Driving For The Road Conditions - How Well Can We Detect Snow Drifts?

Posting Date: 07-Jan 2014

Many seemingly expert advisors are heard instructing the general public to "Drive for the road conditions" and "When you see snow go slow". While these instructions appear to make common sense there are many instances of universal truths in life upon which many fortune tellers make a substantial living. Beyond the truth that snow on a roadway can potentially lead to a vehicle loss-of-control and collision the question remains, can drivers follow this sage advice in all circumstances? Are there certain occasions where road conditions can change character and trick the driver, even though reasonable attention and speeds are followed? We explore this possibility with the simple example of a snow drift on a typical rural highway.

Imagine the scenario shown in Figure 1 below. You are travelling on a rural road in wintertime. You turn onto this road from an intersecting road at a point we will label as "Zero" which is approximately what is shown in Figure 1.

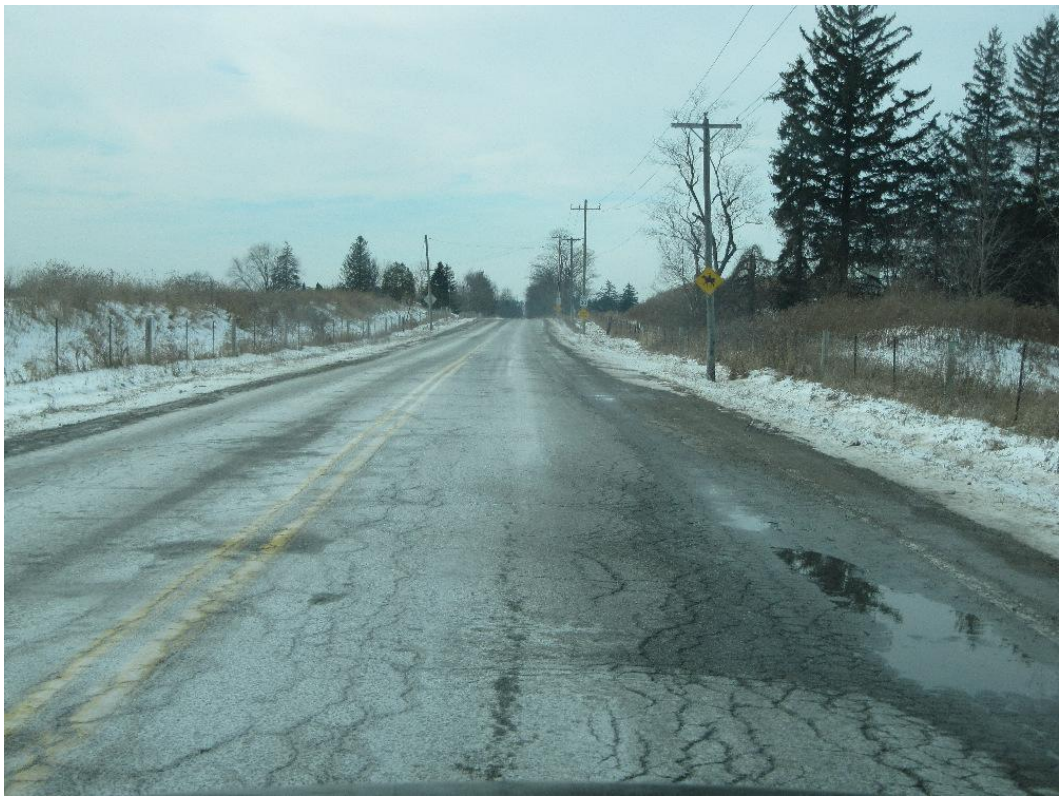

Figure 1: View, looking west, from the "zero" reference on rural road.

Although there is snow visible on the sides of the road the road surface is essentially bare and dry except for a small amount of puddling near the right side of the lane.

What speed would you select for travelling along this road as representing "driving for the road conditions"? The speed limit on this road is 80 km/h and we have observed that the average speed on such roads is often about 10 km/h faster than the speed limit or about 90 km/h or about 25 metres travelled every second. Why would we expect a driver to travel much slower than this speed when the road surface conditions appear to be no different than, say, an August afternoon?

After travelling a short distance along this rural road you approach a downgrade leading to a small creek with a bridge as shown in Figures 2 & 3.

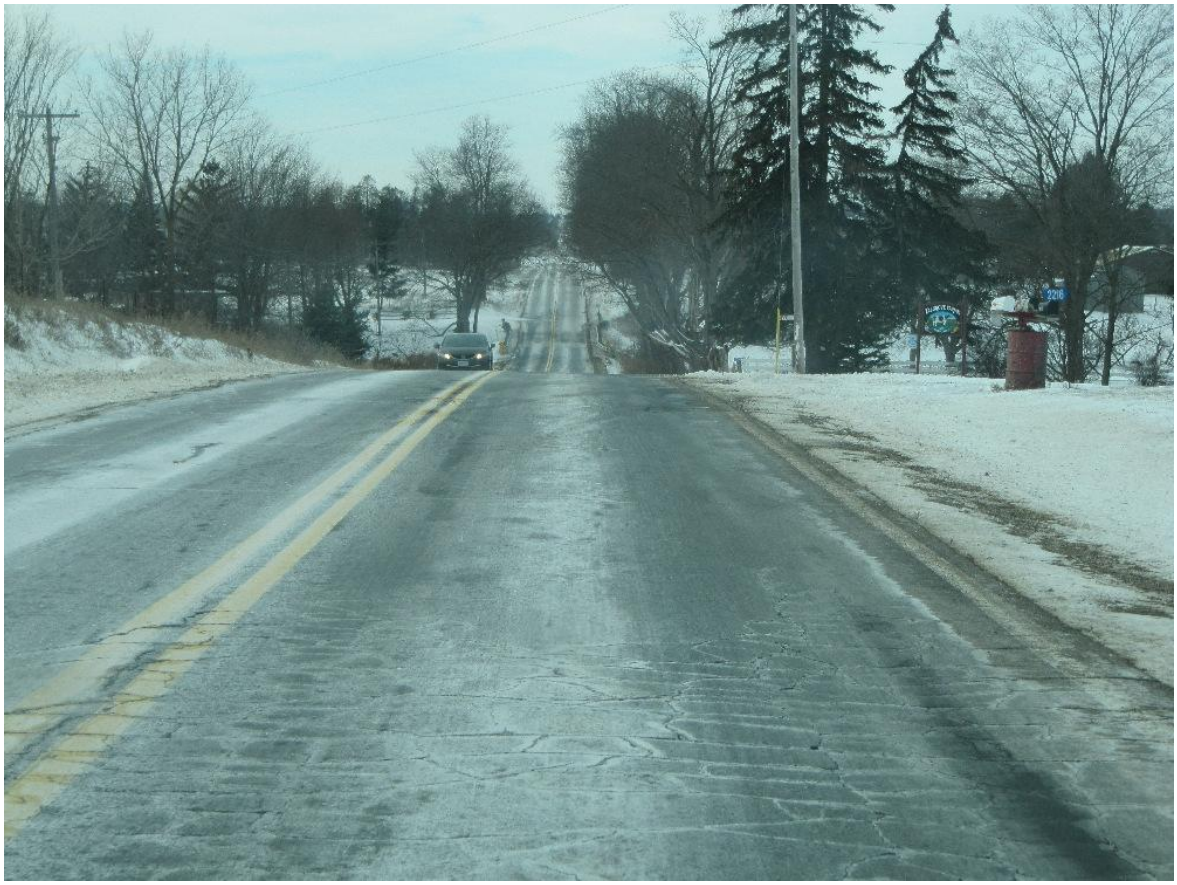

Figure 2: View upon approach to a downgrade leading to a small bridge over a creek.

As can be seen in both Figures 2 and 3 the road surface still remains essentially dry. Figure 4 shows the view for the driver as you are on the small bridge and then Figure 5 shows the view as you travel on the upslope just past the bridge. Note in Figure 5 that your line of sight ahead of you is limited due to that upslope.

In Figure 6 we show the view after you just crest the upgrade and you see that the roadway ahead is generally flat. Yet, you still see that the road surface is generally bare and dry.

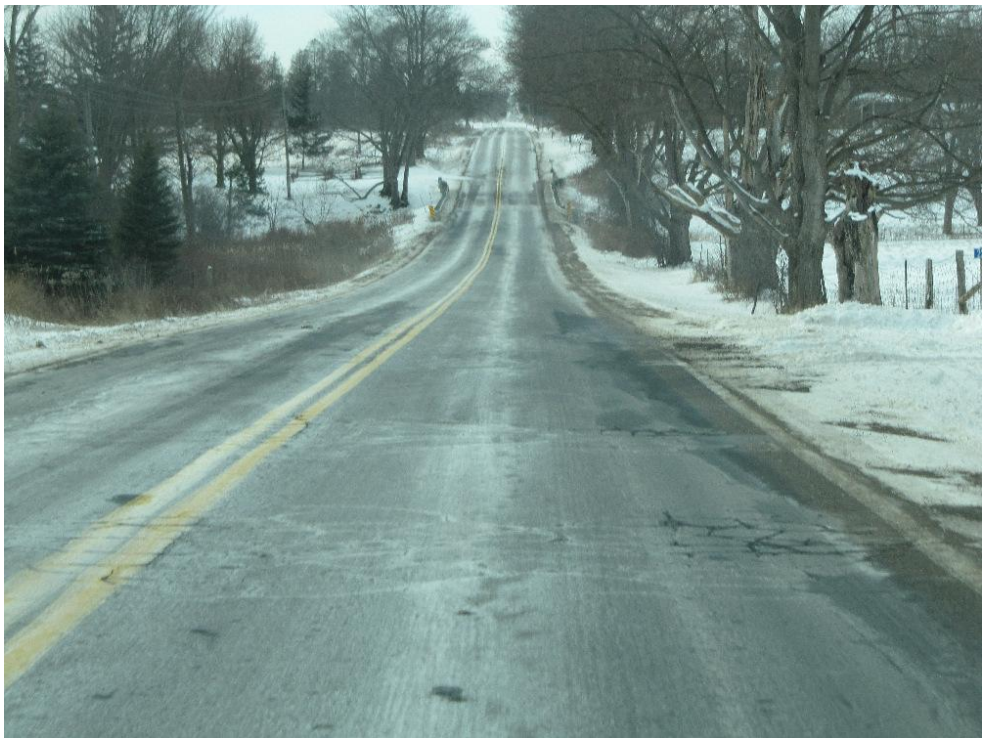

Figure 3: View on approach to a small bridge which is located at approximately the 950-metre location

Figure 4: View while passing over the small bridge.

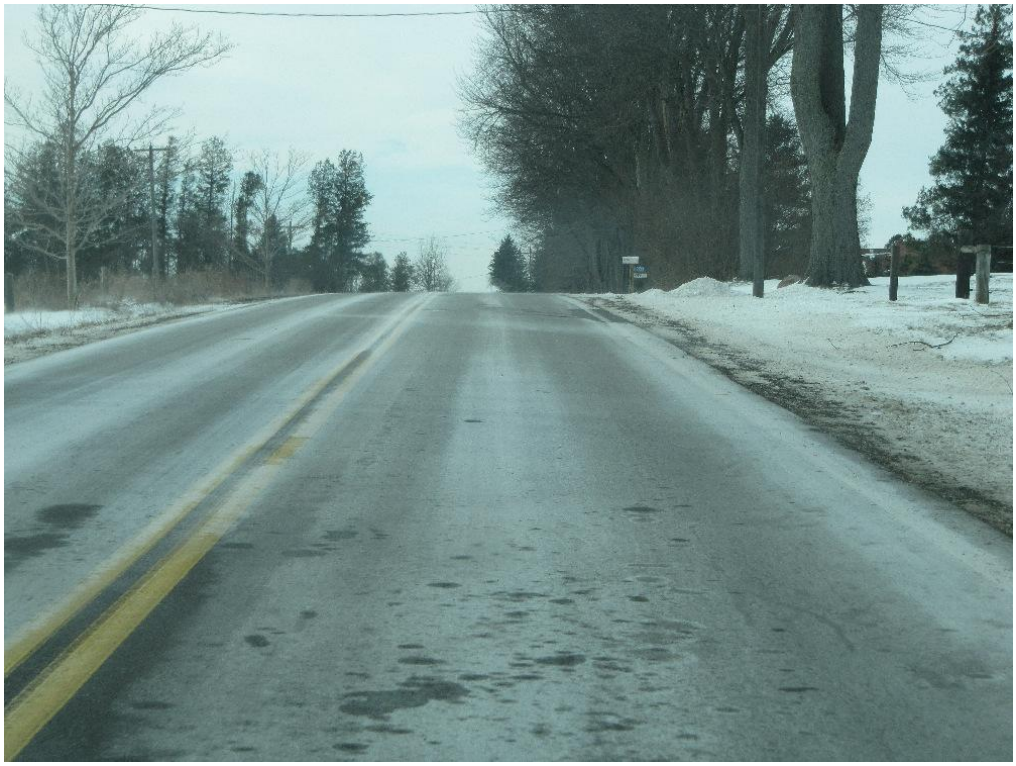

Figure 5: View, upon travelling through the upgrade after passing the small bridge.

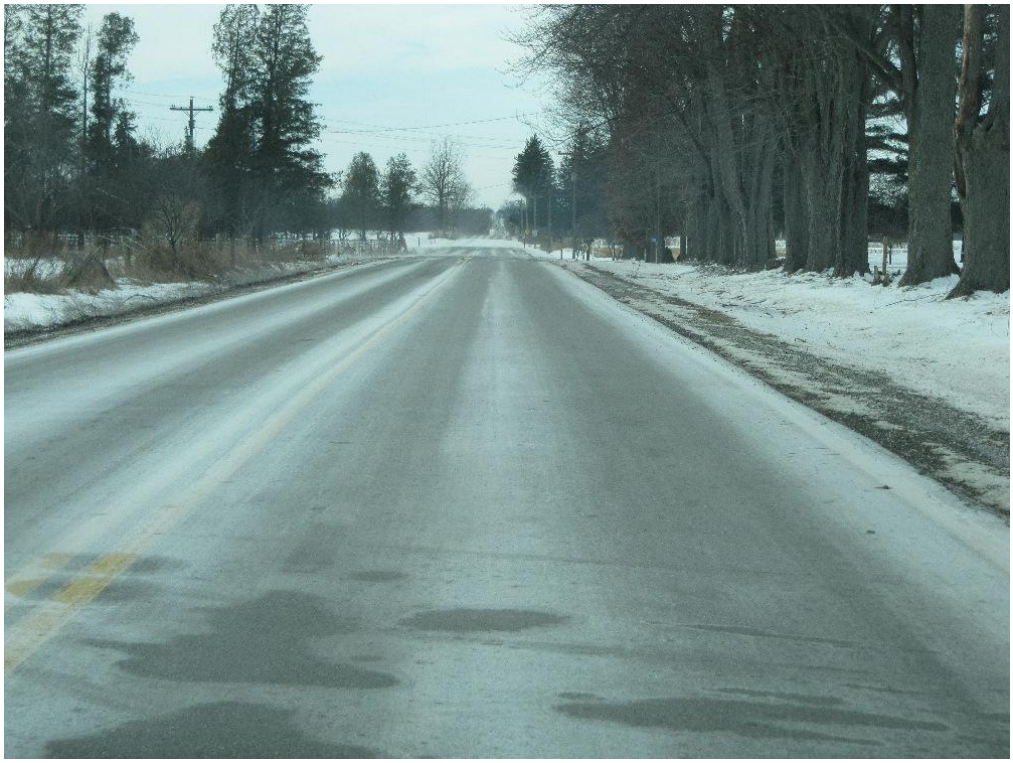

Figure 6: View as a driver crests the upgrade and the roadway ahead is generally flat so that a driver can see for a longer distance ahead.

The question is, when you are a driver at the location shown in Figure 6, what could you see ahead of you? You are approximately at the 1200-metre location, or you have travelled about 1.2 kilometres along this road that has presented you with an apparently bare and dry surface. Certainly there appears to be a small sliver of white directly in line with the road surface in the far distance. But what could you honestly conclude from this location about what that sliver indicates? Is it a reflection of the daylight onto the ground into your eyes? We do not believe a driver could honestly state that much could be concluded about this white sliver, even if the driver was looking directly at it instead of other portions of the road closer to the vehicle.

Figure 7 shows a view at approximately the 1400-metre location. Now there certainly is something visible ahead within the road and it looks white. So the obvious conclusion is that this is snow. But how much snow?

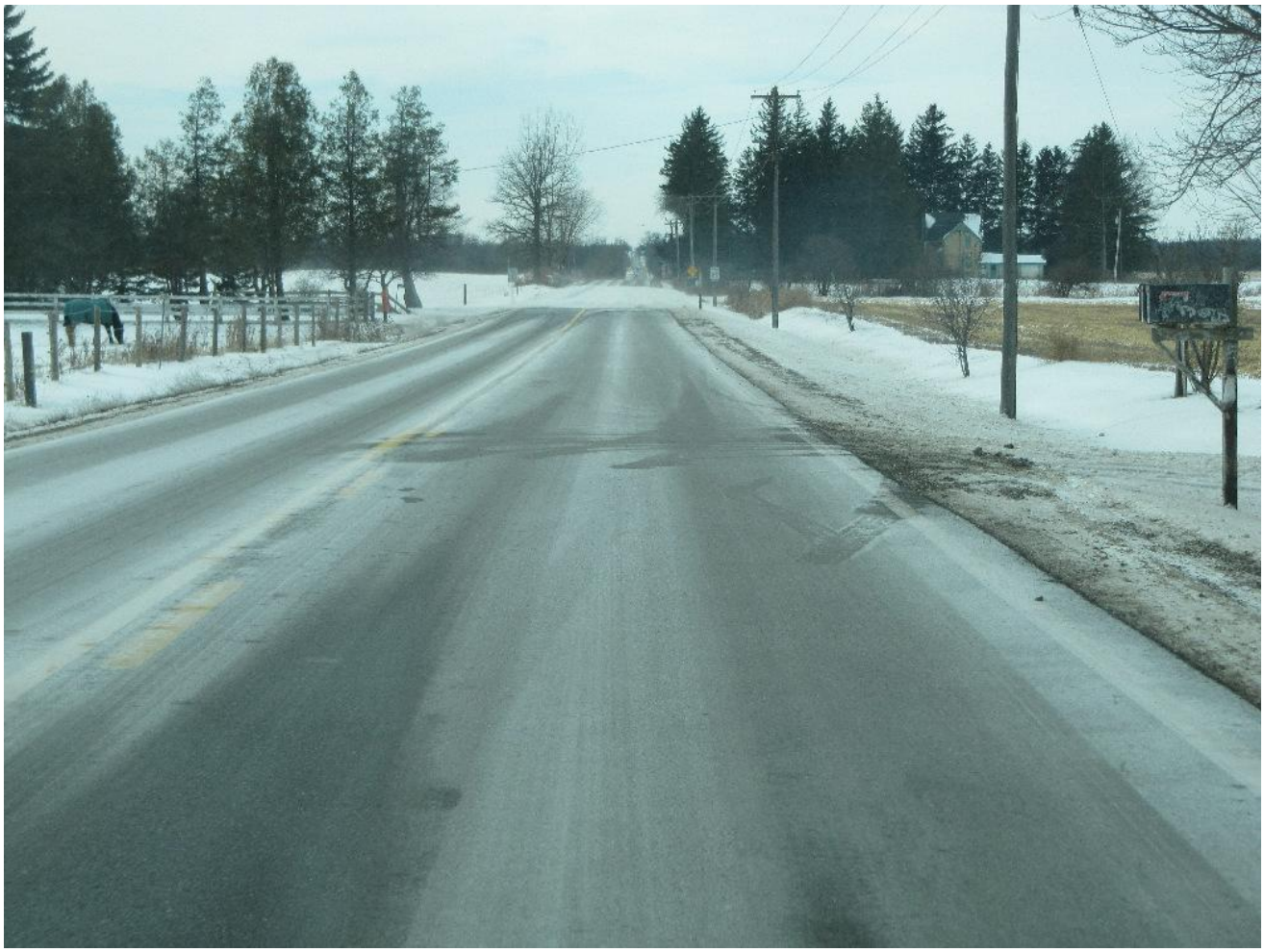

Figure 7: View, looking west toward something white in the background of the road at the approximate 1400-metre location.

Remember, you have just travelled 1400 metres along this road and found it to be bare and dry. If you determined that there was snow on the road ahead would you really expect that there was a large quantity of snow? We do not believe so. But now you are guessing. You cannot be sure but deep snow would be unlikely so you proceed onward.

But that whiteness is actually quite close. The distance travelled between Figure 7 and Figure 8 below is only about 50 metres or about 2 seconds at a speed of 90 km/h. The front edge of the obvious snow drift is less than 50 metres ahead. But can you detect how much snow there is on the road?

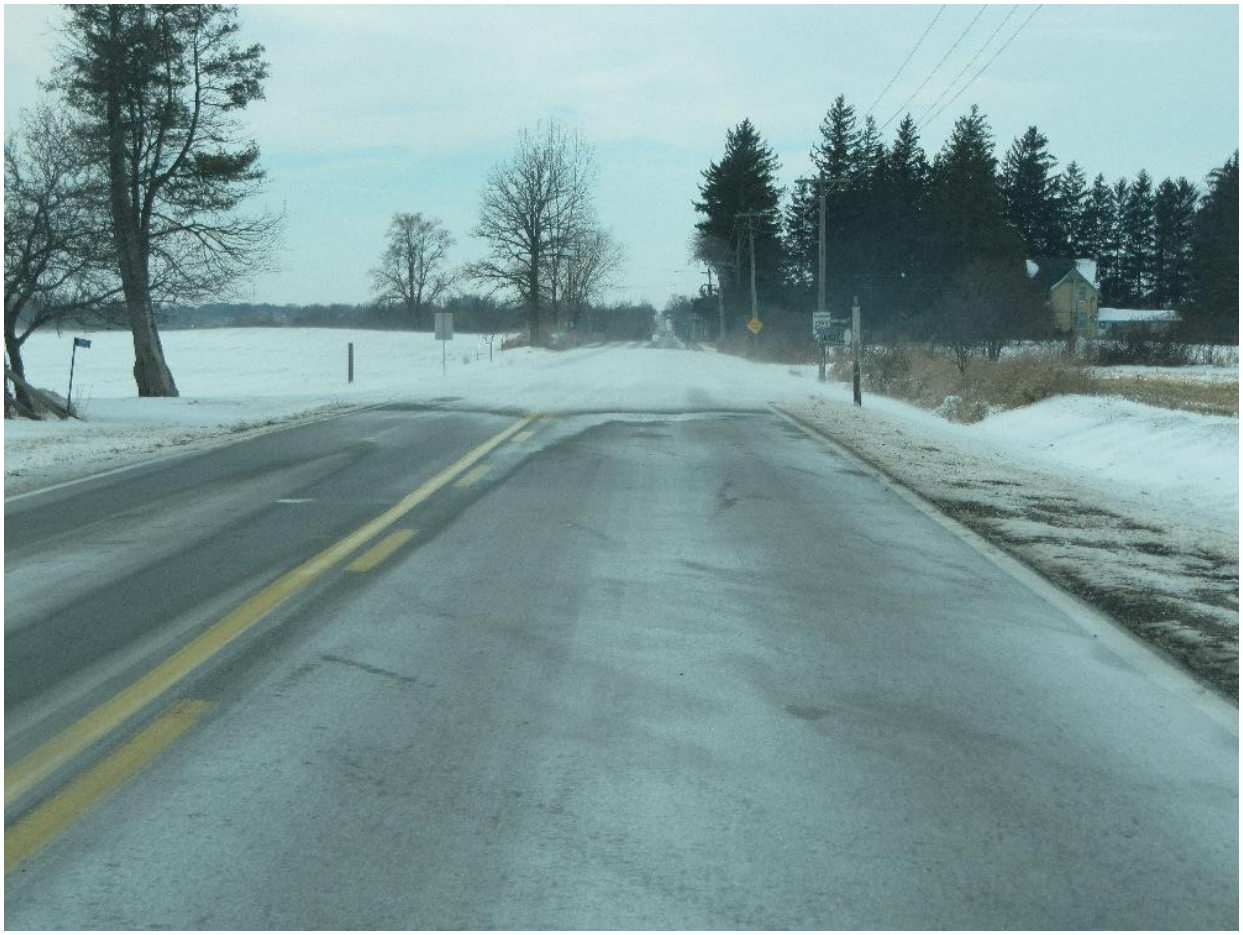

Figure 8: View on approach to an obvious snow drift that covers the full width of the rural road.

This might be a snow drift but it might only be an inch deep. You cannot be sure, even at the distance shown in Figure 8. In our opinion most drivers would not apply hard braking at this point while the previous road conditions would suggest there should not be much snow on the road. So you might apply light braking but reach the edge of the snow drift at close to the speed limit.

As you enter the leading edge of the snow drift you observe the view shown in Figure 9. Even at this location the leading edge of the snow drift does not appear to contain very deep snow. But in the background the depth of snow appears to be deeper. But it is too late to apply hard braking at this location. Entering an area of snow with hard braking could cause your vehicle to go out of control and you have been taught the best method is to just ride into the area by coasting, without applying any braking. And as you proceed through the snow drift Figure 10 shows that the depth of the snow is

substantial, at least several inches or more, as you proceed into the centre of the drift. A depth that was difficult to detect only 50 metres away from its leading edge.

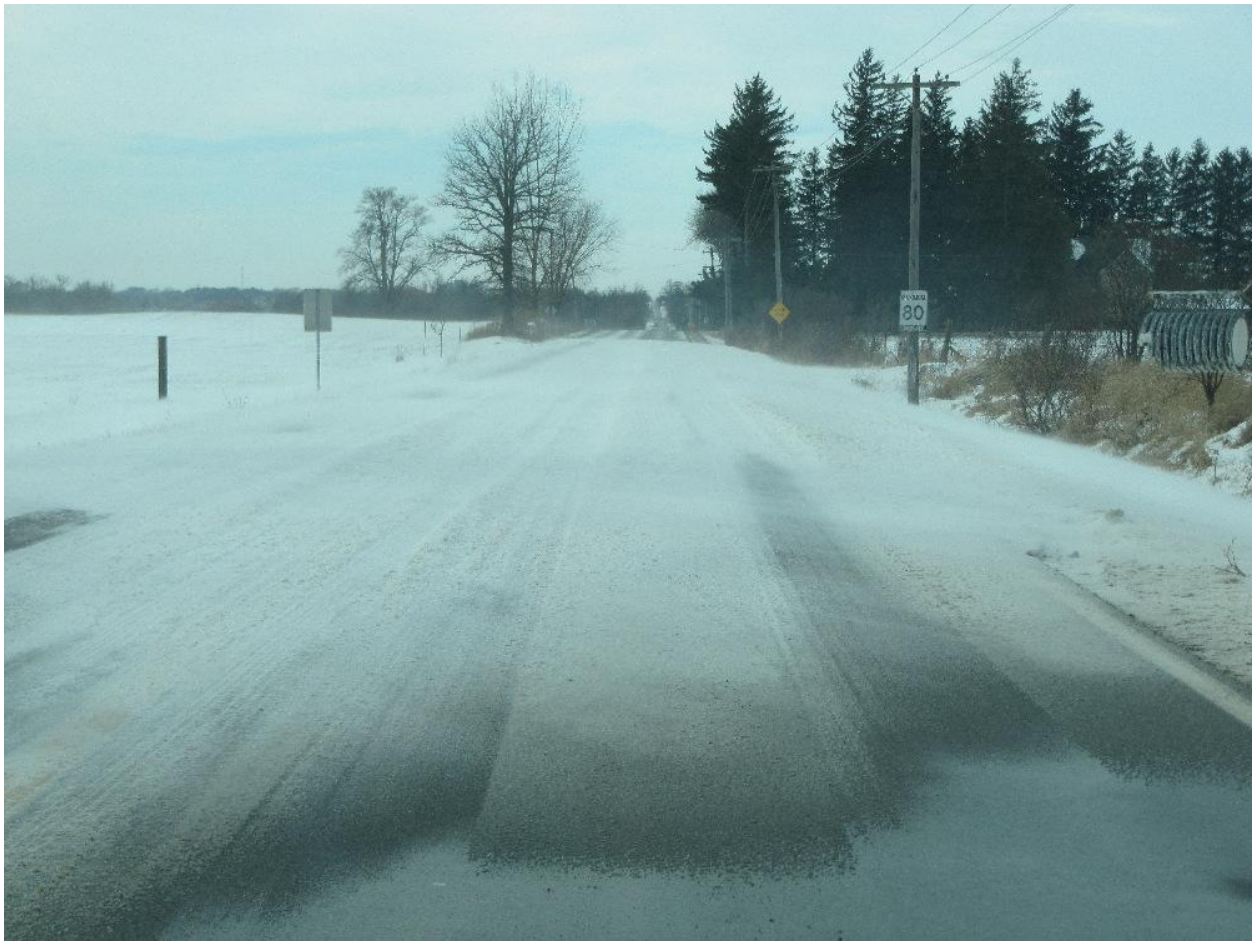

Figure 9: Driver's view as a vehicle approaches the leading edge of an obvious snow drift.

The viewing conditions at this site have been fairly good. Because the road was flat for several hundred metres before reaching the snow drift the driver would have some time to contemplate what was visible ahead. However, if the upslope of the road had been closer to the edge of the snow drift the visibility distance would be shorter.

The Stopping Sight Distance standard in Ontario requires that roads designed for a maximum speed limit of 80 km/h should allow the driver a visibility distance of 135 metres ahead. That standard is based on a driver's eye height of 105 centimetres which is lower than all but the lowest vehicles. However the standard is also based on seeing an object that is 38 centimetres tall, or about 15 inches tall. A snow drift is not likely to be that deep and even so, there would be little changes in contrast between the drift and anything else around it so that, at a longer distance, a driver could easily mistake the snow drift for a slightly different shading of the pavement.

At night-time the headlights of a vehicle might only allow the driver to detect an object such as a pedestrian at a distance of 50 metres at low beam or slightly longer than 100

metres at high beam. In most cases the leading edge of a snow drift would be more difficult to detect than a pedestrian so the difficulty in reacting to the sudden appearance of the snow drift at night would be increased.

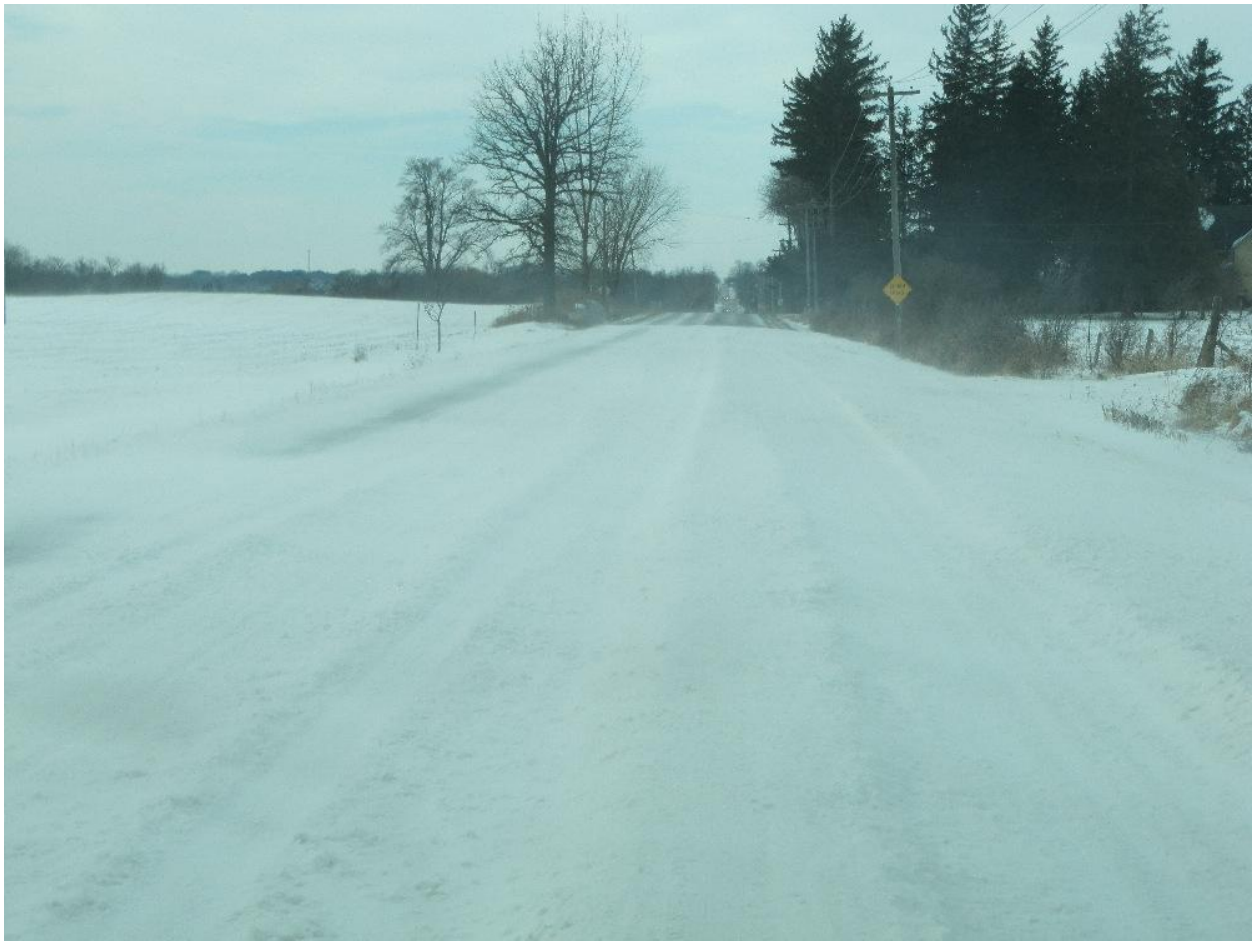

Figure 10: View showing that the depth of the snow within the snow drift is substantial and could cause a loss-of-control of a vehicle travelling at highway speed.

The Ontario Minimum Maintenance Standards (MMS) have been legislated recently and one of their allowances is for roadway maintenance personnel to stop inspecting all roads in their jurisdiction. Instead they are allowed to inspect a select number of "representative" roads when making a decision whether to employ resources for activities such as winter maintenance. We have stated on a number of occasions that it is dangerous to follow such procedures since there is no such thing as a "representative" road that can be used to detect such conditions as drifting snow. While there is some truth to the argument that maintenance personnel who are very familiar with the roadway network in which they operate can predict where such events like snow drifts might occur, this art truly requires a considerable amount of experience that is not guaranteed to exist. Snow drifts can occur in isolated areas such as demonstrated in this article. The complexity of the factors that influence the initiation of

a drift and its progressively increased depth of snow makes us skeptical that any reliable model exists that can take the place of an inspector physically travelling over each road segment.

Ontario's MMS fail to recognize that the danger of winter driving is not the actual quantity of new snow that falls to the road surface. As a result of this failure it allows maintenance personnel not to engage in any maintenance activities until a certain depth of snow has accumulated on its roads. However, there are obvious instances, such as demonstrated in the example shown in this article, where minimal or no snow has fallen and the roads are essentially bare or dry for the most part, yet dangerous and deep snow drifts can exist in isolated areas. Without actual physical attendance by a road inspector maintenance personnel would fail to deploy resources to remove such a danger because they would not be obligated to do so.

The relatively small number of victims who die or are permanently injured as a result of these decisions becomes unimportant when there are millions of dollars in tax savings to the vast majority of the public by weakening maintenance standards. In our opinion it becomes convenient to turn a blind eye to the destruction that is caused to such an insignificant group of victims when politicians can claim to the public that their taxes are being reduced.

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