



## Those Cracks on the Edge of the Road ...What Causes Them?

I'm sure you have seen them. Long, arching cracks near the edge of the pavement. First there is one, then later another one. And before too long the edge of the road begins to ravel and deteriorate.

Have you ever wondered why they form? Why do they curve outward, toward the edge of the pavement? Why do you see them more often on rural roads than on city streets? I have often thought about those questions. I'm not sure I have it right, but I will share my conjecture with you.

I believe a combination of factors leads to edge cracking, not just a single factor. Let's look at a couple of examples to see if we can figure out what might be happening.

The first photo illustrates the sort of cracks I'm referring to, and it gives us our first clues. The cracking here is fairly extensive, covering the entire outer wheelpath. The curved nature of the cracks is not so easy to see here because transverse cracks have formed between the parallel arcs.



**Clue #1** – Note the very dirty material on the shoulder. It will not let the water get out of the base beneath the pavement edge after it enters through the cracks. This softens the subgrade and base under the edge of the pavement.

**Clue #2** – Note the shallow rut in the inner wheelpath. This suggests that the surface and base are weak (i.e., too thin).

**Clue #3** – Note also that the road is not very wide. The vehicle that is traveling away from us in the photo would need to shift closer to the edge of pavement to pass a vehicle coming in the opposite direction. This can pose a safety hazard.

Several more clues are evident in the second photo. Water is ponded on the shoulder near the pavement edge. The edge of the pavement has broken off and raveled away.



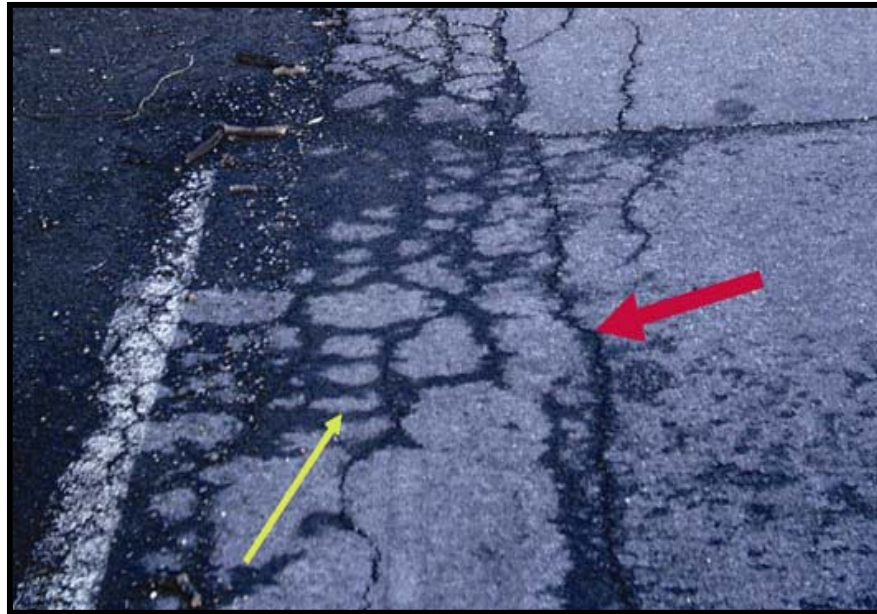
A white edge line is visible in the foreground. The pavement in the distance has been in place for more than 30 years, while the closer pavement has been there for less than 4 years. Nevertheless, the cracks are just as extensive in the newer pavement and minor edge raveling is evident.

The yellow centerline that is visible in the upper right corner of the photo shows that the lane width is relatively narrow.

**Clue #4** – The main crack seems to be a short distance in from the edge of pavement (red arrow).

**Clue #5** – The asphalt surface is fairly thin, probably only 1-1/2 inches thick. Transverse cracks (yellow arrow) form small blocks that are easily dislodged by traffic. The easiest blocks to get loose are those at the very outside edge of the pavement, hence the edge raveling.

Looking at all of these clues, here is what I think is going on.

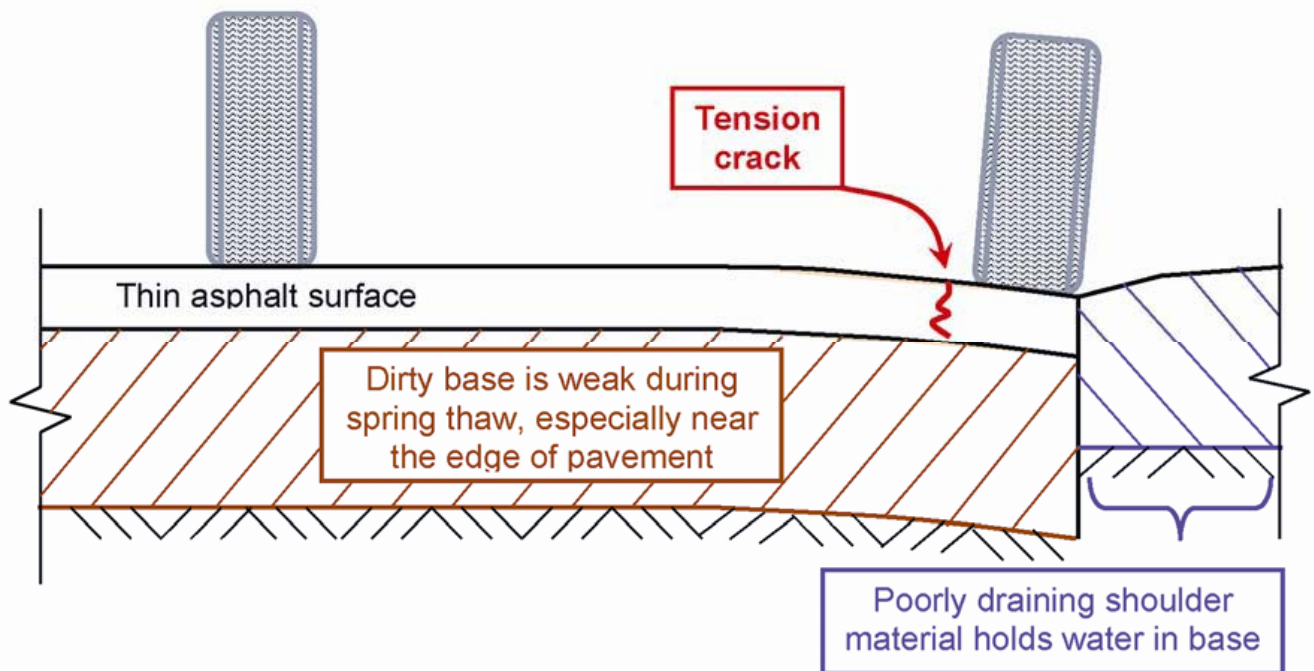


- ❖ The surface and base are both relatively thin, and hence not very strong.
- ❖ The shoulder material and probably also the base are dirty, which makes them "frost susceptible." Such materials tend to grow ice lenses and heave during the winter, and they become very weak and unstable during spring thaw.
- ❖ The base under the asphalt thaws before the subgrade. The excess water cannot drain out in the early spring until the shoulder is completely thawed.
- ❖ Drainage away from the edge of the road is poor. Water is held near the pavement edge and it weakens the dirty base and shoulder materials.
- ❖ In some cases "box construction" may be involved. This means a trench was cut and the road was placed in it. Eventually water gets under the road, but the base is in a "box" so the water cannot drain out.
- ❖ Narrow lanes force the traffic to get very close to the edge of the pavement. Traffic only does this when there is a passing vehicle; otherwise vehicles align themselves closer to the middle of the road. Trucks, being wider, tend to travel near the edge of the lane more often, putting the heaviest loads on the edge of the pavement. **This is a major factor causing the problem.**
- ❖ The wheel loads near the edge of the road bend the pavement down, especially when the base and shoulder materials are weak, as during spring thaw. This causes a tension crack to form, and it widens and propagates with repeated loading.
- ❖ As the crack gets longer it eventually turns toward the outer edge of the pavement, making the characteristic "C" shape. It doesn't turn inward because the pavement is more resistant to cracking in that direction. It doesn't run parallel to the pavement edge because at some point the support gets stronger, and so the crack turns outward.
- ❖ The edge cracks allow surface water to filter into the base and weaken it more. More cracks lead to more water and a softer base and subgrade.



The drawing below illustrates these points. The edge deflection under the wheel is greatly exaggerated.

What can you do to stop the progression of edge cracking? Three things should be done. The goal is to re-establish the pavement edge for the safety of the traveling public.



1. Promote good drainage along the edge of the road. Make sure that surface water will run to the nearby ditch, and not pond along the pavement edge.
2. Remove the dirty, poor draining shoulder material and replace it with a more permeable material. "Daylight" the material to the ditch so water in the base can get out.
3. If you have a lot of truck traffic, place a substantial structural overlay on the road surface. You need three or four inches of hotmix to provide adequate support for today's heavier vehicle loads.

It would also help to widen the road if you have enough right-of-way to permit doing that. Eleven or twelve foot lanes are commonly used these days for traffic safety. We think of wider lanes being done for this reason only. However, there is also some added benefit in helping the longevity of the pavement by getting the heavy loads away from the edge of the road.

Remember, the cracked surface along the roadway edge is not much better than a granular base as far as its load support is concerned. So to keep from having those edge cracks come right back (as seen in the foreground in the second photo) you need to put a substantial thickness of new surface over the cracked and raveling material.

If the damage is as extensive as in the first photo, the best solution may be to remove and replace the surface *and* the base. Remove the cracked section, then provide a new gravel base that is clean and will drain well, improve the shoulder drainage, and put back the pavement thickness that will support the traffic. We realize that in most cases such extensive reconstruction simply will not be done. But the three remedial measures listed above will re-establish the pavement edge, which will make the road safer and smoother to drive on for a period of time.