Cost Saving Methods Lead the Way for Local Roads

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Nationwide there are 3.9 million miles of road, and 3.2 million miles are classified as rural, which means outside the big cities and the highly populated counties. Of that 3.2 million, 1.8 million miles are gravel. Forty-five percent of the total mileage in the nation has a gravel surface. When an area gets a three- or four-inch rainfall, agencies that maintain gravel roads know exactly where there will be ruts. After it rains, you haul more gravel in, it lasts awhile, and the next time it rains, the gravel disappears.

In Oklahoma, we had a Federal Highway research grant to study the use of geotextiles, or engineering fabric. We use the fabric on gravel roads to separate the gravel from the boggy spot. We are not curing the problem, but we do not have the symptom on the surface. In areas where stagnant water covers the roadway several times a year, the fabric can be used to keep the road structure in place even though the road bed is saturated. The fabric also can be used in areas where roads are susceptible to washboarding or chatter stripping effects.

The geotextiles, or engineering fabric, comes on rolls. In one county, the manufacturing company donated the fabric and the county furnished the rock. The manufacturers said to nail the edges of the fabric down and to sew the seams of the fabric together, but over the last five or six years, we have found that all you need to do is overlap the fabric. An overlap of about 18 inches at an end lap or a centerline joint is sufficient.

The fabric is very strong. We once belly dumped 21 or 22 tons of stone out of a truck running between 38 and 40 miles per hour, and we did not tear the fabric. We wrinkled it and pulled it quite a bit, though, so I do not recommend putting the stone down this way, but it showed us how strong the fabric is. We found that construction traffic can drive on the fabric as long as tires do not skid or slide. When truck drivers lock the brakes on a trailer or fail to blow the air before taking off, the tires slide across the fabric and tear it.

Although construction traffic does not usually damage the fabric, we learned not to drive over soft roads. Driving heavy trucks over soft roads mashes the fabric into ruts. This does not damage the fabric, but the fabric on the humps between the ruts can be torn while blading the rock. If the fabric is caught by the blade, it tears easily. For this reason, back dumping the rock is recommended on road sections where the subgrade is soft. In addition, we always pull the trucks onto the fabric about three or four feet and then backdrag across the end of the fabric to begin blading. Dumping rock ahead of the fabric and then blading it onto the fabric pushes and wrinkles the fabric.

We also learned that when blading the rock, you must blade it across the lap of the fabric. Blading rock into a lap separates the fabric. The top lap pulls up and you push rock between the laps. To prevent this from happening, blade the rock across the laps, drifting it to the side, making several passes, and extending the blade continuously to the outside.

On some projects, the wind blows the fabric out of place, so we put rocks on one side to hold it down. Another option is to nail the fabric down. We found that all you need to do is tie the fabric down until the rock gets near the end of the fabric that is laid out. Then you can place and straighten the fabric, making certain that there is enough overlap before spreading the rock over it.

On one section of a road, we put fabric and four inches of crusher run rock, which is the first crack out of the cones at a quarry, the biggest size approximately one-and-one-half inches and 20 percent fines. On another section of the same road, we put four inches of rock without fabric to serve as a control section. On this section, the four inches of rock we put down lasted four months. We examined both sections of the road over a four-year period. Over four years, 18 inches of rock were dumped on the control section. Some of the ruts in the control section were six to eight inches deep. At the point in the road where the control section and the fabric treated section meet, the ruts come out of the road at about 45 degrees. On the section treated with fabric, the rock remains white though the local soil is a brown clay.

When we shoveled the rock off the fabric, we could see that the rock was still clean. There was no mud mixed with it, and it had the same characteristics it did when it was put down four years earlier. When you look under the fabric, which in this case was the non-woven type, you see about one-half inch of fine paste. As traffic drives over the road, the action of water trying to pump soil up through the fabric formed a paste under the fabric. The only hole in the fabric was caused by the point of the shovel when we were digging the rocks off.

On the other hand, the woven type of fabric is highly susceptible to abrasion. It can be punctured by the torque action traffic causes on the rock. We examined the woven fabric about 12 months after installation, and the rock was grinding holes through it. We found numerous punctures in the fabric caused by installation and traffic driving over it.

At a one-mile long section of road, we used a chip spreader to spread the rock. Two people rolled the fabric just in front of the chip spreader. We shut off four gates on the centerline edge of the hopper so we had a bare strip of fabric along the centerline for overlapping. We rolled out one lane of fabric and turned around and rolled out the other lane. When we rolled out the second lane, we opened all the gates of the hopper and put four inches of crusher run rock the entire lane width. Because the rock had been hauled ahead of time and stockpiled at each end of the road section, one-half mile was the farthest we had to haul rock with trucks. We estimated that the costs of the project totaled $15,000: about $10,000 for four inches of rock on a 20-foot wide roadway and about $4,400 for the fabric. We built a mile of subgrade that will not rut. With such a solid base, a chip seal job or a thin asphalt lift will wear well.

Another road section we worked on was an asphalt road about six months old. Because water breaks out into the roadbed, it gets soft and the asphalt gets pushed down. We used a power saw to cut the asphalt section. We used a

front-end loader and a motor grader to cut an eight-inch plug out of the road. We put fabric and rock over it.

In summary, we found that installation—the techniques and set-up of equipment used—is crucial to the success of the project. First of all, the blade needs to be rolled forward into a dragging position as opposed to rocked back into a cutting position. You do not want to cut into the fabric, you want to roll rock onto it. Besides, you do not want to carry a lot of material on the moldboard. Carrying a big mound of material on the moldboard causes the rock to wave out in front of the mound and slide across the fabric. In sliding across the fabric, the rock will tear the fabric.

Secondly, you need to spread rock at least four inches deep so that the blade does not tear the fabric. Tearing the fabric does not cause a big problem, but it takes 20 to 30 minutes to repair. You must shovel the rock back from the torn area about eight inches, then cut a piece of fabric to fit the hole. After you put some rock around the edges and in the middle of the new piece to weigh it down, the blading operation can continue.

Thirdly, we recommend keeping construction equipment on top of rock at all times. And finally, as in all good projects, when we finish spreading the rock, we put a crown in the roadway.