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NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

PAVEMENT ENDS

A North Dakota Success Story

by Dale C. Heglund, NDLTAP Director

Roadway development follows a logical progression: grade, gravel, and pave. But sometimes it's welcome and cost-effective to step back to gravel and replace the "Rough Road Ahead" sign with a "Pavement Ends" sign.

Some local roads should never have been paved. With others, conditions change, creating the need to evaluate the roadway surfacing and long-term strategies. Either way, the opportunity to convert a distressed paved road to an engineered gravel road is a viable option.

The local roadway network is the economic backbone of North Dakota. Of the 107,000 miles of roadway in the state, the North Dakota Department of Transportation (NDDOT) manages about 7,400 miles of paved roadway. The remaining mileage is under local, city, township, Tribal, and county management. The county/township road network includes about 6,600 miles of paved roads, 59,000 miles of gravel roads and 32,000 miles of unsurfaced roads.

Highway realignments can result in jurisdictional road transfers that are made with the intent to provide a benefit to the local users. But over time, these transferred roads can become a liability. Let's take a look at a sample project in North Dakota.

Not far south of the U.S.-Canadian border, Mountrail County owns and maintains an old state highway segment. The original roadway east of Blaisdell was built in 1936 as State Highway 2. In 1939, the base was stabilized to provide an improved "all-weather" surface and, in 1953, the first asphalt wear course was placed.

In 1978, the highway was realigned and the original roadway segment was transferred to Mountrail County. The county accepted the state's no-fee roadway transfer, recognizing local citizen demands to maintain convenient farm to market access. With the bulk of the traffic expected to shift to the new state highway, it was expected that the old route would last forever or at the least for a very long time.

Forty years have now passed and the roadway deteriorated to a point where it couldn't get much worse. On a typical pavement performance curve, it has taken the steep dive so far down that it is starting to flatten out.

While the road has served area travelers well, it has aged and become a liability. Let's take a look at some roadway condition info from last year:

- The International Roughness Index (IRI) quantifies road surface smoothness or ride quality. IRIs of 50 in/mi are the norm for new pavements and anything under 95 in/mi is considered "good." Anything over 170 in/mi is considered "poor." IRI values on the old highway section ranged from 300 in/mi to 600 in/mi. Those potholes and rough surfaces mean more than a rough ride for users, they translate to increased vehicle maintenance and fuel costs. Rough Road Ahead signs were utilized to inform the public of the poor roadway condition.
- North Dakota state law sets roadway speeds at 55 mph unless otherwise posted. The deteriorated pavement was posted at 35 mph.

- In recent years, the county cut out and rebuilt sections that had failed to the point that they were virtually impassable. They were unable to support loaded trucks and unsafe for travel.
- Road users described the road as “unsafe,” “steadily deteriorating,” “rough,” and “worse than gravel.”
- North Dakota state law sets roadway weight limits at 80,000 lbs. unless otherwise posted. The roadway was posted an axle weight limit of 6 tons and a gross vehicle weight limit of 65,000 lbs.

Potholes, rough riding roads, reduced speed limits and reduced load limits all indicate pavement failure and create public outcry for improvements. Proper pavement management helps us to select the right treatment at the right time so that we avoid these pavement ailments. And sometimes, pavement management can help us identify the worst roadways – those so deteriorated that pavement preservation methods are not enough. In some cases, conversion back to gravel is the best solution.

The #1 problem with a gravel road is that it is not a paved road. So how can a paved road be converted to a gravel road without public outcry? Let’s take a look at some of the factors for this project:

- North Dakota’s local road network is primarily gravel. Local users are accustomed to the benefits and shortcomings of graveled roadways.
- Low population density and a low rural population shift. Seasoned gravel road users are typically tolerant of gravel roads, with roadway conditions meeting expectations.
- Agriculture and oil industries drive the local economy and rely on a dense road network. Mountrail County’s road network includes primary improvements on a 6-mile grid with lesser improvements on the one-mile sectionalized grid in between.
- Time and damage cost money. The 35 mph speed limit and vehicle damage from a road in poor condition created a public understanding of a need for change and desire for improvement.
- Truck legal load capacity is a dollars and cents business factor. Reduced legal load capacities mean increased costs.
- Safety. A paved route with potholes and a rough driving surface creates safety risks and difficulty staying in the driving lane.

State Highway 2 before conversion

State Highway 2 after conversion

Jana Hennessy, Mountrail County Engineer, worked with the consulting engineering team at Brosz Engineering along with engineers at the North Dakota DOT and the FHWA to develop and construct a conversion project on an 8-mile section of deteriorated old state highway 2. Hennessy is proud of the process that her team developed to improve the roadway segment through conversion. Steps to success include:

- Notify the public and get their input and support. Help the public to understand the conversion process and the maintenance costs between pavement and gravel. Show the numbers. Show the cost savings.
- Analyze the pavement condition, run cost estimates for all scenarios, and help your commissioners understand the numbers so they can make an informed decision.
- Get input from your maintenance crew.
- Improve the ride and increase the speed. A typical smooth gravel road will have an IRI of about 200 in/mi, a big improvement from the old pavement's IRI values that ranged from 300 in/mi to 600 in/mi. After the conversion, the 35 mph speed limit signs came down and safe speeds increased. Ride enhancement is a safety improvement.
- The reclamation process utilizes material in place, greatly reducing the construction loads and costs that are inherent to the typical remove, process and replace style of reconstruction.
- Cut dust. Pavement provides a dust-free driving surface and environment. To mirror the health and safety factors of a paved surface, they treated the gravel with a topical Calcium Chloride dust suppressant.
- Provide smooth tie-in transitions. They modified the pavement 2.1% slope to a standard gravel slope of 4%. Transitions at the project ends, inslopes and approaches were all ride and safety focus items.
- Look at ADT. The old highway has an average daily traffic count of 30 vehicles – not nearly enough to justify pavement reconstruction when the current State's Highway 2 carries an ADT of 6,000 and parallels the county road only 2 miles to the south.
- Increasing the legal gross weight from 65,000 lbs. to 105,500 lbs. This increase in load carrying capacity is a key factor in profitability for local agricultural producers. A thickened roadway section was created through the addition of gravel and the roadway was proof-rolled to identify any weak subgrade areas. The weak sections were cut out and repaired with a geogrid and gravel.

In-place recycling of asphalt pavement and aggregate greatly reduces costs compared to typical reconstruction.

Calcium Chloride dust suppressant helps consolidate the road surface and provides a dust-free driving surface and environment.

Zach Gaaskjolen, and Ann Taylor, Brosz Engineering team members from the Stanley office, provided a quality reclamation design that was cost–effective and simple to construct. Their construction oversight was key in providing a quality end-product with dramatically improved ride quality and load carrying capacity. "The end product is wonderful. Getting rid of the 35 mph signs and providing a safe roadway that is easy to maintain are success factors that I am most proud of," Taylor said.

Conversion projects typically include full depth reclamation (i.e., in-place recycling) and reshaping. Gravel is either placed ahead of the reclamation process or it is placed as a surfacing layer on top of the pulverized and blended pavement and base gravel layer. Design selections consider the quantity and quality of the in situ asphalt and gravel base. Mix designs provide a design starting point. Minor field modifications are often required to account for the myriad of variations in the existing roadway section. Old pavement sections often contain multiple mixed layers of materials, variable inslopes, patched areas, widened sections, contaminated gravel base, and similar unforeseen conditions.

Jana Hennessy, Mountrail County noted that she believes that a good gravel road is as good as paved road, if not better. "Maintenance is much easier and less expensive. It's all about the gravel quality and proper blading," she said. The Mountrail County and township road network includes 155 miles of paved roadway and 1,563 miles of gravel surfacing. With the 10 to 1 gravel to paved surface ratio, the county has fine-tuned its gravel maintenance efforts, providing a high-quality gravel road network. Most of the paved miles are relatively new and are on a good preventative maintenance schedule. The old highway 2 section had deteriorated to the point that it was beyond the capabilities of normal county crew maintenance equipment and material.

Often, conversion candidates are low-volume roads that should never have been paved. In the past, low material and construction costs often led to paving of gravel roads that fell below a normal paving cost-analysis point. Many local agencies were ill-equipped to take care of the paved surfaces, and as such the pavements deteriorated.

Today, life-cycle costs and preventative maintenance efforts and costs are key considerations in any paving project. When we decide to pave a roadway, we need to be sure that we have the equipment and financial means to maintain it. A typical threshold used to trigger a change from gravel to pavement is when traffic volumes exceed 250 ADT. The Upper Great Plains Transportation Institute at North Dakota State University has developed an easy-to-use analysis tool to help compare improvement alternates. The tool can be used to compare various roadway improvement and maintenance options. The Local Road Surface Selection Tool is free to use and can be found at https://www.ugpti.org/resources/surface-selection/.

Conversion is an option in the toolbox for North Dakota local leaders to use when appropriate. Our case study of an old state highway that is now a deteriorated county roadway is one example of roadway condition and criteria that lead to consideration for this conversion of pavement to gravel. A good reference on conversion is the *NCHRP 485, Converting Paved Roads to Unpaved*. It is a synthesis of highway practices across the United States. The TRB study identifies conversion roadway characteristics, cost justifications and public sentiment; factors that help us understand why the normal progression to paving will at times need to be reversed.

Sources:

Fay, Laura, et al. *NCHRP Synthesis 485: Converting Paved Roads to Unpaved*. Transportation Research Board, Washington, D.C., 2016.

Wrucke, Andrew, Brad Wentz, and Kimberly Vachal. *Local Road Surface Selection Tool: Technical Report*, DP-293. North Dakota State University, Fargo: Upper Great Plains Transportation Institute

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