RED HILL VALLEY PARKWAY INQUIRY

TRANSCRIPT OF PROCEEDINGS
HEARD BEFORE THE HONOURABLE J. WILTON-SIEGEL
held via Arbitration Place Virtual
on Friday, February 17, 2023 at 10:01 a.m.

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Arbitration Place Virtual

--- Upon resuming on Friday, February 17, 2023 at 10:01 a.m.

MR. LEWIS: Good morning, Commissioner, counsel, Mr. Brownlee.

JUSTICE WILTON-SIEGEL: Good morning.

MR. LEWIS: We have with us this morning Mr. Russell Brownlee, who has delivered a report and, of course, he testified back in April as well, with the report, his Primer, if we can call it that, and if the court reporter could please affirm Mr. Brownlee.

AFFIRMED: RUSSELL BROWNLEE

MR. LEWIS: And we made it an exhibit yesterday, but Mr. Brownlee's report is Exhibit 221, dated November 1, 2022, and the doc ID is EXP192, titled Red Hill Valley Parkway Highway Design and Assessment Report. And his report attaches as Appendix A his March 2022 report he testified regarding in April, which is Exhibit 16. But it is attached as Appendix A and, to the extent we need at all to refer to it, we can do it within the attachment to this document.

We covered Mr. Brownlee's

background and qualifications when he testified in April. In the interest of time, I'm not going to do that again today, but Mr. Brownlee's CV is Exhibit 16.

As well, I don't intend to take Mr. Brownlee through every last bit of his report, just very much like yesterday, really where there's no disagreement expressed, in the interest of time, so I'll either be quick or skip it and, for the most part, will focus on the parts of his report for the most part where there's disagreement or where clarification is required.

That said, Commissioner, as I informed participants' counsel yesterday, there are areas in relation to the responding report of one of the two City's experts that responded to Mr. Brownlee's report, Mr. Dewan Karim of 30FE, that requires some additional looking into given the short period of time between the delivery of the 30FE report and evidence today. So, in the interest of good order and presenting Mr. Brownlee's evidence in a clear and organized manner that will be of assistance to you, we are not going to complete Mr. Brownlee's evidence today. We'll get as far as we can and then we'll

return to do so, along with cross-examinations, on Tuesday, February 21, after the long weekend, which should still have us on schedule.

JUSTICE WILTON-SIEGEL: Okay. Thank you.

EXAMINATION BY MR. LEWIS:

Q. And, Mr. Brownlee, before we get started, I want to ask you to confirm that you are aware of and understand that you have an obligation to provide evidence that is fair, objective and non-partisan. We didn't have you sign the acknowledgement that the Rules of Civil Procedure require, but I would ask you to confirm that you understand that obligation today?

A. Yes, I understand that.

Q. Thank you. So, if we could go to Mr. Brownlee's report, start at image 3. And, Commissioner and Registrar, I'll advise that the image and page numbers differ by two here, so image 3 is page 1 of the report, and I'll try, as I go to refer to the image and the page as well, but if I don't, it's the page is two less than the image that we're at.

So, Mr. Brownlee, in the introduction there, you talk about the broad

categories of topics that you were asked to and have opined on in your report. And were you asked to perform an independent research or safety analysis?

A. No, I was not.

Q. Okay. But at the same time, and we'll get to this, you did attend on the RHVP, on the Red Hill, on October 2, I believe, 2022, where you performed --

A. That is correct, yes.

Q. And you performed a ball-bank test and observed the general conditions on the parkway. Is that correct?

A. Yes. I observed the operating conditions and nature of the facility. I've been on it in the past, but for that specific reason, and I completed ball-bank tests just on the mainline of the freeway.

Q. And as well, you have reviewed the report of Mr. Dewan Karim of 30FE responding to your report. Is that right?

A. Yes, I have.

Q. And, Registrar and everyone, that is Exhibit 223, which is doc ID HAM64759, and we'll be going, like yesterday, to

that quite a bit, along with Mr. Brownlee's report, so I'll refer to the Brownlee report or the Karim report or the 30FE report in order to signal when I want to go to it, if that works for our Registrar.

So, Mr. Brownlee, your report deals extensively with the 1985 MTO guidelines, design guidelines, and when you testified in April, you discussed both those guidelines and the TAC manual as well. Is that right?

A. That is correct.

Q. And we know, there's no dispute, that the MTO guidelines are what was followed with respect to the Red Hill design process, but I would like to first ask you about some overall concepts just to refresh or following what you said in April, but overall concept of highway design and compliance with guidelines and standards.

And the first thing is if we could go to Mr. Karim's report at image 9, which is page 6. Mr. Karim's report is three pages off between image and page. And it's the passage below, Registrar, 3.4.2. That's it. Thank you.

And Mr. Karim suggests that

design exceptions or deviations, he uses the word that these are design exceptions or deviations, are encouraged by the industry's professional documents. Do you agree with that? Is that correct, that characterization?

A. The design guidance and whether it's called a standard or a manual or a guideline does provide provisions for deviating from those design requirements in that guidance. It's a bit of a stretch to say that it's encouraged amongst the documents. It does provide that latitude, but I don't generally look at it as encouragement in that we try to work outside those bounds.

Q. Sorry, outside or inside those bounds? Encouraged to work inside or encouraged to work --

A. We're not encouraged to work outside those bounds, no.

Q. Thank you. You can take that down, Registrar. And you spoke about that, this issue, when you testified in April, about why a designer, facility, might be justified in deviating from the MTO guide or the TAC manual, for example. I'm just going to read a couple of

excerpts from your April 27, 2022 testimony.

First is at pages 238 to 239.

You said:

> "Essentially within any design, what's provided in the manual are typical and are the beginning points. There is always latitude for specific situations and combinations of situations to deviate from the guidance, to exceed it. In some cases, to sometimes look at not meeting that particular guideline, to meet other project goals and objectives and constraints."

And then continuing on at pages 239 to 240 of the transcript:

> "There's always the -- and you'll see in the front matter of most of

our engineering guides, there's always guidance to say, here is industry good practice aligned in this manual, but there's always going to be trade-offs, design exceptions, engineering judgment that needs to be applied in all those situations to meet your project goals and funding that you have and the complaints you are dealing with on each project."

Is that a fair summary of your view with respect to deviations and the application of manuals and guidelines?

A. Yes. Yes, it is.

Q. Okay. And could you just describe what sort of things can give rise to deviations from the guidelines, standards, however they're characterized?

A. It could be a wide range

of things depending on the project you're working on, but essentially there could be property impact said, topography, funding mechanisms that you're working within, environmental constraints, a whole host of things that your roadway is not just being put on a piece of paper, it's within the real world and we need to deal with those real world realities in any of our designs.

Q. Okay. And in your report, as we'll get to, you've indicated instances with the RHVP where the MTO guidelines has been adhered to and other instances where they had been deviated from. And, as a general proposition, does strict compliance with the guidelines mean in and of itself that the highway has an acceptable design from a safety perspective?

A. Providing a design that meets our design standards or manuals or guidelines and signing it and marking it as per the Ontario traffic manual and maintaining it based upon the minimum maintenance standard doesn't necessarily guarantee that you're going to have a safe facility and that road users aren't going to be travelling along that facility and be

able to do that in a safe manner.

Likewise, not meeting those standards or meeting those standards doesn't guarantee safety, either. So --

Q. Right. So, meeting the standard doesn't guarantee safety, not meeting them doesn't guarantee that it's not safe?

A. That is correct, yes.

Q. Right. Okay. And is that the concept of nominal versus substantive safety?

A. Yes.

Q. Okay. And if you could just discuss the difference between nominal safety and substantive? This is something Mr. Karim discusses in his report.

A. So, nominal safety is, I guess, no stranger. Back in 2009, I wrote a magazine article for the Ontario Traffic Council explaining the difference between nominal and substantive safety. Nominal safety essentially assumes that meeting a specific standard, such as a lane width or the design of a horizontal curve or the clear zones on the side of the roadway is safe. So, it's a switch on and of; meet the

standard, safe, don't meet standard, unsafe.

Substantive safety relies on evidence based analysis, generally on collision trends, but now in the industry conflict trends as well that will outline how a specific facility, whether it be a freeway section, an intersection, a pathway, et cetera, performs in relation to its peers. And if it's performing better than its peers, it's considered relatively safe, and if it's performing worse than its peers, there is always potential for operational or safety improvement on that roadway. So, from a substantive perspective, that particular facility is performing relatively safe or relatively less safe.

Q. And back in April, a concept you referred to is table picking, which, if I recall correctly, is a discouraged practice of picking, you know, an exact minimum or maximum specified number from a design table, which, strictly speaking, is compliant with the guideline. And that's an undesirable practice. Is that right?

A. Yes. The manuals, the industry guidance isn't meant to be a rigid

document once you select a design speed or other design criteria, that you automatically go to a specific number and a series of numbers out of different tables and you put them together in your design and then hope for the best. Designers are much more elaborate than that and they need to understand that each one of those decisions need to be taken into account with your environment that you're working in and what road user expectations are going to be. And that's why the manuals discourage just picking numbers out of the tables and designing to that specific value with no consideration of how they all work together.

Q. Thank you. And, Registrar, if you could go to the Karim report, images 10 and 11, please, which are pages 7 and 8. And it's the last paragraph on the first image there, which continues on to the top of the second page, if you could call that up. Thank you.

And here, he continues on, but in this particular paragraph, Mr. Karim is seems to draw a distinction between guidelines and standards and he refers to them here. And I know you reviewed this. I'm not sure that Mr. Karim ultimately applies a distinction, although it

refers to it here. Could you just briefly comment on the issue of standards versus guidelines in the context we are dealing with it here, which is highway design and exceptions?

A. So, yeah, when we're dealing in the area of highway design and signing and marking it and illumination, et cetera, there are documents that are termed standards, like the MTO standard for Ontario highways. There's other documents that are referred to as manuals, as the Ontario traffic manual. Then a lot of our guidance now, such as the TAC geometric design guide for Canadian roadways, all have different terms. But essentially transportation practitioners treat them much the same. They are all good industry practice. There are the abilities, as I mentioned in the front matter, of all these documents, indicating that engineering judgment, character and nature, different inputs need to be taken into account and that they're not supposed to be applied in a rigid manner based only on what's in the documents.

So, from, you know, the distinction between what's a standard and what's a guideline and one is more rigid or important or

required in the context that we're dealing with is not correct. It's all good industry practice.

Q. Okay. And upon your reading of Mr. Karim's report, does he apply the distinction between -- a distinction between standard and guidelines?

A. Within this paragraph or within his report?

Q. Within the report.

A. Within his report, no. I mean, essentially we're -- in his evaluations, he's looking at, you know, the nominal safety compliance in many respects to a specific guideline or standard within those documents.

Q. Right. But I mean does he actually use a distinction and say this is a standard and this is a guideline and therefore you treat them differently. Is there any, sort of, treatment of that sort?

A. No.

Q. All right. And when one does a safety review, a traffic engineer does a safety review, of an inservice highway, freeway, is compliance with the design guidelines typically part of that review process?

A. Yes. It would be one of the components. We literally call it a compliance review, so we go and check the geometry, the signings, the marks, the illumination against the guidance, industry good practice.

Q. Right. And you can take that down, please, Registrar, and bring up Mr. Brownlee's report, image 4, please, page 2.

I would like to talk about design speed and posted speed. So, in the first paragraph there under section 2.1, you note that the Red Hill was planned to have a design speed of 100 kilometres an hour and a posted speed of 90. Is that correct?

A. That is correct, yes.

Q. And I understand that is, if you go to the next page, Registrar, image 5, I think that is something that is permissible under the 1985 MTO design guide. Is that correct?

A. Yeah. The latitude that's provided in relation to design speed allows for that speed differential, yes.

Q. Okay. And I think you described it as being within the representation of acceptable design standards?

A. Yes.

Q. And if I can find it on that page, I know it's in there, in the second paragraph, it says:

"From the early planning stages through the preliminary design criteria for the RHVP, a design speed of 100 kilometres an hour is consistently documented. This design is within the range of acceptable design standards."

A. Correct. Yes.

Q. And you can take that down, Registrar. Thank you. The report, you can keep in because we'll be going back.

And am I correct that as part of your report, you were not delving into an analysis of whether the designers of the Red Hill considered the implications of their design choices properly or carefully enough. Is that correct?

A. No, I haven't covered

that off.

Q. And you aren't taking any issue with their having, you know, considered the guidelines and applied their professional judgment to design speed and posted speed. I take it you're assuming they exercise their judgment and they made their choices in accordance with that. Is that fair?

A. Yes.

Q. So, if we could go back one image, please, Registrar, to page 4. And you set out in the middle there:

> "In determining the appropriate design speed of the RHVP, the following should be considered."

And if you could just expand that, Registrar, from that point down on the page. The font is a little small for my eyes anyway on this. Thank you.

And you indicate a number of things there, for example, that the MTO design guide allows a range of design speed from 90 to 120 with 90 only being considered for urban

freeways, which is this one. Correct?

A. That is correct, yes.

Q. But also indicating that the design speed desirably is set 20 kilometres an hour over the posted limit?

A. Yes. That's indicated in the manual.

Q. Okay. And then you go on to describe some reasons why that might be not followed in those instances. So, if you could just describe that?

A. Yeah. There's always going to be instances and you can see from the range that's at the top of this excerpt. The 90 to 100 kilometres an hour, it's quite large. There are instances especially when we're looking at lower functioning roadways, some of the secondary highways and, you know, 500, 600 and 700-series highways that are much lower classes than the freeway facility. It's even acceptable to go as low as providing a design speed equal to the posted speed.

However, the 1985 manual does indicate that it is desirable for freeways that every effort should be met or should be attempted

to meet a desirable design speed, which is 20 kilometres over the posted limit. They do identify urban environments and other challenge topography where you may not be able to meet those desirable design speeds.

And lastly, they outline for the designer the consistency and the uniformity of design standards are very important in that road users operate much better, error free and more quickly when the roadway or other facility that they're traversing is more consistent and up to their expectations and fundamentally safer when they make those proper decisions about speed and path.

Q. So, is it typical -- it's permitted clearly. Is it typical to have a ten kilometre an hour difference between design and posted speed on a limited access freeway facility?

A. It's not typical. It's not common to have that speed differential, but it does occur, yes.

Q. Okay. And the next page of your report, image 5, if you could expand the top paragraph, please, Registrar. Thank you.

And you indicate that CIMA, in

its report, assumed, and we've heard this, a 110 kilometre an hour design speed?

A. Yes. This passage here is examples to illustrate that common practice is to design a freeway facility 20 kilometres and over. So, in their 2015 report, CIMA identified the 90 kilometre posted speed and assumed a design speed of 110 as a matter of industry good practice, I would assume.

Q. Okay. And, I guess, that's my next question. If you don't know the design speed, if you don't have that information, is that a reasonable assumption for a road safety engineer, to assume a freeway facility in Ontario was designed with a design speed 20 kilometres an hour over the posted speed?

A. I'd say it's a proper assumption, yes.

Q. Okay. And then if you could take that down and look at Mr. Karim's report, Registrar. It's image 10, page 7. And if you could expand the paragraph above section 3.4.3 in the middle.

In the middle section there, Mr. Karim notes:

"A few key geometric design decisions -- "

Regarding the Red Hill:

" -- such as a design speed of 100 km/h, which is slightly different than provincial highways, were clearly stated in the City's planning and design RHVP documents, and appropriate descriptions were provided in all documents."

So, he describes that as slightly different than provincial highways. Do you agree with that? Do you consider a 100 kilometre an hour design speed as slightly different from provincial highways from a design and operational perspective?

A. Firstly, I would just like to clarify. Provincial highways is a pretty broad term. Every facility under the province's control is called a provincial highway, so that would be everything from the 403 and the QEW down

to the most rural 700 series highway in northwestern Ontario. So, let's assume that he's describing freeway facilities under the provincial freeway network.

In that regard, I don't think transportation practitioners, whether we're talking about design speed, posted speed or operating speed, would consider 20 kilometres an hour to be slightly different in any of those connections. That's quite a substantial difference. Likewise in law enforcement, I don't think you could get pulled over and say, well, I was only doing 20 kilometres difference, which is slightly different than the posted speed. I don't think that would go very far.

JUSTICE WILTON-SIEGEL: Can I just ask, you referred to 20 kilometres. Are you saying the difference is between 100 and 120?

THE WITNESS: That is correct, yes.

BY MR. LEWIS:

Q. And if we can look at Mr. Brownlee's report at image 5, and it's the middle paragraph again. Can you describe what issues can arise with selecting a 100 kilometres

an hour design speed for a freeway facility?

A. Well, notwithstanding the posted speeds in some cases, within reason, even prudent road users do exceed the speed limit on a regular basis. I think most people attending here today would agree with that in their travels. If they are constantly, as road users, looking at their environment, what kind of conflicts that they are being faced with, what's an appropriate speed to be travelling, how close do you get to and from the cars around you and in front of you. So, they pick a comfortable environment. When they're on a freeway facility with controlled access, freeway ramps, there's no stops, other than congestion, things of that nature, they pick a speed that they're comfortable with. Most road users aren't going to make the distinction between who is responsible for the roadway, whether it's province or municipality. They don't know much. Most of them aren't going to know anything unless they're attending today about design speed and what it actually is and what it's roughly set to. They're making choices on their expectations of driving along a freeway with relatively free flow conditions.

So, to have a design speed of 100 kilometres an hour versus 110 or 120 is going to make a difference from their ability to see ahead on the roadway, to negotiate around curves, et cetera, but they're not going to know that. They're basing their operating speeds, their speed choices and, again, how far they are from other vehicles and when they think they can stop based upon their prior expectations of travelling on a freeway facility in Ontario.

Q. So, if I understand, some drivers, when you have a lower design speed than is typical in the province on a freeway facility, that some drivers will have perceptions coming in of the appropriate speed to drive and what speed they can drive based on their --

A. Yes.

Q. -- experience. Is that fair?

A. Yes.

Q. And then you go on --

JUSTICE WILTON-SIEGEL: Can I just stop for a second and ask, are you saying, well it's a highway that looks like a provincial freeway and, therefore, they will assume they can

drive at 120 kilometres an hour, being what is typical of a freeway, as you've described it, under the province?

THE WITNESS: That is correct, yes, unless warned otherwise.

JUSTICE WILTON-SIEGEL: Unless warned outside. Right. In other words, this sets the context in which traffic safety should be regarded?

THE WITNESS: Yes.

JUSTICE WILTON-SIEGEL: Or assessed? Okay.

BY MR. LEWIS:

Q. And I guess the warning is this is posted speed, is 90. Right?

A. Yes.

Q. And then, so let's talk about the operating speeds, if we could. If we could take that down, Registrar, and I think it's the next -- keep that page up and also pull up the next image, 6. And if you could call up the bottom paragraph, I think it will be helpful, of the first image, and then on the second page the top paragraph and the table, if that works. So it's just the top paragraph in the table, not the

section below it, not 2.2 below it. Maybe not. Okay. Well, why don't we start with that and then we'll go on to the next page.

So, in here you're referring to the 2015 CIMA report documenting operating speeds and noting the 85 percentile speeds of approximately 110 to 115 kilometres an hour. And then going on to the next page, you can take down that one and then -- yeah, there we go. So, I think you've cut off the top of that paragraph. Yeah, it should be from applying down to the bottom of figure -- there we go. Thank you.

Then here you are indicating what CIMA's findings were, and that table is reproduced from there, from the 2015 CIMA report. And first of all, 85 percentile speed, what does that refer to? Is that the speed that 85 percent of the drivers are at or below?

A. That is correct, yes. So, in other words, 15 percent of the motorists are travelling at speeds higher than those values.

Q. Okay. And so, if I understand correctly, what you're saying here is that a significant -- let me back up. Why don't you just tell us what you're describing here?

A. In the 2015 CIMA report, that was during a period when they were assuming the design speed was 100 kilometres per hour, so --

Q. Sorry, I think you mean 110?

A. Sorry, 110 kilometres per hour. The average speed northbound and southbound, you can see, is 95 to 100 kilometres an hour, which is 5 to 9 kilometres over the posted speed. The 85th percentile speeds are showing 110 kilometres an hour in the northbound direction and 115 kilometres an hour in the southbound direction. And at a design speed of 110, you can see a couple rows down, that they estimated 15 to 22 percent of the road users were exceeding their assumed design speed of 110, which may be in the grounds of some highways.

When we actually look at a design speed of 100 kilometres per hour, those percentages would be much higher. So, we have one-third to close to one-half of the individuals driving on this roadway are exceeding the design speed most likely during fair weather conditions when speed studies would be undertaken as opposed

to the middle of the winter and slippery, icy conditions, things of that nature. So, it's a very large proportion.

So, this shows in essence that motorists, especially in the southbound direction, are driving above the design speed, well above the design speed, of the roadway and they are travelling at speeds that typically we would expect on a 400-series highway, notwithstanding the 90 kilometres an hour posted speed presented to them quite readily along the Red Hill Valley Parkway.

Q. And what does that mean? There's less room for driver error? What's the -- I mean, speed, we know, the faster you go, the more likely presumably you might have a collision, but generally speaking, does that mean there's less room for error?

A. Yeah. Essentially, as the operating speeds of the facility, of the road users travelling at those operating speeds, it meets and then exceeds the design speed of the roadway, all else being equal, there are going to be less room for available sight distances at some of the more constrained locations, not along the

whole road network, but essentially along some of the more constrained locations that are designed down to that minimum design speed, where components of the roadway where people are entering and exiting, such as the ramps, are designed to a lower design speed and are more closely spaced. There are going to be occasions where people will be more challenged at those higher operating speeds and there will be more conflict and less room to make decisions, react to other road users that have potentially slowed, stopped or are attempting to change lanes, things of that nature.

Q. And then to back up, am I correct that when you talked about this in your Primer, that design speed choices is at the first stage of the geometric design process, because a bunch of other things flow from that. Is that right?

A. You can see that in the Red Hill Valley Parkway documents where they've set up a design criteria early on and that fed into all the design components that the designers were working with upon preparing the three sections.

Q. Right. And what flows from that? It's the stopping distances?

A. Yeah. It would be everything from stopping sight distances along the freeway, the ability for people to see objects and other hazards and slow moving traffic in advance of them; decision sight distances, which would be in relation to more complicated decisions, such as when you're leaving on and off of ramps to get on and off the freeway system; the horizontal and vertical alignments of the hills, the curves. Everything feeds out of the design speed criteria that is put in place as a starting point.

Likewise, lane width, shoulders, clear zones, everything sort of comes from based on design speed.

Q. And so, if your design speed is 100 rather than 110 or 120, the minimum specified stopping distances and sight distances, for example, those can be set lower?

A. Yes. They can work to those minimums, yes.

Q. Okay. And the same with curve radius?

A. Yes.

Q. And the difference in the allowable minimum curve radius under the 1995 MTO guide when the design speed changes, there's a fairly significant difference in the allowable curve radius from that, I believe.

If we go to image 15, please. It's a little obscure, but --

A. It should be a 525.

Q. This is the horizontal curve?

A. Yeah.

Q. So, at 100, it's 420 is the minimum radius?

A. Yes. With those assumptions, yes.

Q. And then at 110, sorry, you said that's under neath the red circle, that's 525?

A. Should be a 525, yeah.

JUSTICE WILTON-SIEGEL: Sorry, I'm losing you here just for a second. I had the wrong page.

MR. LEWIS: Sorry. It's page 13, image 15.

JUSTICE WILTON-SIEGEL: Right.

BY MR. LEWIS:

Q. And in the top table there, table C3-2, on the left is the design speed. And if you carry it across with the red circle there, thank you, is the 420 is the minimum radius?

A. Correct. Yes.

Q. And below it is for 110 kilometres an hour. It's a little obscured there, but it's 525. Is that right?

A. That's correct, yes.

JUSTICE WILTON-SIEGEL: Right. And the significance of this?

THE WITNESS: It's just a tighter radius curve, so as motorists are travelling at 110, 115, in some cases even in excess of that, their margin of error for travelling around that curve is reduced. They are going to be travelling around a tighter curve. So, when certain conditions outside of clear and dry weather conditions occur, they will be challenged, more challenged, to stay on the roadway. It's a tighter curve.

JUSTICE WILTON-SIEGEL: And are we thinking of a particular curve in this

regard?

MR. LEWIS: Well, we're going to go to the specific alignment and look at them in a bit.

JUSTICE WILTON-SIEGEL: That's fine. Okay.

MR. LEWIS: We'll look at the actual radius. You can take that down, please, Registrar.

BY MR. LEWIS:

Q. And at page 4, image 6, if we could go to there. In the top paragraph that we already looked at, you indicated a potential effect on CIMA if the actual design speed rather than the assumed 110 kilometre speed was used, and you indicate that they would have identified the significant disparities between the posted design and operating speeds and potentially adjusted their assessment scope assumptions and/or range and/or immediacy of potential remedial actions.

Mr. Karim appears to disagree with that in his report. If we could go to the Karim report at image 15 and 16, please. And it's the last bullet at the bottom of the first

image and then the continuation of that in the second bullet on the next. Sorry, the continuation and the second bullet.

JUSTICE WILTON-SIEGEL: Again, I'm just a little behind you. Which pages are we in the Karim report?

MR. LEWIS: So, it is pages 12 to 13, the bottom of page 12, top of 13, starting, "In general, a safety assessment."

BY MR. LEWIS:

Q. And Mr. Karim, as I'm understanding it, he's indicating that it would have predominantly depended on the posted and operating speeds, its review of geometric design and safety guidelines.

Maybe you could address that. We've already looked at your report where you said that CIMA potentially would have adjusted their assessment scope assumptions and/or range and/or immediacy of potential remedial actions. What's your response to Mr. Karim on this point?

A. Well, doing a safety assessment of an existing facility, one always and it's, sort of, a fundamental component, we mentioned before a compliance review is part of

it, but knowing what the design speed is and what the various components geometrically and the roadside, the signing, et cetera, is designed to is a pretty fundamental part of what we do.

While we'll look at what the posted speed and the existing operating speeds are, they're very important as well, the design speed is not the -- or the design speed is definitely a fundamental component when completing some of the components of the safety review. He indicates that the Highway Safety Manual suggests that posted speed and existing operating speed are the most fundamental to a highway safety review, and that's incorrect. The reference, he has footnote 36, the reference he's making in the Highway Safety Manual relates to the calibration of a safety performance function. We're not going to get into that today. Essentially, a model of safety performance on a suburban or urban road section.

Obviously the Red Hill Valley Parkway is a freeway section. Going through the Highway Safety Manual, there's no similar statements for dealing with freeways and that was, I guess, the best attempt at finding a reference

to posted speed within the Highway Safety Manual. It doesn't get that specific. It actually has a whole section on completing operational safety reviews, which CIMA and others have done on the Red Hill and other road networks, what we do on a regular basis, and it does not get specific down to saying that posted speed and existing operating speeds are the main criteria in doing those assessments.

Q. Take that down, Registrar, and just pull up the -- take down the call out. And I think it's, just to expand it, it's footnote 36, which starts on the first image and continues on to the next image. Yeah.

Is this the one that you're talking about?

A. Yeah. So, it's chapter 12, section 12.4, which relates to urban and suburban arterial roadways, which would be similar to some of the major highways in Hamilton, but definitely not the Red Hill Valley Parkway. And you can see it's part of part C, which is Predictive Methods, which is how to establish and set up models to evaluate the safety performance of a particular urban or suburban 4 lane roadway

type of thing.

Q. Thank you. Take that down. And with respect to -- this will now address, Commissioner, your question about particular curves. In the horizontal alignment, you have, I understand, reviewed the horizontal curves on the mainline as they appear on the construction plans in overview document 3.1, and that's reproduced in Appendix C of your report. Correct? Well, we'll get to that.

You reviewed the horizontal curves and their radius. Right?

A. Yes, I did.

Q. Okay. And if we could go to table 1, which is section 16 and 17 of Mr. Brownlee's report. Images 16 to 17. I think that should be the page on the right. Yeah, there we go. Thank you.

And in this, I want to focus on the curve radius. But, first of all, this review is based on the plans that we'll look at from the Appendix C, but it's not the as-built drawings. These are the ones that were developed for the tender and construction. Correct?

A. That is correct, yes.

Q. And just overall, am I correct based on this, with the possible exception of the one curve south of the King Street intersection, which we'll talk about, that the curves do meet the MTO guide minimum horizontal curve requirements for a 100 kilometres an hour design speed?

A. Yes, they do. Yes.

Q. Okay. And at the bottom of the passage at the bottom on the first image there, it's the last one there referring to the bottom part of the chart on the left-hand image on page 14, referring to the south of King Street interchange curve with a radius of 420-metres and the reference to meet or exceeds the MTO guidelines, a design guide, it just says undetermined there. That's the one I was talking about?

A. Yeah.

Q. And what's the reason that it's undetermined? It has to do with the superelevation. Is that right?

A. Yeah. It will depend. Because it's right at the minimum for a 100 kilometres an hour design speed and the assumption

is that it's a maximum of 6 percent. If it's much less than that, it may not meet it, but, you know, it's not -- at this point, if it's within the typical range of what they applied on other horizontal features of the Red Hill, which was roughly between 4.9 percent and 6 percent, it would be either be above or below a design speed of 110 at that radius.

Q. Okay. Because you can't tell from the plans what the superelevation --

A. Right. They were unspecified. Yeah.

JUSTICE WILTON-SIEGEL: So, if I can just confirm, in respect of this particular curve, the radius is at the minimum?

THE WITNESS: That is correct.

JUSTICE WILTON-SIEGEL: So, whether the curve meets the requirements depends on the superelevation?

THE WITNESS: That is correct.

JUSTICE WILTON-SIEGEL: Which you can't determine. If the superelevation is 6 percent, it meets the minimum requirements. If it is less than 6 percent, is does not meet the minimum requirements?

THE WITNESS: That is correct.

JUSTICE WILTON-SIEGEL: Okay. Thank you.

BY MR. LEWIS:

Q. And then at the bottom of page 15, the image on the right there, you indicate that:

> "Based on the above review, the majority of horizontal curves and associated spiral curves have design speeds equal to or greater than the 100 kilometre an hour design speed. The horizontal curves north and south of the King Street interchange had radii of 450 and 420 metres were at or slightly above the design minimum."

So, the 420 is the one we were just talking about and the 450 is the second one?

A. Yeah. So, those -- yeah.

Those are the more constrained curves within the corridor.

JUSTICE WILTON-SIEGEL: And if I may just ask one further question. Is this in the context of the 1985 MTO design guide?

THE WITNESS: That is correct, yes.

JUSTICE WILTON-SIEGEL: Okay. This is all with reference to that 1985 design guide?

THE WITNESS: Yes, yes.

JUSTICE WILTON-SIEGEL: Okay.

BY MR. LEWIS:

Q. Now, if we could go to Appendix C, this is at image 59, and if you could call that -- yeah. Thank you.

So, this is what we call part B of the design documents for essentially the middle section of the Red Hill, which contains the horizontal curves between, like, essentially Greenhill through King Street, Queenston, to Barton, with the south being on the left side of this drawing and north being on the right-hand side. Is that right?

A. Yes, that is correct.

Q. Okay. And just for good order's sake, this is -- Commissioner, we've seen this before in evidence, but the boxes and the arrows were added as part of the overview document 3.1 to the drawings in order to be able, sort of, a one stop shopping to be able to look at the curve radius and superelevations at each curve and, as well, with I think the red for the streets was added as well just to make it clear, because otherwise it's difficult to so and you have to refer to other plans within the tender and construction documents.

And so, the 420-metre curve radius that you were discussing and the Commissioner asked you about, that's the one, as I understand it, it's marked number 3, radius, 420-metres, superelevation unknown, and that's the one just to the south of the King Street interchange?

A. Yes, it is.

Q. Thank you. And then if one is continuing north or to the right on this image, the next curve is the one marked number 5, which says radius equals 450-metres, superelevation equals maximum 6 percent that, sort

of, goes through and past if you're moving to the north of the King Street interchange?

A. Yes, it is.

Q. Okay. And those are the two smallest radius curves. Is that correct?

A. That is correct, yes, along the mainline.

Q. Yeah. And then the next curve is number 6 up towards and including the Queenston Road interchange, which has a larger 690-metre radius. Is that right?

A. Yes, it is.

Q. And on that one, the superelevation is also indicated as unknown, but am I correct that within the parameters, because the curve radius is large enough within the specified parameters of the superelevations, it would comply with the guideline. Is that right?

A. Yeah. Within the range of crossfalls that have been identified throughout the design documents from 4.9 to 6, it would comply at 690-metre radius or kilometres an hour.

Q. And, as I mentioned at the top, you did attend in October 2022 and one of the things you did was conduct a ball-bank test.

If we could go to image 18, please, Registrar.

Can you just describe what is the purpose of a ball-bank test?

A. A ball-bank test is used. It's an in-vehicle device. It measures the dynamics of a vehicle as it travels around a horizontal curve, so it's taking into account the vehicle role, the slope of the superelevation and the radius of the curve all in together. The readings from the device would tell you roughly at what speed, a comfortable speed, that a vehicle could travel around that curve. And, in essence, you know, at the very high level, the reading from a ball-bank, if it's successful at the specific speed, say 80 kilometres an hour, the design speed of that curve is roughly 80 kilometres an hour and we could post our signs, if needed, to advise of an appropriate operating speed if that 80 kilometres an hour is within or outside the bounds of the posted speed, if it was above or below. So, we undertook ball-bank tests along the Red Hill Valley Parkway around all the curves and, at 100 kilometres per hour of an operating speed, I did them myself, all the locations had positive

and acceptable ball-bank readings along those curves.

Q. And so, if I understand correctly, even though, as you describe from the drawings and so forth, you were unable to determine on the one 420-metre radius curve whether it did meet the design speed or not because the superelevation that the ball-bank test suggests that its design speed is within the range of 100?

A. In the range, yes. Ball-bank tests aren't that accurate down to the kilometres per hour, so we're in that ballpark, yes.

Q. Okay. And CIMA had also, as you indicated, conducted a ball-bank test on the lower radius curves and reached the similar conclusion. Is that correct?

A. That is correct.

Q. Okay. And then you, in the last paragraph, sort of, conclude on that point about that they produced acceptable readings on the intended design speed, but you go on. Could you just explain what you're referring to there?

A. So, essentially, I guess, the question being is, if you can travel through it at 100 kilometres an hour, the design speed is 100 kilometres an hour, what's the big deal? Well, in a lot of cases our motorists travel at speeds that exceed the posted speed and in some cases we've seen the design speed of the roadway. So, they make those decisions as they're travelling down the roadway, both in dry conditions and in other surface conditions. Various ranges of traffic, whether it's congested or free flow, and what appears to be occurring in some of the tighter or constrained areas that are designed closer to the design speed, our motorists might not be adjusting their speeds appropriately under wet road conditions and other conditions such as that.

When they're dealing with snow and ice and other very obvious surface, a lower friction surface conditions that they know of, they have slid on ice, they have slid on snow before, they will adjust their speeds. But there may be situations where, given the lower design speed of the facility, they may not adjust properly and that's what appears to be happening

in some of these successive curves and closer spaced interchanges, just making what they feel is a prudent decision for operating speed and following speeds and the path that they're taking through a curve might not be appropriate and could be a potentially contributing factor to the higher collision risk that we've seen in the analysis through the CIMA reports.

Q. Thank you. You can take that down, Registrar. And I want to talk about interchange spacing. And, Registrar, if you could pull up image 21, which is page 19.

While he's doing that, Mr. Brownlee, you reviewed the interchange spacing in relation to MTO design guidance on that topic. Is that correct?

A. Yes. We completed a compliance review.

Q. Okay. And at the top of that is an excerpt from the, as I understand it, urban highway guidance for interchange spacing?

A. That is correct, yes.

Q. And that it generally ranges from two kilometres to three kilometres. Is that right?

A. In general, yes.

Q. But also that interchanges should be located at major arterial roads for the urban area?

A. So, we generally have. If you're building within an urban area and there's existence roadways, that's typically where you're going to have interchanges.

Q. Right. And, sort of, in an urban environment, you take them as you find them?

A. For the most part. I mean, there are provisions and they're alluded to in the manual at the high level talking about the interchange design, aggregating interchanges, having some as flyovers where they don't have ramps.

Q. Can we go to that? I think you're referring to a reference in Mr. Karim's report, I think. If you keep that up, please, Registrar, and go to Mr. Karim's report at image 19. It's at the top there where, if you could expand the top excerpt. Yeah.

So, that's the continuation of the interchange spacing in urban areas that we

already looked at from your report. And then is -- this additional, that short paragraph at the end:

"If arterial roads are spaced closer than two kilometres..."

Is that what you're referring to?

A. Yeah. I just wanted to respond to your you take it as you get it. You don't necessarily have to tie into every arterial roadway that crosses the freeway network that you're building. In many cases, that is, obviously, desirable, to bring your traffic to and from the freeway system along your arterials, but there are provisions that, if you are to space them closer than two kilometres within the geometric design standards for MTO, that they do give, as I said, some high-level discussions about you might want to take into account how you design those interchanges, whether you can aggregate access to some of the arterials and if you may just have flyovers, to provide access across the freeways versus on and off of it.

Q. Okay. So, on those last

two points, the latter one is essentially don't do an interchange. That's one possibility?

A. Yes.

Q. You simply have a bridge over or a tunnel under, I guess, but the freeway is a bridge over it, so that's one possibility. Or the other one is potentially combining two into one so that they feed in together?

A. Then the other one that they mention, they talk about alternative means or in other manuals they speak to making partial interchanges or identifying, you know, the design of a ramp such that you don't have the interaction between too close of a space, interchanges. And you can see that -- probably think of something that you travel through on a regular basis where the interchange only travels to and from, say, the north to the south.

Q. And so, though, if that isn't done with urban highways, I take it that it's not uncommon that they are less than -- their interchanges are spaced less than two kilometres together. Is that a fair assessment?

A. Yeah. There are obviously many examples one can point to in the

urban arterial freeway network in Ontario where that spacing is not met.

Q. Okay. And you can take that down, Registrar, just the excerpt. And then if you could highlight from below figure 15 to the bottom of the page with the interchanges, so table 2 and the paragraph above table 2 in Mr. Brownlee's report. Thank you.

And so, this excerpt from your report sets out the distance between the interchanges themselves on the Red Hill. Is that right?

A. That is correct, yes.

Q. And, as I read it, that four of the five interchange spacings are under the two kilometre guideline in the MTO design guide for urban freeways. Is that right?

A. That is correct, yes.

Q. Okay. And for the interchange itself, is that measured from the centre line of the crossing road of the interchange?

A. Yeah. It would be taken from the centre line of King Street to the centre line of Queenston.

Q. Okay. And just to go back to your general commentary about guideline deviations, does, you know, the fact that these are spaced less than the guidelines specify, does that mean that the spacing is, in itself, unsafe?

A. No, not unto itself. No. It's a compliance check.

Q. And, again, there's -- you're delving into an analysis into the past of whether the designers considered the implications carefully enough of the deviations. That's not something you engaged in. Correct?

A. No.

Q. All right. Same as we talked about earlier on. But does closer interchange spacing nevertheless tend to make the freeway more challenging for the driver as they become closer together?

A. In general, yes. Any time that you put major decision points closer together along a roadway facility, whether it's intersections or driveways or interchanges, less time, less distance to make decisions about your speed and path, to be able to identify other road users and what their intended paths are and react

to those are all going to be lessened within a constrained area.

Also, as interchanges get closer together, you know, you may have weaving on and off at the same time in a particular road section, which creates an additional challenge and all of us can probably identify those in our daily travels where that occurs. And -- yeah. Sorry.

Q. Thank you. And, as part of that, when you describe that generally, is that a situation where there's an increased friction demand?

A. There would be more demand on motorists being able to react to vehicles entering and exiting their lanes, to potential congestion. Sorry, that's where I was going to go with it. There's greater potential for congestion. As people are changing lanes, they cause turbulence in the mainline freeway activities, and that may cause greater potential and probability of people needing to speed up, slow down or come to a complete stop to react to the traffic conditions and other road users.

Q. Okay. And the shortest spacing, interchange spacing there, you indicate

is the fourth one down from King Street to Queenston Road. And am I correct that that is the one in the area of where the 450-metre radius horizontal curve is?

A. Yeah. It was the -- from a geometric perspective, it's the most constrained area of the design, so it is in the vicinity -- both those functional areas of the shortest interchange spacing and the tightest horizontal curves overlap each other, yes.

Q. Okay. And then of the five, the third, with a 1.1 -- sorry, 1.292 spacing is Greenhill to King Street, and is that the location where the 420-metre radius curve is located?

A. The very south portion or, sorry, very north. Get my directions straight. The very north portion of that road section is where the 420 is, yes.

Q. Okay. Maybe if we could just go back to image 58 for a moment, just to give the Commissioner. This is just --

A. 59, actually.

Q. Sorry, did I say 59? 59, please.

JUSTICE WILTON-SIEGEL: Bear with me for a second while I find that. Okay. Go ahead.

MR. LEWIS: Do you have it? It's right at the end of --

JUSTICE WILTON-SIEGEL: I have it in front of me.

BY MR. LEWIS:

Q. So, the first one that we were talking about there, the shortest interchange spacing, is, as we said, between King Street to Queenston?

A. Yes.

JUSTICE WILTON-SIEGEL: King Street, shortest.

MR. LEWIS: That's the shortest distance.

JUSTICE WILTON-SIEGEL: So, King Street to Queen Street.

MR. LEWIS: Queenston, not Queen Street.

JUSTICE WILTON-SIEGEL: Yes. And that's a --

MR. LEWIS: So, that's in the area of the 450-metre curve and moving into the

690-metre radius.

JUSTICE WILTON-SIEGEL: Yes.

MR. LEWIS: Depending on the direction you're going.

BY MR. LEWIS:

Q. The third shortest distance between the interchanges is the Greenhill to King Street, one which is in the area of the 420-metre horizontal curve. Is that correct, Mr. Brownlee?

A. Yes, it is.

JUSTICE WILTON-SIEGEL: Okay.

BY MR. LEWIS:

Q. Thank you. You can take that down. And Mr. Karim, in his report, indicates that there's no definitive studies or models to quantify the safety impact of interchange spacing. Maybe we could go to that in Mr. Karim's report at images 17 to 18. And it's in the bottom part of image 17 in the top of image 18 is what I'm referring to.

Is that accurate, that statement?

A. He's making that in reference to the industry guidance and the Highway

Safety Manual and the vintage of -- around the time that the HSM was developed, which was 2010. Since then, there have been refinements to the industry. While it's not explicitly defined as interchange spacing in the documents, the interaction between two interchanges, there were weaving distances and the spacing between each one of those components, there is modelling that was produced in the U.S. under the federal highways. The model itself is called ISATe, which is specifically designed to estimate collision potential at freeway interchanges and between freeway interchanges along tangents and their approaches and their weaving sections.

Q. And is that something that CIMA looked at?

A. They applied the ISATe, if I remember correctly, in their 2003 report.

Q. Sorry, 2003 or 2013?

A. Sorry, 2013. I apologize. And, at that point, they were looking at estimates. And so, ISATe will generate based on the geometric features of the highway, the interchanges, the horizontal curves of the highway and those ramps and the weaving distances in

between ramps as people are trying to get on and off, and it will come up with an expected collision frequency at which you can assess the relative impacts of your design and/or compare it to the performance, what's happening on your freeway in terms of collision potential.

I think at that time, that was early in the stages. The model is developed from U.S. interchanges, which a lot of information in the Highway Safety Manual is. Even though it's developed by many Canadians in many of the chapters, it's U.S. data that was used to calibrate a lot of the models that we use today.

CIMA identified in that report some of the issues with calibrating and that it would need to be done to Ontario and specific to a corridor to calibrate that model, to do those predictions, but it's definitely tool that could have been used if one wants to assess the impacts of interchange and ramp spacing.

Q. Okay. Mr. Karim indicates in there that -- he says that:

"Although evaluation can be done, no definitive safety model or collision

modification factors are available."

Can one evaluate, you know, in the absence of definitive research, is it something that, generally speaking, the influence of interchange spacing can be assessed in the absence of applying a model of that nature?

A. Yeah. In general terms, we know in the industry that placing decision points closer together is going to create additional conflict and collision risk, but in addition to that, we can do a substantive safety review as we do in a number of our studies and CIMA has undertaken to look at the collision risk along a corridor and what could potentially be contributing to that and they identified spatially in a number of their reports where the highest collision risk is relative to the rest of corridor and essentially the bar graphs speak for themselves that around closer spaced intersections and tighter horizontal curves, you can see the collision risk is going up.

Q. And Mr. Karim's report surveys a number of other urban highways in Ontario and notes that they have interchanges less

than two kilometres from one another. And I take it from what you said, you would agree that's correct?

A. That is correct, yes.

Q. Were you intending to suggest otherwise in your report?

A. No.

Q. If we could go to Mr. Karim's report, image 21. This is a summary at table 2 of the Red Hill along with the Don Valley Parkway, Highway 403 in Hamilton, Highway 406 in St. Catharines and Highway 7/85 in Kitchener and of the -- breaking down the number of interchanges in the area of each highway surveyed and the ratio of interchanges to kilometres on that stretch and the average spacing between them.

And, as Mr. Karim notes in his report, that the RHVP had the highest number of interchanges per kilometre, followed closely by highway way 7/85 in Kitchener, and that the lowest average interchange spacing was Highway 7/85 followed by the Red Hill?

A. Right.

Q. Do you agree with that?

Do you take any issue with that chart in itself?

A. The chart itself, no. Some of the corridors that were selected and their extents may have skewed the results a bit, but overall, I mean, it's a compliance check of ramp spacing on similar corridors, yes.

Q. And the Don Valley Parkway, for example, it says it's up to Eglinton Avenue East. It's not the entire DVP. Is that --

A. Yeah. That's the one I'm most familiar with, having lived in Toronto most of my life. When you look at the corridor that was selected for the Don Valley, and, again, it's a straight measurement in between each interchange, the section north of Eglinton Avenue is Lawrence and York Mills and the 401 and those are some of the more open areas of the Don Valley as opposed to the more southerly section when it gets around more challenging environment with the Don River.

In addition to that, so he's excluded some of the larger interchange spaces in that analysis.

Likewise, some of the interchanges, as we spoke of before, such as

around Queen Street, which would be the more southerly section, are only a single ramp onwards on to the facility. So, from the design guidance, the designers of the Don Valley have incorporated, well, if we're going to put all these closely spaced access to arterials, we may need to modify some of the access you provide so you don't have the weaving sections that you typically would have on a full interchange, so they're very minor interchanges with one route.

Q. And apart from the raw facts, can you comment on the relevance of comparators in this fashion, using comparators in this fashion?

A. It's something that we do in the industry to look at, you know, the ranges that are provided for a specific design feature. We look at peer locations. What it lacks is whether the interchange spacing on these other facilities has any relevance from a safety perspective. So, it would be, if we married this with the safety performance of their facilities and potentially as we have -- as CIMA as done on the Red Hill Valley Parkway, looked at spatially, does interchange spacing, as it decreases or

increases, does it change safety performance? That would be of use. At this point, it's essentially saying there's other facilities in Ontario with similar interchange spacing and then leaving it at that.

Q. Commissioner, it's 11:30. I will definitely be done by lunch. I anticipate I've got about, for today, probably about 45 minutes left, so I think if it's a good idea to take a break now.

JUSTICE WILTON-SIEGEL: Sure. Let's take a 15-minute break. It's 11:30, so we'll return at a quarter to 12:00.

--- Recess taken at 11:30 a.m.

--- Upon resuming at 11:45 a.m.

MR. LEWIS: We're back. Commissioner, may I proceed?

JUSTICE WILTON-SIEGEL: Yes, please proceed.

MR. LEWIS: Thank you.

BY MR. LEWIS:

Q. Registrar, if you could take us to the Karim report, image 17, please, which is page 14. And, Registrar, if you could call up the figure 1 at the top of the page.

And I understand, Mr. Brownlee, that this diagram, taken from the NCHRP, contains two things. On the top is the representation of interchange spacing that we've just been discussing. Is that the first thing?

A. Yes.

Q. Between the midlines of the crossroads on the freeway?

A. That is correct.

Q. And now, the second part is ramp spacing, and could you describe how that is measured? We can see the diagram.

A. Essentially, ramp spacing takes into account the ramps that would be coming from each one of those interchanges and where traffic would generally be merging and diverging within a section. We call it the weaving section in between two interchanges. And the designation for ramp spacing for a measurement is between the painted areas, not the physical what we call gore areas where you would see, you know, energy attenuator and guide rail, things of that nature in some cases. It's from the painted areas where traffic -- it would be permissible for traffic to travel on to or off of the freeway.

Q. Okay. And that's the painted tip that it shows there?

A. Yes.

Q. Okay. And if we could take that down and go to image 21 of Mr. Karim's report. That's page 18.

And at the top, Mr. Karim indicates that -- he says:

> "In addition, our cursory review of weaving areas between the on/off-ramps reveals that most of these ramps' spacing distances or weaving sections were close to the MTO minimum recommended distance of 600-metres for ramp spacing (within 90 to 100 metres)."

Footnote:

> "This typically indicates the most critical element of interchange spacing was considered with

greater care and efforts were made to minimum weaving conflicts."

So, first I should note that the footnote there close to the 600-metre minimum recommended is footnote 48, I believe, is except for the section between Queenston Road and King Street east, which was roughly 415-metres.

So, you can take down that call out, please. So, first of all, is that correct, that the MTO guide recommended a minimum 600-metre spacing between the ramps?

A. Yeah, that's the minimum. And, again, design balance, you would either increase that or decrease that based on site specific needs and volumes.

Q. Okay. And so, as we've seen in the footnote, he indicates the distance between Queenston and King ramps, but he says that they're close to the 600-metre minimum, meaning within 100-metres, but didn't specify whether that meant over or under, except for that one. So, did you have an opportunity to check the spacing following review of his report?

A. Yes. We looked at the

ramp spacing along the Red Hill and we identified three of the weaving sections that would be below the MTO specified minimum of 600-metres.

Q. Okay. And those were?

A. Going in the northbound direction between Greenhill and King Street, the distance is 500-metres. Southbound Queenston to King, identified in 30's footnote of 415-metres. And then, again, northbound King Street to Queenston, 550-metres. All the other spacings along the Red Hill Valley Parkway are greater than 600-metres.

Q. All right. And am I correct those are the ones with the three with the ramp spacing below the recommended 600, are those where the shortest interchange spacing is that we discussed?

A. That is correct, yes.

Q. Okay. And Mr. Karim says that his indicates greater care was taken on-ramp spacing than interchange spacing. Do you understand that statement? What that means?

A. Well, based on the analysis that he's completed, which is a nominal safety review, and he's identified three locations

where they chose to go below that specified amount, and that's the limits of his analysis. I'm struggling to determine where he determined greater care was provided and how, along the expressway or, sorry, the freeway weaving conflicts were minimized at those locations.

Q. You can take that down, Registrar.

You talk about sight distances in your report, section 2.8.

And, Registrar, if you could call up Mr. Brownlee's report at images 22 to 23, which is page 20 and 21.

And I won't go through. You've already talked about stopping sight distances and decision sight distances, which are listed at the top of page 20 there on the left. And we've talked about how it's a function of the design speed, the minimum sight distances and decision sight distances. Could you describe what you did here to ascertain whether operational sight distances were within the design guidelines?

A. Well, generally when we do sight line measurements and assessments, we would undertake them in the field. There are

occasions where you can measure those from plan and profile drawings, like the ones that were produced for the Red Hill Valley Parkway. However, when we get into situations where there's combinations of curves and hills together and roadside obstructions, such as bridge abutments, roadside vegetation and some challenging topography, it would be, in some cases, a very rough estimate of what those sight lines would be. So, we were unable to be able to do that from a desktop review of those design drawings.

Q. And you said it normally would require and, if you weren't able to do it that way, you would have to do an on-site?

A. Yeah. Either you need a very detailed survey that provides three dimensions of all the components of the highway and the vertical features along it to be able to complete those sight distance measurements.

Looking at figure 16 on the right-hand page, you can see how roadside vegetation around ramps and even along the mainline and other -- you can imagine if there is a bridge abutment, et cetera, there, we would just be roughly estimating if sight distances were

provided along the freeway or not versus being able to actually provide a definitive measurement within a reasonable range.

Q. And in order to do that accurately, you would have to conduct measurements on-site for a three dimensional scan?

A. Yes.

Q. And what were you able to determine? I see in the middle of page 22 -- sorry, I guess, towards the bottom there on image 22, page 20, you indicate that they appear to be sufficient, sight distances appear to be sufficient along the tangent and larger radius alignments, which are south of -- these sections are located south of the King Street intersection and in an around the Barton Street interchange, but available sight lines in or around King Street and Queenston Road interchanges are more constrained and we cannot definitively determine if they are deficient for the 100 kilometres an hour design speed. And then the example you give is of the paragraph in figure 16?

A. Exactly, yeah. I mean, essentially in the more southerly sections, more tangent sections, more wide open, the clear zones,

sorry, the roadway, there's less foliage, so it's readily apparent that the sight lines would be obtained there knowing that we have a 100 kilometres an hour design speed, but when we get into those more challenging areas, we won't be able to measure them within enough accuracy for me to be able to specify one way or the other.

Q. Okay. And then if we talk about design consistency and motorist expectations, and that starts there on page 21 at image 23, and you talk about it there, but you also testified in April about the principal of design consistency, and I wonder if you could give us a little bit of a refresher on that today?

A. Essentially --

Q. As detailed as you can while giving us a good refresher on it.

A. Okay. Essentially our road users operate within an environment. They operate better, they make better decision or error free decisions when the roadway or other transportation facility in front of them is consistent in what they expect for that type of facility.

Within a particular road

sections or series of intersections, you have the design, the operations and the line markings, signage, et cetera, are relatively consistent for like situations. It's something they expect. They can focus on, you know, understanding what the roadway environment is and turn their attention more to looking for hazards and other things on the roadway.

When things aren't -- when things deviate from those expectations, then that's when individuals take longer to make a decision, to perceive and react to a new situation and the potential for collisions and conflicts increases, all else being equal.

Q. I see. And then you address it, as I indicated, in section 3.0 there. And, as I understand these paragraphs, you're talking about when you go on, as we'll look at, the potential expectancy violations within the Red Hill design that, again, they're potential. You're not talking about any one issue for any particular driver. Is that fair?

A. That is correct, yes. Did you want me to go through each one of those?

Q. Yeah. If we go to the

next page, keep up page 21 and go to the next image as well, though, please.

A. So, when we look at the design in the operations of the Red Hill Valley Parkway, I identified a number of potential expectancy violations, so areas that may surprise road users that they may not be prepared for or just add to the additional congestion and manoeuvring of vehicles along the highway, the first being the design speed.

So, we heard earlier and I don't want to repeat too much of it, essentially we have a freeway type facility, there may be motorists that have an expectation of what an appropriate posted speed is on that freeway facility and, as they travel along it on one direction or another and they're approaching from the LINC or 403 or QEW, that they have an expectation of that they may be able to continue travelling at those speeds and exceeding the speed limit on a regular basis.

Having a condition where the design speed is a lot closer to what the posted speed is may be an expectancy violation when they are selecting what they feel is an appropriate

speed under dry, wet, snowy, icy conditions, the variability.

The horizontal curve design, again, we just reviewed that, but essentially at the more southerly sections of the Red Hill Valley Parkway, we have more generous curves, more ability to increase our operating speeds and a motorist may feel comfortable doing that. As they get down to the more northerly section -- when whether say down, because it's downhill as well -- they may not expect the congestion and the speed change that's required and an appropriate operating speed for more tightly designed curves without a warning.

So, essentially, we have a condition where all these curves can be operated at 100 kilometres an hour. The posted speed is 90, but the speed differential of those designs may not be readily obvious to the users.

Interchange spacing, likewise, motorists are travelling along, they are in certain sections of freeways where they've got good interchange spacing, they can deal with one conflict at a time. One area that people are diverging or merging as the interchanges get

closer together, those activities increase. They may be ill-prepared for not only people entering and exiting simultaneously or in close proximity to each other, but also the congestion that may occur. And that level of congestion, as you can appreciate travelling to and from work and in your other travels, can vary along a freeway section from day to day. So, where traffic is stopped on a given day and along a corridor will be variable.

And, lastly, pavement friction. Essentially, most of our road users don't have a clue what pavement -- well, they know probably of the concept of pavement friction, but how it's designed and what it provides to them is only based on their prior expectations of their vehicle handling. So, they travel along the roadway, they come up on an intersection and they just about rear end the car in front of them, they think, okay, that wasn't enough space for me to stop. And they're constantly making judgments on what they expect to pavement friction to be going around horizontal curves, trying stop at intersections, trying to react to other road users that might be slowing or stopping or accelerating into their lane. And while they may make

adjustments when they have obvious changes in pavement friction, such as snowy conditions, icy conditions, where they may -- the more prudent motorist may change their following distances, they change their operating speed to accommodate that, they may be ill-prepared to deal with what they would consider as routine dry and wet weather conditions that they deal with on a regular basis if the pavement friction isn't what they expect.

Q. And so, again, it's not -- you're not seeing any one category listed there is going to be a expectancy violation to any particular driver, but they are the things which could individually or collectively have an effect on a driver?

A. Yes.

Q. Okay. And is this something that's dealt with in the Highway Safety Manual?

A. Yes. There's a section in the Highway Safety Manual that deals with human factors. So, as transportation practitioners and road designers, we need to take into account the biggest component of what causes collisions on our roadways, which is the human side of things, us,

every day driving down the roadway, the decisions we make, whether, you know, they're related to our condition at the time or our prior expectations, we need to understand human factors.

So, they do identify design exceptions and how that might impact human factors and how humans may interact with those design exceptions, and they also talk about design consistency and short-term and long-term expectancies.

Now, they don't go -- the point of the human -- or the Highway Safety Manual is not to go into those into detail, but they did give examples of what longer term and shorter term expectancy violations may be or expectancies may be --

Q. Can you pull it up? There was a document referred. The document itself was in Mr. Karim's report, but it's HAM64 -- give me one moment. It's HAM64754.

I'm told that -- I'm not sure why, that Arbitration Place might not have a copy of this and, if that's the case, we could always deal with it next day.

THE REGISTRAR: I believe we

don't have it in file.

MR. LEWIS: Okay. So, maybe we can deal with it next day.

BY MR. LEWIS:

Q. I wonder, Mr. Brownlee, if you could just, from memory, give us your reference, if you're comfortable with doing that. If not, we can take you to it.

A. For future reference, it's image 25 and 26 of the Highway Safety Manual that deals with expectations of road users, and they gave three examples in bolded form of short-term expectancy violations and two of them are similar to the ones that's I just explained. And I'll quote exactly:

> "After driving a few miles on a gently winding roadway, upcoming curves will continue to be gentle."

That would be an expectancy of our motoring public. And the second example of the three that they provide:

> "After travelling at a relatively high speed for

some considerable distance, drivers expect the road ahead will be designed to accommodate the same speed."

Q. Okay. Thank you. We'll get that, then, to Arbitration Place and we can make it an exhibit for Tuesday.

Now, Mr. Karim deals with -- you talked about four areas of potential expectancy violations. Mr. Karim first comments on two of the four. If you go to the Karim report, image 23, and, here, he's dealing with design speed. He's quoting first from Mr. Brownlee's report and then towards the top he says:

"We disagree with these statements."

And could you just tell me what you -- tell us what you think -- what you take Mr. Karim as saying here as a disagreement about design speed potentially being an expectancy violation?

A. So, essentially in response to a road user expectations, he's

indicated that since this facility went through a planning and approvals process, which it did, it was quite rigorous, as those involved could attest to, that there shouldn't be an expectancy violation. And I'm not sure how those two things overlap.

The second is that motorists would -- shouldn't expect that freeways are built to this same level as a 400-series highway and it's not -- and he correctly identifies that the Red Hill Valley Parkway is not part of the provincial highway system.

Unfortunately, our road users are not that savvy and they, in most cases, don't know the difference in jurisdiction or design standard between a municipal road authority, or a regional, or a county road authority and/or a provincial road authority. So, for them to make the distinction that the Red Hill is operated by a different road authority and to different standards based on that particular designation is a bit of a stretch to suggest that our road users are that plugged into our design components and who owns particular roadways.

Based on my experience in the

industry, we get numerous calls, you know, people phoning from their neighbourhood road, you know, phoning the Ministry of Transportation or others about their roadway. And we'll see it in the legal area, too, where suing road authorities that have no jurisdiction with over top of a particular road section or transportation facility, because even after some research, it's not always obvious who owns those things. To expect at a road user understands those things is a bit of a stretch.

Q. And the next section is on interchange spacing, which goes from the bottom of image 23 on to the next one. If you could pull that up as well, Registrar.

And, again, Mr. Karim starts quoting from your report about interchange spacing and then responds to that. The first sentence at the bottom of page 20 there, after the quote from you, it says:

> "We disagree with this statement that the RHVP design and planning process did not consider influencing factors and constraints while

selecting interchange spacing."

Is that what you stated?

A. No, I did not. There's no statement of that nature in my report.

Q. Did you mean to convey that it didn't consider those issues?

A. No, I did not.

Q. Can a design and planning process properly consider all applicable issues and there will nevertheless be safety problems or safety issues that arise notwithstanding proper consideration having been given to the design?

A. Most definitely, and I think we've covered that off quite well today. And that's why road authorities, such as City of Hamilton, MTO, et cetera, complete collision analysis throughout their networks every year, to look for those locations that are, notwithstanding that they're designed to a certain standard, that they are exhibiting a higher collision risk than their peers.

Q. And it's fair to say your conclusions aren't, again, a critique of the design and planning process, but are observations

about the potential products of that process?

A. Correct.

Q. Okay. All right. And then what else? Do you have any other comments with respect to Mr. Karim's comments?

A. In terms of the interchange spacing or contributory factors?

Q. No, the interchange spacing.

A. I mean, essentially -- no, I don't see anything else that really stands out.

Q. Then, yes, on the next section is the friction is a contributing factor. Previously Mr. Karim says that friction for him is out of scope for his report, so he hasn't performed any specific analysis on that topic.

But then he goes on at image 24 to 25, so the second image there and then bring up the next one as well, please, Registrar, he then, after indicating that it's out of scope, he goes on with a description of collision reconstruction and so forth.

And I read this -- I interpret this as focusing on individual accidents. Do you

think that's a fair interpretation?

A. Well, it refers to a detailed collision reconstruction and a human factors review of what appears to be each individual collision, and he indicates that one cannot come to the conclusion that pavement friction is a contributory cause of a collision unless you complete that specific work.

Unfortunately, in the industry that we operate in and where we need to identify contributory causes on a much larger scale, transportation practitioners, for the most part, do not have access to a very limited number of collision reconstruction reports. They're only done in very serious fatal and injury type collisions in Ontario, so it's a small fraction of the collisions, the fatal or the injury and property damage type collisions that occur on our roadways.

We more rely on the collision histories and other indicators such as that to collectively look at a longer term collision trend to identify potential contributory factors. The Highway Safety Manual, it's a thousand pages long, does not mention collision reconstruction anywhere

in its bounds. It is based on technical raters, statistical analysis of collision trends, and that's generally what was undertaken through a series of CIMA reports on the Red Hill Valley Parkway.

Q. And so, just to recapitulate that, if I understand you correctly, individual collision reconstruction is, when it's done, it may, if there's a need to establish a cause individually, then you may indeed, as Mr. Karim points out, get into that in order to determine whether friction or other contributory causes were involved in that particular collision. That's the --

A. That is correct, yes.

Q. Okay. But not something that is required or typically done for a substantive safety review, which often does involve the various potential causes that you were talking about?

A. Yeah. We don't have the opportunity to go into each one of those individual collisions, other than potentially the verbiage that's included in the motor vehicle accident report. We rely on trends and when

something is over-representative or there's a dominant collision type or characteristics, it could be rear-end collisions or it could be wet weather collisions, we would use that data to determine, one, is it different than its peers? Are there higher proportions of those types of or those characteristics of collisions? And then the next step is what typical contributory factors would we assign to those types of dominant trends?

Q. Thank you. You can take those down, Registrar. And speaking, then, of trends -- and this is the last topic that I will cover today -- is the issue of the historic collision trends using the City of Hamilton's annual collision reports.

And in your report, you referred to the City's annual collision reports from 2017 to 2021 under the heading Historic Collision Trends. And as part of that, you indicated various countermeasures, of course, that we've heard about a lot from other witnesses, taken by the City in 2019 particularly, but also in 2020 and 2021, and, of course, that includes the resurfacing in 2019 of the Red Hill.

And so, if we could go to

images 24 and 25, please. Thank you.

And you've set out in summary at the bottom of page 22 going on to page 23 the various countermeasures, including the resurfacing, but also police enforcement and speed limit reduction and so forth. And you indicate on page 23 in the right-hand image about having limited our analysis to comparison of collision attribute proportions as opposed to collision frequencies to exclude and account for some of the effects of lower traffic volumes experienced across North America during the COVID-19 pandemic.

And so, as you said, the analysis in relation to the annual collision reports that you undertook were about the proportions as opposed to overall frequencies. Is that right?

A. That's correct, yes.

Q. Okay. And then over the next few pages there's a discussion of the statistics from the annual collision reports following various countermeasures and resurfacing.

And Mr. Karim, in his report, took issue with any analysis or conclusion respecting a reduction -- whether there's any

reduction in collisions from 2019 forward following the City's countermeasures that year and the resurfacing in 2019.

And, as I read it, first, that's because Mr. Karim indicates that the data set in 2019 is too small, too short a period following the countermeasures and resurfacing before you get to the pandemic. That's the 1st thing. Is that correct?

A. Yes, and that's acknowledged in our report as well.

Q. Right. I think CIMA had noted that in its analysis in 2020, and I think in your footnote 52 it indicates that while the frequency and proportion of wet road surface collisions in Q4 2019 were lower than previous years, collisions are random occurrences, therefore, definite conclusions cannot be drawn based on four months of collision data?

A. Correct.

Q. All right. And so, that's the first part, which you acknowledged.

And then the second part is his objection about the effects of the pandemic, and to put it that simply, beginning in early 2020

and then 2021, that because of the pandemic and the effects that it had on traffic patterns, everything to do with it, that those statistics cannot be used for an analysis to compare any patterns and trends from prior to the countermeasures and resurfacing and after. That's the second part of it?

A. Correct. Yes.

Q. All right. And you had engaged in -- you had looked at, as indicated in your report there in the middle of page 23, that you limited your analysis to exclude collision frequencies, but you looked at proportions, collision proportions.

And I understand that following review in consideration of the 30FE report, Mr. Karim's report, that you have reconsidered on that analysis and about the reliability and comparability of the collision statistics. You've been dealing with proportions. Is that correct?

A. Yes. While volumes went down overall throughout North America and speeds went up, to draw a direct comparison and apply that to a specific collision type is pretty

challenging in our industry and it's been now established that we haven't found a factor to be able to adjust for such a significant change in traffic patterns and traffic speeds.

Q. Even with respect to the proportional collision trends?

A. Well, one -- our assumption was that with lower volumes and higher speeds, that single motor vehicle loss of control would -- and the increase also in fatal and more serious injury collisions across North America as well because of those speeds, that single motor vehicle collisions would not be impacted, which was one of the major contributors to some of the wet weather collisions. But overall, do we make that exact distinction? No.

Q. And, sorry, so that you agree with Mr. Karim that drawing conclusions about changes in the proportions after the countermeasures and resurfacing is not something that can be accurately done. Is that fair?

A. Yeah. Those three together are pretty huge. There's changing the pavement friction. There's a concerted enforcement effort larger than I've seen in my

career. We had a number of delineation and other roadside safety improvements, and on top of that we layer a pandemic where our complete traffic volume profile and speed profile have significantly changed. I think that three of those things together is something that we wouldn't be able to deal with any statistical validity.

Q. All right. And then would you expect that -- I mean, different people can argue about whether the pandemic is fully over or not, but that by the last -- the last information we have is for 2021, that for 2022, when that information is available, that more valid statistical conclusions could be drawn?

A. Yes. Essentially our firm deals quite a bit with different municipalities and doing their network screening and identifying their collision frequencies and rates and dominant collision types, and the recommendation that appears to be taken into the industry now is that we eliminated those years so that we don't skew before and after analysis, including any of those years, from overall collision trends and start fresh in 2022 when

things are, as you said, relatively back to normal, whatever normal is these days.

Q. Okay.

JUSTICE WILTON-SIEGEL: So, could I just summarize what I think you have just said?

I think you've said that there are three factors at play from 2019 on. One is the resurfacing and countermeasures, which were implemented either in 2019 or slightly before that, somewhat before that. Secondly, enhanced traffic enforcement. And then third is a significant change in traffic volume and speed profile during or as a result of the pandemic during the 2020 and 2021 years associated with the pandemic.

THE WITNESS: Sorry.

JUSTICE WILTON-SIEGEL: That's the first part. And the second part is that starting in 2022, effectively you have dropped the third of those considerations and you're saying industry practices would permit you to then assess pre and post-2019, effectively looking at the consequences or the results of the first two?

THE WITNESS: To a certain

extent. We can start, yes. One would want a number of years of data because --

JUSTICE WILTON-SIEGEL: Absolutely. A data set of 6 months or 12 months would not be sufficient, but you can restart the process, but you can't draw statistical conclusions based on the data set that you would get from years 2020 and 2021?

THE WITNESS: No. Many have attempted to. All we have been successful at doing is saying that it's a pretty messed up time and things are very different. We haven't got to the point of how do we adjust it to be able to use that data. I haven't seen anything in the industry that would help us.

JUSTICE WILTON-SIEGEL: Okay.

MR. LEWIS: Thank you, Commissioner. I don't have any further questions, but I understand that Arbitration Place does have the document from the Highway Safety Manual reference that Mr. Brownlee referred to. And, as I said, it was included in Mr. Karim's report, the document, but it was not with Arbitration Place. So, it is HAM64754 and it's particularly, just for the reference, where Mr. Brownlee was referring to

was images 25 to 26 about contributory factors under Driver Expectation.

BY MR. LEWIS:

Q. And that's what you were referring to, Mr. Brownlee?

A. Yes. If you look at the right-hand page, there's a second set of bullet points that says examples of short-term expectations or --

Q. Expectancies, I think --

A. Expectancies, sorry. It's kind of small. And it's in the Driver Expectation section, as you can see from page 25. I read off the first two bullet points. There's a third one there that talks about just different operations on a signalized intersection corridor, which I don't think is applicable. But by no means is this exhaustive. They're just giving examples of very typical expectancies that a road user might encounter, that they have an expectation or experience in a short term that they're going to apply until they see a reason otherwise not to apply. They've been given a warning with a sign or they have used their judgment to alter their operating behaviours,

their speed, their path.

Q. If we could make that an exhibit, please, Registrar. I believe it is Exhibit 229.

THE REGISTRAR: Noted, counsel.

EXHIBIT NO. 229:
Images 25 to 26 about contributory factors under Driver Expectation in the Highway Safety Manual, HAM64754.

MR. LEWIS: Thank you. And as I indicated, Commissioner, I was remarkably accurate in my -- I said I would be 45 minutes after the break and I was. So, I would like to conclude for the day and to finish up on Tuesday with our examination and cross-examination at that time.

JUSTICE WILTON-SIEGEL: Okay. Then we'll adjourn for the weekend and I will simply wish Mr. Brownlee and all counsel a happy Family Day weekend.

--- Whereupon the proceedings adjourned at 12:34 p.m. until Tuesday, February 21, 2023 at 9:30 a.m.