

Characteristics of Tire Marks Influenced by Soft Shoulders - Part 4

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Gorski Consulting has embarked on a research study to document the characteristics of tire marks that exist outside of a paved road surface. This study has involved documentation of hundreds of incidents, both collision-involved, but also incidents of simple travel onto a gravel shoulder.

Three previous articles have been posted to the Gorski Consulting website. These provided some preliminary observations of tire marks caused by light duty vehicles during actions such as coming to a stop on a shoulder, re-entering the paved road, making a U-turn and reversing. The present article will focus on the characteristics of the shoulder surface and how that affects the character of visible tire marks.

The opening of the present article would appear to focus on a strange topic - the issue of tire marks caused by road graders. Yet, this is not that strange. Readers will come to understand that the site where much of the tire mark evidence is discussed in these articles is infrequently visited by road graders that act as erasers, much like a brush on a chalkboard. These graders stir up the gravel and soil of the shoulder resulting in differences in the characteristics of the tire marks created on them. As the discussion of tire marks enters into more details it is necessary for readers to identify the evidence that is produced when a road grader passes through and erases all the tire mark evidence. Recognizing that a shoulder was re-graded in the recent past may help to solve certain questions about how a motor vehicle collision occurred or how a crime was created. It is just another piece of the overall physical evidence that the investigator needs to be acquainted with when becoming a fully-qualified expert.

As usual, the discussion of these influences takes us to the site of the S-curve on Clarke Road north of Fanshawe Park Road in north-eastern part of the City of London, Ontario, Canada.

In Figure 1 we see a typical road grader travelling north along the east shoulder at the north end of the S-curve of Clarke Road. The driver is performing a typical maintenance action of stirring up the surface and then transplanting it toward the pavement edge. This is done because, over time, vehicles passing through the curve wander off the pavement edge and push the gravel/soil away thus producing a dangerous "edge drop-off". Edge drop-offs are dangerous because of the vertical wall that is created when the shoulder surface becomes lower than the pavement edge. At speed drivers exiting the pavement edge encounter difficulties when they try to re-enter the pavement in a zone where there is a significant edge drop-off.



Figure 1: View of a northbound road grader at the site of Clarke Road north of Fanshawe Park Road. Re-grading commences with this initial action of stirring up the shoulder surface and transplanting it toward the pavement edge.

Most jurisdictions in North America have accepted that a drop-off of 2 inches is the threshold at which maintenance, such as re-grading, should take place. However that is not an internationally, or even nationally, accepted value. States in the U.S. and provinces in Canada have selected their own threshold values, some of which differ greatly from the norm.

The Province of Ontario for example has chosen the most lenient threshold in North America. Here the Minimum Maintenance Standards (MMS) indicate that the threshold should be 3 inches (over 8 centimetres). But more importantly, Ontario requires that this threshold be broken for a full length of 20 metres before any maintenance is required, as noted in the MMS wording below:

Shoulder drop-offs

7. (1) If a shoulder drop-off is deeper, for a continuous distance of 20 metres or more, than the depth set out in the Table to this section, the minimum standard is to repair the shoulder drop-off within the time set out in the Table after becoming aware of the fact. O. Reg. 239/02, s. 7

The acceptance of this threshold is truly remarkable. Research conducted by Gorski Consulting indicates that the threshold would never be reached because such a continuous length of edge drop-off is never created in the real world. However, that issue needs to be the subject of another paper.

For the present we return to the action shown in Figure 1 where the grader's initial action is to scrape the shoulder surface and transplant it toward the pavement edge. Figure 2 shows the result after the grader has completed its initial pass through the site.



Figure 2: View, looking south, at the scraped surface of the east shoulder that has been transplanted over the pavement edge.

The road grader then returns for a second northward pass as shown in Figures 3. and 4. During this second pass the stirred up and transplanted material from the shoulder is pushed back onto the shoulder and away from the pavement edge. Note in Figure 4 that the rear tires of the grader follow behind the plow such that the tire marks created by the rear tires are not erased and are left visible after the re-grading is completed.

The final result of the re-grading is shown in Figure 5. On top of the monotone layer of loose gravel and soil is a single, well-defined tire mark caused by the two, right-rear tires of the grader.



Figure 3: View of the grader during its second pass on the east shoulder of Clarke Road.



Figure 4: During the second pass the grader pushes the stirred up material back onto the shoulder surface and away from the pavement.



Figure 5: The final result of the re-grading of the shoulder is a single, well-defined tire mark caused by the two right-rear tires of the grader.

In Figure 6 an investigator demonstrates some of the characteristics of the graded surface and of the tire mark. The tire mark is about 13 inches in width. The softness of the graded material can be observed by the compression that occurs when the investigator's shoe is applied with normal weight.



Figure 6: View of the tire mark produced by the road grader. The compression of the graded material by the investigator's shoe demonstrates the softness of the surface.

Figure 7 shows a closer view of the compression caused by the investigator's shoe. Figures 8, 9 and 10 show the resultant imprint of the shoe and the tire mark of the road grader.

All of the figures provide an example of what the evidence looks like within the hour of a road grader passing through the shoulder. As time passes that evidence changes as the fine details and edges of the markings begin to deteriorate. Other traffic eventually passes over the area thus destroying the evidence. Environmental factors such as rain will also be destructive. Becoming familiar with the characteristics of the road grader evidence enables the analyst to recognize this evidence even after many days have passed and the evidence is not as easily detected.



Figure 7: View of the investigator's shoe compressing the loose, graded material.



Figure 8: View of the shoe imprint and the tire mark of the road grader.



Figure 9: Close-up view of the shoe imprint.



Figure 10: View of the depth of the impression caused by the tire mark of the road grader.

The above photos of the re-grading of the shoulder were taken shortly after 1000 hours on the morning of June 18, 2013. When the site was examined about 2 hours later the right side wheels of a tractor tire had entered the shoulder and produced the tire mark visible in Figure 11. Here we can see that some of the gravel and soil were thrown onto the road grader tire mark which became less visible.



Figure 11: View, looking north, along the east shoulder of Clarke Road. A tractor tire mark (left) was produced on the shoulder after the road grader tire mark (right).

About a week later, on June 24, 2012, the same location was re-examined and the road grader tire mark was no longer visible, as shown in Figure 12. Yet this will not always be the case.



Figure 12: View, looking north along the east shoulder of Clarke Road, on June 24, 2012, showing that the road grader tire mark is no longer visible.

As an example, Figure 13 shows a view taken on February 8, 2012, two days after a road grader passed through the east shoulder of Clarke Road. Here the grader right rear tire marks from both passes of the grader can be clearly seen.

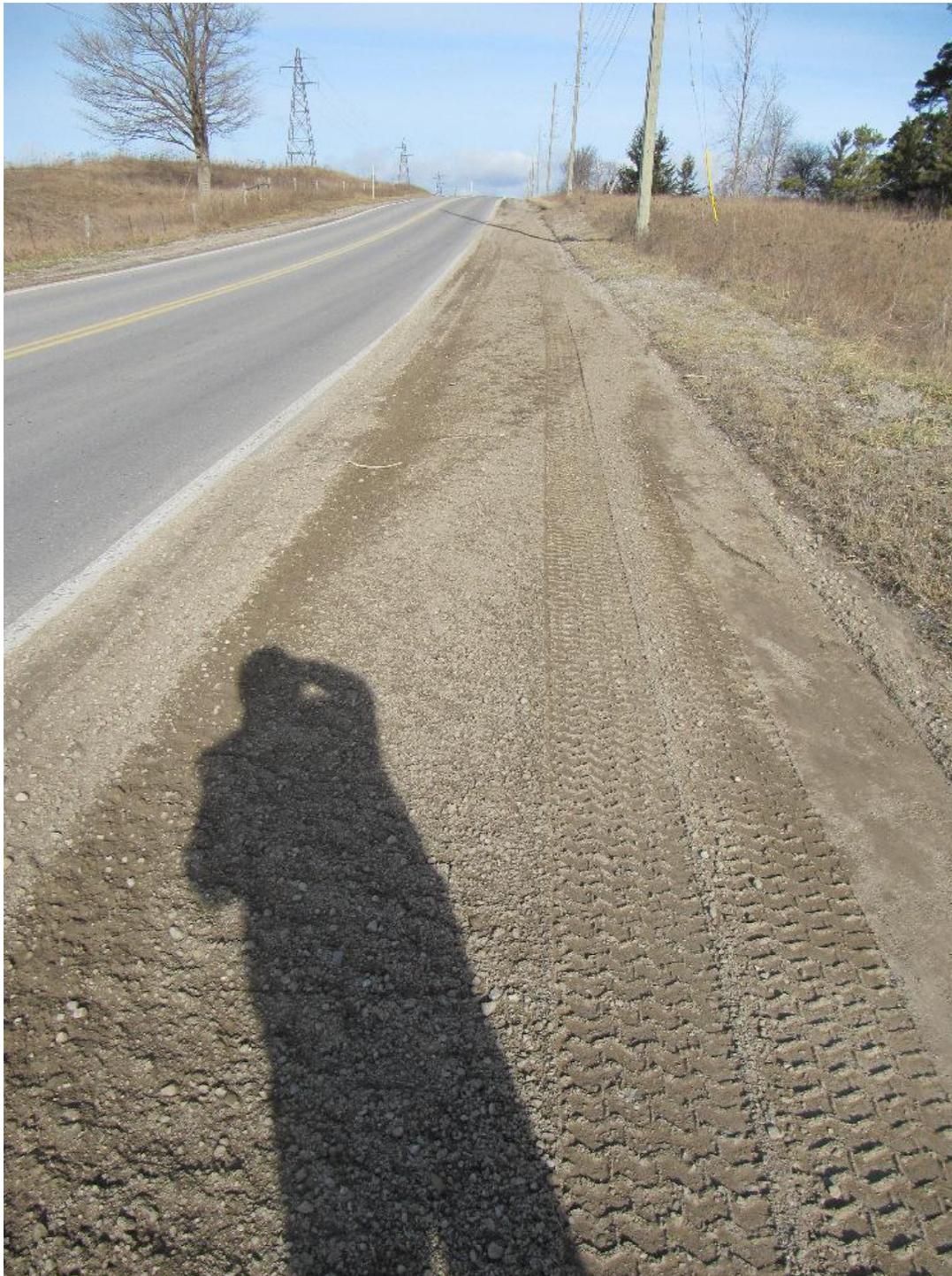


Figure 13: The tire marks from a road grader are clearly evidenced in this view taken on February 8, 2012, two days after the re-grading occurred.

Then, on February 23, 2012, Figure 14 shows the same location of the east shoulder, however viewed in a southward (opposite) direction. Here we can still see the two tire marks from the two passes made by the road grader over two weeks earlier.



Figure 14: View, looking south along the east shoulder of Clarke Road on February 23, 2012. The two tire marks created by the road grader more than two weeks earlier are still clearly visible.

To become familiar with this type of evidence we can look at another example taken from late afternoon on November 19, 2013, shown in Figure 15 below. This view looking southward shows the east shoulder of Clarke Road which had been re-graded earlier that morning. It should be possible to detect the tire mark on the left which was caused by the road grader. The tire marks near the pavement edge were caused by regular traffic some time after the shoulder was re-graded.



Figure 15: View, looking south, along the east shoulder of Clarke Road a few hours after the shoulder was freshly re-graded.

In some instances the tire mark from the road grader may not be very visible. Figure 16 shows such a situation. This photo was taken on November 28, 2013. This view is looking north along the east shoulder of Clarke Road. Here the grader has not stirred up enough of the shoulder surface such that the right rear wheels travelled on the hard surface and did not produce a tire mark that is readily visible. That is why it is important to know what loose gravel looks like independent of the tire mark. The presentation of these examples should make it easier for investigators to identify what a freshly graded shoulder looks like and this is the purpose of this exercise.



Figure 16: This northward view of Clarke Road, shows that a road grader had re-graded the east shoulder. The right rear tire mark that is normally produced in this action is not readily visible because those tires travelled on a hardened part of the shoulder.

As an investigator at the scene of a major motor vehicle collision or crime scene, having a working knowledge of tire marks on un-paved shoulders is just another tool in the tool box. This information may not be useful in many situations, but like any tool, it is invaluable when needed for a specific purpose.

In future articles the presence of this re-grading evidence will be discussed as it forms the background upon which various tire marks are observed.

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