Roadside Barriers and Death By Drowning - An Important and Hidden Issue

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It is not our custom to display photos from news agencies as we appreciate the sensitivity of the issue. However, the photo we display below is not the focus of our discussion but only meant to introduce an important safety issue.

The Chatham Daily News newspaper provided the photo shown below, taken by Ellwood Shreve, apparently a reporter with that newspaper.



The title of the article accompanying this photo was " Vehicle Slams into Guardrail in Chatham". This was a relatively inconsequential event as, from our experience, the damage to the vehicle is relatively light and minor injuries would be expected. The use of the superlative "Slam" gives the connotation that there was something dangerous or improper about the guardrail impact and that is not so.

The reason why it is important to display this photo is to demonstrate how a properly functioning guardrail system should work. Note that the posts that hold up the metal rail

are relatively new and the rail has been placed at a sufficient height that it has arrested the centre-of-gravity of the vehicle and brought the vehicle to a controlled stop. This is a good thing. What we do not want see are old anchorage posts that have no strength, or a rail that is too low and makes the impacting vehicle vault over the top of the rail...and so on. Enough said about the photo.

The important point is that, in recent years, we have observed that many roadside barriers in Southern Ontario show evidence that they have not been inspected or maintained properly. Also in many instances roadside barriers should have been installed but were not, and therefore this fact poses a danger. The average driver simply has no idea that the problem exists. Official news media fail to perform their civic duty to inform the public while those agencies who are actually responsible for the problem continue to maintain a low profile.

The facts speak for themselves.

On September 6, 2013, CTV News reported that a woman was dead after her pick-up truck was found submerged in the Saugeen River near Hanover, Ontario. At the time the cause of the death was "still unclear". However examination of the area via Google Maps suggested this was an issue of lack of guardrails or mis-performance of guardrails on a rural road where a significant area of water was near to the roadway.

On July 21, 2013 the Chatham Daily News newspaper reported that a 55-year-old women was found dead after her car was found submerged in a water-filled ditch along Town Line Road in Dover Township. Police were simply "continuing to investigate...".

On July 31, 2013, CTV News reported on Roman Chorostil, a local resident in Woodstock, Ontario, who was continuing an eight year fight to get guardrails installed along a stretch of Landsdown Avenue which is bordered by Pittock Lake and a potential site for drowning victims if their vehicles happen to leave the roadway.

Similarly, on March 31, 2012, Francis Myers was driving a GMC Jimmy SUV in the darkness of 0515 hours when he stopped in a driveway at 487 Altiman Road near Walpole Island, to drop off some passengers. While reversing the vehicle's wheel slipped and the vehicle rolled into a water-filled ditch next to the driveway. Two of his passengers died as a result of the vehicle being submerged.

Meanwhile, On April 29, 2012, two bodies were pulled from the Niagara River in Fort Erie, Ontario after a vehicle was found in the water at the intersection of Netherby Road and the Niagara River Parkway. Carlos Mejia, 30 and Joseph Holiko, 39, were the deceased persons found in the vehicle. Again, nothing was mentioned in any news agencies of the danger posed by this nearby water.

Meanwhile, on April 22, 2013, 66-year-old, Alan Knowles of Wallaceburg died when his Dodge Ram 2500 Pick-up truck was found upside down in a water-filled ditch on

Stewart line just north of Wallaceburg, Ontario. Again, no publicity of the common events that have occurred in the past year or two.

In the News page of the Gorski Consulting website we also reviewed other recent collisions where vehicle occupants drowned and we paraphrase:

"We have described a number of collisions recently where a group of teenagers are in a vehicle that exits a roadway and their vehicle has been submerged in water resulting in multiple drownings. Six fatalities in Warren, Ohio; three fatalities in Alliston, Ontario, two fatalities on Highway 401 at the Nith River (but not teenagers), and so on. In the most recent incident in Toronto, Ontario there were five occupants in an Acura SUV that plunged into the Don River (Keating Channel)on Friday, March 29th, 2013. One of the teenagers was not able to get out of the vehicle and drowned."

In late July of 2013, six persons were in car that collided with a truck in the area of Lloydminster Saskatchewan . Initial news media reports made it appear as if the car was crushed underneath the truck when it landed in an adjacent pond. It was not until later that investigating police clarified that the car had come to rest in another area of the pond. None of these news reports ever confirmed that these six teenagers actually drowned while not barriers existed between the roadway and the pond.

In almost all of these incidents the lack of a barrier, or the existence of a substandard barrier, was a major contributor to the collision consequences. The vehicles in these incidents left the roadway and travelled into a body of water where the occupants drowned. In almost all of these incidents news media have failed to inform the public of these facts, they only indicate that "police are still investigating..." in the usual form.

It does not require much investigation to uncover that many barriers in the vicinity of Southern Ontario are either missing, substandard, or placed at locations where they are of little help and in some instances their improper location and characteristics actually increase the potential of a vehicle rollover. Let us review some real-life examples.

Real-Life Examples of Sub-Standard Roadside Barriers

In December of 2009 we attended an accident site on Dunborough Road near West Lorne, Ontario where a Pick-up truck had entered a ditch resulting in fatal injuries to a passenger. In examining the existing post and wire barrier it confirmed that the single cable strung between the wooden anchor posts was extremely loose. Although the struck barrier was damaged and could not be fully evaluated the same cable system on the opposite side of the road could be easily deflected by over one foot simply by pressing against it by with one's hand. We returned to the site the following July and noted that little had changed, as shown in the photo below.



Figure 1: View of accident site on Dunborough Road near West Lorne Ontario, taken about 7 months after the collision date.

There was a memorial at the accident site and a single traffic cone. The roadside had been over-grown with weeds such that the existence of the post and cable barrier was difficult to see. Yet, as shown in Figure 2, if one looked closely, the post and cable barrier was still present in a similar condition to what it was 7 months previous. The looseness of the cable can appreciated by noting its angle and how that angle changes along the cable's length.

In another example, on February 8, 2010 we came across a bridge over a river just south of Mitchell, Ontario where another post and cable system existed, as shown in Figure 3. This time the actual cable was completely missing so that only the anchor posts remained. Figure 4 shows a view of the bridge and posts from the opposite side of the river. Clearly, if a vehicle slid off the road it would fall down the significant embankment and down into the water of the river below.

In a third example, on April 23, 2012 we came across another bridge on Egremont Road just west of London, Ontario where the bridge crossed the Oxbow Creek. The guardrail at this bridge looked like something that had been built during the American civil war - it looked that old. An eastward view of the bridge and guardrail are shown in Figure 5. Figure 6 shows how the bottom of the rail is essentially touching the ground, clearly indicating that the rail is positioned far too low. The centre-of-gravity of any vehicle

striking this rail would be above its height and therefore the vehicle's motion would not be arrested, sending the vehicle over the rail.



Figure 2: View of post and cable barrier, still loose 7 months after the fatal collision.



Figure 3: View of bridge south of Mitchell Ontario where there was no cable attached to the anchor posts of the barrier.



Figure 4: View of missing cable on a barrier next to a bridge crossing a river south of Mitchell Ontario.



Figure 5: View, looking east, at guardrail adjacent to the bridge crossing the Oxbow Creek just west of Melrose Ontario.



Figure 6: View of Oxbow Creek guardrail that is clearly far too low to the ground.



Figure 7: A vehicle entering Oxbow Creek could result in the drowning of its occupants.

As shown in Figure 7, a vehicle plummeting over the guardrail has a greater chance of being over-turned and possibly falling into Oxbow Creek on its roof resulting is potentially fatal consequences.

Clearly the anchorage of the rail to the bridge was also substandard. As shown in Figures 8 and 9, the bolts that would normally attach the rail to the bridge were missing. This is an additional danger that few persons understand. In the late 1970's an inquest was held with respect to a fatal collision that occurred on Highway 401 at Dodd's Creek just west of London Ontario. The guardrail there was not properly anchored to the concrete bridge abutment. When a vehicle impacted the rail it was deflected and slid along the rail until it immovable abutment resulting in the fatality. The recommendations of that inquest was to ensure that such rails would be firmly attached to the concrete abutment of bridge. Since then, all the guardrails and bridge abutments along Highway 401 were changed to ensure compliance. Well, as we have stated before, as time passes we crawl back into our caves. The standards that were once applied and adhered to no longer apply and are no longer adhered.

There is considerable propaganda in the industry claiming that inspections are performed, but is that the reality? Are these problems being identified and corrected?



Figure 8: View of missing anchorage bolts at Oxbow Creek guardrail.



Figure 9: View of loose anchorage bolts on Oxbow Creek guardrail.

To test that theory we returned to the Oxbow Creek bridge on September 25, 2013, about 1 1/2 years after taking the above photos. Figure 10 below is the same as Figure 5 only 1 1/2 years apart. Figure 11 is the same as Figure 8.



Figure 10: Eastward view of Oxbow Creek Bridge taken on September 25, 2013.



Figure 11: View of missing anchorage bolt at guardrail to Oxbow Creek bridge on September 25, 2013.

Similarly, Figure 12 is the same as Figure 9, only 1 1/2 years apart.



Figure 12: View of loose anchor bolt to Oxbow Creek guardrail.

What confidence should the public have in the claims that these conditions are being inspected and repaired?

The drowning of a vehicle occupant does not require a great depth of water when the right circumstances are created. Unfortunately, when a vehicle slips off a roadway embankment it often overturns and comes to rest upside down. The rapid nature of over-turning during such an event accompanied by the disorientation of being injured, sometimes with concussive effects, cause vehicle occupants to have difficulty in developing a plan of escape. Even a shallow creek that is a couple of feet deep can become potentially fatal if the occupant is trapped and cannot move above the shallow water line.

A tragic example of this fact occurred on January 12, 2013 just south of Alliston, Ontario when three teenagers became trapped in their upside-down vehicle when the vehicle slid into a steep-banked and narrow, water-filled ditch. Figure 13 shows a view of that accident site taken in February, 2013. All three occupants drowned. It might appear surprising to some since the ditch would appear to contain a small amount of water. No guardrail existed at this location, presumably because officials did not appreciate the details of the hazards posed by this specific site.

The consequences of that lack of understanding were increased when, a month later, on February 12, 2013, another serious collision occurred and resulted in near-fatal injuries to a driver travelling along the same road and in the same direction but only a few kilometres south of the triple-fatal site.



Figure 13: Alliston area triple fatality. A car approaching the camera slid into the narrow ditch in the foreground and over turned, trapping the three occupants in a shallow depth of water. All three were found drowned.

In Figure 14 we show a southbound view along the same road, leading up to this second accident site. Here there was a similar small bridge that was unprotected by a guardrail. But in addition, we can see in the foreground that maintenance personnel attempted to "improve" the pavement by laying down a narrow strip of patching along the right side of the lane. Rather than ensuring that the height of the patch matched with the height of the remainder of the road surface, a substantial edge-drop off was developed precisely where the right wheels of vehicles would travel in the lane. Our testing at the site with an accelerometer demonstrated how there were violent forces exerted on the vehicle from the edge drop off at the junction between the patch and the older surface. The collision involved a frontal impact of the vehicle into the unprotected, immovable, concrete abutment of the bridge, as shown in Figure 15. Had a guardrail been properly installed the vehicle would have slid along the guardrail and would have been re-directed away from that abutment, likely resulting in minimal or no injuries.

But the facts in this second collision were not much different than the first, just fate intervened. A slight difference in the angle of approach could also have sent this vehicle into the creek shown in Figure 16 and we could have had a drowning just like the three drownings mentioned in the previous incident.



Figure 14: View, looking south at the site of the second collision and the presence of a patch along the right edge of the southbound lane.



Figure 15: Evidence of a frontal impact into the concrete bridge abutment in the second collision of the Alliston area roadway.



Figure 16: If the abutment impact had not occurred the vehicle might also have fallen into the creek bed resulting in a possible drowning.

The issue is not only the lack of guardrails or their poor maintenance but in many cases it is an issue of an improper location of the guardrails. As an example, on October 10, 2012 we happened to pass by an accident site on the exit ramp from Highway 401 to Wellington Road on the south side of London Ontario. Figure 17 shows loss-of-control tire marks that show the location where the vehicle exited the road surface. There was no guardrail at this location however, in the background, one can see that a guardrail existed, it just was not extended to the location where the vehicle exited the road.

The argument could be held that guardrails cannot be placed everywhere and there are guidelines that stipulate where there are greater dangers. This often has to do with the steepness and depth of a roadside slope. But "engineering judgment" is often mentioned in these guidelines to alert persons to the fact that not everything is black and white and not every danger can be described. At the present site the guardrail was apparently not required at the point where this vehicle exited the roadway because there was insufficient danger at the roadside. But is that so?

Figure 18 shows that the vehicle knocked over a chain link fence. Such fences are dangerous because the upper pole that runs along the top of the fence becomes dislodged and separates into sections, as shown in Figure 19. The end of such a pole acts as a harpoon and can potentially pierce through the interior of a vehicle. But this is not the only safety hazard at the site.



Figure 17: Tire marks indicate where a vehicle slid off the exit ramp of Highway 401 at Wellington Road in London Ontario.



Figure 18: View of chain link fence that was knocked over as the vehicle travelled through the roadside.



Figure 19: View of dangerous "harpoon" that forms when the top pole of a chain link fence separates.

Figure 20 shows that as we look beyond the chain link fence there is a pond but luckily the vehicle did not have enough speed to enter into it. Given the drownings that are known to occur from roadside water and given the high traffic volumes at the edge of this busy expressway the extension of a guardrail should have been considered to keep vehicles away from these hazards.



Figure 20: View of pond beyond the fence where the vehicle came to rest at the edge of the water.

Not only is this a hazard but it needed to be dealt with before other problems were created. The existence of the harpoon meant that another vehicle entering the area could be in danger. Also the entrance into the pond needed to be closed by some form of barrier. However repairs from the impact took too long to be completed.

For example, we returned to the site on April 26, 2013, or over 6 months later and found what can be seen in Figure 21. The fence was still unrepaired and the pond was open for any vehicle to enter.



Figure 21: Over 6 months after we observed the damaged fence it had still not been repaired.

As we know from the listing of recent drownings listed earlier in this article, the presence of water adjacent to a roadway cannot be taken lightly and maintenance personnel need to consider how they prioritize the level of danger posed by that water.

In another incident, on April 25, 2013 we observed that a tractor-trailer had rolled over on the entrance ramp of Highway 401 at Highbury Avenue, also in London, as shown in Figure 22. At the location of the rollover they was no guardrail, as shown in Figure 23. However that is not totally correct. A guardrail existed but it terminated before the point where the truck rolled over, as shown in Figure 24. In fact the existing guardrail was in excellent condition with no evidence that it had ever been struck by anything. But that only suggests that it was located at a point where vehicles would not be out of control and leaving the ramp's surface.



Figure 22: Tractor-trailer rollover on the entrance ramp to Highway 401 at Highbury Ave., London.



Figure 23: Closer view of rollover location showing no evidence of a guardrail.



Figure 24: View of guardrail that terminated just before the location of the Tractor-trailer's rollover.

Even if the guardrail had been present at the location of this truck rollover the height of the centre of gravity and the large mass of this truck would have caused it to be "tripped" and the likelihood of a rollover would be increased. And this is another issue that is hidden from public discussion.

It has been known of a long time that the high-volume Highway 401 contains about 50 percent heavy vehicles, mostly tractor-trailers. Yet almost all roadside barriers are too low as they are designed for impact with passenger cars and light trucks which only represent 50 percent of the highway's traffic volume.

In another example, a bus crashed through a guardrail near Pendleton Oregon on December 30, 2012 resulting in 9 fatalities and 39 persons injured, as shown in the site photo in Figure 25.

While there were many questions presented to the public essentially nothing has been revealed about the specifics of the cause. In all the mass commotion of news media not a single reporter could look at the guardrail and raise the question whether this barrier was appropriate to prevent a large heavy vehicle from being propelled beyond it. Rarely do the news media ever display a view of the damaged barrier however we can see it in Figure 26. Yes, there was some deflection of this guardrail but the most obvious indication is that the rail was twisted upward indicating that the bus simply rode over top of it. But this is exactly what we would expect due to the high centre-of-gravity of the bus compared to the height of the rail. This barrier system was not meant to deflect the motion of a heavy vehicle and it only contributed to the vehicle's rollover.



Figure 25: View of accident site near Pendleton Oregon.



Figure 26: View of rail showing how it has been rotated upward while the system itself indicated minor evidence of deflection.

In another fatal bus crash on I-95 at the Hutchinson Parkway in New York, on March 11, 2011, an intercity bus struck a low guard rail and flipped over top of it, as shown in Figure 27.



Figure 27: View of inter-city bus that was tripped onto its side by a low guardrail. While on its side the bus struck an immovable stanchion causing massive intrusion into the occupant space of the bus.



Figure 28: View of rail lying on its side indicating that the bus simply flipped over top of it due to is low height.

The low height of this guardrail could be determined by examining it condition before the collision via imagery from Google Maps. Figure 29 shows a screen capture from that imagery showing the guardrail while Figure 30 shows a closer view of its vertical profile.



Figure 29: Screen capture of guardrail before the multiple-fatal bus crash.



Figure 30: From simple extrapolation from a knowledge of the typical height of a standard rail it is possible to note that the gap between the bottom of the rail and ground is too low and therefore the rail itself was too low before the collision.

Again, while multiple newscasts and reporters provided various commentary on the event no one was capable of making the observation that this guardrail was too low. Even to this day this fact has not been raised and the public is unaware of this important issue.

Returning to the local environs of Southern Ontario, we present a similar example from a transport truck passing through a guardrail at the Nith River Bridge, just west of Cambridge, Ontario. Figure 31 shows the general accident site from March 5, 2013.



Figure 31: View Transport truck lying in the Nith River after it plunged through a guardrail at the edge of the Nith Bridge.

Again, nothing was mentioned by the news media about the condition of the guardrail that allowed the truck to pass through it resulting in the death of the two truck occupants. However, on-site photos were made available. In Figure 32 we can see one of those photos that shows work crews making repairs and the rail has already been removed in the area where it was struck. However note how the workers are standing on the snow bank where the guardrail was located. We know from past experience that in late winter the strong sun melts snow banks more rapidly and whatever frozen material remains is often hard as rock. The darkness of the snow and its melted appearance confirms to us that this is a very hard bank. In these circumstances a bank like this acts no differently than if it was made of concrete in that it can support a large weight without being compressed. The result is that this hard bank becomes a ramp for a striking vehicle. Thus the vehicle rides over top of the guardrail as likely occurred in this instance.



Figure 32: View of hard snow bank that was likely used as a ramp for the truck to pass over the guardrail.

In summary, we have presented a number of real-life examples of problems with roadside barriers. It is not just a case of their existence but the problem is compounded by the lack of awareness by the general public that they are being exposed to these conditions. The comparatively small group of persons who are directly involved in these collisions are unaware that they or their friends and family were exposed to these problems because, in many instances their effect is not reported. When person is killed and a drunk driver is involved police and the news media only mention that fact without revealing that roadside barriers may also have contributed to the collision consequences. When a driver has been killed when driving too quickly it is only the fact that "speed was a factor" that the public hears. But it is not reported that the speeding driver could have been saved by a properly functioning roadside barrier that either did not exist or was not maintained properly.

The specific consequence of drowning in roadside stands of water is ignored. When one travels along any highway there are numerous warning signs providing information to a driver about possible hazards. There are curve warning signs, signs that indicate to a driver when they are approaching an intersection and signs that indicate when a road surface might be slippery when wet. However, at none of these highways is there a warning sign that informs drivers that a water filled ditch, pond, or river is nearby. Yet, the consequences of a vehicle entering a body of what are dire. On a percentage basis any incident of a vehicle entering a body of water has a large probability of resulting in a fatality. Much like a vehicle fire, a vehicle coming to rest in a body of water often means that the occupants must take urgent action to escape that vehicle or face certain death.

In some instances, such as the scenario shown in Figure 33, the presence of water next to a highway is obvious, and its depth might be appreciated. However, in many others the depth of a ditch and the depth of the water within it is hidden from a driver's view.



Figure 33: This stand of water on the edge of Oxford County Road 22 northeast of Woodstock Ontario is readily visible even though no warning signs inform drivers of the potential of drowning.

The vertical line of sight of most passenger car drivers is below 1.2 metres, or slightly below the chest and slightly above the abdomen of a typical, standing, adult male. The typical person does not realize how low that height is and how little they are able to see in the vertical plane to the sides of road.

As shown in Figure 34, many roadside ditches and ponds contain bulrushes and tall grasses that hide the true height of the drop of an embankment and whether water might be present. If a driver could stand within the ditch, such as in Figure 35, the extent of the problem could be better appreciated, but that possibility is not available when driving at highway speed.

What is needed is a greater focus on the magnitude of the problem by news media and police so that the public is not ambivalent to the danger. Unfortunately that co-operation is difficult to attain when pressures exist to hide such problems for fear by the provincial transportation department and municipalities of being found liable for any death or injury caused by a roadway hazard.



Figure 34: View of a roadside ditch containing vegetation that hides the extent of the drop and the existence of water.



Figure 35: View of same ditch as shown in Figure 34 except that the photographer is within the ditch and exposing the extent of the drop of the embankment. However the existence of standing water is still masked by the vegetation.

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