

## **Slump: Past and Future**

**Pre 2017:** I had heard a few years back that when Wilbur built this road it was soft in the area of the slump. His dozer operator had to get a lighter machine. Other than that, there is not much more I know. When we got the grant, around 2000, two new culverts were installed in this area. A culvert was placed immediately in front of the slump and another after it. The uphill culvert extends about 20' down the hill and where it empties has eroded a 10' deep canal, as it drains down the hill. This depth gradually lessens to zero. I do not remember how straight the trees used to be or when they started to tilt and die.

**2017-2018:** This was an exceptionally wet winter. We typically think there will be some issues with the road, the question is where and how bad? Aside from the typical pot holes, small slides and fallen trees, it was a manageable winter until the sudden cracking appeared at the location soon to be named 'The Slump.' We were caught off guard, the road cracked further, turned into jelly and proceeded to drop. The hill above the road slipped taking down the trees with it. We moved the traffic into a single lane toward the hill. The road never completely dried and remained soft throughout summer. In hope of remedying the problem, we removed all fallen trees from the slide area and cut the road back approximately 15' into the hill. We jute netted the hillside in hopes of stabilizing the sliding earth. Approximately 50 loads of rock of varying size were compacted into the road base. The drainage ditch was compacted and made smooth helping the runoff to flow more easily to the down road culvert.

**2018-2019:** This winter we experienced a couple of intense storms but the overall precipitation was below normal. The intense storms were enough to cause the hillside to slide even more despite the jute netting. The road held up well.

**2019-2020:** This was a dry winter. There were not any problems with the road. We had two engineers come out and they both recommended we try to get the surface water off the hillside. To accomplish this, three hillside drains were installed with their drainage pipes extending down the road beyond the slump. They also recommended us to try and get water out of the ground via side hill wells.

**2020-2021:** This was a dry winter. There were no problems with the road.

**2021-2022:** This was another dry winter. There were no problems with the road.

**2022-2023:** We had three drought years in a row and did not expect this winter to be the second wettest on record. We almost made it through the year until February when the road began to crack. The cracks were filled and compacted but it still continued to crack and soon began to sink. Again, we moved the traffic to a single lane toward the hill. The outer edges of the road sank similar to the past. However, there was a few positives, the hill above the slump did not slide as it did in the past and the road base remained solid even though it had sunk several inches.

**2023-2024:** Every weather prediction is saying El Niño. El Niño is typically wet. If the eastern Pacific Ocean water temperature is an indication of El Niño's intensity, the current temperatures

are the highest on record. Some meteorologists are calling it a ‘Super El Niño while others are not predicting because they have never seen the extremities they are seeing now. So, what should we do to prepare for the unknown?

The popular consensus is that we need to try and prevent water from getting into the ground. Since we have installed the hillside surface drains and the hill has not slid, it appears we are on the right track. The drainage ditch needs to be carefully graded and compacted so water will flow easily off the slump down to the next culvert. Last year the road cracked and sank slightly in the drainage ditch causing water to pond and enter cracks more easily deep into the road. A solution to the drainage ditch issue is to install a water proof fabric that will allow the water to flow in the ditch without a chance to seep into the ground. The negative on this approach is the cost to purchase and install the fabric. More so is the issue if the ground cracks below the fabric it will not be visible nor can we try to seal it if we cannot see it. The other way water enters the ground is through the road itself. A fabric was considered to prevent rainwater from entering the ground. Its negatives are similar to that of the drainage ditch fabric. We told the soil engineer for Solmax, the manufacturer of the fabric, our soil problems and asked in their opinion, if they could recommend any of their fabric for us. This is her reply,

“After discussing your project with my team, we believe due to the amount of cracking on the slope/road it would be best to dig out the area and put in some kind of retaining wall to help with the landslide issue on the slope. Putting any geosynthetics down now would probably get eroded due to the amount of erosion already occurring on the slope of the hill and into the road. Once digging out the area, we believe using a reinforced geogrid to help hold back the landslide would be a long-term solution as well as putting the H2Ri geosynthetic on the roadway to continuously help with the moisture on the roadway. Overall, the cracking cannot be addressed with a geosynthetic without digging the area out first to address why the area is cracking in the first place.”

Digging out of the road to a hard surface and import good compactable material is probably the best way. However, the cost to dig out the soil and import rock is cost prohibitive. Also, there will be long delays disrupting through traffic. There is also the chance that all of this work is completed and the road will continue to slip.

It was recommended that we seal off the culvert above the slump. This will enable all the water on the road ahead of the slump to cross over the slump to the next culvert. It was also mentioned the culvert on the downhill side of the slump should also be sealed. This would enable all the water to continue and drain to the culvert further down the road at the sharp turn. This is how it was before the grant added numerous culverts. The negative is that by enabling a large amount of additional water to flow over the slump, we increase the potential for more water to enter the ground at the slump. If the slump cracked and sank in the past as a result of a heavy winter, it will sink even worse with more water potentially being added to the cracks.

The culvert ahead of the slump drains approximately 20’ down the hillside. It has eroded a 10’ hole and enabled water to potentially enter under the hill supporting the roadway. This culvert should be extended further down the hill to prevent any chance of it entering under the roadway. This will be expensive but affordable to the road association.

There is a new well installed on the edge of the road directly above the slump. This could possibly be a game changer for us if this well is capable of removing groundwater that would normally migrate under the hill and destabilize the road. My hope is that we can work with him and utilize his well to extract water during the rainy months. Currently there is no well pump or controls, only a casing. (I am trying to find the name and contact information of the owner. I found the owner lives in Vermont but do not have a name. This is part of the property that recently sold that includes what is known as the 'Telephone Booth.' For some reason I have a difficult time communicating with the Clow people. Elizabeth Brasher is my best contact thus far. I asked her to contact the owner and please have him call me. It has been a couple of weeks thus far).