Danger of Passing Large Trucks on Two-Lane Highways

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A recent fatal collision has prompted Gorski Consulting to provide some context into the dangers of attempting to pass large trucks on two-lane rural highways.

On October 6, 2014 an 18-year-old female driver was reportedly travelling westbound on Medway Road on the northeastern outskirts of London, Ontario when she attempted to pass a heavy truck carrying a load of gravel. Tire marks left by the Chevrolet car indicate that some time during this passing motion the female driver applied her brakes hard and steered toward the left shoulder.

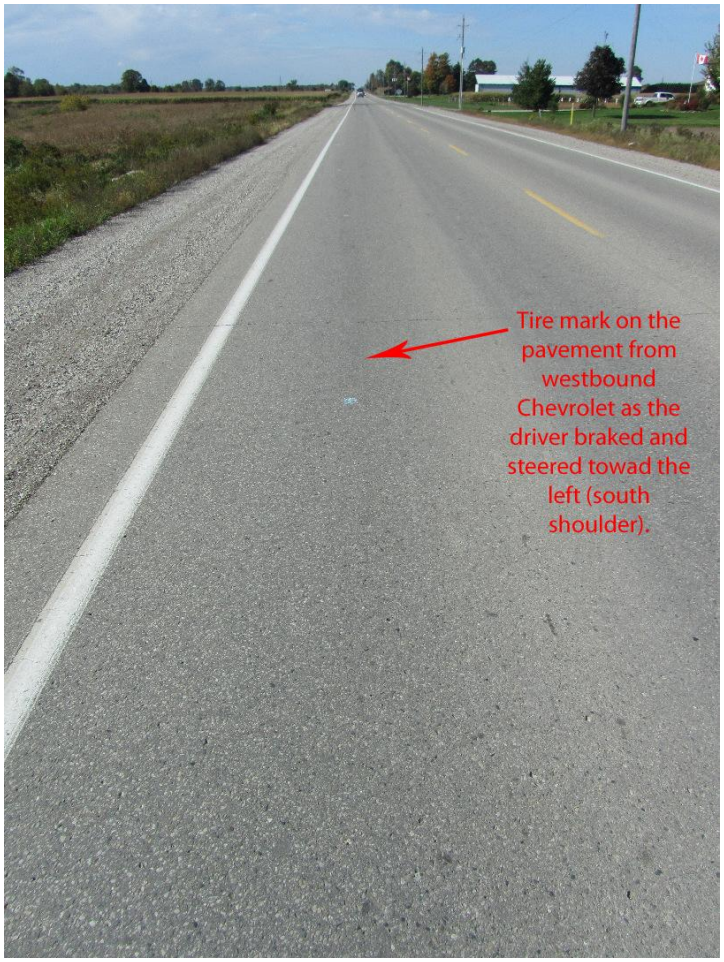

Figure 1: View, looking west, along the eastbound lane where some light-coloured chalk marks highlight a tire mark of the Chevrolet as it was braked and steered toward the left (south) gravel shoulder.

While braking on the shoulder her car entered into a violent clockwise rotation that caused the car to re-enter the road surface and travel into the westbound lane.

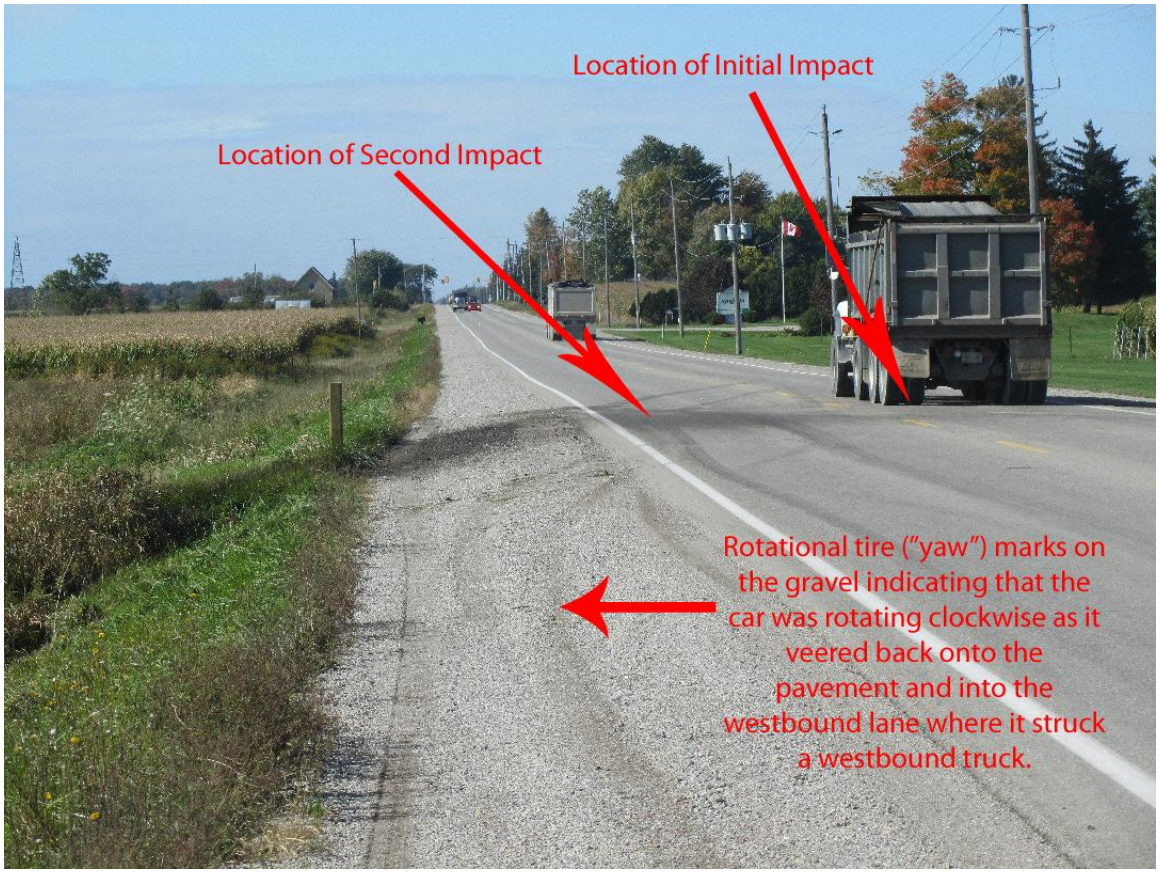

Figure 2: View of curved yaw marks from the Chevrolet as it rotated on the gravel shoulder and returned to the road surface where it collided with the side of a westbound truck.

The car reportedly collided with the trailer of the westbound gravel truck. Judging by the gouges created on the pavement this was a major impact.

Figure 3: View, looking east, of the gouges in the westbound lane caused during the initial impact.

The car was then redirected back into the eastbound lane where it was struck by the front end of an eastbound dump truck.

Figure 4: View, looking east, of the gouges in the eastbound lane where the Chevrolet was struck a second time by an eastbound dump truck.

Not surprisingly, the young female driver was killed.

No mention was made why the deceased driver applied her brakes and steered onto the south shoulder. While the investigating police informed news media that the young driver lost directional control of her vehicle that statement does not provide an accurate depiction of the evidence. The evidence from her vehicles' tire mark on the pavement indicated that her vehicle was likely under her control when she started braking and steered toward the south shoulder. It was only after her vehicle was on the shoulder that the loss of control occurred. So the reason why she felt it necessary to apply her brakes and steer off the pavement was not provided.

Such it the typical circumstance that, in many passing motions, a problem develops that is not fully understood or uncovered. What can be said however is that passing a large truck on a two-lane highway poses additional danger that needs to be understood.

As another example, the photo below shows a scenario that unfolded at another two-lane rural highway where the northbound blue car in the photo approached a gravel truck that just entered the highway ahead of it.

Figure 5: While seeing the dump truck entering the road, the driver of the blue car may not perceive the hitch for the additional trailer.

Because of the long draw bar behind the truck the driver of the blue car may not detect the fact that a trailer is being halted by the dump truck. The characteristics of the dump truck itself does not distinguish it from those dump trucks that do not halt additional trailers and this increases the possibility of a perception error.

Figure 6: While the dump truck continues to enter the road the driver of the blue car still has not applied the brakes. This is often the case because perception takes a finite time before a reaction can take place.

Because of a perception error the driver of the blue delays in applied braking and now must apply those brakes harder and may not feel inconvenienced by that fact.

Figure 7: View of driver of blue car applied the brake. The driver of the blue also may not appreciate that the truck is fully loaded and, acceleration on the upgrade is very slow.

Also, it may be difficult for the driver of the blue car to appreciate that the truck is fully loaded and that its travel up an incline will result is a very slow acceleration.

Figure 8: Although it is possible to see that there is sand or gravel piled over top of the trailer, that fact may not be detectible by the driver of the blue car due to the distance that would exist when that perception is needed.

We now encounter an impatient driver who feels inconvenienced by the this truck driver who was inconsiderate by entering the roadway at this time. Yet, if that car driver had an opportunity to study the road and traffic volume it might become clear that the truck driver had limited opportunities to make the left turn and, when faced with having to wait a very long time, the truck driver must inconvenience the car driver if an exit is to be made.

However, not knowing these facts, the impatient driver of the blue car now wants to pass this slow-moving and inconsiderate truck driver.

Figure 9: Without waiting to confirm that enough space exits to make a passing motion the driver of the blue car proceeds to steer into the opposing lane, when suddenly an opposing vehicle enters the view from over the hill-crest.

Without waiting to confirm that there is a safe passing distance, the driver of the blue car pulls out and begins to pass and a potentially deadly head-on collision may occur.

Normally, passing zones are marked with substantial leeway to cover many eventualities. For example, the AASHTO Geometric Design of Highways and Streets manual (1994) indicates that a vehicle passing motion on a rural highway with a Design Speed of 90 km/h will require a safe passing zone of about 605 metres. But when one considers two opposing vehicles that are each travelling at 90 km/h (25 metres per second) those two vehicles will be approaching each other at 50 metres every second and will reach each other in about 12 seconds.

While there are many exceptions, a typical passing motion can be completed in about 8 seconds. However, at distances of 600 metres an opposing vehicle would be so tiny in a driver's field of view that it would be impossible to detect the approaching vehicle's speed and there are many roads where 20% of vehicles on any rural highway could be

travelling at least 20 km/h above the posted speed limit. So the 12 seconds that might normally available would be shorted.

Furthermore, acceleration ability of vehicles varies. As an example, Gorski Consulting completed maximum acceleration testing with a low-powered Mazda 3 and a higher powered Buick Allure in situations where the initial speed of the vehicles was either 10 or two km/h and we accelerated the vehicles over distance of 50 metres. The low-powered Mazda achieved rates of acceleration of 0.19 to 0.20 g from an initial speed of 10 km/h and about 0.18 to 0.19 g from initial speeds of 20 km/h. In contrast, the higher-powered Allure achieved accelerations of 0.40 g from initial speeds of 10 km/h and 0.34 to 0.35 g from initial speeds of 20 km/h. We know that, at higher speeds, rates of acceleration are reduced so, from an initial speed 80 km/h, the ability to accelerate to a higher speed will be much reduced. However the difference in ability between lower and higher-powered vehicles will make a substantial difference in whether the lower powered vehicle will be able to make a safe passing motion in the required distance of 605 metres or 12 seconds.

Another problem is that the typical wider width of a large truck of about 2.4 to 2.6 metres means that the visibility beyond it will be more difficult than if a driver was attempting to pass a smaller vehicle.

Another problem is that the length of the large truck also has an effect on the time that a passing vehicle need to remain in the opposing lane. Yet, in many instances, a driver who only sees the rear end of a vehicle such as a dump truck may not be able to distinguish its characteristics from a pup trailer such as the one shown in the above example. Very often, persons who are not familiar with dump trucks may not be able to recognize that the rear of a pup trailer looks different from the rear of a dump truck and so it might not be realized that the truck to be passed is not just a single dump truck but a combination of a dump truck, with a long draw bar, followed by a pup trailer. In the above example the driver of the blue car was capable of seeing the combination as it pulled onto the highway however, in many cases, a faster-moving car approached the rear of such a slow-moving truck without being able to detect the truck's actual length.

In instances where a driver makes an error but is already committed into the passing motion there may be an attempt to abort the action by steering the vehicle away from the perceived danger, travelling onto the left shoulder. This could be what might have happened in the example of the young female driver discussed at the beginning of this article. However, such an action requires some skill and knowledge. A vital piece of knowledge is that applying hard braking when the tires on one side of the vehicle are on gravel while the tires on the other side are on an asphalt pavement will result in the type or rotation that led to that driver's death.

In fact, Gorski Consulting had conducting testing precisely at the site of this fatal collision in March of 2013. Using a 2012 Ford Fusion test vehicle we performed a braking test with the right side tires on the gravel shoulder and the left side tires on the asphalt pavement. The result was very similar to what happened in the fatal collision. Our test vehicle entered into a substantial rotation that could not be countered by our

opposing steering input so long as we continued to apply hard braking. This was despite the fact that this newer vehicle was equipped with an electronic stability control system. Young drivers need to be alert to the fact that hard braking should be exercised with caution and an understanding of what conditions may result in a loss-of-control.

All these factors make for a complicated scenario that places drivers in jeopardy whenever they decide to pass a slower-moving truck. Yet, young drivers are not made aware of these complications. During our course of study to become a licensed Ontario Driver Instructor there was nothing in the curriculum that discussed any of these complications. Thus when driver instructors do not receive this necessary knowledge they cannot pass it onto their students.

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