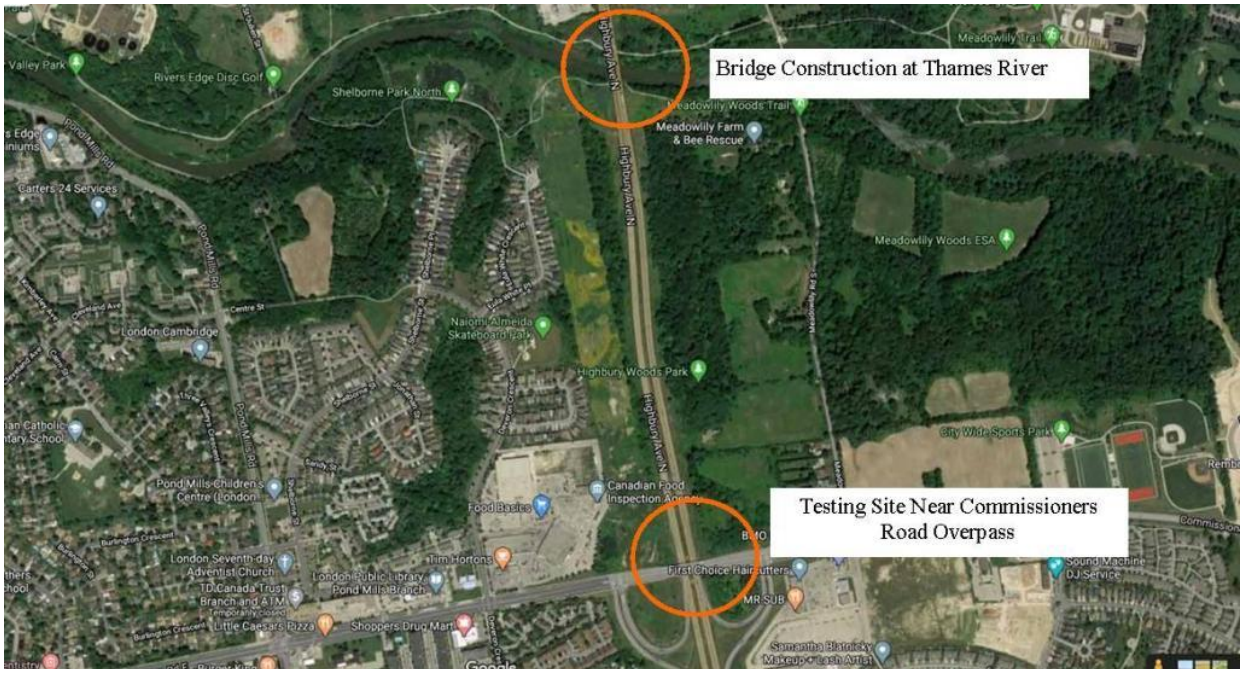
Traffic Conflicts In An Expressway Construction Zone

by Zygmunt | August 1, 2020 | News

As part of our ongoing safety research Gorski Consulting has conducted a detailed examination of the actions of drivers within a line of stopped/slowed traffic approaching a construction zone on the Highbury Ave expressway near Commissioners Road in London, Ontario, Canada. In an article ("Trench Warfare in the Expressway Construction Zone") posted to the Gorski Consulting website on July 17, 2020, results were discussed from observations conducted on July 15, 2020, at the Highbury Ave site. Construction was begun at this site in late April, 2020 causing the closure of the northbound passing lane. This has resulted in the typical queue of stopped vehicles as the traffic from the two northbound lanes must squeeze into the right lane. The article showed how there was a long line of vehicles in the right lane whereas the left lane was often clear. Some drivers attempted to use the left lane to travel past the stopped traffic and this led to purposeful interference by drivers in the right lane who appeared irritated by this action.

The present article continues to review the actions of northbound drivers at the Highbury Ave construction site. The Googlemaps view below shows the location of the construction site with respect to the location of the testing site. The distance between these locations is about 1.1 kilometres.



The testing on July 15, 2020 involved set-up of multiple video cameras in a 400-metre zone, 200-metres each to the north and south of the Commissioners Road overpass. Some cameras were positioned on the overpass facing north and south. A detailed description of the site can be obtained by reviewing the previously mentioned article.

On the approach to a construction zone it has been customary for drivers to pull into the right lane early so as not to have problems trying to squeeze into the lane when the left lane is closed in the distance. An example of this can be observed at the Highbury Ave site as shown in the figure below. This is a frame taken from a video camera mounted on the Commissioners Road overpass, looking north along the northbound lanes of Highbury Ave. This view was taken just after 1600 hours on July 15, 2020.

At the location shown in the above figure many drivers are moving into the right lane.

The next figure shows an example of the traffic looking south from the overpass. This is a composite view from two video cameras. Here we can see that the right lane is completely filled with traffic while the left lane is relatively empty. At the view to the right one can observe that a white pick-up truck is travelling in the left lane toward the camera. At the view to the left we can see two vehicles on the on-ramp that will be entering the right lane. While merging takes place in the right lane vehicles may veer into the left lane. Vehicles approaching the area in the left lane at high speed (such as the white pick-up truck) can cause potentially dangerous scenarios. These types of vehicle motions are common on the approaches to many construction zones.

While these customary motions are occurring there are some drivers who use the openness of the left lane as an opportunity to pass all the slowing or stopped traffic in the right lane. This causes irritation from those drivers in the right lane. The result is that some drivers, often those with large and heavy trucks, will pull out and block the left lane in order to stop those drivers using that lane to pass stopped traffic.

Table 1 shows a selection of instances of vehicles travelling quickly in the left lane while a line of slow-moving vehicles exist in the right lane. In this selection the average speed of vehicles in the left lane is just over 80 km/h whereas the average speed of vehicles in the right lane is just over 23 km/h. The difference in these speeds is about 58 km/h.

July 15, 2020 - Highbury at Commissioners - Speed of Select NB Vehicles

Obs #	Timecode at 200M N	Vehicle Description Type of Motion	Average Speed of Subject Vehicle in L Lane (km/h)	Average Speed of Vehicles in R Lane (km/h)	Difference in Speed
1	01;02;15;12	Red Comm Van Squeezes Past TT	60.78	27.54	33.24
2	01;04;20;07	Burgandy Car to Median Shoulder to Pass traffic	67.67	14.13	53.54
3	01;05;07;58	White Jeep travelling quickly past stopped traffic	94.29	25.32	68.97
4	01;05;13;12	Grey Hatchback travelling quickly past crawling traffic	78.87	27.14	51.73
5	01;05;20;39	White car changes lanes & quickly passes crawling traffic	83.63	25.32	58.31
6	01;05;24;26	Grey car travelling quickly past crawling traffic	77.76	27.14	50.62
7	01;06;08;33	Red Pick-up quickly passing crawling traffic	80.28	24.11	56.17
8	01;11;09;40	White car travelling quickly past stopped traffic	84.82	14.50	70.32
9	01;11;24;31	Navy Blue Car travelling quickly past crawling traffic	89.93	39.62	50.31
10	01;20;42;10	Black Pick-up almost rear-ends stopped traffic in R Lane	103.35	16.12	87.23
11	01;23;02;56	White Van pulls into L lane causing White Car to brake	75.00	19.70	55.30
		Average =	**81.49**	**23.69**	**57.79**

Observation #1 was discussed in detail in the article “Trench Warfare in the Expressway Construction Zone”, posted to the Gorski Consulting website on July 17, 2020.

Travel at high speeds can be relatively safe provided that all the vehicles are travelling at similar speeds. The cause of many collisions is that some vehicles are travelling at speeds that are divergent from the norm. It is therefore not advisable that large differences in speed should exist on a high-speed expressway.

Many rear-end collisions occur at the back end of a queue of stopped or slowing traffic on the approach to a construction zone. Some of these collisions involve heavy trucks whose drivers are used to travelling extremely close to the rear of other trucks resulting in very limited visibility. In other instances those large trucks pose visibility obstructions to drivers of light vehicles. When such collisions are reported modern-day social media becomes the location where seemingly expert opinion is given by persons who believe they know exactly where the problem lies and how it can be fixed. While some comments are well-intended and not all persons can be painted with the same broad brush, in so many respects the public is easily swayed by opinionated personalities who infect the fragile logic of those who would like a quick and easy solution to every problem. However, specific to collision causes, the effectiveness of these infections in logic is related to the reality that useful information about those causes in non-existent in the public domain.

Many collisions occur on the approach to a construction zone yet little useful information is provided to the public so that informed opinions can be developed about what needs to change or what

corrections need to be made to improve highway safety. When a serious collision occurs the roadway is closed and the only persons allowed at the collision site are the investigating police. Such closures are helpful for the documentation evidence. And they are of further help in laying charges against drivers who may be at fault. However police investigations are secretive and are only available to a select few who are either in the police community or Ontario's Ministry of Transportation. Such secretive procedures are not helpful when their content is kept hidden from the public. Rudimentary descriptions of collisions are provided by police and news media but even essential facts, such as the presence of a construction zone, are often not included in these descriptions. Only in rare instances is information provided with respect to how a construction zone may have contributed to a collision. This often leads to public speculation and misguided pressure placed on politicians to address some issue that is not fully understood.

The status quo reflects how importance is placed on punishing at-fault drivers as investigations are geared toward that purpose. Yet the safety of the general public is of lesser importance. The results of those police investigations are rarely available to determine what caused an injury or death. Even when studies are initiated by federal government agencies such as Transport Canada or the NHTSA in the U.S., the results of police investigations have historically not be made available to improve the quality of those studies. As an example, the former NASS program (now CISS) in the U.S. (and a similar program in Canada) involved teams of investigators whose purpose it is to provide data on the safety status of collisions and how injuries/deaths might be mitigated. While NASS/CISS studies use the base police report to locate collision sites, vehicles and the persons involved nothing additional has been made available to these investigators with respect to the detailed photographs measurements and other data from police files. This is not helpful to the determination of how injuries and deaths can be prevented.

In this non-cooperative environment Gorski Consulting has continued to develop a variety of safety studies including the one at the Highbury Ave site. While official support is provided only to select researchers, Gorski Consulting has continued to provide a safety research program that is independent of any government or private institutions.

In the following text an incident will be explored in detail to provide a demonstration of what analysis is possible using fairly inexpensive methods and procedures. This example is taken from Observation #11 in the above table.

In Observation #11 a white car was travelling quickly in the left lane and passing a line of slow-moving traffic in the right lane. A white van pulled out of the right lane and blocked the white car's progress. A dark Pick-up truck, carrying a canoe, was in the left lane in front of the white car prior to the van's lane change. We may not know precisely why these actions occurred but a detailed study of the vehicle motions can provide the basis for informed opinions.

Table 2 provides a summary of the speed and location of the three vehicles involved in this incident.

For those unfamiliar with video timecode we make note of the following. Timecode indicates the hour, minute, second and fraction-of-a-second of the view taken from the video project in which the analysis was conducted. So, looking at the position of the White Car at the 200-metre-south location, the timecode "01;23;02;26" indicates the location within the video project from which the frame was extracted. The timecode indicates that the frame was extracted at a position of 1 hour, 23 minutes and 2 seconds of the project. The final value in the timecode indicates the precise fraction of a second from which the frame was extracted. There are 60 frames in each second so the "26" indicates that it is the 26th frame of the second from which the view is extracted.

Speeds & Locations of White Car, White Van & Pick-up Truck

	White Van	White Car	Pick-up W Canoe
Locations:			
200 Metres South	Enters Near 50 M S	01;23;02;56	01;23;01;50
100 Metres South	Enters Near 50 M S	01;23;06;35	01;23;05;28
50 Metres South	01;22;56;14	01;23;08;45	01;23;07;41
Zero	01;22;59;24	01;23;11;02	01;23;10;15
50 Metres North	01;23;02;42	01;23;13;26	01;23;15;00
100 Metres North	01;23;07;58	01;23;17;00	01;23;37;27
200 Metres North	01;23;32;44	01;23;35;16	01;23;51;11
Speeds (km/h):			
200 to 100 Metres South	Enters Near 50 M S	98.09	99.17
100 to 50 Metres South	Enters Near 50 M S	82.95	80.72
50 Metres South to Zero	56.78	78.26	70.04
Zero to 50 Metres North	54.55	75.00	37.74
50 to 100 Metres North	34.16	58.63	8.01
100 to 200 Metres North	14.53	19.70	26.22

The description of the scenario begins with the White Van when it first enters Highbury Ave from the on-ramp of Commissioners Road, as shown in the Figure below. At the front end of the Van an orange marking can be seen painted on the pavement. This is the “50-metre-south” marker and it indicates that the Van’s present location is 50 metres south of the south edge of the overpass of Commissioners Road. Such markers were painted along the road edge so that during the analysis of the video the precise position of vehicles could be noted and average speeds could be calculated.

As the White Van enters the expressway the figure below shows the status of the traffic in the northbound lanes ahead of it. The figure shows that the right lane contains some space between vehicles and this explains the reason behind the Van's speed is in the mid-50s as it travels from the ramp into the right lane.

The figure below shows the White Van at the bottom of the view as it is approaching the 50-metre-north marker. We can see that there is some space between the vehicles ahead but that the traffic seems to be more dense in the background. Thus we are seeing the development of a slow-down of traffic speed in the right lane.

As we continue the figure below shows the White Van as it is approaching the 100-metre-north marker and it can be seen that the traffic ahead begins to be more dense in the right lane. This might explain why the speed of the White Van reduces to about 34 km/h between the 50 and 100-metre markers.

In the next figure we observe the White Van as it passes the 100-metre marker. We can see two vehicles in the foreground of the left lane that are passing vehicles in the right lane. The driver of the White Van would be in a position to observe these passing motions as the Van is slowed due to the traffic ahead.

Just before this time we can see in Table 2 that the Pick-up truck (with the canoe) and the White Car are passing the 200-metre-south marker, as shown in the figure below. The White car is not visible in the left lane because it is behind the larger Pick-up truck and both vehicles are still a long distance away in the background. However in the inset of the figure we can see the front end of the White Car passing the 200-metre-south marker while the Pick-up is at the extreme right edge of the view.

The figure below shows the Pick-up Truck and the White Car just as the White Car is passing the 100-metre-south marker. The White Car begins to be visible behind the Pick-up Truck at the right view of the figure and we can also see as it passes the 100-metre-south marker in the inset.

The figure below shows the time when the White Car is passing the 50-metre-south marker. This is about the same time as the White Van is approaching the 100-metre-north marker. Note that the Pick-up Truck is starting to move into the right lane. A car that was travelling in front of the Pick-up also moved into the right lane. The driver of the White Car is unlikely to see what is transpiring in the left lane ahead. However as the White Car approaches the Commissioners Road overpass the distance ahead becomes clear and visible.

In the next figure we see the White Van as it has passed the 100-metre-north marker. The second of the two vehicles in the left lane is passing the Van. Although not visible here Table 2 shows that the White Car is about 150 metres behind the position of the White Van, or the White Car is approximately at the location of the 50-metre-south marker.

At this point we can see in the figure below that the White Van suddenly begins to change lanes, from the right lane to the left lane.

And as this lane change is taking the place we can see in the figure below that the White Car begins to become visible in the bottom of the view. As shown in Table 2 the average speed of the White Car in the 50-metre distance north of the overpass is about 75 km/h. We can estimate the speed of traffic in the right lane by looking at the speed of the Pick-up carrying the canoe that was in front of the White Car at the beginning of this demonstration. That Pick-up truck can be seen in the bottom right of the Figure below. Table 2 indicates that its speed at this location is about 38 km/h.

In the figure below the White Van continues its lane change while the White Car approaches. Upon seeing the motion of the White Van one might conclude that perhaps the driver decided not to wait in the right lane and a decision was made to pass the slow traffic via the left lane. But that conclusion becomes nullified as we observe the scenario unfolding in the following frames.

In the figure below we see that the White Car has now reached the rear bumper of the White Van. If the Van driver was intending to accelerate past the slow-moving traffic it does not appear that this is happening.

Table 2 shows that the average speed of the White Van in the left lane is just over 14 km/h. So it is travelling very slow. It is also not passing any of the vehicles in the right lane. Clearly the driver of the White Van did not pull out of the right lane to pass the slow-moving vehicles. The lane change was purposely made to block the passage of the fast-moving vehicles (such as the White Car) in the left lane. As the speed of both vehicles is reduced to a crawl the figure below shows that other vehicles in the left lane are beginning to arrive.

As shown in the figure below the White Van eventually starts to return to the right lane and so does the White Car. Other vehicles behind them also begin moving into the right lane.

The example shown here is typical of the trench warfare that continues on a daily basis on approaches to construction zones. The Ontario Ministry of Transportation has recommended that drivers should use a “zipper merge” procedure in heavy traffic such that both lanes should be populated up to the location of the closed lane. At the point where the lane closes drivers are supposed to alternate, merging into the remaining lane.

A variety of local publicity has attempted to encourage drivers to use the zipper merge. The City of London posted its recommendation on its website as follows.

“Road Safety Strategy: Zipper Merge

Whenever a traffic lane ends, drivers must merge into the remaining lane(s).Choosing the incorrect merging strategy will generate speed differentials between open and closed lanes. This may result in aggressive driving manoeuvers, an increase in the probability of collisions and road rage.

The speed differential is, in part, a result of the traffic volumes and average road speeds. Traditionally, drivers slow down and move into the lane that will continue through the area as soon as they see the first lane closure sign. This is not always the most efficient and safe way for traffic to merge. The best traffic merging strategy is based on the pre-existing traffic conditions. Two potential strategies are outlined below:

Zipper Merge (Late Merge) Strategy

The zipper merge is a late merge strategy where all available lanes of traffic are used right up to the lane closure. Drivers then alternate into the open lane. The zipper merge strategy is most effective when there are ***high traffic volumes*** *on the road, combined with* ***low average speeds*** *due to congestion.*

Potential benefits of the implementing a late merge strategy include the following:

- *Increased traffic capacity through the reduced lane zone;*
- *Reduces the overall length of traffic backup;*
- *Decreases number of collisions; and*
- *Creates a sense of fairness and equity.*

Early Merge Strategy

With the early merge strategy, drivers move out of the closed lane well before the forced merge point, and before traffic starts to backup. The early merge strategy is most effective when there are ***low traffic volumes*** *on the road, combined with* ***high average speeds****.”*

In a National Post newspaper article of January 23, 2017, Tristen Hopper scolded Canadian drivers claiming:

“Canada’s stubborn refusal to merge late in dangerous, anarchic and – amazingly – slower. In some of the better-driving parts of the world, it’s illegal”.

The article went on to note:

“Canadians love lining up. It’s one of our proudest traditions. We line up at bus stops, at Tim Hortons and even on Black Friday. Naturally, we are a country filled with motorists who have spent their whole lives proudly queuing through bottlenecks — and learning to view late mergers as the literal scum of the earth.”

Yet the article acknowledged an important additional fact:

"Anywhere in North America the zipper merge is introduced, the effort quickly fizzles out unless it's aggressively backed by signage and police presence."

Shortly after these postings, a construction project commenced at the Highbury Ave site. The figure below shows a view looking south on Highbury Ave on February 22, 2018 and it shows that the construction was at the same bridge over the Thames River. Besides the typical orange construction zone signs there are additional signs that were posted to advise drivers of the zipper merge technique.

The figure below shows a closer view of those green signs.

Yet when looking northward toward the same construction zone the two figures below provide an indication of what was present on that same date of February 22, 2018.

We see in the above two figures that the zipper merge signs have not been installed for the northbound direction.

The City of London installed a video camera on the Commissioners Road overpass looking north toward this bridge a number of years before February 2018 so they would be appraised of the traffic situations developing at the construction site. But there is no indication that any effort was expended

to provide enforcement, as advised in the National Post article, to make the zipper merge happen. If a zipper merge is expected to occur it must be accompanied by signage and police presence.

In our previous article ("Trench Warfare in the Expressway Construction Zone") posted to the Gorski Consulting website on July 17, 2020, detailed views of the construction site were shown indicating that no zipper merge signs existed at the site. So it would appear that the City has abandoned its advertising of that procedure. And no police enforcement was in existence.

The practical reality is that drivers are not following the zipper merge procedure at the Highbury Ave construction site and we might as why. The National Post article claimed that Canadians line up because this is what they are accustomed to. But is that explanation too simplified?

Drivers have difficulty waiting until the last possible moment to change lanes when it is left to the cooperation of other drivers to "let them in" to the only available lane. Timing of the lane change is also difficult for drivers to grasp with respect to the end of the closed lane and the differences in speed of traffic also make this lane change challenging. While moving forward in the left lane drivers must be aware of any vehicles ahead and the narrowing of the lane ahead. But they must also look to their right and into their rear view mirror to evaluate the position and speed of traffic in the right lane.

As noted above the City of London advisement separated the lane sharing into types depending on the speed of traffic. Yet the speed of traffic is not constant, it is variable, it may slow down but it may also speed up. Thus it is possible for drivers at the end of the left lane to become trapped, coming to a complete stop, because traffic in the right lane has suddenly increased speed and a dangerous difference is speed is developed. It can be understandable that many drivers may chose to avoid this conflict and enter the right lane at an early time/distance.

Yet there is a sense of annoyance when some drivers use this to their apparent advantage by driving quickly in the left lane and passing many vehicles in the right lane. This advantage would appear to be acceptable and appropriate in the eyes of the Ontario Ministry of Transportation officials since it would adhere to the theoretical procedures of the zipper merge.

Even though reportable collisions may not provide a full account of the extent of any safety problems, other evidence may be available to provide a fuller assessment. The presence of visible skid marks can be an indication of near-miss incidents. The figure below shows a northbound view of Highbury Ave approaching the Commissioners Road overpass. One can observe the numerous skid marks that are visible on the pavement. Such skid marks do not exist is such quantity further north past the overpass. Thus this evidence may indicate that a special problem may exist in this area. Because the highway begins a downgrade just before the overpass the highway surface is not visible in the background and vehicles in this area are also less visible. If vehicles are stopped or moving slowly in the right lane within this downgrade and they are more difficult to detect this could mean that drivers approaching the stopped/slowing traffic from behind are caught by surprise and do not detect stopped/slowing traffic until a large braking input is required and thus the skid marks are created. Thus, seeing this evidence an analyst could advise some method of additional warning upon approach to this area. This is another example of observing and interpreting physical evidence to understand that a danger may exist before a serious collision occurs.

One of the greatest concerns with expressway construction zones is the end of the queue of stopped or slowing traffic. This is often where serious rear end collisions occur. The end of the queue is where drivers may be travelling as highway speed and then must be able to detect that the speed of traffic ahead is much lower. That does not always occur successfully. The end of the queue does not always exist at the same location and this is a further problem for drivers who may not be expecting

this variation. This problem needs further detailed study so that solutions may be found to reduce the extent of this safety problem.

In the example discussed above, If the actions of the driver of the White Van resulted a rear-end collision with the White Car it is questionable how police would interpret the scenario and determine how charges might be applied. Without video documentation it might decided that the driver of the White Car was 100% at fault for causing a rear-end impact. Yet the timing of the lane change by the driver of the White Van might also come into play if that timing could be determined with any reasonable precision. If the collision was of a serious nature there might be witnesses that might come forward and their comments might sway the police interpretation and that of any court. The analysis of expert reports might also be included which might provide details from event data recorders (“black boxes”). These post hoc developments are typical of what transpires after the consequences of a collision cannot be reversed. But study of typical vehicle motions and conflicts may prevent those consequences from ever developing.

By using fairly inexpensive video cameras that are synchronized and placed at roadway markers it is possible to conduct detailed evaluations of driver actions and vehicle motions. The City of London mounted a single video camera on the Commissioners Road overpass and this provides a general view of traffic at the Thames River bridge. But it is of minimal assistance in understanding how dangerous incidents develop and how solutions might be found. The more-detailed, objective data provided by the Gorski Consulting procedures allows us to develop a better understanding of what happens on the approaches to roadway construction sites and where conflicts exist that may lead to possible collisions. This can lead to the distribution of objective information, not only to official entities, but even more importantly, to the general public that educates them. Through this education an informed public can make the correct choices about what it will believe and who it will believe from official sources and in the influential realm of social media discussions.