evidence before the Inquiry. I am, however, satisfied that Mr. Moore was strongly inclined to use a perpetual pavement design by the time he met with Dr. Uzarowski in January 2005, provided the Golder feasibility study supported such a decision. By July 2005, prior to completion by Dr. Uzarowski of the feasibility study, Mr. Moore had decided to proceed with the perpetual pavement design, as evidenced, at least in part, by the City's July 21, 2005 award application in which the RHVP pavement was described as a "[f]lexible-perpetual pavement design with SMA surface". Mr. Oddi also recalled learning about the perpetual pavement design at some time during the summer of 2005.

2.6. Grading and Paving Contracts for the RHVP

2.6.1. Grading Contracts

The RHVP construction work began with the grading phase. Between May 2004 and August 2005, the City put out for tender and awarded four contracts for the grading portion of the RHVP. Dufferin won three of the four contracts and Aecon won the fourth. Dufferin's grading contracts included the area of Greenhill Avenue to north of Queenston Road (Contract PW-04-239); the area from south of Barton Road to Nash

Road (Contract PW-04-241); and the mainline structures and creek alignment north of the CN railway overpass (Contract PW-05-242). Aecon's contract included the area from the Mud Street interchange to Greenhill Avenue (Contract PW-04-238).

2.6.2. Perpetual Pavement Design

In November 2005, Golder was retained to complete the second phase of the perpetual pavement feasibility study (the "Pavement Design Study"), ultimately for a cost of $22,500.

Golder's deliverables initially included identifying the applicable Ontario Provincial Standards and Specifications ("OPSS") that applied to the RHVP asphalt mixes, including the SMA surface course mix, and preparing special provisions for the RHVP mainline paving. Special provisions are included in a contract to define or detail additional contractual requirements not covered in a standard specification, and can be used to add, remove, or modify the standard specifications.

On April 10, 2006, Dr. Uzarowski submitted a draft report, titled "Perpetual Pavement Design Study, Phase 2, Red Hill Creek Expressway", to Mr. Moore. For the RHVP mainline, Golder recommended use of four mix types, including an SMA 12.5 mix for the surface course, within the recommended perpetual pavement design. Golder's recommended design is set out in **Figure 2f**.

Figure 2f: RHVP Perpetual Pavement Design

	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

The Pavement Design Study also included recommendations on the various asphalt mixes used for the RHVP mainline shoulders, ramps and ramp shoulders, other roads, and structures, and the specifications for each recommended mix type.

2.6.3. Recommended Pavement Specifications

As part of the Pavement Design Study, Dr. Uzarowski, on behalf of Golder, prepared six City special provisions for use in the RHVP hot mix asphalt ("HMA") specifications. In respect of the RHVP, the City special provisions supplemented the various OPSS identified and recommended by Golder for the RHVP paving. Dr. Uzarowski sent the special provisions to Mr. Moore in April 2006.

Special Provision 1 (titled "Special Provision for Mix Types") established the applicable specifications for the SMA 12.5 layer and the other mainline pavement mix types (Superpave 12.5 FC2, SP 19.0, SP 25.0, and HL1 (for shoulders)).

Among the applicable OPSS was OPSS 1003 which established the material requirements for aggregates used in HMA, including in SMA. OPSS 1003 set out mandatory requirements governing the suitability and acceptability of the coarse and fine aggregates that can be used in an SMA pavement. OPSS 1003 also provided optional appendices that applied only if explicitly invoked by the owner (the City, in the case of the RHVP) in the contract documents. Appendix 1003-A included the following recommendations applicable to SMA surface courses:

> The specification requires that coarse and fine aggregates for SMA…to be from the same aggregate source…
>
> The designer should be aware that in cases of high traffic volumes and high frictional demand, the use of…SMA…, and aggregates may be necessary to give adequate frictional properties.
>
> The design should provide a list of approved aggregate sources for SMA…coarse and fine aggregates…[15]

[15] In the quoted text from Appendix 1003-A, certain content that does not relate to the SMA mix has been omitted for the sake of brevity. Ellipses indicate where text was omitted.

The “list of approved aggregate sources for SMA” referred to in Appendix 1003-A is the MTO’s Designated Source of Materials (“DSM”) list. The DSM is described in detail in Chapter 1.

Dr. Uzarowski did not incorporate Appendix 1003-A into the RHVP SMA paving specifications that Golder developed for the City. In his testimony, Dr. Uzarowski acknowledged that while not mandatory, it is considered good practice to include Appendix 1003-A (and the other OPSS 1003 appendices) in a paving contract. As the City’s pavement design consultant, it was within Dr. Uzarowski’s purview to recommend use of a DSM-approved aggregate.

When asked why he did not make the recommendation to require use of a DSM-approved aggregate, Dr. Uzarowski explained that, in his professional opinion, OPSS 1003 established very tight physical property requirements, such that only high quality coarse and fine aggregates would meet the standard for acceptable use. Moreover, in his experience, it was not common practice for municipalities to require use of a DSM-approved aggregate.

If the RHVP had been a provincial MTO road, a DSM-approved aggregate would have been required for the SMA surface layer. Being a municipal road owned and maintained by the City, no such requirement existed for the RHVP. Although it would have been preferable for Dr. Uzarowski to have mandated use of a DSM-approved aggregate because, if nothing else, it would have avoided the concerns he later raised over the use of the Demix aggregate described below, it was not an unreasonable decision given the OPSS 1003 testing requirements and absence of a binding requirement for municipal roads.

2.6.4. RHVP Paving Contract

On April 25, 2006, the City released the notice of tender and the tender for Contract PW-06-243, “Mainline Paving – Mud Street Interchange to QEW Interchange”. Beforehand, Mr. Oddi, on behalf of the City, worked with Dr. Uzarowski and a consultant from Stantec to prepare the pavement specifications in the tender, which incorporated the six special provisions developed and recommended by Dr. Uzarowski.

The City issued four addendums to the mainline paving contract in May 2006. Contract Addendum No. 1, issued May 10, required the contractor to place approximately 75-tonne trial sections of the SMA and rich bottom mix ("RBM", the bottom asphalt layer), so that the contractor could demonstrate its ability to prepare, place, and compact the material prior to placing the SMA or RBM on the mainline. The addendum stipulated that the main paving could not proceed until approval was given by the contract administrator, based on the trial section outcome. In the event of an unsuccessful trial strip, the contractor was required to repeat additional trial sections until the material met the requirements of the specifications.

In his testimony, Dr. Uzarowski stated that the contractual requirement for the SMA and RBM trial sections implemented a recommendation he made to the City, based on challenges Dr. Uzarowski anticipated with the production and placement of the SMA and RBM mixes during construction.

On July 12, 2006, the City formally awarded the RHVP paving contract to Dufferin in the amount of $30,323,391.13, including tax and contingency. By this time, the RHVP grading work was largely complete. As noted, Dufferin had been involved in works associated with the east-west and north-south transportation corridor intermittently for 10 years, having paved the LINC and the LINC extension in 1997 and 1999, respectively.

2.7. Paving the RHVP

2.7.1. Major Players in RHVP Paving

Many parties were involved in the construction and paving of the RHVP. For purposes of this Inquiry, the major players were the City's RHV Project team; Dufferin, the paving contractor; Philips, the City's Contractor Administrator; and Golder, the City's Quality Assurance ("QA") consultant. Their respective roles and responsibilities are described briefly below, and throughout the remainder of this chapter.

In his capacity as Senior Project Manager on the RHV Project, Mr. Oddi oversaw the construction of the RHVP on a day-to-day basis on behalf of the City. Most communication with the City's consultants and contractors flowed through Mr. Oddi. Other members of the RHV Project team, including Mr. Moore (the Manager of Design)

and Mr. Murray (the Project Director), were kept apprised of developments during bi-weekly team meetings or if issues arose.

Dufferin was responsible for the procurement and supply of paving materials, developing the designs for each asphalt mix, and, most importantly, paving the asphalt on the roadway, in addition to other deliverables stipulated in the contract. Dufferin retained Trow Associates Inc. ("Trow") as its asphalt consultant on the Project. Trow's retainer included developing asphalt mix designs[16] and performing quality control testing on the materials and mixes used.

Golder was retained by Philips in mid-2006 to provide laboratory and field inspection services for the mainline paving at an initial estimated cost of $393,420. During the pre-paving phase, Golder was responsible for material and mixture pre-qualification, for setting up the QA laboratory and for testing; during paving, Golder monitored pavement operations, and conducted and reviewed various field and laboratory tests and test results (including asphalt sampling, compacting testing and laboratory testing). Golder's project team included Dr. Uzarowski (the QA lead) and Andro Delos Reyes (Senior Pavement & Materials Geotechnical Technologist, Golder and the Senior Site Inspector on the RHV Project), and several field and laboratory technicians.

The parties held monthly site meetings throughout the pre-construction and construction phases, until the end of 2007. Site meetings were a forum for the parties to provide progress updates, discuss outstanding deliverables and anticipated next steps, raise issues, and discuss possible resolutions for issues. The Inquiry received copies of the site meeting minutes prepared following each meeting; where relevant, the content of these minutes is discussed in the subsequent sections.

2.7.2. The RHVP as a Project of Firsts

The RHVP was a project of firsts for most, if not all, of the major players and individuals involved. This was especially so for the perpetual pavement structure. The RHVP was one of the first municipal perpetual pavement projects undertaken in Ontario. Neither

[16] Put colloquially, the mix design is the ingredient list and recipe used to create an asphalt mix. Typical components of an SMA mix design include coarse and fine aggregate, asphalt cement, filler, and fibres; the latter is a unique component of SMA mixes.

Dufferin, the City, nor Dr. Uzarowski had ever worked on a perpetual pavement structure.

It is also probable, based on the testimony of Paul Janicas (Senior Quality Control Lab Supervisor (Bituminous), Dufferin) and Mr. Hainer, that this was Dufferin's first SMA project. In addition, the RHVP was the City's first placement of SMA on a freeway, although it had overseen placement of an SMA trial on Burlington Street in 1999. Dr. Uzarowski did, however, have some prior SMA experience, having had exposure on "a few" projects with SMA while at Golder and his prior employer, John Emery Geotechnical Engineering Ltd., and in the course of obtaining his PhD.

2.7.3. Lead Up to the SMA Paving from March to June 2007

2.7.3.1. Dufferin's Decision to Use the Demix Aggregate

The SMA surface course on the RHVP was paved using coarse and fine aggregate sourced from the Demix Varennes quarry, owned by Dufferin's affiliate Demix Agrégats and located just outside of Montreal, Quebec.

Peter Gamble (Manager, Plants, Equipment & Technology, Dufferin) oversaw selection and purchase of raw materials used for Dufferin's paving jobs, including for the RHVP. Mr. Gamble made the decision to use the Demix aggregate for the RHVP paving job in early 2007.

Mr. Gamble provided three rationales for his decision: (1) unlike an MTO contract, the RHVP specifications did not restrict use of an aggregate that was not listed on the DSM; (2) Demix Agrégats was (and remains) an affiliated sister company of Dufferin, and it was preferable to use internally-owned materials where feasible; and (3) it made economic sense to use the Demix aggregate. Fundamentally, Dufferin's use of the Demix aggregate was a business decision based on cost efficiencies and market considerations beneficial to Dufferin.

2.7.3.2. Dufferin Seeks Approval of the Demix Aggregate

Dufferin advised Philips and Golder of its intention to use the Demix aggregate for the SMA surface course and the Superpave 12.5 FC2 asphalt layer via fax on March 20, 2007.

Dufferin's correspondence noted that the Demix quarry was in Quebec and provided information about the aggregate's use in Quebec, including by the Ministry of Transportation of Quebec ("MTQ") as a reference aggregate. Various physical property test results were enclosed in Dufferin's fax. Walter Maranzan (Contract Administrator, Philips) sent Dufferin's request for approval and the enclosed test results to Dr. Uzarowski that day for review.

Dufferin's correspondence clearly stated that the Demix aggregate was not listed on the MTO's DSM list, and Dr. Uzarowski was aware of the Demix aggregate status at the time he reviewed Dufferin's request and the Demix aggregate physical property test results. In his testimony, Dr. Uzarowski acknowledged that he would have preferred that the Demix aggregate had been listed on the DSM as pre-qualified by the MTO, even though DSM-approval was not a requirement of the RHVP contract.

A March 23, 2007 memo prepared by Dr. Uzarowski for the City and Philips advised that, based on Golder's review, the Demix aggregate was not at that time considered acceptable for use on the RHVP. The memo listed several reasons why the aggregate did not satisfy the OPSS 1003 contractual requirements; these related to the manner, timing, and nature of the tests that had been conducted.

However, notwithstanding the concerns referenced in his memo, Dr. Uzarowski also believed that the Demix aggregate was a "good quality aggregate" and that the test results for the aggregate were "excellent". It was significant to Dr. Uzarowski that the coefficient of polishing by project ("CPP") test results, which measure an aggregate's resistance to polishing, exceeded the MTQ's specified requirement.[17] I accept Dr. Uzarowski's evidence in this respect, which is supported by the report and expert testimony of Dr. Hassan Baaj.[18] Nevertheless, I observe that Dr. Uzarowski's favourable first impression of the Demix aggregate was not documented in his review memo.

[17] According to Dr. Uzarowski, the MTQ requires a minimum CPP value of 0.45. The Demix aggregate CPP test result was 0.49, which exceeded the MTQ's specified requirement by a margin of 0.04.

[18] Dr. Baaj is the Director of the University of Waterloo's Centre for Pavement & Transportation Technology.

In response to Golder's initial review, Trow, on behalf of Dufferin, performed additional physical property testing on the Demix coarse and fine aggregates in April 2007. Trow's testing was conducted in a certified laboratory, as required by OPSS 1003. Dr. Uzarowski received the physical property test results via email from Mr. Janicas on April 23, 2007. Mr. Janicas' email reiterated Dufferin's request for approval to use the Demix aggregate in the SMA and Superpave 12.5 FC2 asphalt mixes.

Dr. Uzarowski's evidence, which I accept, was that, based on his review of the April 2007 test results, Golder was satisfied that the Demix coarse and fine aggregates met the requirements in OPSS 1003. Dr. Uzarowski's evidence is supported by the evidence of Dr. Baaj. However, I observe that the Inquiry did not receive any correspondence from April 2007 in which Dr. Uzarowski or Golder communicated satisfaction with the Demix aggregate to their clients, the City and Philips (the contract administrator).

Dufferin and Golder produced additional test results of the aggregate properties over the following months, into the spring and summer of 2007. The additional Demix results are addressed chronologically below, as are my comments and conclusions in respect of the overall suitability of the Demix aggregate.

2.7.3.3. Dufferin Receives Oral Approval of the Demix Aggregate

Approval of the Demix aggregate was a crucial step in the pre-paving process. Without approval, Trow was unable to start developing the SMA and Superpave 12.5 FC2 asphalt mix designs. Throughout April and early May 2007, Mr. Janicas sent multiple requests for approval to Dr. Uzarowski, and advised him that Dufferin could not begin, let alone progress without approval.

Mr. Janicas and Dr. Uzarowski were the principal points of contact for Dufferin and Golder, respectively, on technical issues. Throughout the pre-paving and paving phases of the project, Mr. Janicas and Dr. Uzarowski corresponded on a range of issues related to the RHVP asphalt, from the mix design to the materials used in the mixes to the results of laboratory testing, and it was common for them to direct technical questions or updates to one another. Mr. Janicas described the relationship between Dufferin and Golder as "very collaborative" and "very open".

Dufferin's requests regarding the Demix aggregate approval appear to have gone unanswered by Dr. Uzarowski, or anyone else at Golder, until May 8, 2007, at a site meeting held between the parties.

Dr. Uzarowski, Mr. Janicas, and Mr. Oddi were three of the attendees at the May 8 site meeting; various other representatives from Dufferin and Philips also attended. The site meeting minutes reflect discussion of multiple outstanding issues related to the HMA specification acceptance, including Dufferin's request to use the Demix aggregate (referred to as "Quebec Trap Rock" in the minutes). In respect of the aggregate, the minutes state that the following was agreed to:

> The physical properties of the Quebec Trap Rock are all acceptable. Dufferin is to test the physical properties for all granulars in the SMA and FC2 every 5000 tonnes. Dufferin will carryout trials to determine the best rock chip size for the asphalt mix design and will report which will be used.

Dr. Uzarowski testified that, by this time, he was very pleased with the Demix aggregate's physical properties and the minutes reflect his communication of this to the other attendees.

However, this was not an unqualified acceptance of the Demix aggregate. As Mr. Janicas explained in his testimony, the site meeting minutes reflect that the aggregate was acceptable at this stage, but would nevertheless need to be checked every 5,000 tonnes to ensure the aggregate continued to be acceptable. According to Mr. Janicas, it was standard to perform this type of check during delivery of raw materials and production for quality control. Moreover, as discussed below, Dr. Uzarowski continued to have a lingering concern regarding the properties of the Demix aggregate which prompted certain further tests.

2.7.3.4. Mainline Paving of the RHVP Begins in 2007

Dufferin began the mainline paving on the RHVP on May 29, 2007, beginning with the RBM base course asphalt and the Superpave asphalt binder courses in the southbound lanes. Paving of the base layer of the RHVP mainline and ramps continued throughout June and July.

In mid-June, shortly after the mainline paving began, Chris Murray left his role as RHVP Project Director to take another Director position at the City. The Public Works department, which oversaw the RHV Project Office, did not hire anyone to fill the Project Director position, and the role remained vacant during the remaining months of paving and construction.

Both Mr. Moore and Mr. Oddi conveyed in their testimony that Mr. Murray's departure did not materially affect the day to day project operations, which they principally oversaw. While that may be true, that Mr. Murray's involvement was apparently superfluous by June 2007 reflects the non-technical nature of his role. It is also noteworthy that this very large, complex infrastructure project was without clear leadership during the last months of its work. It is unclear who, if anyone, assumed Mr. Murray's role in interfacing with Council, the media, and members of the public to provide progress updates and to brief Councillors on issues that arose during paving.

2.7.3.5. Dufferin Seeks Approval for the SMA Mix Design

Mr. Janicas submitted the SMA mix design to Dr. Uzarowski for approval on June 22, 2007. Mr. Janicas' email suggested some urgency to Golder's review and the requested approval. He advised that Dufferin expected Golder's review to occur as soon as possible and asked that Golder immediately notify Dufferin of any issues as delay in the approval would impact the project schedule.

The SMA mix design included use of the Demix aggregates for the 12.5 mm coarse aggregate (stone) and the screenings (finer aggregate). The filler, performance grade asphalt cement, and cellulose fibre included in the mix design were sourced from other producers.

Dufferin submitted the mix design about five weeks before the scheduled start of SMA paving. Mr. Janicas, Mr. Gamble, and Mr. Hainer all testified that this timing was within the typical timeframe they expected for mix design delivery. Mr. Gamble and Mr. Hainer both indicated that they had encountered more condensed timelines on some paving jobs.

In the experience of the Dufferin witnesses, it is common for communication back and forth to occur between the contractor and QA representatives regarding mix design and/or the components of a mix, as occurred between Dufferin and Dr. Uzarowski

following Dufferin's delivery of the SMA mix design. However, their interactions stood out in at least one respect. According to Mr. Hainer, there was more back and forth respecting the SMA mix design on the RHVP project than other projects he had worked on.

Mr. Janicas submitted additional test results for the SMA mix to Dr. Uzarowski on June 28, 2007 via email. In his email, Mr. Janicas requested that Dr. Uzarowski provide an update on the status of the mix design approval for the SMA mix and three other mix designs submitted. The Superpave 12.5 FC2 mix design, which used the same Demix coarse and fine aggregates as the SMA, was also completed on June 28.

Mr. Janicas' enquiry went unanswered until the parties' next site meeting on July 10, 2007. The July 10 meeting minutes, excerpted below, reflect discussion of various outstanding asphalt issues, including SMA mix design approval:

> ***2. Asphalt Issues***
>
> ***a) Outstanding Mix Design Approvals***
>
> *Golder indicated that after only a quick glance the SMA mix design appears to be satisfactory. Golder will provide written confirmation of their analysis.*
>
> *Dufferin would like to pave a SMA test strip either late this week or early next week if possible.*
>
> *Golder will provide Dufferin with the SMA test results no later than Thursday afternoon and would like to be present for the test strip paving.*
> *…*
>
> ***b) Material Testing***
>
> *Golder requested that Dufferin produce a trial batch of SMA for the field labs to work out testing correlation differences.*
>
> *Golder indicated the vibratory roller currently being used by Dufferin is likely too heavy for SP19.0 and SMA pavement layers.*

Golder's observation regarding Dufferin's use of the vibratory roller on the SMA pavement layer is discussed later in this chapter.

Dr. Uzarowski explained in his testimony that the SMA mix design met the specified requirements for an SMA mix and so, in that respect, the mix design was satisfactory.

The minutes reflect that Golder intended to provide two deliverables to the other parties arising from the discussion on July 10: (1) written confirmation of the SMA mix design review analysis and (2) Golder's SMA test results. According to the minutes, Golder committed to provide the test results to Dufferin by the afternoon of Thursday July 12, 2007.

Golder did not issue written confirmation of its approval of the SMA mix design following the July 10 meeting, despite its commitment to do so. Emails sent by Mr. Janicas to Dr. Uzarowski reflect that Dufferin continued to enquire about the status of the SMA mix design and the use of the Demix aggregate in the mix on multiple occasions in July.

2.7.3.6. Issues Emerge Around the Demix Aggregate

There was a flurry of activity in the days leading up to Dufferin paving the SMA test strip on July 25, 2007. It is clear that Dr. Uzarowski had lingering concerns regarding the suitability of the Demix aggregate in the SMA and the overall SMA mix design, which Dufferin attempted to address before Dufferin paved the SMA.

On July 17, Mr. Janicas emailed Dr. Uzarowski, copying Mr. Oddi, Philips, and others at Dufferin, noting that concerns had been expressed regarding the ignition oven test results for the Demix aggregate and summarizing the status of various other physical property tests being conducted by Golder and Dufferin. Mr. Janicas' email concluded by stating that Dufferin understood that the SMA mix design would be approved for production if the aggregates continued to meet the physical requirements.

The next day, Mr. Janicas emailed Dr. Uzarowski again, copying a larger group than the day before. Mr. Janicas' email attached physical property test results for the Demix aggregate. Regarding the results, Mr. Janicas wrote:

> It is our understanding that the Micro-Deval was the attribute in question due to the breakdown discovered in the Ignition Oven Testing.
>
> The results indicate that the materials delivered from the Demix quarry meets the requirements of the Micro-Deval Abrasion Loss.

> With the above mentioned results meeting the contract requirements, are the SMA and 12.5FC2 Mixes approved for production on the City of Hamilton PW-06-243 Contract?
>
> If, after reviewing these results, there is still a question of the suitability of the aggregates please advise Dufferin Construction Company immediately and a meeting with all the stakeholders involved will be convened at the earliest possible opportunity.

Some context is required for the aforementioned ignition oven issues. Ignition oven testing is a method of aggregate extraction and gradation. The test method involves burning off asphalt cement at high temperatures (approximately 500°C) to determine the percentage of asphalt cement in the asphalt sample. Gradation testing is performed on the remaining aggregate using sieves to determine the size of the aggregate.

Golder initially used the ignition oven testing method to perform its aggregate gradation testing, and observed some aggregate breakdown in the SMA and Superpave 12.5 FC2 mixes due to the high testing temperature. Golder subsequently resolved the ignition oven degradation issue by relocating the gradation and asphalt cement testing for the SMA and Superpave 12.5 FC2 mixes to Golder's Whitby asphalt laboratory and using the same chemical solvent method as Dufferin.

In testimony, Dr. Uzarowski advised that his concerns stemmed from the unreliability of Golder's ignition oven test results for correlation purposes with Dufferin's gradation results. Dr. Uzarowski was clear in his evidence that the issue of aggregate degradation in the ignition oven did not give rise to concerns about the Demix aggregate in and of itself. However, Dr. Uzarowski's actions on July 18 suggest that he had lingering concerns about the aggregate's suitability. On that day, Dr. Uzarowski called Danielle Fleury at the MTQ. An entry in Dr. Uzarowski's notebook pertaining to the call states: "Very good aggregates – used in HMA, one of the best aggregates." Dr. Uzarowski's evidence was that he called the MTQ to get information about the field performance of the Demix aggregate. He described the information he received from the MTQ as the "missing element" in his opinion about the aggregate.

Dr. Uzarowski told the Inquiry that his opinion that the Demix aggregate was of good quality was also informed by the additional physical property test results he received from Mr. Janicas on July 18, and the results of Golder's Micro-Deval and

Los Angeles abrasion testing conducted on July 17 and 18, 2007. In testimony, Dr. Uzarowski described the test results as “very good”, “exceptional” and “excellent”; in his experience, it was rare for aggregates to have such good characteristics. The Inquiry received no evidence to suggest that Dr. Uzarowski conveyed this favourable opinion to Dufferin, Philips, or the City on or around July 18. Nor did Dr. Uzarowski issue written confirmation accepting the aggregate or the SMA mix design at this time.

Aggregate concerns continued to be addressed in emails between Dufferin, Philips, and Mr. Oddi on July 23 and 24, which were not copied to Dr. Uzarowski. On July 23, Dufferin emailed information to Mr. Oddi and Phillips respecting “SMA- Aggregate Concerns” and to advise of three MTQ contracts where the Demix aggregate was used in an asphalt pavement. The title of one document sent by Dufferin was “Skid Resistance Report.pdf”, which suggests that some of the information Dufferin provided related to the skid resistance (frictional qualities) of the Demix aggregate.[19] However, the actual document was not available to the Inquiry. On July 24, Dufferin also sent physical property test results for the Demix aggregate to Philips and Mr. Oddi.

One would expect that Dr. Uzarowski would have been included on the list of recipients for Dufferin’s July 23 and 24 emails. However, the first time that Dr. Uzarowski saw these emails or learned that they were sent was during this Inquiry. Neither Dufferin nor Mr. Oddi provided a definitive explanation of why these emails were not sent to Dr. Uzarowski or others at Golder. The evidence before the Inquiry does not allow for any conclusions in this respect. I merely observe the oddity of Golder’s exclusion from these emails and the subsequent lack of information sharing by the parties, given Dr. Uzarowski’s QA role and the typical lines of communication on aggregate-related issues up to this point in the project.

Whether innocuous or intended, the effect was that Golder and, in particular, Dr. Uzarowski, the QA consultant who had raised issues with the aggregate and should have been privy to that information, was effectively cut out of the communication. As discussed below, this happened again on August 9, 2007, during the SMA paving.

[19] The copy of the email produced to the Inquiry appears to be a scan of a hard copy without the corresponding attachments. Dufferin and the City were unable to locate any of the four attachments. Consequently, all that is known about these documents are their titles. The title of one of the documents sent was “Skid Resistance Report.pdf”.

Also on July 23, Mr. Delos Reyes emailed Dr. Uzarowski to remind him about the upcoming SMA test strip scheduled for July 25. Mr. Delos Reyes also wrote:

> Also if you are going to issue written approval (with reservation) for the SMA mix design, please include the SP19 mix design (we've already given the verbal approval during the regular monthly meetings), just to confirm it in writing.

It is clear from Mr. Delos Reyes' email that, as of July 23, Dr. Uzarowski had not issued Golder's written approval of the SMA mix design. As discussed above, oral approval was given at the site meeting on July 10, with written approval to follow. Dr. Uzarowski and Mr. Delos Reyes both testified that the reservation referred to in the email stemmed from the ignition oven issues and resulting aggregate breakdown.

2.7.4. The SMA Paving from July to August 2007

2.7.4.1. The SMA Test Strip

Dufferin paved an SMA test strip on July 25, 2007. Various representatives from Dufferin, the City, and Golder (but not Dr. Uzarowski) were on-site to observe the paving. The test strip was one of the Mud Street interchange ramps, although recollections differed on the exact location.

Golder obtained four or five core samples from the SMA test strip for QA lab testing. On July 26, the day after the test strip was paved, Mr. Delos Reyes emailed photos of the cores to Dr. Uzarowski and advised that the thickness of the SMA layer was thinner than required by the specifications. Mr. Delos Reyes also observed that there was some aggregate breakdown in the cores. On July 27, Mr. Delos Reyes provided the laboratory test results for the SMA test strip to Dr. Uzarowski. Four days later, on July 31, Mr. Delos Reyes sent Dr. Uzarowski the SMA nuclear density compaction results (which measured the density of the compacted SMA surface).

A meeting was held on July 27 at the RHVP paving site to inspect the SMA test strip. Dr. Uzarowski's notebook reflects that he, Mr. Delos Reyes, Mr. Oddi, and James Wharrie (Construction Coordinator, Dufferin) were present at the meeting. Dr. Uzarowski's notebook also contains an entry stating that the test strip was rejectable and listed several reasons.

In the early evening on July 31, Dr. Uzarowski emailed Mr. Oddi, Mr. Hainer, Philips, and his colleagues at Golder, repeating his opinion that the test strip was rejectable. Dr. Uzarowski's email enclosed the laboratory and field test results for the test strip and advised of the various requirements not met by the SMA mix. Dr. Uzarowski also advised that the test strip had not met the SMA compaction requirements at several locations. His email concluded with the following:

> The test strip is not acceptable. We recommend that a new test strip be completed.
>
> We understand that Dufferin Construction intends to place the SMA mix on the main line tomorrow. Dufferin Construction should be aware that the test strip has not been approved and the paving will be at their entire risk.

The Inquiry heard evidence from multiple witnesses that failure of, or rejectable results within, a test strip is not an uncommon occurrence, and does not necessarily reflect a serious concern. Several witnesses noted that the very purpose of a test strip is for the contractor to learn how to produce and pave the mix and, if necessary, to adjust the production and placement procedures afterwards.

However, a successful SMA test strip was more than just a learning experience for the RHVP – it was a contractual requirement. In the event of a rejectable test strip, Contract Addendum No. 1 required Dufferin to pave additional test sections until the materials met the contract specifications.

Dr. Uzarowski's recommendation for a new test strip was consistent with this contractual requirement. However, as Dr. Uzarowski explained, his role was limited to advising and making recommendations to the City and Philips. Ultimate authority to require a new test strip rested with Philips as the contract administrator and the City as the project owner, not with Dr. Uzarowski or Golder. Neither Philips nor the City required a second test strip. Accordingly, Dufferin started paving the SMA on the RHVP mainline as scheduled the next day.

Dufferin's decision to proceed with the SMA paving on August 1, notwithstanding Dr. Uzarowski's recommendation and at Dufferin's own risk, was a group decision made by several key members of Dufferin's team. The evidence before the Inquiry is that

Mr. Janicas, Mr. Gamble, Mr. Hainer, and Jake Sudac (District Manager, Dufferin) had varying levels of involvement in the decision, but that Dufferin's decision was ultimately made collectively. According to Mr. Hainer, Dufferin was confident that they could make changes that would result in an acceptable SMA paving surface.

Mr. Oddi testified that, following Dr. Uzarowski's email, Dufferin's team communicated to him their confidence in their ability to adjust the SMA. Mr. Oddi's evidence was that he allowed Dufferin to pave at its own risk on the understanding that Dufferin would need to rip out the SMA if it did not meet contractual specifications.

Mr. Oddi's decision appears to have been made unilaterally within the RHV Project team. While Mr. Oddi speculated, without any specific recollection, that he advised Mr. Moore of the test strip issues, Mr. Moore's recollection was that he did not believe he was advised about Golder's recommendation or that Dufferin paved at their own risk.

For his part, Mr. Oddi also pointed to the absence of any recommendation from Dr. Uzarowski that the test strip be removed as significant, and testified that, had this recommendation been included, it would have been a "totally different story". Mr. Gamble similarly attributed significance to the fact that the test strip, despite being rejectable, was not removed and replaced.

In February 2008, after the RHVP paving was completed, Mr. Oddi sent an email about the RHVP SMA surface course to Dennis Billings (Head, Geotechnical Engineering Section, Central Region, Provincial Highways Management Division, MTO). Included in Mr. Oddi's email was the following statement: "A 280 tonne SMA trial section was placed on the [west-south] ramp of the Mud Street interchange. The trial section met the contract specifications and was left in place."

It is impossible to reconcile Mr. Oddi's email to Mr. Billings with Dr. Uzarowski's July 31 email stating that the test strip was "not acceptable" and listing the various below-specification results. It is also difficult to reconcile Mr. Oddi's email with his own acknowledgment in his testimony that he interpreted Dr. Uzarowski's email as stating that the trial strip "didn't quite meet specs" and was "out on a couple parameters". Mr. Oddi's email to Mr. Billings is not accurate, and nor does it reflect Mr. Oddi's knowledge about the deficiencies identified in the test strip. The Inquiry received no explanation as to why Mr. Oddi sent this email.

2.7.4.2. Dr. Uzarowski Calls the MTO about SMA and the Demix Aggregate

On July 31, 2007, concurrently with his concern regarding the test strip, Dr. Uzarowski called Dr. Chris Raymond (Senior Pavement Design Engineer, Pavements & Foundations, Materials Engineering & Research Office, Highway Standards Branch, Provincial Highways Management Division, MTO) at the MTO to discuss a rumour that Dr. Uzarowski had heard about an MTO prohibition on the use of certain aggregates in SMA, and to discuss the impending use of the Demix aggregate in the RHVP SMA surface course.

In testimony, Dr. Uzarowski explained that one of the reasons he called Dr. Raymond was because he had concerns, which he wanted to share with Dr. Raymond, that the Demix aggregate was not listed on the MTO's DSM list. It is therefore evident that, as of July 31, the day before SMA paving was scheduled to start, Dr. Uzarowski still had lingering doubts about the use of the Demix aggregate in the RHVP SMA. Dr. Uzarowski's call to Dr. Raymond and the events that followed from it, including friction testing conducted by the MTO on the RHVP in October 2007, are described at length in Chapter 3.

2.7.4.3. Dufferin Proceeds with Paving the SMA at its Own Risk

Dufferin started SMA paving on the RHVP mainline on August 1, 2007. The SMA paving was completed on August 13.

The Inquiry received much evidence about low compaction observed in the RHVP SMA, particularly in the initial days that Dufferin placed the SMA. The compaction deficiencies were shown in the nuclear density compaction test results produced by Golder (and which Golder had performed) for each day of SMA paving. Dr. Uzarowski raised Golder's observations regarding low compaction to Mr. Oddi in an email on August 8, 2007. However, Golder's nuclear density compaction test results suggest that Dufferin's compaction efforts improved over the course of the SMA paving.

With regard to this issue, the Inquiry heard a lot of evidence about the inherent difficulties of paving and compacting SMA due to the high amount of polymer used in the asphalt cement and the stony nature of the mix. The Inquiry also heard that contractors are discouraged from using rubber tire rollers on SMA due to the risk of creating fat spots (locations where asphalt binder has come to the surface) in the

surface course. OPSS 310 ("Construction Specifications for Hot Mix Asphalt") does not prohibit use of roller vibration during SMA compaction. However, witnesses explained that contractors must exercise caution if the vibratory feature of their roller is engaged and should use it only when the mix is very hot. Improper use of the vibratory roller can cause aggregate cracking.

Golder's concern about use of vibration on the SMA was raised early in the paving operations, including at the site meeting on July 10, 2007. The minutes from this meeting reflect Golder's words of caution that "the vibratory roller currently being used by Dufferin is likely too heavy for SP19.0 and SMA pavement layers".

Mr. Delos Reyes and Dr. Uzarowski both testified as to their belief that Dufferin likely used vibratory rollers during the placement of the SMA test strip on July 25, and that use of the vibratory roller may have caused the aggregate breakdown observed in the cores taken from the test strip.

Golder's asphalt nuclear density compaction test results for August 1, the first day of SMA paving, reflect that Dufferin used vibration for approximately 1300 m of the asphalt placement that day. The nuclear density compaction results for the subsequent days of SMA paving do not indicate whether vibration was or was not used, or what Dufferin's rolling pattern was.

A paper authored by Dr. Uzarowski, Mr. Moore, and Mr. Gamble in September 2008, titled "Innovative, Comprehensive Design and Construction of Perpetual Pavement on the Red Hill Valley Parkway in Hamilton", contains the following regarding SMA paving procedures and compaction efforts:

> The compaction was generally achieved by using increased number of rollers (6 rollers were used for SMA paving, for instance), careful control of the mix temperature during compaction, and following the effective compaction operation procedure such as keeping the rollers close to paver screed…and avoiding excessive water, etc. Paving in echelon contributed to the successful achievement of the compaction requirements and mitigated problems with longitudinal joints.

In his November 2022 report prepared for the Inquiry titled "Analysis of Friction on the RHVP", Dr. Gerardo Flintsch[20] observed:

> While the low compaction observed in asphalt nuclear density test results for the mix placed in early August 2007 in some of the sections could have a negative impact on durability, in my view the low compaction would not have contributed to low friction. Nor, in my view, would cracking or breaking of the aggregates due to over-compaction contribute to low friction.

Having received no evidence to the contrary, I accept Dr. Flintsch's conclusions in this respect. Accordingly, for the purposes of this Report, it is not necessary to devote any further discussion to the issue of SMA low compaction or aggregate cracking. It is sufficient to note that the identified instances of low compaction did not have a material or detrimental effect on the frictional performance of the RHVP SMA, although it is possible that they may have negatively affected durability and contributed to the need to resurface the RHVP independent of any issues related to friction.

2.7.4.4. Mr. Oddi Provides Written Approval of the Demix Aggregate and SMA Mix Design

2.7.4.4.1. Demix Aggregate Approval

On August 9, 2007, Mr. Oddi emailed Mr. Hainer, with a copy to Philips and Dufferin staff to confirm that the Demix aggregate was approved for use in the SMA and Superpave 12.5 FC2 asphalt mixes. Mr. Oddi also stated that the trial batches for both mix designs met the specified requirements. No one at Golder was copied on Mr. Oddi's email. Dr. Uzarowski testified that he was unaware of Mr. Oddi's email at the time, and that he only learned of it and Mr. Oddi's approvals through this Inquiry.

Mr. Oddi was asked about this email at the Inquiry. Mr. Oddi testified that he understood the Demix aggregate to have been approved as of May 8, and so his email merely stated a fact known to all. Mr. Oddi had no recollection of why he sent the email, at whose request it was sent, or why Golder was not copied. Mr. Hainer recalled that

[20] Dr. Flintsch is the Director of the Center for Sustainable and Resilient Infrastructure at Virginia Tech Transportation Institute.

Mr. Oddi's email may have followed an on-site conversation about closing the loop on outstanding requests. He did not have any insight into why Golder was not copied.

Mr. Oddi's email is the only written record of the Demix aggregate approval the Inquiry received. Dr. Uzarowski confirmed that he was not aware of any written approval given for the Demix aggregate by him or anyone else at Golder after the May 8 site meeting (at which oral approval was given).

The Inquiry did, however, receive expert evidence from Dr. Flintsch and Dr. Baaj about the suitability of the Demix aggregate. Dr. Baaj's opinion, which Dr. Flintsch agreed with, was that the Demix aggregate met all mandatory requirements in the OPS specifications and that, as of 2007, the Demix aggregate was fully adequate for use in surface courses of high volume, high speed highways in Ontario.

I accept the opinions of Dr. Baaj and Dr. Flintsch that there were no aggregate quality issues disclosed in the various Demix aggregate test results and that the aggregate was suitable for use. Accordingly, it was reasonable for Golder to accept Dufferin's use of the Demix aggregate in the RHVP SMA and Superpave 12.5 FC2. The observations of Dr. Flintsch and Dr. Baaj regarding in-service polishing of the Demix aggregate on the RHVP are addressed in Chapter 12.

2.7.4.4.2. SMA Mix Design Approval

Mr. Oddi's August 9, 2007 email is also the only written approval of the SMA mix design produced to the Inquiry. Although the minutes from a site meeting on August 21 reflect that Golder completed its analysis and "provided written confirmation indicating the SMA mix design is satisfactory" some time after the July 10 site meeting, Golder's written confirmation was not produced to the Inquiry.

There is no evidence to suggest that Golder did not, in fact, provide written confirmation, regarding the SMA mix design, other than the absence of the communication itself. Due to this documentary gap, the Inquiry received no evidence regarding the timing of Golder's written confirmation (although I infer, based on the emails discussed earlier, that it was delivered after July 23, 2007) or the contents of the confirmation.

Dr. Flintsch also gave evidence to the Inquiry about the SMA mix design. Dr. Flintsch's opinion, upon which I rely, was that, based on his review of the SMA mix design, "[t]he

mix design was consistent with current mix design practices for SMA, based on [his] experience." Having received no contrary evidence, I am satisfied that there were no anomalies in the RHVP SMA mix design and that no material issues arose from the use of this mix design and its ultimate approval.

2.7.4.5. Discrepancies in Golder's SMA Laboratory Test Results

As discussed above, Golder performed aggregate gradation QA testing for the mainline SMA and Superpave 12.5 FC2 in Golder's Whitby laboratory using the solvent extraction/gradation method. The Whitby laboratory did not send the gradation test results to Golder until August 21, 2007, three weeks after SMA paving began and eight days after it was completed by Dufferin. Dr. Uzarowski received 32 SMA and SP 12.5 test results from the Whitby staff in the morning on August 21.

Dr. Uzarowski and Mr. Delos Reyes exchanged emails about the test results that afternoon. Dr. Uzarowski's emails indicate that he was uncertain about whether the results were for SMA or Superpave 12.5 FC2 asphalt, and was concerned that 9 of 28 SMA samples contained rejectable results that did not meet the gradation requirements. Dr. Uzarowski's concern about the rejectable results appears to have been heightened because SMA paving had been completed and according to his email, "the plant and aggregate [were] already gone".

The Inquiry received evidence from Dr. Uzarowski and Mr. Delos Reyes about the aggregate gradation test results and the issues discussed in their August 21 emails. The evidence of both is that four SMA samples were mislabelled by the Whitby lab; these samples had been labelled SMA but actually were Superpave 12.5 FC2 samples. As I understand the evidence, and accounting for the mislabelling, Dr. Uzarowski received 18 SMA test results and 14 Superpave 12.5 FC2 test results on August 21.

Golder identified 30 SMA test results for samples received by Golder between July 17 and August 14 in the documents produced to the Inquiry (which accounted for the aforementioned labelling discrepancies). Dr. Uzarowski's evidence was that 8 SMA test results were acceptable on all sieves; 12 SMA test results contained a mix of acceptable and borderline aggregate gradation; and 10 SMA test results were rejectable on a single sieve (with 3 results that were also borderline on a single sieve). Dr. Uzarowski's opinion is that the SMA test results were "good overall". Although he

did not specifically recall, he believes he would not have recommended rejection of the entire paved areas represented by the 10 rejectable samples.

Dr. Uzarowski and Mr. Delos Reyes both testified about Golder's practice of providing a summary of test results, including issues in the results and the results' implications, to the client and the contract administrator. Dr. Uzarowski expected that the typical practice was followed and that the findings of the test results were reported to the City and Philips. However, neither Golder nor the City produced a document showing that the SMA test results and Golder's review thereof were transmitted to the City and Philips.

Again, I rely on the work of Dr. Flintsch, who reviewed the SMA laboratory test results and the evidence of Dr. Uzarowski regarding the mislabelled test results, in forming my conclusion in respect of the above. Dr. Flintsch's opinion was:

> Although the records indicate 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.

Having received no evidence to the contrary, I accept Dr. Flintsch's conclusion regarding the minimal impact of the mix design deviations on the SMA pavement friction.

2.8. The RHVP After Construction

2.8.1. October 2007 Friction Testing and Monitoring Systems

On October 16, 2007, prior to the opening of the RHVP, the MTO performed friction testing on a 4 km section of the RHVP, in the southbound lanes, using the ASTM E274 locked-wheel trailer. The MTO testing, which originated from Dr. Uzarowski's July 31 phone call to Dr. Raymond regarding the Demix aggregate, is discussed in Chapter 3.

During construction, the City installed a pavement instrumentation and monitoring system in the RHVP mainline pavement. The system's purpose was to verify the performance of the pavement materials and the perpetual pavement design, and to predict pavement performance. A traffic monitoring system was also installed. The traffic monitoring system recorded information about the number of vehicles,

vehicle speed, vehicle spacing, and loading of the vehicles, and was intended to be synchronized with the pavement response data.

2.8.2. Stantec's Plan for Post-Construction Maintenance of the RHVP

In October 2007, Stantec submitted to the City a plan to maintain the RHVP and LINC, titled "Lincoln Alexander Parkway and Red Hill Valley Project Sustainability Plan" (the "Stantec Sustainability Plan"). The Stantec Sustainability Plan was presented to the Mayor and Council in an information update report on November 5, 2007. The information update advised that the Stantec Sustainability Plan outlined the activities and costs required to maintain the RHVP and LINC infrastructure assets, which consisted of the roadway corridor and environmental features.

It is not necessary to provide an exhaustive summary of the Stantec Sustainability Plan, given the fact that Council did not implement it. However, the Stantec Sustainability Plan contains the following statements regarding pavement condition and pavement safety, and recommendations for friction testing that are relevant to this Inquiry's purposes:

> Pavement Safety 2.1.1
>
> Pavement surface condition and skid resistance contribute to the safety characteristics of the pavement section. Wet surface accidents may occur because of the lack of skid resistance (low friction) or because of the existence of some safety related distresses, such as rutting.
>
> Pavement safety is usually evaluated in terms of the ability of the pavement surface to provide adequate skid resistance, or surface friction, to minimize the possibility of slipperiness of the vehicles. Although pavement safety is primarily evaluated in term of skid resistance, other components such as rutting and roughness should be considered in the overall framework of safety.
>
> Pavement skid resistance measurements are typically empirical. Therefore, results from any given procedure or devise [*sic*] to evaluate

> the skid resistance of the pavement has to be interpreted in terms of the standard testing methods.
>
> Pavement skid resistance would typically deteriorate over time due to pavement surface weathering. Therefore, since skid resistance constitutes a safety concern, it is recommended that pavement skid resistance be evaluated on regular basis to identify areas of potential hazard, such that remedial measures to improve the skid conditions of the pavement surface could be implemented.
>
> …..
>
> Skid Resistance 2.2.1
>
> The main purpose of the skid resistance testing is to identify the areas with low skid resistance that may affect public safety. It is recommended to perform skid resistance testing every 1 - 2 years.
>
> ASTM E274 is the most widely used method for measuring the skid resistance, using a calibrated locked-wheel skid trailer. Based on the current market prices, the estimate for the probable cost for performing a skid resistance testing along the LINC and the RHVP is approximately $5,000.

Stantec acknowledged Mr. Murray, Mr. Moore, and Mr. Oddi as “major contributors” to the Sustainability Plan, in addition to various other City staff and consultant engineering participants. However, it is not clear if any of them had any input on the friction testing section.

In the Sustainability Plan, Stantec recommended an average annual operations and maintenance budget of $4 million for the LINC and the RHVP roadways and $280,000 for the Red Hill Creek Valley. The information update noted that estimates for the annual budget would be submitted by the Operations & Maintenance division in the 2008 budget process.

An internal City email sent in June 2019, in the context of a pavement-related Value for Money Audit performed by the City’s Office of the Auditor General, stated that the requested funding amount ($4.28 million) was not supported by Council and

consequently, the RHVP/LINC maintenance plan was not implemented. The Value for Money Audit is discussed in Chapters 9 and 10.

2.8.3. The RHVP Wins Awards

The RHVP opened to the public on November 17, 2007.

In the months and years that followed, the RHVP project was heralded as an innovative, environmentally conscious, and precedent-setting project. Praise for the RHVP centered, in large part, on the RHVP's status as one of the first municipal roads built in Ontario with a perpetual pavement structure. Several awards and accolades were bestowed on the RHVP and the key players in the freeway's design and construction, including the City, Dufferin, and Golder.

A number of industry papers and profiles were also written, and industry presentations and lectures given, about the RHVP. Dr. Uzarowski and Mr. Moore were active in the post-construction profile-building for the RHVP. Presentations and papers often emphasized the project's innovative nature, the City's decision to use a perpetual pavement structure on the RHVP, and the instrumentation and monitoring systems installed in the RHVP pavement.

As a result, a strong narrative of success was built up around the RHVP in the asphalt and paving industry and within the City. By extension, this narrative was also built up around the individuals involved, including Mr. Moore, given his 20-plus years of involvement with the RHVP from conception to completion.

CHAPTER 3

Involvement of Ontario Ministry of Transportation with the RHVP from 2007 to 2019

3.1. Overview

Between 2007 and 2014, the Ontario Ministry of Transportation ("MTO") conducted friction testing on sections of the RHVP. With the exception of the testing conducted in 2007, the City of Hamilton (the "City") was not aware of the MTO's testing or the results of that activity until 2019. This chapter describes the MTO's purposes in conducting the testing, the nature of the friction testing conducted, and the results of the MTO testing.

The MTO conducted friction testing on the RHVP for two reasons:

1) In 2007, because Dr. Ludomir Uzarowski (Principal, Pavement & Materials Engineering, Golder) requested it on behalf of the City to confirm the acceptability of the Demix aggregate used in the RHVP stone mastic asphalt ("SMA") surface course, and to consider any early age low friction issues respecting the pavement, the latter of which was also of interest to the MTO; and

2) In 2008 and 2009, for the purpose of evaluating the suitability of the Demix aggregate to be listed on the MTO's Designated Source of Materials ("DSM") list, and in 2010, 2011, 2012, and 2014, to evaluate the continuing performance of the Demix aggregate as a requirement for remaining on the DSM.

The MTO promptly provided the 2007 test results to Dr. Uzarowski in October 2007, who in turn provided them to Gary Moore (Manager, Design, Red Hill Valley Project, Public Works, Hamilton) and Marco Oddi (Senior Project Manager, Red Hill Valley Project, Public Works, Hamilton). The MTO considered the 2007 results to be acceptable for newly laid SMA pavement.

The MTO considered the results of the testing conducted between 2008 and 2014 to be acceptable for DSM purposes. This testing was conducted for the MTO's own DSM-related purposes, not as part of a traffic safety investigation on the RHVP. The MTO provided these results to the City in February 2019 after the Tradewind Report was disclosed to the public, as discussed in Chapter 11.

3.2. MTO Friction Testing on the RHVP in 2007

On October 16, 2007, the MTO conducted friction testing limited to a stretch of approximately 4 km of the RHVP in the southbound lanes. The MTO carried out this testing at the request of Dr. Uzarowski on the City's behalf, made in Golder's capacity as the Quality Assurance consultant for the RHVP paving project.

The events precipitating Dr. Uzarowski's request, and the October 2007 RHVP friction testing itself, are detailed below.

3.2.1. Initial Origins of the MTO Friction Testing

The idea of the MTO conducting friction testing on the RHVP dates back to May 2007. At that time, the City requested financial support from the MTO to cover the instrumentation and monitoring system the City planned to install in the various layers of the RHVP perpetual pavement structure. Internally within the Materials Engineering & Research Office ("MERO"), the MTO considered providing services-in-kind to the City, including friction testing using the MTO's ASTM E274 brakeforce locked wheel trailer, rather than a financial contribution. The MTO's interest in doing so was related to the ongoing SMA early age low friction issues with which the MTO continued to grapple with in the spring of 2007 related to SMA paving contracts on MTO highways. However, this idea remained an internal proposal only, and went no further than the MTO at that time.

3.2.2. The Precipitating Event: Dr. Uzarowski's Call to Dr. Raymond

As described in Chapter 2, Dr. Uzarowski had concerns about the suitability and use in the SMA surface course of the RHVP of the aggregate from Demix Agrégats' quarry in Varennes, Quebec, and he had also heard a rumour about an MTO prohibition on the use of Ontario Trap Rock aggregate which, like the Demix Agrégats' aggregate, was classified as a trap rock. As a result, on July 31, 2007, Dr. Uzarowski called Dr. Chris Raymond of the MTO (Senior Pavement Design Engineer, Pavements &

Foundations, MERO, Highway Standards Branch, Provincial Highways Management Division, MTO)[1] to discuss these issues.

Dr. Uzarowski and Dr. Raymond knew each other through the relatively small, interconnected pavement engineering industry. As Dr. Uzarowski explained, he called Dr. Raymond in part because of their professional relationship, but also because he viewed Dr. Raymond as knowledgeable about SMA. What Dr. Uzarowski was not aware of was that, as of March 2007, Dr. Raymond had been a member of a joint MTO/ industry SMA task group that earlier in 2007 had recommended the prohibition on using aggregate in SMA mixes sourced from the Ontario Trap Rock quarry. The SMA task group and the issue of early age low SMA friction are discussed in Chapter 1.

On August 1, the day after the call, Dr. Raymond emailed his MTO colleagues, Becca Lane (Senior Pavement Design Engineer, Pavements & Foundations Section, MTO), Kai Tam (Manager, Bituminous Section, MTO), and Chris Rogers (Manager, Soils and Aggregate Section, MTO) reporting on his discussions with Dr. Uzarowski. Both Dr. Raymond and Dr. Uzarowski agreed in their testimony that Dr. Raymond's email accurately summarized their discussion on July 31. Dr. Raymond wrote:

> I received a call yesterday (Tuesday Aug 31st)[2] from Ludamir U. of Golder Associates. He had heard a rumour that the Ministry no longer allows Ontario Trap Rock in SMA. I informed Ludamir that the Ministry has had concerns with early life friction in some SMA pavements. In response to these concerns the Ministry is continues [*sic*] to investigate early life friction and has formed MTO-Industry task groups to discuss the issue the last two winters. As an interim measure the Ministry has developed a short list of acceptable SMA aggregates which are communicated through special provision (313S45 and now 110F12). The Special provisions do not currently list Ontario Trap Rock. Also in SWR [Southwest Region] we look at the cost implications of the limited SMA aggregate sources in the area to determine if SP 12.5 FC2 should be

[1] In this chapter, unless stated otherwise, all MTO staff referenced by name are in the MTO's Materials Engineering & Research Office (MERO) in the Highway Standards Branch of the Provincial Highways Management Division.

[2] Dr. Raymond confirmed in his testimony that the date referred to in his August 1, 2007, email is incorrectly dated; the date of the call was July 31, 2007.

> the surface course on potential SMA projects. Action has also been taken on carry over contracts to ensure acceptable early life friction.
>
> Ludamir expressed concern regarding the proposed use of SMA on a City of Hamilton project (Red Hill Creek Expressway) where the contractor has submitted a mix design using a Quebec source (Demix Varennes) – the aggregate is not on the Ministry's DSM. Ludamir indicated he was going to follow up with Chris Rogers regarding the background of this source. A possible outcome is that the City of Hamilton could make a request for friction testing.

I accept Dr. Uzarowski's evidence that he first learned about the MTO's ongoing concerns with SMA early age low friction during the phone call with Dr. Raymond on July 31. Dr. Uzarowski did not convey this new information to his client, the City, at the time. The evidence of Mr. Moore and Mr. Oddi is that they were unaware of the SMA early age low friction issue until Dr. Uzarowski advised them in the fall of 2007, after the RHVP SMA surface had been paved.

Dr. Uzarowski explained that his concern as of July 31, 2007 related to the Demix aggregate not being listed on the MTO's DSM list, as summarized in the second paragraph of Dr. Raymond's email. The DSM is described in Chapter 1.

Dr. Uzarowski acknowledged in his testimony that he would have preferred that the Demix aggregate had been listed on the DSM, and that this concern in part motivated his call to Dr. Raymond. Dr. Uzarowski recalled that he may have attempted, unsuccessfully, to contact Mr. Rogers, as Dr. Uzarowski advised Dr. Raymond he intended to do. Mr. Rogers, as the Head of the Soils & Aggregates section in MERO at the time, was responsible for overseeing the administration of the DSM and had extensive knowledge about aggregate sources in Ontario and beyond. Mr. Rogers was also very familiar with the early age SMA low friction issue because he was also a member of the joint MTO/industry SMA task group.

Neither Dr. Uzarowski nor Dr. Raymond recall who suggested the friction testing referred to as a "possible outcome" in Dr. Raymond's August 1 email, nor were they aware of the MTO's internal consideration of a similar proposal in May 2007. This does not matter for the Inquiry's purposes. What is significant is that the two concerns described above – the SMA early age low friction issue and the fact that the Demix

aggregate was not on the DSM – gave rise to the suggestion of friction testing on the RHVP. Dr. Uzarowski testified that, by the end of his call with Dr. Raymond, he was convinced that the friction levels on the RHVP should be tested following the completion of paving.

3.2.3. Dr. Uzarowski Requests Friction Testing on the RHVP

The subject of RHVP friction testing appears to have lain dormant after July 31, for six weeks, until early September 2007. On September 10 and/or 11, Dr. Uzarowski and Dr. Raymond spoke again about the possibility of MTO friction testing on the RHVP. At that time, the focus of discussion was primarily logistical: who would conduct the testing, the location of the testing, the mechanics of the testing, and what was required before the MTO would conduct the testing.

From the MTO's perspective the principal benefit of the testing was the prospect of additional SMA early age friction data, although the testing would also yield information regarding the Demix aggregate source.

The MTO initially required a formal request from the City or City approval of Dr. Uzarowski's request on its behalf. The rationale for this requirement was explained to the Inquiry as partly a courtesy since the RHVP was a municipal road, rather than provincial, and partly because of the potential that further action might have been warranted or required if the results indicated low friction numbers. This is consistent with the MTO's general practice. As described in Chapter 1, municipal road friction testing by the MTO is uncommon, and is typically performed following a request from municipal staff to an MTO contact.

Dr. Raymond explained the need for a City-approved request to Dr. Uzarowski during their discussions in early September. According to Dr. Raymond, Dr. Uzarowski told him that the City agreed with the MTO performing testing but would not make the request of the MTO directly. Dr. Uzarowski did not explain to Dr. Raymond the reason(s) for the City's unwillingness.

For his part, Dr. Uzarowski told the Inquiry that he recalled the City agreeing with his suggestion to do the testing; however, he has no recollection of why the City did not want to issue a formal request. Similarly, Mr. Moore acknowledged the City's

agreement, but does not remember the City being asked to make a formal request or why, if asked to provide such a request, the City would not have agreed to issue one. It was in the context of discussing the friction testing request that Mr. Moore recalled first learning about the early age SMA low friction issue from Dr. Uzarowski.

Whatever the reason, the City never made a direct request to the MTO for the post-construction RHVP friction testing, nor did the MTO ultimately require one. Rather, the request for the RHVP friction testing and all subsequent, related correspondence flowed through Dr. Uzarowski or others at Golder. From the time of the request through to delivery of the results, there was never any direct contact between the MTO and City staff regarding the MTO's 2007 friction testing.

3.2.4. MTO Conducts Friction Testing on the RHVP

3.2.4.1. Testing Arrangements and October 16, 2007 Testing

After the MTO committed to conducting the friction testing on the RHVP, Frank Marciello (Pavement Evaluation Supervisor, Pavements & Foundations Section, MTO) was directed to arrange and conduct the work.

In the lead-up to the RHVP testing, Mr. Marciello corresponded with Andro Delos Reyes (Senior Pavement & Materials Geotechnical Technologist, Golder) to organize the testing. Mr. Delos Reyes, who was on-site at the RHVP daily, described his role in the MTO's testing as two-fold: first, to ensure that the route that Mr. Marciello tested was clear and free from any obstacles or obstructions that would impede testing, and second, to obtain permission from the relevant project stakeholders. He also acted as the intermediary between Mr. Marciello and the project stakeholders on matters of general correspondence.

On October 4, 2007, Mr. Delos Reyes sent the logistical details about the MTO's impending RHVP friction testing to Philips Engineering (the City's contract administrator on the RHVP project) ("Philips"), James Wharrie (Construction Coordinator, Dufferin), Mr. Oddi, and Dr. Uzarowski, writing that he was doing so for their "information and permission." Details of the MTO testing were subsequently escalated within Dufferin by Mr. Wharrie to David Hainer (Site Superintendent, Dufferin), Peter Gamble (Manager, Plants, Equipment and Technology, Dufferin), and Brandon Dodds (Project Engineer, Dufferin). Dufferin's permission was also necessary because the RHVP remained

an active construction site under Dufferin's custody and control. The Inquiry did not receive any documents evidencing Dufferin's permission, but I accept, by virtue of the fact that the testing was ultimately conducted, that the authorization must have been given.

On October 16, Mr. Marciello conducted the friction testing on a section of both RHVP southbound lanes. He did not conduct testing in the northbound lanes because of ongoing construction activities in those lanes. The tested section in the southbound lanes was just short of 4 km in length from the CN Railway overpass (the northern boundary) to Greenhill Avenue (the southern boundary). As described later in this chapter, this section also served as part of the test section for the DSM application by Demix Agrégats and continued DSM-related monitoring by the MTO between 2008 and 2014.

Mr. Marciello conducted the RHVP testing using the MTO's ASTM E274 locked-wheel friction tester, in accordance with standard MTO testing practices. The MTO testing practices are described in detail in Chapter 1**.** The testing was conducted at or in the range of 90 km/h, in keeping with the 90 km/h posted speed limit on the RHVP. One deviation from the MTO's standard testing practices was that the testing was not done in mixed traffic conditions. The RHVP did not open to traffic until November 17, 2007.

Friction testing is not a standard post-construction test for the MTO. According to Mr. Marciello, who performed thousands of friction tests over his 29-year career at the MTO, it was not very common to test a road before it opened to the public. Nor was friction testing a standard post-construction test encountered by paving contractors. It was rarely, if ever, something that Dufferin had encountered on a paving project. This is almost certainly because, as was the case with the RHVP paving contract (Contract PW-06-243), paving contracts generally do not include requirements or specifications tied to surface friction levels.

3.2.4.2. Distribution of the 2007 RHVP Friction Results Within the MTO

On October 17, 2007, the day after the testing, Mr. Marciello emailed the test results to Dr. Raymond and Ms. Lane. The results were set out in two spreadsheets that contained the detailed test results for each spot at which the test was conducted and a chart that plotted the friction numbers in each lane. Mr. Marciello requested that Dr.

Raymond and Ms. Lane forward the results to the appropriate personnel. Echoing an email he received from Mr. Delos Reyes earlier that day (discussed below), Mr. Marciello noted that Dufferin, Philips, and Mr. Delos Reyes were "eager for" the results.

Figure 3a sets out the average, the minimum, and the maximum friction numbers ("FN"), by lane.

Figure 3a: 2007 RHVP Friction Results

Lane	Average FN	Minimum FN	Maximum FN
Southbound Lane 1	33.9	28.1	36.5
Southbound Lane 2	33.8	28.4	37.4

The detailed results for Southbound Lane 1 and Southbound Lane 2, respectively, are set out in **Figure 3b**.

Figure 3b: Detailed 2007 RHVP Friction Results

PAVEMENT FRICTION SURVEY 2007

MTO ASTM E274, E501 MERO

Red Hill Valley Pkwy > DIR: SBL1 LANE: 1 DATE: Oct-16
SITE: CNR OH STRUCTURE TO GREENHILL AVE (HAMILTON)
LHRS: N/A O/S: N/A TEMP: 12 DEG

DIST	SPEED	AVG FN	DIST - LANDMARKS		COMMENTS
0.000			0.00 >	CNR STRUCTURE	SMA in Contract PW-06-243 (RHV)
0.249	93.9	33.6			Unopened to Traffic
0.438	90.2	28.7	0.49 >	BARTON ST	
0.619	92.4	34.3			
0.791	93.3	35.7			
0.967	93.0	32.5			
1.146	92.2	32.8			
1.307	91.6	33.8			
1.581	91.4	35.1			
1.748	90.9	28.1	1.82 >	QUEENSTON RD	
1.937	92.8	35.4			
2.120	91.5	35.5			
2.291	92.6	34.9			
2.499	91.1	33.6			
2.740	92.8	32.6	2.65 >	KING ST	
2.930	93.6	36.5			
3.129	93.6	34.9	3.14 >	CPR STRUCTURE	
3.316	90.4	34.2			
3.487	90.8	36.3			
3.677	90.2	34.2			
3.815	90.6	35.5	3.95 >	GREENHILL AVE	
AVG. SPD	**91.9**	**33.9**	AVG. FN		
		28.1	Min. FN		
		36.5	Max. FN		
		2.2	Std.Dev.		
		20	Field		

PAVEMENT FRICTION SURVEY 2007

MTO — ASTM E274, E501 — MERO

Red Hill Valley Pkwy > DIR: SBL2 LANE: 2 DATE: Oct-16
SITE: CNR OH STRUCTURE TO GREENHILL AVE (HAMILTON)
LHRS: N/A O/S: N/A TEMP: 12 DEG

DIST	SPEED	AVG FN	DIST - LANDMARKS		COMMENTS
0.000			0.00 >	CNR STRUCTURE	SMA in Contract PW-06-243 (RHV) Unopened to Traffic
0.263	89.6	34.7			
0.442	90.9	29.6	0.49 >	BARTON ST	
0.609	91.0	33.9			
0.751	90.2	34.5			
0.908	92.5	35.4			
1.063	91.2	34.6			
1.210	90.6	34.6			
1.343	91.4	34.0			
1.477	90.9	35.9			
1.609	91.1	37.4			
1.743	93.1	28.4			
1.943	91.0	35.2	1.82 >	QUEENSTON RD	
2.091	90.5	34.9			
2.248	90.8	36.7			
2.400	90.3	33.5			
2.583	89.1	28.6			
2.759	90.0	29.7	2.65 >	KING ST	
2.905	90.7	36.8			
3.094	90.1	33.9	3.14 >	CPR STRUCTURE	
3.286	91.5	35.1			
3.481	90.2	34.2			
3.644	89.6	33.2			
3.793	88.9	33.6	3.95 >	GREENHILL AVE	
AVG. SPD	**90.7**	**33.8**	AVG. FN		
		28.4	Min. FN		
		37.4	Max. FN		
		2.5	Std.Dev.		
		23	Field		

The MTO assessed the results from the perspective of its experience with early age low friction problems with SMA. From this perspective, the results did not raise any early age friction concerns for the MTO, and they were acceptable without any further investigation or remediation. In contrast to some MTO friction results for early age SMA pavements, which ranged between FN20 and below FN30, the average RHVP results were above FN30. As described in Chapter 1, friction values for SMA pavements are expected to increase somewhat after traffic wears down the asphalt film layer, and then decline over time in line with other (non-SMA) pavements.

3.2.4.3. Distribution of the 2007 RHVP Friction Results to Golder and the City

On the morning of October 18, 2007, Dr. Raymond emailed the RHVP friction test results to Dr. Uzarowski and Mr. Delos Reyes, stating:

> Attached please find the friction testing results for the Red Hill Valley Parkway.

> Please pass the results on to those involved with the project.
>
> You may wish to note that some of the friction numbers less than 30 correlate with being located under a structure.
>
> Should you have any questions regarding the results please do not hesitate to contract us.

From there, it was left to Dr. Uzarowski and/or Mr. Delos Reyes to distribute and discuss the results as needed. Dr. Uzarowski forwarded Dr. Raymond's email with the attached test results to Mr. Moore and Mr. Oddi at the City later that morning, indicating he would follow up with a call to discuss the results.

No one from Golder or the City contacted Dr. Raymond with questions regarding the results or to discuss the MTO friction testing further, although Dr. Uzarowski and Dr. Raymond subsequently discussed the use of shotblasting as a friction treatment for new SMA pavements.

Dr. Uzarowski understood that the MTO used FN30 as a guideline to assess friction testing results. His understanding undoubtedly informed his interpretation of the RHVP results, which he described as "good, acceptable numbers."

Mr. Moore testified that, in the follow-up discussion, Dr. Uzarowski conveyed that the MTO found that the City's initial friction numbers were higher than what the MTO got on their new SMA pavements and that, consequently, the City was "good to go". However, Mr. Moore was not aware of the MTO's use of FN30 as an informal guideline, nor did Dr. Uzarowski convey this to him.

Mr. Oddi recalled Dr. Uzarowski advising him, during an on-site discussion, that the RHVP friction numbers from the MTO testing were "very good" for an SMA pavement. It was during this conversation that Mr. Oddi learned about the early age low friction issue associated with SMA pavements. According to Mr. Oddi, he and Dr. Uzarowski did not discuss the technical details of the results or the MTO informal FN30 guideline in this conversation, and Mr. Oddi "didn't know what the numbers meant".

Golder did not provide the 2007 friction testing results to anyone else at the City, nor did Mr. Moore or Mr. Oddi. In addition, none of them told anyone else at the City that the testing had taken place.

3.2.4.4. Distribution of the 2007 RHVP Friction Results to Philips and Dufferin

As noted, on October 17, the day after the friction testing, Mr. Delos Reyes emailed Mr. Marciello to follow-up on the results. Mr. Delos Reyes advised that Dufferin and Philips were "highly interested".

Mr. Delos Reyes thought this statement originated from a conversation he had with employees at Dufferin and Philips at the RHVP work site. Beyond this, Mr. Delos Reyes had no recollection at the Inquiry of with whom he spoke or the nature of the interest expressed by Dufferin and Philips. The Inquiry did not receive any documents that shed light on Philips' interest. In the absence of specific evidence, I am unable to reach any conclusions about who at Philips was "highly interested" in the RHVP test results, or the reason for that interest.

Commission Counsel made inquiries of Philips (which changed its name to 228704 Ontario Inc. in 2009) and its successor entity Wood Canada Limited respecting production of documents relevant to the Inquiry. Wood Canada Limited advised that, while it purchased the assets of Philips, it had no documentation respecting completed projects. The numbered company was unresponsive. Accordingly, no representatives of Philips or its successor firm(s) produced documents or testified at the Inquiry.

Dufferin, however, was interested in the RHVP friction testing results because of Dufferin's concurrent application for inclusion of the Demix aggregate on the MTO DSM list.

On October 15, 2007, the day before the MTO friction testing, Paul Janicas (Senior Quality Control Lab Supervisor (Bituminous), Dufferin) submitted a cover letter and application package to the contract administrator of an MTO paving project, for which Dufferin was the paving contractor. Dufferin submitted the application on behalf of Demix Agrégats, an affiliate of Dufferin, which was (and is) a Quebec-based aggregate producer with a quarry near Montreal at Varennes, Quebec. The application package requested a trial section be used from that project to evaluate the use of the Demix aggregate in the Superpave 12.5 FC2 surface course. As support for the application, Mr. Janicas emphasized the use of the Demix aggregate in the Superpave 12.5 FC2 and SMA layers of the RHVP and the planned RHVP friction testing. He wrote:

> Also, please note that the Ministry is currently performing "skid resistance" testing on the SMA from the Red Hill Valley project, which uses these aggregates. By allowing this trial section, it would facilitate a full evaluation of this product.

In any event, however, no one at either Dufferin or Philips received the MTO's October 2007 RHVP friction testing results. The Inquiry received no emails or other correspondence transmitting the results to Dufferin and/or Philips and, indeed, Mr. Janicas, Mr. Gamble, and Mr. Hainer – all of whom were senior staff at Dufferin – testified that they did not receive the actual test results or know what the friction numbers were.

The only evidence of communication of the results to Dufferin is Mr. Hainer's vague recollection of a passing discussion at the RHVP work site or at a site meeting in which he learned that the friction testing results were good and indicated no concern. The source of this information was beyond Mr. Hainer's recollection.

3.3. MTO Pauses Use of SMA in November 2007

In early November 2007, the MTO paused the use of SMA on provincial highways. The pause was put in place to respond to ongoing concerns about low pavement friction on the MTO's SMA pavements and the associated rising construction costs for SMA pavements. The final impetus for the pause was, in part, low pavement friction results on an MTO contract on Highway 401 near Woodstock (Contract 2005-3030), which exhibited results ranging from the low to high FN20s when tested immediately after construction. The MTO's SMA pause, including the precipitating events and the eventual reinstatement of SMA in 2014, is discussed in Chapter 1.

Importantly for the Inquiry's purposes, the October 2007 RHVP friction test results did not factor into the MTO decision to pause its use of SMA. To the contrary, as noted above, the RHVP results were an outlier, with higher early age friction levels than the MTO typically observed on its own SMA paving contracts.

3.4. MTO Friction Testing on the RHVP Between 2008 and 2014

The MTO also conducted friction testing on a section of the RHVP in 2008, 2009, 2010, 2011, 2012, and 2014. All friction testing on the RHVP in these years was conducted at the request of the Soils & Aggregates section within MERO, in connection with Demix Agrégats' request for listing on the MTO DSM list. The MTO testing during this period was not performed or analyzed for traffic safety purposes. The 2008 and 2009 RHVP testing was conducted for purposes of evaluating the suitability of the Demix aggregate to be listed on the DSM. Thereafter, in 2010, 2011, 2012, and 2014, the RHVP testing was conducted to evaluate the suitability of the Demix aggregate to remain on the DSM list. In 2016, Demix Agrégats voluntarily withdrew its aggregate from the DSM, which meant that no further friction testing was conducted.

Demix Agrégats' DSM application and the MTO's friction testing in 2008 to 2012 and 2014 are detailed below. The DSM requirements and the MTO's procedures respecting the processing and approval of DSM applications are described in Chapter 1.

3.4.1. Dufferin/Demix Agrégats' December 2007 DSM Application for the Demix Aggregate

The initial DSM application of Dufferin on behalf of Demix Agrégats in October 2007, described above, was denied by the MTO because it did not comply with the standard DSM application process and requirements.

On December 7, 2007, Mr. Janicas emailed Mr. Rogers on behalf of Demix Agrégats, enclosing a second Demix Agrégats application for a DSM listing. Attached to Mr. Janicas' email was a letter from Estel Gagnon (Chef Section Qualité, Demix Agrégats) to Mr. Rogers, dated November 22, 2007, formally requesting the commencement of the DSM approval process. As he had done in the prior, unsuccessful Demix Agrégats application, Mr. Janicas' email also referenced the recent use of the Demix aggregate in the SMA and Superpave 12.5 FC2 mixes on the RHVP (Superpave 12.5 FC2 was the asphalt mix used as the surface course on the RHVP ramps rather than SMA which was used for the RHVP mainline).

Both of Mr. Janicas' communications — the initial October 15 application and his December 7 email — were sent at the request or instruction of Mr. Gamble. According to Mr. Gamble, Dufferin internally discussed a possible DSM application for the Demix aggregate before Dufferin paved the RHVP. After the RHVP paving was completed, Mr. Gamble was of the view that the Demix aggregate was a "very, very good material". It was at that point that Mr. Gamble decided to move forward with the DSM application, relying on Mr. Janicas to get the process started.

On December 11, Mr. Marciello emailed the October 2007 RHVP friction test results to Mr. Rogers and Bob Gorman (Senior Aggregate Engineering Officer, Soils & Aggregates Section). Mr. Gorman was the primary person responsible for managing and overseeing the DSM list, in consultation with the Head of the Soils & Aggregates section (then Mr. Rogers). Both Mr. Rogers and Mr. Gorman considered the RHVP results acceptable for a newly placed SMA surface not yet open to traffic.

Two days later, on December 13, Mr. Rogers sent a response letter to Demix Agrégats. The letter acknowledged receipt of Demix Agrégats' request for DSM qualification, set out the requirements for approval, and advised about the next steps in the process. The DSM requirements and the MTO's process for DSM applications are described in further detail in Chapter 1. The letter also included the following statements:

> We are somewhat familiar with the rock from your quarry. In 1992, we tested a sample of the coarse aggregate from the quarry. The test results are portrayed in Table 1. Our Petrographer has classified your rock as a Syenite (Trachyitic Phonolite). The test results are generally acceptable. The only exception is the Polished Stone Value (PSV) test results, which did not meet our ministry's criteria.
>
> I note that your quarried aggregate was recently used on Hamilton's Red Hill Valley Parkway in a 12.5 SMA mixture (Contract No. PW-06-243). We plan to monitor the performance of your aggregate in the expressway.

PSV testing and the MTO's PSV requirements for DSM-listed aggregates are also described in Chapter 1.[3] As Mr. Rogers' letter highlighted, the 1992 PSV results were unsatisfactory based on the MTO's criteria. To qualify for DSM approval, an aggregate must maintain an average PSV of no less than 50, with no value less than 48.

The unsatisfactory PSV results from 1992 were not, however, considered by the MTO in relation to Demix's 2007 application. Instead, Demix's 2007 DSM application was considered afresh.

Mr. Rogers' letter included the statement that "we plan to monitor the performance of your aggregate in the expressway." According to Mr. Rogers, monitoring likely referred to a visual examination of the RHVP and, in due course, friction testing using the MTO's locked-wheel friction tester. From Mr. Rogers' perspective, the reference to monitoring was not, however, a commitment to use the RHVP as the test section for Demix's DSM application, nor a commitment to conduct future friction testing on the RHVP.

The next step in the application process — as outlined in Mr. Rogers' letter — was typically to visit the Demix Varennes quarry to obtain samples for laboratory testing. However, in this case, the MTO conducted skid testing on the RHVP in June 2008, before Soils & Aggregates staff visited the Demix Varennes quarry. These events are discussed later in this chapter. Mr. Rogers retired from the MTO in April 2008.

Neither the fact of Demix's application for DSM approval nor the MTO's planned monitoring of the RHVP for these purposes was communicated to the City by MTO staff in December 2007. This was in keeping with Soils & Aggregates' standard practice to communicate only with applicants in respect of their own DSM applications. The standard practice assumed, as Mr. Gorman explained in his evidence, that applicants had the necessary authorization from the asset owner (that is, the owners of the road)

[3] PSV is also discussed in the Flintsch Primer, prepared by Dr. Gerardo Flintsch for this Inquiry ("Primer on Friction, Friction Management, and Stone Matrix Asphalt Mixtures") at pages 7 and 15. Consistent with Mr. Rogers' evidence, Dr. Hassan Baaj (Golder's expert in this Inquiry, and the Director of the University of Waterloo's Centre for Pavement & Transportation Technology) and Dr. Flintsch both testified that the 1992 PSV results were not relevant to the PSV of the aggregate used in the RHVP surface course as the aggregate likely came from a different part of the quarry.

to propose or agree to test sites on the owner's asset. Thus, it is likely that neither Mr. Rogers nor Mr. Gorman even turned their mind to advising the City.

3.4.2. Post-2007 MTO Friction Testing: Context and Key Conclusions

The MTO conducted friction testing on a section of the RHVP in 2008, 2009, 2010, 2011, 2012, and 2014. The tested sections were the sections of the two southbound lanes tested in 2007 and the sections of the two northbound lanes in the same location. The test area extended from the CN Railway overpass (as the northern boundary) to Greenhill Avenue (as the southern boundary), totalling just short of 4 km in length.

As noted, all MTO friction testing conducted on the RHVP after 2007 was for purposes of evaluating the suitability of the Demix aggregate for the DSM. The MTO performed the testing initially to determine if the Demix aggregate had sufficient frictional qualities to be included on the DSM and, once the Demix aggregate was listed on the DSM in 2009, to assess if the aggregate's frictional qualities supported continued inclusion.

As the sole operator of the MTO's locked-wheel friction tester, Mr. Marciello conducted the MTO friction testing on the RHVP in the same manner as he had done in October 2007. In each year, Mr. Marciello distributed the results to selected staff in the Soils & Aggregates section (Stephen Senior (Head, Soils & Aggregate Section, MTO) and Mr. Gorman) and the Pavements & Foundations section. Mr. Marciello distributed results to the Head of Pavements & Foundations because he was part of that section in MERO, and this was part of his reporting requirements to his supervisor.

Except for possibly on one occasion in 2010 (discussed below), MTO staff did not share the RHVP friction test results from 2008 to 2014 with the City. Other than that one possible exception, the RHVP friction test results were not shared externally at all, including to Dufferin or Demix Agrégats, until February 2019, after the disclosure of the Tradewind Report to Council and the public.

The MTO had an established practice and unwritten policy not to share friction test results with outside parties subject to three exceptions. A discussion of the MTO's (non)distribution policy and its exceptions is included in Chapter 1. For purposes of

this chapter, it is sufficient to note that none of the exceptions to the MTO's policy applied for purposes of sharing the results with the City between 2008 and 2019.

There is also no evidence to suggest that staff at Demix Agrégats or Dufferin contacted the City to advise of the DSM application or to obtain authorization for testing in 2008, or in any subsequent year.

3.4.3. 2008

3.4.3.1. RHVP Friction Testing Conducted in 2008

On June 12, 2008, Mr. Marciello conducted friction testing on the RHVP at the request of the Soils & Aggregates section. Mr. Gorman accompanied Mr. Marciello during the testing. Mr. Marciello emailed the test results to Mr. Gorman, Dr. Raymond, and Joseph Ponniah (Senior Research Engineer, Pavements & Foundations Section, MTO) on June 18, 2008.

Figure 3c sets out the 2008 RHVP average, minimum, and maximum friction numbers, by lane.

Figure 3c: 2008 RHVP Friction Results

Lane	Average FN	Minimum FN	Maximum FN
Southbound Lane 1	40.3	36.3	45.1
Southbound Lane 2	38.2	34.1	43.4
Northbound Lane 1	41.2	36.8	44.1
Northbound Lane 2	38.7	35.7	40.6

According to Mr. Gorman, the results were acceptable for the purpose of evaluating a potential DSM list inclusion. All 2008 results, including the minimum friction values, were above FN30, the threshold of the MTO's internal guideline for this purpose. The results for the southbound lanes reflect an increase in the overall average friction numbers in Southbound Lane 1 and Southbound Lane 2 of 6.5 and 4.4, respectively, as compared to the 2007 results. These increases reflect the upward trajectory of

friction numbers expected for in-service SMA pavements compared to unopened SMAs, once the asphalt film wears off.

3.4.3.2. Additional Evaluation of the Demix Aggregate by Soils & Aggregates Staff

Mr. Gorman and Carole Anne MacDonald (Petrographer, Soils & Aggregates Section, MTO) visited the Demix Varennes quarry on July 17, as part of the standard DSM application review procedure. Mr. Gorman and Ms. MacDonald inspected the quarry (including the rock face and the homogeneity of the rock type) and took hand and stockpile samples for testing at the Soils & Aggerates section's laboratory. Subsequently, Ms. MacDonald performed the testing on the Demix quarry samples obtained that day.

3.4.3.3. MTO Confirms Ongoing Monitoring of the Demix Aggregate's Performance in the RHVP

On December 4, 2008, Mr. Senior advised Ms. Gagnon by letter that testing results for the coarse aggregate and screening samples obtained during the quarry visit were favourable and met the requisite criteria for a DSM listing. The PSV of the Demix aggregate was 52, two points above the MTO's mandatory average PSV of 50.

The correspondence made clear that the RHVP would serve as the test strip for DSM application purposes and that testing would measure the frictional performance of the aggregate in the RHVP surface course:

> Because your quarried aggregate was used on Hamilton's Red Hill Valley Parkway in a 12.5 SMA mixture (Contract No. PW-06-243), we will allow this city job to act as the trial section needed for your source to be included on the ministry's Designated Sources for Materials List (DSM #3.05.25). This contract has undergone one winter of service demand and requires at least two winters before an approval decision can be made. The mix must obtain the desirable level of friction before the source can be considered for DSM inclusion. We plan to monitor the performance of your aggregate in the parkway.

Allowing the RHVP to act as the test strip deviated from the MTO's standard practice in four respects: first, the RHVP was a municipal roadway, rather than an MTO

road; second, there was no adjacent control pavement containing a DSM-approved aggregate that could be used for comparison purposes; third, SMA pavements were not commonly used for test sections; and fourth, the test strip was much longer than the standard 500 m test strip.

The MTO standard practice was to have an adjacent control section containing a DSM-approved aggregate against which to compare the performance of a test strip. However, the Soils & Aggregates section had, in some other instances, conducted DSM-related friction testing on a test section that did not have an adjacent control pavement. According to Mr. Gorman, this was typically done on "after pavements" where a contractor requested DSM inclusion for an aggregate used in an already paved road (or segment of road). The RHVP was, in this respect, an "after pavement". I accept the MTO's submission that the collection of measurements from a non-MTO road for DSM listing purposes, while "highly unusual", made practical and economic sense in the circumstances.

Both Mr. Senior and Mr. Gorman confirmed that the "desirable level of friction" referred to in Mr. Senior's December 4 letter to Ms. Gagnon was FN30. As is described in Chapter 1, the MTO uses an average of FN30 as the minimum threshold for DSM suitability. The absence of specific friction measurement numbers in the MTO's correspondence, or reference to FN30 as the acceptable threshold against which those results were being assessed, was in keeping with the MTO's standard practice not to provide specific friction standards or friction numbers to DSM applicants.

As in the year prior, none of the MTO, Demix Agrégats, or Dufferin sent correspondence to advise the City of Demix Agrégats' DSM application or the friction testing on the RHVP, or to request permission to conduct testing on the RHVP. MTO staff did not consider advising the City or seeking permission because of the purpose for which the testing was done.

3.4.4. 2009

3.4.4.1. RHVP Friction Testing Conducted in 2009

On May 7, 2009, Mr. Marciello conducted friction testing on the RHVP. Mr. Gorman requested the 2009 testing on behalf of the Soils & Aggregates section. Mr. Gorman's annual request memo for friction testing, dated March 16, 2009, asked that the "Red

Hill Valley SMA be evaluated as soon as possible, since it will have passed its second winter."

Figure 3d sets out the 2009 RHVP average, minimum, and maximum friction numbers, by lane.

Figure 3d: 2009 RHVP Friction Results

Lane	Average FN	Minimum FN	Maximum FN
Southbound Lane 1	38.9	34.1	40.7
Southbound Lane 2	34.5	31.8	39.1
Northbound Lane 1	39.4	36.2	41.0
Northbound Lane 2	37.1	34.9	38.9

Mr. Marciello emailed the 2009 results to Mr. Senior, Mr. Gorman, and Ms. Lane, then the Head of the Pavements & Foundations section, on May 8, 2009. In his covering email, Mr. Marciello wrote, "[m]ight be too early to tell but it appears that friction levels/ trends may be starting to decline with time."

Figure 3e compares the average friction numbers in 2008 and 2009, by lane.

Figure 3e: 2008 and 2009 RHVP Friction Results, Comparison

Lane	Average FN – 2008	Average FN – 2009
Southbound Lane 1	40.3	38.9
Southbound Lane 2	38.2	34.5
Northbound Lane 1	41.2	39.4
Northbound Lane 2	38.7	37.1

Mr. Senior responded to Mr. Marciello three days later, writing:

> Frank, both Bob and I agree that there is no clear indication of any early trend in the data. Maybe you just have a "gut" feel for what's going on out there. Time will tell.
>
> We will be sending out a notice regarding conditional approval of the source, pending satisfactory performance of the pavement and of the source materials. Thanks for everything.

In his testimony, Mr. Senior explained that he felt it was "premature" to say there was a specific trend – in this case, a declining trend – in the absence of extended friction testing data. At the time of this email exchange, there were only two in-service data points for the RHVP from the 2008 and 2009 testing.

3.4.4.2. Conditional DSM Approval of the Demix Aggregate

On May 20, 2009, Mr. Senior wrote to Ms. Gagnon at Demix Agrégats to advise that the Demix aggregate was conditionally approved as a source of Superpave 12.5 FC1 coarse aggregate and Superpave 12.5 FC2 coarse and fine aggregate. Mr. Senior's letter stated that approval was based on acceptable physical property test results and:

> satisfactory performance in the northbound and southbound lanes of the above-noted 12.5 SMA mixture located on the Red Hill Valley Parkway.
>
> After two years of service, the surface course of the SMA pavement has developed satisfactory frictional properties, as indicated by friction determined during recent skid-resistance testing.

The MTO added the Demix aggregate to the DSM list sometime in the summer of 2009. Approval of the Demix aggregate was however, as Mr. Senior's letter indicated, conditional on continued satisfactory frictional performance of the RHVP SMA mix in future testing and the aggregate meeting the aggregate requirement specifications, including the PSV requirements.

It was consistent with the MTO's standard practice to grant conditional approval rather than full, unconditional approval. Conditional approval gives the Soils & Aggregates section oversight capabilities, allowing it to rescind approval if an aggregate source fails to perform adequately over time. Conditional approval also explains why the MTO continued to conduct friction resistance testing beyond the two-winter review period.

3.4.5. 2010

3.4.5.1. RHVP Friction Testing Conducted in 2010

Mr. Marciello conducted friction testing on the RHVP on March 30 and 31, 2010. Mr. Gorman requested the testing on behalf of the Soils & Aggregates section. As in 2008 and 2009, the 2010 testing was done for DSM purposes.

Mr. Marciello circulated the 2010 results to Mr. Senior, Mr. Gorman, and Ms. Lane on April 1. Mr. Marciello noted in his distribution email that:

> [t]he attached Read Only files will show a decline in friction in the NB [northbound] lanes averaging 5 FN. Some values are at or below FN100 of 30.
>
> SB [southbound] lanes performed at similar levels (mid 30s) as in 2009.

Figure 3f sets out the 2010 RHVP average, minimum, and maximum friction numbers, by lane.

Figure 3f: 2010 RHVP Friction Results

Lane	Average FN	Minimum FN	Maximum FN
Southbound Lane 1	34.9	29.1	38.8
Southbound Lane 2	32.2	28.4	37.7
Northbound Lane 1	35.1	29.4	39.8
Northbound Lane 2	31.7	29.0	33.8

In response to Mr. Marciello's email, Mr. Gorman stated that they would "have to watch this one", suggesting another round of friction testing take place after the summer. Mr. Marciello agreed with Mr. Gorman's suggestion.

Despite the suggestion by Mr. Gorman and Mr. Marciello's agreement to that suggestion, additional RHVP testing did not take place in 2010. There was no evidence before the Inquiry as to why it did not.

Mr. Marciello's reporting email and the test data reflect that the 2010 testing was conducted at 100 km/h. 100 km/h is the MTO's standard testing speed on 400-series highways. However, all prior (and subsequent) MTO testing on the RHVP was conducted at 90 km/h, consistent with the RHVP's posted speed.

The 10 km/h speed difference has some significance. Generally, the higher the testing speed, the lower the resulting friction number will be (and vice versa). For the 2010 RHVP results, the testing suggested a rapid decline in friction values from the year prior. As MTO witnesses explained, this year-to-year decrease was unusual and troubling. They had concerns that if another significant drop occurred the next year, the results could dip below FN30, possibly into the mid-20s. In its closing submissions to the Inquiry, the MTO noted that the drop was more significant than would be expected with one year of wear-and-tear.

Mr. Marciello did not notice the speed discrepancy in the 2010 RHVP testing until the next year, when he again conducted the RHVP testing. Upon recognizing the discrepancy in 2011, Mr. Marciello circulated adjusted 2010 test results, which reflected a less sharp decline from the 2009 test results. The adjusted results are dealt with later in this chapter.

3.4.5.2. MTO Discussions of RHVP Friction in November 2010

On November 15, 2010, Mr. Marciello and Ms. Lane exchanged emails under the subject line "Red Hill SMA". Mr. Marciello's initiating email gave details about the October 2007 RHVP testing, Dr. Uzarowski's involvement in those tests, and the overall trends in RHVP frictional performance since 2007. Ms. Lane replied, writing: "Good stuff Frank – thank you. Perhaps I will call Ludomir for a City of Hamilton contact." Mr. Marciello also recirculated the March 2010 test results to Ms. Lane which were, unbeknownst to them at the time, erroneously low.

The Inquiry received no emails or documents that give context to or explain why Mr. Marciello sent the RHVP-related email to Ms. Lane on November 15. I accept Ms. Lane's explanation that their emails likely reflect the continuation of an in-person discussion in which Mr. Marciello expressed concerns about the RHVP results, and Ms. Lane requested more information.

Ms. Lane called Dr. Uzarowski as she indicated she would. Ms. Lane and Dr. Uzarowski had known each other for years through the industry. Dr. Uzarowski's notebook contains a short entry on November 15, reflecting the call. It stated:

5) Becca Lane

- 2007 friction on RHVP

Dr. Uzarowski had no recollection of what he and Ms. Lane discussed on the call beyond what this entry reflects. He did, however, testify that he does not think they discussed post-2007 testing by the MTO; if they had, Dr. Uzarowski was certain that his notes would have reflected that.

For her part, Ms. Lane also did not recall the substance of their discussion, aside from that they must have discussed the RHVP and friction. Ms. Lane thought, without specific recollection, that she likely did receive a Hamilton contact from Dr. Uzarowski, since this was the purpose of her call. However, she did not remember receiving the contact information or who the contact was (if received). I accept Dr. Uzarowski's evidence that, had Ms. Lane requested a City contact, he would have provided Mr. Moore's information to her. However, Dr. Uzarowski also had no recollection of what information, if any, he provided.

In his testimony, Mr. Moore stated that he did not believe he spoke to Ms. Lane in 2010 about friction on the RHVP. Moreover, he stated: "I don't ever recall talking to MTO about friction on the Red Hill ever." There is some possibility that Ms. Lane contacted or attempted to contact someone at the City following her telephone conversation with Dr. Uzarowski on November 15, based on Ms. Lane's professional practices and her testimony that, if she sought and received a City contact, she would likely have followed up with that person. However, she did not have any specific recollection of actually doing so in this case.

Given the limited evidence on this issue, I conclude that the evidence does not a support a finding that Ms. Lane contacted Mr. Moore in or about November 2010 to discuss the MTO 2010 friction test results.

3.4.6. 2011

3.4.6.1. RHVP Friction Testing Conducted in 2011

On May 25, 2011, Mr. Marciello conducted friction testing on the RHVP. Mr. Gorman requested the testing on behalf of the Soils & Aggregates section.

Mr. Marciello circulated the 2011 results to Mr. Senior, Mr. Gorman, and Ms. Lane the day after testing was completed. He also provided adjusted results for 2010, to account for the discrepancy Mr. Marciello identified in the 2010 testing speed. Mr. Marciello's email explained the 2010 and 2011 results, and the discrepancy [underlined in original]:

> Data for 2010 was collected and reported at 100km/h. That's 10km/h over all the previous years' collection speed. This would definitely explain why this SMA's performance dropped significantly last year. I made and reported an adjustment in the data below
>
> The Hamilton site was also tested yesterday, so the attached Read only files reflect performance levels since 2007.
>
> Overall performance in 2011 is in the low to mid 30 range
>
> Most lanes (NBL1, SBL1 and SBL2)[4] within the test limits of Greenhill Ave and the CNR Overhead Structure had their average FN90 reduced by 2. This also caused some minimum values to dip below 30.
>
> NBL2 maintained its same frictional levels when compared to 2010

Figure 3g sets out the adjusted 2010 RHVP average, minimum, and maximum friction numbers, by lane.

[4] This refers to Northbound Lane 1, Southbound Lane 1, and Southbound Lane 2, respectively.

Figure 3g: Adjusted 2010 RHVP Friction Results

Lane	Average FN	Minimum FN	Maximum FN
Southbound Lane 1	37	31	41
Southbound Lane 2	34	30	40
Northbound Lane 1	37	31	42
Northbound Lane 2	34	31	36

Mr. Marciello testified that he prepared the adjusted results by increasing the average FN in the 2010 test results by FN2 so that: Southbound Lane 1 increased from 34.9 to 37; Southbound Lane 2 increased from 32.2 to 34; Northbound Lane 1 increased from 35.1 to 37; and Northbound Lane 2 increased from 31.7 to 34. Mr. Marciello's methodology was based on his understanding that a speed differential of 10 km/h corresponded with an increase or decrease of FN2.

Figure 3h sets out the 2011 RHVP average, minimum, and maximum friction numbers, by lane.

Figure 3h: 2011 RHVP Friction Results

Lane	Average FN	Minimum FN	Maximum FN
Southbound Lane 1	34.8	29.3	37.6
Southbound Lane 2	32.4	28.8	37.5
Northbound Lane 1	35.0	28.6	37.2
Northbound Lane 2	34.3	30.5	37.0

The 2011 results, as Mr. Marciello noted, reflected an FN decrease of almost 2 from the adjusted 2010 values, except for Northbound Lane 2.

Notwithstanding the general decline in friction values, the 2011 RHVP results were acceptable to the MTO for continued DSM-status for the Demix aggregate.

3.4.7. 2012

3.4.7.1. RHVP Friction Testing Conducted in 2012

Mr. Marciello conducted friction testing on the RHVP on April 10, 2012. Mr. Gorman requested the testing, on behalf of the Soils & Aggregates section. Mr. Marciello emailed the 2012 results to Mr. Senior, Mr. Gorman, and Karen Smith (Head, Geotechnical Engineering, Central Region, Provincial Highways Management Division, MTO) on April 20, 2012.

Mr. Marciello's email advised: "Other than a few FN90 hovering under 30, looks consistent with 2011."

Figure 3i sets out the 2012 RHVP average, minimum, and maximum friction numbers, by lane.

Figure 3i: 2012 RHVP Friction Results

Lane	Average FN	Minimum FN	Maximum FN
Southbound Lane 1	34.4	28.8	37.5
Southbound Lane 2	31.2	27.8	35.2
Northbound Lane 1	35.4	28.9	37.8
Northbound Lane 2	32.7	29.2	34.5

As Mr. Marciello noted, each lane had at least one friction result below the desired FN30 level, but each lane's average was above FN30. As such, the results were considered suitable by the MTO to continue listing the Demix aggregate on the DSM.

3.4.8. 2013

3.4.8.1. MTO Network-Level Friction Testing

In 2013, the MTO conducted friction testing across the MTO's roadway network as part of the MTO's consideration of including a friction performance specification requirement in MTO contracts. The purpose of the network-level testing was to develop reasonable

performance specification requirements for friction based on representative friction values from a sample of MTO pavements. The MTO's consideration of a performance specification for friction is summarized in Chapter 1.

As a result of the demands of the network-level friction testing, the MTO did not conduct friction testing on the RHVP in 2013. However, in 2013, as described below, the City initiated a request for friction testing.

3.4.8.2. Golder Requests MTO Friction Testing on the RHVP, LINC, and City Crosswalks

As discussed in Chapter 6, in September 2013, Mr. Moore (who was then Director, Engineering Services, Public Works, Hamilton) contacted Dr. Uzarowski to request that Golder arrange for friction testing on the RHVP. In furtherance of this request, in early October 2013, Dr. Vimy Henderson (Pavement & Materials Engineer, Golder) emailed Stephen Lee (Head, Pavements and Foundations Section, MTO) to discuss whether the MTO could conduct friction testing on the RHVP for the City. Dr. Henderson's email explained that the scope of the City's request included testing along the 18 km length of the RHVP and the LINC (in all four lanes), some ramps, and some crosswalks.

Dr. Henderson contacted Mr. Lee at Dr. Uzarowski's suggestion or direction. Dr. Uzarowski explained that his "first thought" when arranging the 2013 friction testing was to contact the MTO because of the past RHVP testing done by the MTO. Dr. Uzarowski testified that, although he did not remember details, it was "very likely" that he told Dr. Henderson about the 2007 testing.

Dr. Henderson testified that, to her knowledge, she was not aware that the MTO had conducted friction testing in October 2007 at the time she spoke with Mr. Lee. She recalled learning about the MTO's October 2007 testing in or around January 2014, in the context of receiving the Tradewind friction test results. The Inquiry did not receive any contemporaneous documents that speak to Dr. Henderson's knowledge in October 2013. It is sufficient for the Inquiry's purposes to note that she did not reference past MTO testing when making the request to Mr. Lee.

Mr. Lee declined Dr. Henderson's request on October 29, 2013. He advised that the MTO was not able to accommodate the testing that season because the MTO

was behind in the network-level friction testing described above. Mr. Lee knew Mr. Marciello had no capacity to take on additional work, and thus did not speak to Mr. Marciello about the City's request before declining.

According to Mr. Lee, he was unaware of the prior MTO testing on the RHVP at the time of his email exchange with Dr. Henderson and therefore did not mention the MTO's prior testing to Dr. Henderson. Mr. Lee assumed his position as Head of Pavements & Foundations in October 2012, over four months after the 2012 RHVP testing was conducted. There was no reason why prior DSM-related testing, overseen by a different section in MERO (the Soils & Aggregates section), would have come to Mr. Lee's attention unless someone had a specific reason for informing him. I accept Mr. Lee's evidence that he most likely learned about the MTO having conducted prior friction testing on the RHVP in or around July 2014 when he received the 2014 RHVP friction test results from Mr. Marciello as described below.

In summary, based on their own evidence, neither Dr. Henderson nor Mr. Lee were aware of the past MTO testing of the RHVP when they communicated with one another about further testing in October 2013. In any event, however, reference to past MTO testing by either Dr. Henderson or Mr. Lee would not have changed the MTO's denial of Golder's request in 2013.

More significantly, as a result of the MTO's inability to conduct the requested friction testing, Golder retained Tradewind Scientific Ltd. ("Tradewind") to conduct the City's requested testing on the RHVP and LINC. One week after corresponding with Mr. Lee, Dr. Henderson contacted Tradewind to request Tradewind's testing services. The Tradewind Report, including the origins of the report, are discussed at length in Chapter 6.

3.4.9. 2014

3.4.9.1. RHVP Friction Testing Conducted in 2014

Mr. Marciello conducted friction testing on the RHVP on July 12 and 23, 2014. Mr. Marciello sent the results to Mr. Senior, Mr. Gorman, and Mr. Lee on July 25. As mentioned above, this was the first time that Mr. Lee received, or became aware of, friction testing results for the RHVP.

Figure 3j sets out the 2014 RHVP average, minimum, and maximum friction numbers, by lane.

Figure 3j: 2014 RHVP Friction Results

Lane	Average FN	Minimum FN	Maximum FN
Southbound Lane 1	31.7	27.4	36.2
Southbound Lane 2	30.5	26.1	34.0
Northbound Lane 1	33.2	30.3	36.2
Northbound Lane 2	30.7	27.4	33.7

Mr. Marciello's covering email stated: "4 Lanes of the Parkway were tested a few days ago. Performance shows friction levels continuing to drop." In response, Mr. Gorman stated: "I was hoping it would of [*sic*] stabilized at 35."

The results that Mr. Marciello sent included graphs plotting the average RHVP friction values for all years of testing for each lane; for the southbound lanes, the graphs reflect the 2007 to 2014 data and for the northbound lanes, the graphs reflect the 2008 to 2014 data. This type of historical plotting was standard in the results Mr. Marciello prepared and circulated.

The graphs for Northbound Lanes 1 and 2 and Southbound Lanes 1 and 2, respectively, are reproduced below in **Figures 3k** to **3n**. I note that the graphs say "Pavement Evaluation 2012" at the top, which is a typographical error; the titles should say 2014.

Figure 3k: 2008 to 2014 Friction Values, Northbound Lane 1

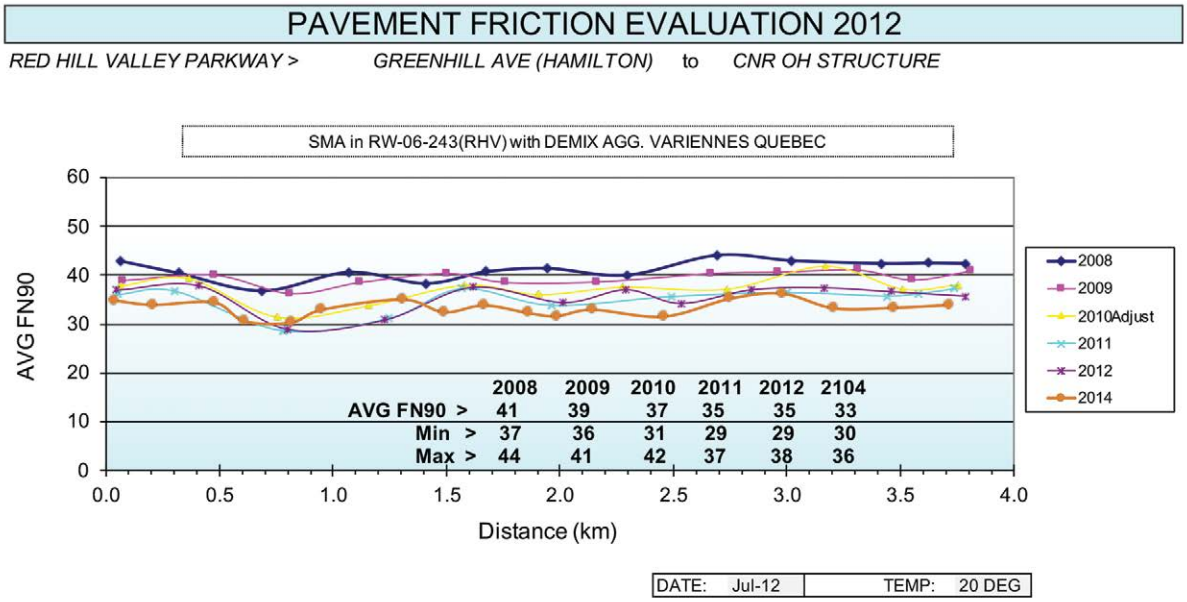


Figure 3l: 2008 to 2014 Friction Values, Northbound Lane 2

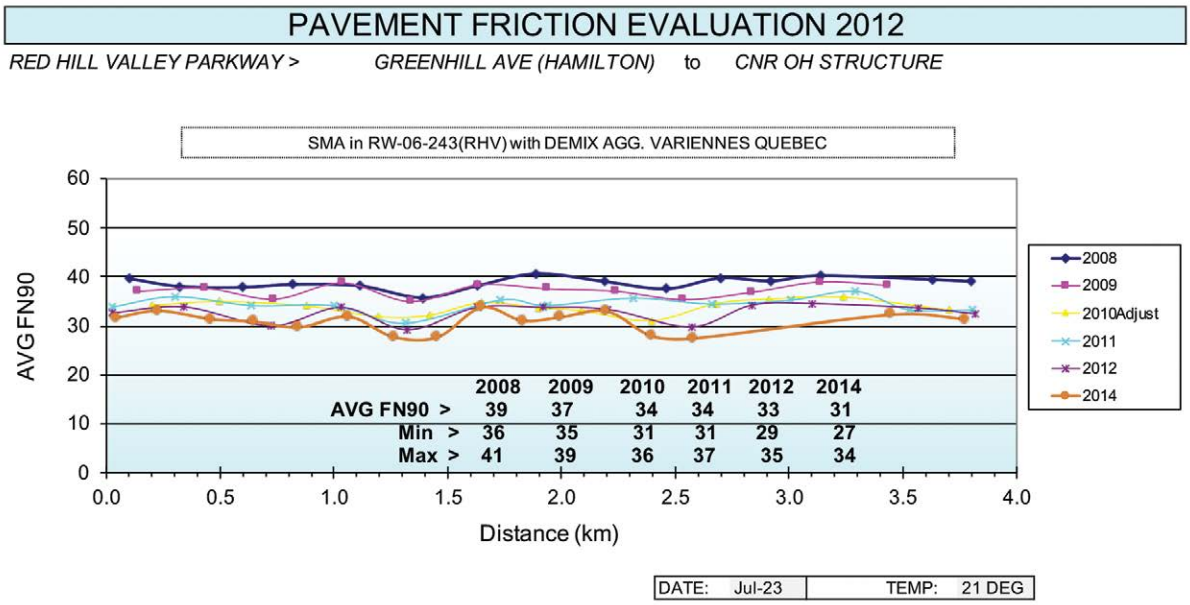


Figure 3m: 2007 to 2014 Friction Values, Southbound Lane 1

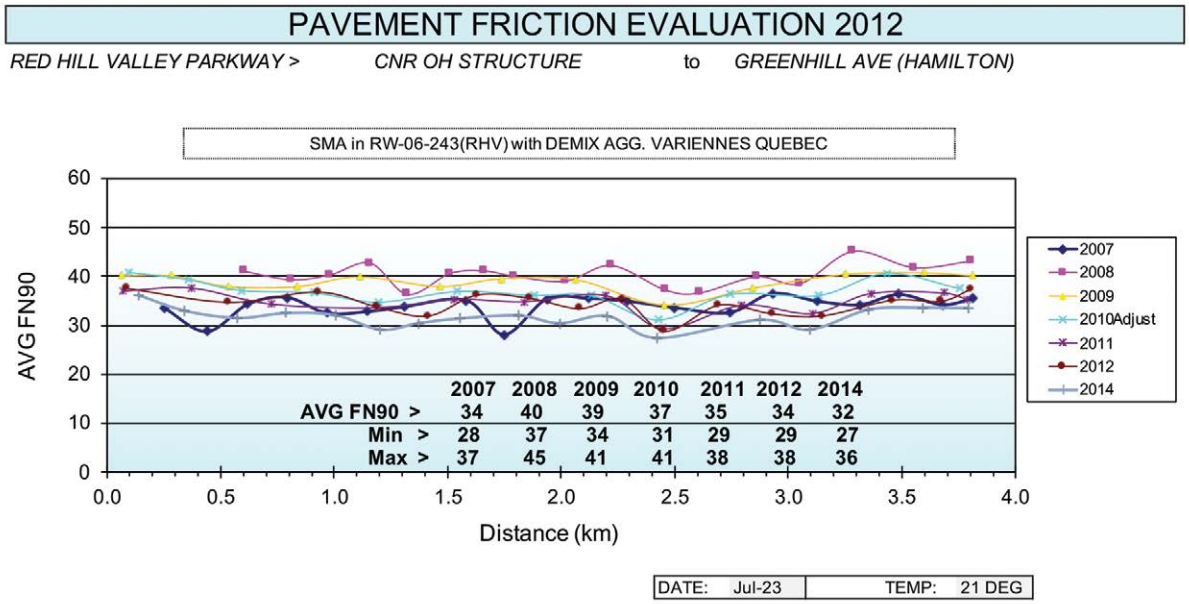
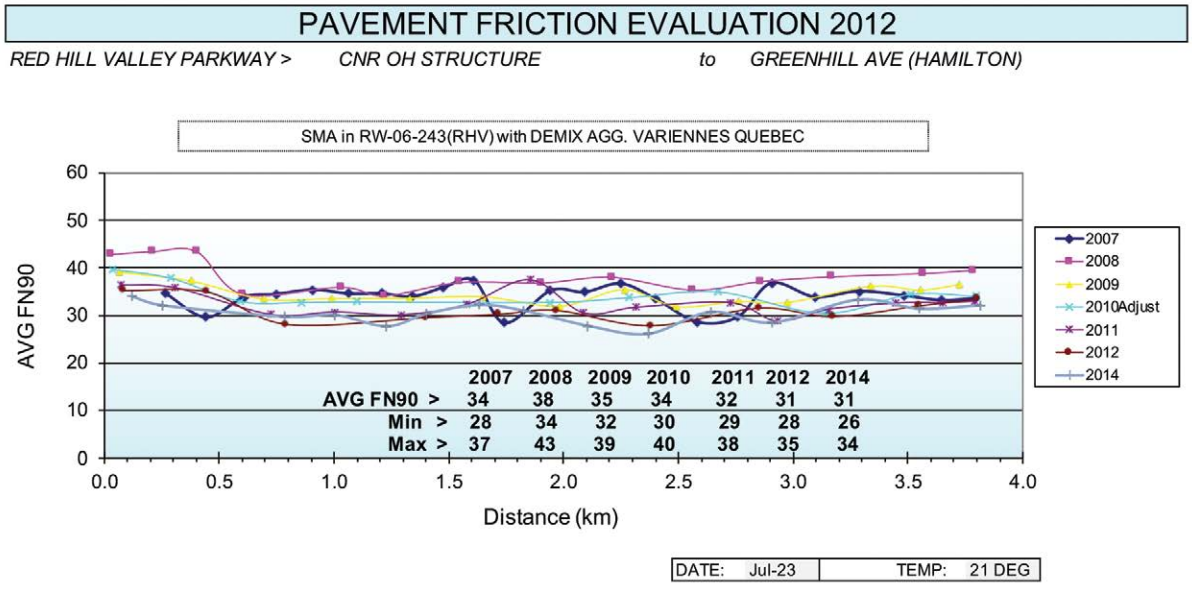


Figure 3n: 2007 to 2014 Friction Values, Southbound Lane 2



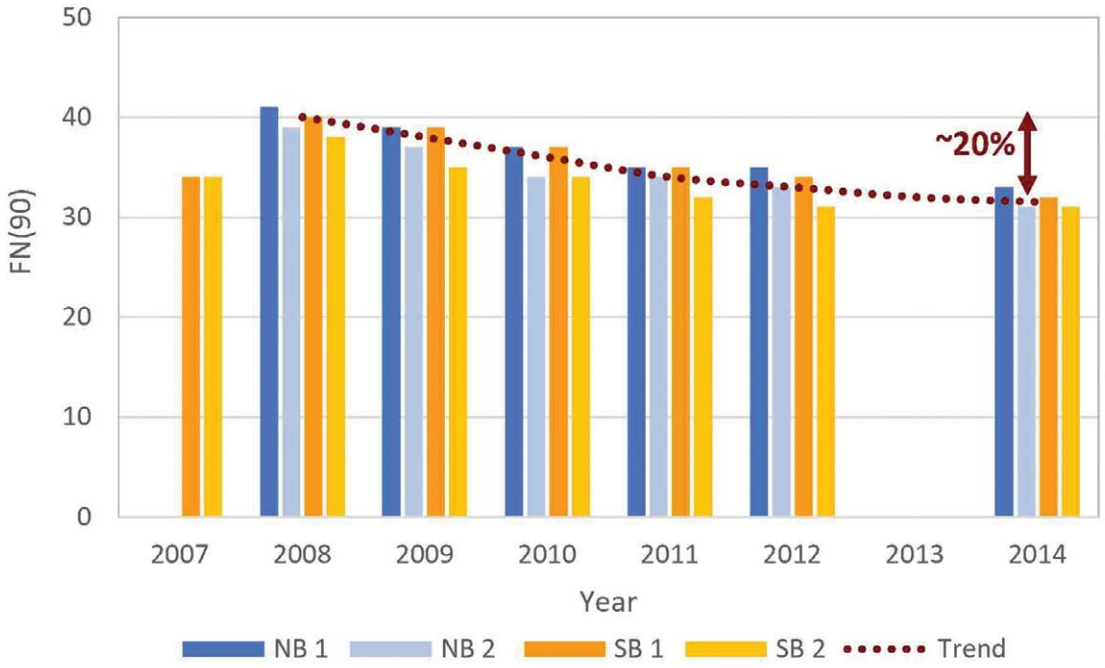
As set out in **Figure 3o**, the 2014 RHVP results reflect a decline in average friction values in all four lanes over the course of the testing period.[5]

Figure 3o: 2008 and 2014 RHVP Friction Results, Comparison

Lane	Average FN – 2008	Average FN – 2014	Overall Decline
Southbound Lane 1	40.3	31.7	8.6
Southbound Lane 2	38.2	30.5	7.7
Northbound Lane 1	41.2	33.2	8
Northbound Lane 2	38.7	30.7	8

The same trajectory in MTO friction test results is represented graphically in the Flintsch Report, reproduced as **Figure 3p**.

Figure 3p: Trajectory of RHVP Friction Results



[5] For comparison purposes, this chart reflects the decline between 2008 to 2014, since the 2007 testing reflects the early age SMA testing and only includes testing data for the two southbound lanes.

The significance of the MTO results for the purposes of the Inquiry, including the views of Dr. Gerardo Flintsch[6] and David Hein[7] (the Inquiry's and the City's friction experts, respectively) is discussed in Chapter 12.

From the perspective of continued inclusion of the Demix aggregate on the DSM list, there was nothing alarming or concerning about the 2014 friction numbers. According to the MTO witnesses, the 2014 results were still considered acceptable, although on the low end, for DSM purposes, notwithstanding the overall decline in friction values. That said, as Mr. Senior explained in his testimony, the Demix aggregate was "on the lower end of all of the…DSM material."

In this regard, Ms. Lane recalled that, some time in 2014, Mr. Marciello and Mr. Gorman (who, as noted, was the primary person who oversaw the DSM list within the Soils & Aggregates section) came to her office with the 2014 RHVP friction test results. They wanted to speak with her about the DSM status of the Demix aggregate and discuss if the MTO remained satisfied with the Demix aggregate's performance for this purpose. By that time, Ms. Lane was the Manager of MERO, having assumed the role in April 2013, and so Mr. Senior (the Head of the Soils & Aggregates section) reported to her. Ms. Lane, Mr. Marciello, and Mr. Gorman then walked over to Mr. Senior's office to continue the discussion. The decision resulting from their conversation was to allow the Demix aggregate to remain on the DSM.

It is important, however, to emphasize that the MTO's assessment of the friction testing results was focused on whether the Demix aggregate should continue to be included on the DSM list. As discussed in Chapter 1, the MTO would have assessed the 2014 results in a different manner if the friction testing had been conducted pursuant to an MTO regional office request to investigate an area of concern. As stated in the MTO's closing submissions, "continued 'monitoring' for DSM list purposes (i.e., yearly friction testing) is standard procedure within the [Soils & Aggregates] section. It should not be conflated with regional staff 'monitoring' identified in-field issues."

[6] Dr. Flintsch is the Director of the Center for Sustainable and Resilient Infrastructure at Virginia Tech Transportation Institute.

[7] Mr. Hein is the President and Principal Engineer at 2737493 Ontario Limited.

Mr. Lee, the Head of the Pavements & Foundations section since October 2012, testified that if the RHVP testing had been initiated by an MTO regional office request, based on the drop in friction values over time, the MTO would "definitely look at continuous monitoring of the result[s]". If the friction number continued to drop, then "definitely [staff] would look at additional factors above and beyond just friction number alone." The results of the engineering investigation and assessment would then determine whether any remedial or intervention measures were required.

There is no evidence that Ms. Lane contacted Dr. Uzarowski or anyone at the City regarding the 2014 results.

3.5. MTO Involvement with the RHVP from 2016 to 2019

3.5.1. Demix Agrégats' DSM Status from 2015 Onwards

Friction testing was not conducted by the MTO on the RHVP in 2015 or thereafter.

Mr. Marciello and Mr. Gorman both retired from the MTO in early 2015. While it is probable that Mr. Gorman intended to conduct friction testing on the RHVP in 2015, the MTO did not have a friction tester operator after Mr. Marciello's departure until a new person was hired for the role in 2016. Accordingly, there was no one to conduct friction testing on the RHVP in 2015.

The Demix aggregate remained on the DSM until some time in 2016, when it was delisted at the request of Demix Agrégats. There is no evidence to suggest that the reason Demix Agrégats decided to delist was related to the quality of the aggregate. Internal MTO emails indicate that Demix Agrégats "removed themselves from the DSM as a business decision, since they never sell aggregate originating from Montreal and surrounding area to Ontario." There was a modest annual fee required to maintain an aggregate on the DSM and so it is logical that an aggregate supplier would not continue to pay the fee in the absence of sales.

As a result of delisting of the Demix aggregate the MTO did not conduct friction testing on the RHVP in 2016 or thereafter.

3.5.1.1. Hamilton Spectator Asks the MTO about RHVP Friction Testing in January 2016

On January 22, 2016, Matthew Van Dongen (Reporter, Hamilton Spectator) emailed staff in the MTO's Communications office inquiring about friction testing conducted on the RHVP. Mr. Van Dongen wrote:

> So, here's an odd question: has the MTO ever conducted friction testing on the Red Hill Valley Parkway? I know it is owned by the City of Hamilton.
>
> But I was contacted recently by a self-identified retired engineer, who suggested the ministry has always been interested in the parkway's performance; he believed the MTO has conducted friction tests periodically over the years.

The identity of the "self-identified retired engineer" who contacted Mr. Van Dongen is unknown to the Inquiry. What prompted the email from Mr. Van Dongen is also unknown.

It is possible that this request was originally prompted by comments of Mr. Moore, the Director of Engineering Services in the City's Public Works Department, made shortly before at a Public Works Committee ("PWC") meeting on December 7, 2015. At that meeting, Mr. Moore advised the PWC that the MTO performed initial friction testing on the RHVP and that the RHVP results were "at or above" what the MTO typically expected from high-grade friction mixes. Mr. Moore also stated that "we subsequently did it [friction testing] five years after, so 2012/2013, and found that it was holding up exceptionally well". The December 7, 2015 PWC meeting is discussed in greater detail in Chapter 7.

The Inquiry did not receive any evidence establishing that the MTO responded to the Hamilton Spectator's question or that these communications ever resulted in a newspaper article. In the absence of any such evidence, I find it is likely that a response was not sent. However, the Hamilton Spectator's media request appears to have led to communications between staff at the MTO, Golder, and the City.

In the late evening on January 22, 2016, Ms. Lane emailed Dr. Uzarowski to advise that she had received a "strange media request about the performance of the Red Hill Valley Parkway". She asked Dr. Uzarowski if he kept in touch with the City and if he was aware of any performance issues, possibly related to asphalt cement cracking. Although Ms. Lane did not have a specific recollection at the Inquiry of the media request in question, she acknowledged it was likely the same media request sent by Mr. Van Dongen.

On January 23, in response to Ms. Lane, Dr. Uzarowski advised that he would talk to the City, and provided some information to her about RHVP performance.

There is no mention of friction testing or frictional performance in any of the emails exchanged between Ms. Lane and Dr. Uzarowski. Both Dr. Uzarowski and Ms. Lane testified that their comments regarding asphalt cement may have related to other matters unrelated to friction testing that they had in common.

Dr. Uzarowski forwarded Ms. Lane's January 22, 2016 email to Mr. Moore on January 25 at 12:26 pm. Two minutes later, Ms. Lane emailed Dr. Uzarowski again. Ms. Lane stated that she thought she should call Mr. Moore, and requested his phone number. In her testimony, Ms. Lane explained that she considered calling Mr. Moore to ask him if there were any performance issues on the RHVP. In response, Dr. Uzarowski provided Mr. Moore's phone number and advised that he had provided her correspondence to Mr. Moore, with a call to follow.

There appears to have been no further discussion between Mr. Moore and Dr. Uzarowski on this issue, nor between Ms. Lane and Mr. Moore. Ms. Lane testified that she did not believe she contacted Mr. Moore because it would have been "overstepping" to do so after Dr. Uzarowski indicated he would call Mr. Moore: "[i]f he's saying he'll call him, then he's going to follow up."

3.5.1.2. MTO Shares RHVP Friction Testing Data with City and Media in February 2019

City staff learned about the MTO's 2008 to 2014 friction testing on the RHVP on February 12, 2019, six days after public disclosure of the Tradewind Report to Council and to the public (discussed in Chapter 11), under the following circumstances.

On February 1, 2019, Edward Soldo (Director, Transportation Operations & Maintenance, Public Works, Hamilton) emailed Kevin Bentley (Executive Director & Chief Engineer, Highway Standards Branch, Provincial Highways Management Division, MTO), asking whether there was a person the City could contact regarding pavement friction testing and anticipated friction values for SMA pavements.

Mr. Soldo followed up with Mr. Bentley on February 11. The next day, February 12, during a telephone call between them, Mr. Bentley told Mr. Soldo about the MTO testing. Contemporaneously, Dan McKinnon (General Manager, Public Works, Hamilton) and Jasmine Graham (Communications Officer (Public Works), Strategic Partnerships & Communications, City Manager's Office, Hamilton) learned about it from Mr. Van Dongen of the Hamilton Spectator. It is evident that City staff were unaware of the 2008 to 2014 MTO testing, or the test results, at the time the Tradewind Report was discovered (in 2018) and disclosed (in 2019).

The City received the MTO's 2007 to 2014 friction test results on February 12, via an email from Mr. Bentley to Mr. Soldo. The MTO also provided the 2007 to 2014 results to the media on the same day. This was a significant deviation from the MTO's standard practice of not releasing friction test results externally, except in limited exceptions. In this instance, the direction to release the RHVP results came from the office of the Ontario Minister of Transportation.

On February 13, Mr. Bentley emailed Mr. Soldo the following background information to the MTO testing based on the information Mr. Bentley had at that time:

> From what we have been able to determine so far……
>
> In 2007 some concerns had been identified in the province with the initial friction qualities of the SMA mix given the higher levels of AC.
>
> As a result, at the request of the city, the 2007 testing of a 4km section that was constructed SMA was completed by MTO and results shared with the city.
>
> No concerns were identified with the initial friction qualities.

> The 2008 to 2014 testing for the same 4km section was completed to evaluate the acceptability of the stone used in the asphalt for potential use on provincial highways.
>
> Based on a preliminary review of MTO's records, and based on the intended purpose of this testing, it would appear that these results were not shared with the city.

In the days that followed the City learning of the MTO testing, there were a number of telephone and email discussions between MTO and City staff about the MTO testing. The discussions centered on information gathering (on the City's part) and information sharing (on the MTO's part). MTO staff also compiled the relevant background information and RHVP test data to provide to the City, in keeping with a direction of Jeff Yurek (Minister of Transportation, MTO) to "review all ministry involvement with pavement testing" on the RHVP and offer technical assistance to City staff as needed.

CHAPTER 4

The City of Hamilton: Structure, Organization, and Consultant Relationships

4.1. Overview

On January 1, 2001, the City of Hamilton was created from the amalgamation of the municipalities, cities, and towns of Hamilton-Wentworth, Hamilton, Dundas, Stoney Creek, Ancaster, Flamborough, and Glanbrook.

This chapter provides an overview of the City of Hamilton's governance structure and operational organization since that date, with particular attention to the departments, divisions, and key staff thereof, and external consultants retained by the City, who had a role in managing and maintaining the Red Hill Valley Parkway ("RHVP") or were the subject of this Inquiry's mandate.

The most central department was of course the Public Works department (overseen by the General Manager of Public Works), which was responsible for the construction, maintenance, and operation of the RHVP. This chapter focuses on the organizational structure and responsibilities of certain divisions, sections, and groups within Public Works during the time relevant to this Inquiry, and key Public Works staff. It provides context to understand how Public Works staff interacted within the department, with staff in other departments, with external consultants, and with Hamilton's City Council ("Council"), as described in this Report. The divisions and sections within Public Works that were the most immediately involved in the events relevant to the Inquiry's mandate were the Engineering Services division (overseen by the Director of Engineering Services) and the Traffic Operations & Engineering group/section (overseen by the Manager of Traffic Operations & Engineering, who reported to various senior directors and/or directors).

This chapter also describes the Legal Services division (in the Finance & Corporate Services department), which played an important role following Public Works' receipt of a freedom of information ("FOI") request related to RHVP friction testing in November 2018 and in the related disclosure of the Tradewind Report to Council and the public.

The City engaged a number of contractors and consultants in respect of the RHVP over the period covered by this Inquiry, including some retained through the City's roster program, governed by the Consulting and Professional Services policy. The involvement of three firms was central to this Inquiry's mandate: Dufferin Construction Company ("Dufferin"), CIMA+ ("CIMA"), and Golder Associates Ltd. ("Golder").

4.2. Hamilton City Council

Council is made up of the Mayor and 15 City councillors, each of whom represents one of the City's wards. The Mayor and Council are elected every four years.

The *Municipal Act, 2001*, SO 2001, c 25 provides the legislative framework for the municipality and outlines the roles and responsibilities of Council and the City employees. The role of Council includes representing the City of Hamilton, developing and evaluating municipal policies and programs, delivering public services, and ensuring accountability and transparency in municipal operations.

A City by-law establishes procedures that govern proceedings of Council and standing committees of Council, including establishing the dates for regular meetings of Council. A special Council meeting may also be held outside the specified dates, generally to ratify items from a special meeting of a standing committee.

Council has a number of standing committees and sub-committees. Standing committees must meet at least once each month. Under the City's standard procedures, matters are typically discussed and voted on at the relevant standing committee or sub-committee and are subsequently brought forward at a meeting of Council for ratification purposes. Matters are typically not brought to Council in the first instance but rather go to a committee or sub-committee before going to Council.

The Mayor is an ex-officio member of all standing committees and has full voting privileges when the Mayor attends a standing committee meeting. **Fred Eisenberger** was the Mayor of Hamilton from 2006 to 2010 and 2014 to 2022. **Bob Bratina** was the Mayor from 2010 to 2014. **Andrea Horwath** succeeded Fred Eisenberger as Mayor for the Council term commencing in 2022. A chart of the individuals who held positions as Mayor or councillor during the time periods relevant to this Inquiry is included as **Figure 4c**, set out at the end of this chapter.

For purposes of this Report, I discuss only two standing committees: the General Issues Committee ("GIC") and the Public Works Committee ("PWC").

4.2.1. General Issues Committee

All members of Council, including the Mayor, are members of the GIC. The mandate of the GIC includes, among other things, review and monitoring of Council's Strategic Plan and the Corporate Strategic Plan; administering the annual Capital, Rate and Operating budgets; addressing labour relations matters; and receiving briefings on legal matters involving the City and giving direction to the City Solicitor on litigation matters.

The GIC meets once each month at a minimum, but typically meets at least twice monthly. A special GIC meeting may be held outside the prescribed dates at any time or date to deal with a specific matter. Matters triggering a special GIC are typically those that are expected to require lengthy Council discussion, such as contentious litigation or potential litigation. Special GICs may be requested by senior leadership and/or councillors. At the time relevant to this Inquiry, the Mayor or two-thirds of Council had the authority to direct a special GIC. As described in Chapter 11, the Tradewind Report was disclosed to the public after a regularly scheduled meeting of the GIC on February 6, 2019.

4.2.2. Public Works Committee

As its name suggests, the PWC reports on and makes recommendations to Council on the construction, operation, maintenance, and delivery of public works in the City. This includes, among other areas, maintenance of the City's roads, traffic safety, major road construction projects, and capital planning and implementation. Councillors volunteer to join the PWC. However, the Inquiry received evidence that the PWC was to be comprised of a minimum of 8 councillors. The Councillors appointed to the PWC during the time periods relevant to the Inquiry are identified in **Figure 4c** below. Staff in the Public Works department, discussed below, report to the PWC.

The PWC had, and continues to have, oversight of the RHVP and the connecting LINC.

4.2.3. Staff Reports to Committees and Council

One of City staff's primary functions is to implement directions of Council or committees of Council communicated by motions. Staff reports to Council and committees are a

principal means of communication between staff and the Mayor and Council. Staff reports are the means by which staff request direction from Council and provide updates and information about outstanding action items, issues, and deliverables.

Given this Inquiry's focus and the evidence received from City witnesses (the majority of whom worked in the Public Works department), many of the practices and processes governing staff reports and implementation of direction(s) to staff discussed in this report pertain to the PWC and staff in the Public Works department.

The responsibilities of the various divisions within the Public Works department usually dictated and determined responsibility for action items arising from a motion – in other words, each director of a division in Public Works (discussed below) was expected to oversee and implement any direction that fell within their division's respective mandate. During the relevant period for this Inquiry, there did not appear to be any formal practice for determining the responsibility for a deliverable or action item that crossed divisional lines, as discussed elsewhere in this Report.

The Inquiry was advised that three types of reports are routinely submitted to the PWC, the GIC, and/or to Council:

Recommendation Reports: A recommendation report is written for matters that require Council approval, direction, and/or funding (that is, matters that staff do not have delegated authority to perform without approval). A recommendation report sets out staff's recommendation(s) on work to be done and/or action to be taken, the basis for staff's recommendation, the timing, and the cost.

Information Reports: An information report provides information and updates to Council. The purpose of an information report is to keep councillors informed about the status of a project or deliverable on the outstanding business list ("OBL"), which tracks outstanding Council requests, or for which staff has already received Council approval. Information reports do not require any action by members of Council.

Information Update Reports: An information update report is sent to Council as an update on an event that has occurred, such as a heads up regarding the progress or intended direction of a project. Information updates can be sent directly to members of Council via email, rather than as part of a meeting agenda package.

The OBL comprises the outstanding deliverables and follow-up items requested by Council or a committee from staff and any applicable deadlines. Legislative Coordinators in the City Clerk's Office prepare the Council follow-up notices to advise the City's Senior Leadership Team ("SLT") of Council outcomes and circulate the items or issues on the OBL to the SLT. The Council follow-up notices and OBL items are subsequently circulated to the relevant staff.

On occasion, consultant reports are appended to a related staff report (that is, a report to Council or a committee summarizing the consultant report), although no formal policy governed distribution of consultant reports during the relevant period for this Inquiry. During this period, staff had discretion to distribute or withhold consultant reports. The Inquiry heard differing views from City witnesses regarding the desirability and appropriateness of appending consultant reports to staff reports and/or providing such reports to councillors. Instances where consultant reports were and were not provided to Council as part of a staff report are discussed in Chapters 6, 7, and 11.

4.3. City of Hamilton Organizational Structure

4.3.1. City Departments

The City's structure and organization has changed a number of times since the City was amalgamated in January 2001.

At present, there are five departments at the City: the City Manager's Office, Public Works, Finance & Corporate Services, Healthy & Safe Communities, and Planning & Economic Development. Each department is headed by a general manager (except the City Manager's Office, which the City Manager oversees) and consists of multiple divisions which are, in turn, comprised of sections and groups.

4.3.2. City Manager

The City Manager is the Chief Administrative Officer at the City and reports directly to the Mayor and Council. The City Manager is responsible to Council for the administration of the City's affairs. They provide advice and support to the Mayor and Council for the development and implementation of Council's policies, plans, and programs, and oversee the delivery of City services and Council policies by City staff.

The City Manager leads the City's SLT, which consists of the City Manager, the general manager of each City department, the Executive Director of Human Resources, and the Director of Communication & Strategic Initiatives. All members of the SLT report to the City Manager.

Chris Murray served as Hamilton's City Manager from 2009 to August 2018. **Mike Zegarac** replaced Mr. Murray as City Manager on an interim basis from August 2018 until May 2019. **Janette Smith**, the current City Manager, was appointed to the role in May 2019.

4.3.3. Office of the Auditor General

The City's Auditor General is appointed under a by-law pursuant to Section 223.19 of the *Municipal Act, 2001.* The Auditor General, who oversees the Office of the Auditor General (also referred to as the Audit Services division),[1] reports to the City Manager and ultimately to Council.

Charles Brown is the City's current Auditor General; he was the Auditor General during the period relevant to this Inquiry. **Domenic Pellegrini** was a Senior Auditor in the Office of the Auditor General as of 2010.

4.4. Public Works Department

The City describes its Public Works department as providing "the services that bring the City to life". The Public Works department provides the following essential services, among others: roads operations and maintenance, roadway safety, infrastructure rehabilitation, parks and open spaces, public transit, waste management, water services, forestry and horticulture, and corporate facility management. Maintenance of the City's public infrastructure is central to Public Works' mandate. This includes the RHVP.

At the time of writing this Report, there are eight divisions within Public Works each headed by a director: Corporate Asset Management; Corporate Facilities & Energy

[1] The terms Office of the Auditor General and Audit Services division are both used throughout this Report.

Management; Engineering Services; Environmental Services; Hamilton Water; Transit; Transportation Operations & Maintenance; and Waste Management. In addition, a director-level position of Chief Roads Official was created on a temporary basis from June 2021 until June 2023. This position is under review. **Edward Soldo** was the Chief Roads Official from June 2021 until mid-January 2023 when the position became vacant. The Chief Roads Official position is briefly described in Chapter 11.

With regard to the City's road network, the Public Works department is collectively responsible for designing roads that are safe for road users and pedestrians, and for operating and maintaining City roads in compliance with legislated standards and regulations and good operating practice. Public Works is also responsible for the planning, design, and provision of roadway rehabilitation work, and the assessment and implementation of initiatives and remedial measures to improve traffic road safety within the City.

Individual divisions of Public Works, or the sections or groups within a division, are accountable for different components of the collective responsibility of the Public Works department to provide safe, well designed, functional roadways. The divisions and groups relevant for this Inquiry's purposes, during the relevant time period for the Inquiry, are the Engineering Services division; the Operations division, later reconstituted as the Roads & Traffic division and presently the Transportation Operations & Maintenance division; and the Traffic Operations & Engineering group/ section. These divisions and groups are described below.

4.4.1. Reorganizations within Public Works

The Public Works department was created in 2003, during the early years of the new City of Hamilton. In the intervening 20 years, Public Works has been restructured several times. Some of the City's restructuring efforts are detailed in this chapter.

According to a Public Works business plan for 2019 to 2022, over 2200 staff are employed department wide. Between 2015 and 2021, the Public Works department underwent several organizational reviews, conducted externally and internally. The initial consultant review, which was completed from 2015 to 2016, considered the question of whether the Public Works department was too large. Ultimately, the review process determined the department was not too large, but it recommended

improvement opportunities within Public Works, including those to address “grouping, work redistribution, and layering issues that [would] allow for one General Manager of Public Works”.

According to a March 2017 staff report, a subsequent consultant review reviewed the distribution of work and responsibilities within the Public Works divisions, with the intention of providing an overview of the existing Public Works organization and its operation and identifying areas for improvement and development. This review identified several structural inefficiencies in Public Works — including issues related to grouping and levelling of work, clarity of roles, and teamwork within Public Works and across other City departments — and led to several reorganizations of the organizational structure of Public Works including the creation of the Transportation division.

A January 2019 staff report also identified and recommended several organizational structure changes within Public Works to “increase efficiencies, streamline delivery of services, and support effective collaboration”, focused largely on the Roads & Traffic division. As with the changes in 2017, the 2019 organizational changes were intended to better align work “to achieve strategic priorities and [have] the right staff, in the right roles, working at the right level.”

A March 2021 staff report described a 2020 consultant review that was undertaken to conduct a “structural health check” of Public Works. During the review, the consultant identified “an operational weakness” related to oversight of the management and operation of the City’s road network. The staff report stated:

> The current organizational structure, and system of work, as it relates to managing and operating the road network is fragmented and creates organizational risk in that it permits for partial accountabilities and responsibilities, impacting quality management, financial resources and document control. There are significant risks such as instances where decision authorities are unclear, particularly in relation to the stewardship of Complete Streets and the allocation and distribution of capital within transportation infrastructure projects.

The Chief Roads Official position, discussed above, was created as a product of the 2020 consultant review.

Certain restructurings of the relevant Public Works divisions, sections, and groups are discussed later in this chapter.

4.4.2. General Manager of Public Works

The General Manager of Public Works is the head of the Public Works department, and a member of the City's SLT. All Public Works staff report to the General Manager, either directly or indirectly. Since 2013, the director of each Public Works division has reported directly to the General Manager, with one exception between 2013 and 2017, when several directors in the Corporate Assets & Strategic Planning division (as it then was) reported to a senior director (for that division), who in turn reported to the General Manager.

The General Manager's role includes supporting and executing the strategic priorities of the City Manager and the SLT, consulting and liaising with members of City Council, and overall management of the Public Works department. The latter includes overseeing and assisting divisional directors with strategic planning and executing strategic plans.

Prior to 2015, City policy required the General Manager to sign off on and submit staff reports to Council. As of 2015, each divisional director, not the General Manager, signs off on and submits the staff reports submitted by their respective divisions.

Gerry Davis was the General Manager of Public Works from 2009 to April 2016. **Dan McKinnon** replaced Mr. Davis as the General Manager in September 2016 and served in the role until September 2021.

For the period between Mr. Davis' and Mr. McKinnon's tenures, from April to September 2016, **John Mater** held the General Manager role on an interim basis. Mr. Mater then took on the role of Associate General Manager of Public Works, a role which existed only until December 2018 when Mr. Mater retired. In the Associate General Manager of Public Works position, Mr. Mater's primary responsibility was to assist the General Manager in running and overseeing the Public Works department. In 2017, Mr. Mater held the Associate General Manager role concurrently with the role of Director of Transportation; in 2018, Mr. Mater held the Associate General Manager role on a full-time basis. Mr. Mater's scope of responsibilities was "fluid" and included leading

transportation planning-related initiatives, cross-divisional coordination related to outstanding RHVP deliverables, and quality management improvements.

4.4.3. Engineering Services Division

The Engineering Services division in the Public Works department is responsible for the capital planning and capital budgeting for infrastructure and assets within the City's right-of-way, among other responsibilities. This includes planning, design, construction, and major rehabilitation of the City's road network including the RHVP. Engineering Services typically does not handle minor rehabilitation or maintenance work, such as crack sealing or patching on a road; this is the responsibility of another division, as described below.

Engineering Services is headed by the Director of Engineering Services. Prior to 2013, Engineering Services was a section within the Capital Planning & Implementation division (in 2008) and in the Environment & Sustainable Infrastructure division (2009 to late 2012 or early 2013). During these periods, the Director of Engineering Services reported to a Senior Director of the respective division. Engineering Services became its own division in Public Works in late 2012 or early 2013. Since then, the Director of Engineering Services reports directly to the General Manager of Public Works. The managers of each section within Engineering Services report to the Director.

Gary Moore was the Director of Engineering Services from 2009 until May 2018. Between January and May 2018, Mr. Moore and **Gord McGuire** shared leadership of Engineering Services: Mr. Moore oversaw the Design, Construction, and Waterfront Development sections and Mr. McGuire oversaw the Geomatics and Corridor Management and Asset Management sections. Mr. McGuire replaced Mr. Moore as the Director of Engineering Services on an interim basis in May 2018. In June 2018, Mr. McGuire became the Director of Engineering Services on a permanent basis, and he was in this position until late 2021.

Figure 4a below sets out the sections within Engineering Services and the staff in these sections that are relevant for this Inquiry.

Figure 4a: Overview of Sections Within Engineering Services

Design
The Design section is responsible for the investigation, design (preliminary engineering through to detailed design and preparation of tenders), and implementation of capital infrastructure projects in the City, including roadway reconstruction and rehabilitation. **Susan Jacob** became the Manager of Design in 2007, and held this role until February 2022, when she became the Acting Director of Engineering Services. As of 2016, **Mike Becke** reported to Ms. Jacob (indirectly and directly), first as a Project Manager and then as a Senior Project Manager in the Design section.
Construction
The Construction section provides construction, contract administration and management, and site inspection services for capital works construction projects in the City. The Construction section's work begins after a project has passed through the Design section. **Marco Oddi** was a Senior Project Manager in the Construction section from March 2009 until January 2016, when he became the Manager of Construction.
Geomatics & Corridor Management
The Geomatics & Corridor Management section (formerly the Surveys & Technical Services section) provides engineering survey services for Engineering Services' projects, including preparing detailed plans and background materials. Until February 2019, lighting design and installation were part of Geomatics & Corridor Management's portfolio, through the Street Lighting & Electrical group (formerly the Street Lighting & Electrical Engineering group) within this section. **Gord McGuire** was the Manager of Geomatics & Corridor Management from the mid-2000s until May 2018. **Mike Field** was a Project Manager and later Senior Project Manager in the Street Lighting & Electrical group (and its predecessor, Street Lighting & Electrical Engineering) from 2010 until February 2019, when

street lighting functions were transferred to the Transportation Operations & Maintenance division in a new Street Lighting group within the Transportation Operations section.

Asset Management

The Asset Management section is responsible for capital programming for the City's infrastructure assets, including developing the scope and funding for a project, and preparing and delivering the City's capital budget. Asset Management also creates asset management plans for City assets. With regard to the RHVP, Asset Management is responsible for the infrastructure durability of the roadway, including monitoring and preservation of the RHVP pavement condition. Condition assessments were typically performed every five years.

Richard Andoga was the Senior Project Manager of Infrastructure Programming (Surface) in Asset Management as of 2014, and was previously a Project Manager. In this capacity, he had management responsibility for the City's roads and bridges infrastructure.

4.4.4. Operations Division, Roads & Traffic Division, and Transportation Operations & Maintenance Division

The City's Operations division and the sections within it underwent several reorganizations and name changes between 2005 and 2019. This division was known as the Operations & Maintenance division from 2005 to 2008, the Operations & Waste Management division from 2010 to late 2012 or early 2013, and the Operations division from that time until January 2018. The Operations division has not existed since January 2018. In this Report, and for the period between 2005 until January 2018, I refer to this division as "Operations". Operations was responsible for operating and maintaining the assets for which Public Works was responsible, including all roads in the City's network. The relevant section in Operations for this Inquiry's purposes was the Roads & Maintenance section, which planned and delivered operations and maintenance service programs for the City's roadways, as described in **Figure 4b** below.

From 2013, Operations was overseen by a director, who reported to the General Manager of Public Works. The managers of each section within Operations reported to the director. **Betty Matthews-Malone** was the Director of Operations from November 2014 until January 2018.

In January 2018, a new division called Roads & Traffic was established. Some (but not all) of the sections that had been in Operations were transferred to the Roads & Traffic division, and as described below, the Traffic Operations & Engineering group was also transferred to Roads & Traffic. The Roads & Traffic name reflected the principal focus of this division's mandate.

In February 2019, the Roads & Traffic division was restructured and renamed the Transportation Operations & Maintenance division. In this restructuring, the Roads & Maintenance section was reconstituted as the Roadway Maintenance section. Traffic Operations & Engineering was reconstituted as the Transportation Operations section. The Traffic Engineering & Operations group is discussed separately below in view of its significance for the matters of the Inquiry. In this Report, I refer to these divisions using their respective names during the periods in which they operated: Roads & Traffic and Transportation Operations & Maintenance.

Ms. Matthews-Malone was the Director of Roads & Traffic from January 2018 to August 2018. Ms. Matthews-Malone was replaced by **Edward Soldo** in August 2018. After the reconstitution of the Roads & Traffic division as the Transportation Operations & Maintenance division in February 2019, Mr. Soldo became the director of that division.

Both Engineering Services and Operations, and thereafter Roads & Traffic and Transportation Operations & Maintenance, had responsibility for road rehabilitation. Engineering Services was responsible for major rehabilitation and reconstruction projects while the Roads & Maintenance section (later the Roadway Maintenance section), oversaw maintenance and minor rehabilitation works. **Figure 4b** describes the focus of Roads & Maintenance.

Figure 4b: Overview of the Roads & Maintenance Section

Roads & Maintenance
The Roads & Maintenance section of Operations planned and delivered operations and maintenance service programs for over 6000 lane kilometres of municipal roadways (including the RHVP), sidewalks, paved surfaces, and related surface drainage facilities. In respect of road operations, Roads & Maintenance's responsibilities includes patrolling and inspecting roads, sweeping roadways, paved surface management, and pavement repair and crack sealing. Roads & Maintenance was divided into geographic districts, plus one after-hours district. Each district was overseen by a District Superintendent who reported to the Manager of Roads & Maintenance. Several Roads Supervisors reported to each District Superintendent. The Roads Supervisors were responsible for the roads and roadway lanes within their respective areas, which included attending at accidents and roadway incidents (including those on the RHVP) to assist with emergency closures, traffic diversions, and cleaning up of fluids or debris on roadways.

4.4.5. Traffic Operations & Engineering Section/Group

Unlike Engineering Services and Operations (which were divisions), Traffic Operations & Engineering was a section or a group that existed as a constituent element of a division. It was not in itself a division. While the Traffic Operations & Engineering group has been subject to various reorganizations within the Public Works department since 2009, described below, it existed as a discrete group or section under that name from late 2012 or early 2013 to February 2019. In February 2019, its mandate was expanded to include street lighting, among other responsibilities, and it was renamed Transportation Operations. In this Report, I refer to the group as Traffic Operations & Engineering or simply "Traffic".

Traffic Operations & Engineering was responsible for roadway safety initiatives and for the design, installation, inspection, review, and replacement of traffic signs, traffic signals, and roadway pavement markings. The group's mandate was to provide

sustainable infrastructure management and to create a safe, efficient roadway system in the City, including on the RHVP.

The two subgroups within Traffic that are relevant for this Inquiry's purposes are Traffic Engineering and Traffic Operations, respectively:[2]

- **Traffic Engineering**, which was involved in some of the events at the center of this Inquiry's mandate, was responsible for collision analysis, speed limit reviews, traffic signal and pavement marking design, service requests from the public, and legal claims, among other matters.

- **Traffic Operations** was responsible for the installation, inspection, repair, and maintenance of traffic signals, traffic signs, parking signs, and pavement markings within the City.

Below I summarize the structural changes to Traffic between 2003 and 2019.

From 2003 until some time in 2009, the City's traffic engineering & operations functions were performed by one group, Traffic Engineering & Operations of which **Hart Solomon** was the Manager. From approximately 2009 until around late 2012 or early 2013, these functions were performed by two separate groups, Traffic Operations and Traffic Engineering, respectively, which were in different sections and divisions of Public Works. Traffic Operations was in the Energy, Fleet, Facilities & Traffic section of the Transportation, Energy & Facilities division. Traffic Engineering was in the Engineering Services section of the Environmental, Sustainable Infrastructure division.[3]

In late 2012 or early 2013, Traffic Operations and Traffic Engineering were again combined (along with a third subgroup Traffic Services, which is not relevant for Inquiry purposes) to create the new Traffic Operations & Engineering group ("Traffic", as

[2] There was also a third subgroup, Traffic Services, in Traffic Operations & Engineering. However, Traffic Engineering and Traffic Operations were the relevant subgroups for this Inquiry's purposes.

[3] During this period, Martin White was the Superintendent of Traffic Operations for the Traffic Operations group. Hart Solomon was the Manager of Traffic Engineering for the Traffic Engineering group until Mr. Solomon's retirement in 2011.

noted above). Traffic Operations, Traffic Engineering, and Traffic Services were each subgroups within the group and were overseen by a Superintendent who reported to the Manager of Traffic Operations & Engineering. Traffic was within the Energy, Fleet & Traffic section of the Corporate Assets & Strategic Planning division until February 2017. During this time, the Manager of Traffic Operations reported to the Director of Energy, Fleet & Traffic, who reported to the Senior Director of Corporate Assets & Strategic Planning.

Traffic Operations & Engineering became a section in the Transportation division when that division was created in February 2017. In January 2018, Traffic Operations & Engineering was transferred to the new Roads & Traffic division (discussed above), which then comprised some of the existing sections of the former Operations division, plus the Traffic Operations & Engineering section. In February 2019, as part of a restructuring in which Roads & Traffic became the Transportation Operations & Maintenance division, the Traffic Operations & Engineering section was renamed the Transportation Operations section (within the Transportation Operations & Maintenance division) and the street lighting functions were transferred from Engineering Services to it.

Below I highlight the staff in Traffic Operations & Engineering and the sections and divisions that oversaw Traffic during the relevant period for the Inquiry.

Jason Worron was a Senior Project Manager in the Traffic Engineering subgroup from January 2015 to August 2017. **Stephen Cooper** was a Project Manager in Traffic Engineering as of at least 2013. Mr. Cooper reported administratively to Mr. Worron during the period Mr. Worron was the Senior Project Manager.

David Ferguson was responsible for Traffic Engineering from August 2013 until February 2019 in his role as Superintendent of Traffic Engineering. From February 2019 until July 2021, Mr. Ferguson was the Superintendent of the Traffic Safety group. Mr. Ferguson reported to Martin White in both capacities.

Martin White was the Manager of Traffic Operations & Engineering from late 2012 or early 2013 until February 2019 and the Manager of its successor, the Transportation Operations section, until April 2019. Mr. Ferguson and the superintendents of the other subgroups within Traffic reported to Mr. White.

From late 2012 or early 2013 until February 2017, while Traffic was part of the Corporate Assets & Strategic Planning division, Mr. White reported to **Geoff Lupton**, the Director of the Energy, Fleet & Traffic section, and Mr. Lupton reported to **John Mater**, the Senior Director of Corporate Assets & Strategic Planning. From February 2017 until January 2018, Mr. White reported directly to Mr. Mater who was the Director of Transportation during that period. In January 2018, when Traffic moved to the Roads & Traffic division, Mr. White reported to **Betty Matthews-Malone** who was the Director of Roads & Traffic until August 2018, and thereafter to **Edward Soldo**, initially in his role as Director of Roads & Traffic and later, as of February 2019, as Director of the Transportation Operations & Maintenance division.

Mr. Mater, Ms. Matthews-Malone, and Mr. Soldo all reported directly to the General Manager of Public Works.

4.5. Finance & Corporate Services Department

4.5.1. City Solicitor and Legal Services Division

The City Solicitor is the City's top legal official. The City Solicitor provides legal advice and legal counsel to Council and to the corporation of the City of Hamilton. In that role, the City Solicitor coordinates the City's internal legal services, provided through the Legal Services division (which the City Solicitor heads), and any external legal counsel, as required.

Since 2017, Legal Services has been a division within the Finance & Corporate Services department. The City Solicitor has a two-pronged reporting relationship: reporting directly to Council providing legal advice and/or reports on legal issues and reporting administratively to the General Manager of Finance & Corporate Services.

The structure of the Legal Services division has changed over time. For purposes of this Report, it is sufficient to note that Legal Services has two key sections: the Dispute Resolution section and the Commercial, Development & Policy ("CDP") section. Each section, comprised of staff lawyers and other legal staff, is overseen by a Deputy City Solicitor who reports to the City Solicitor. Staff lawyers report to their respective Deputy City Solicitor.

Lawyers in the Dispute Resolution section oversee a variety of litigation-related files and manage the bulk of the City's civil litigation work, in addition to providing general legal advice to other City departments and divisions.[4] This includes civil litigation related to or arising from motor vehicle accidents on the RHVP.

Litigation matters come to the Dispute Resolution section via the Risk Management office, a subgroup within Dispute Resolution. The role of Risk Management is discussed below. Although most claims involving the City are handled internally, some litigation is referred to external defence counsel. External referrals typically arise from resource or expertise constraints or the preference of the City's insurer.

On occasion, the Dispute Resolution section also assists client departments in responding to FOI requests. FOI-related assistance may include providing information or advice regarding potential exemptions and/or answering questions raised by the Access & Privacy Office. The City's Access & Privacy Office oversees and administers FOI responses on behalf of the City. The involvement of Legal Services in an FOI request related to RHVP friction testing received by the Public Works department on November 8, 2018 ("FOI 18-189"), and in the related disclosure of the Tradewind Report to Council and the public in late 2018 and early 2019 is discussed in Chapters 10 and 11.

In contrast to the Dispute Resolution section, the CDP section primarily handles solicitor-type work, including real estate, planning and development, corporate commercial work, contract reviews, and general and administrative advice for Council or pertaining to the *Municipal Act, 2001.*

Nicole Auty was the City Solicitor from February 2017 until February 2021. **Ron Sabo** has been the Deputy City Solicitor of Dispute Resolution since 2005. **Debbie Edwards** was the Deputy City Solicitor of CDP from June 2013 until April 2019.

[4] In these circumstances, the department or division receiving advice from Legal Services staff is referred to as the "client department".

Byrdena MacNeil was a solicitor in the Dispute Resolution section from April 2006 until December 2020; she reported to Mr. Sabo.[5]

4.5.2. Risk Management

The role of the Risk Management office is to procure and maintain the City's insurance coverage and to administer all claims that the City receives. In practice, Risk Management functions much like an internal insurance department within and for the City. All claims that the City receives flow through Risk Management. For Risk Management purposes, claims include any complaints, concerns, and/or legal claims made to or against the City. City witnesses estimated that Risk Management receives between 1800 and 3000 claims annually.

Since April 2018, Risk Management has been part of the Dispute Resolution section and the Manager of Risk Management reports to the Deputy City Solicitor of Dispute Resolution. Prior to April 2018, the Manager of Risk Management reported to the Director of Financial Services as part of the Financial Services Division. The Risk Management staff consists of one Claims Supervisor who reports directly to the Manager of Risk Management, and several claims representatives and risk analysts who report to the Claims Supervisor.

Litigators in the Dispute Resolution section give advice to and take direction from Risk Management staff. Similarly, Risk Management staff provide direction and instruction to external counsel retained to defend claims on behalf of the City.

Claims arising from motor vehicle accidents on the RHVP were administered and overseen by Risk Management. As of around 2012, all RHVP-related claims were handled by the Claims Supervisor and, accordingly, communications with the City's defence counsel (internal or external), the City's insurers, and Public Works staff arising from RHVP litigation were handled by Diana Swaby.

[5] The Honourable Justice Byrdena MacNeil was appointed to the Superior Court of Justice in December 2020. I refer to Her Honour as "Ms. MacNeil" in this Report to reflect her pre-appointment position.

John McLennan became the Manager of Risk Management in June 2012, and held this position until November 2021. **Diana Swaby** was the Claims Supervisor as of 2012 and continued in that role until she became the Acting Manager of Risk Management in November 2021.

4.6. The City's Roster Program, Contractors, and Consultants

The City engaged a number of contractors and consultants in respect of the RHVP over the period covered by this Inquiry. The mandates of these contractors and consultants ranged from initial planning and design, construction, maintenance, and safety improvements. Below I highlight three firms whose involvement with the RHVP was central to this Inquiry's mandate.

4.6.1. City Procurement Policies and Roster Program

City procurements are governed by the City's procurement policy by-law. The procurement by-law included the approval authorities for contracts and the roster program for engaging consultants and other professional services. The City's roster program is used to develop a list of qualified consultants and suppliers from which City staff can select a service-provider for use in certain City contracts and assignments.

The City's Approval Authority policy establishes the authority of Council and senior staff to approve and award City procurements based on specified financial thresholds. The Approval Authority policy (set out in the City's procurement by-law) remained substantially the same from 2011 until at least 2020. Under the Approval Authority policy, the general manager of a department (or their authorized delegate) could approve procurements with a value of up to $100,000; the City Manager (or their authorized delegate) could approve procurements between $100,000 and $249,000; and Council approval was required for procurements with a value of $250,000 or more.

The City's roster program, which existed City-wide, was governed by the Consulting and Professional Services policy set out in the City's procurement policy by-law and a document entitled "Professional and Consultant Services Roster Procedures". The latter included detailed terms and conditions applicable to the City and roster

consultants. Under the 2011, 2012, and 2013 Consulting and Professional Services policies, work assignments that had an estimated procurement cost of less than $100,000 were to be "distributed on a rotational basis as well as a 'best fit' basis" by the applicable roster captain. The responsibilities of the roster captains are detailed below.

In the 2016 Consulting and Professional Services policy, the allowable procurement threshold for roster assignments was increased to $150,000. For the 2017 to 2018 and the 2019 to 2020 roster terms, and on a trial basis, Council approved a Request for Roster Quotations for Roster Assignments process to solicit and award work assignments with an estimated procurement value between $150,000 and $249,000.

The City used a formal Request for Rostered Candidates process, issued either every two or three years, to add consultants to roster categories. As of September 2016 (when the 2017 to 2018 roster was created), 42 separate roster categories existed. Those most relevant to this Inquiry included Category 3: Transportation and Traffic Engineering Planning, and Category 12: Geotechnical Investigation and Inspection Services.

In addition, "scoped consultants" were included in the roster. Scoped consultants were candidates that might not possess sufficient general qualifications to merit a roster candidate spot on the roster for a specific roster category, but "may possess unique expertise in a specific field, access to which may be required for various projects during the term of the [r]oster."

The general managers of each "[c]lient [d]epartment" approved roster appointments and prepared annual reports to Council on roster assignments by consultants used and a breakdown of the total cost utilized by each roster category.

Each roster category was managed by a roster captain, whose role was, among other things, to maintain a summary of roster assignments for each category including the name of the firm, a description of the roster assignment, the dollar value of the assignment, and the City contact who was the project manager for the assignment, which was reported on a semi-annual basis to staff in the City's Procurement office. Upon request from staff, the roster captain also selected the consultant for a particular roster assignment. Work assignments presented to rostered candidates were to be

distributed on a reasonably equitable rotational basis as well as a "best fit" basis. Roster captains were members of the City's Roster Committee, which was responsible for upholding the principles of the roster in accordance with the roster procedures.

4.6.2. Dufferin Construction Company

Dufferin is a full-service contractor in the civil construction industry. Dufferin's corporate structure has changed over time. Presently, Dufferin is a division of CRH Canada Construction Group Inc.; Dufferin was previously a business unit of St. Lawrence Cement Inc.

Dufferin's involvement with the RHVP was first as the grading contractor for three of the four grading contracts for the RHVP, and then as the paving contractor for the entire RHVP from mid-2006 until November 2007, when the parkway opened to the public. Dufferin was formally awarded the mainline paving contract (Contract PW-06-243) in July 2006 after a tender process. In its capacity as the paving contractor, Dufferin selected and sourced the aggregates for use in the RHVP asphalt, prepared the asphalt mix designs, and placed the asphalt on the RHVP mainline and ramps.

Dufferin had limited involvement with the RHVP after 2007. Dufferin's involvement in the construction of the RHVP is further described in Chapter 3.

4.6.3. Golder Associates Ltd.

Golder (now WSP Golder) is an independent consulting, design, and construction services engineering firm with specialist areas in earth, environment, and energy.

As discussed in this Report, Golder provided consulting services to the City related to pavement design (including for the RHVP), RHVP construction, ongoing monitoring and testing of the RHVP, and the eventual rehabilitation of the RHVP (which occurred in 2019). Golder was also involved in the resurfacing of the LINC, which took place in 2011. All of these services were provided by Golder's Pavement and Materials Engineering Group, which operates within Golder's Environmental practice.

Golder's engagements for the City, specifically for the RHV Project Office and Engineering Services, between 2005 and 2019 were central to the Inquiry mandate. Over this 14-year period, Golder's Pavement Materials & Engineering group was

retained by Mr. Moore (in his capacity as Manager of Design for the RHV Project or Director of Engineering Services) to complete the following 11 assignments and/or reports:[6]

- "Perpetual Pavement Feasibility Study, Red Hill Creek Expressway", submitted in August 2005;
- "Perpetual Pavement Design Study, Phase 2, Red Hill Creek Expressway", issued in draft in March 2006 (the "Pavement Design Study");
- Laboratory and field testing Quality Assurance services for the paving of the RHVP ramps and mainline, beginning in mid-2006 until November 2007;[7]
- Periodic engagements pertaining to data collection from the pavement instrumentation and monitoring system and the traffic data system installed in the RHVP mainline pavement, beginning in November 2007;
- Phases I, II, and III of the City-wide "Pavement and Materials Technology Review", (the "PMTR") conducted between 2009 and 2013;
- "Red Hill Valley Parkway – Performance Review after Six Years in Service", which included the results and related report of friction testing conducted by Tradewind Scientific Ltd. on the RHVP and LINC (the "Tradewind Report"), delivered in draft in January 2014 (the "2014 Golder Report");
- Inertial Profiler testing on the RHVP (to identify the location of dips and bumps on the parkway), the results of which were presented on March 4, 2016;

[6] The 11 assignments identified in this section are those that are relevant to this Inquiry's purposes, pertaining either to the RHVP or the City's road network. Golder also provided services throughout the same period pertaining to other roads in the City and other consulting sections of Golder were also engaged by City divisions other than Engineering Services.

[7] Golder was retained by Philips Engineering Ltd., rather than the City, for this engagement. Philips was the City's Contract Administrator on the RHVP mainline paving contract.

- "Evaluation of Pavement Surface and Aggregates – Red Hill Valley Parkway, City of Hamilton", submitted in March 2019 (the "Golder Pavement Evaluation"); and

- "Red Hill Valley Parkway HIR Suitability Study", submitted in March 2019 (the "HIR Suitability Study").

Dr. Ludomir Uzarowski, a principal and Senior Pavement & Materials Engineer at Golder, was the principal contact and/or author for all the above-listed engagements. Mr. Moore was Dr. Uzarowski's primary contact between 2005 and May 2018, when Mr. Moore retired from his role as Director of Engineering Services.

Golder was a scope consultant for Roster Category 12: Geotechnical Investigation & Inspection Services. Many of Golder's retainers for the above-noted projects were issued through the City's roster program.

4.6.4. CIMA+

CIMA is a multi-disciplinary consulting engineering firm that operates across Canada.

Between 2013 and 2020, CIMA was retained by the City of Hamilton to complete 12 studies and assignments related to the RHVP and the LINC. All of CIMA's engagements related to the LINC and the RHVP pertained to traffic safety and traffic engineering. The relevant assignments were:

- "Red Hill Valley Parkway Safety Review", finalized in December 2013 (the "2013 CIMA Report");

- "Lincoln Alexander Parkway Median Safety Study", submitted in November 2015 (the "2015 CIMA LINC Report");

- "Red Hill Valley Parkway Detailed Safety Analysis", submitted in November 2015 (the "2015 CIMA Report");

- "Lincoln Alexander Parkway / Red Hill Valley Parkway Collision Rates" memo, completed in January 2018 (the "2018 CIMA Collision Memorandum");

- "Hamilton LINC and RHVP Speed Study", finalized in October 2018 (the "Speed Limit Study");
- "Detailed LINC/RHVP Illumination Review", finalized in January 2019 (the "Lighting Study");
- "Roadside Safety Assessment – Red Hill Valley Parkway", completed in January 2019 (the "RHVP Roadside Safety Assessment");
- "Lincoln Alexander Parkway / Red Hill Valley Parkway Collision Rates" memorandum, completed in January 2019 as an update to CIMA's January 2018 memorandum (the "2019 CIMA Collision Memorandum");
- "Red Hill Valley Parkway – Pavement Friction Testing Results Review", dated February 4, 2019 (the "February 4 CIMA Memorandum");
- "Red Hill Valley Parkway – Review of MTO Pavement Friction Data 2008-2014", completed February 26, 2019;
- "Red Hill Valley Parkway Analysis", prepared in April 2020; and
- "Review of Red Hill Valley Parkway Friction Test Results", finalized in May 2020.

Except for the Lighting Study and the February 4 CIMA Memorandum, all of CIMA's engagements were overseen by and delivered to staff in Traffic Operations & Engineering and/or the department overseeing this group.

CIMA's work in relation to the RHVP and LINC was primarily conducted by staff in CIMA's Transportation Group, which operated out of CIMA's Burlington office. During the relevant time for this Inquiry, CIMA was a roster consultant for Category 3: Transportation & Traffic Engineering Planning services. Many of CIMA's assignments were issued through the City's roster program.

Figure 4c: City of Hamilton Mayor and City Councillors, 2001 to 2022

Elected Term [8]						
	2001 to 2003	2003 to 2006	2006 to 2010	2010 to 2014	2014 to 2018	2018 to 2022
Mayor	Robert Wade*	Larry Di Ianni*	Fred Eisenberger*	Bob Bratina*	Fred Eisenberger*	Fred Eisenberger*
Ward 1	Marvin Caplan	Brian McHattie	Brian McHattie	Brian McHattie*	Aidan Johnson	Maureen Wilson
Ward 2	Andrea Horwath	Andrea Horwath (until June 2004) Bob Bratina (from October 5, 2004)	Bob Bratina*	Jason Farr	Jason Farr	Jason Farr*
Ward 3	Bernie Morelli	Bernie Morelli	Bernie Morelli	Bernie Morelli (until Jan 15, 2014) Matthew Green	Matthew Green	Nrinder Nann*

[8] Membership on the Public Works Committee is indicated with an asterisk (*) in **Figure 4c**. The Mayor is an ex-officio member of the Public Works Committee.

Elected Term [8]						
	2001 to 2003	2003 to 2006	2006 to 2010	2010 to 2014	2014 to 2018	2018 to 2022
Ward 4	Sam Merulla	Sam Merulla*	Sam Merulla*	Sam Merulla*	Sam Merulla*	Sam Merulla*
Ward 5	Chad Collins	Chad Collins*	Chad Collins*	Chad Collins*	Chad Collins*	Chad Collins* (until September 20, 2021)
Ward 6	Tom Jackson	Tom Jackson*	Tom Jackson*	Tom Jackson*	Tom Jackson*	Tom Jackson*
Ward 7	Bill Kelly	Bill Kelly	Scott Duvall	Scott Duvall*	Scott Duvall* (until October 22, 2015) Donna Skelly (from March 30, 2016 - June 27, 2018) Terry Anderson (from August 17, 2018)	Esther Pauls*
Ward 8	Frank D'Amico	Terry Whitehead	Terry Whitehead	Terry Whitehead*	Terry Whitehead*	John-Paul Danko*
Ward 9	Anne Bain	Phil Bruckler*	Brad Clark	Brad Clark	Doug Conley*	Brad Clark

Elected Term [8]						
	2001 to 2003	2003 to 2006	2006 to 2010	2010 to 2014	2014 to 2018	2018 to 2022
Ward 10	Larry Di Ianni	Maria Pearson	Maria Pearson	Maria Pearson	Maria Pearson	Maria Pearson*
Ward 11	David Mitchell	David Mitchell*	David Mitchell*	Brenda Johnson	Brenda Johnson	Brenda Johnson
Ward 12	Murray Ferguson	Murray Ferguson*	Lloyd Ferguson*	Lloyd Ferguson*	Lloyd Ferguson*	Lloyd Ferguson*
Ward 13	Russ Powers	Russ Powers (to June 2004) Art Samson (from October 5, 2004)	Russ Powers*	Russ Powers*	Arlene VanderBeek*	Arlene VanderBeek*
Ward 14	Dave Braden	Dave Braden*	Robert Pasuta	Robert Pasuta*	Robert Pasuta*	Terry Whitehead*
Ward 15	Margaret McCarthy	Margaret McCarthy*	Margaret McCarthy*	Judi Partridge	Judi Partridge	Judi Partridge

CHAPTER 5

Hamilton's Road Safety Programs and Asset Management, and the RHVP from 2007 to 2012

5.1. Overview

This chapter covers the time period from 2007 to 2012. It sets out significant events for the first five years of the operation of the RHVP, which included significant flooding events in July 2009 and July 2010 and the experience of much higher traffic volumes on the RHVP than had been anticipated prior to its opening.

During these first years that the RHVP was in operation, the Mayor, councillors, and City staff began receiving complaints from members of the public about safety concerns arising from the driving experience on the parkway. This chapter addresses complaints of drivers' inability to see pavement markings and roadway delineators, particularly in the dark or during inclement or snowy weather conditions; lack of lighting on certain portions of the RHVP, such as the area where the RHVP connects with the LINC at the south-east end of the parkways; potential or perceived slipperiness of the road surface; and improper or inadequate signage.

This chapter also addresses relevant road safety initiatives and programs implemented by the City during this time. These included the City's network screening programs, collision countermeasures program, Traffic Safety Status Reports, and Hamilton Strategic Road Safety Program. Many of these traffic safety initiatives and road safety programs were on hiatus or significantly diminished for several years following retirement of the Manager of Traffic Engineering in 2011 and reorganization of staff engaged in traffic safety. It also describes the Hamilton Transportation Master Plan ("TMP"), which was used to guide the City's overall transportation planning needs, timing, and budgeting, and the City's asset management program and the related State of the Infrastructure ("SOTI") Reports, in which roads and traffic assets (and other City infrastructure) were reviewed and assessed.

Finally, this chapter outlines Golder's three-phase project referred to as the Pavement and Materials Technology Review (the "PMTR"). The PMTR focused on reviewing the different road pavement technologies and materials the City used on City roads, the City's practices, and recommended improvements. The PMTR originated from the concerns of Gary Moore (Director, Engineering Services, Environment & Sustainable Infrastructure Division, Public Works, Hamilton) about the quality and performance of the City's newly constructed and rehabilitated pavements, and had the long term objective of improving pavement performance.

5.2. Significant Events in the RHVP's First Five Years of Operation

5.2.1. Flooding on the RHVP in 2009 and 2010

The RHVP experienced significant flooding in July 2009 and July 2010, following heavy rainfalls in the City.

After the rain and flooding in July 2010, Gerry Davis (General Manager, Public Works, Hamilton) emailed the Mayor and Council about the flooding issues in the City. Mr. Davis noted that flooding on certain sections of the RHVP, which had resulted in closure of the parkway, was caused by a stormwater retention pond that had overflowed. Mr. Davis advised that the RHVP flooding was "not a result of any engineering/design issues" or the Red Hill Creek.

Between August and December 2010, at the suggestion of Council, staff considered signage on the RHVP and the LINC to alert drivers to potential closure of the RHVP during heavy rainfall due to flooding. Ultimately, City staff did not implement the signage.

The evidence the Inquiry received suggests the floods in July 2009 and July 2010 may have affected the performance of the RHVP pavement.

Dr. Ludomir Uzarowski (Principal, Pavement & Materials Engineering, Golder), Dr. Vimy Henderson (Pavement & Materials Engineer, Golder), and Mr. Moore co-authored a 2011 technical paper about the RHVP. They noted that significantly increased moisture levels had been observed in the pavement's subgrade, and that pavement distresses, including rutting, were anticipated to develop if the subgrade layer of the RHVP perpetual pavement became wet.

In addition, the subsequent report prepared by Golder as a six-year review of the RHVP (referred to as "the 2014 Golder Report") identified slight to moderate distortions in the pavement, which Golder theorized were the result of the prior floods. Golder anticipated that the floods had worsened the subgrade conditions and caused a few areas of localized depressions. The 2014 Golder Report and Golder's findings therein are discussed at length in Chapter 6.

5.2.2. The RHVP Experiences Higher than Anticipated Traffic Volumes

As discussed in Chapter 2, the City installed a pavement response system and a traffic monitoring system in the RHVP mainline pavement during the construction of the RHVP. Golder was involved in the installation of these systems and entered into a contract with the City to perform data analysis and reporting for a three-year period following installation. In the years after the RHVP opened in November 2007, the parkway had much higher traffic volumes than had been anticipated prior to the RHVP's opening. Documents that the Inquiry received indicate that prior to opening, the RHVP's anticipated annual average daily traffic ("AADT") was 30,000 or 40,000 vehicles in the first year of operation, and was expected to increase to 90,000 or 100,000 by the fiftieth year of operation (2057). In fact, the traffic levels on the RHVP far exceeded these estimates.

In their 2011 paper, Dr. Uzarowski, Dr. Henderson, and Mr. Moore referenced traffic loading data obtained from the RHVP pavement monitoring system. This data indicated an AADT of approximately 70,000 vehicles by 2011. This reflected a 15% growth rate based on an estimated initial AADT of 40,000, as compared to the growth rate of 1.8% anticipated before the RHVP opened. The paper forecast that traffic growth would continue to increase at higher than anticipated levels in the future. The 2014 Golder Report also noted the increased amount of traffic on the RHVP following opening.

The higher than anticipated RHVP traffic volumes were of significance. As one might expect, more traffic means more wear and tear on the roadway, and an expedited depreciation of the roadway asset. These much higher than anticipated traffic volumes were among the factors that led to the first resurfacing of the RHVP much earlier than originally anticipated.

5.2.3. Resurfacing of the LINC in 2011

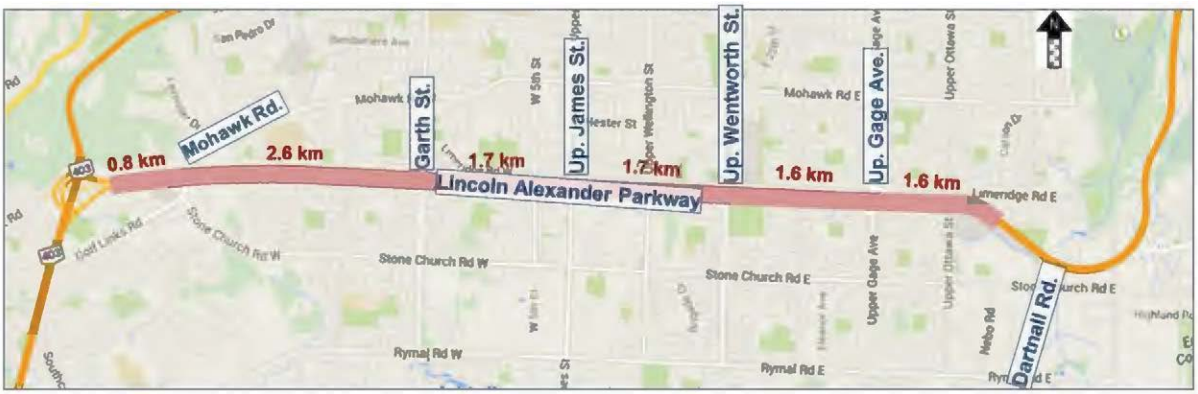
The LINC was resurfaced in 2011. The LINC resurfacing project was tendered in early 2011 and repaving was completed on July 22, 2011. By that time, most of the LINC had been in service for approximately 14 years, since 1997, and the LINC extension from Dartnall Road to Mud Street had been in service for 12 years, since 1999. The

Inquiry received evidence that the decision to resurface the LINC was made by the Asset Management section in Engineering Services.

The LINC was resurfaced using a traditional mill and overlay, in which the top 50 mm of the LINC's existing surface course was removed and replaced with a new layer of Superpave 12.5 FC2. The new layer differed from the original surface course (which was a modified HL-1 mix) and from the SMA mix used for the RHVP surface course. The limits of the LINC resurfacing were from Highway 403 (to the west) and at or near the Mud Street interchange (to the east). The Request for Tender for the LINC resurfacing contract (Contract No. PW11-07(H)) described the project limits as 755 m west of the Mohawk Road/Golf Links Road interchange to 600 m east of the Dartnall Road interchange. As I understand it, this would have included all of the LINC sections paved in 1997 and all or most of the LINC sections paved in 1999, but did not include the Dartnall Road interchange ramps. No alterations were made to the mainline lane widths or configuration, or to the guiderail on the LINC during the resurfacing.

Figure 5a is an annotated map prepared by CIMA for the City in CIMA's November 2015 report, entitled "Lincoln Alexander Parkway Median Safety Study" (the "2015 CIMA LINC Report"). This map provides some visual context and reference for the 2011 LINC resurfacing and the areas that were included in that project. The street name labels and distance markers appear to have been added by CIMA for its purposes in the 2015 CIMA LINC Report, and are not related to the LINC resurfacing. In addition, the Mud Street interchange, which is not reflected on the map, is to the east of Dartnall Road (to the right of Dartnall Road in **Figure 5a**).

Figure 5a: Map of the LINC



Rankin Construction was the paving contractor. Golder was retained to perform quality assurance testing and inspection for the LINC resurfacing project. Dr. Uzarowski was the project manager. Andro Delos Reyes (Senior Pavement & Materials Geotechnical Technologist, Golder), who had been the site supervisor for the RHVP paving, was also on the project team. The City Engineering Services staff involved in the LINC resurfacing project included Marco Oddi (Senior Project Manager, Construction Management, Construction, Engineering Services, Environment & Sustainable Infrastructure Division, Public Works, Hamilton), Susan Jacob (Manager, Design, Engineering Services, Environment & Sustainable Infrastructure Division, Public Works, Hamilton), and Mike Becke (Project Manager, Design, Engineering Services, Environment & Sustainable Infrastructure Division, Public Works, Hamilton).

5.2.4. Councillors and City Staff Receive Complaints about the RHVP

In the years after the RHVP opened, the Mayor, councillors, and City staff received complaints from members of the public about safety concerns arising from the driving experience on the parkway. Staff received complaints directly and through councillors. Councillors passed along constituents' complaints and suggestions for improvements for consideration by staff and asked for assistance from staff to provide responses to constituents. As Mr. Moore explained in his testimony at the Inquiry hearings, staff were often in "feedback mode" when responding to councillors, unless councillors raised issues at Committee or Council meetings or gave specific requests for staff to take action. According to Mr. Moore, when councillors contacted staff about the RHVP, staff typically provided them with the rationale for why a certain element existed on the parkway.

Complaints from the public related to, among other issues, drivers' inability to see pavement markings and roadway delineators,[1] particularly in the dark or during inclement or snowy weather conditions; lack of lighting on certain portions of the RHVP,

[1] The MTO's Ontario Traffic Manual (March 2000) defines delineators as "small, retroreflective devices erected in a series to guide drivers. They are placed…on the edge of the traveled portion of the roadway (in urban areas). Delineators describe the horizontal alignment of the roadway and help the driver to identify its limits. Delineators are guidance devices".

such as the area where the RHVP connects with the LINC at the south-east end of the parkways; potential or perceived slipperiness of the road surface; and improper or inadequate signage. In his testimony at the Inquiry, Councillor Tom Jackson (Ward 6, Hamilton) recalled darkness and perceived slipperiness as the two primary topics of concern as of late 2012 and early 2013.

Constituents also suggested or requested improved signage in certain locations; installation of lights in the area of the Mud Street/Stone Church Road interchanges and the Greenhill Avenue interchange; installation of reflective in-laid lane markings to improve lane visibility; and installation of more prominent curve markings, such as reflective flags or poles.

5.2.4.1. City Staff Investigate RHVP Complaints and Areas of Concern

Beginning in 2008, City staff discussed and took steps to address RHVP-related safety concerns, including considering potential improvements to the parkway. Some of these aligned with those suggested by constituents.

In December 2008, staff reviewed the area in and around the Mud Street interchange to consider adding delineators to the area and to address lighting-related concerns that had been raised. In early 2009, staff in the Street Lighting group reviewed the collision history associated with the Mud Street interchange and concluded that there was no demonstrated relationship between lighting (or lack of lighting) and collisions that occurred in the area. However, staff in a different group later decided to add speed advisory signs and chevron delineation to that area. There was no evidence before the Inquiry as to why staff decided to proceed with the chevron delineation and speed advisory signs. Emails amongst staff also indicate that as of early 2009, just over one year after the RHVP opened, many of the existing delineators had been knocked down due to collisions or by snowplows.

In early 2010, Traffic Engineering staff conducted a collision review of the area where the LINC and RHVP met, around/between the Dartnall Road and Stone Church Road interchanges, to identify “sideswipe or…other collision[s] whereby motorists were confused by lane markings or lack of visibility of markings”. Staff determined from the review that, of the 27 collisions in that area, 10 were caused primarily by sideswipe or improper lane changes. Staff attributed those 10 collisions to drivers having been

unable to see pavement markings in the dark or under rain or wet conditions. Staff discussed "poor pavement markings" on that section of the RHVP and LINC and considered the possibility of increasing the pavement line painting program to twice annually.

Also in 2010, staff discussed an observed "kink" on the RHVP, which was a flat spot in the pavement markings in the curve where the RHVP and LINC joined where there should have been a pure circular curve. In an email discussing the kink, Hart Solomon (Manager, Traffic Engineering, Engineering Services, Environment & Sustainable Infrastructure Division, Public Works, Hamilton), advised that although the "error in the layout [was] clear", changes could not be achieved without widening the shoulder and relocating the existing edge-line rumble strip, neither of which were justified from a cost perspective based on the collision history. CIMA also observed the kink in the project that became the 2013 CIMA Report, discussed in Chapter 6.

5.2.5. Public Works Reorganizations and Departure of Senior Traffic Engineering Staff

As noted in Chapter 4, as of some time in 2009 until late 2012 or early 2013, Traffic Engineering and Traffic Operations (which had previously existed as the Traffic Engineering & Operations group) were separate groups within the Public Works department. During this period, Traffic Engineering was in the Engineering Services section and Traffic Operations was in the Energy, Fleet, Facilities & Traffic section.

As Manager of Traffic Engineering, Mr. Solomon and his Traffic Engineering group oversaw the City's network screening programs, collision countermeasures, and Traffic Safety Status Reports, discussed below, among other initiatives. During this period, Mr. Solomon reported to Mr. Moore, the Director of Engineering Services, until Mr. Solomon's retirement in 2011. As detailed below, the Inquiry received evidence that many of these traffic safety initiatives were on hiatus for several years following Mr. Solomon's retirement.

As the Superintendent of Traffic Operations during this period, Martin White (Superintendent, Traffic Field Operations; Energy, Traffic Operations & Facilities; Transportation, Energy & Facilities Division; Public Works, Hamilton) managed only the operations and maintenance of signs, traffic signals, and pavement markings;

he had no responsibility for the engineering of traffic facilities at that time. Those responsibilities belonged to Traffic Engineering.

In late 2012 or early 2013, Traffic Engineering and Traffic Operations were reunified as the Traffic Operations & Engineering group in the Energy, Fleet & Traffic section of the Corporate Assets & Strategic Planning division. The effect of this restructuring was that traffic engineering functions were moved out of Engineering Services. Mr. White oversaw this group as Manager of Traffic Operations & Engineering. Mr. White's evidence was that it took some time for the safety programs that were formerly under Mr. Solomon's group to become re-established once Traffic Operations & Engineering was formed. The City, in its closing submissions to the Inquiry, described the hiatus of these safety programs as due to personnel issues. While this may be true, the result was a significant diminution of the City's road safety programs in the years after Mr. Solomon retired in 2011.

The work of the Traffic Operations & Engineering group, overseen by Mr. White, is discussed extensively in the chapters that follow.

5.3. Other City Pavement and Road Safety Initiatives from 2007 to 2012

5.3.1. Traffic Safety Programs Run by Traffic

Three of the traffic safety programs and initiatives overseen by the Traffic Engineering & Operations group (as it was until 2009) and the Traffic Engineering group (from 2009 until late 2012 or early 2013), referred to collectively in this section as "Traffic", were the Hamilton Strategic Road Safety Program, the Traffic Safety Status Reports, and the collision countermeasures program. Each are described below.

5.3.1.1. Hamilton Strategic Road Safety Program

The Hamilton Strategic Road Safety Program existed in the City from around the time of amalgamation in 2001. In 2007, Council approved an annual reporting process for the Hamilton Strategic Road Safety Program, under which staff was directed to report its actions under the program and its findings annually in August or September

of each year. Staff was also directed to develop a strategic action plan to support the Hamilton Strategic Road Safety Program.

The Hamilton Strategic Road Safety Action Plan (the "2009 Action Plan") was issued in April 2009. The mission of the 2009 Action Plan was to reduce property damage and injury resulting from collisions. Its primary goal was to reduce fatal, personal injury, and property damage collisions by 10% every three years, beginning in 2009. The 2009 Action Plan was intended to be used by several stakeholders, including the Public Works department, the City's emergency services, and the MTO, as a working document that would be regularly updated to reflect new goals, safety programs, and collision data.

The 2009 Action Plan identified three primary areas of emphasis that contributed to the largest number of collisions in the City between 2003 and 2007: aggressive driving, intersections, and vulnerable users. The Action Plan intended to prioritize resources for actions to address the three primary emphasis areas.

The Hamilton Strategic Road Safety Program was, however, dormant from some time after the 2009 Action Plan was released in 2009 until mid-2014. A staff report submitted to the Public Works Committee ("PWC") in August 2014, titled "Re-establishment of the Hamilton Strategic Road Safety Program", stated "[d]ue to staff turnover and lack of a champion, implementation of the…Hamilton Strategic Road Safety Program has been limited". Recommendations in the staff report included hiring staff and allocating funding to the Hamilton Strategic Road Safety Program. As part of reviving the program, the staff report listed several areas for the Hamilton Strategic Road Safety Program to consider focusing its efforts, including undertaking a detailed collision analysis. The Hamilton Strategic Road Safety Committee was re-activated in March 2015. Annual reporting appears to have been subsequently reinstated, as evidenced by updates that Council received in April 2016 and June 2017, pertaining to 2015 and 2016, respectively.

5.3.1.2. Traffic Safety Status Reports

Prior to 2007, the City published data about collisions in Traffic Safety Status Reports. The Traffic Engineering & Operations group (later the Traffic Engineering group, in 2009 and 2010), overseen by Mr. Solomon, prepared the Traffic Safety Status

Reports. The Traffic Safety Status Reports were published in two volumes: the first volume, published every year or every other year, summarized the police-reported collision data and trends for the year of publication (for instance, data specific to 2007 for the 2007 Traffic Status Safety Report); the second volume, published every three years, provided information on drivers, vulnerable road users (including pedestrians and cyclists), pedestrian behaviour, and road and weather conditions on a three-year average.

The intention of the Traffic Safety Status Reports was to provide factual information to the agencies and individuals concerned with the safety of the City's roadway transportation system. During the period from 2007 to 2012, the City published three Traffic Safety Status Reports: the 2007 Traffic Safety Status Report, the 2009 Traffic Safety Status Report, and the 2010 Traffic Safety Status Report.

The reports referenced the City's network screening program, which was run by the Traffic Engineering & Operations group, starting in 2000. The network screening program comprehensively reviewed and ranked sections of the City's road network to see trends in collisions in terms of location and type of road group. Sections of the LINC and RHVP were one road group; the LINC on- and off-ramps were two of the other road groups (of which there were a total of 12 types). The goal was to use a risk analysis methodology to identify locations where programs or techniques to reduce collision frequency could be applied.

Each of the 2007, 2009, and 2010 Traffic Safety Status Reports listed the 60 locations that ranked the highest in the City's network screening overrepresentation ranking. The RHVP, which had newly opened, was not included in the 2007 ranking. However, the 2009 and 2010 Traffic Safety Status Report rankings listed the "Mud: Mud SB – EB off ramp – RHVP" as the fourth highest over-represented collision area, based on 2005 to 2009 collision data. The overrepresentation ranking reflected locations which exceeded the expected number of collisions for the respective roadway group and "further experienced an overrepresentation of causal factors" for 2005 to 2009. The overrepresentation ranking identified 23 collisions as having occurred at the Mud Street southbound-eastbound off-ramp.

After 2010, the City did not publish network-wide annual collision data again until early 2019, when the City published the 2017 Annual Collision Report, discussed in Chapters 9 and 11.

5.3.1.3. Collision Countermeasures Program

The City established a collision countermeasures program in 2004. Through the program, staff in the Traffic Engineering & Operations group (later the Traffic Engineering group) proactively reviewed locations on the network screening list that had relatively high collision rates to identify potential countermeasures to mitigate collisions. All staff in the Traffic Engineering group and the Hamilton Police Service were involved in the collision countermeasures program.

The high-ranking locations were divided amongst Traffic Engineering staff, who met every other month as a group to present on the locations. At the collision countermeasures meetings, staff presented and discussed recommendations for countermeasures that they felt were appropriate for the location under review.

As I understand it, the program's focus shifted from year to year – for instance, the Inquiry received evidence that in one year the program focused on vulnerable road users, and, in particular, the top locations that identified issues with vulnerable road users.

The southbound-eastbound Mud Street off ramp on the RHVP, noted in the Traffic Safety Status Reports above, was discussed at a collision countermeasures review meeting on March 31, 2010. A slide presentation prepared for this meeting indicated that 25 collisions had occurred on the ramp since the RHVP opened in November 2007 and the ramp was ranked as the 64th highest collision area overall based on 2004 to 2008 collision data. One slide described the ramp as slippery when wet. Another slide contemplated rumble strips and the installation of signage and markings as short term solutions, and the installation of street lighting and jersey wall barriers as potential long term recommendations. The Inquiry did not receive any evidence regarding the outcome of the March 31, 2010 discussion. CIMA also reviewed this ramp in the project that led to the 2013 CIMA Report, discussed in Chapter 6.

As discussed above, the collision countermeasures program did not run from sometime in 2011 (when Mr. Solomon retired from the City) until 2018.

5.3.2. Hamilton Transportation Master Plan

Council approved the TMP in 2007. The purpose of the TMP was to "guide the City's overall transportation planning needs, timing, and budgeting to 2031" and to guide planning needs for certain areas in the City. The TMP was a policy document setting out the framework for future growth of the City's transportation network. A March 2010 working draft of a TMP Implementation/Monitoring Program ("TMPI") described the purpose of the TMPI as including the development of a "performance monitoring program for tracking the implementation of ... policies, infrastructure improvements and periodic measurements of progress towards achieving the vision, goals and objectives" of the TMP.

One of the City's seven key transportation objectives was to offer safe and convenient access for individuals to meet their daily needs. For this objective, the TMPI proposed to monitor the following road safety indicators, among others: road injuries, road fatalities, reported pedestrian collisions, and reported cyclist collisions. City staff circulated a summary of the existing City-wide data for these indicators (and others) in March 2010.

The draft 2010 TMPI report listed proposed short term, medium term, and long term road infrastructure improvements; the short term were anticipated between 2007 and 2011, medium term between 2012 and 2021, and long term beyond 2021. For each project, the list noted the nature of the anticipated work, the total cost, and the applicable class of environmental assessment. The listed works appear to have been structural changes, such as road widening or creation of a new road, rather than maintenance or rehabilitation activities. The Inquiry received documentary evidence that suggests that the TMPI was updated annually to reflect and track how the City progressed in implementing TMP objectives.

Council also received periodic updates on the TMP from staff. In February 2015, staff presented a TMP five-year review and update to the General Issues Committee ("GIC"). As discussed in Chapter 7, in December 2015, on recommendation from staff, Council deferred the implementation of certain medium and long term RHVP countermeasures recommended in the 2015 CIMA Report pending the outcome of a TMP review in progress. In August 2018, the GIC received that TMP review and update from staff.

5.3.3. Asset Management Program and State of the Infrastructure Reports

The City established an asset management program in 2001, which was overseen by the Asset Management section. The asset management programs were based on and guided by the following seven questions: (1) what do you have? (2) what is it worth? (3) what condition is it in? (4) what do we need to do to it? (5) when do we need to do it? (6) how much money do we need? and (7) how do we achieve sustainability?

In 2005 and 2006, the City released the first "Life Cycle State of the Infrastructure Report on Public Works Assets"[2] and related report card to evaluate the existing state of various public works assets. Later SOTI reports were released in 2011 and 2016 and SOTI reports specific to the City's road network and traffic systems were released in May 2011, August 2014, and January 2017. The Inquiry received documents that suggest that, as of 2014, the City's SOTI reports may have been a component of the City's newly issued Asset Management Plan, which the City was required to submit for provincial funding.

The SOTI reports were prepared through a series of interviews with City staff. In many years, Richard Andoga (Senior Project Manager, Infrastructure Programming, Asset Management, Engineering Services, Environment & Sustainable Infrastructure Division, Public Works, Hamilton) coordinated these interviews. Stantec and R.V. Anderson Associates were the City's consultants on the SOTI reports.

The purpose of the SOTI reports was to measure and report the effectiveness of the City's management practices pertaining to the physical condition of infrastructure, the capacity of infrastructure to service peak demand, and the availability of funding to address infrastructure needs. The reports were seen as a tool to identify "issues and trends facing the management of public works infrastructure and services on a sustainable basis".

The 2009 SOTI report stated that roads and traffic was the City's largest single asset category having an estimated infrastructure value of $4.4 billion and accounting for

[2] The 2005 and 2006 report and subsequent iterations of the report released in later years are each referred to in this Report as a "SOTI report". "SOTI" refers to State of the Infrastructure.

32% of Public Works' total assets. Roads and traffic received a D- rating in the 2009 infrastructure report card, which was down from the 2005/2006 ratings of D for roads and C for traffic. The report card noted the following major factors for the D- rating were "[c]apacities managed by major concern for backlog and lack of reliable funding." The City's expressways, urban arterial roads (major and minor), and urban collector roads, collectively, received a D rating. The 2009 SOTI report also identified a $96 million deficit between the City's average life-cycle capital investment requirement and the actual 2008 capital investment for roads and traffic.

The 2011 SOTI report, entitled "City of Hamilton State of the Infrastructure Review – Road Network and Traffic Systems", focused entirely on the City's road network and traffic system. This report was the result of a direction from the PWC to staff after the 2009 SOTI was presented. Staff were directed to report back on the implications and funding needed to move the roads and traffic infrastructure from the D- rating to a B+ rating. The 2011 SOTI report reflected an overall condition index ("OCI") of 100 for the RHVP.[3] This was higher than the City road network OCI (55.8) and the expressway network as a whole (79.5). The 2011 SOTI report reflected overall ratings for the City's road network, structures, and traffic system were D+, C-, and D+, respectively, in 2009 and D+, B+, and D+, respectively, for 2010. The "Recommended Best Practices" section included in the report outlined several preventative maintenance strategies the City could consider, including crack sealing, microsurfacing, and slurry seal.

5.3.4. Golder's Three-Phase Pavement and Materials Technology Review

Following completion of the RHVP, Engineering Services retained Golder for pavement-related projects in Hamilton. It appears from these projects, and those discussed later in this Report, that Golder became one of the City's principal consultants on pavement-related projects during the period relevant to this Inquiry.

[3] The OCI is comprised of two elements: the surface condition index, which is based on visual inspection performed while driving on the roadway, and the ride condition index, measured using electric sensors on the vehicle while driving on the roadway. Friction levels are not a factor in the OCI rating a road receives. The Inquiry received documents that indicate that the City used an OCI of 60 as a rehabilitation trigger.

Between 2009 and 2013, the City retained Golder to complete a three-phase project referred to as the PMTR. The PMTR focused on reviewing the different road pavement technologies and materials used by the City, the City's practices, and recommended improvements. The PMTR originated from Mr. Moore's concerns about the quality and performance of the City's newly constructed and rehabilitated pavements, and the long term objective of improving pavement performance. Golder prepared a report for each phase of the PMTR. Although Golder reviewed the RHVP in the course of its work, the PMTR was not related to the RHVP in particular.

PMTR Phase I was conducted in 2009. It focused on construction quality, consisting of a review of the City's quality control and quality assurance practices and procedures and a field inspection to assess the condition of selected pavements in the City. The RHVP was not included in the Phase I field inspections. In the Phase I report, Golder provided several recommendations, including improvements to the City's quality assurance, quality control, and construction practices.

PMTR Phase II was completed in 2012. It focused on "development of specific recommendations for upgrading and improving the current City's Materials and Construction Specifications." Phase II also involved site visits to selected pavements (of which the RHVP was not one) to assess their performance. Golder's Phase II report included a description of various techniques to rehabilitate and preserve pavement, including hot-in place recycling[4] and microsurfacing, among many others. Golder noted the friction benefits associated with some of the identified treatments, including microsurfacing and slurry seals. Regarding pavement preservation, Golder wrote that pavement preservation was "the only way to maintain the [City's road] network within available budget."

PMTR Phase III was conducted in 2013, and is mentioned in Chapter 6. It included a review of the implementation of the recommendations made in Phases I and II, a review of and recommendations regarding the City's pavement design matrix, and an analysis of new paving technologies, including preventative treatments such as microsurfacing and bonded wearing course. As it had in Phase II, Golder identified several treatments, including microsurfacing and bonded wearing course, that would

[4] The City's consideration of hot-in place recycling ("HIR") for the RHVP resurfacing, known also as "HIP" or "HIPR", is discussed in Chapters 8 and 9.

improve skid resistance, among other benefits. Golder conducted visual condition inspections during Phase III, including on the RHVP and LINC. Golder observed top-down cracking on the RHVP. This observation was consistent with Golder's finding in the six-year condition evaluation review that Golder subsequently conducted, which was the subject of the 2014 Golder Report discussed in Chapter 6.

CHAPTER 6

The 2013 CIMA Report, the 2014 Golder Report, and the Tradewind Report from 2012 to 2014

6.1. Overview

This chapter discusses the findings, recommendations, and preparation of the reports from three expert consultants delivered to the City in 2013 and 2014.

In 2012, the Red Hill Valley Parkway (the "RHVP") had its first fatal collision. In 2013, in response to complaints about "darkness" and, to a lesser extent, "slipperiness" on the RHVP, the Public Works Committee ("PWC") directed City staff to investigate upgrading lighting, installing better reflective signage and lane markings, and other initiatives to assist motorists on a portion of the RHVP. Traffic retained CIMA to prepare a safety review of a portion of the RHVP (the "2013 CIMA Report"). Staff from Engineering Services' Geomatics & Corridor Management section, which was responsible for lighting, were included on the City's project team.

This chapter addresses CIMA's findings of a high proportion of single motor vehicle and wet surface collisions, and its recommendations for signage and marking changes, friction testing, application of a high friction pavement on one ramp, and illumination of certain interchanges. It also addresses CIMA's reduction in the scope of its assessment regarding lighting, which occurred after CIMA spoke to Gary Moore (Director, Engineering Services, Public Works, Hamilton). In November 2013, Traffic staff presented a staff report summarizing some of CIMA's findings to the PWC, in which staff recommended deferring consideration of CIMA's recommendations on lighting until the effect of the other recommendations could be evaluated. However, the PWC maintained lighting on the PWC's outstanding business list for later review. This chapter addresses the implementation of the recommendations within Traffic's scope of responsibility, and the absence of coordination between Traffic and Engineering Services in respect of the recommendations within Engineering Services' scope of responsibility.

This chapter also addresses two reports commissioned by Mr. Moore. In March 2013, Mr. Moore retained Golder Associates Ltd. ("Golder") to conduct a review of the RHVP five years after its opening (the "2014 Golder Report"). In September 2013, following a series of collisions on the RHVP during a heavy rainfall event, Mr. Moore undertook to have friction testing done on the RHVP and the Lincoln M. Alexander Parkway (the "LINC") to proactively address any legal claims that might allege the RHVP was unduly slippery when wet. Golder's subcontractor, Tradewind Scientific Ltd. ("Tradewind"),

conducted friction testing on the RHVP and LINC on November 20, 2013, and later delivered its final report to Golder (the "Tradewind Report"). Golder sent Mr. Moore the Tradewind Report, attached as an appendix to the draft 2014 Golder Report, on January 31, 2014.

The Tradewind Report concluded that the LINC friction levels were generally comparable to or above investigatory thresholds under a UK standard and that the RHVP friction levels were "below or well below" the same investigatory threshold. It recommended that a more detailed investigation be conducted, and possible remedial action be considered to enhance the surface texture and friction characteristics on the RHVP. The 2014 Golder Report, which addressed the state of the pavement on the RHVP and contained one section on the Tradewind Report, noted that the RHVP friction levels were considered to be "relatively low", despite being higher than the friction levels measured in 2007. Golder recommended that a mill and overlay be conducted to remedy longitudinal cracking on sections of the RHVP where the most frequent top-down cracking was observed, and that the remaining section be routed and sealed to remedy other cracking in the SMA surface course, followed by the application of microsurfacing.

Mr. Moore discussed the 2014 Golder Report with Dr. Ludomir Uzarowski (Principal, Pavement & Materials Engineering, Golder) at a meeting on February 7, 2014, but he did not review the 2014 Golder Report or Tradewind Report in any detail prior to this meeting. Mr. Moore did not share the Tradewind Report or the 2014 Golder Report with Traffic staff, despite being aware at that point that CIMA had recommended that the City consider friction testing on the RHVP in the 2013 CIMA Report. Engineering Services did not implement the remediation of the RHVP pavement recommended by Golder, or conduct any further investigation of the friction levels on the RHVP.

6.2. The First Five Years of the RHVP and Its First Fatal Collision in September 2012

In the fall of 2012, as the RHVP approached five years of operation, Mr. Moore was involved in two streams of unrelated discussions about the parkway.

First, Dr. Uzarowski and Mr. Moore began discussing RHVP-related projects including an evaluation of the pavement conditions five years after the RHVP's construction.

As set out below, these discussions ultimately resulted in Golder's preparation of the 2014 Golder Report.

Second, City councillors continued to receive complaints about the RHVP, which they communicated to Mr. Moore and other City staff. As some councillors raised at the time, and later testified about at the Inquiry, the complaints centered around the "darkness" of the RHVP and that the RHVP seemed "a bit slippery" at times. City staff consistently reported that the RHVP had been designed to the highest standards, but complaints persisted.

On September 18, 2012, the RHVP's first fatal collision occurred. A couple died in a cross-median collision with a truck. The media reported that "speed and a rain-soaked road are the suspected causes" and quoted a detective in the Collision Reconstruction Unit as saying:

> Weather may have played a part in it because it was raining at the time …. The Toyota vehicle was making its way down the ramp, to go southbound ... and for some reason lost control and bounced over the concrete median and shot across in front of the southbound truck.
>
> He [the driver of the Toyota] was going too fast to stay in the lane that he was in, and [his vehicle] hit the concrete median and it shot him right across, in front of the truck .... In order for the vehicle to do what it did, it was going too fast for the road conditions.

6.3. The 2014 Golder Report

6.3.1. Discussions Regarding an Evaluation of RHVP Condition

On March 1, 2013, Dr. Uzarowski and Mr. Moore met to discuss three projects: Phase III of the Pavement and Materials Technology Review (the "PMTR"), reactivation of the RHVP instrumentation that had been installed at the time of the RHVP's construction, and a review of the condition of the RHVP five years post-construction. Following the meeting, Dr. Uzarowski sent Mr. Moore three project proposals, co-signed by Dr. Uzarowski and Dr. Vimy Henderson (Pavement & Materials Engineer, Golder), and a consulting services agreement.

The focus of the PMTR project and each phase of the project, including Phase III, are discussed in Chapter 5. The budget for the PMTR Phase III proposal was $98,000. Mr. Moore subsequently approved a revised version of the proposal for PMTR Phase III.

Regarding the RHVP pavement instrumentation, Golder had been previously contracted by the City to collect the data from the monitoring systems and provide it to the City. By 2013, the City was no longer obtaining this data. At Mr. Moore's request, Golder provided a proposal to reactivate collecting data from the instrumentation that Golder had installed in the pavement to monitor traffic and the performance of the RHVP's perpetual pavement, and downloading and storing the data. Golder's proposal was for a three-year contract for collection and storage only. The proposed budget was $35,000. Mr. Moore approved this project.

Golder's proposed project to assess the condition of the pavement on the RHVP five years after construction (which was ultimately delivered six years after construction, in 2014) included various field investigations, analysis (which involved compiling data and evaluating the current condition of the RHVP, comparing the measured performance with the performance anticipated for 400-series highway pavements, and setting a baseline for future comparisons), and a report on Golder's investigations, analysis, and recommendations. Golder proposed a $23,500 budget. Mr. Moore approved the five-year condition review project as proposed, with a $23,500 budget and a $4,500 contingency. This project ultimately resulted in a draft report provided to the City on January 31, 2014 (the 2014 Golder Report).

Mr. Moore had previously declined Dr. Uzarowski's invitation, made in February 2013, that they jointly present a paper at an upcoming Transportation Association of Canada ("TAC") conference, about the evaluation of the RHVP's pavement performance five years post-construction. At that time, Golder had not been retained by the City to complete the testing, analysis, and investigation that were contemplated to be included in the paper and the paper did not proceed.

Golder was retained for each of the three projects through the City's roster program. The City's roster program is described in Chapter 4.

6.3.2. Golder Conducts Field Evaluations for the 2014 Golder Report

Golder began its field evaluations for the 2014 Golder Report in the spring of 2013. It conducted a visual inspection of the pavement on two occasions in April 2013, during which staff from Golder found the pavement to be "generally good in condition with limited surface distresses being observed." However, Golder noted instances of micro cracking, longitudinal cracking, distortions, and construction joints starting to open up.

Golder performed Falling Weight Deflectometer ("FWD") testing on May 9, 2013. FWD testing is a method of quantifying the structural or load bearing capacity of pavement. Marco Oddi (Senior Project Manager, Construction Management, Construction, Engineering Services, Public Works, Hamilton) had some contact with Golder at this time related to scheduling and logistical arrangements. Rabiah Rizvi (Pavement & Materials Engineering Analyst, Golder) conducted the analysis of the FWD test results, and did not identify any major structural concerns. However, Ms. Rizvi emailed Dr. Uzarowski on May 17, and asked if the City should consider either a mill and resurface of the surface layer, or alternatively microsurfacing, to prevent water getting into the pavement structure through the existing cracks that Golder staff had observed.

Dr. Uzarowski testified that based on Golder's observation of some more severe cracking on the RHVP surface, Golder asked to take and analyze a few core samples from the RHVP. Golder ultimately removed these cores samples on August 6, 2013, and included its analysis of the samples in the 2014 Golder Report.

6.3.3. Initial Drafts of the 2014 Golder Report

Golder prepared two drafts of the 2014 Golder Report between June and September 2013. In its September 2013 draft, Golder stated that "the pavement structure is in good condition and performing well. The observed cracking is anticipated to be a function of the material and not due to fatigue damage or the environment."

When testifying at the Inquiry hearings, neither Mr. Moore nor Dr. Uzarowski could recall if Mr. Moore received a draft of the 2014 Golder Report prior to January 31, 2014, when Dr. Uzarowski delivered the 2014 Golder Report to Mr. Moore. I am

satisfied that, at a minimum, Mr. Moore was aware of Golder's principal findings by September 2013, when a rainfall event occurred in the City, as discussed below.

6.4. The 2013 CIMA Report

6.4.1. The Origins of the 2013 CIMA Report

While Mr. Moore and Golder were working on the 2014 Golder Report in the spring, summer, and fall of 2013, the City was also dealing with another RHVP-related project, which ultimately resulted in the retainer of CIMA to prepare the 2013 CIMA Report.

On January 16, 2013, the PWC passed the following motion proposed by Councillor Chad Collins (Ward 5, Hamilton), as set out in PWC Report 13-001, which was later approved by Council:

> (h) MOTIONS (Item 9)
>
> (i) Red Hill Parkway Improvements (Item 9.1)
>
> > On a Motion staff were directed to investigate upgrading the lighting on the Red Hill Parkway in the vicinity of the Mud/Stone Church Rd interchanges; and
> >
> > Staff were directed to investigate better reflective signage and lane markings or other initiatives to assist motorists in the same area; and
> >
> > That a full costing of all options and alternatives be presented to committee for their consideration.

The Traffic group (which was then in the Energy, Fleet & Traffic section of the Corporate Assets & Strategic Planning division) had responsibility for traffic safety including reflective signage and lane markings or other initiatives to assist motorists in safely navigating the City's roads. The Geomatics & Corridor Management section in the Engineering Services division had responsibility for lighting. Further information about the City's organizational structure, and in particular, the organizational structure of divisions and sections within the Public Works department is provided in Chapter 4.

Martin White (Manager, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton) and Stephen Cooper

(Project Manager, Traffic Engineering, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton) from Traffic initially wanted Engineering Services to address the lighting aspects of the motion at the same time that Traffic would hire a consultant to review the collision history, signage, and pavement markings on the RHVP and recommend improvements. In contrast, Mike Field (Project Manager, Street Lighting & Electrical Engineering, Geomatics & Corridor Management, Engineering Services, Public Works, Hamilton), Gary Kirchknopf (Senior Project Manager, Traffic Planning, Geomatics & Corridor Management, Engineering Services, Public Works, Hamilton), and Gord McGuire (Manager, Geomatics & Corridor Management, Engineering Services, Public Works, Hamilton) from Engineering Services thought that lighting, signage, and pavement markings should be reviewed together, "holistically". Mr. Field testified that the "safety issue" that gave rise to Councillor Collins' motion was about driver comfort and navigation comfort.

Ultimately, Traffic took the lead in responding to the motion. Mr. Cooper was assigned as the project manager. Over the course of the project, between late February and December 2013, Traffic established the terms of reference for the project, engaged CIMA as a consultant, gathered the relevant information, liaised with CIMA during its review and report preparation, and wrote a staff report for PWC.

However, Public Works staff differed in their understanding of the role of Traffic as the "lead" on the project. Public Works did not establish a project charter for this project that would have clarified individual roles and the respective responsibilities of Traffic and Engineering Services. Traffic viewed Engineering Services, and specifically Mr. Field with his expertise in lighting, as responsible for responding to the lighting components of the motion and any related recommendations to Council. However, Engineering Services staff on the project team, principally Mr. Field, viewed themselves as mere "stakeholders", who would provide information but not make decisions, and instead viewed Traffic as having responsibility to make recommendations to the PWC.

6.4.2. CIMA's Retainer and the Scope of Project

The City, via Mr. Cooper, retained CIMA through its roster program to complete a safety review of the RHVP. The City approved CIMA's proposed fixed-fee budget of $75,530 for the project.

The project was limited to the study area from the Dartnall Road ramp to the Greenhill Avenue ramp (in both directions) and included the Stone Church Road/Mud Street ramps. Dartnall Road is the southernmost portion of the RHVP, where the RHVP joins the LINC. A map of the study area is below at **Figure 6a.**

Figure 6a: RHVP Study Area from the 2013 CIMA Report

At the outset, both the City and CIMA agreed that the project would be a comprehensive safety review taking into consideration geometrics, signage, lighting, pavement markings and alignment, a human factors assessment, and the collision history of the parkway. CIMA would also provide recommendations, costing of those recommendations, and cost-benefit analysis for all recommendations.[1] CIMA identified

[1] CIMA's cost-benefit ratio was the ratio of the present value of the safety benefit of a given countermeasure calculated for its service life to the present value of the cost of the countermeasure. A cost-benefit ratio of greater than 1.0 represents an economically efficient countermeasure. In this criterion, the monetary value of the collisions reduced as a result of implementation of a countermeasure is considered as the benefit of the countermeasure.

the purposes of the review as being to "establish the existing safety performance of the study area, identify any potential or actual safety issues, and investigate possible solutions to improve the safety performance of the Red Hill Valley Parkway within the study area. The key aspects that will be examined include, but may not be limited to Lighting; Signs and markings; and Geometry." It is not clear that CIMA was ever provided with a copy of Councillor Collins' motion.

The primary contacts at the City and CIMA throughout the project were Mr. Cooper and Brian Applebee (Project Manager, Transportation, CIMA), although CIMA's proposal identified Mr. Cooper and Ron Gallo (Senior Project Manager, Signals and Systems, Traffic Operations & Engineering; Energy, Fleet and Traffic; Corporate Assets and Strategic Planning, Public Works, Hamilton) as the instructing clients for the project, and Brian Malone (Partner, Vice-President, Transportation, CIMA) as CIMA's Project Director and Dr. Alireza Hadayeghi (Partner, Director, Transportation, CIMA) as the Project Manager.

6.4.3. CIMA's Preliminary Work and Collision Analysis

CIMA began its work in April 2013. Between April and June 2013, CIMA conducted a field investigation of the RHVP. During CIMA's internal kick-off meeting on May 10, 2013, CIMA recorded a plan to assess the RHVP during a rainy night of the field investigation, but the Inquiry received no evidence that this review was completed. CIMA also collected data from the City, including design guidelines, standards, and assumptions; lighting standards; the history of changes to signage and markings; complaints from members of the public; and five years of collision data. Using the collision data, CIMA completed a preliminary analysis of collision patterns on the RHVP. CIMA also applied the MTO's Policy for Highway Illumination (referred to as the MTO warrant system) to the RHVP to assess whether illumination was warranted in the study area.

CIMA reported on its progress at two progress meetings with Mr. Cooper, Mr. Field, Mr. Gallo, and Mr. Kirchknopf in June and July 2013. At both meetings, CIMA presented its collision history analysis, which was later recorded in the 2013 CIMA Report. As described in more detail below, CIMA found that, within the study area, the most common collision type was Single Motor Vehicle ("SMV") collisions, that there was an atypically high proportion of non-daylight collisions, and that a high proportion of

collisions occurred under wet road surface conditions. These collision trends were most pronounced on the Mud Street ramp (identified as Ramp 6 in the 2013 CIMA Report), which accounted for 65% of all ramp collisions.

6.4.4. CIMA's Scope of Work is Reduced

Over the course of the project, City staff challenged the feasibility of CIMA's anticipated recommendations and/or reduced CIMA's project scope in three areas: application of high friction pavement, geometric design, and illumination.

6.4.4.1. Concerns with Recommendation for High Friction Pavement Application

At the progress meetings in June and July 2013, CIMA identified a number of potential countermeasures to address its findings. One potential countermeasure was "pavement surface friction testing / improve pavement friction through high friction pavement" for mainline segments identified by CIMA as "Dartnall 3-5" and "Mud 4-6". CIMA also identified the installation of high friction pavement on the Mud Street ramp as a potential countermeasure given the ramp's tight curve radius and high number of collisions occurring on it in wet road conditions.

At the progress meetings, City staff advised CIMA that high friction pavement could be examined for the RHVP ramps, but not for the mainline because the mainline had "different new pavement that may not be recommended to be overlaid with high friction" and "due to the specialized nature of the existing pavement and on-going monitoring".

Following the July 2013 progress meeting, Mr. Kirchknopf advised CIMA that the City's Asset Management section (in the Engineering Services division) had retained Golder to oversee testing and monitoring of the "specialized surface material" on the RHVP mainline. Mr. Kirchknopf directed Mr. Applebee to contact Dr. Uzarowski directly if CIMA required "any additional information regarding 'weight in motion' or 'friction testing' on the R.H.V.P. mainline," although I note that the City was not contemplating any friction testing by Golder at that time. CIMA did not contact Golder.

As set out below, the 2013 CIMA Report included a recommendation for a high friction pavement application for the Mud Street ramp and a recommendation to complete friction testing across the study area, including on the mainline.

6.4.4.2. Geometric Review is Removed from CIMA's Scope

During its work, CIMA identified findings related to the RHVP's geometry, including that the curve radius for some of the ramps could be below typical design standards and that the speed change lane on the Mud Street segments was shorter than typical design standards. CIMA also identified an alignment discontinuity — a kink — on the RHVP mainline. In theory, straightening the RHVP to remove the kink would have been a safety improvement.

Despite the fact that the City and CIMA agreed at the outset that the safety review would include a geometric review, City staff later directed CIMA to not examine geometric design features in the 2013 CIMA Report. CIMA reported the following direction in its minutes of the progress meeting on July 3, 2013: "[f]or geometric design aspects, CIMA should include text in the report describing the design philosophy; design choices made, challenges with respect to various constraints, etc., and not specifically examine design features in the report." Accordingly, in the final version of the 2013 CIMA Report, CIMA wrote that "a review of the fundamental roadway design geometry" of the RHVP was beyond the scope of the study due to the parkway's history, unique geography, design refinements and assessments undertaken over the years, and environmental agreements and approvals.

I do not suggest that it was unreasonable to exclude recommendations for actual changes in the RHVP's geometry from the scope of the 2013 CIMA Report. However, insofar as CIMA was directed to exclude the effect of existing geometry as a contributing factor to the collision experience on the RHVP, it would have real significance for future traffic safety analyses.

6.4.4.3. Examination of Mainline Illumination is Removed from CIMA's Scope

Lighting was a source of public complaints from the RHVP's opening, and remained an issue throughout the time period relevant to the Inquiry. The 2013 CIMA Report was the first, but not the last, time lighting on the RHVP was reviewed.

CIMA's scope at the outset of the project included a review of lighting on the entire study area, which included portions of the mainline of the RHVP (see **Figure 6a** above), and CIMA did assess mainline lighting (limited to the study area) as part of its work. In a July 2013 internal CIMA draft of the report, CIMA stated that "continuous,

full illumination" was suggested for the whole RHVP study area based on the TAC Roadway Lighting Guide (referred to as the TAC warrant system). However, in the 2013 CIMA Report, CIMA only reviewed illumination for the ramps of the three interchanges in the study area, but did not provide an assessment or cost-benefit analysis for illumination on mainline sections within the study area. This section of the report sets out how the 2013 CIMA Report was revised to remove content about illumination of the mainline of the RHVP.

CIMA used the TAC and MTO warrant systems to determine if additional illumination should be considered in the RHVP study area. The TAC warrant system is more commonly used on roads owned and operated by municipalities than the MTO warrant system. These policies use an analytical approach to determine if illumination is needed, performed through the use of warrants that consider a variety of factors including road geometry, operations, environmental factors, and collision data. For each of these factors, a rating between one and five is assigned, depending on the conditions encountered. The higher the rating, the greater the hazard and the more critical the need for illumination. A weight is also attributed to each factor, indicating its relative importance. The MTO warrant system also provides additional criteria based on the cost-benefit ratio of providing illumination.

At the June 2013 progress meeting, CIMA reported that full or partial illumination[2] was warranted under the MTO warrant system at all interchanges within the study area, specifically the Dartnall Road, Mud Street, and Greenhill Avenue interchanges. Full illumination of certain interchanges on the RHVP would have resulted, in effect, in continuous illumination of portions of the mainline in the study area because there was significant overlap between the interchanges and mainline of the RHVP between Dartnall Road and Mud Street. At the July 2013 progress meeting, CIMA reported that

[2] CIMA defined partial, full and continuous illumination in a July 26 draft of the 2013 CIMA Report as follows: (1) partial interchange illumination "refers to lighting at decision points where identification is required, typically at on ramps and off ramps. Few luminaires are needed for partial interchange lighting than for full lighting"; (2) full illumination "refers to lighting of the entire width within a defined area in a uniform manner, beginning at the start of the warranted area and ending where lighting is no longer warranted"; and (3) continuous illumination "is defined as the full lighting between intersections or interchanges that are fully lighted."

full illumination was warranted on all ramps and mainline segments under both the MTO and TAC warrant systems.

There was some resistance to consideration of full illumination of the RHVP study area from staff in Engineering Services. As recorded in the minutes of the June 2013 progress meeting, Mr. Field advised CIMA to "be cautious with illumination, B/C [cost-benefit analysis] is critical for this assignment due to political & other design & cost constraints and that site specific locations are probably better than full illumination". Mr. Field also requested that CIMA ensure that illumination, if recommended, would actually assist in reducing collisions. In this regard, Mr. Malone testified that illumination does not need to be installed in every instance in which an illumination warrant is achieved and that illumination warrants, by themselves, do not guarantee that additional illumination will reduce collisions. Rather a cost-benefit analysis and engineering judgment, including consideration of other factors, such as the collision experience of the roadway, are required to determine whether illumination should be installed on a roadway to reduce collisions.

Mr. Field testified there were several "design constraints" having material cost consequences that would be engaged by installing additional lighting on the RHVP, and that Mr. Moore conveyed these to him after the June 2013 meeting and before the July progress meeting. For example, a Hydro One high voltage transmission line partially cuts across the Mud Street/Stone Church Road ramp and diagonally cuts across the RHVP, and structural modification would be required to a bridge between two interchanges because the bridge was constructed without provision for street lighting. I conclude that Mr. Field did not convey these constraints to CIMA in any detail.

In any event, Mr. Field and Mr. Applebee testified that they both understood that CIMA would do an illumination review of both the ramps and mainline segments in the study area. Throughout the project, including when the report was being drafted in late July 2013, Mr. Applebee understood that CIMA's scope included an assessment of partial, full, and continuous lighting, although he also understood that City staff preferred site-specific illumination over full illumination.

In contrast, Mr. Malone came to a different understanding about CIMA's scope regarding illumination after he spoke to Mr. Moore by telephone on June 6, 2013, after

the June progress meeting. Mr. Malone contacted Mr. Moore on direction of Mr. Field or Mr. Cooper. As the most knowledgeable and experienced individual at the City in regard to the RHVP, Mr. Moore was well suited to answer questions about design constraints for illumination on the RHVP. Mr. Malone was familiar with Mr. Moore from Mr. Malone's time as a former employee of the City.

Mr. Malone testified that Mr. Moore told him on their June 6, 2013 call that lighting was prohibited on the mainline RHVP because of environmental constraints identified in the environmental assessment ("EA") process required to approve construction of the RHVP. Mr. Moore could not recall the details of this call. I am satisfied that, on this call, Mr. Moore communicated to Mr. Malone that lighting was prohibited on the RHVP mainline because of environmental constraints identified in the pre-construction EA process. In conveying this information, Mr. Moore relied on his memory and did not review the RHVP EA or other EA-related documents, nor did he give Mr. Malone or another representative of CIMA a copy of such documents. Mr. Malone relied on Mr. Moore's statement, without taking any further steps to verify it.

I have no doubt that Mr. Moore believed that what he told Mr. Malone on June 2013 was accurate. However, as is discussed in Chapter 2 and Chapter 8, it was not accurate. Although environmental concerns influenced the decision not to illuminate the RHVP mainline, illumination was not expressly prohibited by any EA or prior documentation and was not a condition of any approvals granted for the RHVP; however, a new EA would have been required if the City wished to install additional illumination on the RHVP.

I also have no doubt that Mr. Moore made this statement to Mr. Malone with the intention of ensuring that CIMA did not address illumination on the mainline of the RHVP in the study area in the 2013 CIMA Report. As Mr. Moore's subsequent actions demonstrate, he did not believe additional illumination on the RHVP was feasible for a number of reasons. Even if Mr. Moore did not expressly tell Mr. Malone to exclude an assessment of illumination on the mainline RHVP in the study area from the 2013 CIMA Project — as Mr. Moore denied he did in his testimony — Mr. Moore would have understood that his statements to Mr. Malone would have that effect, in the absence of any clarification from Mr. Moore that full or continuous illumination on the RHVP mainline would be possible if it satisfied a new EA.

Mr. Malone took Mr. Moore's statements, in effect, as a direction to CIMA that it should exclude an assessment of illumination of the RHVP mainline from its scope. However, Mr. Malone did not tell Mr. Applebee or other CIMA staff working on the illumination-related analysis about the new information that he obtained from Mr. Moore.

Neither Mr. Moore nor Mr. Malone told City staff on the 2013 CIMA Report project team about their discussion on June 6, 2013. However, at the July progress meeting, the attendees (including Mr. Malone) did discuss the RHVP EA. CIMA's meeting minutes also indicate that the City was to "provide available background documentation from EA's, etc., as input into the report". The minutes did not, however, stipulate who was to provide the EA to CIMA. Mr. Cooper and Mr. Field both appeared to think it was the other's responsibility. At the time, neither Mr. Cooper nor Mr. Field had seen the EA, and neither had access to it or knew who did, apart from Mr. Moore. Mr. Moore did not offer or provide any EA-related documentation to Mr. Field in connection with the progress meeting or the 2013 CIMA Report more generally, nor does it appear that Mr. Field or Mr. Cooper specifically asked Mr. Moore for this documentation. No one at the City provided a copy of the EA or a comprehensive set of other EA-related documents to CIMA as part of the 2013 CIMA Report project. CIMA did, however, reference certain documents related to the approval and construction of the RHVP in the 2013 CIMA Report, although it is not clear how CIMA came to obtain those documents.

Mr. Applebee and other contributors on CIMA's project team completed an internal draft of the 2013 CIMA Report by July 26, 2013. In this internal draft, CIMA concluded, similar to its findings reported at the July 2013 progress meeting described above, that "[b]ased on the TAC warrant, continuous, full illumination is suggested in the whole study area." CIMA also stated that full illumination of the RHVP corridor and ramps was "justified." The cost-benefit ratio was 4.27.

Mr. Malone first reviewed the internal draft of the 2013 CIMA Report on July 26, 2013. Based only on Mr. Moore's representations about the EA, Mr. Malone questioned the drafted content regarding full, continuous illumination being suggested for the whole study area, commenting within the draft about restrictions in the EA and the analysis of illumination of the entire study area as being "out of scope". Dr. Hadayeghi also made similar comments, although the basis for his impression on the issue is unclear. On July 26, Mr. Malone emailed his mark-up of the draft to his colleagues and wrote:

"We need to discuss the lighting. Is it in scope or not? As written it's a hand grenade that will go off in the City's hands."

Mr. Malone testified that he referred to the lighting section as a "hand grenade" because it was contradictory: in some sections, the report discussed environmental constraints around lighting, but in other sections, the report recommended lighting on the mainline, despite Mr. Malone's belief that this issue was not within CIMA's scope. Mr. Malone also testified that while these recommendations could technically result in safety improvements, it would be irresponsible to make a recommendation that, in his view, would not be feasible to a client.

Mr. Applebee responded to Mr. Malone's email, stating that he believed lighting was in scope and he had not received anything from Mr. Field "that would act as an 'out'." Despite his response to Mr. Malone, in a subsequent draft, Mr. Applebee deleted the references to full illumination being warranted for the entire study area and the cost-benefit analysis relating to the full illumination for the entire study area. In place of the deleted content, Mr. Applebee instead obtained and inserted cost-benefit calculations for illuminating the Mud Street interchange, as well as for the ramps individually. Mr. Applebee testified that he did not talk to Mr. Malone, and that neither he nor Mr. Malone talked to anyone on the 2013 CIMA Report project team at the City before he made these changes.

CIMA first sent a draft of the 2013 CIMA Report to the City on July 29, 2013. In this draft, the Methodology subsection of the Illumination Review section stated: "the understanding that the decision to not illuminate the entire RHVP section was inextricably linked to environmental concerns and approvals, review of full illumination was not undertaken but restricted to spot locations." This content had been revised from CIMA's prior internal draft. During his testimony, Mr. Applebee agreed that this statement was not fully accurate because CIMA had done a review of full illumination in the study area.

Mr. Field reviewed the draft report on August 2, 2013, and emailed Mr. Cooper that "[t]he illumination of the mainline is excluded (this is decision is [*sic*] based upon information we provided to CIMA)". The Inquiry did not receive any evidence that anyone at the City provided information about illumination of the RHVP mainline or its exclusion, apart from Mr. Moore's call with Mr. Malone referenced above.

Mr. Field also advised Mr. Cooper that, in his view, "[t]he exclusion is not well explained. Considering that illumination of the mainline is the first request in the council motion to review I think that there should be far more explanation as to why it was excluded." Mr. Cooper provided this request for further explanation to CIMA.

CIMA provided a revised draft of the 2013 CIMA Report on August 23, 2013, which included a more detailed explanation for the exclusion of mainline illumination in the Methodology section about the illumination review [with additions underlined]:

> The understanding that the decision to not illuminate the entire RHVP section was inextricably linked to environmental concerns and approvals, therefore review of full illumination was not undertaken but restricted to spot locations (ramps). The primary objective of illumination is to increase safety by providing drivers with improved nighttime visibility of roadway conditions and potential hazards. However, as noted, illumination of the mainline section of the RHVP was not examined for this study.
>
> This is because the illumination design choices that were made during the design phase were intimately linked to approvals. Reference materials note that, "The sole reason for making design changes was to reduce environmental impacts." The Valley section of the Parkway traverses the Niagara Escarpment, a UNESCO World Biosphere Reserve, designated for its unique landform characteristics and the presence of a provincial land use plan to guide development in its area. Because of this unique area, and because of the costs associated with building a roadway on the escarpment, the City identified several design refinements that included restricting illumination to intersections and on/off ramps.

Mr. Cooper forwarded Mr. Applebee's email, with its attachments, including the revised draft report, to Mr. Field, Mr. Gallo, Mr. White, Mr. Kirchknopf, and David Ferguson (Superintendent, Traffic Engineering, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton) on August 23. Mr. Field recognized that CIMA's statement that CIMA had not examined illumination of the mainline was "not fully accurate" as to what CIMA did. However, Mr. Field could not recall taking any steps to address this inaccuracy in the draft 2013 CIMA Report.

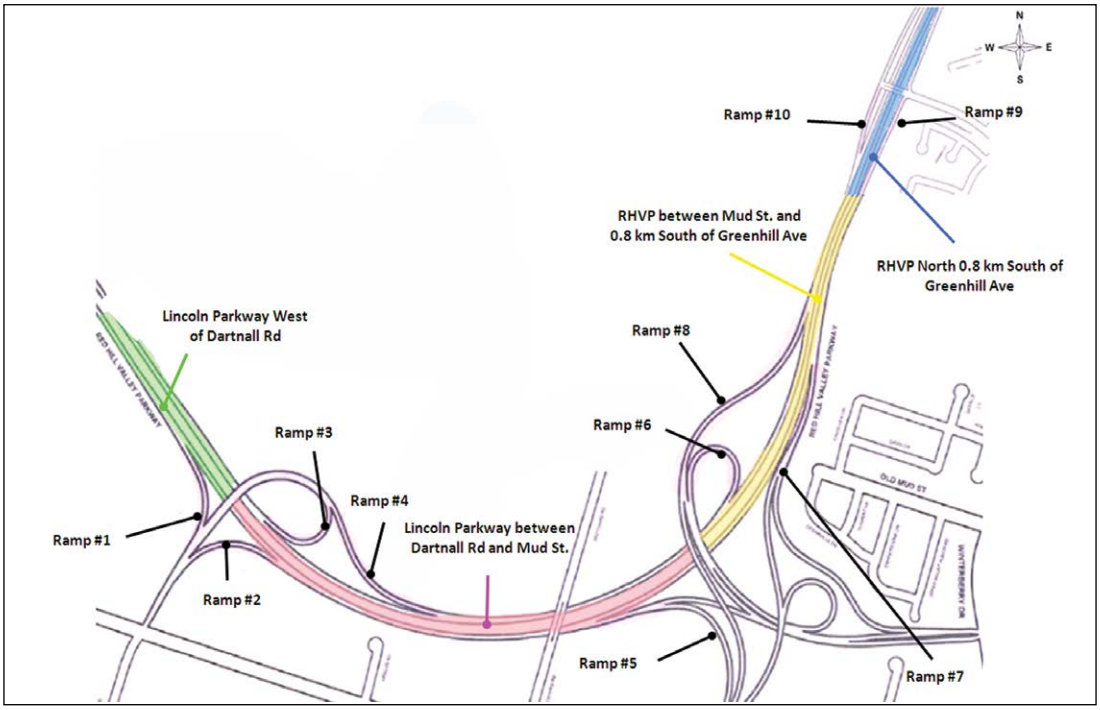
From the foregoing, it is clear that CIMA excluded consideration of illumination on the mainline RHVP from the 2013 CIMA Report based on the inaccurate information provided by Mr. Moore to Mr. Malone that additional lighting was prohibited on the RHVP mainline because of the RHVP EA.

6.4.5. Findings and Recommendations in the Draft 2013 CIMA Report

The draft of the 2013 CIMA Report sent to the City on August 23, 2013, included a collision analysis, illumination review, field investigation and human factors assessment, and list of potential countermeasures with a cost-benefit analysis.

CIMA conducted a collision analysis of collision data provided by the City for a five-year period from October 2008 to October 2013, using two different methods. In the first, CIMA looked at the historical observed number of collisions on the RHVP on the mainline and on ten ramps. In the second, CIMA used an analytical tool known as the Enhanced Interchange Safety Analysis Tool ("ISATe"). CIMA broke the RHVP into segments, including ten ramp and four mainline segments, for the purposes of these analyses as noted in **Figure 6b.**

Figure 6b: Segments in the 2013 CIMA Report Study Area



CIMA's historical collision analysis findings included the following:

1) CIMA assessed the severity of collisions on the RHVP, and determined that collisions within the study area were more likely to be severe in two segments than collisions elsewhere in the RHVP study area. Those segments were between Dartnall Road and Mud Street and between Mud Street and south of Greenhill Avenue.

2) The most common impact type observed within the study area of the RHVP was SMV, with an overall proportion of 63%. More than 90% of all collisions on Ramp 6 (Mud Steet) were SMV, which was significantly higher than other locations and than the provincial average for SMV collisions occurring on ramps from 2004 to 2011.

3) The study area had an atypically high proportion of non-daylight collisions — higher than the provincial average and higher than the average for all City roads.

4) The RHVP study area overall average of collisions that occurred under wet road surface conditions was 45%. This rate of wet road surface collisions was significantly higher than the provincial average (17.4%) and the City average (13%). In particular, 68% of collisions on Ramp 6 and 49% of collisions on the mainline segment of the RHVP between Mud Street and 0.8 km south of Greenhill Avenue occurred under wet road conditions.

CIMA's ISATe analysis indicated that some of the segments in the study area were performing below average, specifically Ramps 5, 6, and 7b (all on the Mud Street interchange), Ramps 9 and 10 (both on the Greenhill Avenue interchange), and segment "Mud 4" (a mainline segment between Mud Street and 0.8 km south of Greenhill Avenue). These segments had more collisions than predicted by ISATe. Overall, CIMA found that the RHVP study area was operating safely in most segments with the calculated expected number of collisions being lower than the predicted number of collisions for a roadway with similar characteristics. However, as CIMA acknowledged in the report, "one significant limitation" with the use of ISATe was that it had not been calibrated to the "collision experience in Hamilton".

In the Illumination Review section, CIMA restricted its analysis of illumination in the study area to an assessment of whether full illumination was justified on the ramps for the three interchanges in the study area (Dartnall Road, Mud Street, and Greenhill Avenue). CIMA revised its finding that illumination was warranted for the Mud Street interchange (which had been included in the prior draft sent to the City in July 2013) to state that "[i]llumination of the ramps at the Mud Street interchange [was] warranted". CIMA determined that illumination was warranted on the ramps for the Mud Street interchange based on the TAC warrant. However, CIMA also noted that illumination does not need to be implemented simply because a warrant is achieved.

In the section on CIMA's field investigation, CIMA discussed its findings regarding signage on the RHVP, as well as the kink in the southbound RHVP mainline just south of the Pritchard Road overpass (discussed above and in Chapter 2).

CIMA developed a list of countermeasures to address the issues identified in the 2013 CIMA Report and assessed the cost-benefit of these countermeasures. One of the countermeasures that CIMA stated was that the City could consider undertaking pavement friction testing on the RHVP asphalt because of the high proportion of wet surface condition and SMV collisions. CIMA prepared a chart of these countermeasures, set out below at **Figure 6c**, which set out the cost, cost-benefit ratio, and CIMA's recommended timing for implementation for each recommended countermeasure in the overall study area. The chart included friction testing.

All of the countermeasures for the entire study area were identified as "ST", meaning short term. CIMA identified the term for implementation of short term countermeasures as 0 to 5 years, of medium term countermeasures as 5 to 10 years, and of long term as 10 or more years.

Figure 6c: List of Identified Countermeasures in the 2013 CIMA Report (Overall Study Area)

Countermeasure	B/C Ratio	Cost	Timing
Friction Testing	n/a	$10,000	ST

PRPM[3] or ST	3.29	$75,000	ST
Inverted Profile Markings	n/a	n/a*	ST
Wide Markings	3.39	$40,000	ST
Slippery When Wet Signs	n/a	$5,000	ST
Enforcement of Travel Speeds	n/a	n/a	ST
Trailblazer Signage	n/a	$2,000	ST
Remove Lane Exit Signs	n/a	$1 ,000	ST
Total Costs		$133k	

CIMA also prepared a chart summarizing its recommended countermeasures for each RHVP segment in the study area. CIMA's recommended segment-specific countermeasures included changes to signage and guardrails, as well as the installation of lighting on Ramps 5, 6, 7, and 8. CIMA also recommended that the City install high friction pavement approaching and through the curve on Ramp 6.

6.4.6. Select Councillors Receive the Draft 2013 CIMA Report

Mr. Ferguson joined the City in August 2013 in the role of Superintendent of Traffic Engineering in the Traffic group. From that date forward, Mr. Gallo and Mr. Cooper, both Project Managers, reported to Mr. Ferguson, who reported to Mr. White. Mr. Ferguson was involved in the finalization of the 2013 CIMA Report and the staff report to Council.

In September 2013, Mr. Ferguson provided a copy of the August 23, 2013 draft of the 2013 CIMA Report, with mark-ups, to Councillor Collins, Councillor Tom Jackson (Ward 6, Hamilton) and Councillor Brad Clark (Ward 9, Hamilton), whose wards bordered the RHVP. Mr. Ferguson offered to meet with these councillors to discuss the draft report and its future presentation to the PWC. Both Mr. Ferguson and Mr. White testified that, in 2013, the practice within Traffic was to communicate with interested and/or impacted councillors to make them aware of items that would be

[3] PRPM refers to permanent raised pavement markers or cats' eyes.

coming forward. According to Mr. White, there was also no policy, rule, or procedure stipulating that City staff could not send certain information to individual councillors.

Mr. Ferguson and Mr. Cooper met with Councillors Collins and Jackson on September 12, 2013; Councillor Clark was unable to attend. Mr. Ferguson later reported to his Traffic colleagues that the councillors were "very supportive and appreciative" for the meeting.

6.4.7. Mr. Moore is "Not Pleased" with the Draft 2013 CIMA Report

On September 16, 2013, Mr. Applebee emailed a further revised draft of the 2013 CIMA Report, without appendices, to Mr. Cooper.[4]

On September 19, Mr. Cooper emailed Mr. Ferguson and Mr. White to relay that Mr. Field had told him that Mr. Moore saw "the report" and was "not pleased" with the recommendations provided by CIMA. None of the witnesses who testified at the Inquiry could identify why Mr. Moore was not pleased. Mr. Moore testified that he likely had concerns about the 2013 CIMA Report, but he could not recall why he was not pleased with it.

Mr. Cooper's email led Mr. White, Mr. Ferguson, and Geoff Lupton (Director, Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton) to discuss having a meeting with Mr. Moore. Mr. White viewed the 2013 CIMA Report as politically sensitive because councillors were getting complaints about the RHVP, and he wanted to ensure a unified front from City staff before Council. Mr. Lupton agreed that a meeting with Mr. Moore was a good idea, as did John Mater (Director, Corporate Assets & Strategic Planning,[5] Public Works, Hamilton).

Mr. Lupton testified that he was confident that he spoke to Mr. Moore — and that Mr. Moore's primary concern "was the history of the Red Hill and environmental aspects" — but Mr. Lupton was unable to recall when this conversation occurred. As set out

[4] Prior to the circulation of this draft, documents indicate that CIMA revised the draft 2013 CIMA Report to reflect comments from the City and their own internal discussions, but neither CIMA nor the City could produce these comments to the Inquiry.

[5] As noted above and in Chapter 4, Corporate Assets & Strategic Planning was the division to which Traffic reported at the time.

below, I am satisfied that the conversation between Mr. Lupton and Mr. Moore occurred only after Traffic prepared and submitted its staff report to PWC in late October 2013.

6.5. September 2013 Rainfalls Trigger RHVP Friction Testing

On September 21, 2013, Hamilton experienced heavy rainfall. The rainfall was followed by a series of collisions on the RHVP. Unlike the two flooding incidents in 2009 and 2010 discussed in Chapter 5, the September 2013 rainfall did not result in flooding of the RHVP.

However, the collisions prompted the exchange of several emails amongst staff in Roads & Maintenance (within the Operations division), Engineering Services, and Traffic, between September 22 and October 1, 2013, resulting in several different — and overlapping — email exchanges which discussed an assertion that the RHVP was unduly "slippery when wet".

Beginning on September 22, staff members in the Roads & Maintenance group (at least one of whom had been on scene on the RHVP during the rainfall), emailed their colleagues and supervisors noting their observations that the RHVP mainline and ramps were "very slippery" whenever it rained. They noted that putting down sand did not assist. They theorized that the pavement, and even the mix design, along with speed, might be contributing to collisions in wet weather. They requested that "slippery when wet" signs be placed all along the mainline and ramps of the RHVP to alleviate some of the potential claims and collisions. This request and their concerns regarding the RHVP's performance in wet weather were escalated to senior staff in Traffic and Engineering Services, including Mr. White, Mr. Mater, and Mr. Lupton in Traffic, and Mr. Moore in Engineering Services. This resulted in discussion of three initiatives within Public Works.

First, amongst Traffic staff, Mr. White viewed the request to place "slippery when wet" signs to be "extra ordinary" and one that should be substantiated by a collision history. Mr. White had reviewed the collision history for the RHVP study area in the draft 2013 CIMA Report by this time, but stated in his testimony that a review of the entire RHVP was required to establish that such signs were necessary throughout the parkway. Accordingly, Mr. White directed Mr. Ferguson to "review the collision history facility

wide for a statistically significant time period and review for a percentage of collisions on wet pavement." Although Mr. White and Mr. Ferguson testified that this collision history was completed at some time, the Inquiry received no written memo, analysis, or other document to confirm this.

Second, during the same period, Mr. White advised various City staff members, including Mr. Moore, Mr. Mater, Mr. Lupton, Brian Shynal (Director, Operations, Public Works, Hamilton), and John McLennan (Manager, Risk Management, Finance & Corporate Services, Hamilton) via email of his intention to obtain a collision history and his view that installing signs throughout was unusual, and could be construed as an admission "that the roadway surface is systemically unacceptable". In his email, he wondered whether there were claims "relevant to the road conditions", and sought comments on this from Mr. McLennan. John Mater responded that the matter should be discussed at the Transportation Coordinating Committee, a committee chaired by Mr. White established to bring together and encourage discussion between different working groups that had involvement in traffic, traffic safety, or transportation, including managers from Engineering Services and Traffic. While the Transportation Coordinating Committee did meet the following day, on September 24, the Inquiry received no evidence that it played any significant role in addressing concerns regarding the RHVP or safety measures proposed to reduce collisions on the RHVP.

Third, in response to the concern for liability and the question regarding existing claims expressed in Mr. White's email, Mr. McLennan advised on September 26 that Risk Management had no record of a significant claims history for slippery conditions on the RHVP. He further advised:

> What we do have is a situation of which we, the City, are aware, and also the general public. In the event of a serious accident in future this experience will be cited and the allegation will be that "we knew of the problem and ought to have done something about it." Lawyers love to use the word "ought".

Mr. Moore was copied on some of these email chains. On September 23, Mr. Moore addressed comments that had been made by a Roads & Maintenance staff member in a separate chain about the mix of the RHVP asphalt and referred to "recent testing" of the pavement (being the Golder testing in the RHVP pavement condition evaluation referenced earlier in this chapter) in the following terms:

> I'm not sure where this information on Superpave is coming from but it is totally incorrect. There are no glass shards of any kind in the mix, the asphalt content in the surface is consistent with other mixes being used all over the City. It is the entire pavement that will last more than 50 years due to the depth of pavement and the design of the supporting layers at depth The surface course is meant to last 14 -17 years before a shave and pave. The surface course mix is called SMA (stone mastic asphalt) it is a gap graded premium asphalt surface course with premium aggregates to provide for long term skid resistance and grip. By putting sand down you reduce the ability of the pavement to provide this skid resistance in fact you are providing an intermediate layer between the tire and the road (not the same as sand on ice). There is no pavement that provides grip when the road is covered with water and the speeds are excessive (hydroplaning). These are high performance pavements that were tested when they were put down. They exceeded all MTO criteria (in fact better than any 400 series highway). Recent testing has shown little cracking, no rutting or load related deformation and there is no reason the surface course pavement should not last the full 15 years (it is only 6 years old now). Glad to answer any other questions you may have on this road.

Mr. Moore subsequently contacted Dr. Uzarowski (as described below) and thereafter responded to Mr. McLennan's email (which, as noted, was in a separate email chain from that in which he made the above-quoted comments) on September 30. In this email, sent to Mr. McLennan, Mr. Shynal, Mr. White, Mr. Mater, and Mr. Lupton, Mr. Moore stated that he would have skid resistance testing done on the RHVP for asset management purposes, writing:

> As part of the ongoing pavement monitoring (traffic loading, pavement response, condition assessment) for Asset Management purposes, we will have skid resistance testing completed on both the LINC and Red Hill. There is standard by which we can report on the relative level of resistance and by which we can gauge the performance of each mix and road surface. This should be sufficient for any due diligence required, eliminating the "ought to have known's" as well dealing with the "we think it was slippery" issues. I'll let you know when we get this.

Mr. Moore's commitment, and subsequent request to Golder for friction testing on the RHVP, ultimately led to the Tradewind Report.

The impetus for Mr. Moore's consideration of friction testing was Mr. McLennan's email (partially excerpted above), and "trying to figure out the 'ought to do' part". He felt friction testing was something proactive that Engineering Services could do to defeat any litigation claim that might arise in the future. Mr. Moore believed that the SMA surface course was a superior pavement mix with a premium aggregate, which had "exceeded all MTO criteria" including during the 2007 friction testing and, accordingly, there was no issue with the pavement under wet conditions beyond what was normal and expected.

There is no evidence that Mr. White or any of his staff spoke to anyone at CIMA to advise that Mr. Moore had committed to perform friction testing on the RHVP.

6.6. Mr. Moore Retains Golder to Conduct Friction Testing on the RHVP

Prior to committing to conduct friction testing to his colleagues, Mr. Moore emailed Dr. Uzarowski to ask if Golder had done "skid resistance" testing during its testing for the 2014 Golder Report, and if not, if Golder could do it. Mr. Moore also noted that "the Police" had been attributing accidents to the "slipperiness of the pavement" during rainfalls. Mr. Moore testified that he decided to ask Golder to conduct the testing because it was convenient given Golder's other testing for the 2014 Golder Report, particularly if Golder was still engaged in testing the RHVP for that report.

Dr. Uzarowski agreed to arrange testing. In his response, Dr. Uzarowski reminded Mr. Moore of the 2007 skid testing conducted by the MTO (discussed in Chapter 3), remarking that they "got good numbers, better than MTO typically has." Dr. Uzarowski testified that his comment was related specifically to early age friction of SMA, although he did not reflect this in his email to Mr. Moore.

On October 1, 2013, Kris Jacobson (Superintendent, Traffic Operations, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton) emailed Mr. Moore that he was looking to retain a firm to conduct friction testing of new paint used on some crosswalks and asked if

he could “piggy back” this work onto the friction testing Mr. Moore was arranging. Mr. Jacobson had not been copied on Mr. Moore’s email in which Mr. Moore advised that friction testing would be performed.

Mr. Moore forwarded Mr. Jacobson’s email to Dr. Uzarowski the same day, asking if Golder could also have crosswalk friction testing conducted. The significance of this exchange is that, in forwarding Mr. Jacobson’s email to Dr. Uzarowski, Mr. Moore included the long chain of internal City emails relating to the heavy rainfall on September 21, 2013, many of which are described in the paragraphs above. I am satisfied that Dr. Uzarowski read and understood from this email chain that there were concerns regarding slipperiness on the RHVP. Other than this forwarded email chain, and Mr. Moore’s earlier email regarding police concerns, there is no evidence of any discussions between Dr. Uzarowski and anyone at the City or CIMA regarding wet surface collisions in 2013. In particular, Mr. Moore did not advise Dr. Uzarowski that, in connection with the 2013 CIMA Report, CIMA identified areas of the RHVP within the study area with high proportions of wet surface collisions, or otherwise advise Dr. Uzarowski of CIMA’s assignment.

6.6.1. Golder Arranges for Tradewind to Do the Friction Testing

Mr. Moore did not give Golder any direction regarding the type of friction testing to be conducted, as he relied on Dr. Uzarowski to arrange the appropriate testing.

Golder first contacted the MTO to request its assistance with the testing. As noted in Chapter 3, the MTO was unable to accommodate the testing request due to the MTO’s own friction testing demands. The MTO staff who responded to Golder’s enquiry recommended that Golder instead request assistance from Applied Research Associates (“ARA”).

Dr. Uzarowski did not contact ARA because he understood that the MTO had the only locked-wheel friction tester located in Ontario, and that ARA would need to bring equipment up from the United States. Instead, Golder retained Tradewind to conduct the friction testing.

Dr. Uzarowski was familiar with Leonard Taylor[6] (President & CEO, Tradewind) and the GripTester friction testing equipment that Tradewind used, and understood that Leonard Taylor was regarded as an expert in friction testing in Canada and the United States, particularly in the airport industry. When asked at the Inquiry about his understanding of Tradewind's experience testing friction on roadways, Dr. Uzarowski testified that he was comfortable with Tradewind performing the testing requested by the City. The GripTester device is described in Chapter 1.

In response, Tradewind advised that it was able to complete testing of the RHVP "on a priority basis", likely between November 19 and 21, 2013 at a cost of approximately $4,000. Leonard Taylor also outlined the logistical arrangements required for the testing.

Dr. Uzarowski testified that he knew that Tradewind used testing equipment different than that used by the MTO to test the RHVP in 2007. He was not concerned about this as Tradewind's device was recognized, well-established, and described in "the TAC guide" as equipment used for friction testing. Dr. Uzarowski testified that he did not consider the issue of whether Tradewind's results could be correlated with the results of the MTO's October 2007 friction testing when Golder was in the process of retaining Tradewind. He prioritized having the testing conducted before the onset of winter conditions would prevent any testing.

On November 19, 2013, Dr. Uzarowski sought, and Mr. Moore approved, the cost of $8,000 for the friction testing and a short report to be provided by Golder regarding the results. Diana Cameron (Administrative Assistant to the Director of Engineering, Engineering Services, Public Works, Hamilton) prepared a purchase order for Golder's work, as a roster assignment.

Mr. Moore included Mr. Oddi, Rich Shebib (Traffic Technologist, Corridor Management, Geomatics & Corridor Management, Engineering Services, Public Works, Hamilton), and Mr. White in his response to Golder approving the testing. He did so in order to

[6] Leonard Taylor was unavailable to give evidence at the public hearings due to his health. Leonard Taylor's son, Rowan Taylor, was called as a witness as he was also employed by Tradewind at the relevant time and involved in the assembly of the data in the Tradewind Report. Both are referred to in this Report and for clarity, I refer to Leonard and Rowan Taylor by their full names.

obtain their assistance in coordinating traffic and lane closures. Although Mr. Moore provided Mr. White (and the others) with notice of the testing, Mr. Moore did not otherwise discuss the testing with staff in Traffic, or the other City staff who had been included in the emails related to the September rainfalls. Dr. Uzarowski's colleague, Dr. Henderson, then corresponded with City staff, including Mr. White, Mr. Shebib, Mr. Oddi, Mr. Jacobson, and Mr. Moore, among others, to make logistical arrangements for the friction testing to occur on November 20, 2013.

The day before the testing, Dr. Henderson sent an email to Leonard Taylor inquiring whether Tradewind could also test the crosswalks as Mr. Jacobson had requested. She also asked whether there could be a conversion between the crosswalk results obtained using Tradewind's GripTester and results of testing performed using a British Pendulum Tester ("BPT"), a test device to which Golder had access. Leonard Taylor responded that they might be able to test the crosswalks, and that as part of its report, Tradewind would provide comparative values with other friction measuring equipment including the BPT and Sideway-force Coefficient Routine Investigation Machine ("SCRIM"). This testing of the crosswalks was ultimately conducted by Tradewind at the same time as the friction testing on the RHVP.

6.6.2. Tradewind Conducts Friction Testing on the RHVP, LINC, and City Crosswalks

Tradewind conducted friction testing on the RHVP and LINC on November 20, 2013.

Tradewind's primary field testing technician, Michael Hogarth (Field Testing Technician, Tradewind), conducted the testing. Dr. Henderson attended the testing on behalf of Golder, along with three City staff members from Traffic.[7] Only Mr. Hogarth and Dr. Henderson were present in the vehicle during the friction testing.

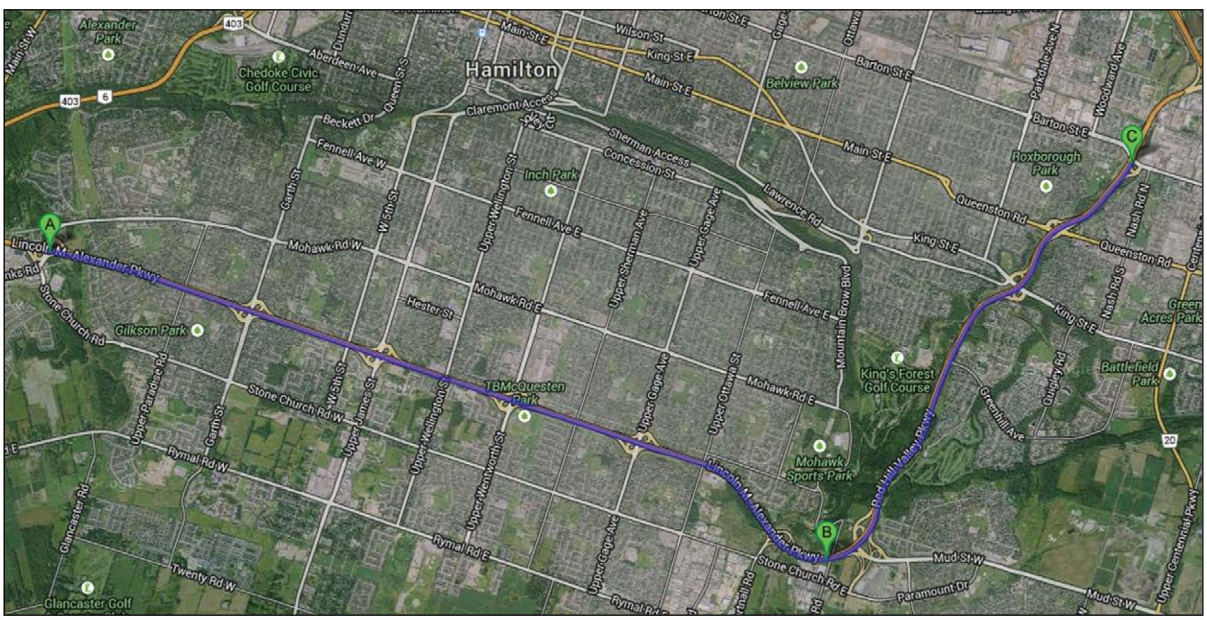
[7] These staff were: Joe Gueretta (Traffic Services Foreman, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton); Larry Stewart (Traffic Specialist, Traffic Operations & Engineering; Energy, Fleet & Traffic, Corporate Assets & Strategic Planning, Public Works, Hamilton); and Jason Medeiros (Signs/Markings Specialist, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton).

Mr. Hogarth conducted friction testing on the mainline sections of the LINC and the RHVP, from approximately the overpass of Golf Links Road (the west end of the LINC) to the Barton Street exit (the northern end of the RHVP), and 400 m sections of the Greenhill Avenue on and off ramps and the Stone Church Road off ramp.[8]

Mr. Hogarth conducted five full length test runs of the RHVP and LINC, which were collected as continuous 17 km runs of the RHVP (consisting of approximately 7 km) and the LINC (consisting of approximately 10 km). This included a test run of the right-hand wheel path of each lane in each direction, and a test run of the centreline of the right-hand lane in the northbound and eastbound directions of the RHVP and LINC respectively.[9]

As set out in **Figure 6d**, Tradewind approximated the location of the surveyed road sections in its report with the following image. Point A to Point B is the tested section of the LINC. Point B reflects the approximate point of demarcation between the RHVP and LINC. Point B to Point C is the tested section of the RHVP.

Figure 6d: Sections of the RHVP and LINC Surveyed by Tradewind



8 These ramps are the RHVP southbound off ramp to Greenhill Avenue, the Greenhill Avenue on ramp to the RHVP southbound, and the RHVP southbound off ramp to Stone Church Road at the Mud Street interchange, respectively.

9 Tradewind referred to the RHVP and LINC as one continuous run, and described the direction of the test runs as “eastbound” or “westbound”. It is understood these directions refer to the “northbound” and “southbound” lanes of the RHVP, respectively.

Tradewind also conducted friction testing on four crosswalks as requested.

Mr. Hogarth conducted the friction testing using Tradewind's GripTester, under standard test conditions, described as "50 km/hr and 0.25mm applied water film depth, using an ASTM 1844 Test Tire inflated to 140 KPa (20 psi)". In its report, Tradewind stated that the GripTester "was subjected to full primary load/drag calibration procedures prior to the test survey and both the load zero and drag zero offsets were verified following the work." Friction testing methodologies, including GripTester testing methodology, are described in detail in Chapter 1.

After the testing, Mr. Hogarth emailed Leonard Taylor and Rowan Taylor (Engineering Manager, Tradewind) a summary of the testing, as was Mr. Hogarth's practice. Mr. Hogarth described the crosswalk testing data as "very inconclusive", explaining that he could not determine where the test wheel crossed the paint.

Tradewind prepared its analysis and report of the data collected on November 20, 2013, and ultimately delivered its final report to Golder on January 26, 2014, as discussed below. Rowan Taylor testified that a delay of approximately eight weeks between testing and the delivery of a report was typical of Tradewind's practices at the time.

6.7. City Staff Prepare a Staff Report on the 2013 CIMA Report for the Public Works Committee

In the fall of 2013, at the same time as Golder was organizing the Tradewind friction testing, Traffic staff were finalizing the 2013 CIMA Report and a City staff report to be submitted to the PWC for the meeting of the PWC on November 18, 2013. This staff report was staff's response to Councillor Collins' January 2013 motion, which gave rise to the 2013 CIMA Report, as discussed above.

In early October 2013, Mr. Applebee emailed Mr. Cooper a further version of the 2013 CIMA Report with minor wording changes. Neither CIMA nor the City produced any documents to the Inquiry that gave context for these changes to the 2013 CIMA Report.

Also in October 2013, Mr. Ferguson updated Mr. Lupton and Mr. White about a phased approach to the implementation of CIMA's recommended countermeasures to present to the PWC and Council. The phased approach involved modifying signage and line markings first, which would be evaluated for effectiveness after one year. If those countermeasures had no effect, the City would pursue the higher cost countermeasures that CIMA had identified, including lighting.

Around this time, Councillor Collins began advocating for a safety review of the LINC, which Mr. Ferguson, Mr. Lupton, and Mr. White also discussed. The eventual LINC safety review is addressed briefly in Chapter 7.

Mr. Cooper prepared an initial 10-page draft of a staff recommendation report for the PWC and sent a copy to Mr. Field. While Mr. Cooper considered that the project was being jointly managed with Mr. Field, Mr. Field did not feel he had any responsibility for the staff report on the 2013 CIMA Report, including for the sections related to lighting. Mr. Field testified that he believed Mr. Cooper sent him the email as a courtesy only — that is, advanced notice of, and an opportunity to comment on, a cross-divisional report. I received no evidence to suggest that Mr. Field provided any comments.

On October 23, 2013, Mr. Lupton requested significant changes to the draft, which was late to be delivered to PWC. Regarding length, Mr. Lupton directed Mr. Ferguson and Mr. White to shorten the report to two to three pages, which resulted in a number of details about the recommendations being moved from the body of the staff report to tables of recommendations appended to the report. Regarding substance, Mr. Lupton directed that staff change the report from a recommendation report, in which staff sought approval for the recommended changes, to an information report, which would not require the PWC approval of the proposed recommendations.[10] This reflected the fact that the majority of the short term countermeasures recommended in the 2013 CIMA Report could be completed within Traffic's current budget and that items requiring approval, including lighting, were not being recommended under the phased approach. Both directions were implemented in the final version of the staff report, which became Report PW13081, discussed below.

[10] The different types of staff reports are discussed in Chapter 4.

Mr. Lupton also asked Mr. White and Mr. Ferguson if Mr. Moore had agreed to implement CIMA's recommendation to conduct friction testing. Mr. Lupton had not yet spoken to Mr. Moore, nor had Mr. Ferguson or Mr. White. The final version of the staff report also read: "Staff will also review further countermeasures such as friction testing with Construction Engineering and complete under their schedule." "Construction Engineering" refers to the Construction section of the Engineering Services division.

Mr. White, Mr. Lupton, and Mr. Ferguson further revised the draft staff report on October 24, 2013. Gerry Davis (General Manager, Public Works, Hamilton) signed off on the staff report on October 25, 2013, as was the sign-off practice at the time.

There is no evidence that Mr. Lupton met with Mr. Moore (as he had advised Mr. Mater he would do in mid-September) until after Traffic staff submitted the report to Mr. Davis. This may reflect that the finalization of the staff report was rushed. In any event, as with the project itself, the drafting of the staff report was not a collaborative task reflecting the different roles, responsibilities, and expertise of Traffic and Engineering Services. In my view, the language in the staff report regarding friction testing and lighting reflected Mr. Lupton's approach that Traffic should not commit to tasks recommended by CIMA that would fall to Engineering Services.

Mr. Lupton did meet with Mr. Moore on October 28, 2013, and reported on that meeting to Mr. White and Mr. Ferguson as follows:

> I've reviewed with Gary… he's good, but suggests that we manage the final version of the report to reflect what we are saying. He said it's not uncommon to get and [*sic*] FOI [Freedom of Information request] to this type of thing. I'm not asking to change opinions, but to soften and stage the report similar to what we have done with our info. report. e.g. do this first and measure results, etc. Please sit down with CIMA and make this happen. Please ensure you manage this directly.

In their testimony, neither Mr. Moore nor Mr. Lupton could recall the specifics of their meeting. In any event, Mr. Ferguson understood Mr. Lupton's email as a direction to determine if CIMA would revise the 2013 CIMA Report to mirror the phased approach set out in their staff report, which Mr. Ferguson did.

In early November 2013, the City provided CIMA with a document outlining the City staff's phased approach to CIMA's recommendations, which reflected the City's suggested revisions. CIMA subsequently agreed to make changes to the 2013 CIMA Report. The revised wording that CIMA included in the final version of the 2013 CIMA Report indicated that CIMA had considered "information from the City regarding funding and capital programs/planning" in making its recommendations. It further stated that the City would undertake a staged approach to implementing certain countermeasures. CIMA indicated that the City would implement other recommendations and monitor their effectiveness for at least one year before reviewing new illumination on the RHVP. The 2013 CIMA Report with this revised wording incorporated was not finalized until after the staff report related to the 2013 CIMA Report was presented to the PWC, as discussed below.

6.8. Public Works Committee Meeting on November 18, 2013

Traffic staff presented their information report on the 2013 CIMA Report to the PWC on November 18, 2013. Mr. Moore did not attend for its presentation. City staff did not append the 2013 CIMA Report itself to their information report.

The final version of the information report, Report PW13081, was two pages long, plus a four-page appendix (Appendix A) setting out CIMA's short and medium term countermeasures for the overall study area and countermeasures for specific segments and ramps. Report PW13081 stated that CIMA determined the RHVP was operating safely, but further countermeasures could enhance driver safety and security. In the body of the report, staff advised that signage changes would be completed by the end of 2013 and pavement markings would be addressed in the spring of 2014, weather permitting. The body of the report further provided that CIMA had recommended permanent raised pavement markings (or PRPM, also called "cat's eyes"), and that City staff was supportive of this recommendation. Report PW13081 noted that because cat's eyes are best installed as part of a repaving project, Traffic staff would speak to "Construction Engineering" (Engineering Services) to coordinate installation with the repaving schedule and would install temporary markings in the interim in 2014.

Friction testing was listed on a table of short term countermeasures in Appendix A. However, text in the body of the report stated that "staff" would review "further countermeasures such as friction testing with Construction Engineering". Similarly, CIMA's recommendation for the installation of a high friction pavement application approaching and through the curve of the Mud Street ramp was listed as a short term countermeasure in Appendix A, but it was not addressed at all in the body of the report. Report PW13081 did not reference the wet surface and SMV collision patterns identified by CIMA as a basis for these recommendations. In fact, the information report did not summarize the findings of CIMA's collision analysis for the RHVP.

Report PW13081 stated that CIMA had reviewed roadway lighting, and recommended lighting on the westbound Mud Street on ramp. While the information report stated that CIMA did not recommend lighting along the entire RHVP segment in the study area, it did not clarify that CIMA had excluded continuous lighting on the mainline from consideration in the 2013 CIMA Report. Report PW13081 merely stated that "roadway lighting was not recommended or implemented as a result of the environmental concerns". Instead, City staff proposed that signage and pavement marking countermeasures should be implemented and the RHVP should be monitored for at least one year before further consideration of any new lighting on the RHVP.

At the PWC meeting, Councillor Collins advised City staff that he was prepared to accept the phased nature of the recommendations. However, he also wanted to ensure that lighting remained on the PWC's agenda — this is, that a further assessment of lighting on the RHVP would occur after implementation of the first round of countermeasures. Councillor Collins therefore asked that lighting improvements for the RHVP be placed on the PWC's Outstanding Business List ("OBL").

The PWC recommended that Council receive Report PW13081. On November 27, 2013, Council approved the PWC's recommendation.

6.9. The 2013 CIMA Report is Revised After the Staff Report is Presented to Council

On December 9, 2013, three weeks after Report PW13081 was presented at the PWC meeting, Mr. Cooper told Mr. Applebee that he had received the "go ahead" for

CIMA's proposed changes related to the phased approach, which CIMA had sent to the City on November 7. Mr. Cooper directed Mr. Applebee to make final copies of the 2013 CIMA Report. When Mr. Applebee asked if Mr. Cooper wanted him to change the date on the report from October 2013 to December 2013, Mr. Cooper directed him to use the October date.

Mr. Cooper testified that he directed Mr. Applebee not to change the date on the 2013 CIMA Report after making the final changes because the changes were minor and staff's information report had already gone to the PWC. He did not think the date on the final version of the 2013 CIMA Report mattered. He made this decision on his own. In hindsight, he recognized that he should have directed Mr. Applebee to change the date on the final report to December 2013.

6.10. Mr. Moore's Response to RHVP Lighting on the Outstanding Business List

On November 29, 2013, the Office of the City Clerk sent the OBL arising from the November 18, 2013 PWC meeting to Mr. Davis. Councillor Collins' request to have lighting listed on the OBL was included as follows: "Staff were directed to Report back respecting the lighting aspects of Outstanding Business list C respecting the Red Hill Parkway Improvements." In June 2014, the OBL listed that "Red Hill Parkway Improvements – Lighting" were to be reviewed by PWC on June 15, 2015.

In early December 2013, following circulation of the OBL to Public Works staff via email, Mr. Moore emailed Mr. Lupton, Mr. White, and Mr. Mater expressing his frustration:

> What part of 1) the road was approved environmentally not only without lighting, but specifically not to have it; 2) the road geometrics were done with no lighting required ; 3) there are constraints that preclude the erection of lighting on several ramps; 4) it is not recommended in any way shape or form to erect lighting on partial basis and 5) we can't afford it; didn't committee get?. That doesn't even begin to address the fact we shouldn't be talking about potential improvements that will give any claimants more ammunition! I thought you guys met with Chad and he was happy????? Did we get CIMA to finalize the report to our liking? Before they ask for a copy?

Mr. Lupton responded that Councillor Chad Collins wanted the lighting issue to remain on the PWC agenda for review following implementation of the first phase of recommendations. Mr. Moore responded that "They don't want you to report in a year they want another report just on lighting! Now!"

Mr. Lupton testified that he was not surprised by Mr. Moore's email. Both Mr. Lupton and Mr. Mater testified that, in their experience, Mr. Moore could "bark" or be "bombastic" but once he had blown off steam, he would "calm down" and "come around".

In January 2014, Mr. Moore reported to Mr. Lupton, Mr. White, Mr. Field, Mr. McGuire, and other City staff that he had talked to Councillor Collins who confirmed (just as Mr. Lupton had advised) that Councillor Collins was not expecting an updated report "in 2014", but instead was expecting an update after the first improvements had been implemented and their effectiveness evaluated.

On February 11, 2014, Mr. Moore responded to concerns from a member of the public about "a serious lack of lighting" on the RHVP that posed a "real danger", particularly in bad weather conditions. Mr. Moore responded that the lighting in place on the RHVP[11] was approved for construction for environmental and social impact reasons, although staff were working on other improvements to aid driver awareness and roadway definition.

I note two features of Mr. Moore's responses. First, it is clear that Mr. Moore's understanding at this time was that lighting on the mainline RHVP was prohibited, as he referred in his email to approval "specifically not to have" lighting, without any consideration of whether that prohibition could be changed through a new EA. Second, Mr. Moore was also motivated by his personal assessment that further illumination could not be justified, given certain technical constraints, the cost, and his concern for liability, and it was therefore of no value for Council to continue to address it.

[11] As noted in Chapter 2, the lighting configuration on the RHVP was non-continuous decision point lighting located at the exit ramp of each interchange.

6.11. Traffic and Engineering Services Do Not Discuss Implementation of Countermeasures

In January 2014, Mr. White forwarded Mr. Moore's message about his conversation with Councillor Collins to Mr. Ferguson and Mr. Jacobson. Mr. White wrote:

> Dave and Kris see below fyi. Please ensure all remedial works on the Linc are completed and then we will have to measure their effectiveness and we also have to follow up on the entire safety issue on the Linc also. What are we doing with the Roads request to sign slippery when wet signs everywhere? I forgot about that one. We need the asphalt skid tests to see what they determine also! Let's talk! Ty

As mentioned above, Mr. White had been copied on emails in 2013 in which Mr. Moore undertook to perform friction, and later when Mr. Moore requested traffic coordination assistance for the testing. Mr. White was referencing the results of this testing in his email to Mr. Ferguson and Mr. Jacobson. However, Mr. Ferguson did not know about this testing and understood Mr. White's reference to "skid tests" to be to the friction testing recommended by CIMA. For his part, Mr. White thought that if the friction testing results showed that the "asphalt was way out of line" on the RHVP, it would help his team explain collision patterns on the parkway.

Mr. Ferguson testified that he expected that Engineering Services staff would advise Traffic staff when the friction testing was completed, and the results were available. However, there is no evidence suggesting that anyone in Traffic contacted Mr. Moore or anyone else in Engineering Services to "discuss friction testing" as they had committed to in Report PW13081. In addition, there do not appear to have been any discussions between Traffic and Engineering Services staff regarding CIMA's recommendation for friction testing and the approval by the PWC and Council of this recommendation, the timeline for such testing, any involvement of Traffic in the testing, or any friction testing results, to the extent that the friction testing had been completed.

Similarly, the Inquiry received no evidence to suggest that Traffic and Engineering Services ever discussed the approved CIMA recommendation to apply a high friction pavement application on the Mud Street ramp, either before or after the approval of Report PW13081 (which identified this as a recommended short term countermeasure

identified in the 2013 CIMA Report). I also find that Engineering Services did not undertake any analysis to implement this recommendation, to the extent they were aware of it, although I acknowledge that the ramps were eventually resurfaced in 2019.

In summary, Traffic staff took steps throughout 2014 to implement the countermeasures from the 2013 CIMA Report that they thought were within their area of responsibility, as discussed later in this chapter. Traffic staff left the implementation of the countermeasures that they considered to be the responsibility of Engineering Services entirely in the hands and at the discretion of Engineering Services, and did so without any clear communication between the sections.

6.12. The Tradewind Report

The following section summarizes the preparation and delivery of the 2014 Golder Report and Tradewind Report to Mr. Moore, and the content of the 2014 Golder Report and the Tradewind Report.

6.12.1. Golder Follows Up on Test Results and Other Materials

On December 31, 2013, Dr. Uzarowski sent a draft report for Phase III of the PMTR to Mr. Moore, who forwarded it to two of his staff, John Murray (Manager, Asset Management, Engineering Services, Public Works, Hamilton) and Richard Andoga (Senior Project Manager, Infrastructure Programming, Asset Management, Engineering Services, Public Works, Hamilton). The Phase III PMTR report, which is summarized briefly in Chapter 5, was subsequently finalized and signed.

Around this time, Dr. Uzarowski also spoke with Trevor Moore (Corporate Technical Director, Miller Paving Ltd., Miller Group) about microsurfacing.[12] Dr. Uzarowski testified

[12] Microsurfacing is a type of preventative maintenance treatment. Golder's Phase III PMTR Report described that microsurfacing treatment can be applied on highways carrying medium to high volume traffic on high speed roads that are in good structural condition without significant surface distresses. According to Golder's summary, "[m]icrosurfacing provides a high quality skid resistant surface for an existing asphalt concrete pavement, seals the pavement surface, restores surface profile, eliminates hydroplaning, and provides a surface that is more resistant to rutting."

that he was considering microsurfacing related to the surface issues addressed in the 2014 Golder Report and the PMTR Phase III report. He considered microsurfacing to be a potential treatment for both the surface distresses that Golder observed on the RHVP through its field testing, and for the City's roads more generally as identified in Phases II and III of the PMTR.

Golder followed up with Tradewind at least twice, in December 2013 and January 2014. Dr. Uzarowski testified that he had been receiving pressure from Mr. Moore to receive the test results from Tradewind. There is no evidence, however, that Mr. Moore's pressure to review the results related to anything other than the fact that he wanted to review the 2014 Golder Report as soon as possible.

6.12.2. Mr. Moore Requests and Receives Summary of Friction Testing Results

During the morning of January 24, 2014, Dr. Uzarowski sent two emails to Leonard Taylor to ask for the friction testing results, noting in the first email that his client needed Tradewind's friction tests results "for a meeting with management to discuss the pavement issue" and in the second email, that Dr. Uzarowski's client needed a comparison of RHVP friction numbers from 2007 and 2013 by noon that day.

Dr. Uzarowski testified that the client he referred to in his emails was Mr. Moore. He surmised that he and Mr. Moore had spoken by telephone. Dr. Uzarowski could not recall if Mr. Moore told him specifically that Mr. Moore needed the friction testing results for a management meeting, but that was what Dr. Uzarowski understood at the time.

In any event, at 11:44 am on January 24, Dr. Uzarowski sent Mr. Moore an email summarizing the 2007 and 2013 friction testing results of the RHVP and attaching spreadsheets from the MTO 2007 testing and a paper on SMA early age friction (the "January 2014 Uzarowski Email"). Dr. Uzarowski's email to Mr. Moore read as follows:

> The surface asphalt on the RHVP is Stone Mastic Asphalt (SMA). Immediately following construction of the RHVP in 2007, the Ontario Ministry of Transportation performed friction testing in both southbound

lanes. The following table summarizes the results of this testing. The complete testing results are attached.

Lane	Average Friction Number	Friction Number Range
Southbound Lane 1	33.9	28.1 to 36.5
Southbound Lane 2	33.8	28.4 to 37.4

In 2013, the Friction Numbers were measured on the RHVP in both directions by Tradewind Scientific using a Grip Tester. The average FN numbers were as follows:

SB Right Lane 35

SB Left Lane 34

NB Right Lane 36

NB Left Lane 39

In 2009 the Ontario Ministry of Transportation published a paper at the Canadian Technical Asphalt Association Annual Conference titled “Early Age Low Friction Problem of SMA in Ontario”. The paper presented results of SMA that had been placed on Highway 401. The Friction Number results following construction were below anticipated value of 30 and ranged from 24.9 to 28.8. The paper is attached.

The content of the January 2014 Uzarowski Email was compiled from two sources. The first source was a summary Dr. Henderson prepared of the 2007 MTO friction testing results, which Golder had received in October 2007, as described in Chapter 3. Dr. Henderson emailed this summary to Dr. Uzarowski earlier in the morning of January 24.

The second source was a phone call between Dr. Uzarowski and Rowan Taylor in the morning on January 24, during which Rowan Taylor provided summary information in

the form of average friction values for the four tested lanes of the RHVP.[13] I am satisfied that Dr. Uzarowski obtained this summary information because he understood Mr. Moore required the RHVP results quickly, and felt Mr. Moore would be satisfied if he received the averages in advance of a written report.

While Dr. Uzarowski did not have a specific recollection of the call with Rowan Taylor, he recalled that Tradewind referred to the directions on the RHVP as eastbound and westbound (which would be consistent with the direction of travel on the LINC), rather than northbound and southbound. This may have contributed to Dr. Uzarowski inadvertently reversing the averages for the southbound and northbound lanes of the RHVP in the January 2014 Uzarowski email, and later in the 2014 Golder Report. This error was ultimately of no consequence.

Rowan Taylor testified that he would not have used the term “average FN numbers” to describe the Tradewind testing results, as Dr. Uzarowski did in his email to Mr. Moore. His evidence was that he likely would have referred to the numbers as “GN” or “grip numbers” or more generically, “friction”. Rowan Taylor testified that he was unaware of the MTO’s October 2007 testing at the time of this phone call on January 24.

The January 2014 Uzarowski Email sent to Mr. Moore did not include any cautionary language or limitations in comparing the MTO’s 2007 results with the Tradewind 2013 results. Dr. Uzarowski did not reference that the results were collected using different equipment and methodologies, and at different speeds. Dr. Uzarowski testified that he was aware in January 2014 that the results from a locked-wheel friction tester, which the MTO used, and the GripTester, which Tradewind used, could be different, and that the GripTester results would be slightly higher, but at the time, he was not aware of any reliable correlation between the two types of results. However, in January 2014, Dr. Uzarowski also knew that Tradewind would be providing a final report that would give more detailed information and analysis about its testing.

Dr. Uzarowski did not know how Mr. Moore would use the information he provided. Nor could he predict that Mr. Moore would return to and rely on the January 2014 Uzarowski Email, and not the Tradewind Report itself, in subsequent discussions with

[13] By this point, Rowan Taylor had demarcated the 17 km of testing data to the RHVP (approximately 7 km) and the LINC (approximately 10 km).

CIMA, the media, and his colleagues. Mr. Moore testified that he was not aware at this time of any limitations on the comparison between the 2007 and 2013 results, and he considered them directly comparable. In hindsight, Dr. Uzarowski's email providing these summary results, without signalling to Mr. Moore that there were limits in the ability to compare the different results, left Mr. Moore with the impression that they were directly comparable, and the further impression that the 2013 testing exhibited favourable results when compared to the 2007 results.

6.12.3. Mr. Moore Circulates Friction Testing Results Externally

Mr. Moore testified that he could not recall asking Dr. Uzarowski for the friction testing results on January 24, 2014, nor any reason for requiring the results that day. In particular, he did not recall any meeting with other members of management to discuss RHVP pavement issues. The evidence establishes that there was no such meeting scheduled that day. Instead, Mr. Moore sought a comparison of the 2007 and 2013 testing to provide to Tom Dziedziejko (General Manager, AME, Aecon Materials Engineering Corp.), an industry colleague with whom Mr. Moore had attended an event in Toronto the night before, for inclusion in an industry presentation that Mr. Dziedziejko was preparing.

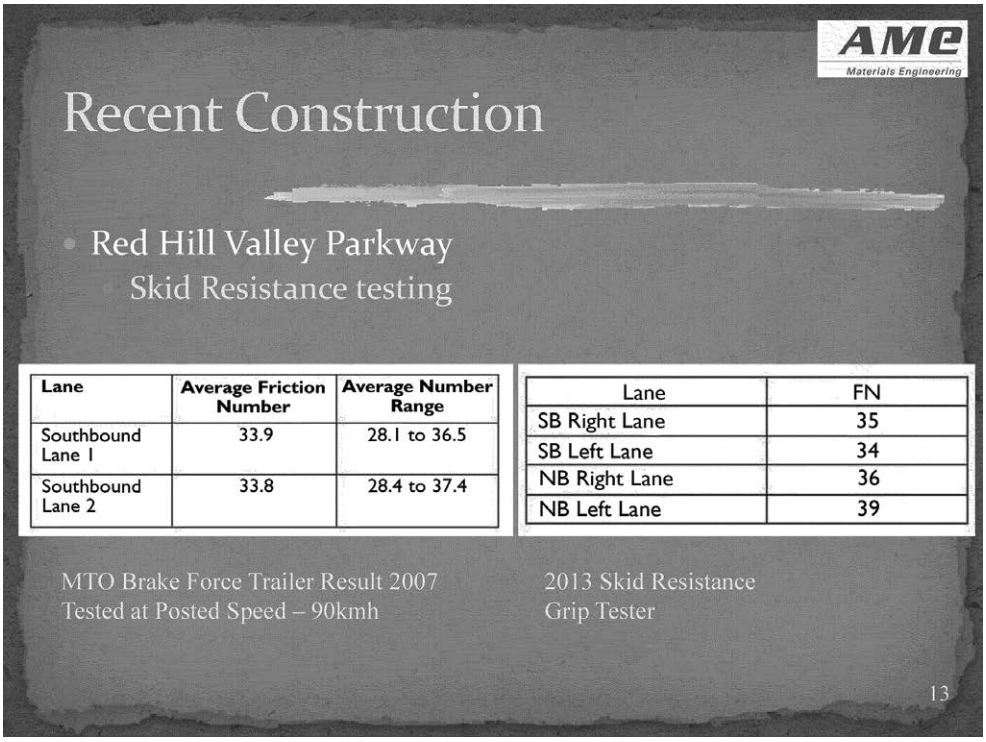
Fifteen minutes after receiving the January 2014 Uzarowski Email, Mr. Moore incorporated most of the content into a new email. He sent that new email to Mr. Dziedziejko. This email included the text from the January 2014 Uzarowski Email regarding the completed friction testing and the associated results, and information about the use of SMA on the RHVP. Mr. Dziedziejko was one of the listed authors of the paper that Dr. Uzarowski provided in the January 2014 Uzarowski Email. Mr. Moore did not include the paragraph pertaining to the paper (or the original attachments) in his email to Mr. Dziedziejko. Mr. Moore did not restrict the manner in which Mr. Dziedziejko could use the information in any way.

Mr. Dziedziejko included information from Mr. Moore's email regarding the RHVP on two slides in the presentation he gave at a TAC Municipal Roads Technologies Workshop on January 29 and 30, 2014, entitled "SMA For Municipalities There and Back Again". Mr. Dziedziejko listed Mr. Moore in a slide of acknowledgements.

In a slide describing the use of SMA on the RHVP, Mr. Dziedziejko stated the "City Rates Performance to Date as Excellent". On the following slide, reproduced below at

Figure 6e, Mr. Dziedziejko included the 2007 and 2013 friction testing numbers from Mr. Moore's email.

Figure 6e: Slide Related to RHVP Friction Testing Results in Mr. Dziedziejko's January 2014 Presentation



Mr. Moore did not believe he attended this conference or saw the presentation slides prior to this Inquiry. There is no evidence before the Inquiry to suggest anyone from the City attended the conference or saw the presentation slides. As noted in Chapter 12, several MTO staff members received a link to or copy of Mr. Dziedziejko's presentation slides in March 2014.

The Inquiry received no evidence indicating that Mr. Moore sent the content from the January 2014 Uzarowski Email to anyone other than Mr. Dziedziejko at that time.

6.13. Tradewind Provides Its Final Report to Golder

On January 26, 2014, Tradewind provided its final report to Golder. Leonard Taylor emailed Dr. Henderson and Dr. Uzarowski an electronic copy of the Tradewind Report,

and advised that a hard copy and invoice would follow by mail. He provided a brief summary of the results in his email, writing as follows:

> You will note that while the average GripNumber friction levels were generally uniform and comparable to or above the relevant reference levels on the Lincoln Valley Parkway, those from the Red Hill Valley Parkway were considerably below the reference levels and less consistent.

The same day, Leonard Taylor also responded to Dr. Uzarowski's January 24, 2014, email requesting friction results, apologizing for the delay in providing the report. He also referenced the January 24, 2014, call between Dr. Uzarowski and Rowan Taylor.

Dr. Uzarowski did not speak with Mr. Moore between his receipt of the Tradewind Report on January 26, 2014 and January 31, 2014, when Dr. Uzarowski sent Mr. Moore the draft 2014 Golder Report as described below.

As the Tradewind Report is central to this Inquiry, I will describe its preparation, contents, and findings, in some detail.

6.13.1. Preparation of and Findings in the Tradewind Report

In accordance with Tradewind's usual practice at the time, Rowan Taylor processed the friction testing data collected by Mr. Hogarth, including preparing graphs and charts for use in the eventual report. Leonard Taylor then interpreted the data and prepared the report.

The Tradewind Report was signed by Leonard Taylor and dated January 2014, although the date of the testing, November 20, 2013, featured more prominently on the report cover and the first page, which led to some confusion years later for City staff describing the date of the report itself. The Tradewind Report was 18 pages long, five pages of which were appendices. The report was in final form when Tradewind delivered it to Golder in January 2014. Golder applied a "draft" watermark to the Tradewind Report when Golder included it as an appendix to the 2014 Golder Report (discussed below), which also led to some confusion later for City staff.

Tradewind included a description of the equipment and methodology used to conduct the testing on November 20, 2013. These details are referenced above in this chapter. In describing the GripTester equipment used, Tradewind provided some context for common uses of the GripTester, noting it as "an ICAO [International Civil Aviation Association] listed and FAA [United States Federal Aviation Administration] approved runway friction measurement device and one that is used extensively by road authorities in the U.K., Australia and New Zealand".

Early in the Tradewind Report, Tradewind made clear that there are no "directly applicable" standards or guidelines in Canada and the United States with which to compare the data collected on roads and highways by Continuous Friction Measurement Equipment ("CFME"), the class of friction testing devices that includes the GripTester. Tradewind noted its use of a UK reference table, described as the "Reference Grip Number Data for Roads: UK Investigatory Skidding Resistance Levels (Risk Rating) for different Categories of Site", as an established and reasonable guideline against which to compare the results of its testing. Tradewind also provided the following Canadian examples in which GripTester measurements were used to assess the frictional performance of roadways:

> The company responsible for the maintenance of the Highway 407 Express Toll Route owns and operates a GripTester provided by Tradewind Scientific and uses the collected data to monitor friction levels along its entire route. Engineering companies and some provincial highway authorities in Canada have also used GripTester measurements to assess road surface friction performance.

Tradewind included the UK reference table noted above, and reproduced as **Figure 6f**, as an appendix to the Tradewind Report. Rowan Taylor testified that he obtained this table from one of Tradewind's prior reports, and that he understood the original source for the table to be a 1994 user manual on machine data collection prepared by the UKPMS (United Kingdom Pavement Management System).

The investigatory levels table at **Figure 6f** sets out risk ratings based on the Grip Number (GN), using friction demand categories based on both the type of roadway facility and the particular roadway geometry, with different investigatory levels for each marked in red, along with an explanatory note. The concepts of "investigatory levels" and "friction demand categories" are explained in Chapter 1.

Figure 6f: UK Investigatory Levels Table Included in the Tradewind Report

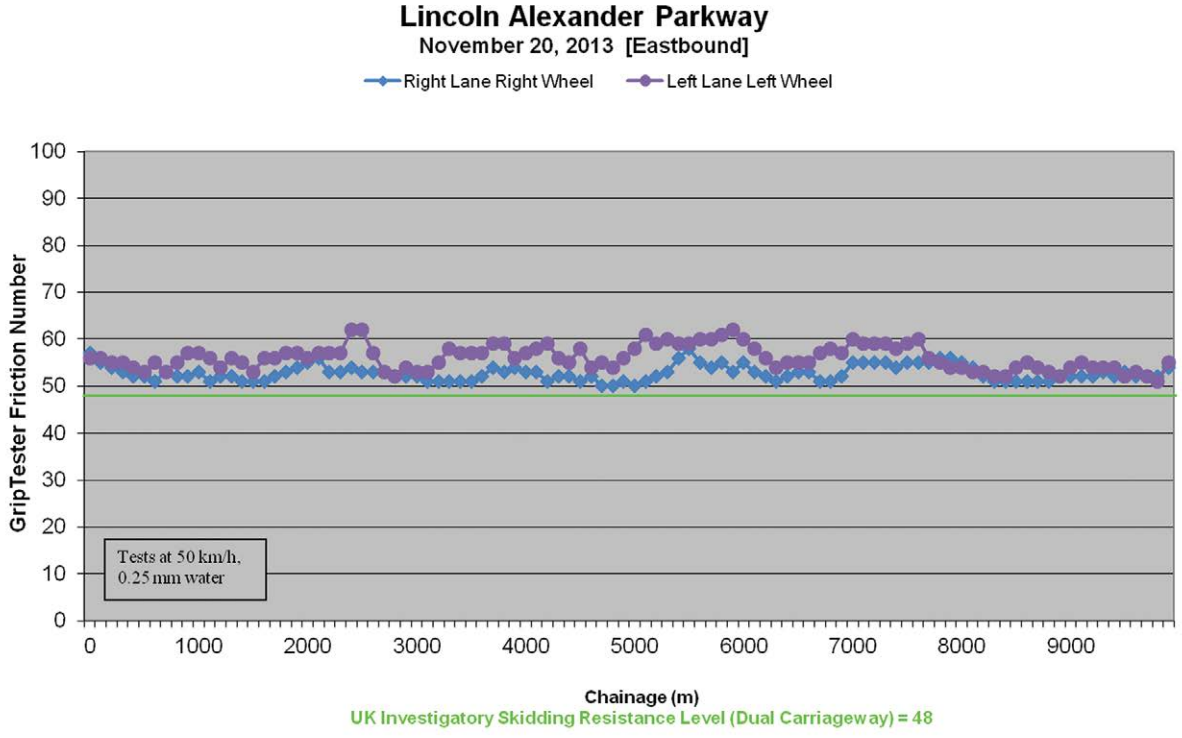
Site Definition	Levels in terms of GN							
Risk Rating	0.42 1	0.48 2	0.54 3	0.60 4	0.66 5	0.72 6	0.78 7	0.84 8
Motorway								
Dual Carriageway								
Single Carriageway								
Dual Carriageway – Minor Junctions								
Single Carriageway – Minor Junctions								
Approaches and Major Junctions								
Gradient 5% to 10%. Longer than 50m								
Gradient steeper than 10%. Longer than 50m								
Bend. Radius <250m								
Approach to Roundabout								
Approach to traffic signals, pedestrian crossings, Railway crossings								

Note*: The UK Highway Friction Investigatory Levels are based on GripTester Friction Numbers measured with an ASTM 1884 tire (140 kPa) at 50 km/hr with an applied water depth of 0.25. Table Courtesy Findlay Irvine Ltd.*

As noted in Chapter 1, the investigatory levels table that Tradewind included in the Tradewind Report was an older version of the UK investigatory levels table than the version in place at the time of Tradewind's testing in 2013. However, the Tradewind results were below the investigatory level of whichever version of the UK standard was applied.

In the "Friction Measurement Results" section of the Tradewind Report, Tradewind summarized and analyzed the friction results for the LINC and RHVP. It also included graphs to present the friction values obtained by the five test runs for both roadways, which are reproduced below in **Figures 6g** to **6i**. **Figures 6g** to **6i** show the friction test results along the length of the LINC and RHVP for the right and left lanes of the eastbound/northbound and for the westbound/southbound test runs, as well as a centreline reference (described above) for the RHVP and LINC. The green horizontal line at 48 GN corresponds to Investigatory Level 2, as noted in **Figure 6f.**

Figure 6g: Friction Values from Tradewind's Eastbound LINC and Northbound RHVP Test Runs



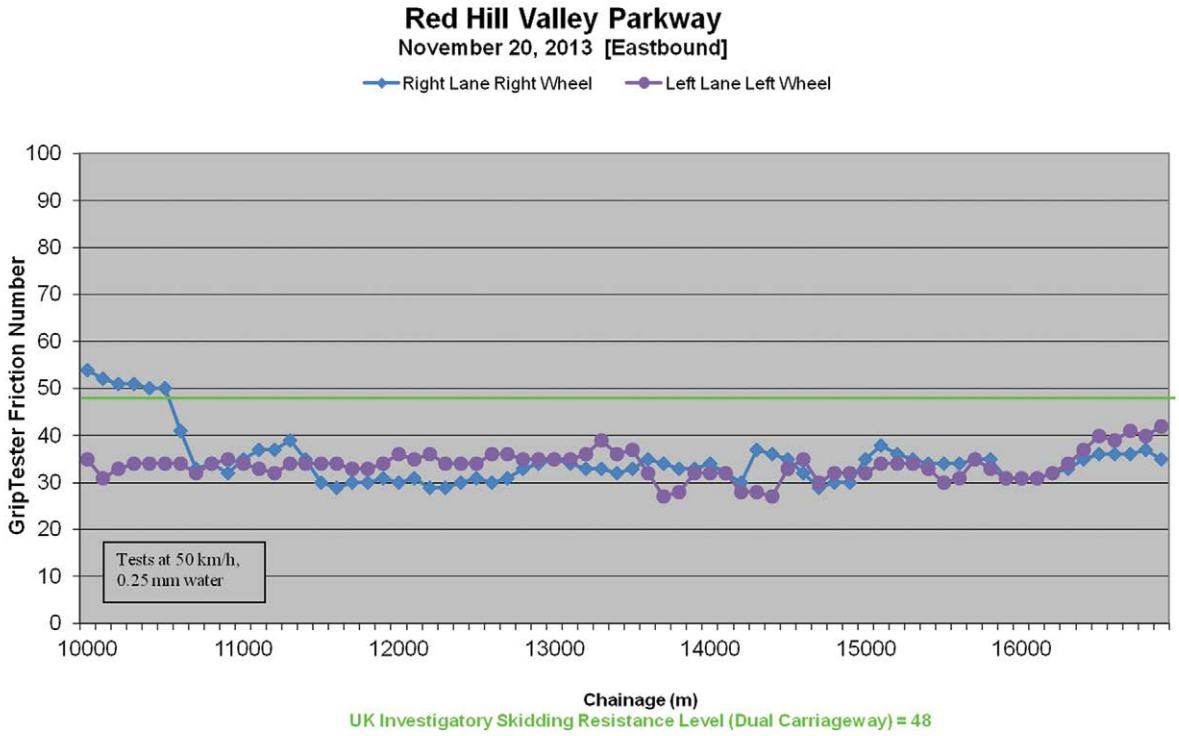
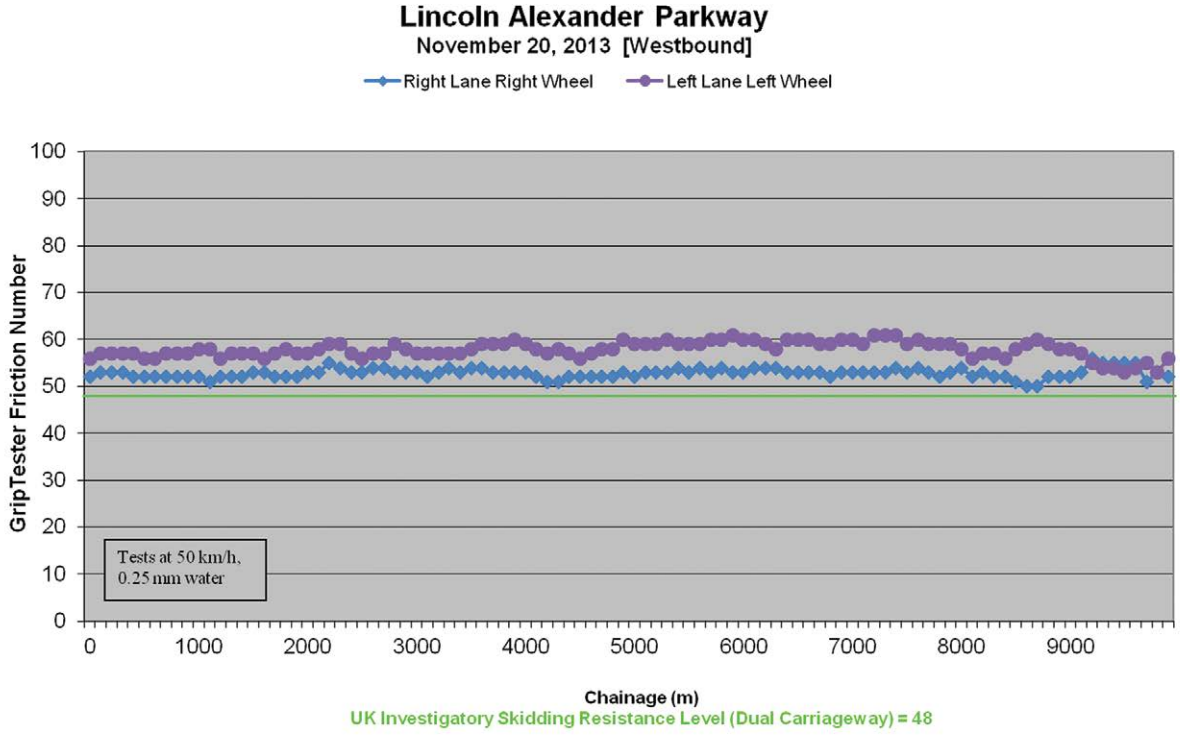


Figure 6h: Friction Values from Tradewind's Westbound LINC and Southbound RHVP Test Runs



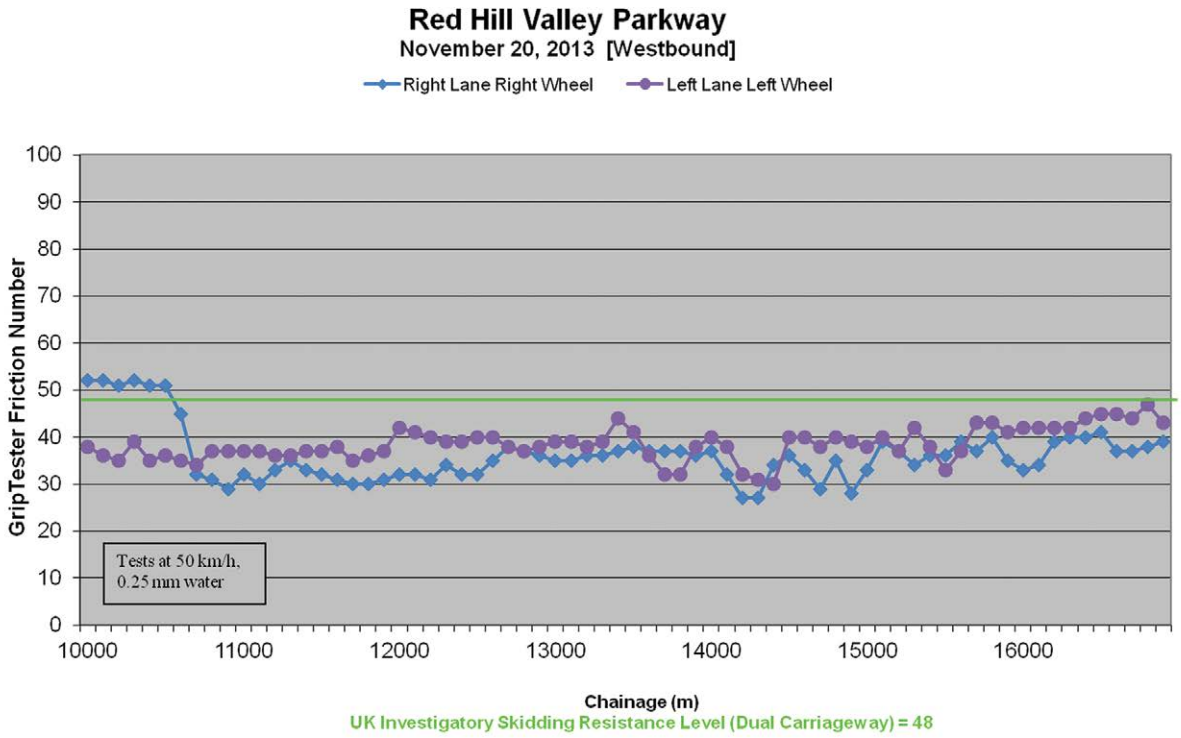
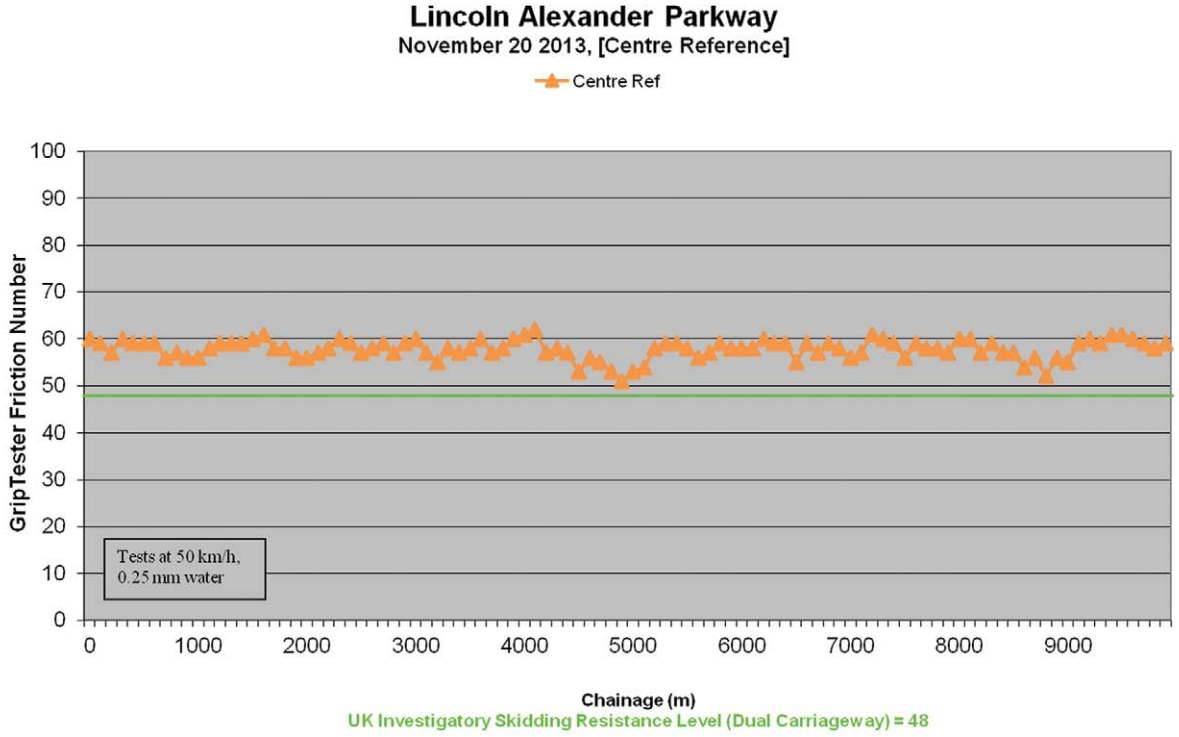
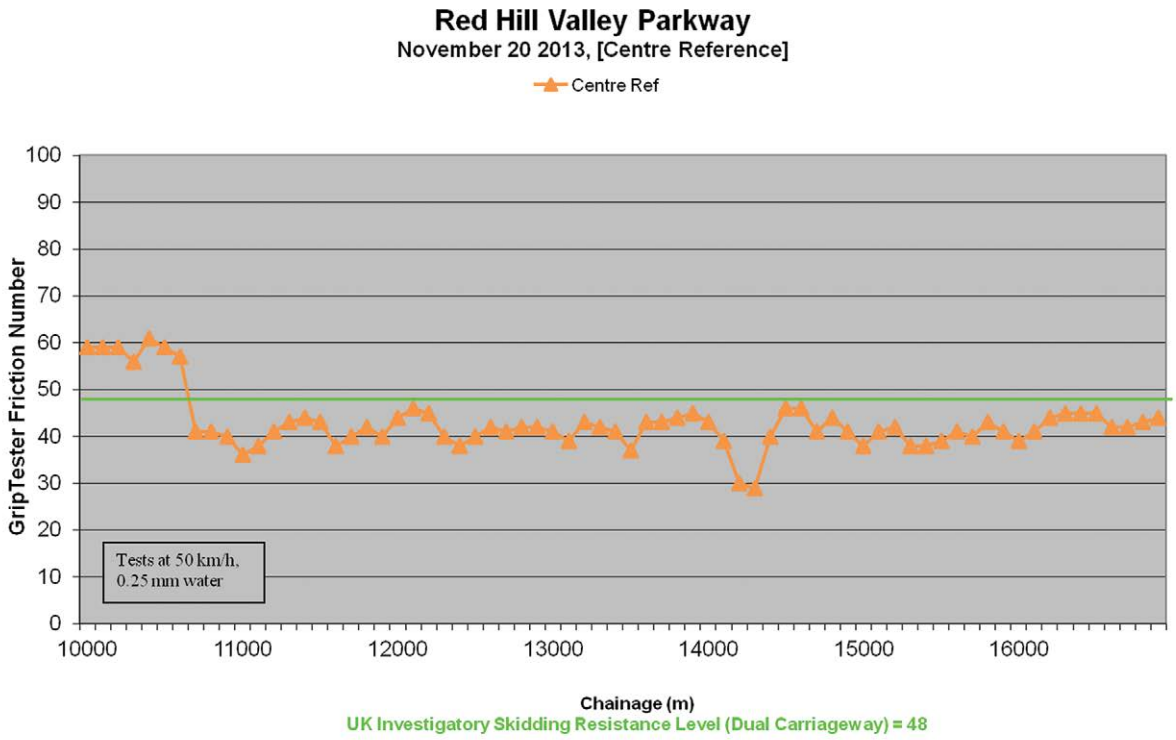


Figure 6i: Friction Values from Centreline Reference LINC and RHVP Test Runs





Tradewind found that the average results from the LINC were "generally *comparable to or above* the reference Investigatory Level 2 (Grip Number = 48)." It also found the LINC results from the four test runs to have "displayed remarkable consistency when subdivided into 100m section values." Tradewind explained that this "indicates a high level of uniformity in the surface texture and pavement composition along the full extent of the road".

In contrast, Tradewind found the average results from the RHVP to be "generally *well below* the reference Investigatory Level 2. Most of the length of the RHVP had Grip Numbers in the range of 30-40. Only a short section, approximately 600m in length, of the right hand wheel track of the right hand (outside) lanes near the southwest end of the Parkway had friction values above the UK Investigatory Level 2."

It is noteworthy that the LINC was repaved in 2011, as discussed in Chapter 5. The Inquiry received evidence that the 600 m section of the RHVP testing that Tradewind referred to as having values above "the UK Investigatory Level 2" was likely a section of pavement included in the 2011 LINC resurfacing, and therefore, was not SMA placed during the construction of the RHVP in 2007. Accordingly, the drop in friction

values shown on the RHVP graphs at **Figures 6g** to **6i**, set out above, likely reflects the point of demarcation between the asphalt used in the 2011 LINC resurfacing and that used in the 2007 RHVP construction.

Tradewind also found the results from the four test runs in the right-hand wheel path of the two lanes in each direction were "quite consistent", but had more localized variations over relatively short lengths which "indicate[d] significant variation in the surface texture and pavement composition along the extent of the facility". Tradewind found the results from the centreline reference test run to be approximately 6 to 8 points (Grip Numbers or "GN") higher than the right wheel path of the outside lanes. Tradewind described this as "consistent with what would be expected from wear-related texture loss that occurs primarily in the wheel track areas, and indicates substantial loss of surface texture and friction due to vehicular traffic".

In addition to the friction test data for the mainline sections, Tradewind included a summary of the data from the friction testing of the sections of the three tested ramps, summarized in **Figure 6j**.

Figure 6j: Summary of RHVP Ramp Friction Results

Chainage (m)	Greenhill Off Ramp	Greenhill On Ramp	Stone Church Off Ramp
0-100	51	60	38
100-200	48	60	40
200-300	68	52	33
300-400	77	42	39
Average:	**61**	**54**	**38**

Tradewind found the friction values from the 100 m sections of the Greenhill Avenue ramps to vary significantly over the 400 m tested section, and that they were "comparable to or slightly higher than the UK Investigatory Level 3", the investigatory level that applies to dual-carriageway roads with minor junctions. Tradewind identified this level as a GN of 54. The Tradewind Report also noted that the corresponding "UK

Investigatory Level 4" for approaches and major junctions was a GN of 60. This latter distinction appears to relate to whether the three tested ramps would be considered a minor or major approach. Tradewind did not specify in the Tradewind Report which investigatory level it considered to be applicable to the RHVP ramps.

Tradewind found the results from the Stone Church Road ramp in the Mud Street interchange, which had an average GN of 38 over the 400 m tested length to be more consistent "but considerably lower" across the 400 m than the Greenhill Avenue ramps. Dr. Uzarowski testified that he believed that the Stone Church Road off ramp tested by Tradewind was the location of the SMA test strip, and was therefore paved with SMA. Rowan Taylor similarly testified that the ramp Dr. Uzarowski identified as being paved with SMA was likely the same Stone Church off ramp tested by Tradewind.

Based on the notes Mr. Hogarth prepared during the testing, Dr. Henderson's testing field notes, and the testimony of Dr. Uzarowski, it appears that the on and off ramps at Greenhill Avenue were paved with a Superpave 12.5 FC2 mix, except for the last 140 m of the on ramp and the first 260 m of the off ramp, which may have also been paved with SMA.

In the "Conclusion and Recommendations" section, Tradewind found the LINC results to "indicate a generally uniform pavement surface texture and composition, with limited variation due to vehicular traffic wear." Tradewind concluded the following regarding the RHVP friction results:

> However, the overall friction averages as measured by the GripTester on the designated lanes and sections of the Red Hill Valley Parkway were *below or well below* the same UK Investigatory Level 2.
>
> The overall low levels and the variability of friction values along the length of the Parkway indicate the need for a further examination of the pavement surface, composition and wear performance. It should be noted that, in addition to the overall low average Grip Number levels on this facility, there are some localized sections with quite low friction values, reaching 27-30 in several areas. We recommend 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.

In the Friction Measurement Results section, Tradewind also noted that although four crosswalk sections were also tested, the data for that testing was inconclusive. Tradewind recommended that the "localized areas should be tested with a more appropriate device or methodology." In email discussions between Dr. Uzarowski and Leonard Taylor on January 30, 2014, Leonard Taylor confirmed that it would not be possible to extract friction values for the crosswalk testing.

6.13.2. Golder Internally Discusses Tradewind Results

On January 27, 2014, the day after receiving the Tradewind Report, Dr. Uzarowski emailed his colleagues at Golder — Dr. Henderson, Ms. Rizvi, Dr. Michael Maher (Principal, Pavement and Materials Engineering, Golder), and Andrew Balasundaram (Principal, Pavement and Materials Engineering, Golder) — writing:

> I hope this will be of interest to you. We have just received a friction testing report for the Red Hill Valley Parkway and Lincoln Alexander Parkway, both in Hamilton. The FN values for the RHVP are generally about 35 to 40 while for the Linc between 50 and 60, so drastically better. There was a SMA mix with traprock from Quebec used on the RHVP and SP 12.5 FC2 with Ontario traprock and 10 RAP used on the Linc.
>
> The traprock used on the RHVP met all the specified requirements. We haven't tested Polished Stone Value (PSV) for any of the aggregates. There is also an interesting question: Are the SN numbers for the surface on the Linc so much better only because of better traprock or the fact that there was 10% RAP with much softer limestone aggregate added to the Linc mix, so a mixture of hard and soft rok [*sic*], had a big impact on the frictional characteristics?
>
> I think that the road authorities realize more and more the importance of the frictional characteristics of our pavements. I am, therefore, interested in buying PSV testing equipment as I discussed it with Michael.

Dr. Uzarowski testified that he emailed his colleagues about the difference in friction values between the RHVP and LINC, because he felt it was a "technical question to discuss with [his] colleagues". He attributed the LINC "unusually high" values to the additional 10% of "soft materials" added to the LINC pavement mix.

It is my view that Dr. Uzarowski's attention to the friction values tested in 2013 reflected lingering questions in his mind about the performance characteristics of the Demix aggregate used in the RHVP's SMA surface course, rather than an issue of immediate concern for traffic safety on the RHVP, traffic safety being an area in which he was not an expert. In this regard, I also note that Golder and Dr. Uzarowski were not aware of the collision patterns on the RHVP that had been identified by CIMA in the 2013 CIMA Report.

6.14. Mr. Moore Receives the 2014 Golder Report and Tradewind Report on January 31, 2014

On January 31, 2014, Dr. Uzarowski emailed the draft 2014 Golder Report, which included the Tradewind Report as an appendix, to Mr. Moore. Dr. Uzarowski copied Dr. Henderson and Ms. Rizvi on his email. He wrote:

> Please find attached an updated draft report on the condition of the pavement on the RHVP 6 years after construction. We have included the friction testing results in the updated report. If you have any questions or require more information please do not hesitate to contact me.

Dr. Uzarowski confirmed in his testimony that he did not share or discuss the 2014 Golder Report (or the appended Tradewind Report) with anyone at the City other than Mr. Moore. Neither Ms. Rizvi nor Dr. Henderson provided or discussed either report with anyone at the City at that time.

6.14.1. Findings in the 2014 Golder Report

The 2014 Golder Report is a 120-page document, with the first 12 pages being the body of Golder's report, followed by appendices, including the 18-page Tradewind Report. At the time the 2014 Golder Report was provided to Mr. Moore on January 31, it was in draft form and included a "draft" watermark. It was unsigned, although

it included signature lines for Dr. Uzarowski, Dr. Henderson, and Ms. Rizvi, each of whom contributed to the 2014 Golder Report in varying capacities.

It was typical for Golder to provide its clients with draft reports prior to finalizing and signing the report. Mr. Moore and other witnesses from the City testified that this was common practice not just for Golder, but also for consultants retained by the City more generally.

As noted above, although Golder applied a “draft” watermark to the entire 2014 Golder Report, including the Tradewind Report, Golder did not intend to give the impression that the Tradewind Report was not final in doing so.

The 12-page body of the 2014 Golder Report was divided into six parts. The first four parts and most of the appendices, which collectively comprise the substantial majority of the 2014 Golder Report, reflect Golder’s original mandate from March 2013, discussed above, and relate strictly to the condition of the RHVP pavement. Only two pages of the 2014 Golder Report, Parts 5 and 6 refer to the friction testing conducted by Tradewind, which had been added in September 2013.

Parts 1 to 4 of the 2014 Golder Report were comprised of a brief introduction and a summary and analysis of the results of Golder’s field testing in the spring and summer of 2013. The four tests and their results, as well as Golder’s discussion of the RHVP friction testing and its analysis and recommendations in Parts 5 and 6 are summarized below.

Part 3.1: Visual Condition Inspection

In Part 3.1, Golder outlined the results of its visual condition inspection, and described the RHVP pavement to be “generally in good condition with limited surface distresses being observed.” Golder noted various surface distresses, including pavement edge cracking in the shoulder and along the edge of the driving lanes in numerous locations, slight to moderate distortions which Golder anticipated to be the result of prior significant flooding, and slight to moderate “generally longitudinal cracking” in portions of the driving lanes in both directions (primarily in the outside lane), which Golder anticipated to be top down in nature. Golder also observed a few locations where longitudinal construction joints were opening, primarily where the RHVP widened to three lanes in one direction.

Part 3.2: Asphalt Cores

As described above, in August 2013, Golder removed four core samples at locations where longitudinal cracks were visible on the surface to further investigate the longitudinal cracking. Golder reported in the 2014 Golder Report that it found the cracking to be within, at most, the top two layers of asphalt. This included the SMA surface course, which was the top layer of the RHVP perpetual pavement.

Part 3.3: Surface Profiler Testing

Part of Golder's field investigation involved measuring the RHVP's longitudinal profile — that is, the road roughness or smoothness and rideability. Testing was performed in both the RHVP northbound and southbound lanes, with measurements taken every 100 m in accordance with the International Roughness Index ("IRI"). Golder provided the average, minimum, and maximum IRI in metres per kilometre in the body of the 2014 Golder Report, and included the complete results in Appendix C to the report.

Part 4: Falling Weight Deflectometer Testing

The 2014 Golder Report also evaluated the pavement with FWD testing, which looks at the physical properties of the pavement and the capacity to hold up to heavy loads on the roadway. The report summarized the FWD testing Golder performed on May 9, 2013. Golder found that the "results indicate that there is no significant deterioration of the load bearing capacity of the pavement layers on the RHVP." Ms. Rizvi conducted the analysis of the FWD test results (as noted above) and drafted this section of the 2014 Golder Report. This was the only section of the 2014 Golder Report to which Ms. Rizvi contributed.

Part 5: Friction Testing

Golder addressed the Tradewind Report in Part 5 of the 2014 Golder Report. Golder also appended the Tradewind Report as Appendix E, found at pages 102 to 119 of the 2014 Golder Report. Dr. Uzarowski testified that he drafted Part 5 of the 2014 Golder Report.

Golder's summary of Tradewind's testing, reproduced below, was brief, and pertained only to the RHVP testing (although it referenced that Tradewind had also tested and reported on the LINC):

> 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.

Table 6: Friction Testing Results[14]

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.

In other words, the 2014 Golder Report contained the conclusion that friction levels on the RHVP were "relatively low". Dr. Uzarowski testified that he conducted some research in order to draft this part of the 2014 Golder Report, and that his research led him to conclude that Tradewind was overly conservative in its assessment of the friction testing results, in particular its use of a GN of 48 for the UK Investigatory

[14] I note that, like with the January 2014 Uzarowski Email that Dr. Uzarowski sent to Mr. Moore, Dr. Uzarowski reversed the northbound and southbound results in this table.

Level 2, and that he would instead use an investigatory level of GN40. Dr. Uzarowski testified that he based this conclusion on three documents:

1) the British Department of Transportation Standard for Investigatory Levels of Road Surface Friction Resistance (found at table 2.7 of the 1997 TAC Pavement Design and Management Guide), which identified 0.35 (being a GN of 35) as the investigatory level for a motorway or dual carriageway based on a SCRIM testing machine at 50 km/h;

2) a UKPMS chart which converted SCRIM friction values to Grip Numbers; and

3) a Pennsylvania standard from a National Cooperative Highway Research Program paper (found at table 2.6 of the 1997 TAC Pavement Design and Management Guide), which that indicated that "no further action required" for skid numbers greater than 40. The "skid number" of 40, however, referred to the results obtained from a locked-wheel tester, taken at a speed of 40 mph (65 km/h), not from a GripTester.[15]

Dr. Uzarowski testified that he also took into consideration his understanding that the MTO viewed FN30, as an expected or acceptable value although not a clearly defined friction threshold.

From all of this, Dr. Uzarowski came to the conclusion that "[t]ypically the FN values should be at least equal to or higher than 40 to be considered adequate", which he reflected in the 2014 Golder Report, without including the analysis by which he reached that conclusion because he wanted to keep the report "pragmatic, simple". Although he conflated FN and GN in the 2014 Golder Report, Dr. Uzarowski was correct that the GN48 investigatory level used in the Tradewind Report (based on the outdated UK reference table) was too conservative.[16] The friction value of 40, which Dr. Uzarowski used in the 2014 Golder Report, and which he rounded from 41, aligned with the then current UK standard investigatory level of GN41 (as set out in Chapter 1). In using the phrase "relatively low" to describe the RHVP results, Dr. Uzarowski

[15] This table is also discussed in Chapter 11, in context of a subsequent report Golder delivered to the Engineering Services department in 2019.

[16] Discussion regarding the UK investigatory standards applicable at the time of the Tradewind Report is included in Chapter 1.

testified that he intended to convey that the results were "not a red flag value, but not what would be adequate" because they were below the investigatory level of GN41 (which he rounded to GN40).

Golder did not summarize or describe the LINC results in comparison in the 2014 Golder Report. Dr. Uzarowski explained in his testimony that he did not reference the LINC results (including his description to his colleagues of the LINC results being "drastically better" than the RHVP) because the 2014 Golder Report related only to the RHVP. He also testified that his recommendation (discussed below), if followed, would have provided the RHVP with friction numbers more comparable to the adjoining LINC.

Golder did not note in the 2014 Golder Report that the Tradewind results were obtained using different equipment than the 2007 MTO results, and Golder's reference to the Tradewind results being higher than when measured in 2007 may have given a reader the impression that they were in fact directly comparable. There was also no reference to the SMA early age low friction issue and/or the fact that the MTO October 2007 friction values were expected to increase once traffic wore off the asphalt cement film on the then newly paved SMA surface of the RHVP.[17] Dr. Uzarowski had, however, raised the topic of early age friction in the January 2014 Uzarowski Email, and attached a paper on that topic. In hindsight, a statement in the 2014 Golder Report clarifying that the friction results were not directly comparable may have been helpful.

In his testimony, Dr. Uzarowski acknowledged that the "wording" in the 2014 Golder Report, by which I understand him to mean the absence of certain background information, was "maybe not very fortunate" but said that his overall intention was to convey that the Tradewind results were not adequate, and that "[s]omething ha[d] to be done".

However, Golder's conclusions as to its view of the adequacy of the Tradewind results was clear. The 2014 Golder Report expressly stated that although the Tradewind values were higher than those measured in 2007, they were considered to be relatively low, and that, in Golder's view, values should be at least equal to or higher than 40 to be considered adequate. Golder's conclusions regarding the adequacy

[17] The SMA early age low friction issue is discussed in detail in Chapter 1.

of the reported values would also have been reinforced upon reading the appended Tradewind Report.

Part 6: Analysis and Recommendations

Golder included its analysis and recommendations in Part 6 of the 2014 Golder Report. The focus in Part 6 was on the state of the pavement of the RHVP, although, as Golder noted, implementation of its recommendations to treat the pavement issues would also address the relatively low friction numbers on the RHVP.

The 2014 Golder Report explained that as part of the perpetual pavement design for the RHVP and its life cycle cost analysis, "it was anticipated that some cracking, mainly longitudinal top down, will occur and will have to be addressed".[18] Golder also found that the top down longitudinal cracking was "most visible at the end of the RHVP that is closest to the QEW" and that the "FWD testing clearly indicate[d] that the subgrade [was] the softest along this section of the RHVP."

Golder noted that the volume of traffic on the RHVP in the six years of service was much higher than the values assumed during the original design. The life cycle cost analysis assumed that certain remedial work would be needed over time based on assumed traffic volumes. It also found that the two flooding events "likely worsened the subgrade conditions and resulted in a few areas of localized depressions".

Golder made the following recommendations for pavement treatment of the RHVP:

> 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 [Superpave] 19.0 layer

[18] The RHVP's perpetual pavement design and the related life cycle cost analysis are described in Chapter 2. The concept of perpetual pavement is also discussed in Chapter 1.

observed during the milling and overlaying operation, the debonded [Superpave] 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 [*sic*] incorporate aggregates that have good Polished Stone Value (PSV). It is recommended that the PSV of potential aggregate sources be tested in the laboratory.

The cracks in the paved shoulder along the edge of the driving lanes should also be routed and sealed to stop the ingress of water.

6.15. Dr. Uzarowski and Mr. Moore Discuss the 2014 Golder Report and the Tradewind Report in February 2014

6.15.1. Meeting on February 7, 2014

On February 4, 2014, Dr. Uzarowski and Mr. Moore spoke by phone and agreed to meet in person on February 7. Dr. Uzarowski prepared a list of items to discuss at this meeting, which included references to, among other topics, the PMTR III, the instrumentation project, the 2014 Golder Report, and the Tradewind Report.

Dr. Uzarowski brought two hard copies of the 2014 Golder Report to the meeting on February 7, one for each of them. Mr. Moore testified that he likely reviewed the 2014 Golder Report after receiving it electronically on January 31, 2014 and before the meeting on February 7, 2014. Dr. Uzarowski testified that his impression was that Mr. Moore had not read the 2014 Golder Report or the Tradewind Report in advance of their meeting. As set out below, I conclude that, at most, Mr. Moore may have read the 12-page body of the 2014 Golder Report (excluding appendices) before the meeting, retaining nothing regarding the Tradewind Report.

To the extent that Mr. Moore reviewed Part 5 of the 2014 Golder Report when he received it, he would have seen Golder's conclusions that friction levels on the RHVP were "relatively low", and that "[t]ypically the FN values should be at least equal to or higher than 40 to be considered adequate", along with a statement that the complete friction testing results were provided in the Tradewind Report at Appendix E. Among other things, the Tradewind Report would have informed him of the particular testing equipment Tradewind used and the UK standard applied by Tradewind in reaching its conclusions.

Dr. Uzarowski recalled that the discussion regarding the 2014 Golder Report and the Tradewind Report was relatively brief, approximately 10 to 15 minutes. Insofar as the meeting addressed the friction results, Dr. Uzarowski testified that they did not discuss the Tradewind Report "broadly or over a long period of time". However, both Mr. Moore and Dr. Uzarowski recalled that Dr. Uzarowski described the difference in friction results between the RHVP and LINC.

It is important to note that, as mentioned above, the focus of the 2014 Golder Report and the discussion between Dr. Uzarowski and Mr. Moore was on the state of the RHVP pavement generally, not the friction testing results of Tradewind. Regarding the pavement surface, Dr. Uzarowski testified that he discussed various pavement treatment options during the meeting, as reflected by his note "micro, blasting". Dr. Uzarowski brought a brochure on microsurfacing he had obtained from Trevor Moore at Miller Paving, which he provided to Mr. Moore during the meeting. He recalled telling Mr. Moore that Golder recommended microsurfacing the RHVP to address both the condition of the roadway and the friction levels. Dr. Uzarowski also recalled raising shotblasting with Mr. Moore, telling him that it was a "quick, very cost effective" technology to improve the microtexture and macrotexture of pavement. Dr. Uzarowski could not recall how Mr. Moore reacted to the discussion of microsurfacing and shotblasting, other than perceiving Mr. Moore to have received this information, or what Mr. Moore's viewpoint was on Golder's recommendation to mill and overlay a portion of the RHVP, discussed below.

Mr. Moore did not recall discussing Golder's recommendation to mill and overlay a section of the RHVP. However, he testified that it was "not a surprising recommendation, and it's consistent to what we anticipated" and that it was a viable and understandable recommendation to preserve the integrity of the perpetual pavement. Mr. Moore also

testified that the cost of the mill and overlay, though perhaps significant, was "relatively cheap in terms of what you might have to do if you don't do it".

Mr. Moore explained in his testimony that he had prior unsuccessful experiences using microsurfacing on City roads, and that, although he did not recall discussing microsurfacing with Dr. Uzarowski during their February 7 meeting, he would have made it clear to Dr. Uzarowski at some time that microsurfacing was not something the City would likely consider "as a useful and good value for money type of treatment".

Dr. Uzarowski's meeting notes included a reference to "PSV". He testified that he asked Mr. Moore at the meeting if he was interested in Golder conducting PSV testing of the existing RHVP material to verify the friction testing results, and that Mr. Moore declined the PSV testing. In February 2014, Dr. Uzarowski knew that the Demix aggregate used in the RHVP SMA surface course in 2007 was on the MTO's Designated Sources for Materials ("DSM") list, which meant that the PSV of the aggregate could not have been less than 50 at the time it was tested by the MTO and placed on the DSM list. In his testimony Dr. Uzarowski explained that he proposed the PSV testing despite this knowledge for two reasons: because the friction testing results were "relatively low" and because of the emails he reviewed in September 2013 in which it was reported that police had said the RHVP was slippery. Dr. Uzarowski explained that, in his opinion, aggregate characteristics could change when a pavement was in service, so he wanted to verify the PSV to determine if the friction results were related to the Demix aggregate. Dr. Uzarowski understood Mr. Moore declined the testing because the aggregate was on the DSM. Mr. Moore testified that he did not recall Dr. Uzarowski raising PSV testing to determine if there was an issue with the aggregate. Mr. Moore was satisfied that the RHVP was paved using premium materials as he later described them, whereas, in my view, the Tradewind friction testing results revived Dr. Uzarowski's lingering questions with the Demix aggregate that he hoped to dispel with further testing. There is no suggestion, however, that either Mr. Moore or Dr. Uzarowski connected this discussion to any issue of traffic safety.

Mr. Moore and Dr. Uzarowski's recollection of the February 7 meeting diverge significantly on the topic of Tradewind's use of a UK standard which also raises the more fundamental question of whether Mr. Moore read the Tradewind Report at this time.

Mr. Moore testified that Tradewind's use of a UK standard "jumped off the page" and was "the major issue as far as [he] was concerned in both the Tradewind [results] and their recommendations." Mr. Moore testified that he understood from the 2014 Golder Report that the October 2007 MTO results could be directly compared to the Tradewind results, and that he expressed confusion to Dr. Uzarowski during the February 7 meeting that he had been told earlier that the MTO testing resulted in "good numbers" but was then being told that numbers higher than the MTO testing were "not good". According to Mr. Moore, he wanted Dr. Uzarowski to obtain more information and clarify how the standard applied to the City's roads, and he asked Dr. Uzarowski to do so. Mr. Moore stated that, accordingly, he did not accept Tradewind's results or its recommendation to further investigate and made no decision at the meeting. Mr. Moore testified that he would not "expend any funds or take any actions" until he understood the basis for Tradewind's conclusions.

In contrast, in testimony at the Inquiry, Dr. Uzarowski did not recall Mr. Moore suggesting that he considered anything in the 2014 Golder Report or Tradewind Report to be invalid, incomplete, or unclear, nor did Mr. Moore raise any concern with Tradewind's use of a UK standard. Dr. Uzarowski had no action items arising out of this meeting, and Mr. Moore did not ask him to contact Tradewind to obtain more information regarding the UK standard and how it applied in Ontario.

I conclude that Mr. Moore did not review the Tradewind Report, or at best gave it a very cursory review from which he retained nothing, prior to his meeting with Dr. Uzarowski on February 7, 2014. This meeting focused on the principal matter relating to the state of the RHVP pavement surface generally and devoted only limited time to discussing the friction testing.

In fact, while Mr Moore was steadfast in his testimony that he asked Dr. Uzarowski to make these inquiries regarding the UK standard and its application to Ontario roads in February 2014, I am satisfied that he did not do so until late 2015, when there is clear documentary evidence that he raised these issues with Dr. Uzarowski. Until that point, Mr. Moore's understanding of the Tradewind friction testing on the RHVP was limited to the contents of the January 2014 Uzarowski Email and the summary and conclusions in Parts 5 and 6 of the 2014 Golder Report. Mr. Moore's subsequent actions demonstrate that, from these materials, he retained a faulty understanding of

the comparability of the MTO 2007 friction testing results and the Tradewind 2013 test results.

Following the February 7 meeting, Mr. Moore did not implement the remediation recommended by Golder, which would have addressed the "relatively low" friction levels reported by Golder, nor did he conduct any further investigation of the friction levels on the RHVP.

6.15.2. The 2014 Golder Report is Not Formally Finalized

Golder never delivered a signed version of the Report with the "draft" watermark removed. I find the absence of a finalized report was not because Mr. Moore was dissatisfied with the 2014 Golder Report. Rather, Dr. Uzarowski testified that Mr. Moore "didn't care about finalizing. He just wanted the information. He wanted the numbers and [to] move ahead". As I understand Mr. Moore's evidence, Mr. Moore was not particularly concerned about receiving final reports — referring to this as "making it pretty and putting it on the bookcase". What he was interested in receiving was the report's content and the action the City needed to take.

In Dr. Uzarowski's view, regardless of the "draft" watermark on the 2014 Golder Report, the analysis and recommendations contained in the report were final. It was Golder's practice to wait for comments or direction from the client to finalize the report. He asked Mr. Moore on January 31, 2014 to contact him should Mr. Moore have any questions or require further information, and Dr. Uzarowski did not receive any such requests. Typically Golder would receive a direction to finalize; it was uncommon for reports to remain in draft form indefinitely. In this instance, Mr. Moore gave no further instructions or comments regarding the status of the 2014 Golder Report. As a result, both Dr. Uzarowski and Mr. Moore effectively treated the 2014 Golder Report as finalized from this time onward.

6.16. Mr. Moore's Actions After Receipt of the 2014 Golder Report and Tradewind Report

As set out in Chapter 9, I find that the hard copy of the 2014 Golder Report that Mr. Moore received from Dr. Uzarowski in February 2014 remained in his office until Mr.

Moore cleaned out his office in May 2018, when he retired as Director of Engineering Services. It was this copy that Mr. McGuire later found in 2018.

Mr. Moore likely deleted the electronic copy of the 2014 Golder Report at some point after Dr. Uzarowski gave him a hard copy. Mr. Moore testified that he did not save all emails and documents that he received due to the City's electronic storage limits in 2014. His practice when saving documents received via email was to save the email, along with the corresponding attachment(s), within a folder system in his email inbox. This folder system included a "Red Hill" folder. Mr. Moore could not recall if he saved the electronic version of the 2014 Golder Report that he received from Dr. Uzarowski. However, as described in Chapter 9, when Mr. Moore retired in 2018, he cleaned out this inbox and uploaded several documents to ProjectWise, a document management system used by the City. These documents included the January 2014 Uzarowski Email and Mr. Moore's email to Mr. Dziedziejko. There is no evidence that he uploaded a copy of the 2014 Golder Report to ProjectWise. This indicates that he had not retained an electronic copy at the time of his retirement, and suggests that he likely deleted the electronic copy in 2014 given his email storage limits.

Mr. Moore did not send, or otherwise make available, the 2014 Golder Report or the Tradewind Report to anyone at the City in 2014 after he received it. In particular, he did not provide an update to Mr. McLennan or to any of the staff in Traffic who he had advised in September 2013 that he would conduct testing and update with the friction results. He testified that Traffic was aware that the testing had been done "when [he] advised them that…we couldn't do the crosswalk testing for them." As discussed below, I find that, if Mr. Moore did convey anything to Traffic about the crosswalk friction testing, he did so at some point after June 23, 2014. At this time, there was no central location used across the Public Works department to store and access RHVP-related documents, as discussed in Chapter 9.

Mr. Moore testified that it was possible that he advised staff in Asset Management about Golder's mill and overlay recommendation in the 2014 Golder Report, but he did not have a specific recollection of this during his testimony, nor of whether he provided Asset Management staff with the 2014 Golder Report itself. I received no evidence to conclude that he did. Mr. Moore also did not contact Mr. Dziedziejko, to whom he sent a summary of the results on January 24th, to provide him with the Tradewind Report or the additional context Mr. Moore had since received.

Mr. Moore did not see any urgent need to address the pavement issues raised in the 2014 Golder Report, which were the focus of the 2014 Golder Report, and did not review the Tradewind Report until much later. He continued to view the pavement as "working out well" as he indicated in an industry video in the summer of 2014. Mr. Moore testified that it was not his practice to follow up with consultants on matters he did not understand to be urgent, explaining "[i]f I didn't have a need for it, given the normal level of the work that was going on there, then I wasn't any better than anybody else in chasing things that weren't, you know, of an urgent nature."

Although Mr. Moore also testified that it was possible he had verbal discussions regarding the UK investigatory standard with individuals from the MTO, his evidence on this lacked specificity or corroboration. Because I do not accept Mr. Moore's evidence that he had any questions or concerns regarding the Tradewind Report at the time he received it in January 2014, I similarly do not accept any of this evidence.

6.17. Golder's Invoicing for Friction Testing and City Project Recordkeeping

Between January and March 2014, Golder invoiced the City for its work related to friction testing. From January to March 2014, Golder issued invoices for the friction testing, for $4,000, $2,000, and $2,000. The invoices were approved by Mr. Moore, and in one instance, Mr. McGuire, who approved the invoice on behalf of Mr. Moore while temporarily acting as Director of Engineering Services.

Although Golder viewed Tradewind's testing as one part of the 2014 Golder Report, the City had created a separate purchase order for the testing in January 2014 and Golder invoiced with respect to that purchase order. By March 2014, Golder had also invoiced a total of $23,500 for the 2014 Golder Report, which was the total project budget, excluding contingency.

At Mr. Moore's direction, the purchase order for the 2014 Golder Report remained open. As of mid-April 2014, the budget of $23,500 for the project had been used; however, some contingency funds remained available. Ms. Cameron, who was Mr. Moore's assistant, testified that Mr. Moore did not provide her with any details on why he wanted the purchase order to remain open. The Inquiry has received documents

indicating that the purchase order for the 2014 Golder Report had been closed by January 15, 2019, but the purchase order for the Tradewind Report was still open.

The City kept spreadsheets recording details relating to various roster assignments in the geotechnical category (in which Golder was a "scoped consultant" and for which Mr. Moore was the roster captain) from 2013 to 2014, which included five Golder assignments. Throughout 2014, all but one of Golder's listed projects, including the "Red Hill Pavement condition investigation/report" were marked as "complete" in the status column. The assignment related to friction testing was marked as "started". Mr. Moore explained in his testimony that the "status" column in this spreadsheet was more reflective of project spending, rather than the status of the project's completion itself. The Inquiry received no evidence as to why the status of the friction testing assignment remained unchanged after the $8000 budget had been exhausted following the receipt and payment of Golder's final invoice, dated March 18, 2014.

I do not find, however, that the status of the friction testing project in the spreadsheet or the open purchase order regarding the 2014 Golder Report, reflected a request of Mr. Moore to Dr. Uzarowski for further information regarding the UK standard to better inform Mr. Moore's understanding of the Tradewind Report. In this regard, because Mr. Moore's practice regarding information that he sought from Dr. Uzarowski was to ask for it directly, and because Dr. Uzarowski's practice was to respond promptly, it is improbable that any such information request would have remained outstanding for any period of time.

6.18. Continued Contact Between Golder and the City in 2014

The evidence suggests that Golder and City staff remained in contact after the February 7, 2014 meeting between Dr. Uzarowski and Mr. Moore. This contact was predominantly, although not exclusively, between Dr. Uzarowski and Mr. Moore.

Dr. Uzarowski's notebooks contained various entries from March through to the end of 2014, which reference Mr. Moore and/or the City. The notes suggest that Dr. Uzarowski and Mr. Moore may have spoken on one or more occasions. However, the Inquiry received no evidence regarding the purpose of such conversations, and in

particular, no evidence that Mr. Moore raised any questions regarding friction testing on the RHVP or the Tradewind Report and was awaiting follow up from Dr. Uzarowski.

6.18.1. Crosswalk Friction Testing Results

Mr. Jacobson, who had requested the crosswalk testing that was "piggybacked" onto the Tradewind RHVP and LINC friction testing in November 2013, followed up with Golder regarding the testing results fairly regularly after the testing was conducted. On February 12, 2014, Mr. Jacobson emailed Dr. Henderson, asking for an update on the crosswalk friction testing. Dr. Henderson did not respond or discuss the Tradewind Report with Mr. Jacobson, or anyone else.

The substance of the crosswalk friction is noteworthy for this Inquiry only insofar as it relates to communications from Mr. Moore to others about Tradewind's testing. Mr. Moore testified that he advised Mr. Jacobson that the crosswalk friction testing did not produce meaningful information and therefore, that Traffic was aware that friction testing had been conducted from that time. There is no evidence indicating when these discussions occurred, if at all. As discussed below, the Inquiry received evidence which suggests that any such discussions may not have occurred until several months later, after late June 2014.

On June 23, 2014, Mr. Moore emailed Dr. Uzarowski writing "Did we ever get the results of the pavement roughness through the intersections with the new paint?". The Inquiry did not receive any emails sent in response to this email. While Mr. Moore did not give evidence on why he sent this email to Dr. Uzarowski in June 2014, the email suggests that Mr. Moore had not yet advised Mr. Jacobson that "there was no meaningful information" from the crosswalk friction testing, since Mr. Moore did not appear aware of the status of that data as of that time. This email also strongly suggests that if he did in fact advise Mr. Jacobson that friction testing had been conducted as he testified, he likely did not do so before late June 2014.

I also note that by the time Mr. Moore sent this email to Dr. Uzarowski, Mr. Moore would have had the Tradewind Report, including its conclusion that the crosswalk testing data was "inconclusive" due to the equipment used, for more than four months. This further supports the conclusion that Mr. Moore had not reviewed the Tradewind Report up to this time.

6.19. Traffic Begins to Implement Countermeasures in 2014

Throughout 2014, Traffic staff took steps to implement the countermeasures from the 2013 CIMA Report that they thought were within their area of responsibility.

Mr. Lupton was eager to implement recommended countermeasures on the RHVP in 2014 as weather permitted. In June 2014, Mr. Ferguson advised Mr. White, who in turn advised Mr. Lupton, that many of the minor signage changes recommended by CIMA had been implemented by Traffic, that work orders were in progress for lane markings, and that permanent raised pavement markings would be installed by early fall 2014. Mr. Lupton responded that Traffic needed to implement cat's eyes before the next election, as the RHVP safety improvements were "high on the political agenda" and Traffic had promised to complete them in spring 2014.

In July 2014, Traffic prepared a work order for the installation of durable pavement markings in the area identified for the installation of cats' eyes. However, the installation of cat's eyes required specifications and was delayed. Dufferin was awarded a $234,520 contract to supply and install recessed reflective pavement markers on the RHVP from Dartnall Road to Greenhill Avenue in November 2014. Dufferin's tentative start date for this work was December 22, 2014, weather permitting. However, due to Dufferin's work schedule around the winter holidays, Mr. Ferguson authorized Dufferin to leave the work until 2015.

In January 2015, Mr. Moore raised concerns about the length of the cut in the pavement that would be required to install the recessed reflective pavement markers on the RHVP. Dufferin could not reduce the cut length, as the cuts were already under the MTO's typical five-foot slot length for such reflectors. When Mr. Moore was advised that Traffic could not use a cut length under four feet, Mr. Moore replied: "Ok (but when the pavement fails prematurely because of these cuts I'll be asking you to provide an explanation about this need for both the reflectors and the cuts.)". As of November 2015, Mr. Cooper advised Mr. Ferguson that cat's eyes had been installed on the Dartnall Road on ramp and on the RHVP mainline. Mr. Jason Worron (Senior Project Manager, Traffic Engineering, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton) testified

that curve warning signs and “slippery when wet” signs had also been implemented around Ramp 6 (Mud Street) as of November 2015.

With respect to the kink in the RHVP roadway observed in the 2013 CIMA Report, Traffic concluded that it was unlikely that it could be corrected through pavement markings alone. Traffic concluded that it would have to wait until the RHVP was resurfaced to implement the design changes required to address the kink.

CHAPTER 7

The 2015 CIMA Report and Discussions on RHVP Rehabilitation from 2015 to 2016

7.1. Overview

By May 2015, the Traffic group had implemented or planned to implement the countermeasures from the 2013 CIMA Report and approved by the Public Works Committee ("PWC"). In contrast, there is no evidence that Engineering Services had considered the lighting, high friction pavement application, or friction testing recommendations from the 2013 CIMA Report.

In May 2015, following the deaths of two young women on the RHVP on May 5, the City retained CIMA to prepare a safety review of the RHVP (the "2015 CIMA Report"). Traffic, who took the lead on the project following Council's direction to staff, did not include a staff member from Engineering Services on this project. This chapter addresses CIMA's work in preparing the 2015 CIMA Report and CIMA's contact with Gary Moore (Director, Engineering Services, Public Works, Hamilton) to discuss past friction testing conducted on the RHVP, during which Mr. Moore provided incomplete and inaccurate information to Brian Malone (Partner, Vice-President, Transportation, CIMA) about past friction testing that was "not for republication". As a result of CIMA's findings regarding collisions, CIMA recommended countermeasures to the City in the 2015 CIMA Report, including repeating its prior recommendation from the 2013 CIMA Report that the City conduct friction testing. CIMA also concluded that continuous illumination was warranted on the RHVP, subject to a cost-benefit analysis.

This chapter also discusses Mr. Moore's opposition to CIMA's proposed recommendations in the 2015 CIMA Report regarding friction testing and illumination, and Traffic staff's management of Mr. Moore's opposition. The staff report to PWC that Traffic staff ultimately prepared and delivered in December 2015 did not provide a clear picture of CIMA's collision findings, and recommended deferral of the installation of rumble strips, median barriers, and end-to-end illumination, pending an assessment of potential widening of the RHVP, which was being conducted as part of an update to the City's Transportation Master Plan ("TMP"). Staff also recommended in the staff report that friction testing, which CIMA recommended be conducted in the short term, be similarly deferred, without explanation.

This chapter describes the December 2015 PWC meeting during which Traffic staff and Mr. Moore focused on driver behaviour and discounted the possibility of pavement issues. This led to further discussion by the public, staff, and Council in response to

the 2015 CIMA Report statistics regarding excessive speeding on the RHVP. It also led Mr. Moore to read the Tradewind Report and seek further information from Dr. Ludomir Uzarowski (Principal, Pavement & Materials Engineering, Golder) regarding the results and recommendations resulting from Tradewind's testing.

Finally, this chapter discusses efforts by Engineering Services in the spring of 2016 to plan future rehabilitation of the RHVP, including statements made by staff about the intended purpose of this rehabilitation and certain testing conducted by Golder.

7.2. LINC Safety Review and Recommendation for RHVP Safety Review

In October 2014, a young man and woman were killed on the LINC when their vehicle crossed the median and collided with vehicles travelling westbound.

Shortly thereafter, City staff began to discuss retaining a consultant to complete a safety review of the LINC, which Councillor Chad Collins (Ward 5, Hamilton) had requested the year prior. In November 2014, John Mater (Director, Corporate Assets & Strategic Planning, Public Works, Hamilton) sent Gerry Davis (General Manager, Public Works, Hamilton) an email stating that City staff had reviewed the collision history on "the Red Hill/Linc" and concluded, based on their review, that there was "enough of a concern" that City staff needed to do "a more in depth review". On his email to Mr. Davis, Mr. Mater copied Mr. Moore, Geoff Lupton (Director, Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton), Martin White (Manager, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton), David Ferguson (Superintendent, Traffic Engineering, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning; Public Works, Hamilton), and other City staff. At Mr. Davis' direction, Mr. Mater directed Traffic staff to begin scoping out a safety review and considering a third-party expert to complete the review. In January 2015, Traffic retained CIMA to complete a safety review of the LINC, which resulted in a report titled "Lincoln Alexander Parkway Median Safety Study" (the "2015 CIMA LINC Report").

Mr. Ferguson testified that he spoke to Mr. Mater and Mr. White in late 2014 or early 2015, and recommended that the City also retain CIMA to do a safety review for the

RHVP similar to the 2015 CIMA LINC Report. Mr. Ferguson gave evidence that he felt a RHVP safety review was "required" because "[his] review" had identified a higher proportion of wet weather collisions than expected on the parkway. However, apart from Mr. Mater's email noted above and an October 2013 email (which was sent in context of staff's preparation for Report PW13081 and reporting on the 2013 CIMA Report) from Mr. White to Mr. Lupton advising that Traffic staff had identified a statistically significant number of wet weather collisions on the RHVP, the Inquiry received no documents that evidence this collision analysis or Mr. Ferguson's recommendation.

7.3. Events Before the May 21, 2015 Public Works Committee Meeting

7.3.1. City Staff Prepare a Report on the Status of Countermeasures

In February and March 2015, Mr. Ferguson, Stephen Cooper (Project Manager, Traffic Engineering, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton), and Jason Worron (Senior Project Manager, Traffic Engineering, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton), prepared drafts of an information update report to be presented to the Public Works Committee ("PWC").[1] This information update report, which became Report PW13081A, was intended to advise the PWC on the phased implementation of countermeasures recommended in the 2013 CIMA Report. As set out in Chapter 6, the PWC had directed staff, as an Outstanding Business List ("OBL") item, to monitor changes to signage in the area of the RHVP covered by the 2013 CIMA Report and report back respecting lighting in the second quarter of 2015. The presentation of this information update report was scheduled for June 15, 2015. It was later moved to the May 21, 2015 PWC meeting to accommodate Mr. Moore's attendance.

Mr. Ferguson provided a draft of the information update report to Mike Field (Project Manager, Street Lighting & Electrical Engineering, Geomatics & Corridor Management,

[1] A general description of information update reports and other types of staff reports to Council is provided in Chapter 4.

Engineering Services, Public Works, Hamilton) and Mr. Moore on March 9, 2015. Although Mr. Ferguson invited Mr. Moore and Mr. Field to modify the information in the draft information update report "with respect to Lighting", neither Mr. Field nor Mr. Moore had any substantive comments on the draft.

On lighting, the draft information update stated that the original RHVP design and Council approval omitted use of roadway lighting as a result of the various environment concerns within the area and that, as a result, CIMA had recommended installation of cat's eyes reflectors "to assist with positive guidance for motorists". The draft information update initially recommended that lighting be removed from the OBL because Traffic had installed cat's eyes reflectors on the RHVP in 2015 and had received positive feedback. However, the recommendation to remove lighting from the OBL was removed from the final information update report presented to the PWC on May 21, 2015.

The draft and final information update (Report PW13081A) stated that the 2013 CIMA Report determined that the RHVP was operating safely. This statement was overly broad, given that CIMA had assessed a specific study area of the RHVP, rather than the entire RHVP, and it did not reflect the totality of CIMA's 2013 findings.

Traffic's final information update included two tables outlining the countermeasures recommended for specific road segments and the ramps in the 2013 CIMA Report, and the implementation status of each. The draft and final version of the information update did not include the countermeasures that CIMA recommended for the entire RHVP study area, which were different from the road segment and ramp-specific recommendations, and included CIMA's recommendation to conduct pavement friction testing. Traffic identified the signage and pavement marking countermeasures Traffic intended to complete, including the installation of reflective markers and curve warning signs, and the installation of pavement markings in 2015, weather permitting. Other countermeasures, such as installing dynamic/variable speed warning signs at the Mud Street interchange, were identified for completion in the summer and fall of 2015.

In the information update, Traffic staff also identified two road segment-specific countermeasures that were to be reviewed and completed during future repaving: (1) installing high friction pavement approaching and through the curve at the Mud Street

interchange, and (2) modifying pavement markings and rumble strips from Dartnall Road to Mud Street.

The final version of the information update report did not reference friction testing on the RHVP at all. Although the 2013 staff report (Report PW13081) had indicated that Traffic staff would review further countermeasures such as friction testing with "Construction Engineering", as noted in Chapter 6, there is no evidence that anyone in Traffic was ever assigned to review CIMA's recommendations for friction testing with Engineering Services staff after Report PW13081 was submitted to the PWC in November 2013, or at any time thereafter. Mr. Worron, Mr. Ferguson, and Mr. Cooper all denied that it was their responsibility to discuss CIMA's friction testing recommendation with Engineering Services staff, and suggested others were responsible for doing so.

CIMA's 2013 recommendation to install high friction pavement approaching and through the curve at the Mud Street interchange also fell within Engineering Services' scope of responsibility. In his testimony, Mr. Moore could offer no evidence that Engineering Services staff considered how, when, or whether to install high friction pavement approaching and through the curve at the Mud Street interchange. Mr. Moore testified that he was not involved in the decision to single out this countermeasure for review and completion during future RHVP resurfacing in the information update.

In short, there was no evidence that Traffic and Engineering Services discussed friction testing in order to prepare information update Report PW13081A, which I conclude was as a result of strictly defined roles of Engineering Services and Traffic and an ill-defined allocation of responsibility within the 2013 CIMA Report project, as described in Chapter 6. Similarly, there is no evidence that Engineering Services considered the approved countermeasure of applying a high friction application to the curve at the Mud Street Interchange.

7.3.2. Traffic Retains CIMA for the 2015 CIMA Report After a Fatal Collision on the RHVP

There was a fatal collision on the RHVP on May 5, 2015, a few weeks before the May 21, 2015, PWC meeting at which staff presented information update Report PW13081A. Two young women were killed. They were driving northbound on the

RHVP when their vehicle crossed the median barrier and collided with a vehicle travelling in the southbound lanes near Greenhill Avenue.

Media and public concern about the RHVP increased after this fatal collision. Members of the public wrote to councillors with their concerns, including "vehicles sliding into, or through the medians", exacerbated by rain, snow, and frost. There were calls from the public to install median barriers on the RHVP to prevent further cross-median collisions.

On May 12, a motion from Councillor Sam Merulla (Ward 4, Hamilton) for consideration at the PWC meeting on May 21 was circulated to Public Works staff. Councillor Merulla's motion stated that "staff be directed to investigate additional safety measures for the Red Hill Valley Parkway and the Lincoln M. Alexander Parkway, such as additional guardrails, lighting, lane markings or other means to help prevent further fatalities and serious injuries; and, report to the Public Works Committee with recommendations by December 7, 2015."

In emails with Mr. Mater, Mr. Lupton, and Mr. Ferguson in response to Councillor Merulla's motion, Mr. Moore raised the cost of median barriers, stating:

> The motion is fine. If they (Council) have the money to spend $150,000 per kilometer to put in guide rail (22kilometers x 2= 44km= $6.6M) and another $200,000 per year for maintenance when the only thing it will do is increase the number of reportable accidents and possibly the number of deadly accidents, then it's their decision. The lane orientation, median width, speed limit all allow for recovery of a vehicle that leaves the road without further incident or damage. Put up a guiderail and you have immediate damage to the car as well as the guiderail as well as the possibility of redirecting the car back into the travelled lanes. Not a simple answer especially when you add the speed profile issue.

As noted, by this time, CIMA was already retained on the ongoing 2015 CIMA LINC Report. Before the May 21 PWC meeting, Mr. Ferguson, Mr. Mater, Mr. Lupton, and Mr. Moore discussed retaining CIMA for a safety review of the RHVP. On May 13, 2015, Mr. Ferguson spoke to Mr. Malone for this purpose, which resulted in the preparation of the 2015 CIMA Report, described throughout this chapter. Mr. Ferguson testified that he wanted this safety review to include a full review of lighting on the entire RHVP,

including the mainline, regardless of any comments or environmental assessments that had been done previously.

7.4. Public Works Committee Meeting on May 21, 2015

At the PWC meeting on May 21, 2015, the PWC received information update Report PW13081A on the implementation of recommendations from the 2013 CIMA Report, described above.

The PWC also passed Councillor Merulla's motion at the meeting. Also on May 21, 2015, Mr. Ferguson advised Mayor Fred Eisenberger (Mayor of Hamilton) and members of Council via email about Traffic's intention to obtain an RHVP safety review by the end of 2015. Council later passed the PWC report from this meeting, which included a recommendation that Council receive Report PW13081A, with amendments to content unrelated to the RHVP.

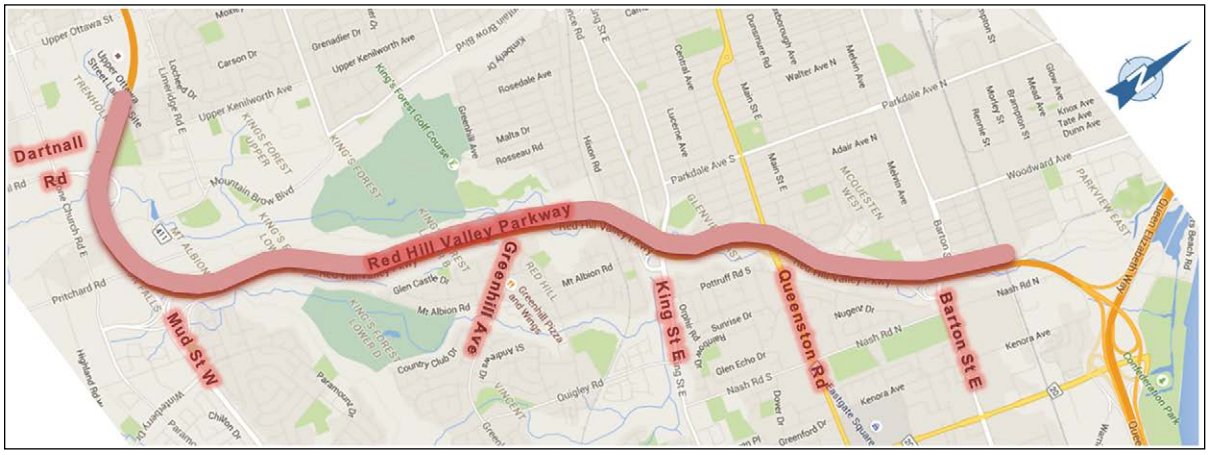
7.5. The 2015 CIMA Report

7.5.1. Scope and Mandate of the 2015 CIMA Report

On May 22, 2015, Mr. Ferguson emailed Mr. Cooper and Mr. Worron, copying Mr. Malone, explaining that CIMA should review the need for, and cost of, barriers and lighting on the RHVP in the 2015 CIMA Report. He also asked for an analysis of the type and causes of collisions on the RHVP. Mr. Ferguson wanted the 2015 CIMA Report completed by September 2015.

Mr. Malone provided CIMA's preliminary work plan for the 2015 CIMA Report the same day. CIMA initially proposed studying a 5 km road section along the RHVP, which started 1 km south of the Greenhill Avenue interchange and extended to the rail overpass north of the Barton Street interchange. This study area was later expanded to touch the limits of CIMA's study area on the LINC so that the project covered the entire RHVP mainline, including the sections that had been excluded from the 2013 CIMA Report, as shown in **Figure 7a.**

Figure 7a: Study Area in the 2015 CIMA Report



CIMA wanted to restrict its review to the mainline sections and acceleration and deceleration lanes at the interchanges of the RHVP. CIMA confirmed that it would perform a collision review, review basic roadside design elements and illumination, and consider the need for a median barrier system on the RHVP. To that end, CIMA provided a list of data that the City needed to provide in order to allow CIMA to complete the assignment. This list included a full collision summary report, motor vehicle accident reports, traffic volume data, and information related to planned work in the study area. Later, in July 2015, Mr. Worron asked Mr. Malone if there was merit in comparing the safety performance of the RHVP and LINC against similar facilities. Mr. Malone replied that comparing the RHVP to other facilities would be more challenging and costly due to a lack of publicly available data on comparator roadways.

On June 3, 2015, Mr. Ferguson emailed Mr. Malone to let him know that the City's TMP would consider widening of both the RHVP and LINC. City staff were concerned that CIMA's recommendations might change if the roadways were widened. Mr. Malone advised that CIMA would consider the potential widening of the roadways in making its recommendations.

In July 2015, there was another fatal collision on the RHVP in which a young man on a motorcycle collided with a car between the Greenhill and Mud Street exits.

7.5.2. City Delay in Authorizing CIMA to Proceed with 2015 CIMA Report

As a result of ill-defined roles and an apparent miscommunication between Mr. Worron and Mr. Cooper, and some delays in the City's Procurement office, the City did not provide CIMA with a purchase order or formal authorization to proceed with the 2015 CIMA Report until mid-July. City staff also did not provide comments on CIMA's preliminary work plan until July 2015. These delays extended CIMA's timeline for providing a draft report.

Mr. Cooper, Mr. Worron, and Mr. Ferguson were all involved in the 2015 CIMA Report project, although it is clear that their roles and responsibilities on the project were not clearly defined. In contrast to Mr. Field's involvement in 2013, no one from Engineering Services was engaged to join the City's project team for the 2015 CIMA Report.

7.5.3. Mr. Moore Sends Mr. Malone RHVP Friction Testing Data from 2007 to 2013

By the end of July 2015, Mr. Cooper reported to his colleagues in Traffic that CIMA had all the data required for the 2015 CIMA Report, but that the City would need to provide CIMA with ongoing information about recent collisions on the parkway.

By early August 2015, CIMA had done a collision analysis for the entire RHVP using the updated collision information it received from the City, which comprised data for the period from December 2007 to June 30, 2015. CIMA found that certain areas of the RHVP had a significant number of wet road collisions, including the section of the RHVP CIMA had studied in the 2013 CIMA Report. CIMA also found that vehicles on the RHVP were travelling at high speeds.

Mr. Malone testified that because the 2013 study area continued to have a preponderance of wet road collisions, CIMA thought this collision history could be "indicative of a need for friction testing to understand the asphalt performance". In the 2013 CIMA Report, CIMA had recommended friction testing between Dartnall Road and Greenhill Avenue. Following that recommendation, the City had not provided CIMA with any friction testing results and, as of early August 2015, CIMA did not know whether the City had done friction testing on the RHVP or had taken any other steps

to improve friction on the RHVP. In 2015, CIMA identified the same findings about wet road collisions in the areas of the RHVP that had been included in the 2013 CIMA Report study area, as well as in the areas that had not been considered in 2013.

CIMA did not ask any of the City's project team members for the 2015 CIMA Report (Mr. Worron, Mr. Cooper, or Mr. Ferguson) for information about whether the City had done friction testing on the RHVP since 2013. Instead, Mr. Malone called Mr. Moore, who was not on the City's project team. Mr. Malone testified that he knew that Mr. Moore would be the person at the City responsible for undertaking friction testing on the RHVP, and that he thought asking Mr. Moore for the results was the most expedient route.

Mr. Malone called Mr. Moore on August 6, 2015. Mr. Malone did not have a detailed recollection of the content of this call; Mr. Moore did not recall the call at all. During that call, Mr. Malone testified that Mr. Moore told him that the RHVP was paved with SMA, which Mr. Moore said had "higher skid resistance". Mr. Moore also said that the MTO had done friction testing on the RHVP, although he did not say when the MTO performed this testing. However, Mr. Malone's impression from the call was that the MTO testing, of which Mr. Moore advised him, was not responsive to CIMA's 2013 recommendation and that the City had not done friction testing on the RHVP in response to that recommendation.

The next day, on August 7, 2015, Mr. Moore forwarded Mr. Malone the January 2014 Uzarowski Email and its attachments (spreadsheets of data from the MTO's RHVP friction testing in October 2007 and a 2009 paper on SMA early age low friction problems in Ontario). As set out in Chapter 6, the January 2014 Uzarowski Email stated:

> The surface asphalt on the RHVP is Stone Mastic Asphalt (SMA). Immediately following construction of the RHVP in 2007, the Ontario Ministry of Transportation performed friction testing in both southbound lanes. The following table summarizes the results of this testing. The complete testing results are attached.

Lane	Average Friction Number	Friction Number Range
Southbound Lane 1	33.9	28.1 to 36.5
Southbound Lane 2	33.8	28.4 to 37.4

In 2013, the Friction Numbers were measured on the RHVP in both directions by Tradewind Scientific using a GripTester. The average FN numbers were as follows:

SB Right Lane 35

SB Left Lane 34

NB Right Lane 36

NB Left Lane 39

In 2009 the Ontario Ministry of Transportation published a paper at the Canadian Technical Asphalt Association Annual Conference titled “Early Age Low Friction Problem of SMA in Ontario”. The paper presented results of SMA that had been placed on Highway 401. The Friction Number results following construction were below anticipated value of 30 and ranged from 24.9 to 28.8. The paper is attached.

In his covering email forwarding the January 2014 Uzarowski Email to Mr. Malone, Mr. Moore wrote only: “Here is the Red Hill friction testing summary. Not for republication! Thanks”. In testimony, Mr. Moore could not recall what he meant when he told Mr. Malone that the friction information was not for republication, except to say that he “just didn’t want too much information out there” and he anticipated that, if CIMA had required this information for its report, Mr. Malone would have said so in response to Mr. Moore’s statement. Mr. Moore testified that he was aware that the MTO believed there were liability concerns associated with disclosing friction testing values publicly, and this “may in turn have led to a belief in that regard for [himself]” and for the City.

Mr. Malone testified that he interpreted Mr. Moore’s comment to mean that the friction testing information was the property of the MTO, rather than the City, and that Mr. Malone would not publish this information in the 2015 CIMA Report because it was

proprietary MTO information. In any event, there is no suggestion in any documentation or otherwise that CIMA contemplated the publication of this information in the 2015 CIMA Report.

Later on August 7, Mr. Malone responded to Mr. Moore's email with several questions, shown below in black text. Mr. Moore responded on August 10 by adding his own answers to Mr. Malone's original email in red text:

> Thanks very much Gary. Don't worry, we will not re-publish this information.
>
> To make sure I'm understanding correctly, this is the data from the MTO testing in 2007, as well as the MTO report on the subject. Am I correct that FN numbers of less than 30 are below a desired level? Only MTO could tell you that. They keep this info very close to the vest so it can't be used against them in an action or suit. But that seems to be the case. Figure 1 of the MTO report shows 30 as what appears to be a threshold. I have also read that FN numbers greater 35 (or higher) in a zone that would suggest skid resistance is not an issue on the pavement. Is that correct? Don't know.
>
> Do you have a performance specification for the FN value you strive for? No, it is not a city specification. The SMA traditionally satisfied all the criteria we were looking for ; lower noise profile, high performance pavement in terms of rut resistance and friction (skid resistance).
>
> The 2013 testing values certainly look higher. Are they done using the same methodology and tool as the MTO work, and thus could be directly compared? The testing was done by MTO both times so I would say they are comparable.

Mr. Malone understandably took from Mr. Moore's responses that the MTO had conducted friction testing in 2007 and again in 2013, and that the City itself had not done any friction testing on the RHVP as CIMA had recommended in the 2013 CIMA Report.

In testimony, Mr. Moore could not explain why he did not send the Tradewind Report to Mr. Malone in 2015, or why he told Mr. Malone that both friction tests were done by

MTO, if as he asserted, he knew that Tradewind did the 2013 testing, and that "it was different".

Mr. Moore's responses were incorrect in a number of respects, including that the MTO had conducted the 2013 testing. However, I do not think that Mr. Moore intended to mislead Mr. Malone at the time, either in sending Mr. Malone the January 2014 Uzarowski Email but not the Tradewind Report, or in his responses to Mr. Malone's questions. Instead, Mr. Moore's conduct and responses reflect how little Mr. Moore understood or had retained at this time regarding the Tradewind friction testing. It is further evidence that Mr. Moore did not read the Tradewind Report when he received it, as discussed in Chapter 6, and that he had not done so by August 2015, and that, contrary to his testimony, Mr. Moore was not waiting for Dr. Uzarowski to provide him with more information about the Tradewind Report.

Mr. Malone accepted Mr. Moore's statements at face value, and did not take steps to confirm the information Mr. Moore provided to him with other City staff. Mr. Malone testified that he understood Mr. Moore's response to be a definitive answer that the City had not conducted its own friction testing because it came from the person who would be responsible for friction testing on the RHVP. Mr. Malone forwarded Mr. Moore's email to his CIMA colleagues, stating that it was not for public release. Based on his understanding that the MTO, not the City, had done the 2013 testing, Mr. Malone told his colleagues that the City had "abdicate[d] responsibility for assessing friction on the pavement surface to the MTO for some reason" and that CIMA would "need to decide how to deal with this in the report."

Mr. Moore did not tell Mr. Ferguson or anyone else in Traffic that he provided this information about friction testing to Mr. Malone. At this point, no one in Traffic knew the Tradewind results existed. Mr. Moore testified that he expected that Mr. Malone would relay the information about friction testing to the City staff responsible for the 2015 CIMA Report project. If true, this is a sign of the lack of transparent communication and siloed nature of Public Works at the time. In any event, CIMA did not communicate this information to the City's project team for the 2015 CIMA Report.

7.5.4. CIMA Delivers a Draft of the 2015 CIMA Report

CIMA sent the City a draft of the 2015 CIMA Report, summarized below, on September 6, 2015, having earlier delivered the 2015 CIMA LINC Report. Mr. Ferguson planned to provide a draft staff report to senior management on both the 2015 CIMA Report and the 2015 CIMA LINC Report by September 14, 2015.

7.5.4.1. Findings and Recommendations in the Draft 2015 CIMA Report

The draft 2015 CIMA Report identified its purpose as the following: to review the safety and operational performance along the entire length of the RHVP, and to identify measures that could potentially improve performance and reduce the number and/or severity of collisions. CIMA advised that particular focus had been placed on collisions related to the median and median crossover, and on the potential need for illumination on the parkway. However, the scope of the 2015 CIMA Report did not allow for consideration of any major changes in the geometric design of the RHVP.

CIMA reviewed the RHVP collision data from January 1, 2008, to July 23, 2015, to understand the safety issues on the parkway. CIMA conducted its review in two parts — the first considered all collision types, while the second focused on collisions related to medians. CIMA determined that:

a) Wet surface collisions represented approximately 50% of all collisions in the RHVP study area, which was “significantly high compared to typical proportions”;

b) 44% of all collisions in the RHVP study area were Single Motor Vehicle (“SMV”) collisions, and 56% of SMV collisions occurred under wet surface conditions;

c) The most frequent apparent driver action reported in RHVP collisions was “lost control” (35%), followed by “driving properly” (23%) and “speed too fast” (12%). According to CIMA, the “lost control” driver action was related to unexpected circumstances such as mechanical malfunction, an object on the roadway, a slippery road surface, or losing consciousness. Both “lost control” and “speed too fast” were significantly higher than typical proportions, and four of every five collisions reported as “speed too fast” occurred under wet surface conditions;

d) The RHVP areas with the highest collision frequencies were (1) a 600 m section around the King Street interchange in the northbound lane and (2) 100 m sections near the on ramps for the Queenston Road, Barton Street, and King Street interchanges in the southbound lanes. All of these locations are located within, on approach to, or leaving horizontal curves;

e) 28% of all collisions in the RHVP study area were median related, and approximately 58% of median related collisions occurred under wet surface conditions; and

f) The locations on the RHVP with the highest frequency of median related collisions were in the vicinity of the King Street and Queenston Road interchanges. CIMA determined that wet surface conditions were present in 74% of median related collisions at these locations.

CIMA went on to state in the draft 2015 CIMA Report that the overall findings from the collision review indicated that the proportion of wet surface collisions in the RHVP study area (from approximately 500 m west of the Dartnall Road interchange to approximately 500 m north of Barton Street) was significantly higher than observed in the City and Ontario. CIMA stated that a high proportion of wet surface condition collisions suggested that one or more of the following conditions may be present:

a) inadequate skid resistance (surface polishing, bleeding, contamination);

b) hazardous manoeuvres that may be related to avoidance manoeuvres or surface deficiencies (potholes, waves, other deformations, water accumulation); and/or

c) excessive speed.

In that regard, CIMA made the following comment regarding the context in which excessive speed could be a factor:

> Another indication that high speeds may be involved is the fact that some curves within the study area (in particular the four curves in the vicinity of King Street and Queenston Road) appear to have curve radii of approximately 525 metres, which is the minimum per Provincial Standards for a design speed of 110 km/h and a maximum superelevation

of 6%. Under these circumstances, a vehicle slightly exceeding the design speed could run off the road while negotiating these curves. This section of the RHVP presents the highest concentration of collisions in the study area, with an increased proportion of wet surface collisions.

CIMA concluded, based on the collision review, that it appeared that the combination of high vehicle speeds and wet surface conditions might have been the primary contributing factors to collisions on the RHVP, particularly in the vicinity of the King Street and Queenston Road interchanges where vehicles have to travel small-radius horizontal curves. The driver experience on these curves is described in Chapter 2.

CIMA also conducted a field study on the RHVP and observed that most drivers adhered to the 90 km/h speed limit. However, speed studies conducted by Pyramid Traffic Inc. ("Pyramid") on the RHVP in 2013, which CIMA included in the draft 2015 CIMA Report, showed that one in six drivers exceeded the assumed design speed of 110 km/h (as discussed in Chapters 2, 10 and 12, the correct design speed is 100 km/h) in the northbound direction and one in five drivers did so in the Southbound direction. CIMA noted that these high speeds could be contributing to collisions, especially SMV and wet surface condition collisions. CIMA also noted that an average of more than 500 vehicles per day were recorded exceeding 140 km/h on the RHVP. CIMA's chart summarizing the results of its speed study is set out in **Figure 7b.**

Figure 7b: Results of CIMA's Speed Studies Included in 2015 CIMA Report

Measure	Northbound	Southbound
Average speed	95 km/h	99 km/h
85th percentile speed	110 km/h	115 km/h
Exceeding speed limit	60%	72%
At or exceeding design speed	15%	22%
Exceeding 140 km/h	> 500 per day	
Location: Mainline between Mud St. and Greenhill Ave. *Date: May 2013*		

While CIMA referred to the statistic of drivers exceeding 140 km/h, it is important to note CIMA's observation that much lower speeds, only slightly over the assumed design speed, could result in accidents, given the tight geometry of some of the curves on the RHVP, particularly the four curves in the vicinity of King Street and Queenston Road.

CIMA also conducted an illumination review using warrants from the TAC Roadway Light Guide and MTO Policy for Highway Illumination[2] (referred to as the TAC and MTO warrant systems, respectively) to determine if the City should consider installing illumination in the RHVP study area. In the draft 2015 CIMA Report, before CIMA addressed the results of the warrants, CIMA observed that the illumination design choices on the RHVP were intimately linked to the approval process for the parkway. CIMA then explained that the MTO and TAC warrant systems assess road geometry, operations, environmental, and collision factors to determine if illumination is needed on a roadway. The result of both the TAC and MTO warrants was that continuous illumination was warranted on the RHVP, subject to a cost-benefit analysis.

CIMA set out a number of countermeasures for reduction of overall collisions on the RHVP, plus the expected costs and benefits for each countermeasure. CIMA's recommended countermeasures included targeted police enforcement for speeding and installation of speed feedback signs, oversized speed limit signs, continuous illumination, and "slippery when wet" signs. CIMA also recommended that the City consider undertaking pavement friction testing on the RHVP in light of the high proportion of wet surface condition and SMV collisions on the parkway. To mitigate median related collisions, CIMA recommended that the City install a high-tension cable median barrier on the RHVP.

CIMA summarized its recommendations in a "Countermeasures Summary Table", reproduced below at **Figure 7c.** The version of the countermeasures table included in the draft 2015 CIMA Report did not include illumination. CIMA identified timelines for implementation of the listed countermeasures as either short, medium, or long term. However, CIMA did not include any information to establish the respective time range for those categories, which it had done in the 2013 CIMA Report.

[2] The illumination warrant systems are described in Chapter 6.

CIMA listed “conduct pavement friction testing” as a short term countermeasure in the draft 2015 CIMA Report. Mr. Malone testified that CIMA elevated the importance of the friction testing recommendation in 2015 by listing it as a short term countermeasure, because he had not been provided with any information to indicate that the City had completed friction testing in response to CIMA’s 2013 recommendation to do so. However, this rationale was not explicit in the 2015 CIMA Report.

Figure 7c: Countermeasures Summary Table from Draft 2015 CIMA Report

Countermeasure	Construction Cost ($)	Timeline	Comment
Conduct speed enforcement	—	ongoing	
Trim vegetation at on-ramps	—	ongoing	
Install oversized speed limit signs	$7,000	short term	
Install “slippery when wet signs”	$8,000	short term	
Supplement “slippery when wet signs” with rain activated flashing beacons	$120,000	short term	4 signs in the vicinity of King and Queenston interchanges
Install “merge” signs	$1,000	short term	
Install “bridge ices” signs	$2,000	short term	
Upgrade median guide rail end treatments	$70,000	short term	

Countermeasure	Construction Cost ($)	Timeline	Comment
Install, replace or trim vegetation obscuring Wa-33 signs at guide rail end treatments	$3,500	short term	
Conduct pavement friction testing	$40,000	short term	
Install speed feedback signs	$80,000	short term	In conjunction with regular speed enforcement; costs may be higher depending on design
Install PRPMs from Greenhill to QEW	$98,800	short term	
Short Term Total	**$430,300**		
Install high-tension cable guide rail	$2,528,400	long term	Consider effect on median related collisions of countermeasures to reduce speed and wet surface collisions
Grand Total	**$2,958,700**		

7.6. City Staff Prepare a Draft Staff Report Related to the 2015 CIMA Report and 2015 CIMA LINC Report

7.6.1. Traffic's Initial Draft Staff Report

On September 19, 2015, Mr. Ferguson emailed Mr. White a copy of a draft recommendation report[3] addressed to the PWC (which became Report PW15091). This draft report summarized the 2015 CIMA LINC Report and the draft 2015 CIMA Report.

With respect to CIMA's collision analysis for the RHVP, the draft recommendation report set out that the RHVP experienced an average of 63 collisions per year between January 2008 and July 2015, and that, of the total 474 collisions, 28% were median related and 63% occurred in daylight conditions. The draft recommendation report also stated that CIMA had determined that high speed was contributing to collisions on the RHVP, reiterating CIMA's finding that roughly 500 vehicles per day were travelling the RHVP in excess of 140 km/h.

However, the draft recommendation report omitted CIMA's finding that approximately 50% of all collisions in the RHVP study area occurred in wet surface conditions, and that the observed proportion of RHVP wet surface collisions was significantly higher than those observed in the City and Ontario. It also did not set out CIMA's finding that the primary contributing factors to collisions on the RHVP might be a combination of high vehicle speeds and wet surface conditions, exacerbated by the geometry of the roadway in certain locations. The draft recommendation report also did not reference CIMA's finding that inadequate skid resistance and/or hazardous manoeuvres that might be related to avoidance manoeuvres or surface deficiencies could be contributing to the high proportion of wet surface collisions on the RHVP, in addition to the excessive speeds.

There is no explanation for these omissions. By this time, Traffic staff were well aware of the high proportion of collisions occurring under wet conditions on the RHVP from the collision analysis in the 2015 CIMA Report. In addition, as noted above, in October

[3] A general description of recommendation reports is provided in Chapter 4.

2013, Mr. White had also advised Mr. Lupton that his staff had identified a “statistically significant” number of wet surface collisions on the RHVP. In fact, collisions occurring under wet surface conditions appear to have been a regular topic among Traffic staff. In 2015, staff emailed one another about wet surface collisions as they occurred. At the same time, staff in Operations who were responsible for roadway inspections, minor rehabilitation, and maintenance work on the RHVP, also internally discussed further collisions in wet weather conditions on the RHVP throughout 2015, on one occasion describing the RHVP as a “demolition derby” whenever it rained.

Consistent with the draft 2015 CIMA Report, the draft recommendation report stated that illumination was included in the scope of CIMA’s work, but that illumination in the original design for the RHVP was restricted for reasons connected with environmental approvals. The draft recommendation report did not explicitly state that the RHVP met the MTO and TAC warrants for continuous illumination, but it included a recommendation that Engineering Services investigate the implementation of illumination on the RHVP.

The draft report recommended that investigation and/or implementation of the countermeasures be shared between several divisions and sections in Public Works: Traffic, Engineering Services, Forestry, and Roads & Maintenance (in Operations). The recommendations contemplated that Traffic would use the Red Light Camera fund to complete the countermeasures that were not assigned to another Public Works division or section in the report.

The draft recommendation report included recommendations for actions to be investigated or completed by Engineering Services, with funding for these actions to be identified by either Council or Engineering Services. These recommendations were that Engineering Services be directed to investigate the installation of a high-tension steel cable median barrier and illumination on the RHVP, to report back to PWC with a proposed implementation and budget plan for the barrier and illumination, and to complete pavement friction testing using the 2016 Engineering Services Operating Budget. The draft report did not include a rationale for such testing or reference the fact that CIMA had recommended friction testing in 2013.

The draft recommendation report further explained that the ongoing review of the City’s TMP, which would be completed by Transportation Planning in 2016, would

review the need for additional lanes on the RHVP and LINC, and that, if additional lanes were recommended, the median barrier design and type might change. In Traffic staff's view, it was therefore prudent to wait for the TMP to be approved before proceeding with a median barrier on the RHVP or LINC.

7.6.2. Mr. Moore Objects to Recommendations from the Draft 2015 CIMA Report

Although the subject matter in the 2015 CIMA Report involved the mandates of both Traffic and Engineering Services, Traffic did not involve Engineering Services staff in setting CIMA's mandate in the 2015 CIMA Report, or at any point while CIMA was completing its work for the 2015 CIMA Report. The events described below illustrates the difficulty Traffic staff had in reporting on CIMA's recommendations to the PWC, due to the absence of proper coordination with, and buy-in from, Engineering Services from the outset of CIMA's assignment.

As noted above, in Mr. Ferguson's draft recommendation report, he assigned specific Public Works divisions and sections to complete the measures recommended by CIMA to ensure that responsibility for the recommendations was clearly allocated. This drafting was not typical; generally, recommendation reports direct the General Manager of Public Works to complete the recommendations approved by the PWC. In turn, the General Manager of Public Works would then assign tasks to specific divisions or sections.

On September 22, 2015, Mr. Ferguson emailed several directors in Public Works, including Mr. Moore, setting out the recommendations he had assigned to their respective staff in the draft recommendation report. Mr. Ferguson's email to Mr. Moore, set out the recommendations from the CIMA reports that he proposed to assign to Engineering Services as follows:

> As you are aware, I am just finalizing the RHVP/LINC report and I have included the following recommendations that impact Engineering Services;
>
> (b) That Engineering Services be directed to investigate the High Tension Steel Cable Median Barrier installation and Shield Rock Cuts

> on the LINC and RHVP and report back to Public Works Committee with a proposed implementation and budget plan.
>
> (c) That Engineering Services be directed to identify a funding source to complete Pavement Friction testing on the RHVP in its entirety at an estimated cost of $40,000, and
>
> (d) The Engineering Services be directed to identify a funding source to complete the installation of Shoulder Rumble Strips along the LINC at an estimated cost of $105,000, and
>
> (e) That Engineering Services be directed to investigate the installation of Illumination on the RHVP and report back to Public Works Committee with a proposed implementation and budget plan, and
>
> C and D I see as works to take place, B and E I believe will be long term possibilities.
>
> Are you ok with the recommendations or is there other wording you would like?

Mr. Moore replied to Mr. Ferguson the next day, copying Mr. Mater into the email chain:

> Dave, sorry I wasn't aware! I need to see it and it needs to be discussed at DMT or at least with John, Gerry and myself before it goes, but in any event here's my comments.
>
> 1. You can take Engineering Services off every line. We don't do investigations we do programming, design and tender and construction supervision
>
> 2. What is friction testing going to tell you if, you don't have anything to compare it to. There's no provincial data base or guideline. The MTO will never discuss this with you because it opens up an entire line of liability on every road.
>
> 3. With regard to rumble strips. Our previous information from industry was that you really need to put these in fresh asphalt not old asphalt. The shoulder is the original pavement from 1997, if you start milling

> you could do damage to the shoulder integrity. We discussed this when we were doing the LINC overlay in 2012, it would have required and additional 0.6m of shave and pave along the entire length of the LINC in both directions. Not affordable or required. Milling of existing pavement should be investigated further but I think your number is off by about $500K. If it is possible, then if you want rumble strips , say so, and direct the GM of PW to identify possible funding in up-coming budget submissions.
>
> 4. We have said over and over, illumination of the Red Hill or Linc is never going to happen so stop asking. The approval was based on no illumination for environmental reasons, it is unaffordable, un-sustainable and un-necessary. It would be a $8-12M project plus protection(barriers, guide rail) and then the maintenance costs.

Mr. Moore testified that he did not know whether he had reviewed the draft 2015 CIMA Report prior to responding to Mr. Ferguson's email. In his testimony, Mr. Moore agreed that Engineering Services would be responsible for installing median barriers and shield rock cuts, but stated that Engineering Services' responsibility only began once those items had been identified and approved by the PWC. In his view, Engineering Services did not do investigations. He testified that he was "making an attempt to educate Mr. Ferguson" on the impacts of the recommendations in his email.

Leaving aside Mr. Ferguson's atypical drafting approach, there is no doubt that all the actions identified in Mr. Ferguson's email and any investigations into such work fell under Engineering Services' purview. It was reasonable for Mr. Ferguson to assume those actions would be assigned to Engineering Services, if the PWC and Council approved them.

Mr. Moore's comments in his email to Mr. Ferguson reflect Mr. Moore's views on lighting, including those expressed during his testimony. He had concluded that illumination on the RHVP was "unnecessary" because "the original design concluded that partial illumination…satisfied all the design parameters for the roadway". Mr. Moore testified that, even if a traffic safety expert concluded that the RHVP was unsafe without illumination, he did not know if he would have gone through the process of trying to figure out how to implement illumination on the parkway. He would need

Council to know what all of the constraints would be before time and resources were spent on “expectations that can’t be fulfilled”.

Mr. White and Mr. Ferguson testified, in effect, that it was the responsibility of Mr. Moore and Engineering Services staff to advise Council of the time, resources, and process involved to change the RHVP’s lighting in response to Councillor Merulla’s motion, and this did not happen at this time given Mr. Moore’s views. It is evident from Engineering Services’ subsequent actions regarding lighting, discussed below and later in this Report, that this was Engineering Services’ responsibility.

In his testimony, Mr. Moore did not provide a persuasive explanation when asked at the Inquiry why he did not tell Mr. Ferguson that he had already done friction testing on the RHVP in 2013 and had not found it helpful. Mr. Moore maintained in his testimony that he “did not know what you would do with [friction testing results] if you didn’t know what the standards were or how to interpret it” since “no one had any ability to assess what the number meant even if you could compare it to something”, and that his view in this respect was bolstered by the fact that he was purportedly waiting for an explanation of friction standards from Golder, the latter of which is testimony I have rejected in Chapter 6.

There is no evidence that Mr. Moore had provided any written update or confirmation to Traffic staff that friction testing of the RHVP had been conducted in 2013, other than possibly providing Kris Jacobson (Superintendent, Traffic Operations, Traffic Operations & Engineering; Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton) with the conclusion that the crosswalk testing had not provided useable results at some time after June 2014 and involving Mr. White in the logistical arrangements for the Tradewind testing in 2013. At this time, Traffic staff — namely, Mr. Ferguson, Mr. White, Mr. Cooper, and Mr. Worron — were all either unaware or had not received confirmation that friction testing had been done, either in response to the 2013 CIMA Report or for any other reason.

Related to this point, Mr. Lupton testified that he discussed friction testing on the RHVP with Mr. Moore, Mr. Mater, and Betty Matthews-Malone (Director, Operations, Public Works, Hamilton), possibly following a Department Management Team (“DMT”)

meeting,[4] as Mr. Moore had suggested in his email to Mr. Ferguson above. Mr. Lupton could not recall exactly when this discussion occurred, but thought it might have occurred in the days following the meeting between City and CIMA staff on October 20, 2015, discussed below. Mr. Lupton recalled that he was aware that friction testing had been conducted and that Mr. Moore made comments similar to those in Mr. Moore's September 23 email to Mr. Ferguson, set out above, regarding the value of friction testing.

None of Ms. Matthews-Malone, Mr. Mater, or Mr. Moore recalled this meeting specifically, although Mr. Moore suggested it was possible that he discussed the draft 2015 CIMA Report at or after a DMT meeting. It is not possible to confirm that this discussion occurred. However, the comments attributed to Mr. Moore regarding the merits of friction testing are generally consistent with other comments which Mr. Moore made.

7.7. Mr. Moore Meets with CIMA and Comments on the Draft 2015 CIMA Report in October 2015

7.7.1. Meeting with CIMA

CIMA sent Mr. Worron, Mr. Cooper, and Mr. Ferguson revised copies of the 2015 CIMA Report and 2015 CIMA LINC Report on October 7, 2015, which CIMA considered final at the time.

On October 20, 2015, Mr. Malone, Giovani Bottesini (Project Engineer, Transportation, CIMA), and Khaled Hawash (Traffic Engineering, Transportation, CIMA) met with Mr. Moore, Mr. Ferguson, and Mr. White to discuss the reports. None of the attendees who provided evidence before the Inquiry had a clear memory of this meeting, or why Mr. Moore attended. As noted above, Mr. Moore was not a member of the City's project team for the 2015 CIMA Report.

[4] DMT meetings were meetings between the senior directors and/or directors of the various divisions in Public Works and the General Manager of Public Works, and were generally held every two weeks.

The minutes of this meeting, which CIMA prepared, indicate that Mr. Malone summarized the findings and recommendations from the 2015 CIMA Report. The minutes reflect that Mr. Moore advised the attendees that friction testing had been "conducted recently following standards" and "resulted satisfactory", contrary to Mr. Moore's testimony that he would not have done that. I find that he did provide this information as recorded in the minutes.

The minutes went on to note that CIMA clarified that "actual weather conditions occurring on the RHVP may exceed typical testing conditions and more rigorous testing could be undertaken in order to rule out pavement friction as a problem" and that "speeding is definitely a contributing factor but the contribution of pavement should be ruled out." I understand these to mean that CIMA believed more testing was required before a determination could be made that friction was not a possible contributor to the accident experience on the RHVP.

The minutes appear to reflect that CIMA proposed that the City address speed and wet surface collisions first and then re-evaluate the benefit of a median barrier.

Mr. White and Mr. Ferguson both testified that they did not recall this meeting with CIMA. This meeting would have been, however, the first time they received information from Mr. Moore about the results of friction testing, as they testified that they had not been advised by Mr. Moore that friction testing results for the RHVP were "satisfactory" at any time before October 20, 2015.

There is no evidence that Mr. White or Mr. Ferguson took any steps after this meeting to obtain the friction testing results Mr. Moore referenced, or that Mr. Moore offered CIMA (or that CIMA requested) a copy of friction testing results. Mr. White testified that if Mr. Moore said the friction testing results were satisfactory, he would have taken that information at face value. For CIMA's part, CIMA was not looking for friction testing results for the purposes of finalizing the 2015 CIMA Report, and Mr. Malone had already received friction information (which he understood to have been from the MTO) from Mr. Moore in August 2015.

The meeting minutes also reflect that the attendees discussed "[i]ssues with illumination…(cost + environmental restrictions)" and that Mr. Moore expressed a preference for the term "potential solutions" instead of "recommendations".

Following this meeting, CIMA emailed what it identified as “final draft” versions of its reports to the City, which were distributed by email to Mr. Ferguson, Mr. Cooper, Mr. Worron, Mr. White, Mr. Mater, Mr. Lupton, and Mr. Moore on October 20, 2015.

7.7.2. Mr. Moore Comments on the Draft 2015 CIMA Report

On October 29, 2015, Mr. Moore sent his comments on the draft 2015 CIMA Report to Mr. Ferguson. Mr. Ferguson forwarded Mr. Moore’s comments to Mr. White, Mr. Lupton, and Mr. Mater later that day.

The following summarizes Mr. Moore’s comments on the October 2015 version of the 2015 CIMA Report, which I will refer to here as the draft 2015 CIMA Report.

Section 3, Study Area, of the draft 2015 CIMA Report described the study area, including that the RHVP’s design speed was “assumed to be 110 km/h”. Mr. Moore commented “not necessarily true” on this statement, without any other explanation. Mr. Moore did not correct CIMA’s assumption of the parkway’s design speed, which Mr. Moore believed varied from 100 km/h to 110 km/h, depending on the portion of the RHVP. Both Mr. Moore and CIMA’s assumptions were incorrect; as described in Chapters 2, 10, and 12, the design speed for the entire length of the RHVP is 100 km/h.

Mr. Moore commented in two sections of the draft 2015 CIMA Report regarding CIMA’s recommendation to install “slippery when wet” signs on the RHVP due to the high proportion of wet pavement collisions. Mr. Moore wrote that the RHVP was “not slipperier when wet any more than any other road” and commented, in respect of CIMA’s language that the RHVP had significantly reduced wet weather skid resistance, “So does every other road in Ontario!” Mr. Moore acknowledged in his testimony that he had no data to support the former statement, apart from his own knowledge that there was a “premium pavement” on the RHVP and his own driving experience on the RHVP. His statement was inconsistent with the findings of the collision history analyses performed by CIMA in both 2013 and 2015. In place of the recommended “slippery when wet” signs, Mr. Moore suggested a sign that said “drive according to road conditions”, which is not a recognized roadway sign in Ontario. He also commented “I can’t increase the skid resistance!”

The draft 2015 CIMA Report included a statement that guidelines suggested that slippery when wet signs should be installed where, for no identifiable reason, more than one-third of all collisions on a given road section were occurring on wet pavement. In response to this statement, Mr. Moore commented: “We know the reason, excessive speed!”

Section 6, Illumination Review, of the draft 2015 CIMA Report set out CIMA’s findings about RHVP illumination, including that illumination was warranted on the RHVP according to both the TAC and MTO policies. Mr. Moore commented on this section: “There is no sense at looking at the warrant for something that can’t and won’t be considered.”

In Section 7, Determination of Potential Countermeasures, Mr. Moore proposed deleting the entire subsection on friction testing. Mr. Moore also commented in this section: “[T]here is no basis, nothing to compare to and no other agency including the MTO doing this! It means absolutely nothing, except proving potential exposure to legal actions and confusion!”. The section he proposed to delete in full read as follows:

> Pavement friction plays a vital role in keeping vehicles on the road by enabling the drivers to control/manoeuver the vehicle in a safe manner (in both the longitudinal and lateral directions). Several methods and devices are available for measuring pavement frictional characteristics. Pavement surface texture is influenced by many factors, including aggregate type and size, mixture proportions, and texture orientation and details. Texture is defined by two levels: microtexture and macrotexture. Currently, there are no direct means for measuring microtexture in the field. However because microtexture is related to low slip speed friction, it can be estimated using a surrogate device. Macrotexture is characterized by the mean texture depth and the mean profile depth; several types of equipment are available for measuring these indices.
>
> 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. It is important to perform the tests under normal conditions as well as under typical wet pavement conditions encountered on the RHVP in order to simulate, as best as possible, the conditions

> under which collisions occur. For example, if more water accumulates on the pavement under typical conditions than under normal testing conditions, the tests may result satisfactory, when in reality friction may be reduced. Tests should also be performed near locations with the highest frequencies of wet surface collisions, especially curves.
>
> The estimated costs to undertake these are approximately $40,000. Based on the results, the City may be in a better position to determine if further action is required.

Mr. Moore confirmed in testimony that he was proposing that CIMA delete this content from the 2015 CIMA Report, but denied that his ultimate intention was to have CIMA remove the friction testing recommendation from the 2015 CIMA Report. However, he also acknowledged in his testimony that he wanted to discuss his comment, which "could very well have resulted" in that outcome. When Mr. Moore was asked during his testimony whether he turned his mind to the 2007 and 2013 RHVP friction testing results when he said there was "no basis" and "nothing to compare" the recommended friction testing with, Mr. Moore testified that comparing the results from 2007 and 2013 against new testing in 2015 "still doesn't tell you where you're going". Mr. Moore also denied that Engineering Services would be responsible for implementing the friction testing recommendation if it was approved by Council. Although Engineering Services had done the friction testing on the RHVP in the past, Mr. Moore stated that "anyone" could have been responsible for the recommendation in the 2015 CIMA Report.

7.8. Traffic Staff Continue to Prepare the Staff Report

7.8.1. Traffic Staff Discuss and Revise Their Recommendation Report

On October 30, 2015, in an email to Mr. Ferguson, Mr. White, and Mr. Lupton, Mr. Mater set out the internal deadlines Traffic would need to meet in order to present the recommendation report on the 2015 CIMA Report and the 2015 CIMA LINC Report to the PWC on December 7, 2015.

Mr. Moore was copied on this email because Mr. Moore and Mr. Mater planned to meet with Mr. Davis about the staff report. Mr. Mater testified that it was Traffic's job

to draft the report — they had taken on that responsibility — but that did not mean that they were responsible for all the action items arising from the 2015 CIMA Report. Traffic would present the staff report on the 2015 CIMA Report to the PWC over Mr. Moore's objections if necessary. The Inquiry received no evidence to determine if or when the meeting occurred, or about its content or outcome.

Following Mr. Mater's email, Mr. White directed Mr. Ferguson to redraft the recommendation report on the 2015 CIMA Report so that the recommendations were not assigned to specific Public Works divisions. Mr. White and Mr. Ferguson declined to make any changes to the draft recommendation report in response to Mr. Moore's comments on the draft 2015 CIMA Report, which they had received the day before. As Mr. White wrote to Mr. Lupton:

> Dave is making some changes in the recs and we will resend it to you. After that I'm not sure what to say. It recs the guiderail and lighting review and asphalt testing. All the things Gary argues against. Despite that I believe them to be prudent and required that we do this ethically and technically responsibly. We can talk after Dave sends it to us. Thanks.
>
> Frankly I think Chris Murray should be in on the discussions. He built the roadways. We can prevent some of these accidents from occurring and we should take action. Thanks.

Mr. Ferguson circulated a revised draft of the recommendation report to Mr. Mater, Mr. Lupton, and Mr. White on November 2, 2015. In this draft, the primary recommendation to PWC was for the General Manager of Public Works to "be directed to implement the collision countermeasures as outlined in [the] report". Mr. Ferguson listed the countermeasures proposed by CIMA, their estimated cost as identified by CIMA, and the time period for the implementation of each (short, medium, or long term).

In the revised draft recommendation report, the friction testing countermeasure was listed as a "medium term" measure, without identifying the fact that CIMA had characterized it as a short term measure in the 2015 CIMA Report. In fact, there were no medium term recommendations in the 2015 CIMA Report at all.

Mr. Ferguson further revised the draft recommendation report after he circulated the November 2 draft, having received comments from Mr. Lupton by email. The Inquiry

received documentary evidence that Mr. Ferguson may also have discussed the draft with Mr. Davis, Mr. Mater, and/or Mr. Moore, in advance of making further revisions, although there is no evidence as to what comments, if any, they may have made on the draft report.

In a further revised draft prepared by November 12, the recommendations for implementation were broken down into two sections, as follows.

First, the General Manager of Public Works would implement the "short-term safety options for consideration" as set out in Appendix A to the recommendation report and report back to PWC on the results. Appendix A included "Install Oversized Speed Limit Signs", "Install "Slippery When Wet" Signs", and "Conduct Study to Install Queue End Warning Systems" as short term options (0 to 2 years).

Second, "the design with [respect] to the medium and long term items would be deferred pending the outcome of the Transportation Master Plan (TMP) update." The medium and long term items (three in total) were listed on Appendix B to the recommendation report. "Conduct Pavement Friction Testing" was listed as a medium term option (2 to 5 years) and the installation of rumble strips, median barriers, and end to end illumination were long term options (6+ years).

The revised recommendation report contemplated that the TMP would be completed by Public Works in 2016, and that the TMP would review the need for additional lanes (widening) on the RHVP and LINC to address high traffic volume and congestion at certain times of the day. The Inquiry received evidence that the question of widening the RHVP and LINC was politically charged, and the subject of advocacy by many councillors and other politicians over the years. When it was suggested to Mr. Mater during his testimony that it could have been years, or even decades, before the RHVP could be widened, Mr. Mater stated that it would not be unreasonable to expect any big project, particularly one with the history of the RHVP, might take some time.

Although the recommendation report recommended deferring all medium and long term countermeasures pending the outcome of the TMP, it provided an explanation only for the recommended deferral of the median barrier installation. As had been noted in earlier drafts, the recommendation report advised that a median barrier (if installed) might need to be redesigned to accommodate additional travel lanes

if the LINC or RHVP were expanded pursuant to the TMP. The recommendation report further advised that implementation of short term countermeasures could also eliminate the need for a median barrier by reducing collisions on the RHVP.

The treatment of friction testing as a medium term countermeasure to be deferred pending completion of the TMP could not be explained or justified by the City witnesses.

The Inquiry received unsatisfactory evidence about the change of friction testing to a medium term countermeasure. Mr. Ferguson testified that he made this revision at the direction of either Mr. White, Mr. Lupton, or Mr. Mater, and that they gave this direction because the City wanted to identify “easy wins” to be completed within 0 to 2 years (that is, short term). Mr. Ferguson testified that no one ever explained to him why friction testing on the RHVP was not an easy win that could be completed in 0 to 2 years.

Although the 2015 CIMA Report had not set out time ranges for the short, medium, or long term countermeasures, Mr. Ferguson’s understanding was that CIMA had intended a 0 to 5 year timeframe when it identified friction testing as a short term countermeasure. Based on this, Mr. Ferguson considered the change to medium term to be consistent with the timeframes contemplated in the 2015 CIMA Report. Mr. White similarly testified that Traffic staff had not changed any of the information or timelines from the 2015 CIMA Report by categorizing friction testing as a medium term recommendation in the recommendation report. Rather, according to Mr. White, Traffic had simply identified short term options that could be completed in 0 to 2 years and set them out in Appendix A to the staff report. This explanation makes no sense and is most likely an after-the-fact justification. It is inconsistent with the rationale for the friction testing recommendation, which was to assess whether current friction levels were a contributory factor to the wet surface collisions occurring on the RHVP and to establish a baseline friction level for comparison purposes.

While the installation of rumble strips, median barriers, and illumination could all reasonably be affected by the possible widening of the RHVP and/or LINC, friction testing was not connected to, or impacted by, the potential widening of the RHVP in any manner. Mr. Mater told the Inquiry that he did not know how friction testing came to be included as one of the countermeasures deferred pending the outcome of the TMP, nor was he aware that CIMA had characterized friction testing as a short term

countermeasure in the 2015 CIMA Report. Mr. Mater could not recall if he obtained Mr. Moore's support to defer the friction testing pending the outcome of the TMP. By November 2015, he believed that some friction testing had already been done on the RHVP. Further, he and his staff in Traffic believed that Engineering Services would do friction testing on the RHVP after the completion of the TMP. At that time, they expected the TMP to be completed "more quickly" than it ultimately was. Although the recommendation report indicated that City staff expected to complete the TMP update in 2016, it was not completed until August 2018.

By December 3, 2015, a version of the recommendation report (which became Report PW15091) with the phased approach was approved as final and delivered for the PWC for its meeting on December 7.

As a result of the division of responsibility for, and deferral of, the medium and long term countermeasures, none of the work that would be the responsibility of Engineering Services had to be completed (or even considered) pending the outcome of the TMP. In my view, the approach was adopted by Traffic to avoid a confrontation with Mr. Moore regarding the merits of these countermeasures.

7.8.2. Mr. Ferguson Asks Mr. Malone to Revise the 2015 CIMA Report

On November 12, 2015, Mr. Ferguson emailed Mr. Malone the revised version of the draft recommendation report (described above) and requested that Mr. Malone make three changes to the 2015 CIMA Report and the CIMA LINC Report.

First, Mr. Ferguson asked Mr. Malone to change the use of "Recommendations" to "Option[s] for Consideration", which was the language Mr. Moore had suggested in the October 20, 2015 meeting with CIMA. CIMA implemented this change as requested. In reference to these changes, Mr. Malone explained during his testimony that the term "should be considered", which was included in the 2015 CIMA Report, has a very specific meaning in traffic and transportation engineering. It means that the action should be done unless there is a reason not to do it.

Second, Mr. Ferguson asked Mr. Malone to "add a blurb that talks about how the short term options may address the overall collision patterns that are occurring and therefore

potentially reducing the overall cost benefit ratio for the need of barriers and lighting." CIMA inserted a statement in the 2015 CIMA Report that the installation of a median barrier on the RHVP should only be considered after evaluating the performance of short term countermeasures.

Third, Mr. Ferguson directed Mr. Malone to the draft recommendation report in which City staff identified short, medium, and long term options, and asked Mr. Malone if the CIMA reports could have "a similar layout". After internal discussions within CIMA, CIMA chose not to change friction testing from a short term to a medium term countermeasure in the 2015 CIMA Report. Mr. Malone did not communicate the reason that CIMA declined to make the requested change to City staff, because, as he explained in his testimony, he did not think it was necessary to remind them that CIMA had already made a friction testing recommendation in 2013 and was repeating it in 2015.

CIMA emailed Mr. Ferguson the final copies of the 2015 CIMA Report and 2015 CIMA LINC Report on November 20, 2015.

7.9. Staff Present the 2015 CIMA Report to the Public Works Committee

7.9.1. City Staff Discuss Whether to Provide the 2015 CIMA Report to the Public Works Committee in Advance of the Meeting

On December 1, 2015, Mr. Ferguson provided Lauri Leduc (Legislative Coordinator, Office of the City Clerk, Finance & Corporate Services, Hamilton) with the final versions of the 2015 CIMA Report and the CIMA LINC Report for circulation to members of the PWC. Mr. Mater later raised a concern that the media might obtain and circulate CIMA's reports before the PWC meeting, and so he instead proposed distribution of the reports to interested councillors at the PWC meeting on December 7.

In the end, because the recommendation report indicated that copies of CIMA's reports were available, Ms. Leduc emailed copies of the 2015 CIMA Report and 2015 CIMA LINC Report to the Mayor and members of Council on December 3, 2015. Accordingly, the councillors on the PWC had copies of the two CIMA reports, as well

as the related recommendation report (Report PW15091), which was circulated as part of the PWC agenda package, in advance of the PWC meeting. The 2015 CIMA Report and 2015 CIMA LINC Report were also included in the PWC agenda package, which was uploaded to the City's website.

7.9.2. Public Works Committee Meeting on December 7, 2015

On December 7, 2015, Mr. Ferguson and Mr. Cooper presented the recommendation report to the PWC. As noted above, in the recommendation report, City staff recommended that the General Manager be directed to implement the short term safety measures, many of which Traffic was responsible for, and that the General Manager be directed to defer the medium and long term countermeasures for friction testing, the installation of rumble strips, median barriers, and end-to-end illumination, pending the outcome of the TMP update. City staff did not explain that their recommendation in Report PW15091 for the timing of the friction testing differed from CIMA's in the final 2015 CIMA Report.

7.9.3. Mr. Moore's Statements about RHVP Friction Testing at the Public Works Committee Meeting

At the December 7 PWC meeting, Mr. Ferguson addressed questions from Councillor Merulla about the effectiveness and necessity of CIMA's recommendations, which led to a discussion about speeding and wet surface conditions on the RHVP. Councillor Merulla raised a question about the quality of the asphalt on the RHVP during this discussion, stating:

> if the road is wet and you're speeding, that's going to contribute to the collision more so than the wet road itself, and I'm hearing a lot of nonsense on social media surrounding the fact that, through you Madam Chair, that the City had somehow provided or put in a low-grade asphalt, which is contributing to the frequency of collisions. Can you elaborate on how much nonsense that actually is?

Mr. Ferguson's response focused on driver behaviour, referring to the speed statistics described in Report PW15091. He explained the design speed of the RHVP (referring

to it as being 110 to 120 km/h, and asking Mr. Moore to confirm), and that the 85th percentile speed was in excess of the design speed, meaning drivers were:

> already in a predicament of putting themselves in a position that when you have bad weather is going to cause incidents to occur, they're going to slide, and that's what's creating the issue. It has nothing to do with, that I'm aware of, the pavement – it's the outright driver behaviour and the vehicle speeds.

Councillor Merulla asked Mr. Moore to elaborate on Mr. Ferguson's answer, with reference to the fact that "the asphalt that we're using is not a low grade asphalt compared to that of the MTO". Mr. Moore responded by advising that the RHVP had an SMA mix, a "premium asphalt mix". Mr. Moore then stated:

> We did friction testing – the Ministry actually did the friction testing initially, to see how it was – [be]cause we have a little different mix than them – and found that it was at or above what they would normally find with their high grade friction mixes. And we subsequently did it five years after, so 2012-2013, and found that it was holding up exceptionally well, so we have no – we have no concerns about the performance of the surface mix.

In response, Councillor Merulla asked Mr. Moore, "so the quality of that roadway is no different than that of any 400-series highway?" Mr. Moore responded that it was "actually above that grade."

In his testimony, Mr. Moore did not recall this exchange, nor did he recall attending the PWC meeting on December 7 more generally. However, this exchange between Councillor Merulla and Mr. Moore was available to the Inquiry in the form of a video of the PWC meeting.

Mr. Moore's comments regarding SMA and the 2007 friction testing were generally accurate. It is also true that the perpetual pavement structure was generally performing well. However, Mr. Moore's statement that 2012-2013 friction testing found friction levels that demonstrated that the pavement was "holding up exceptionally well" is problematic. The statement was clearly contrary to the opinions expressed in the Tradewind Report, as was recognized much later after Gord McGuire (at the time

Director, Engineering Services, Public Works, Hamilton) discovered the Tradewind Report.

I note as well that the statement was similar to, if not more positive, than what Mr. Moore had told Mr. Malone in August 2015. Mr. Moore's comments to the PWC on December 7 further demonstrate how Mr. Moore's knowledge of the 2007 and 2013 friction testing to this point was limited to the incomplete information that he retained from Dr. Uzarowski's emails in 2007 and 2014. Mr. Moore also provided no caveats in his response to the PWC that the results from the friction testing in 2013 were inconclusive or subject to a standard that Mr. Moore did not understand.

Mr. Ferguson testified that the first time he learned about RHVP friction testing having been conducted in 2012 or 2013 was at this PWC meeting, through Mr. Moore's comments. He was surprised by this information given CIMA's two recommendations for friction testing in 2013 and 2015, and Mr. Ferguson's understanding that Mr. Moore had not brought this information forward to Traffic or CIMA. According to Mr. Ferguson, if Traffic had known earlier about the friction testing previously done, Traffic would have asked CIMA to evaluate or comment on the content of the RHVP friction testing reports.

Mr. Ferguson testified that, at Mr. White's direction, he asked Mr. Moore for the results of this friction testing after the PWC meeting. This was questioned by Mr. White in testimony and is not supported by any evidence. In any event, Mr. Moore did not send Traffic a copy of the Tradewind Report or the 2014 Golder Report after the PWC meeting or ever. Neither Mr. Lupton nor Mr. Mater testified that they took any action in response to Mr. Moore's comments at the December 7 PWC meeting. Mr. Mater did not consider it part of his role to discuss with his own staff in any detail Mr. Moore's comments to PWC about an issue within Mr. Moore's area of expertise. Mr. Mater's evidence on this issue is illustrative of the negative impact of Traffic's deference to Mr. Moore on all matters within the responsibility of Engineering Services.

The councillors[5] who testified at the Inquiry hearings respected Mr. Moore, and believed and relied on his statements about the quality of the asphalt on the RHVP.

[5] These councillors included Councillor Jackson, Councillor Merulla, and Councillor Doug Conley (Ward 9, Hamilton).

In particular, Councillor Tom Jackson (Ward 6, Hamilton) testified that because of the assurances Mr. Moore gave about the quality of the RHVP asphalt, he began to think that driver behaviour was the biggest factor in collisions on the RHVP. Councillor Jackson felt that Mr. Moore's comments addressed the concerns he was hearing from constituents about slipperiness on the RHVP which, as described in Chapter 5, dated back to late 2012 or early 2013.

In addition to Mr. Moore's comments, Traffic staff's report and presentation to PWC highlighted speeding, instead of providing the more nuanced view of the contributing factors to collisions that CIMA had identified, including friction and wet surface conditions. As a result, Council was left with the impression that speeding was the principal cause of collisions on the RHVP. As discussed further in Chapter 12, identifying contributing factors to collisions is much more complicated than staff presented, and understanding the nuance and interplay between these factors is important. Given their familiarity with the 2015 CIMA Report, staff should have better explained the multiple possible contributing factors identified by CIMA that affect the speed at which the parkway becomes more challenging to drive. The explanation of collisions provided by staff downplayed the significance of the high proportion of wet surface collisions and the factors, in addition to "excessive speed", which CIMA identified as contributing to such accidents.

7.10. Responses to the 2015 CIMA Report and the Recommendation Report

Several events relevant to this Inquiry's mandate occurred after the December 7 PWC meeting, related both to the findings and recommendations of the 2015 CIMA Report and staff's recommendation report, and to Mr. Moore's understanding of the Tradewind friction testing. These events are set out below, organized thematically; however, it should be kept in mind that these events occurred contemporaneously with one another.

7.10.1. Council Meeting on December 9, 2015

The PWC prepared a report to Council (PW Report 15-016) following the December 7, 2015 meeting, for the Council meeting on December 9. PW Report 15-016 recommended approval of the recommendation report presented to the PWC (Report

PW15091), with one additional direction for staff added to the recommendations staff had set out in their recommendation report (Report PW15091). The added direction was that staff "install signs stating the penalties and costs associated with speeding at appropriate locations on the Lincoln M. Alexander Parkway and the Red Hill Valley Parkway."

The PWC also directed staff to undertake three additional tasks relating to the RHVP and/or the LINC. These directions arose from further discussions and motions at the PWC meeting on December 7, 2015. They were addressed separately from the PWC's recommendations further to the 2015 CIMA Report in Report PW15091 as a result.

These three additional tasks were as follows: (1) staff were directed to report to PWC with information on the costs and process of investigating an improved lighting system on the RHVP and the LINC; (2) staff were directed to investigate installing rumble strips on the sides of the LINC; and (3) staff were directed to seek out provincial approval from the MTO to allow the City to implement photo radar on the roadways, and to assess the feasibility of implementing photo radar.

7.10.2. The Speed Statistics in 2015 CIMA Report are Questioned

After the 2015 CIMA Report was presented to the PWC on December 7, councillors and members of the media began to raise questions about CIMA's finding that an average of more than 500 vehicles per day travelled in excess of 140 km/h on the RHVP. For instance, on December 9, 2015, prior to the Council meeting, Councillor Lloyd Ferguson (Ward 12, Hamilton) emailed Mr. Ferguson to request an explanation for how CIMA reached this conclusion. The Hamilton Spectator also published articles on December 14, 2015 and January 22, 2016, in which Councillor Ferguson was quoted as expressing disbelief about CIMA's findings on speeding.

CIMA's finding was based on speeds that Pyramid collected and reported in 2013 on behalf of the City, in connection with CIMA's 2013 safety review, which Mr. Cooper had given CIMA for CIMA's work in 2015. In January 2016, after the 2015 CIMA Report had been presented to the PWC and Council, Rich Shebib (Traffic Technologist, Corridor Management, Geomatics & Corridor Management, Engineering Services, Public Works, Hamilton) advised Traffic staff of recent traffic data that Mr. Shebib had

obtained from permanent traffic count stations on the RHVP, which Mr. Shebib felt did not support the conclusions about speeding that CIMA had drawn from the Pyramid data. City staff had not provided the count station data to CIMA in connection with the preparation of the 2015 CIMA Report.

Ultimately, to resolve the issue, Mr. Malone and Mr. Ferguson decided to emphasize for Council that speeding on the RHVP was an issue generally, rather than breaking down the differences between data used in the 2015 CIMA Report and the more recent RHVP count station speeding data. In an email to Mr. Ferguson sent on January 29, 2016, Mr. Malone summarized this general issue as follows:

> There does seem to be agreement with the police, albeit with variation on the exact magnitudes, that speeding is an issue. Also agreed by all is that large numbers of users exceed the posted speed limit – 90% of the traffic. It is also clear that there are at least some vehicles with very high, excessive, speeds, on a daily basis. That particular behaviour, given the geometric limitations of the highway, is a recipe for disaster.
>
> We concluded that some drivers are unaware of the potential consequences of their behaviours since they likely perceive the road as just another 400 series highway. It is not, particularly on the Red Hill section, and the speed + geometry combination can quickly result in collisions in the right circumstances. Enhanced enforcement on Red Hill remains the best tool to address these driver behaviour problems linked to speed. If we can start the conversation with the councillor from that place, as opposed to battling over who[se] data is better, it might be a way to move forward. We all have the same goal, making travel on the road more safe.

7.10.3. Lakewood Beach Community Council Requests Friction Testing

7.10.3.1. Request for Friction Testing

On December 9, 2015, two days after the December 7 PWC meeting, a local Hamilton community group, the Lakewood Beach Community Council (“LBCC”), emailed Mayor Eisenberger and Council with an item the LBCC wanted Council to consider

at its meeting scheduled for later the same day. The LBCC requested that friction testing be treated as a short term safety option consistent with the 2015 CIMA Report, rather than a medium term safety option as recommended in Report PW15091. As noted, PW Report 15-016 was on the agenda for the December 9 Council meeting, which meant that the recommendations the PWC had passed on December 7 were scheduled for ratification.

In making this request, the LBCC highlighted the results of CIMA's collision history analysis for daylight, wet surface, and SMV collisions, and the anecdotal evidence from members of the public about the RHVP being "slippery". The LBCC advised that it felt the cost-benefit of conducting the friction testing (at an estimated cost of $40,000, as noted in the 2015 CIMA Report) would be money well spent. It was clear from the LBCC's email that the LBCC had read the 2015 CIMA Report as they stated: "Since the majority of the collisions are single car occurring in the daylight, in clear weather, but with wet road surfaces we are respectfully requesting you consider adding this Friction Test to the short term recommendations."

Council did not discuss the LBCC's correspondence on December 9, 2015. However, Councillor Jackson referred the LBCC's correspondence to the next PWC meeting, and told this to the LBCC in an email response sent on December 10. In an email on which Mr. Ferguson, Mr. White, and Mr. Moore were copied, Councillor Jackson stated that collisions on the RHVP were "unfortunate occurrences, primarily through careless, reckless, irresponsible behaviour along the Red Hill and Lincoln Parkways". Councillor Jackson testified at the Inquiry that he would not have made this comment if Mr. Moore had not given assurances that the RHVP was safe at the December 7, 2015 PWC meeting. However, based on Mr. Moore's assurances, Councillor Jackson's impression was that driver behaviour could very well be the cause of collisions on the RHVP, rather than the surface of the roadway.

On December 14, 2015, Mr. Mater directed Mr. Lupton, Mr. White, and Mr. Ferguson to coordinate with Mr. Moore to send a response to the LBCC.

7.10.3.2. Mr. Ferguson Advises that Engineering Services Will Perform RHVP Friction Testing in 2016

The next PWC meeting was scheduled for February 1, 2016. On January 28, 2016, Councillor Jackson emailed Mr. Ferguson, copying Mr. Moore, requesting

Mr. Ferguson's input on how Councillor Jackson should address the LBCC's correspondence at the upcoming PWC meeting. Mr. Ferguson replied: "I believe as part of the overall works this is already being covered off (road friction testing). I have copied Director Moore for clarification." Mr. Ferguson had not spoken to Mr. Moore at the time, but understood that Engineering Services would complete friction testing, after completion of the TMP as provided in the recommendation report (Report PW15091), on a schedule to be decided by Engineering Services. While I accept that may have been Mr. Ferguson's understanding, his email response to Councillor Jackson was not responsive to the LBCC's request to have friction testing completed in the short term.

In response, Councillor Jackson advised Mr. Ferguson and Mr. Moore that he would make the motion of "receiving the correspondence only" with the caveat that staff provide a written response to the LBCC that commented on the LBCC's suggestions and indicated how staff were already (or would be) implementing these measures accordingly. Mr. Ferguson responded to Councillor Jackson in agreement, writing: "I would concur with that direction". The Inquiry did not receive any documents that suggest that Mr. Moore responded to these emails. Mr. Moore testified that he could not recall discussions with his Public Works colleagues about the LBCC's request to have friction testing changed to a short term measure. At its meeting on February 1, 2016, the PWC acknowledged receipt of the LBCC's correspondence requesting that the City conduct friction testing on the RHVP as a short term safety option, but did not discuss the LBCC's correspondence in any detail.

Instead, on February 16, 2016, Mr. Ferguson emailed the LBCC, copying the Office of the Mayor, members of Council,[6] Mr. White, Mr. Lupton, Mr. Mater, Mr. Moore, and Janet Pilon (Manager Legislative Services/Deputy Clerk, Office of the City Clerk, Finance & Corporate Services, Hamilton) to advise that Engineering Services would perform friction testing on the RHVP in 2016. Mr. Ferguson's email stated:

---

[6] The members of Council copied on this email were Councillors Aidan Johnson (Ward 1, Hamilton), Jason Farr (Ward 2, Hamilton), Matthew Green (Ward 3, Hamilton), Sam Merulla, Chad Collins, Tom Jackson, Terry Whitehead (Ward 8, Hamilton), Doug Conley (Ward 9, Hamilton), Maria Pearson (Ward 10, Hamilton), Brenda Johnson (Ward 11, Hamilton), Lloyd Ferguson, Arlene VanderBeek (Ward 13, Hamilton), Robert Pasuta (Ward 14, Hamilton), and Judi Partridge (Ward 15, Hamilton). A complete list of councillors over time is set out in Chapter 4.

> The following information is provided with respect to your email dated December 9, 2015, to the Mayor's Office and Members of the Public Works Committee.
>
> Your email was requesting that the identified Friction Test for the Red Hill Valley Parkway be considered for Short Term Testing. Through support from Public Works Committee, I am pleased to inform you that this testing will be completed by Engineering Services in 2016. We are confident that this testing along with implementation of the other Short Term recommendations as outlined in the report, will assist in raising awareness and educating motorists as we work to change driver behaviour along the Red Hill Valley Parkway and Lincoln Alexander Parkway with the ultimate goal to make both roadways safer for motorists.
>
> If you have any questions, please feel free to contact me directly.

Mr. Moore replied by email to Mr. Ferguson only, saying "perfect."

Mr. Ferguson testified that he believed he had contacted Mr. Moore by telephone before sending the above email to the LBCC, and that Mr. Moore had committed to complete new friction testing on the RHVP in 2016. Mr. Ferguson had no expectation as to whether or not Mr. Moore would provide him with the results of the friction testing in 2016, only that Mr. Moore would perform it. Mr. Ferguson did not ask Mr. Moore for a copy of the friction testing results that Mr. Moore had mentioned at the December 7, 2015 PWC meeting during their call about the 2016 friction testing.

In contrast, Mr. Moore testified that he did not recall planning any friction testing in 2016, and none was completed by Engineering Services in that year. Mr. Moore testified that he did not recall any discussions with Mr. Ferguson about friction testing in 2016. Regardless, by his affirmation "perfect", Mr. Moore effectively confirmed a commitment from Mr. Ferguson on behalf of the City to conduct friction testing on the RHVP in 2016. Whether intentionally or otherwise, Mr. Moore misled Mr. Ferguson and, by extension, all individuals copied on Mr. Ferguson's email to the LBCC, including the Mayor's Office and councillors, regarding Engineering Services' intentions.

7.10.3.3. Mr. Moore Tells Traffic Staff Friction Testing Has Been Done but Needs Analysis

On February 25, 2016, after the Public Works directors were notified via email about an unrelated delegation request that the LBCC made to PWC, Mr. Moore emailed Mr. Lupton and Mr. Ferguson (which Mr. Lupton later forwarded to Mr. White), in which he stated:

> FYI – Some roughness/skid resistance/friction testing has been done. However I'm still trying to get the analysis for it and to put it into context (like how does this compare to other highways of similar type.) MTO is very guarded of this information and does not share numbers due to liability and concerns they will form part of a legal action. We should be similarly wary!

It is unclear to what testing Mr. Moore was referring. By this time, it could have been any or all of the 2007 MTO testing, the 2013 Tradewind testing, or the 2016 Golder inertial profiler testing, discussed below in this chapter. Mr. White testified that he understood Mr. Moore was referencing the 2013 friction testing in this email. Mr. Ferguson, on the other hand, who was unaware of the Tradewind testing, interpreted Mr. Moore's email to mean that Engineering Services had completed friction testing in the short window between February 16 when Mr. Ferguson emailed the LBCC, and February 25 when Mr. Moore sent this email.

In any event, neither Mr. Ferguson nor Mr. White followed up with Mr. Moore for the analysis referenced in his email. Mr. Ferguson, Mr. White. Mr. Lupton, and Mr. Mater provided evidence about why Traffic did not take steps to obtain friction testing results after Mr. Moore's comments at the PWC meeting on December 7, 2015, or after his email of February 25, 2016.

Mr. Ferguson testified friction testing was a task that fell within Mr. Moore's jurisdiction, so there was no point in Mr. Ferguson asking for the information.

Mr. White testified that he and his staff had asked Mr. Moore for friction testing results more than once. Mr. White testified that, by this time, Mr. Lupton and Mr. Mater were both aware that Traffic could not get the friction testing results from Engineering Services. In an email Mr. White sent to Mr. Lupton, Mr. Ferguson, and Mr. Mater on

February 23, 2016, about the LBCC's delegation request, Mr. White advised that Mr. Moore said the "asphalt friction test" was done and that Traffic had asked for but never seen a copy of the results. Mr. White testified that he thought that the intervention of someone at the director level or even the General Manager would be required to get this information from Mr. Moore. In Mr. White's view, it was "pointless" for his staff to ask for the results again.

Mr. Mater testified that he did not take specific note of Mr. White's statement that Traffic had requested and not received the friction testing results. Prior to Mr. White's email, no one had told Mr. Mater that Traffic had requested and been refused friction testing results for the RHVP, and Mr. Mater did not understand that his staff were frustrated about their inability to obtain friction testing results. In fact, Mr. Mater testified that he did not know why Mr. White would even want the friction testing results — friction testing was the purview of Mr. Moore's division and Mr. Moore would be the one making any decisions about pavement, not Traffic staff.

Mr. Lupton also testified that it was not Traffic's responsibility to obtain friction testing results to address a LBCC delegation request; rather, it was Mr. Moore's job to ensure he or his staff were present at the PWC meeting to address the issue if it came up. Mr. Lupton did not think he would have directed his staff to request friction testing results from Mr. Moore unless they needed the results to complete updates for the PWC that addressed the 2015 CIMA Report recommendations. In Mr. Lupton's view, his team would have had no ability to evaluate friction testing results even if they did obtain them.

7.11. Mr. Moore's Discussions with Golder Following the December 7, 2015 PWC Meeting

Mr. Moore did not complete friction testing in response to or after the LBCC's request. Rather, Mr. Moore took two actions that cast light on his February 25 email about the testing that "has been done" and the analysis he was "trying to get". First, on December 17, 2015, Mr. Moore obtained a second copy of the Tradewind Report from Dr. Uzarowski and read it, likely for the first time. Second, Mr. Moore had requested that Golder conduct "roughness" testing — more precisely inertial profiler testing —

of the RHVP pavement. Dr. Uzarowski provided Mr. Moore with initial results for this testing in February 2016.

7.11.1. Mr. Moore and Dr. Uzarowski Discuss Friction Testing

On December 17, 2015, 10 days after the PWC meeting on December 7, Mr. Moore emailed Dr. Uzarowski a condensed version of his email to Tom Dziedziejko (General Manager, AME, Aecon Materials Engineering Corp.) in January 2014. As described in Chapter 6, the content of that email was sourced from the January 2014 Uzarowski Email, which Mr. Moore had also forwarded to Mr. Malone in August 2015. It read as follows:

> Here's a summary of the skid resistance tests.
>
> Immediately following construction of the RHVP in 2007, the Ontario Ministry of Transportation performed friction testing in both southbound lanes. The following table summarizes the results of this testing.

Lane	Average Friction Number	Friction Number Range
Southbound Lane 1	33.9	28.1 to 36.5
Southbound Lane 2	33.8	28.4 to 37.4

> In 2013, the Friction Numbers were measured on the RHVP in both directions by Tradewind Scientific using a Grip Tester. The average FN numbers were as follows:
>
> SB Right Lane 35
>
> SB Left Lane 34
>
> NB Right Lane 36
>
> NB Left Lane 39
>
> Hope this helps

Neither Dr. Uzarowski nor Mr. Moore was able to explain why Mr. Moore sent Dr. Uzarowski this email on December 17, 2015, or if they spoke about the Tradewind Report before Mr. Moore's email. Dr. Uzarowski testified that the email from Mr. Moore came "out of the blue". It is reasonable to conclude that Mr. Moore reached out as a result of the December 7 PWC meeting.

On the same day, December 17, Dr. Uzarowski responded to Mr. Moore's email, attaching a standalone copy of the Tradewind Report (the "December 2015 Uzarowski Email"). Unlike the version appended to the 2014 Golder Report that Dr. Uzarowski sent to Mr. Moore on January 31, 2014, this copy of the Tradewind Report did not have a draft stamp on it. In his email, Dr. Uzarowski wrote to Mr. Moore:

> Please find attached the November 2013 report from Tradewind Scientific on friction testing on Red Hill Valley Parkway and Lincoln Alexander Parkway. I will look at some standards or anticipated values and call you.

I accept Dr. Uzarowski's evidence that he and Mr. Moore likely spoke before Dr. Uzarowski sent the December 2015 Uzarowski Email. During that call Mr. Moore asked Dr. Uzarowski, for the first time, for information about the correlation between the GripTester and locked-wheel tester friction test methods and the UK standard referenced in the Tradewind Report.[7]

In the afternoon on December 17, Dr. Uzarowski emailed Leonard Taylor (President & CEO, Tradewind), copying Rowan Taylor (Engineering Manager, Tradewind), Susan Ames (Office Manager, Tradewind), and Dr. Vimy Henderson (Pavements & Materials Engineer, Golder), writing:

> You have followed the ASTM 1844 standard in the friction testing you carried out on the Red Hill Valley and Lincoln Alexander Parkways in the City of Hamilton in 2013. Your [*sic*] determined the Griptester Numbers. MTO did some Friction Number (FN) testing on the Red Hill Valley

[7] Friction testing methods, equipment, and standards are described in Chapter 1. As discussed in Chapters 1 and 3, the MTO uses an ASTM E274 locked-wheel tester to perform its friction testing, and that was the tester used to perform the MTO's friction testing on the RHVP in October 2007.

> Parkway in 2007 but they followed ASTM 501. Do you know if there is any correlation between 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?

This email, sent almost two years after Tradewind submitted its report to Golder in January 2014, was the first time that Dr. Uzarowski raised the UK standards referenced in the Tradewind Report with anyone at Tradewind.

As set out below, Dr. Uzarowski continued to communicate with Leonard Taylor on these issues into 2016 and ultimately reported his conclusions about the friction testing correlation and standards to Mr. Moore in March 2016.

7.11.2. Golder Conducts Inertial Profiler Testing and Bumps and Dips Analysis

Also in December 2015, Mr. Moore instructed Golder to complete an inertial profiler scan of the RHVP, ideally to be completed between Christmas and the new year. Mr. Moore wanted to locate irregularities in the longitudinal profile of the road — colloquially known as dips and bumps — and to determine how to address them. The inertial profiler scan would measure the profile of the pavement surface.

In his testimony, Dr. Uzarowski described the profile testing as being “so urgent” for Mr. Moore. Mr. Moore also indicated in an email to Dr. Uzarowski that the work was “time sensitive”. However, the reason for Mr. Moore’s urgency at that time is unclear.

Mr. Moore approved the work prior to Golder providing a proposal or the creation of a purchase order, which led to some confusion about what Mr. Moore wanted, and some accounting irregularities in the invoicing and payment for this work later on.

On February 2, 2016, Dr. Uzarowski advised Mr. Moore that Golder had conducted “the profile survey on the Red Hill Valley Parkway and also the initial roughness analysis”. He provided “initial quick plots” of International Roughness Index (“IRI”) values of two lanes in each direction from 2013 and 2016 to compare how the roughness had changed over three years. Dr. Uzarowski testified that the results indicated that “overall the profile was good”, but that it had slightly deteriorated since 2013. He noted that

Golder also identified the locations of “deeps and bumps”. Dr. Uzarowski asked to meet with Mr. Moore to “discuss the repair strategy [Golder] initially recommended”, after which the scope of work and Golder’s final analysis could be defined.

In response, Mr. Moore advised that the information from Dr. Uzarowski did “nothing really for [him]” and that he was interested in dealing with the settlements along the RHVP, stating “Where are they? Are they related to any buried infrastructure, trench, excavation, duct??? That’s what I want to fix”. On February 4, Dr. Uzarowski advised that Golder had identified locations of the dips and bumps but “had to precisely correlate the stations in both directions to check if a particular deep or bump is in one direction or both”.

Dr. Uzarowski testified that he considered Mr. Moore’s response to be typical in terms of providing feedback, saying that Mr. Moore was typically “very direct responding and very promptly”. Back in December 2015, Mr. Moore had used a similar tone to address Golder’s failure to provide Mr. Moore with a proposal for this urgent work in a timely way.

7.11.3. Mr. Moore and Dr. Uzarowski Discuss Friction and Inertial Profiler Testing in March 2016

Dr. Uzarowski and Mr. Moore met on March 4, 2016, principally to discuss the results of Golder’s inertial profiler testing, and also for Dr. Uzarowski to provide Mr. Moore with a summary of, and his conclusions regarding, his discussions with Leonard Taylor. On the same day, Dr. Uzarowski emailed Mr. Moore regarding the RHVP “Dip/Bump Analysis”, attaching an Excel spreadsheet with analysis tables. He also provided Mr. Moore with a link to the associated drawings.

In advance of this meeting, Dr. Uzarowski and Leonard Taylor had exchanged emails. Dr. Uzarowski asked for information about the correlation between numbers from the locked-wheel tester and the GripTester. In response, Leonard Taylor provided Dr. Uzarowski with a paper titled “A White Paper on Correlation of the GripTester Trailer to the ASTM E 274 Skid Trailer”. Dr. Uzarowski testified that he was already familiar with this paper, and felt it was “good from an academic point of view” but not useful to determine how numbers obtained from a GripTester correlated with those obtained from a locked-wheel tester. In his testimony, Dr. Uzarowski agreed that this paper

supported the observation that a GripTester will generally return higher values than the values from a locked-wheel tester.

In response to Dr. Uzarowski's question about whether there were any values for the GripTester used for evaluating highways in Canada or the United States, Leonard Taylor responded that he was not aware of "any 'official' recognized highway [GripTester] reference levels in the Canada or the US", and that he considered the best approach to be to use a cross-correlation with values from other established devices, such as the ASTM 274 standard.

Dr. Uzarowski testified in some detail about the March 4, 2016 meeting with Mr. Moore. Dr. Uzarowski said that at that meeting, he advised Mr. Moore of his discussions with Leonard Taylor, and told Mr. Moore that "there was no clear correlation between the GripTester and locked-wheel". Mr. Moore did not have a specific recollection of the meeting but disagreed that Dr. Uzarowski provided him with this information at it. He testified that he did not understand from this meeting that the GripTester and locked-wheel tester results were anything other than "apples-to-apples", and that he maintained this understanding for the duration of his tenure as Director of Engineering Services. He explained that, given the significance of that information on his view of the Tradewind Report, he believed he would have recalled receiving that information if it had been provided.

I note, however, that Mr. Moore also appeared to concede in his testimony that in "some correspondence", Dr. Uzarowski had advised him four or five years later, possibly in 2016 or 2017, that the MTO and Tradewind testing were not "apples-to-apples" and that the GripTester numbers were more conservative. Mr. Moore said that he was "obviously disappointed in the timing of that information being finally provided."

Mr. Moore's evidence is unconvincing. I am satisfied that Dr. Uzarowski told Mr. Moore at this meeting that there was no clear correlation between results from a GripTester and results from a locked-wheel tester. The evidence is that Dr. Uzarowski's practice was to respond as quickly as possible to Mr. Moore's various requests. Consistent with this practice, Dr. Uzarowski had almost immediately begun seeking information to respond to the request for clarification Mr. Moore appears to have made in mid-December 2015. After receiving that information from Leonard Taylor, there is no

reason that Dr. Uzarowski would not have provided this information to his client promptly.

The information that Dr. Uzarowski provided Mr. Moore was that the Tradewind GripTester numbers, although numerically higher than the MTO locked-wheel numbers, were not indicative of the Tradewind results being either better, or satisfactory. From this point in time, Mr. Moore therefore had the information necessary to understand the Tradewind Report, and had no basis to discount the findings and recommendations in the Tradewind Report. Even if Mr. Moore had remaining questions about the applicability of the UK standard referenced in the Tradewind Report in Ontario, the evidence of both Dr. Gerardo Flintsch and David Hein, the technical experts engaged by Commission Counsel and the City in this Inquiry,[8] respectively, was that the recommendations made by Tradewind in the Tradewind Report to investigate the friction levels on the RHVP should have been acted on in some manner, as described in more detail in Chapter 12.

Dr. Uzarowski also testified that, at the meeting on March 4, 2016, he made recommendations to Mr. Moore for pavement remediation techniques that could address low friction – microsurfacing and shotblasting – which is consistent with a reference to “blasting and micro” in Dr. Uzarowski’s notes from this meeting. Dr. Uzarowski testified that microsurfacing could also address other structural aspects, but that shotblasting would be used only to address friction. Dr. Uzarowski did not have a specific recollection of what exactly he said to Mr. Moore about the need to improve friction of the RHVP, nor the specifics of what Mr. Moore said to him. He did, however, testify that Mr. Moore told him “in a careful way” that “the police [were] expressing opinion that the pavement was slippery.” Dr. Uzarowski’s impression from their March 4 discussion was that Mr. Moore had concerns about friction. Dr. Uzarowski says that he made recommendations for microsurfacing and shotblasting to address those concerns.

Mr. Moore also recalled speaking with Dr. Uzarowski regarding microsurfacing, shotblasting, and skidabrading at some time, but could not recall precisely if that

[8] Dr. Flintsch is the Director of the Center for Sustainable and Resilient Infrastructure at Virginia Tech Transportation Institute, and Mr. Hein is the President and Principal Engineer at 2737493 Ontario Limited.

discussion occurred on March 4, 2016. However, Mr. Moore did not recall this discussion having been in the context of a broader discussion about the RHVP friction testing results or his request to Dr. Uzarowski for more information on standards and how to interpret them. In testimony, Mr. Moore did not recall Dr. Uzarowski expressing any potential safety concerns about friction levels on the RHVP if the City did not proceed with shotblasting or skidabrading. Mr. Moore believed the nature of the discussion to be "if you want to do this type of thing, here's what you can do." He testified that he did not believe that he asked Dr. Uzarowski to conduct any inquiries regarding shotblasting or skidabrading.

Dr. Uzarowski, however, left the March 4 meeting with the impression that Mr. Moore wanted Dr. Uzarowski to provide him with information on how to address friction levels on the RHVP. This prompted Dr. Uzarowski to immediately contact various individuals in the pavement rehabilitation industry after the meeting, including companies that offered shotblasting and skidabrading, to request pricing information for these treatments "on a highway near Toronto". One of the quotes Dr. Uzarowski received was $301,888 for the entire mainline of the RHVP.

Dr. Uzarowski and Mr. Moore appear to have misunderstood one another. On March 15, Mr. Moore emailed Dr. Uzarowski, presumably in response to Dr. Uzarowski's provision of the quote for the use of the Skidabrader (which was not produced to the Inquiry). From Mr. Moore's email, it appears that Mr. Moore's expectation was that Dr. Uzarowski was to provide him with a quotation for further testing of the RHVP pavement surface, although what testing Mr. Moore had in mind was unclear. Under the subject line "Skid testing", Mr. Moore wrote:

> No, $300,000 is just a ridiculous amount. I don't need the whole road tested. And I don't need every wheel path of lane. 4 to 6 spots that would be representative or worst case is all I need at the most. But I suspect that is still too expensive.

Mr. Moore could not recall at the Inquiry what he meant by "4 to 6 spots that would be representative or worst case."

Dr. Uzarowski believed Mr. Moore misunderstood the quote for the Skidabrader to be a quote for friction testing. He responded to Mr. Moore that $300,000 was the "price for the entire surface" and that the Skidabrader "machine restores the texture and

brings the skid numbers high". Dr. Uzarowski also advised that, as an alternative, he could also check the cost of having a local company run a "NAC machine" used to "measure skid resistance at the airports" on the RHVP and determine the "worst locations".

Mr. Moore responded later on the same day, writing:

> Sorry I thought you were talking about more testing. 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. Thanks

Two points emerge from this confused correspondence.

First, Mr. Moore's focus at this time was on the remediation of the RHVP and on correcting the various surface deformities (dips and bumps, and cracking). Whatever information Mr. Moore received or understood from his communications with Dr. Uzarowski on and/or after March 4, Mr. Moore was not interested in friction remediation if it did not also address the surface distresses and deformations, as he had expressed in his email to Dr. Uzarowski on March 15. Mr. Moore testified that he did not believe he ever asked Dr. Uzarowski for some measure to address friction numbers on the RHVP, and explained further that "I don't believe I was looking to address any frictional characteristics of the pavement because I – I had no concern with them". Moreover, Mr. Moore testified that the decision to rehabilitate the RHVP which was made shortly afterwards (discussed below) would address any concerns about the friction of the RHVP, including those expressed by the LBCC. Friction testing would not provide insight for the resurfacing.

Second, I accept that Dr. Uzarowski suggested shotblasting or skidabrading of the RHVP pavement to improve the frictional qualities of the pavement surface. However, Dr. Uzarowski did not do so as a matter of traffic safety, which was neither his mandate or expertise, nor was it Mr. Moore's concern. Dr. Uzarowski suggested these remedial measures in part, to address the concerns he believed Mr. Moore to have raised, as he testified to, and further because of what I perceive to have been lingering questions on Dr. Uzarowski's part about the suitability of the Demix aggregate that he had approved in 2007, as discussed in Chapter 2.

Dr. Uzarowski testified that he did not recall having any further discussions with Mr. Moore on this topic after receiving Mr. Moore's March 15, 2016, email. He understood that Mr. Moore was not interested, and that it was his final answer. Dr. Uzarowski testified that he did not reference the recommendations made in the 2014 Golder Report at this time, because he understood Mr. Moore to be "very familiar with the report", including Golder's recommendations.

On April 28, 2016, Mr. Moore forwarded the dip and bump analysis tables he had received from Dr. Uzarowski on March 4 to Marco Oddi (Manager, Construction, Engineering Services, Public Works, Hamilton). Mr. Oddi testified that Mr. Moore likely sent him the analysis to review because, given Mr. Oddi's background as a member of the RHV Project team and his familiarity with the RHVP, Mr. Oddi could "pull out the Red Hill contract drawings and look and correlate it" and identify relationships between the bump and dip analysis tables and locations on the RHVP where there might be culverts, sewers, and watermains, for example. Mr. Oddi did not recall if he discussed the bump and dip analysis with Mr. Moore, but would have relayed this information if such a discussion did occur.

It is possible that Dr. Uzarowski had a further conversation with Leonard Taylor on or about May 26, 2016, respecting the possibility of a correlation between the GripTester and locked-wheel testing results, as well as their application to Canadian and US standards. Dr. Uzarowski believed he spoke with Mr. Moore following this discussion, although he could not recall it in detail, and again relayed the "lack of good correlation" between GripTester and locked-wheel testing results. If this conversation occurred, it only reaffirmed the information that Leonard Taylor had provided previously, which Dr. Uzarowski had already conveyed to Mr. Moore. There is no evidence of any further discussion between Dr. Uzarowski and Mr. Moore on these matters after this date.

7.12. RHVP Rehabilitation

7.12.1. Engineering Services Decides to Rehabilitate the RHVP

Engineering Services began actively considering rehabilitation of the RHVP for the first time in the spring of 2016. At that time, Engineering Services anticipated that the rehabilitation would occur in 2017.

It is important to state at the outset that rehabilitation is an umbrella term. Rehabilitation encompasses a range of actions that can be done to repair an existing pavement surface, and includes preventative surface treatments as well as a complete resurfacing. As set out below and in Chapter 8, although Engineering Services initially contemplated rehabilitation efforts short of resurfacing (that is, a surface treatment) in 2016, at some point in early 2017, staff decided to proceed with a full resurfacing of the RHVP.

The Inquiry did not receive evidence to clarify what triggered staff's decision in 2016 to consider rehabilitation of the RHVP. Mr. Moore previously advised the PWC, in May 2015, that he anticipated the first "wholesale resurfacing" of the RHVP would occur in 2021 and stated to staff and Council on various occasions prior to 2016 that the RHVP was not programmed for any capital work.

According to Richard Andoga (Senior Project Manager, Infrastructure Programming, Asset Management, Engineering Services, Public Works, Hamilton), Engineering Services likely made this decision, which he described as a "mutual decision", shortly before he sent an email to staff in the Design, Asset Management, and Construction sections within Engineering Services on April 15, 2016, to advise that Asset Management had programmed the RHVP and LINC for rehabilitation in 2017. Mr. Andoga did not specifically recall the precipitating discussions, or who participated in them, but he explained they would have been "very informal", possibly a hallway conversation or meeting at someone's desk. I am satisfied that Mr. Moore, as Director of Engineering Services, and other Asset Management staff must have been involved in these discussions.

Mr. Andoga testified that the decision was based on visual inspection of the roads as part of Asset Management's regular road inspections. According to Mr. Andoga, rehabilitation was intended to address, and was prompted by, the top-down cracking on the RHVP as a "major concern".

Mr. Andoga testified that he was not aware of any concerns about friction on the RHVP and had not seen either the 2014 Golder Report or the Tradewind Report in April 2016. I accept this, notwithstanding Mr. Moore's speculation during his testimony that he may have provided Mr. Andoga with all or part of the 2014 Golder Report.

In its closing submissions, Golder suggested that knowledge of top-down cracking on the RHVP implied knowledge of the 2014 Golder Report or the specific findings in that report. However, there were a number of other sources of that information including visual observation, Golder's PMTR Phase III Report,[9] and/or general conversations amongst staff, including Mr. Moore, about the condition of the RHVP.

For his part, by the end of March 2016, Mr. Moore had on hand the 2014 Golder Report and Golder's assessment of the "dips and bumps" on the RHVP, which he probably considered in connection with the rehabilitation decision. He also had the Tradewind Report and had recently discussed microsurfacing, shotblasting, and skidabrading with Dr. Uzarowski (notwithstanding that their communications on this had been confused).

Mr. Andoga's email communications and actions in April 2016, described further below, suggest that Engineering Services wanted to ensure that rehabilitation measures would result in improved friction on the RHVP, among other objectives. As described below, Mr. Andoga sought proposals from contractors for a rehabilitation strategy for the RHVP and LINC, and identified improving skid resistance as one of the listed objectives in his requests. Mr. Andoga also advised other staff in Engineering Services that Asset Management had programmed the RHVP and LINC for rehabilitation in 2017, referencing similar objectives, including improving RHVP skid resistance. In response, Mike Becke (Senior Project Manager, Design, Engineering Services, Public Works, Hamilton) asked Mr. Andoga if they were thinking of microsurfacing and Mr. Andoga replied affirmatively.

7.12.2. Discussions with Norjohn Contracting and Miller Paving Ltd. in March and April 2016

On April 15, 2016, Mr. Andoga invited Derek Nunn (Division Manager, Asphalt Emulsions, Norjohn Contracting, Walker Industries) to submit a proposal for a rehabilitation strategy for the RHVP and LINC, which Mr. Andoga stated was to be for the purposes of improving skid resistance of the RHVP, sealing the existing pavement

[9] As noted in Chapter 6, Mr. Andoga received a draft of the PMTR Phase III Report from Mr. Moore on January 3, 2014. The draft report stated: "Red Hill Valley Parkway – Stone Mastic Asphalt (SMA) paved in 2007 was observed to have a number of top down cracks."

for the ramps of the LINC, and extending pavement life, as well as increasing the service levels the roadway provided. As part of this invitation, Mr. Andoga also invited Norjohn Contracting to complete short test sections of the proposed treatment on ramps at the Dartnall Road interchange in 2016, so that staff could assess and monitor the treatment's outcome for use on the RHVP and LINC mainline and ramps.

Mr. Andoga testified that he included the objective of improved RHVP skid resistance because Asset Management wanted a product with positive frictional characteristics, rather than something that could reduce friction and create a problem on the RHVP. Mr. Andoga testified that he specifically referenced skid resistance on the RHVP, rather than the LINC, because the RHVP was more of a concern due to the RHVP's curvy alignment (compared to the straight LINC) and high vehicle speeds.

Despite having expressed this objective, neither Mr. Andoga personally, nor Engineering Services staff more broadly, had any knowledge at that time of the Tradewind friction results (other than Mr. Moore), nor expressed any concern for the existing friction levels from a traffic safety perspective.

Norjohn Contracting's proposal to use a product called an Ultra-Thin Bonded Wearing Course that, according to the proposal, "greatly improves skid resistance (particularly in wet conditions)" was discussed at a meeting between Mr. Nunn and Engineering Services and Operations staff on April 27, 2016. Ultimately, the City did not proceed with use of this product for the rehabilitation.

Miller Paving Ltd. was also invited to submit a proposal for the RHVP and LINC rehabilitation and test sections in early 2016, around the same time as Norjohn. Although City staff and Miller Paving Ltd. discussed pavement preservation techniques, including microsurfacing, and Mr. Andoga's request for a proposal, it appears that Miller Paving Ltd. did not submit a formal proposal for this work.

The Inquiry received little evidence to demonstrate further consideration or programming in 2016 for the RHVP rehabilitation programmed for the next year.

7.12.3. Mr. Moore Advises Traffic Staff of Resurfacing in Response to an Information Update

Also in April 2016, Traffic provided an update to the PWC on its work under the Hamilton Strategic Road Safety Program. The Hamilton Strategic Road Safety Program is described in Chapter 5. As part of the program, and pursuant to a recommendation aimed at reducing speed-related collisions, Traffic planned to use a new Advanced Traffic Management System technology, install new speed monitoring cameras on the RHVP and the LINC, and provide the Hamilton Police Service with a display of the images and recorded vehicle speeds for enforcement purposes. Ultimately, this program did not proceed.

In May 2016, Traffic staff prepared a draft information update (which became Report CASP1615) setting out the status and timeline for the implementation of the short term traffic safety improvements for the RHVP and LINC, arising from the 2015 CIMA Report and 2015 CIMA LINC Report and approved in December 2015.

Mr. White emailed the draft information update to Mr. Moore, Mr. Lupton, and Ms. Matthews-Malone in mid-May 2016. He included a timeline for the completion of the short term safety options in 2016, and asked for comments on the draft from Mr. Moore and Ms. Matthews-Malone because it impacted their divisions.

In response, Mr. Moore commented that staff should not plan on any RHVP pavement work in 2016 because Engineering Services was considering pavement rehabilitation in 2017, and advised that raised pavement markings (which were a short term safety option under the 2015 CIMA Report and the staff recommendation report) should be coordinated with future rehabilitation works. Mr. White responded with a request that durable markings and inlaid pavement reflectors be included in the future repaving contract.

Despite Mr. Moore's email to Mr. White, the evidence suggests Engineering Services did not seek the budget for rehabilitation work to be implemented in 2017 as part of the 2017 Capital Budget process. However, in August 2016, as part of the 2017 Capital Budget process, staff did seek to program a $2 million RHVP-related Capital Budget project (titled "RHCE & LINC Ramps Rehabilitation") for implementation in 2018. The consequence was a further deferral of the implementation of the permanent raised

pavement markings that had been recommended by CIMA in the 2015 CIMA Report. The programming and budgeting of RHVP-related rehabilitation is discussed further in Chapter 8.

On May 20, 2016, Mr. White emailed the final information update (Report CASP1615) to Mayor Eisenberger and members of Council. The information update set out the following timeline for the short term safety improvements. Signage changes were to occur in June to October 2016, and upgrading of guiderail end treatments in the fall. The installation of permanent raised pavement markings from Greenhill Avenue to the QEW was listed as "timing pending pavement review. Possible resurfacing".

The information update also stated that further analysis was required for certain short term safety options, including the implementation of a queue-end warning system, the rain activated "slippery when wet" flashing beacons, and a variable speed limit on the LINC and RHVP. Further, the information update advised that City staff were working with the Hamilton Police Service to investigate various types of digital radar speed feedback signs that would meet the needs of both groups, and allow the police to deploy selective speed enforcement on the RHVP and LINC as required.

7.13. The Public Works Committee Directs a Comprehensive Lighting Review in September 2016

On September 19, 2016, Engineering Services delivered an information report (Report PW16077) to the PWC regarding lighting on the RHVP and LINC. The report responded to the PWC's December 7, 2015 direction to staff to report back to the PWC with information about the costs and process to investigate an improved lighting system on the RHVP and the LINC. This direction was made after the PWC received and approved the recommendation report (Report PW15091), which contained the findings and recommendations of the 2015 CIMA Report and 2015 CIMA LINC Report. As described above, Report PW15091 identified installation of end-to-end illumination as a long term measure to be deferred pending the outcome of the City's TMP.

Mike Field (Project Manager, Street Lighting & Electrical, Geomatics & Corridor Management, Engineering Services, Public Works) was the primary author of Report

PW16077. Mr. McGuire (Manager, Geomatics & Corridor Management, Engineering Services, Public Works, Hamilton) reviewed the draft. Mr. Moore approved it.

Report PW16077 stated that the original environmental assessments ("EA") completed for the LINC and RHVP "included a review of lighting" and stated that it was "identified that through the Red Hill Creek Valley, that lighting would have a detrimental environmental impact and lighting restrictions were imposed." The information report indicated that the EA would need to be renewed and updated if additional lighting were added and that, in staff's view, it would be prudent for any such EA review to be delayed and undertaken concurrently with other proposed changes to the parkways, such as widening. The information report also described other challenges with implementing lighting, including a high cost. Report PW16077 concluded that a detailed review and business analysis of continuous lighting was required to fully understand the benefits, risks, and challenges of adding lighting on the parkways.

According to Mr. Field, Mr. Moore was the source of the information about the RHVP lighting restrictions, which he conveyed to Mr. Field and Mr. McGuire. Mr. Field did not review the full EA, or request it from Mr. Moore while preparing the information report, although Mr. Field reviewed a 2003 impact assessment report that Mr. Moore provided. Instead, Mr. Field accepted that what Mr. Moore conveyed was "accurate and…good enough to include" in Report PW16077.

In my view, City staff intended this information report to discourage further consideration of lighting on the mainline at least until a decision was made on the possible widening of the RHVP. However, Council remained engaged with the issue of lighting on the RHVP. Accordingly, on September 19, when Report PW16077 was presented, the PWC directed staff to undertake a "comprehensive study of lighting opportunities" on the RHVP and LINC at an estimated cost of $100,000. Funding for the study was approved in late 2016 as part of the 2017 Capital Budget process and became available for use in early 2017. The PWC motion did not direct staff to report back by a certain date. The Street Lighting & Electrical group in the Geomatics & Corridor Management section of Engineering Services was responsible for responding to the PWC's lighting directions.

CHAPTER 8

Consideration of Resurfacing Methods, Continued Implementation of Traffic Safety Countermeasures, and CIMA's Review of RHVP Illumination from 2017 to Mid-2018

8.1. Overview

This chapter addresses RHVP-related work undertaken by the Public Works department, in particular the Engineering Services division and the Traffic group, for the period between early 2017 and mid-2018. The continued interaction between these groups, as well as their respective projects with CIMA on speeding, lighting, and collision statistics, in the face of continued fatalities on the RHVP and calls for action from councillors and the public, will be addressed throughout the chapter. This period saw the beginning of Dan McKinnon's tenure as General Manager of Public Works in September 2016 following Gerry Davis' retirement from this position, a substantial restructuring of the Public Works department in early 2018, and Gary Moore's retirement as Director of Engineering Services in May 2018.

In early 2017, the City shifted from considering a surface treatment rehabilitation of the RHVP to conducting a more extensive mill and overlay resurfacing. Later in 2017, the City began considering the use of a different technology — hot in-place recycling ("HIR") — for the resurfacing, which delayed the commencement of the resurfacing. The City retained Golder in late 2017 to conduct field testing, including a type of friction testing and other pavement surface testing, to evaluate the HIR resurfacing method for the RHVP (the "Golder Pavement Evaluation"). Golder's work on this project, including its March 2018 presentation of the results to Engineering Services staff and its views on the feasibility of HIR, as well as Engineering Services' response, are discussed in this chapter.

This chapter also discusses Traffic's continued reporting to the Public Works Committee ("PWC") and Council regarding RHVP-safety related items, including the implementation status of the collision countermeasures approved by Council in late 2015. Council was advised during this period that friction testing, which had been approved as a medium term countermeasure, had been completed. This, along with media coverage regarding the RHVP that referenced friction testing and concerns regarding slippery pavement, prompted various requests for information on friction testing. These requests — both successful and unsuccessful — are discussed in this chapter.

In addition, CIMA was retained in March 2018 to study the feasibility and safety benefits of reducing the speed limit on the LINC and the RHVP from 90 km/h to 80

km/h (the "Speed Limit Study"). CIMA was also retained in April 2018 to conduct a review and study of lighting on the RHVP (the "Lighting Study"). In the years before 2018, councillors were consistently told, and many City staff assumed or understood, that mainline illumination was prohibited on the RHVP due to environmental concerns, or that lighting restrictions were imposed in order to obtain the required environmental approvals. However, in connection with the Lighting Study, CIMA reported in May 2018 that this was incorrect, although any changes to illumination would require new environmental approvals. The conclusions of CIMA's Speed Limit Study and the remaining conclusions of the Lighting Study are discussed in Chapter 9.

8.2. The City Shifts Its Plans from Rehabilitation to Resurfacing

As described in Chapter 7, Asset Management staff began actively considering rehabilitation of the RHVP and the LINC in the spring of 2016, for work to be completed in 2017. Initially, Asset Management staff contemplated rehabilitation work in the form of a surface treatment, rather than resurfacing.

However, as of at least early February 2017, Public Works' plan changed to a complete resurfacing of the RHVP and the LINC, with work anticipated to commence in 2018. On February 6, 2017, staff from the Engineering Services and Operations divisions and the Traffic group attended a meeting to discuss items that Traffic and Operations requested for inclusion in the scope of the mill and overlay resurfacing (also called a "shave and pave"), as opposed to a surface treatment rehabilitation. While the resurfacing plans were far from finalized at this time, it is clear that by February 2017, and as described in this chapter, staff began focusing on a larger scale, more intensive resurfacing project.

As described in Chapter 2, Golder's 2005 feasibility study on the RHVP perpetual pavement anticipated a resurfacing in year 21 of the RHVP's operation (that is, in 2028), based on the anticipated annual average daily traffic at that time. However, by 2015, it was clear that traffic volumes on the RHVP far exceeded the estimates on which Golder's 2005 finding was premised. As mentioned in Chapter 7, Gary Moore (Director, Engineering Services, Public Works, Hamilton) had previously advised the

PWC, in May 2015, that he anticipated that the first "wholesale resurfacing" of the RHVP would occur in 2021.

The Inquiry received very little evidence to explain when or why the plan changed from a surface treatment rehabilitation to a more extensive resurfacing earlier than 2021, or who made this decision, although Mr. Moore was involved in the decision making process, in addition to Asset Management staff. The limited evidence the Inquiry received suggests that this shift was made for strictly financial reasons and that, although more expensive, resurfacing would be more cost effective long term than a preventative treatment because it would provide a longer life. There is no evidence that the shift to a complete resurfacing of the RHVP was specifically motivated by the friction levels on the roadway or any concern for traffic safety associated with RHVP friction levels on the part of anyone in Engineering Services.

The Inquiry also received evidence to suggest that the availability of additional funding may have prompted this project's expansion. Dan McKinnon (General Manager, Public Works, Hamilton) testified that he and Mr. Moore spoke about the RHVP resurfacing project in the fall of 2017 when the 2018 Capital Budget was prepared as described below and that, in these conversations, Mr. Moore explained that his rationale for doing the resurfacing work was that additional funding had become available for the next year which allowed for resurfacing to be undertaken.

Staff's shifting plans for the RHVP rehabilitation efforts are also reflected in the funding for this project over time, which changed significantly between the 2017 and 2018 Capital Budgets.

The evidence the Inquiry received about the City's capital budget process provides useful context for the budgeting process with respect to this project, and the discussions that staff had throughout 2017 about the scope and timing of the RHVP resurfacing project, described below in this chapter. As explained to the Inquiry, the aspects of the budgeting process relevant to this Inquiry were as follows: on an annual basis, staff begin to prepare the capital budget around June and throughout the summer. Asset Management delivered the final proposed budget including capital projects to the General Manager of Public Works for review in the early fall. It would then go to Council for approval, which typically occurred early in the following year. The

Inquiry received evidence that larger capital projects would typically be “forecast” in the capital budget several years before the work was scheduled to occur, and that Mr. Moore, who oversaw the capital budget prepared by Asset Management, preferred this forecasting approach.

In August 2016, a capital budget project named “RHCE & LINC Ramps Rehabilitation” was budgeted for $2 million and programmed as part of the 2017 Capital Budget. The project budget was to be used in 2018 for RHVP and LINC rehabilitation and related Dartnall Road ramp test strips that City staff discussed with Miller Paving Ltd. and Norjohn Contracting in the spring of 2016.

In June 2017, as part of the 2018 Capital Budget process, this project was revised at the request of Asset Management staff and renamed “RHVP Rehabilitation”. Staff budgeted $6.75 million for each of 2018 (the commencement year) and 2019 (the completion year) for the RHVP resurfacing project. The project objectives were described as follows:

> The roadway has become surface deficient and is in need of resurfacing and base repairs. This will extend the life of the roadway, improve the level-of-service, increase safety and reduce maintenance costs. Works will include the mainline expressway and associated on/off ramps. Condition assessment of subsurface appurtenances completed and cleared.

Resurfacing had not been forecast in any prior capital budgets, aside from the $2 million RHCE & LINC Ramps Rehabilitation programmed in 2016 for implementation in 2018. Based on the City’s typical processes, the capital project submission for the RHVP resurfacing project would have been reviewed by Council and funding received in early 2018, with work anticipated to commence in 2018. Instead, and in summary, in 2017, as part of the 2018 Capital Budget process, the project was renamed, its scope was changed, the budget was increased, and the project’s start was programmed for the same year. Thus, in respect of the RHVP rehabilitation project, the capital budget process departed both from the City’s usual practices and Mr. Moore’s own practices for forecasting significant capital projects.

8.3. The Work of Traffic Staff in Early 2017

8.3.1. Traffic Requests Installation of Median Barriers as Part of RHVP Resurfacing

On January 26, 2017, a young man was killed in a crossover collision on the RHVP near Dartnall Road. On February 21, 2017, another young man was killed in another crossover collision on the RHVP near Greenhill Avenue. Following these fatal crossover collisions, the public and media renewed their calls for median barriers to be installed on the RHVP and LINC.

Meanwhile, as noted above, City staff also began discussing the scope for repaving the RHVP, which was anticipated to occur in 2018 and 2019. In February 2017, Richard Andoga (Senior Project Manager, Infrastructure Programming, Asset Management, Engineering Services, Public Works, Hamilton) asked Traffic if they wished to add anything to the scope of the resurfacing project. On behalf of Traffic, David Ferguson (Superintendent, Traffic Engineering, Traffic Operations & Engineering, Transportation, Public Works, Hamilton) requested, among other things, that barriers be installed on the RHVP from Dartnall Road to King Street based on a collision history review that focused on crossover collisions. Traffic's request was made notwithstanding that the issue of median barriers had been deferred in the December 2015 Council resolution that accepted recommendation report PW15091 on the 2015 CIMA Report (as discussed in Chapter 7). Traffic also requested installation of permanent recessed pavement markings on the RHVP (and LINC) mainline and ramps, and edge markers on the RHVP from King Street to Barton Street.

In response, Mr. Andoga asked about costing and budgeting for some of Traffic's requested items, and commented that the installation of barriers would be "a sensitive issue". In his testimony, Mr. Andoga explained that he was aware that barriers would have been expensive, and that Engineering Services was trying to keep the project from expanding too far beyond its initial scope.

8.3.2. Traffic Provides an Information Update to the Mayor and Council on the Status of Countermeasures

On March 24, 2017, Martin White (Manager, Traffic Operations & Engineering, Transportation, Public Works, Hamilton) submitted an information update report (Report TRANSP1701),[1] entitled "The Lincoln M. Alexander Expressway (LINC) and The Red Hill Valley Parkway (RHVP) Safety Improvements" to Mayor Fred Eisenberger (Mayor of Hamilton) and Council, via email. This information update was prepared by Mr. Ferguson and Stephen Cooper (Project Manager, Traffic Engineering, Traffic Operations & Engineering, Transportation, Public Works, Hamilton). The two appendices to this information update set out the implementation status of the short, medium, and long term safety improvements approved in recommendation report PW15091. In Appendix A to Report TRANSP1701, Traffic advised that they expected to complete many of the short term countermeasures, including the installation of "slippery when wet" signs and other signage by the summer of 2017.

In Appendix B to Report TRANSP1701, which set out the status of the medium and long term safety improvements, Traffic identified that the long term countermeasures of installing rumble strips and median barriers were "to be reviewed and considered during resurfacing". Although Appendix B did not include the resurfacing dates, an entry in Appendix A identified a timeline for resurfacing of 2018 to 2021. End-to-end illumination was listed in Appendix B as "to be reviewed by Engineering Services" and the medium term countermeasure of friction testing was identified in Appendix B as "completed".

Traffic staff relied on Mr. Moore's prior statements that friction testing had been completed on the RHVP when making this representation to Council in Appendix B. Mr. Ferguson testified that he and Mr. Cooper marked friction testing as completed in the information update report based on Mr. Moore's email on February 25, 2016, (described in Chapter 7) advising that "some roughness/skid resistance/friction testing [had] been done" on the RHVP. Mr. White also testified that Traffic listed friction testing as completed because Mr. Moore said friction testing had been done on prior

[1] The cover page of the information update reflects that Mr. White was the Acting Director of Transportation, in place of John Mater (the Director of Transportation) at the time the report was submitted.

occasions. Neither Mr. Ferguson nor Mr. White took any steps to confirm the accuracy of Mr. Moore's statements or to obtain the friction testing results before preparing the information update report. However, according to Mr. White, by this time, he and his staff in Traffic had asked for the RHVP friction testing results a number of times, and had received no answer from Mr. Moore. There are no emails or other documentary evidence demonstrating that Traffic made such requests.

8.3.3. Concerns About Visibility on the RHVP from the Mayor and a Councillor

On April 4, 2017, Mayor Eisenberger and Councillor Tom Jackson (Ward 6, Hamilton) shared and expressed views on their experiences driving on the RHVP and LINC in emails sent to Mr. McKinnon, Chris Murray (City Manager, Hamilton), and other members of Council. Mayor Eisenberger reported that the lane markers on the RHVP and LINC were "very faint on dry days and virtually invisible when it is raining". Mayor Eisenberger also raised concerns about missing or non-reflective lane markers. He asked Mr. McKinnon to advise on what could be done to "remedy this unsafe condition" and requested "immediate attention to this safety issue". Councillor Jackson agreed with Mayor Eisenberger, stating that it was "horrendous" trying to determine the location of the lane markings, and emphasized that the situation was "even worse" during rainfall. Councillor Jackson asked why the problem persisted, despite efforts to enhance the RHVP with "'cats eyes' markings and other reflectors".

In response, Mr. White advised Mayor Eisenberger and Council that the RHVP and LINC would be repainted in May 2017, and that missing pavement markers would be addressed during Engineering Services' resurfacing project for the LINC and RHVP, which was scheduled to occur "over the next few years".

8.4. Hamilton Police Service's Five Year Statistical Analysis of Fatal Collisions in Hamilton

In April 2017, the Hamilton Police Service submitted a report to the Hamilton Police Services Board, which stated that the three most common contributing factors to fatal collisions on the RHVP and LINC were speed, intoxicating substances, and inattentiveness. These factors, all of which are rooted in driver behaviours, were

consistent with the narrative presented by City staff in connection with the 2015 CIMA Report — that the primary cause of collisions on the RHVP was speeding and other driver behaviours. In an article about the Hamilton Police Service's report, the Hamilton Spectator quoted Councillor Sam Merulla (Ward 4, Hamilton) as stating that he hoped the report "dispel[ed] myths" about structural problems on the RHVP and LINC and allowed the City to "focus on new priorities". According to the article, Councillor Merulla's own top priority was reducing speed on the roadways.

8.5. Interactions Between Engineering Services and Traffic Regarding the RHVP

8.5.1. Public Works Leadership Meet About the RHVP on May 1, 2017

On May 1, 2017, members of Public Works leadership — Mr. McKinnon, John Mater (Associate General Manager & Director, Transportation, Public Works, Hamilton), Mr. Moore, Betty Matthews-Malone (Director, Operations, Public Works, Hamilton), and Mr. White — met to discuss the RHVP. Mr. Ferguson, Jason Worron (Senior Project Manager, Traffic Engineering, Traffic Operations & Engineering, Transportation, Public Works, Hamilton), and Alan Kirkpatrick (Manager, Transportation Planning Services, Transportation, Public Works, Hamilton) also attended.

Mr. Mater testified that he organized the meeting to brief Mr. McKinnon on the RHVP, including about the status of the many outstanding business list ("OBL") items and repeated motions from councillors to address complaints about the RHVP. Mr. McKinnon was relatively new as the General Manager of Public Works at that time, having been in the role for approximately nine months (since September 2016). According to Mr. Mater, the RHVP was a "big topic of conversation, both in the public and within [Public Works]". The meeting had been arranged three days after Traffic circulated the information update report on RHVP and LINC safety improvements (Report TRANSP1701, described above) to the Mayor and members of Council on March 24, 2017.

The agenda for the May 1 meeting included the following: review of reports and Council direction, the status of recommended improvements, friction testing results,

OBL directions, and strategy to address. In his testimony, Mr. Mater presumed, without specific recollection, that he likely had some input in setting this agenda. He testified that he probably added friction test results to the agenda to seek clarity. Friction testing was "part of the Red Hill Valley story", along with other roadway improvements and OBL items.

Mr. Worron prepared a slide presentation and presented it at the meeting. The slides summarized the numerous RHVP and LINC-related staff and consultant reports and Council motions since 2013.[2] Neither the 2014 Golder Report nor the Tradewind Report were included in Mr. Worron's slides. Mr. Worron testified that the tone of the meeting was "stressful" and that people were "not happy"; but no other attendees who testified at the Inquiry had that perception.

The slides summarizing the implementation of recommendations from the 2013 CIMA Report and the 2015 CIMA Report (as approved by Council in Reports PW13081 and PW15091) both stated that friction testing had been completed. However, Mr. Worron had not seen any results of friction testing on the RHVP, nor had any other staff in Traffic. Mr. Worron explained in his testimony that he listed friction testing as completed based on Mr. Moore's representation that it had been done.

No minutes were recorded for the May 1 meeting. Most attendees who testified at the Inquiry did not recall any discussion of friction testing results at the meeting. Mr. Ferguson, however, recalled Mr. Moore commenting that "they had done friction testing, they had received the results, and he was still reviewing to determine what they meant". He remembered Mr. Moore mentioning that there was no Canadian standard for friction. According to Mr. Ferguson, no one at the meeting asked Mr. Moore to provide a copy of the test results.

Mr. Moore did not recall any discussion about the 2014 Golder Report or the Tradewind Report at this meeting, or what, if anything, he told his colleagues about friction testing at this meeting.

[2] The slides also included an April 2004 "Tolling of the RHVP" report. Aside from this report, all of the content included in the slide presentation was from 2013 or after.

Given the lack of clear recollection by the attendees at this meeting (aside from Mr. Ferguson), I am not able to reach any findings about what, if anything, was discussed at this meeting about RHVP friction testing results. I am nevertheless satisfied that, at this meeting, Mr. Moore did not discuss the existence of either the 2014 Golder Report or the Tradewind Report by name or provide a copy of either report to his colleagues or superiors, despite the fact that by this time, his colleagues had previously requested the friction test results from him, as Mr. Moore acknowledged in testimony. There is also no evidence that Mr. Moore was asked about the rationale for the RHVP rehabilitation or the position of Asset Management regarding the scope of the project.

Mr. Mater and Mr. McKinnon discussed the meeting and the next steps with regard to the RHVP via email the next day, on May 2. Mr. Mater advised that it was his intention that Traffic would prepare a report that considered the status of all of the PWC motions regarding the RHVP, and indicated that the RHVP repaving project might affect the approach taken.[3] In response, Mr. McKinnon stated that he was "concerned about the optics of the paving, nowhere in the forecast and suddenly getting done right away." The Inquiry received no evidence about what discussion, if any, had occurred among the attendees at the May 1 meeting about the sudden programming by Engineering Services of the previously unforecasted rehabilitation.

8.5.2. Continued Discussions Regarding Median Barriers

Throughout June 2017, Traffic and Engineering Services staff continued to discuss Traffic's request to install median barriers and the other improvements that Traffic thought should be included in the resurfacing project.

These discussions were eventually elevated to Mr. Moore and Mr. Mater. On June 12, Mr. Moore forwarded to Mr. Mater an email from Mr. Worron sent earlier that day, which set out Traffic's requested scope for the resurfacing project, including median barriers. Mr. Moore wrote "[w]hy are we getting this? I though [*sic*] you, and I and the

[3] The City also provided the Inquiry with an information update report about the RHVP and LINC safety improvements from the 2015 CIMA Report and 2015 CIMA LINC Report approved by Council, which states that it was submitted to Council on May 19, 2017, by Mr. Mater. Friction testing is marked "completed" in Appendix B to this update, as it was in the March 2017 update. However, the May 2017 information update report was not signed by Mr. Mater, and the Inquiry has received no clear record that it was provided to Council.

GM were going to decide what to do. Where do your people get this from. Do they think we are going to spend $10M". Mr. Mater replied to Mr. Moore that his staff were providing the scope they believed was required.

Later in June 2017, Mr. Ferguson provided Engineering Services staff with an updated submission for Traffic's requested scope, which removed some of the requests in Mr. Worron's June 12 email. In response, Mr. Andoga advised Mr. Ferguson that Asset Management had agreed to add pavement markers, rumble strips, and pavement markings, but that Asset Management assumed that median barriers and previously discussed lighting improvements would not be required. Mr. Andoga indicated that "Council direction as well as a funding source will be required for any such enhancements." As noted above, in February 2017, Traffic had requested inclusion of median barriers in two locations — one on the LINC and one on the RHVP — as part of the scope for the resurfacing project. However, neither of the lists provided by Mr. Ferguson or Mr. Worron in June 2017, or Mr. Ferguson's February 2017 list, referenced illumination.

Mr. White and Mr. Ferguson exchanged emails following Mr. Andoga's response. Both interpreted Mr. Andoga's response to mean that Asset Management refused to program the installation of median barriers and lighting unless Traffic provided a funding source and got Council approval. As this was prior to the 2018 Capital Budget process, and Council had not yet approved the budget for the resurfacing project, Mr. White and Mr. Ferguson took the view that Council could consider and address Traffic's proposed inclusions in the capital budget, and in effect, that Asset Management was usurping Council's consideration.

Ultimately, Mr. Mater advised his staff to remove their request for the installation of median barriers, as that issue had been deferred pending the TMP. Accordingly, in late July 2017, Traffic removed their requests for median barriers in the two identified locations and the installation of edge markers from their list of requested inclusions. The City did not install continuous median barriers on the RHVP as part of the resurfacing project, which ultimately occurred in 2019. As noted above, Traffic had not sought the inclusion of illumination in its requested additions to the resurfacing project, and it was not discussed as part of the scope of the RHVP resurfacing project again following Mr. Andoga's June 2017 email.

8.6. Repeated Requests for RHVP Friction Test Results from the Media and Councillors

Mr. Moore received multiple requests for RHVP friction testing results in the late spring and summer of 2017, all of which originated from Nicole O'Reilly (Reporter, Hamilton Spectator). Mr. Moore did not provide friction test results in response to any of these requests.

On May 25, 2017, Mr. White and Mr. Ferguson met with Ms. O'Reilly to discuss RHVP and LINC safety improvements. The next day, Jasmine Graham (Communications Officer (Public Works), Strategic Partnerships & Communications, City Manager's Office, Hamilton) emailed Mr. Moore to advise that Mr. White and Mr. Ferguson had deferred questions about RHVP lighting and pavement to him, and asked if there was any information that could be provided to Ms. O'Reilly. Ms. Graham also relayed a request from Ms. O'Reilly for the RHVP pavement friction test results and asked if the results were a public document.

The Inquiry did not receive any emails indicating that Mr. Moore responded to Ms. Graham. However, Mr. Moore and Ms. O'Reilly eventually spoke about the RHVP pavement and lighting on June 21, 2017, and spoke again in passing after a Committee meeting shortly before July 15, 2017, when Ms. O'Reilly published an article in the Hamilton Spectator titled "Highway traffic tragedies: Why are there so many crashes on the Red Hill?" Mr. Moore did not recall friction testing being discussed at the June 21 interview, and testified that Ms. O'Reilly did not request the results from him that day. However, because Ms. O'Reilly attributed friction-related quotes to Mr. Moore in her July 15 article (excerpted later in this chapter), it is probable that they did discuss friction testing, either on June 21 or in their subsequent discussion.

On May 30, a few days after her interview with Mr. Ferguson and Mr. White, Ms. O'Reilly emailed Councillor Doug Conley (Ward 9, Hamilton) to advise that she was interested in information about the friction testing conducted on the RHVP "last year". Robert Ribaric (Assistant to Ward 9 Councillor Doug Conley, Hamilton) emailed Mr. Ferguson and asked if pavement friction testing had been done on the RHVP "last year" and what the results were if it had. Mr. Ferguson responded, writing that he had copied Mr. Moore on the email. He did not take any further steps to assist Councillor

Conley in locating the friction testing results, nor did he follow up with Mr. Moore to confirm that Mr. Moore would address the request. In Mr. Ferguson's view, this was not his job; Mr. Moore was responsible for friction testing.

Mr. Ribaric followed up on Mr. Ferguson's email on June 5, copying Diana Cameron (Administrative Assistant to the Director of Engineering, Engineering Services, Public Works, Hamilton). Also on June 5, Councillor Conley sent an email to Mr. White and Mr. Moore following up on the requests. In this email, Councillor Conley indicated that it said on "[his] update sheet…that the pavement friction testing is completed". At that time, Mr. Moore was out of the office until June 12. Councillor Conley and Mr. Ribaric both forwarded their respective emails to Ms. Cameron and asked her to follow up in Mr. Moore's absence. From there, Ms. Cameron brought Marco Oddi (Manager, Construction, Engineering Services, Public Works, Hamilton) and Susan Jacob (Manager, Design, Engineering Services, Public Works, Hamilton) into the correspondence, both of whom testified at the Inquiry that they had not seen the RHVP friction test results at that time.

Mr. Oddi replied that he "was not aware of and [had] not seen the results from the RHVP pavement friction testing." Ms. Jacob suggested to Ms. Cameron that they could contact Dr. Ludomir Uzarowski (Principal, Pavement & Materials Engineering, Golder) about the test results, to which Ms. Cameron responded that nothing should be given to Councillor Conley without Mr. Moore's permission.

In response to Councillor Conley's June 5 email, Mr. White emailed Councillor Conley and Mr. Moore, advising that Traffic did not have the test results but that he thought that the Asset Management section in Engineering Services did. Mr. White copied Sam Sidawi (Manager, Asset Management, Engineering Services, Public Works, Hamilton) and Mr. Andoga from Asset Management on this email. On June 8, Mr. Sidawi responded that Asset Management was "trying to track down who [had] the info".

Mr. White also forwarded Councillor Conley's June 5 email to Mr. Ferguson and Mr. Mater, writing "[l]et's see what answer he gets!!" Mr. White testified that he responded to Councillor Conley's request in this manner because he was curious to see if Councillor Conley would get an answer since "none of" them had received an answer.

Although Councillor Conley had been told that the response would have to wait until Mr. Moore returned to the office, his request continued to go unanswered upon Mr. Moore's return. Mr. Ribaric followed up on June 27, 2017, reiterating to Mr. Moore, Mr. White, Mr. Sidawi, and Mr. Andoga that Councillor Conley was still looking for the friction test results. In response, Mr. Sidawi advised that he was unable to locate the skid resistance information, but that staff were proposing to resurface the RHVP beginning in 2018.

When Councillor Conley's request was still outstanding on June 27, 2017, Mr. White emailed Mr. Mater: "This isn't going to go away I don't think". Mr. White testified that he hoped Mr. Mater would take action to address a "continuing theme" of "people asking for the results of the friction testing and having no results." According to Mr. White, he and Mr. Ferguson, Mr. Mater, and Geoff Lupton (former Director, Energy, Fleet & Traffic; Corporate Assets & Strategic Planning, Public Works, Hamilton, who had left his position with the City in February 2017) were all aware that requests for friction testing results had gone unanswered by Mr. Moore. However, there is no evidence that Mr. White explicitly requested help from Mr. Mater in dealing with this issue in June 2017 or that Mr. Mater took any action.

Mr. Moore responded via email solely to Mr. Ribaric, asking Mr. Ribaric to have Councillor Conley call him to discuss the request for information. However, at the Inquiry, neither Mr. Moore nor Councillor Conley recalled a telephone conversation on or about June 27, and Councillor Conley emailed Mr. Moore several hours after Mr. Moore's email to Mr. Ribaric, asking if he had "any information or results from pavement friction testing done last year". The Inquiry did not receive any documents evidencing any further communication between the Councillor's office and Mr. Moore, or other Public Works staff, on the issue of RHVP friction results, after this date. Thus, what is certain is only that, despite several requests over the span of a month, Councillor Conley did not receive the RHVP friction results from Mr. Moore.

8.7. Hamilton Spectator Publishes an Article About Collisions on the RHVP

8.7.1. Mr. Moore Gives Inaccurate Information About Friction Testing to the Hamilton Spectator

As noted above, on July 15, 2017, the Hamilton Spectator published a lengthy article about the RHVP entitled "Highway traffic tragedies: Why are there so many crashes on the Red Hill?" The article, written by Ms. O'Reilly, described the RHVP collision history in comparison to the adjacent LINC and some of the countermeasures implemented by staff on the RHVP over time. Mr. Moore, Mr. Ferguson, and Mr. White were quoted throughout.[4]

The article included the following:

> Rumour and speculation about the RHVP being slippery have plagued the parkway since it opened in 2007, and now the city is planning to repave the road's surface, starting next year. The work, at least a year ahead of schedule, will pre-emptively address a question staff cannot answer: is the Red Hill too slippery?
>
> The city has done limited friction testing on the road, but refuses to make the results public, saying only they were ultimately inconclusive.
>
> …
>
> Yet that 2015 engineering report found crashes when the road is wet are inexplicably going up, not down, and recommended the city study friction.
>
> And the city did test friction later that year, The Spectator has learned. But the results were never made public.

[4] Councillor Merulla, the mothers of two young women who died on the RHVP, a professor of civil engineering at the University of New Brunswick, and Dr. Hassan Baaj (Director of the University of Waterloo's Centre for Pavement & Transportation Technology, and Golder's aggregate expert in this Inquiry) were also quoted in the article.

> There is no official report, Moore said, only an informal chart sent in an email in December 2015. The friction testing was not fulsome and the results were "inconclusive", he said.
>
> But instead of doing further testing, as was recommended, the city decided to repave.
>
> "All we got was an indication that we should do further work," Moore said. "It was moot when we decided to go ahead with (repaving)."
>
> The city refused to share that chart with The Spectator.
>
> "No one ever releases (that type of) information…because it's the first thing anybody (would use in a) lawsuit," Moore said.

Mr. Moore testified that he believed he read this article at the time of publication. He was unsure if some of the comments or quotes attributed to him, such as "informal chart", reflected his words. However, Mr. Moore did not seek any corrections, or take other steps to address the purported inaccuracies[5] and the statements are consistent with the views and information Mr. Moore expressed about friction testing in other documents that the Inquiry received, in his testimony, and in accounts from other witnesses at the Inquiry.

There are several inaccuracies in the Hamilton Spectator article of July 15, 2017. Friction testing was conducted in November 2013, not in 2015. Mr. Moore received a full and complete report on RHVP friction, not an informal chart in January 2014 when Dr. Uzarowski delivered the 2014 Golder Report appending the Tradewind Report. Mr. Moore received the Tradewind Report again from Dr. Uzarowski in December 2015. The results of Tradewind's testing were not inconclusive even if they referred to a UK standard, nor had Tradewind or Dr. Uzarowski qualified the accuracy of the results in any respect.

In my view, the inaccuracies in the article resulted in large part because of inaccurate and misleading information provided by Mr. Moore to Ms. O'Reilly. Mr. Moore had not

[5] Public Works staff, including Mr. Moore, received media training about how to respond to media inaccuracies, and were supposed to advise Ms. Graham if they were misquoted in an article or if incorrect information was reported.

told his Public Works colleagues a number of the things that he is quoted as stating in Ms. O'Reilly's article, including that he had an "informal chart", that he had "an indication" that the City "should do further work" on the RHVP, or that Engineering Services scheduled the repaving of the RHVP as an alternative to further testing on the RHVP, and so they could not have been the sources of this information.

Mr. Ferguson testified that, if there had been a report stating that further investigation of the friction levels on the RHVP was warranted, he felt it would have been beneficial for Engineering Services to share that report with Traffic. Traffic was trying to determine the cause of collisions on the RHVP, and CIMA had identified friction testing as a countermeasure in both the 2013 CIMA Report and the 2015 CIMA Report. Neither Mr. White nor Mr. Ferguson spoke to Mr. Moore about the statements attributed to him in this article. In fact, none of the City staff who testified at the Inquiry gave evidence that they spoke to or with Mr. Moore about this article when it was published.

Mr. Moore's comment that friction testing information was never released because of potential use in lawsuits (which he believed was an accurate quote) was prophetic. In the weeks that followed, several requests were made to locate and produce the friction test results in ongoing RHVP litigation.

8.8. City's External Legal Counsel Receives the Tradewind Report

8.8.1. The City's External Legal Counsel Finds the Hamilton Spectator Article Quoting Mr. Moore

As of mid-July 2017, the City was a party to a number of outstanding civil claims arising from motor vehicle accidents on the RHVP and LINC. Diana Swaby (Claims Supervisor, Risk Management, Finance & Corporate Services, Hamilton) oversaw the handling of all these claims. In this capacity, Ms. Swaby was a liaison between defence counsel and City staff. The role of the City's Risk Management office and the Legal Services division, of which Risk Management was a part as of April 2018, is described in Chapter 4.

Actions in respect of certain of these claims gave rise to issues respecting the disclosure of the Tradewind Report. Shillingtons LLP ("Shillingtons") was the City's defence counsel on a claim arising from a collision on the LINC.[6] Dana Lezau (Solicitor, Dispute Resolution, Legal Services, Finance & Corporate Services, Hamilton) internally handled a claim arising from a collision on the RHVP.

On July 17, 2017, John McLennan (Manager, Risk Management, Finance & Corporate Services, Hamilton) and Colleen Crawford (Senior Law Clerk, Shillingtons LLP) separately sent Ms. Swaby a link to the July 15, 2017 Hamilton Spectator article "Highway traffic tragedies: Why are there so many crashes on the Red Hill?" that had just been published. Although Ms. Swaby reviewed the article at some point, she did not take any action to obtain the informal chart referred to by Mr. Moore. She explained in her testimony that defence counsel was responsible for document collection and review, including in relation to information obtained from media reports. I understand from Ms. Swaby's evidence that she viewed it as defence counsel's responsibility to determine if the friction testing chart to which Mr. Moore referred was a relevant document to be produced in their RHVP-related claims.

8.8.2. Mr. Moore Gives the Tradewind Report to the City's External Counsel

Shillingtons did take the steps expected by Ms. Swaby. On July 20, 2017, Ms. Crawford contacted Mr. Ferguson to "review the roads, the recent friction studies completed by the City and the proposed roadwork" in connection with Shillingtons' LINC and RHVP matters. Mr. Ferguson referred Ms. Crawford to Mr. Moore, stating "[w]hen it comes to the Friction Testing, Gary Moore, Director of Engineering should be approached as I have not seen the results nor have I been involved in the process."

Mr. Moore, Ms. Crawford, and Terry Shillington (Partner, Shillingtons LLP) arranged a call on August 15, 2017. No other City staff were present on the call, nor does it appear that other City staff knew about it, aside from Mr. Moore's assistant, Ms. Cameron.

[6] Although this litigation arose from a motor vehicle accident on the LINC, it was relevant to this Inquiry's Terms of Reference, as the Tradewind Report was produced as a responsive document in that litigation.

On August 11, before the call with Mr. Moore, Shillingtons received correspondence from counsel for the plaintiff in the above-noted litigation arising out of an accident on the LINC, in which counsel specifically requested that "copies of the friction testing conducted by the City" be included in the list of documents the City was required to produce to the plaintiff (in an affidavit of documents). The letter requested immediate production of the City's affidavit of documents.

Mr. Moore testified that he had no recollection of the August 15 call with Shillingtons. However, Ms. Crawford made contemporaneous notes during the call, and drafted a reporting email to David Thompson (Lawyer, Shillingtons LLP) shortly thereafter, which confirmed that Mr. Moore had provided information about the MTO testing, the SMA early age low friction issue, the Tradewind testing, and the proposed resurfacing of the RHVP in 2018 and 2019.

On the same day of their call, Mr. Moore provided Ms. Crawford with a standalone copy of the Tradewind Report, without the draft watermark, writing, "As requested, the testing was done in late 2013 and I received it in early 2014." There is no evidence that Mr. Moore expressed any caveats or concerns regarding the Tradewind Report or the applicability of the friction test results to Shillingtons, and similarly there is no evidence that he suggested that the results were "inconclusive", either during or after the call with Shillingtons. Shillingtons later included the Tradewind Report in the City's affidavit of documents in the LINC-related litigation, as noted in Chapter 9.

Neither Shillingtons nor Mr. Moore told any other City staff that Mr. Moore had provided this information and/or the Tradewind Report to Shillingtons in August 2017.

Jumping forward in time, several months after this call, on January 31, 2018, Ms. Swaby received a reporting letter from Shillingtons, written by Mr. Thompson, regarding the LINC-related litigation on which Shillingtons was retained. Ms. Swaby was the sole City recipient of this letter. She testified that she assumed she reviewed this letter at some time, but could not recall when.

Shillingtons' reporting letter summarized the "voluminous productions" produced by the City as relevant documents for the litigation, including staff emails, studies on the

LINC, and minutes of Council and Committee meetings.[7] The reporting letter contained a four-paragraph summary of the Tradewind Report. The summary stated that Mr. Moore "advised that the City commissioned the report as it was considering repaving options." This is not accurate as it related to the rehabilitation and resurfacing of the RHVP, which the City only started to contemplate in 2016, and certainly not correct as it related to the LINC, which was the subject of the litigation. Shillingtons' reporting letter noted that the LINC had "superior" friction values compared to the RHVP, but that no directly applicable reference standards or guidelines existed in the United States or Canada. Aside from this, the RHVP friction values were not mentioned. The Tradewind Report was not appended to the reporting letter.

The reporting letter noted that Council had not received the Tradewind Report. Elsewhere in the letter, Shillingtons referenced complications stemming from certain engineering studies not having been submitted to Council, including an opaque reference to "buried reports". Ms. Swaby did not follow up with Mr. Thompson to seek clarification about what "buried reports" referred to. If "buried reports" related to the Tradewind Report, Shillingtons' reporting letter was perhaps the first, but certainly not the last, instance in which such a descriptor was used to describe the report.

8.8.3. Legal Services' Request for a RHVP Surface "Study"

The July 15, 2017 Hamilton Spectator article was also discussed internally in the City's Dispute Resolution group within Legal Services (described in Chapter 4). On August 3, 2017, in an email to Ms. Lezau about the claim she was handling involving a collision on the RHVP, Ron Sabo (Deputy City Solicitor, Dispute Resolution, Legal Services, Finance & Corporate Services, Hamilton) wrote:

> This may be somewhat related to recent articles in the Spectator, questioning the choice of paving material for the Red Hill. The stories has a staffer saying they wouldn't release a study done on the surface to the effect of 'or everyone would sue us'. I expect the study will be a relevant record.

[7] Some of this letter was redacted for privilege. The redacted reporting letter was an exhibit before the Inquiry.

In his testimony, Mr. Sabo confirmed that his email related to the July 15 article. Although Mr. Sabo's email did not mention friction testing, it is clear that the "study" he referenced referred to Mr. Moore's comments about the release of the RHVP and LINC friction test results, which Mr. Sabo noted were potentially relevant records.

A law clerk subsequently forwarded Mr. Sabo's email to Ms. Swaby to enquire if Ms. Swaby was aware of the study and to ask where the clerk and Ms. Lezau could obtain a copy. Ms. Swaby replied that she was not aware of a study and directed them to Mr. Oddi. The Inquiry did not receive evidence of further correspondence with Mr. Oddi.

The Inquiry did not receive testimony from Ms. Lezau. However, it appears that, unlike Shillingtons, Ms. Lezau did not receive the Tradewind Report, or the friction test results, at any time before at least late 2018 or early 2019, as discussed further in Chapter 10. The City's affidavit of documents in the claim being handled by Ms. Lezau, which Mr. Oddi affirmed on May 3, 2018, stated that it included all relevant documents. Neither the Tradewind Report nor the 2014 Golder Report were listed in the affidavit.

8.9. The Public Works Committee Directs Additional Studies on the RHVP

8.9.1. The Speed Limit Study

On August 18, 2017, the PWC passed a motion directing Traffic to study the feasibility and safety benefits of reducing the speed limit on the LINC and RHVP from 90 km/h to 80 km/h and to report the findings back to the PWC in one year's time. The language of this motion expressed that speed was an ongoing concern on the LINC and RHVP and that speed related accidents had led to serious injuries and fatalities.

CIMA submitted a proposal for the Speed Limit Study to Mr. Cooper on December 14, 2017. CIMA's workplan for the study included a review of the best practices relevant to determining an appropriate speed limit, speed data collection (for which Pyramid was retained by CIMA), and a review of the existing RHVP and LINC speed limits. CIMA was retained for the Speed Limit Study in March 2018. CIMA's conclusions and report for the Speed Limit Study, which was finalized in October 2018, as well as

staff's related recommendation report, which Council ultimately received on February 6, 2019, are addressed in Chapters 9 and 11.

8.9.2. Another Lighting Study

As noted in Chapter 7, on September 19, 2016, Engineering Services delivered an information report (Report PW16077) to the PWC regarding lighting on the RHVP and LINC. The September 2016 information report was in response to the PWC direction of December 7, 2015, that staff report back to the PWC with information about the costs and process to investigate an improved lighting system on the RHVP and the LINC.

Despite Engineering Services' intention in that September 2016 information report to defer further consideration of lighting on the RHVP mainline at least until a decision was made about the possible widening of the parkway, at the PWC meeting on September 19, 2016, the PWC directed staff to undertake a "comprehensive study of lighting opportunities" on the RHVP and LINC at an estimated cost of $100,000. Funding for this study was approved in late 2016 as part of the 2017 Capital Budget process and became available for use in early 2017. The PWC's September 2016 motion did not direct staff to report back by a certain date.

The Street Lighting & Electrical group in the Geomatics & Corridor Management section of Engineering Services was responsible for responding to the directions of the PWC regarding lighting matters. The Street Lighting & Electrical group did not initiate the lighting study that was directed in 2016, and funded in 2017, until early 2018. Mike Field (Senior Project Manager, Lighting & Electrical, Geomatics & Corridor Management, Engineering Services, Public Works, Hamilton) testified that implementation of the lighting study was delayed due to a large, resource-intensive City-wide LED retrofitting project that this group worked on between 2015 and late 2017. Mr. Field explained that the LED upgrade project was a "priority" of Council and management (specifically Gord McGuire (Manager, Geomatics & Corridor Management, Engineering Services, Public Works, Hamilton) and Mr. Moore), particularly because the project's funding was time-limited, and that other projects, including the Lighting Study, were delayed as a result.

In the interim, in December 2017, the PWC issued another direction to staff to investigate lighting on the RHVP. This time, staff were directed to report back to the PWC about the cost of installing "brighter lights" on the southern portion of the RHVP and to advise what impact, if any, brighter lights could have on the RHVP environmental assessment ("EA"). An email about this motion sent within Engineering Services indicated that Councillor Conley reported that he was still receiving complaints regarding lighting on the RHVP.

The December 2017 motion was the fourth time since 2013 that Public Works staff were asked to investigate questions related to RHVP lighting. It is evident from these repeated requests that RHVP lighting had been and remained a concern of the PWC.

As set out below, CIMA was retained in the spring of 2018 to complete the Lighting Study.

8.10. Public Works is Restructured in January 2018

Mr. McKinnon oversaw a restructuring of the Public Works department in early 2018. As described in Chapter 4, effective January 1, 2018, the Traffic Operations & Engineering group, which had been in the Transportation division (as of February 2017), became part of a new Public Works division called Roads & Traffic. Ms. Matthews-Malone was the director of this new division. At the same time, Mr. Mater, who had been the Director of Transportation and the Associate General Manager of Public Works, assumed the Associate General Manager role on a full-time basis. Mr. Mater retired at the end of 2018.

In 2017, Mr. Moore had begun to focus increasingly on the City's light rail transit ("LRT") project. In that regard, in August or September 2017, Mr. Moore and Mr. Murray, the City Manager, began discussing the possibility of Mr. Moore's retirement from the Director of Engineering Services role to take a contract position with the LRT project office. There was competing evidence as to whether Mr. Moore formally retired in order to take the position in the LRT office, or if he took this position as a result of his eligibility for retirement. Those specifics are not relevant to the Inquiry's purposes.

In any event, the January 2018 restructuring in Public Works also changed the leadership of the Engineering Services division. Effective January 1, 2018, Mr. Moore

and Mr. McGuire, who was then the Manager of Geomatics & Corridor Management, began sharing the role of Director of Engineering Services. Mr. Moore remained responsible for the Design, Construction, and Waterfront Development sections within Engineering Services, while Mr. McGuire assumed oversight of the Asset Management and Geomatics sections. Mr. McKinnon testified that this decision was largely driven by his desire to lighten Mr. Moore's "extreme" workload. It also provided Mr. McGuire with an opportunity to gain additional experience in anticipation of Mr. Moore's eventual retirement.

Mr. Moore ultimately retired from his role as Director of Engineering Services in May 2018.

8.11. An Omnibus Report on the RHVP and LINC is Presented to the Public Works Committee

8.11.1. LINC and RHVP Transportation and Safety Update (Report PW18008)

On January 15, 2018, Traffic Operations & Engineering (by then part of the Roads & Traffic division) presented an omnibus recommendation report on the RHVP and LINC, entitled "Lincoln Alexander and Red Hill Valley Parkway Transportation and Safety Update" (Report PW18008), to the PWC. Mr. Ferguson and Mr. White prepared this report. It was submitted to the PWC by Jennifer DiDomenico (Acting Director, Transportation, Public Works, Hamilton).[8]

This recommendation report resulted from the May 1, 2017, meeting of Public Works senior leadership, described above. Report PW18008 indicated that there had been 10 Council motions regarding the RHVP and LINC since January 2013. The recommendation report consolidated Traffic staff's response to the five motions that were still outstanding as of January 2018, other than those related to illumination on the

[8] Although the cover page of Report PW18008 indicates that it was submitted by the Transportation division, this division no longer existed at the time Report PW18008 was presented to the PWC on January 15, 2018. As noted, effective January 1, 2018, the Traffic group that prepared this report was part of the Roads & Traffic Division overseen by Ms. Matthews-Malone.

RHVP, described below, which were under the purview of Engineering Services. The report recommended that the PWC direct staff to implement a broad range of safety and traffic initiatives, including the continued implementation of the short and medium term safety improvements identified in the 2015 CIMA Report and 2015 CIMA LINC Report, and approved in Report PW15091, which had not yet been implemented; an annual detailed collision analysis of the RHVP and LINC and an annual traffic count program (as part of the Hamilton Strategic Road Safety Program Annual Report); and continued speed and aggressive driving enforcement on the LINC and RHVP by the Hamilton Police Service. The recommendation report also recommended installation of median barriers in conjunction with any future widening of the facilities.

City staff included a section in Report PW18008 summarizing CIMA's collision history analysis from the 2015 CIMA Report and the 2015 CIMA LINC Report. Staff's summary noted that CIMA's collision analysis had identified an overrepresentation of incidents that occurred on the RHVP under wet road conditions, and that "[b]oth [s]afety reports identified that collisions are occurring as a result of speeding, aggressive driving, following to[o] close, distracted driving, and driving too fast for weather conditions". Elsewhere in the recommendation report, staff identified speeding, distracted, and aggressive driving as the "primary 'root cause'" of collisions on the roadways.

Appendix A to Report PW18008 was a chart that set out the completion status of the safety improvements approved in Report PW15091, and identified in the 2015 CIMA Report and the 2015 CIMA LINC Report. As they had in their March 2017 information update (Report TRANSP1701), Traffic staff indicated in this chart that pavement friction testing was completed.

8.11.2. The 2018 CIMA Collision Memorandum

On January 9, 2018, Mr. Ferguson asked CIMA staff to investigate questions raised by Mr. McKinnon and Mr. Mater about collision statistics, including the collision rate, for the RHVP and LINC, which had arisen during the preparation for the January 15 PWC meeting at which Report PW18008 would be presented. CIMA committed to prepare a memo addressing these questions by January 15 to allow City staff to respond to questions that might be raised at the PWC meeting.

CIMA sent a memo response to the City in the evening on January 12 (the "2018 CIMA Collision Memorandum"). Mr. White subsequently forwarded the 2018 CIMA Collision Memorandum to Mr. Mater, Mr. Moore, Ms. Matthews-Malone, and Mr. McKinnon.

In the 2018 CIMA Collision Memorandum, CIMA compared the average collision rates for the RHVP and LINC between 2009 and 2013 against the collision rates for sections of three provincial MTO highways: Highway 406 (between Highway 58 and the QEW in St. Catharines), Highway 7/8 (between Conestoga Parkway/Victoria Street N and Trussler Road in Kitchener), and Highway 8 (between Sportsworld Drive and Highway 7 in Kitchener). Unlike the MTO collision data used in the 2018 CIMA Collision Memorandum, the RHVP and LINC collision data that CIMA used included only collisions reported to police and did not include self-reported collisions. This difference had the effect that the RHVP and LINC collision dataset used by CIMA was not comparable with the collision data for the comparator provincial highways. As described in Chapter 11, this fact only surfaced in January 2019, in connection with a subsequent CIMA assignment.

CIMA's analysis concluded that the RHVP had a lower overall collision rate than the three MTO comparator highways. The RHVP average weighted collision rate was 0.36 (collisions per million vehicle kilometres travelled), compared to 0.77 for Highway 406, 0.59 for Highway 7/8, and 0.79 for Highway 8, and 0.20 for the LINC.

However, two days later, on January 14, 2018, Dr. Pedram Izadpanah (Associate Partner, Senior Project Manager, Transportation, CIMA) sent Mr. Ferguson an email, stating that he had been thinking about Mr. Ferguson's questions, and thought it would be useful for Mr. Ferguson to know the proportion of severe collisions on the RHVP, LINC, and comparison highways. Dr. Izadpanah went on to explain that notwithstanding the RHVP's lower overall rate, the RHVP had a significantly higher proportion of severe collisions (which Dr. Izadpanah described in his email as "fatal and injury collisions") than the MTO comparator highways. The LINC also had a higher proportion of severe collisions than the comparator highways. Dr. Izadpanah's analysis prompted discussion and questions amongst management in Public Works, including Mr. McKinnon, Mr. Moore, and Mr. Ferguson, regarding the severity of collisions on the RHVP and LINC. Following a discussion between Mr. Ferguson and CIMA to understand why this was the experience on the RHVP and LINC, CIMA clarified that the statistics categorized as severe collisions included all personal injury collisions,

not specifically serious personal injury collisions, and therefore did not distinguish between minor and major injuries.

Discussions regarding the 2018 CIMA Collision Memorandum, including the severity level of injuries on the roads, continued throughout February 2018. On March 6, 2018, Mr. Ferguson emailed Mr. McKinnon, copying Ms. Matthews-Malone, Mr. Moore, Mr. Mater, and Mr. White, providing further analysis from CIMA in response to questions that Mr. McKinnon had raised. Mr. Ferguson provided some updated collision statistics for the LINC and RHVP, and noted that "[t]he Consultant has confirmed that the observations show that speeding is the number 1 problem", that the Hamilton Police Service's enforcement statistics had found that 91.2% of tickets were directly related to speeding and 53% involved drivers speeding over 120 km/h, and that the police had identified a concern with stunt driving (in which drivers drove more than 50 km/h over the speed limit). Mr. Ferguson also provided the following response to Mr. McKinnon's question:

> 2. Why are collisions occurring and injuries occurring?
>
> For confirmation, Injuries are identified as any type of injury that has been recorded by the Police Officer ranging from minor to serious injuries. The collision data information does not break it down so whether it is a sprained wrist or broken leg, it is just classified as an injury. The Consultant confirmed that the biggest issue, especially on the LINC, is the big speed differentials between the two lanes which was identified in the original safety reports. This large speed differential is unusual and not necessarily observed on the comparison roadways. […]

On March 29, 2018, Mr. Ferguson put the information from his March 6 email into a memo for Mr. McKinnon and Ms. Matthews-Malone (the "March 2018 RHVP/LINC Collision Memorandum"). As noted above, City staff (and CIMA) were unaware of the discrepancy between the datasets used by CIMA in the 2018 Collision Memorandum at this time, and until January 2019, as described in Chapter 11.

Around this time, Mr. McKinnon initiated what was intended to be a regular meeting every two months between various managers and directors in Public Works, including from Engineering Services and Roads & Traffic, to discuss the RHVP and LINC. Mr. McKinnon testified that he sought to arrange "a regular meeting so that nothing fell

through the cracks", because he recognized that responsibilities regarding the RHVP and LINC were shared amongst different divisions, even following the restructuring in Public Works. These meetings later became known first as the Parkway Coordination Committee and later as the Parkway Management Committee. The first of such meetings was scheduled for April 9, 2018. There is some evidence to suggest that the March 2018 RHVP/LINC Collision Memorandum was discussed at this meeting.

8.12. Engineering Services Considers Hot In-Place Recycling for the RHVP and the Golder Pavement Evaluation from November 2017 to May 2018

As noted above, by early 2017, Engineering Services had decided to resurface the RHVP beginning in 2018. The scope of the resurfacing project was discussed between staff in Engineering Services, specifically Asset Management, and Traffic in 2017. The capital budgeting information for this project was updated in July 2017 to reflect the anticipated resurfacing, but had not yet been approved by Council in the 2018 Capital Budget (which is understood to have occurred in early 2018). Until October 2017, staff's plan was that the RHVP resurfacing project would be funded and completed over two years — in 2018 and 2019 — using a mill and overlay method. However, in November 2017, after discussions with Dr. Uzarowski, Mr. Moore began considering the possibility of using an alternative resurfacing method called HIR (hot in-place recycling)[9] for the RHVP resurfacing.

HIR is a resurfacing method that involves heating and partial depth hot milling of an existing asphalt pavement, mixing it with a beneficiating hot mix asphalt or a rejuvenating agent or both, and compacting the recycled hot mixture in-place in one single operation. Heather Bell (Senior Bituminous Engineer, Bituminous Section, Materials Engineering & Research Office, Highway Standards Branch, Provincial Highways Management Division, MTO), who was the lead for the MTO's HIR specifications and a contact for some MTO regional offices about HIR, testified at the Inquiry that HIR can be used for asphalt that has aged, become hardened, and/or

[9] Hot in-place recycling was also occasionally referred to in documents and in witness testimony as "HIP" or "HIPR".

begun cracking. This is because the HIR process involves taking the existing asphalt, heating it, adding a rejuvenating agent, and putting it back down without cracks.

Because HIR involves reusing some of the existing asphalt, it is potentially less expensive and more environmentally friendly compared to a mill and overlay, which requires all new material for the resurfaced layer. Because HIR can also be completed more quickly than a mill and overlay, it also results in less interruption and inconvenience to roadway users.

In her testimony, Ms. Bell described some of the limitations of HIR. One limitation is that HIR can only be used if a pavement does not have structural distresses; if there is cracking that exceeds the first 50 mm surface layer of a pavement, then a deeper treatment (that is, one that goes below the surface) must be used to repair the cracking. Another limitation is that the expected lifespan of a road resurfaced using HIR is estimated to be a few years shorter than a road that is resurfaced through a mill and overlay.

On November 10, 2017, Dr. Uzarowski emailed Mr. Moore offering to arrange a meeting with Pat Wiley (President, EcoPave Asphalt Recycling Inc. ("EcoPave")) during an industry conference that they would be attending. The 2017 Canadian Technical Asphalt Association ("CTAA") conference took place in Halifax between November 12 and 15, 2017. EcoPave was a company that engaged in HIR, and Mr. Wiley was based in British Columbia. At this time, the meeting was not intended to be about the RHVP in particular. In his testimony, Dr. Uzarowski explained that "the City", which I understand to mean Mr. Moore, had expressed interest in the use of HIR more generally on City roads.

HIR had been used to resurface roads in Ontario in decades prior, but fell out of use. However, HIR had advanced or changed technology since it was last used in Ontario and HIR had been used more recently in British Columbia. EcoPave was interested in re-introducing HIR into Ontario.

It is not clear from the evidence before the Inquiry precisely how or when discussions between Dr. Uzarowski and Mr. Moore about HIR turned to the RHVP, although it appears to have been at the CTAA conference, and possibly in the course of their discussions with Mr. Wiley. It is clear, however, that following the CTAA conference,

the City — and Mr. Moore in particular — was very interested in the prospect of using HIR to resurface the RHVP.

8.12.1. Golder Prepares a Proposal for the Golder Pavement Evaluation

After the CTAA conference and their meeting with Mr. Wiley, Mr. Moore emailed Dr. Uzarowski requesting a proposal for "cores, BPT and PSV testing for the Red Hill". In response, Golder began drafting a proposal for a study (referred to in this Report as the "Golder Pavement Evaluation"), which included three field tests: British Pendulum Testing ("BPT"), Polished Stone Value ("PSV") testing, and pavement texture measurements ("Sand Patch Testing"). The details of each of these tests are described in Chapter 1.

Both Mr. Moore and Dr. Uzarowski had some urgency in completing the testing before the City experienced snow fall and freezing temperatures. In an email sent internally at Golder on November 23, 2017, Dr. Uzarowski indicated that he was concerned that freezing temperatures would impact the BPT. This concern was warranted, as ultimately the weather at the time of testing (which did not occur until December 6 and 7, 2017) did impact Golder's analysis of the BPT results.

Rabiah Rizvi (Pavement & Materials Engineer, Golder) prepared the initial draft of the Golder proposal on November 22, 2017. In her draft, Ms. Rizvi framed the Golder Pavement Evaluation as an evaluation of skid resistance on the existing surface of the RHVP. Ms. Rizvi's draft proposal contemplated that the results of the study were to be used to determine if the existing surface had sufficient frictional resistance, and, if not, that Golder would determine the cause for the low frictional number and provide recommendations for methods to improve the skid resistance on the RHVP pavement surface if required. The draft proposal also contemplated that Golder would "evaluate the potential of using hot-in-place recycling to restore the pavement friction".

Dr. Uzarowski revised the draft proposal to describe the purpose of the Golder Pavement Evaluation as an investigation of the existing pavement surface. His draft contemplated that the results of Golder's laboratory and field testing "would be used to determine if the current material in the RHVP pavement can provide sufficient frictional characteristics." I understand this comment in the context of the next two

sentences, which stated that Golder would also evaluate the potential of using the existing surface course SMA and underlying Superpave 19 mm binder course for HIR of the RHVP, with the objective of producing, if feasible, "a mix that would meet the requirements or would be close to [Superpave] 12.5 FC2 mix". The revised proposal removed the statements that Golder was to determine the cause of or provide recommendations to address low friction values, if necessary. In short, the revised proposal reflected that the focus of the field testing, including the friction testing and the pavement texture testing, was to evaluate the suitability of the existing aggregate from a frictional perspective for use in a recycled mix, not to evaluate the frictional properties of the existing pavement surface from a traffic safety perspective.

The proposal contemplated that Golder would present its findings to the City in a draft report, which would be finalized upon receipt of comments from the City and any necessary revisions by Golder.

Dr. Uzarowski sent Mr. Moore the revised draft of the proposal on November 22, 2017. The following day, on November 23, Dr. Uzarowski sent Golder's final, signed proposal to Mr. Moore, advising that Golder could complete the work "in the first or second week of December" and that Golder would monitor the weather to ensure the testing could be done without frost. Mr. Moore approved the proposal the following day; he also separately forwarded Dr. Uzarowski's email, attaching the final proposal, to Mr. Andoga and Mike Becke (Senior Project Manager, Design, Engineering Services, Public Works, Hamilton). Several staff members from Traffic and Operations, including Ms. Matthews-Malone, Mr. White, Mr. Ferguson, and Mr. Mater, were made aware of the upcoming testing (although there is no evidence they received the proposal itself) so that they could arrange to notify the public and later repair the roadway where cores were removed.

Although Dr. Uzarowski intended the final proposal to be the revised proposal (which Mr. Moore had received the day before in draft), the signed proposal Dr. Uzarowski actually attached and sent to Mr. Moore had inadvertently reverted back to the initial draft prepared by Ms. Rizvi. Thus, the final proposal the City received was not reflective of the intended purpose of the testing on the part of either Golder or the City, as described below. This inadvertent error in finalizing Ms. Rizvi's draft proposal did, however, cause some confusion amongst City staff regarding the purpose of the

Golder Pavement Evaluation later in time, following the discovery of the Tradewind Report, as discussed in Chapters 10 and 11.

Both Mr. Moore and Dr. Uzarowski testified that the main focus of the Golder Pavement Evaluation was HIR. However, Mr. Moore and Dr. Uzarowski differed in their recollections on whether all three tests in this project were included solely for that purpose.

Dr. Uzarowski testified that only the PSV testing was directly related to evaluating the feasibility of HIR, while the BPT and Sand Patch Testing were instead additions "just for information", in that, because the surface was going to be replaced (either through HIR or a mill and overlay) in the near future, any concerns with friction values would be addressed through the resurfacing. Dr. Uzarowski testified that he believed Mr. Moore requested friction testing, but did not know why. Dr. Uzarowski speculated in his testimony that Mr. Moore may have wanted to know "what it was before it was resurfaced". He also recalled that Mr. Moore expressed a concern that "maybe the asphalt was filled with rubber", which prompted Dr. Uzarowski to propose testing the macrotexture on the RHVP surface with the Sand Patch Testing.

In contrast, Mr. Moore testified that the purpose of the Golder Pavement Evaluation was to assess the viability of HIR for the RHVP resurfacing, and that he understood that this was the purpose of each of the three field tests. From Mr. Moore's perspective, the testing of the frictional characteristics of the RHVP was simply to evaluate the potential to reuse the aggregates, and it was not to assess the sufficiency or adequacy of surface friction on the existing RHVP surface.

I note that Mr. Moore's testimony in this respect could be considered to be inconsistent with a quote about pavement testing attributed to him in a January 15, 2018, Hamilton Spectator article, entitled "Scratching the surface for answers on Red Hill paving", in which Mr. Moore was quoted as stating "[w]e don't know why they feel that [the pavement on the RHVP is] slippery... That's all part of (why the city is doing) the testing." When asked about this quote, Mr. Moore testified that he was not sure if he was quoted correctly, or if he misspoke, and referred to the testing as being connected to the resurfacing. I therefore do not place any weight on this article to demonstrate that Mr. Moore sought the testing to establish the friction levels of the

RHVP for safety purposes.[10] I think it is clear that, despite Dr. Uzarowski's testimony which suggested otherwise, Mr. Moore understood the testing to be solely for the purpose of evaluating the feasibility of using HIR to resurface the RHVP and not to assess the friction values of the existing pavement surface. Dr. Uzarowski's testimony that the purpose of including BPT and Sand Patch Testing in the Golder Pavement Evaluation was for a reason other than the evaluation of HIR is also inconsistent with Dr. Uzarowski's revisions to the draft proposal and his later actions regarding the results of this testing, discussed below.

Dr. Uzarowski gave evidence that Mr. Moore did not direct him to complete a specific type of testing. It was Dr. Uzarowski who selected the BPT method instead of using other friction testing methods, such as a GripTester or locked-wheel tester. Dr. Uzarowski testified that he opted to use the BPT method over the two other types of friction testing equipment, which had been used by Tradewind and the MTO, because of ease of access to BPT equipment, the seasonality of the MTO's locked-wheel tester, and Dr. Uzarowski's experience with delays in receiving the Tradewind results. Dr. Uzarowski was not concerned about whether he could correlate the BPT results to the prior friction testing results. He testified that this was based on his past experience using BPT, from which he knew what values would demonstrate poor, good, or excellent friction. Given that the purpose of the testing was for HIR feasibility, there was no need for a correlative testing method.

Dr. Uzarowski testified that he wanted to conduct PSV testing to assess the quality of the in-service aggregate in the RHVP surface course if the aggregate was going to be recycled for use in the RHVP, and that he sought to do so notwithstanding his knowledge that the MTO had tested and placed the Demix aggregate on its Designated Sources for Materials ("DSM") list. In my view, Dr. Uzarowski's proposal of PSV testing also reflects his continuing residual questions about the quality of the Demix aggregate, given that the aggregate had not been on the MTO DSM list in 2007 when it was used in the RHVP's SMA surface course of the RHVP so there had been no verification by the MTO of its in-service performance.

[10] I return to Mr. Moore's inaccurate statements to the media and others in Chapter 12.

Dr. Uzarowski described his rationale for testing the PSV of the in-service aggregate, rather than quarry aggregate, in an email he sent to Ms. Rizvi on November 22, 2017, during the preparation of Golder's proposal. He wrote:

> 1. The traprock material is from Montreal, not local. The pavement is 10 years old and you don't know if the same material is still available or even if the quarry still operates.
>
> 2. When we get cores we will extract the aggregates. Some of the particles will obviously have the faces polished but the majority will not.
>
> 3. Gary want to know what he has on site. He has asked me about PSV. He is considering the Hot In-Place (HIP) recycling there. My first concern would be to make sure the recycled material is suitable from PSV point of view.
>
> 4. I am not too keen on HIP there for three reasons: if we use the same rock we will not improve friction for a longer period of time (I anticipate low PSV); Gary would like to change the mix during the HIP process from SMA to SP 12.5 FC2 but I am not sure i[f] this is feasible (at least it would be very difficult) from the gradation point of view; and I am not sure if this HIP mutant mix will be suitable for such heavy traffic (90 million ESALs or even more in 50 years).

In his testimony, Dr. Uzarowski explained that he anticipated low PSV results because, the "PSV could only go down". He agreed that this would always be the case when evaluating in-service aggregates in this manner, and that for this reason, he had some reservations about conducting HIR on a "major highway or high-speed, high-volume, high-speed highway". As discussed in the sections of this chapter that follow, Dr. Uzarowski continued to have reservations regarding use of HIR to resurface the RHVP following Golder's field testing.

8.12.2. Golder Conducts Testing and the Lack of Results Impacts the Resurfacing Schedule

Golder conducted the field testing for the Golder Pavement Evaluation overnight, from December 6 to 7, 2017. Golder conducted BPT and Sand Patch Testing at 30

locations on the RHVP (at 15 northbound and southbound locations respectively). Golder obtained a core of the surface course asphalt layer at each location. Although Golder's field notes do not reference the weather or temperature at the time of testing, Dr. Uzarowski testified that the field technician told him that there had been light snowfall and that the temperature was below 0°C. Dr. Uzarowski later verified this by checking Hamilton weather data.

Following the field testing, Golder made arrangements for PSV testing of aggregates obtained from the core samples that had been removed from the RHVP. Although Golder's proposal had contemplated that aggregates would be sent overseas for the PSV testing, Dr. Uzarowski initially contacted the MTO and a local laboratory to see if the PSV testing could be done locally, in order to expedite the testing given the City's timeline for the resurfacing in 2018. Neither could. Golder therefore began making arrangements to send the core samples to Ireland for testing. Throughout December 2017 and into the new year, Golder had discussions, both internally and with the City, regarding the expected timing of receipt of the results of the field testing. Ms. Rizvi went so far as to ask Golder's laboratory staff in December 2017 if the extraction process could be expedited because "the client is facing an urgent safety issue with their road and would like an answer before further issues arise." Despite this language, I accept Ms. Rizvi's testimony that she used this language only to "add a little more urgency" to the request, and she was not aware of any safety issues on the RHVP.

Similarly, in January and February 2018, Dr. Uzarowski followed up with the laboratory, and Mr. Moore pursued Dr. Uzarowski to obtain the results. While neither Dr. Uzarowski nor Mr. Moore testified as to the reason for such urgency, the evidence suggests that Mr. Moore wanted to finalize the RHVP resurfacing project design to get to the tender stage if the resurfacing was to commence in 2018. This required completion of the investigation into HIR, for which receipt of the PSV results was necessary.

By February 2018, the window to tender for a summer 2018 resurfacing had either closed, or would soon close. Initially, the contract for the RHVP resurfacing was to be tendered by January or February 2018. In mid-January 2018, Ms. Jacob emailed Mr. Sidawi, Mr. Moore, Mr. McGuire, and Mr. Becke about changes to the delivery of various 2018 capital projects, including the RHVP resurfacing. In her email, Ms. Jacob expressed that although the RHVP "was committed for a Jan 24th tender", the project was "still in programming with Scope still being modified" and, as a result, the Design

group in Engineering Services had reallocated its resources to other projects. Ms. Jacob testified that missing the January 24, 2018 tender date effectively meant that the project would need to be deferred to the following year (2019), given the size and coordination required for the project. Mr. Moore did not share this view, and testified that a mill and overlay resurfacing could have been done in 2018, without deferral to 2019, if the tender was out by mid-summer.

Golder ultimately received the PSV results in February 2018. Dr. Uzarowski reported the results of the three tests to the City during a meeting in March 2018, as discussed below.

8.12.3. Dr. Uzarowski Reviews a Hamilton Spectator Article About RHVP Collisions

On January 22, 2018, David Hein (Principal Engineer and Vice President of Transportation, Applied Research Associates Inc. ("ARA"))[11] emailed Dr. Uzarowski under the subject line "Red Hill Valley Friction Problem….". In his email, Mr. Hein advised that Dr. Uzarowski should let him know when Dr. Uzarowski next needed friction testing done on the RHVP because ARA had an ASTM brakeforce trailer (the same type of tester used by the MTO) in the Toronto area every year to do testing.

What is noteworthy about this exchange is that Mr. Hein subsequently emailed Dr. Uzarowski a link to the above-referenced January 15, 2018 Hamilton Spectator article, written by Ms. O'Reilly, regarding RHVP collisions, entitled "Scratching the surface for answers on Red Hill paving". Dr. Uzarowski had not seen this article and was not aware of the fatal collisions on the RHVP referred to in it until he received Mr. Hein's email on January 22.

In addition to including references to fatal collisions, the article referenced complaints that the RHVP had a slippery surface and contained several inaccurate statements. The article restated certain information from prior Hamilton Spectator articles, including information that was attributable to Mr. Moore, as discussed in Chapter 7, in context of the July 15, 2017 Hamilton Spectator article. It also included information

[11] Mr. Hein is currently President and Principal Engineer at 2737493 Ontario Inc., and was the City's pavement expert in this Inquiry.

about the more recent testing that occurred in December 2017, some of which is described above, suggesting that Mr. Moore spoke again to Ms. O'Reilly in advance of this article and she had not simply reused quotes from past articles:

> The City of Hamilton has hired a consultant to test the asphalt on the Red Hill Valley Parkway — results expected to show once and for all whether there is a problem with the material.
>
> The parkway has been the subject of complaints regarding slippery pavement since it opened in 2007. Friction testing done in December 2015 was inconclusive, and a consultant recommended further testing; instead the city opted to repave ahead of schedule starting later this year.
>
> "We don't know why they feel that it's slippery," said Gary Moore, director of engineering. "That's all part of (why the city is doing) the testing."
>
> The testing includes samples that were collected before Christmas being sent to Ireland for specialized analysis. The city needs a comprehensive look at the asphalt mix to know if it can be recycled during repaving using a new technique being explored by the city, he said.
>
> Slippery roadways have been among the concerns expressed by the grieving families who have lost loved ones in crashes along the parkway.
>
> But the major rallying point has been a call for median barriers along the Red Hill and the connecting Lincoln Alexander Parkway, to prevent crossover crashes where cars travel through the median onto the other side.

Mr. Hein did not have a detailed recollection of why he emailed Dr. Uzarowski, whom he knew as a former colleague. He testified that he was aware that Dr. Uzarowski had been involved with the RHVP for some time, although Mr. Hein could not recall if he understood Dr. Uzarowski to have been involved in the context of friction specifically. It appears that upon reviewing the article (including its references to a City consultant and friction testing), Mr. Hein assumed that Dr. Uzarowski was the consultant referred to therein, based on his awareness of Dr. Uzarowski's involvement with the RHVP,

and contacted him to offer ARA's friction testing services. Mr. Hein was not retained by the City at that time.

8.12.4. Results of the Golder Pavement Evaluation and Concerns About Feasibility of HIR on SMA

Dr. Uzarowski received the results of the PSV testing in the Golder Pavement Evaluation on February 15, 2018. These results indicated that the average PSV was 45. Dr. Uzarowski testified that his initial view was that the PSV was "probably lower than [he] anticipated", and insufficient for HIR purposes. By this date, Dr. Uzarowski had the results from all three field tests that comprised the Golder Pavement Evaluation. However, Dr. Uzarowski did not provide a copy of the results or his views on the results in writing to City staff at this time. He instead verbally reported on the results and his views at a meeting on March 9, 2018, as described below.

Dr. Uzarowski was scheduled to give a presentation to City staff on February 23, 2018, about new City asphalt specifications, unrelated to the RHVP. Dr. Uzarowski and Mr. Moore arranged to meet to discuss "RHVP and other aspects" prior to Dr. Uzarowski's presentation.

On February 22, before his meeting with the City, Dr. Uzarowski contacted Daryl Finlayson (Senior Material & Pavement Engineer, Geotechnical, Materials & Pavement Engineering Section, BC Ministry of Transportation & Infrastructure) to ask if Mr. Finlayson had any experience using HIR for SMA mixes, and whether he had any concerns. Mr. Finlayson advised that HIR "should work" for SMA mixes, noting that the resulting mix "might not be a true SMA mix" due to possible changes in gradation. Dr. Uzarowski's email suggests that he continued to have concerns regarding the feasibility of using HIR on an SMA pavement, a concern which Dr. Uzarowski said he expressed to City staff on February 23, 2018.

8.12.5. Dr. Uzarowski Has "Side Discussion" About the RHVP Resurfacing with City Staff

Following Dr. Uzarowski's presentation on February 23, Dr. Uzarowski met with Mr. Becke, Mr. Oddi, and Tyler Renaud (Project Manager, Construction Quality Assurance, Construction, Engineering Services, Public Works, Hamilton), and possibly one or two

additional City staff about the RHVP resurfacing. Neither Mr. Oddi nor Mr. Becke had any specific recollection of this conversation, including regarding HIR, at the Inquiry, and Mr. Renaud was not called as a witness at this Inquiry. Mr. Becke later referred to this as a "side discussion" to Dr. Uzarowski's presentation in an email he sent on February 28. Mr. Moore attended the presentation but not this side discussion. It is not clear whether Mr. Moore and Dr. Uzarowski spoke regarding the RHVP as they had intended the day prior.

Dr. Uzarowski testified that, during the side discussion, he expressed concerns regarding HIR, its use on the RHVP, and converting SMA into a dense grade mix (such as Superpave 12.5 FC2), given the nature of an SMA mix. Dr. Uzarowski believed that Mr. Renaud also expressed concerns regarding the use of HIR to resurface the RHVP. However, as noted above, Mr. Renaud was not called as a witness at the Inquiry.

Dr. Uzarowski could not recall if he presented the PSV results to the City staff involved in the side discussion, or if he expressed his view that these results were too low to use the aggregate in HIR. He recalled providing recommendations for treatment of the RHVP, but could not recall in detail what he advised City staff. He testified that the side discussion occurred shortly after his email exchange with Mr. Hein, through which he learned about the Hamilton Spectator article discussing fatal collisions.

Dr. Uzarowski thought he recommended using "shot blasting as a quick and simple alternative for friction — friction improvement of the Red Hill Valley Parkway" in advance of resurfacing. He also testified that one of the City staff present, likely Mr. Oddi, advised that the City would not conduct friction improvement measures as that would be regarded as confirmation that there was a problem with the RHVP and "the public would blame the City." In his testimony, Dr. Uzarowski advised that Mr. Oddi and/or Mr. Becke also expressed this sentiment to him on other occasions. As noted, neither Mr. Oddi nor Mr. Becke recalled the meeting, nor did they recall expressing this sentiment on any occasion. Both Mr. Oddi and Mr. Becke testified that they were not aware of the Tradewind Report or the friction results therein at the time of the February 23 side discussion. Given the absence of any definitive recollection of this part of the discussion by any of the people who attended it and gave evidence to the Inquiry, there is insufficient evidence to conclude that these topics were, in fact, discussed on February 23. It is possible that Dr. Uzarowski was instead confusing it

with a similar conversation that did occur at the meeting on March 9, 2018, discussed below.

In any event, this side discussion prompted Mr. Becke to propose another meeting between City staff and Dr. Uzarowski. The meeting was ultimately scheduled for March 9, 2018.

In preparation for the March 9 meeting, Dr. Uzarowski contacted Mr. Wiley to see if he had any knowledge or experience using SMA for HIR. Mr. Wiley advised that EcoPave had not used SMA for HIR and noted that the MTO's HIR guidelines advised against using HIR on SMA. Mr. Wiley's view was that it should be considered "very cautiously, perhaps its not feasible".

In an email sent only to Mr. Becke on March 1, Dr. Uzarowski conveyed Mr. Wiley's views that HIR for SMA was perhaps not feasible and that Mr. Wiley had referenced that the MTO guidelines did not allow HIR of SMA. Dr. Uzarowski excerpted part of the MTO's June 2015 guidelines which expressly stated that "[t]he HIR process shall not be used to recycle SMA or composite pavements."

Mr. Becke did not recall discussing Dr. Uzarowski's views with anyone before the meeting on March 9, 2018. Mr. Moore testified that he believed he was aware of some of the concerns expressed in Dr. Uzarowski's email (which he had not been copied on), but could not recall who made him aware of that information or when he learned about those concerns.

8.12.6. Dr. Uzarowski and City Staff Meet to Discuss the Feasibility of HIR on March 9, 2018

Dr. Uzarowski, Mr. Moore, Mr. Becke, Mr. Oddi, Ms. Jacob, Mr. Andoga, Mr. Renaud, Sarath Vala (Project Manager, Design, Engineering Services, Public Works, Hamilton), Claudio Leon (Project Manager, Contracts and Standards, Design, Engineering Services, Public Works, Hamilton), and Dennis Perusin (Senior Project Manager, Construction, Engineering Services, Public Works, Hamilton) met on March 9, 2018 (the "March 9 Meeting"). Many of the attendees testified at the Inquiry hearings. These witnesses testified about their recollections of this meeting, many of which diverged on a number of topics, including who attended and who was present for

which portions of the meeting. The meeting was not formally recorded in minutes, although Dr. Uzarowski and Mr. Becke both took some contemporaneous notes and Dr. Uzarowski emailed his colleagues at Golder about the meeting a few days later.

Dr. Uzarowski planned to tell City staff at the March 9 Meeting that he considered that HIR of SMA was not feasible. He anticipated this would be a "difficult message" because the City, and Mr. Moore in particular, were "very keen" on using HIR to resurface the RHVP, and considered HIR a good, feasible alternative to a mill and overlay. Dr. Uzarowski made notes to prepare for and guide discussion at the meeting, which he annotated during the meeting.

Dr. Uzarowski testified that, at the March 9 Meeting, he presented the results of the three field tests performed in the Golder Pavement Evaluation, but did not provide a copy of the results. Dr. Uzarowski's views on these results were as follows:

- the results of the Sand Patch Testing were an average texture depth of 1.25 mm, which he described as "okay" or "good";
- the PSV results were 45, which he described as "medium" for trap rock[12], based on a paper authored by Dr. John Emery (John Emery Geotechnical Engineering Limited). Trap rock with a PSV of 50 or higher would be considered good. Based on this result, Dr. Uzarowski conveyed that it was somewhat risky to recycle the RHVP SMA; and
- the BPT results were "unreliable" due to weather.

Mr. Oddi recalled Dr. Uzarowski discussing PSV results at the meeting, including saying that the PSV of the aggregate was low. Mr. Oddi also recalled, that when Mr. Moore questioned how that could be, given that Dr. Uzarowski had approved the aggregate at the time of construction, both Dr. Uzarowski and Mr. Moore "chimed in and said it's a very good aggregate, it's strong, it's durable, it's good." Mr. Moore also recalled discussing PSV, possibly in the context of HIR, and that the discussion caused him some confusion.

[12] The Demix aggregate used in the SMA surface course of the RHVP was a trap rock.

While none of the City witnesses specifically recalled a discussion about the BPT results, or being told that the results were unreliable, I am satisfied that Dr. Uzarowski communicated that conclusion.

Dr. Uzarowski also testified that he raised the results of prior friction testing conducted on the RHVP and provided the averages from the 2007 MTO testing (noting low values under structures) and the 2013 Tradewind testing (which he described as variable). Dr. Uzarowski testified that he did not know that the Tradewind Report and the 2014 Golder Report had not been shared internally at the City at the time of the March 9 Meeting, and based on the absence of follow up questions on this topic during the meeting, Dr. Uzarowski's impression was that these reports were known. In its closing submissions, Golder submitted that Dr. Uzarowski presented the summaries of the prior friction testing results because Dr. Uzarowski considered the BPT results unreliable.

However, none of the City witnesses had a specific recollection of the prior friction testing results being discussed or, in particular, of Dr. Uzarowski using the name "Tradewind". Mr. Oddi and Mr. Becke's evidence (through their testimony and Mr. Becke's written notes, respectively) supports that friction was a topic of discussion, but Mr. Becke's notes do not specifically state that the Tradewind results in particular were raised. Mr. Oddi recalled Mr. Moore saying that the friction numbers were inconclusive at some time during the meeting, but recalled that this was in context of discussion of "the aggregate friction PSV numbers". Given this evidence and the subsequent actions of attendees at this meeting, I do not think that Dr. Uzarowski presented the 2007 and 2013 friction testing results in the detail he suggested in his testimony and I conclude that, to the extent friction test results were discussed, none of Mr. Oddi, Mr. Becke, Ms. Jacob, Mr. Andoga, or Mr. Vala appreciated the significance of the test results, nor did they learn specifically of the Tradewind Report from this discussion.

Dr. Uzarowski testified that the tone of the meeting changed when he expressed his opinion that using HIR on the SMA of the RHVP was not feasible and conveyed Mr. Wiley's views (as described above) to the attendees. Many of the witnesses who attended the March 9 Meeting testified that it was "heated", with raised voices and frustration being expressed. The testimony of those present was very inconsistent as to whether or not there was yelling or if profanity was used, or if so, who was doing it and to whom it was directed. However, it is clear that Mr. Moore was frustrated,

perhaps loudly so, with Dr. Uzarowski because Dr. Uzarowski's current report of Mr. Wiley's views was the opposite of what Mr. Moore understood Mr. Wiley to have communicated at the CTAA conference — that is, that HIR of SMA was feasible.

Dr. Uzarowski presented two resurfacing options for the RHVP at the meeting on March 9: (1) HIR of the RHVP for which he had communicated his concerns about feasibility, followed by a layer of microsurfacing to ensure consistent surface characteristics, or (2) mill and overlay. Microsurfacing was rejected by City staff, although there was some inconsistency on whether Mr. Moore or someone else made this decision. Mr. Moore did not recall if Dr. Uzarowski presented these two resurfacing options, but testified that he did not believe he would have been amenable to the microsurfacing recommendation, given the City's prior unsuccessful experience with microsurfacing. This is consistent with Mr. Moore's view, which Mr. Moore believed that he had expressed to Dr. Uzarowski at some time prior.

Dr. Uzarowski's meeting notes included a warning that neither option would "solve the accident hazard issue. The speed has to be controlled. Skid hazard increases drastically when the speed increases." He testified that he presented this message to the group. In his testimony, Dr. Uzarowski explained that after reading the Hamilton Spectator article he received from Mr. Hein (described above), he felt it was important to raise his concern about speeding. Mr. Oddi generally recalled a discussion about driver behaviour, including speed, but did not recall this discussion being limited to the RHVP or it being in context of a discussion regarding friction. Mr. Oddi did not, however, recall anyone raising safety concerns at the meeting, nor did any of the other City witnesses.

There are varying recollections in terms of when the March 9 Meeting ended, and whether Mr. Moore and Ms. Jacob left the meeting some time before its end. It is unclear whether they were present for the preceding discussion regarding "the accident hazard issue". It is probable that they were not present for the discussion below.

Dr. Uzarowski testified that, as noted in the last item in his preparatory notes, he recommended that the City consider conducting shotblasting or skidabrading[13] "as the interim way of improving friction on the Red Hill Valley Parkway" if resurfacing was to be delayed. In my view, Dr. Uzarowski proposed shotblasting on the basis that the City, not Golder, would decide whether the friction levels on the RHVP required rehabilitation. Dr. Uzarowski was not in a position to assess whether shotblasting was necessary from a traffic safety perspective, as he had neither the knowledge of the operating experience of the RHVP nor the professional expertise.

Dr. Uzarowski testified that Mr. Oddi declined this recommendation, and again expressed that it would confirm that there was an issue with the RHVP pavement for which the City could be blamed, and that Mr. Becke "confirmed" this. In his testimony, Mr. Oddi denied that he made this comment during the March 9 Meeting or otherwise, but agreed that he did not support the recommendation because it would be a waste of taxpayer dollars to perform shotblasting on the RHVP before resurfacing. Mr. Becke also testified that he did not make or "confirm" such statements, nor did he recall anyone else doing so. Likewise, none of the other witnesses recalled such a statement. I do not think that either Mr. Oddi or Mr. Becke would have been as categorical in respect of shotblasting as Dr. Uzarowski suggested in his evidence, if they made such statements at all. Neither was the ultimate decision maker for any rehabilitation work on the RHVP and there is no evidence that they had any discussion(s) with Mr. Moore that would have prompted such a statement. In any event, there is also no evidence that Mr. Oddi's statement, if made, was intended to reflect anything more than his personal view.

Dr. Uzarowski planned to raise the issue of shotblasting (as he had with Mr. Moore in the past) in this meeting, as his preparatory notes indicate, although that was not the focus of this meeting. It is necessary to address why he chose to do so in the manner that he did and did not follow up directly with Mr. Moore after the meeting to make the recommendations directly to him.

In my view, Dr. Uzarowski was in an uncomfortable position. He had identified "relatively low" friction levels in the 2014 Golder Report. The Demix aggregate in the asphalt mix

[13] I understand "skidabrading" to be a type of "shotblasting". For ease, I have referred to both as "shotblasting" for the balance of this chapter.

that he had approved could be called into question, as demonstrated by Mr. Oddi's comments in response to the PSV results. I think he personally also had lingering questions about the performance of the aggregate over time which were further heightened by his review of the Hamilton Spectator article sent to him by Mr. Hein and any comments made regarding the City's own concern for liability discussed above. He wanted to be able to deflect any future criticism directed against Golder or himself personally in respect of the performance of the SMA pavement surface. At the same time, Mr. Moore had rejected Dr. Uzarowski's recommendations of microsurfacing and shotblasting in definitive terms when Dr. Uzarowski raised them on prior occasions and was unlikely to be more receptive, particularly as neither treatment option would have been cost effective in light of the intended schedule for resurfacing. Mr. Moore's sole focus at this time remained finding the most cost effective and efficient means of resurfacing the RHVP.

Whether or not Dr. Uzarowski intentionally waited until Mr. Moore had left the meeting to raise the issue of shotblasting is unclear but, in any event, Mr. Moore's absence served his purpose. Given that Dr. Uzarowski was not a traffic expert, these comments were more in the nature of suggestions. Mr. Moore would need to approve the implementation of any such suggestions. Instead, Dr. Uzarowski made these suggestions to Engineering Services staff, who would not have been able to implement them without Mr. Moore's agreement and who did not have a full appreciation of the context in which he was making these suggestions.

There is no evidence that any of the Engineering Services participants in this part of the meeting raised Dr. Uzarowski's suggestions with Mr. Moore. There is also no evidence that Dr. Uzarowski took any further steps to ensure that his suggestions were raised with Mr. Moore, other than making a similar suggestion at a later meeting with at least Mr. Becke, Mr. Andoga, Mr. Perusin, and Mr. Renaud. For his part, Mr. Moore did not consider that Dr. Uzarowski's presentation called for any interim measures pending resurfacing of the RHVP and did not take steps to act. As a result, Dr. Uzarowski's suggestions did not receive any further consideration within Engineering Services after the March 9 Meeting.

8.12.7. Golder Reconsiders the Feasibility of HIR for SMA

Based on the discussion during the March 9 Meeting, later on March 9, Dr. Uzarowski reached out to Mr. Wiley again regarding the feasibility of SMA. This indicates that, despite the concerns and possible challenges Dr. Uzarowski raised during the meeting, the City and in particular, Mr. Moore, was not prepared to accept Dr. Uzarowski's view that conducting HIR on the RHVP was not feasible without further information.

In their discussion, Mr. Wiley reversed his earlier comments and advised Dr. Uzarowski that he thought that, in principle, SMA could be recycled using HIR, subject to confirming that the RHVP material could be recycled. This conclusion is consistent with the evidence of Ms. Bell, the MTO lead on the HIR specifications, that the relevant MTO guidelines, OPSS 332 (titled "Hot In-Place Recycling"), prohibited the use of HIR for SMA because of MTO's lack of experience with HIR on SMA pavements, rather than because of any perceived inherent incompatibility of HIR with SMA pavements.

As a result of Mr. Wiley's newfound optimism regarding HIR and SMA, and Mr. Moore's continued interest in HIR, Dr. Uzarowski advised Mr. Moore in the evening of March 9 that he and Mr. Wiley would work together to "see how we can adjust the mix to make HIR feasible", and told Mr. Moore to leave it to him and Mr. Wiley. Dr. Uzarowski reiterated to Mr. Moore approximately a week later that Mr. Wiley thought it was possible to recycle SMA, and that he sought Golder's input on materials. Dr. Uzarowski outlined what he envisaged Golder's and EcoPave's respective involvement to be moving forward. Mr Moore replied that this work would have to be tendered.

8.12.8. Golder Continues Its Assessment of HIR Feasibility

It is clear from the evidence that, until at least February 20, 2018, Golder intended to prepare a report for the City regarding the results obtained in the Golder Pavement Evaluation. However, Golder ultimately did not prepare a report for this project, until much later, and not until after Dr. Uzarowski discussed the project with Mr. McGuire in late 2018 and early 2019, as described in Chapters 10 and 11.

Dr. Uzarowski testified that Golder did not prepare a report for the Golder Pavement Evaluation, or repeat the BPT, at this time as a result of a telephone discussion he had with Mr. Becke a few days after the March 9 Meeting. Dr. Uzarowski understood

from this discussion, and the absence of a request from the City for a report or further testing, that he should "leave" the results and not prepare a report.

Mr. Becke disputed Dr. Uzarowski's evidence. Mr. Becke testified that he did not recall this discussion with Dr. Uzarowski, nor did he recall advising Dr. Uzarowski not to prepare a report regarding the Golder Pavement Evaluation. He testified that he would not have made such a statement because "[i]t wasn't [his] original request for the report", it was Mr. Moore's and that telling Golder not to provide a report for the Golder Pavement Evaluation "wouldn't be his call". However, Mr. Becke also acknowledged that there was no evidence that he asked Dr. Uzarowski to deliver a report.

In any event, up to this time, mid-March 2018, Golder's primary contact at the City for the Golder Pavement Evaluation had been Mr. Moore, not Mr. Becke. Dr. Uzarowski did not contact Mr. Moore to discuss the delivery of a written report for a project that Mr. Moore had approved. In the months following the March 9 Meeting, and until November 2018, no one at the City, including Mr. Moore, sought a written report of the Golder Pavement Evaluation or its results in written form, and Golder did not provide it.

Dr. Uzarowski and Mr. Becke did not discuss the possibility of interim measures, including shotblasting, in their discussion after the March 9 Meeting, even though proceeding with the feasibility study would inevitably delay the resurfacing. The City did not request, nor did Golder suggest, additional friction testing.

As a result of the City's continued interest in HIR and Dr. Uzarowski's discussions with Mr. Wiley after the March 9 Meeting, Golder and the City's next step was to initiate a study on the feasibility of HIR on the RHVP, which became the "HIR Suitability Study", discussed in Chapters 9 and 10.

I gather from evidence given by City witnesses involved in the consideration of HIR for the RHVP resurfacing that the willingness to continue down this path, notwithstanding the concerns and suggestions raised by Dr. Uzarowski on March 9, was largely due to the possibility of substantial cost savings if HIR were feasible. However, continuing the investigation into HIR was certain to further delay the repaving schedule, given the significant amount of work to be done on the feasibility study and, if HIR was feasible, the mix design. On the other hand, if HIR was feasible, it could be completed

more quickly and with less downtime than a mill and overlay resurfacing. As described in Chapter 11, the RHVP resurfacing, which was completed using the mill and overlay method, ultimately did not begin until June 2019, instead of the summer of 2018 as had been originally contemplated.

Mr. Moore's retirement as Director of Engineering Services was announced in April 2018, followed by Mr. McGuire's subsequent transition to the role of Acting Director of Engineering Services, which began when Mr. Moore retired in May 2018. This period coincided with the planning of the RHVP resurfacing and the ongoing investigation and consideration of HIR. The documents indicate that Mr. McGuire began to have some involvement in the resurfacing project, including the consideration of the HIR option, in or around April 2018, but he became more meaningfully informed about the project in June. Mr. Moore remained involved with the project until his retirement, and, over time, Mr. Becke, rather than Mr. Moore, became Golder's main contact on the project.

In May 2018, Dr. Uzarowski and a group of City staff, including at least Mr. Becke, Mr. Andoga, Mr. Perusin, and Mr. Renaud, met to discuss HIR again. Mr. Moore likely attended the meeting, and it is possible that Mr. Oddi did as well, although he did not believe he did. The purpose of the meeting reflected the shift to a more technical phase of the HIR investigation: determination of the suitability of the RHVP SMA asphalt mix for HIR, and the potential mix design. By this point, the City and Golder had learned that the MTO was working on its first HIR job since 2003, and there was discussion between the City and the MTO about City staff attending the MTO's HIR project for a possible site visit.

Dr. Uzarowski recalled that, at the May 2018 meeting, Mr. Moore said that the PSV results from the Golder Pavement Evaluation were inconclusive. Dr. Uzarowski did not agree that they were inconclusive, but could not recall if he said this during the meeting. Dr. Uzarowski believed he raised shotblasting again during the meeting, after Mr. Moore had left the meeting, and that shotblasting was rejected, although he could not recall specifically who rejected the idea.

Although the May 2018 meeting was just over 10 days prior to Mr. Moore's retirement from the Director of Engineering Services role, Dr. Uzarowski's evidence is that he was not aware of Mr. Moore's upcoming retirement at the time.

8.13. Mr. Moore Retires from his Role in May 2018

As noted above, Mr. Moore's retirement was announced to Public Works staff on April 13, 2018. Around this time, Mr. McGuire was offered the role of Acting Director of Engineering Services. Mr. Moore retired from his position as Director of Engineering Services on May 25, 2018, at which time Mr. McGuire became the Acting Director of Engineering Services. Mr. McGuire ultimately became the Director of Engineering Services in a permanent capacity in June 2018. Mr. Moore's transition out of this role and Mr. McGuire's transition into it are discussed further in Chapter 9.

8.14. CIMA Determines That the RHVP EA Does Not Prohibit Continuous Illumination

In April 2018, the City retained CIMA to complete the Lighting Study on the RHVP and LINC in response to lighting-related directions given by the PWC in September 2016 and December 2017, as described in Chapter 7 and above.

CIMA's retainer followed preliminary discussions between Brian Malone (Partner, Vice-President, Transportation, CIMA), Mr. Field, and Mr. McGuire in early 2018, and a meeting on March 14, 2018. Mr. Malone testified that he understood that the City was "seriously considering reviewing adding lighting" to the RHVP. Mr. Moore was not involved in these discussions, which occurred in the months before his retirement and after Mr. McGuire had begun sharing the responsibilities of the Director of Engineering Services, including oversight of the Geomatics & Corridor Management section (which included the Street Lighting & Electrical group).

As mentioned above, in the years before 2018, councillors were consistently told, and many City staff assumed or understood, that mainline illumination was prohibited on the RHVP due to environmental concerns, or that lighting restrictions were imposed in order to obtain the required environmental approvals. However, it appears that Mr. Field's expectation about what the existing EA would reveal was not as definitive. Notes from the Lighting Study project start-up meeting on April 24, 2018 indicate that Mr. Field thought the decision to use interchange lighting[14] (as opposed to continuous

[14] As described in Chapter 2, the RHVP and LINC have non-continuous decision point lighting located at the exit ramp of each interchange.

lighting) was a "cost based decision" and he expected there would "not be a prohibitive statement about lighting in the documents reviewed". In his testimony, Mr. Field explained that, at that time, he expected there were "design considerations… not prohibitive restrictions" regarding lighting in the EA. The source of Mr. Field's information is not clear.

In any event, CIMA's tasks for the Lighting Study included a review of the existing RHVP and LINC EAs to determine whether changes in lighting were prohibited by the existing EA. As part of this work, CIMA requested a copy of the EA for the RHVP. CIMA was also tasked with revisiting findings from previous collision analyses using more recent collision data, with a specific mandate to "investigate the impact of illumination on traffic safety", and with conducting various reviews, including an illumination warrant review, an environmental impact assessment, a human factors assessment, and a cost-benefit analysis. Part of CIMA's mandate was also to recommend next steps for the City, in the circumstances both if the EA contained a prohibition on lighting (that is, how to remove any applicable restrictions), or if the EA did not contain any such prohibition.

CIMA staff worked on the Lighting Study assignment throughout April and May 2018. In an update memo that CIMA sent the City in May 2018, CIMA set out its findings regarding the assumed prohibition on lighting in the EA as follows:

> It does not appear that any element of road design or corridor alignment was predicated on reducing impacts from illumination on the natural environment. It appears that the illumination plan was based on MTO standards and municipal requirements only. Therefore, there is no documentation that continuous illumination would be precluded.

In its draft and final versions of the Lighting Study report, addressed in Chapter 9, CIMA put its findings in this way: "[t]he review of the previous environmental studies found that there is no documentation, previous findings or recommendations in those reports that would preclude the implementation of continuous illumination along the facilities." CIMA's final Lighting Study report stated, however, that a Municipal Class Environmental Assessment would be required to proceed with an improved illumination plan, and that any future assessment would require an in-depth environmental impact study and scientific literature review on the effects of lighting.

In his testimony at the Inquiry, Mr. Malone stated he was surprised to learn that the EA did not prohibit continuous illumination on the RHVP, having previously understood this to be the case from his discussion in 2013 with Mr. Moore, described in Chapter 6.

The Lighting Study is discussed further in the chapters that follow. Engineering Services staff initially identified December 10, 2018, as the date on which they would report back to the PWC on the results of the Lighting Study. However, as discussed in Chapters 9 and 11, staff's update on the Lighting Study was consolidated with other RHVP-related reports, and presented to the GIC on February 6, 2019, at the meeting at which the Tradewind Report was disclosed to Council.