Further Interpretations of Loss-of-Control Tire Marks on a Gravel Shoulder

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At Gorski Consulting we have prepared a number of previous articles discussing loss-of-control tire marks and their interpretation. In 2013 we prepared two articles as noted below:

" Lessons Learned From Tire Marks On Freshly Re-Graded Gravel Shoulders"; posted to Gorski Consulting website January 4, 2013.

"Evaluation of Loss of Control Tire Marks on a Gravel Shoulder", posted to Gorski Consulting website on August 3, 2013.

Both of these articles were developed from examples of tire marks found or created on the S-Curve of Clarke Road north of Fanshawe Park Road in north-east London, Ontario.

In the January, 2013 article we examined some tire marks on a freshly re-graded shoulder and we also conducted a braking test on that shoulder to illustrate the characteristics of the tire marks that were produced. In the August 2013 article we took a close look at a set of loss-of-control tire marks on the east shoulder of Clarke road.

We decided to create this additional article because the tire marks we will discuss occurred essentially at the same location as the tire marks discussed in our August, 2013 article. Additionally these tire marks were very similar in terms of the vehicle motion. So it is useful to provide this additional example as a way of emphasizing our points and also to compare one set of evidence to the other.

We can recall from our August, 2013 article that a northbound vehicle travelled onto the east shoulder of Clarke Road and produced the tire marks shown in Figure 1. The vehicle travelled back onto the paved road surface momentarily and then returned to the east shoulder, as shown in Figure 2. The driver then regained control of the vehicle and sped off without further incident. We attached a number of detailed photographs of the tire marks and discussed their characteristics.

In the new example, Figures 3 and 4 show the same location of the north curve of Clarke road, and again we are looking southbound along the east shoulder. In this new example a northbound vehicle travels further onto the east shoulder so that all four wheels are on the gravel. After veering back toward the paved surface the vehicle then returns to the gravel shoulder where the driver regains control and leaves without incident.

Figure 1: Southbound view of tire marks on east shoulder of Clarke Road that were discussed in Figure 7 of our August, 2013 article.

Figure 2: View, looking south, of tire marks from Figure 1 visible in the background and showing how the vehicle returned to the east gravel shoulder in the foreground. This was Figure 8 in our August, 2013 article.

Figure 3: View, looking south, along the east shoulder of Clarke Road, at a set of loss-of-control tire marks caused by a northbound vehicle.

Figure 4: View, looking south, of the tire marks produced by a northbound vehicle as it returns into the east gravel shoulder and partially on the grass roadside.

A difference between the two examples is that, the August, 2013 tire marks are more easily discerned from the surrounding , undisturbed gravel particularly at their beginning when they first exit the paved surface. Although this is partly due to the disturbance from other traffic, it is also due to the relationship between the camera and the sun, as we will demonstrate later in this article.

The August, 2013 tire marks are also more visible because of the quicker rotation of the vehicle which has resulted in a smaller radius of the yaw marks that contain a consistent and typical curvature. The vehicle's lateral motion is greater as it moves back onto the pavement whereas in the new example the vehicle travelled further into the shoulder and essentially stayed on that shoulder except for the momentary change in direction toward the paved surface. This is an important point because it tells us why some tire marks may be more visible than others. Sometimes vehicles do not leave the very common, curved yaw marks that we always expect to see. Not only is it more difficult to see some marks because of other markings on the shoulder, but the observer's relationship to the sun is a factor and so is the motion carried out by the vehicle.

Before looking at the specifics of this new example the following photos will provide some more general views. Figure 5 is another southward view from a point north of where the driver regained control of the vehicle and reentered the road surface to speed off into oblivion. We will now move backwards along the vehicle's path.

Figure 5: View, looking south, from north of the point where the northbound vehicle reenters the pavement and continues on its way.

Figure 6 brings us back southward, closer to the tire marks so that they are more visible in the gravel shoulder and on the east, grass, roadside.

Figure 6: View, looking south, at the tire marks as they exit the grass road side and travel toward the point where they return to the pavement.

Figure 7 shows a view further south where we see the tire marks passing through the grass roadside. Figure 8 shows a view of those tire marks where they enter the grass roadside (Remember we are progressing backwards along the path of the northbound vehicle). Figure 9 takes us closer to the beginning of the point where the vehicle first left the road surface. If you look closely to the left side of the photo you should be able to detect the two tire marks, side-by-side, produced by the left side tires of the vehicle. The fact that these two tires are not tracking the same path indicates that there is a slight yawing of the vehicle and that it is at the limit of centripetal force that keeps the vehicle within the curve.

So what caused this vehicle to travel to the outside of the curve? Clearly it was not far from going completely out of control and the difference between this non-event and a possible fatality could be a minimal twist of fate. The initial and obvious conclusion is that the driver was travelling too quickly for the curve or was simply not paying enough attention. We need to examine all the evidence to make a proper assessment.

Figure 7: View, looking south at the tire marks as they pass through the east, grass, roadside.

Figure 8: View, looking south showing the point where vehicle enters the east grass roadside.

Figure 9: View, looking south, along the tire marks as the vehicle comes off the pavement and is at the limit of the available centripetal force.

Figure 10 gives us the first evidence of concern. The investigator's fingers are pointing to an area of the shoulder next to the tire marks and closer views of this area are shown in Figures 11 and 12. In Figure 12 the evidence is obviously a deer hoof mark.

So now the plot thickens. Did this driver lose control of his/her vehicle because there was a deer on or near the road? What other evidence is there?

Figure 13 shows some other suspicious evidence. If you look closely just to the left of the left side tire marks of the vehicle, there is another fresh imprint of a wiggly, narrow tire. Is this a mark that is produced by a bicycle? Certainly it has those characteristics. So did the driver lose control because he/she encountered a bicycle on this curve? So the plots thickens even further. To evaluate these concerns we need to look at the rest of the physical evidence.

When we look further along the tire marks we come across an interesting, overlapping imprint on top of the left tires as shown in Figure 14. Close-up views of the area are shown in Figures 15 and 16. A close inspection of the centre of Figure 16 shows a deer hoof imprint on top of the tire marks produced by the left side tires of the vehicle.

Figure 10: View of investigator's fingers pointing to some evidence on the east shoulder next to the loss-of-control tire marks.

Figure 11: Closer view of the area shown in Figure 10.

Figure 12: Close-up view of deer hoof print in the area shown in Figures 10 and 11.

Figure 13: View of a narrow, wiggly tire print just to the left (east) of the tire mark produced by our subject vehicle.

Figure 14: Southward view with finger pointing to the area of an interesting overlap of an imprint on top of the left side tire marks.

Figure 15: Closer view of portion of left side tire marks containing an interesting imprint.

Figure 16: A close-up inspection of the centre of this photo shows deer hoof imprint on top of the tire marks produced by the left side tires of the vehicle.

The finding of the deer hoof imprint on top of the tire mark indicates that the deer travelled over this mark after it was created. Although this does not eliminate the possibility that the deer may still somehow have been involved in these events, it demonstrates that the finding of evidence on top of other evidence can help one to understand how the events unfolded.

Similarly, we can study of bicycle tire mark. Figure 17 shows an area where the motor vehicle has come off the east roadside and is headed back onto the pavement and we are looking at the mark produced by the left side tires. If you look closely you can also see the narrow tire mark produced by the bicycle and the two marks converge. And Figure 18 provides a closer view of that convergence. One should be able to detect that the bicycle tire mark is overlapping the mark from the motor vehicle, just like the deer hoof imprint discussed earlier. Figure 19 provides an even closer view of that convergence.

Again, this is not definitive that the bicycle was not somehow involved in caused the motor vehicle driver to lose control, but it is helpful in answering some questions.

Figure 17: Southward view showing area where the bicycle tire mark converges with the motor vehicle tire mark.

Figure 18: Closer view of the convergence between the bicycle and motor vehicle tire marks.

Figure 19: Close-up view of convergence between bicycle and motor vehicle tire marks.

There is additional value in exploring the characteristics of the motor vehicle tire marks as the vehicle gets tangled up in the east grassy roadside just before the driver finally gains control of the vehicle. If we recall the review from August, 2013, a similar action occurred very close to the same portion of the shoulder. Figure 20 is a copy of Figure 11 from that August, 2013 article and see a northward view of the tire marks as they travel partially on the east grassy roadside, and Figure 21 shows the same tire marks, except from a southward view. We can recall from the August, 2013 article that our northbound vehicle was out-of-control as it slid into the grassy roadside and the driver regained control in the vicinity where the vehicle was on that grassy roadside. Well, a similar case can be said for the motion of the vehicle in the present scenario.

As shown in Figure 22, in the present case, our vehicle does not enter the grassy roadside as abruptly as evidenced by the more shallow angle of entrance of the left side tires into the grass. We follow those tire marks in Figures 23 and 24 and then as those tire marks exit the grassy roadside in Figure 25.

Figures 6, 7 and 21 have already provided some general, southward views of the tire marks in the vicinity where they exit the grassy roadside, so now we will look at some details of those marks.

Figure 20: A copy of Figure 11 from the August, 2013 article showing a northerly view of the tire marks entering partly onto the east grassy roadside.

Figure 21: A copy of Figure 16 from the August, 2013 article showing a southerly view of the tire marks as they exit from the east grassy roadside.

Figure 22: Northward view of the tire marks from the present scenario where the tire marks enter the grassy roadside.

Figure 23: Northward view as we follow the tire marks in the east grassy roadside.

Figure 24: Northward view of tire marks on east grassy roadside.

Figure 25: Northward view of tire marks as they exit the grassy roadside.

Figure 26 provides a closer view of the tire marks produced by the left side tires of the vehicle. You should be able to detect the pattern of the tread of the tire mark in the foreground as that tire mark is just exiting the grass.

Figure 26: Southward view of left side tire mark exiting the grass.

That tread pattern is more clearly visible in the closer view of Figure 27. However there is a point further to the south where that tire mark does not exhibit that visible tread mark but that characteristic is difficult to show because it is masked by the grass. The status of the vehicle's motion is more clear by looking at the right side tires that are still on the gravel shoulder, as shown in Figure 28.

One can easily distinguish between the tracking tire in the foreground and the upheaval visible in the background that is indicative of the tire sliding with respect to gravel surface. Recall that the "sliding" can take place either from positive acceleration (throttle application) or from negative acceleration (applying the brake pedal), so we need to discern what is the actual case. Certainly, Figure 28 shows a fairly deep furrow where the tire has dug deeply into the gravel however that depth can also be a function of the softness/looseness of the surface and not necessarily indicative of maximum acceleration. Also the tire with the least load may be the first to "spin".

Figure 27: Closer view showing the visible tread pattern in the left side tire mark as it passes through the grass.

Figure 28: View of right side tire mark with a visible tread pattern in the foreground and an upheaval of the gravel in the background.

However, we know that the vehicle was in a state of loss-of-control in the latter stage as it entered the grass and we know that the driver gained control as the vehicle exited the gravel shoulder. Somewhere in between these two states there should have been a point of transition between loss-of-control and gaining control and that area had to be somewhere in the vicinity where the vehicle travelled over the grass.

As we look slightly south of the view shown in Figure 28, we see a curious characteristics in the right side tire mark as shown in Figure 29. There appears to be a patch of tire mark that has its tread mark visible.

Figure 29: View, looking south at a portion of the right side tire mark containing a visible tread.

Figure 30 shows a closer view of that area. Is this the point where the driver regained control of his/her vehicle? It is an interesting argument that we will allow the reader to consider.

Before concluding our discussion we want to demonstrate how lighting can affect an investigator's ability to see various features of tire marks. The present case is a good example because the photos in the article were taken in the late morning of October 8, 2013 and then we returned to this site and took additional photos after 1630 hours.

Figure 30: Closer view of area of visible tread in the right tire mark.

Figure 31: Southward view taken in the late afternoon, demonstrating the difference in the visibility of the characteristics of the tire marks.

Figure 31 is showing a similar view to that of Figure 6 but note how the characteristics of the tire marks are more vivid. Because the sun is low on the horizon it accentuates the character of vertical height differences so that ridges in the tire mark edges are more pronounced. Note in Figure 32 how the existence of shadows helps to define areas of vertical changes such as the ridges of the tread pattern and the depth of the hollow where the tire dug into the gravel.

Figure 32: View of right tire mark taken in the late afternoon when the shadows help to define the vertical changes in the tire mark.

Figure 33 also shows a southward view of the east shoulder and we can see how much more visible the bicycle tire mark is because the depth of the impression causes the shadows to become contrasted against the monotone shade of the gravel,

Our general advise is that, when taking photos in bright sunshine during the mid-day many markings can be difficult to see and photograph. An investigator should return to an accident site either near dawn or near sunset when the sun is low on the horizon because that is when roadway markings will be more visible. Also, it is recommended that photos be taken on a cloudy day as opposed to a sunny day. So if a collision occurs on a sunny day the investigator should return to the site on the first opportunity when the area becomes cloudy. It can be surprising how much more evidence becomes visible when it is observed in more favourable conditions.

Figure 33: Southward view of bicycle tire mark demonstrating its increased visibility when the sun is low on the horizon.

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