



# An Orphaned Highway

*Reconstruction and emergency repairs aim to resolve longstanding ownership and maintenance troubles for a historic roadway near Yellowstone.*

*by Michael Kulbacki,  
Bert McCauley, and Steve Moler*

(Above) In this panoramic view, a switchback section of the Beartooth Highway climbs toward the 3,345-meter (10,974-foot) Beartooth Pass in Montana, making a 1,219-meter (4,000-foot) elevation gain over 16.1 kilometers (10 miles). *Photo: MDT.* Inset: One of the “bear’s teeth” for which the Beartooth Highway was named is visible along the ridgeline in the center of this photo taken from the highway looking into Montana from the Wyoming side. Another bear’s tooth visible from the highway is located on Beartooth Butte in Wyoming.

A woman planning a summer vacation once wrote a letter to CBS travel correspondent Charles Kuralt and asked, “What are America’s most beautiful highways?” As documented in his 1979 book *Dateline America*, Kuralt answered, “The most beautiful road in America is U.S. 212”—the Beartooth Highway.

From the Beartooth’s western end at the northeastern entrance of Yellowstone National Park to the highway’s eastern end just outside Red Lodge, MT, the 108-kilometer (67-mile) Beartooth offers travelers

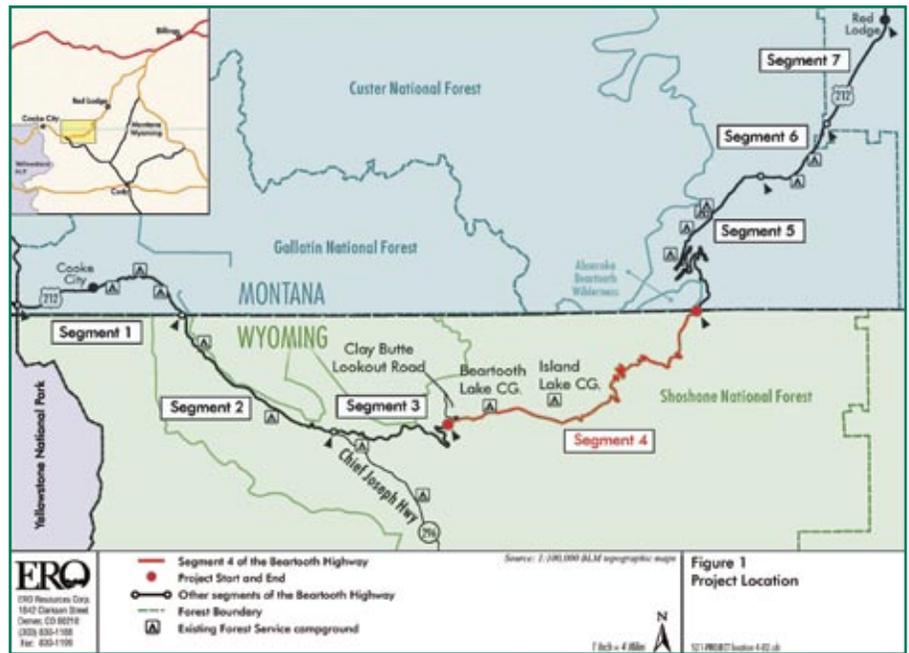
an incredible high-country driving experience. The highway crosses some of the most rugged mountains in the lower 48 States, with 20 peaks more than 3,600 meters (12,000 feet) high. In June 2002, the Federal Highway Administration (FHWA) designated a large portion of the highway as an All-American Road because of the corridor’s historical, cultural, and scenic significance.

Built between 1931 and 1936 as a long approach road to Yellowstone, the Beartooth Highway today is an economic lifeline for the Montana

resort towns of Cooke City and Red Lodge, connecting them on a two-lane, roughly crescent-shaped roadway that bends southward into Wyoming when viewed from above. About 200,000 people entered Yellowstone through the park's northeastern gate near Cooke City in 2004, most via the highway, according to the U.S. Department of the Interior's National Park Service (NPS).

Despite its renown and significance to the local economy, the highway has suffered neglect over the years. Even though the Beartooth carries visitors to the Nation's oldest national park and zigzags through three national forests, three counties, and two States, no government agency has claimed ownership of large segments of the roadway through much of its history, earning it the nickname the "orphaned highway."

Since the mid-1990s, however, the FHWA Federal Lands Highway Division (FLHD) has worked with NPS, the U.S. Department of Agriculture's (USDA) Forest Service, the Montana Department of Transportation (MDT), and other partners on a major initiative to resolve the highway's ownership and maintenance issues. The goal is to repair and upgrade substandard sections to meet current State highway standards so that the relevant counties or States can adopt the portions of



The seven segments of the Beartooth Highway designated during the planning for the reconstruction are shown on this map. Segment 1, to the left, and segment 4, in the middle, are the focus of the reconstruction, while the switchback area of segment 5 was the site of May 2005 mudslides and subsequent emergency repairs that summer.

the highway within their boundaries into their road systems, thereby ensuring long-term stewardship.

Partners acknowledge hurdles in the endeavor. "It is quite challenging building a project with such controversy regarding ownership," says

Project Engineer Jason Hahn, who manages a portion of the project for FHWA's Western Federal Lands Highway Division (WFLHD), "trying to figure out for whom you are building the road—the Forest Service, the National Park Service, or the Montana Department of Transportation."

But, adds Larry Smith, recently retired division engineer for FHWA's Central Federal Lands Highway Division (CFLHD), interagency cooperation has been instrumental in construction and resolving ownership. "The development of solutions for the future of the Beartooth Highway has been successful due to the partnership developed among the many stakeholders and their drive for success," he says.

Despite the challenges of interagency cooperation and a recent natural disaster that set the project back, reconstruction is underway, and the Beartooth may yet find a permanent steward.

### History

The Beartooth Highway came into existence after the automobile became a popular method of traveling to Yellowstone, beginning around 1915. The introduction of cars spurred a rapid rise in local tourism, with guest



Flasb's Photography

Among other things, the Beartooth Highway was intended to spur tourism and commerce in Red Lodge, shown here during the Memorial Day parade in 1927.

## A History of Mixed Fortunes

Although the original construction of the Beartooth Highway was completed according to schedule and budget, the fortunes of its contractors were not so uniformly successful. McNutt & Pyle of Eugene, OR, was responsible for the 40.2-kilometer (25-mile) stretch heading up the western slope of the Beartooth Plateau and over Beartooth Pass to the Montana-Wyoming border. The company's \$478,000 bid was \$40,000 below the engineering estimate and \$200,000 below the only other bid, causing fear in some that the firm did not know what it was getting into.

History proved that the firm underestimated the costs. McNutt & Pyle had only begun working with mechanized equipment 2 years earlier, in 1929, having used horses for power in all its grading contracts until then. The company had never worked a project so large and technically complex, or so demanding of qualified workers. It spent \$30,000 building a "tote road" from Cooke City to the western end of its project to move equipment and supplies. At the same time, the firm had its two excavation teams "walk their shovels into the project" from Gardiner, MT, 129 kilometers (80 miles) away, observed an incredulous BPR engineer, Harry Mitchell.

Mitchell claimed the company would reach Beartooth Lake, roughly the contract's midpoint, in 30 days. But by the end of the first construction season in late 1931, according to Mitchell, the contractor had "practically demolished" the little equipment it did have on the glacial boulders and solid rock reefs that lay in the path. Workers would not reach Beartooth Lake for another year.

As winter set in, the company continued to house its workers at a temporary camp on Muddy Creek. A large tent became a makeshift mess hall. Many families simply left for fear of freezing to death. This freed up tents for other uses at least, and on one occasion, a work crew drove a truck in need of repair into a large vacant tent. In keeping with the company's luck, however, the tent burned to the ground and the truck was barely saved when a fire lit from old crankcase oil for warmth spread.

McNutt & Pyle merged with Washburn & Hall later in the winter. BPR forced a project reorganization enabling Washburn & Hall managers to supervise McNutt & Pyle workers directly. Mitchell credited this with the ability of the firm to finally complete the project.

By comparison, the Morrison-Knudsen Company of Boise, ID, was much more efficient. Morrison-Knudsen worked on the difficult switchback area, the 19.3-kilometer (12-mile) section extending from the State line northeast to Quad Creek. The firm also was responsible for an 8-kilometer (5-mile) section from the eastern end of the first section to the beginning of the Federal-aid portion 13.8 kilometers (8.6 miles) outside Red Lodge in Custer National Forest.

Morrison-Knudsen drew on its experience with three large grading projects inside Yellowstone in 1929–1931, employing more experienced construction managers and skilled workers than McNutt & Pyle had. The company kept employee morale high by providing good working conditions. Its camp had wide streets, electric lighting, clean and reliable water supplies, and houses that were weatherproofed against the cold. A blacksmith shop enabled workers to undertake practically any repair.

The Beartooth took its toll on McNutt & Pyle, however, and the company went bankrupt, despite the merger, soon after completing its work. Some subcontractors on the roadwork went the same way, while other contractors—mainly S. J. Groves & Sons and Winston Brothers Company—at least survived. Morrison-Knudsen, on the other hand, prospered on the Beartooth, becoming a world-class mining, engineering, and construction conglomerate decades later.



Flash's Photography

In July 1931, this Grane & Company shovel and truck was helping in the early stages of construction of the Beartooth.

ranches, lodges, and hunting facilities beckoning travelers to come and view the scenery and wildlife.

The rise in tourism and the need to support the local mining industry increased demand for better roads. In 1925 the Forest Service and FHWA's predecessor, the Bureau of Public Roads (BPR), conducted the first known feasibility studies for a new road from Cooke City to Red Lodge.

Around this time, groups from both towns began lobbying the U.S. Congress to finance an eastern approach to Yellowstone. Finally, in January 1931, President Herbert Hoover signed the National Park Approaches Act, and the Red Lodge-Cooke City route was the first park road to receive funding. But the law contained general restrictions that affected the Beartooth Highway. One stricture was that a park approach road could not be more than 96.6 kilometers (60 miles) long. The final Beartooth alignment, however, measured 110.4 kilometers (68.6 miles). To cover the excess mileage, the remaining 13.8 kilometers (8.6 miles) to the west of Red Lodge would be designated as part of the Federal-aid highway system, with another short portion inside Custer National Forest placed under the jurisdiction of the forest highway system.

Financing was sorted out by spring 1931, with support coming from forest highway, Federal-aid, and park approach act funding. NPS allocated the first \$1 million for initial construction of the 96.6 kilometers (60 miles) covered under the park approach act. Montana constructed the Federal-aid section and incorporated it into the State highway system.

A 1926 NPS-BPR agreement signed during construction of Glacier National Park's Going-to-the Sun Road had given BPR responsibility for designing and building roads throughout the entire national park system. Therefore BPR managed the work along the section of the Beartooth being built under the park approach act. The first contracts were let in June 1931, and actual construction began later that summer. Despite presenting serious engineering and logistical challenges for contractors, the highway was completed on time and within budget.

## Maintenance Issues Raised

Although constructing the highway progressed rather smoothly, maintaining it became an entirely different story. Snowplowing and removing rockslide debris were immediate concerns. In 1937, for example, it took BPR road crews until June 19 to clear the road of snow. The following year the road opened just a few days earlier, on June 10. Who would continue such maintenance over the long term—and who would pay for it—became topics of debate in the years following construction.

The park approach act was credited with making construction of the Beartooth possible, but it also created problems. Even though the act authorized NPS to contract for maintenance work, Congress did not provide additional money for that purpose. So NPS urged the Montana State Highway Commission to assume full responsibility for maintenance, and even pushed legislation giving Montana authority to maintain the Wyoming section. NPS reasoned that the road was a Montana approach to Yellowstone, was built at the urging of the Montana congressional delegation, and connected two Montana communities (Red Lodge and Cooke City).

Montana, however, argued that maintenance responsibility belonged to the Federal Government since the road was an approach to a national park. In the end, the Federal Government agreed to do minimal maintenance such as snowplowing and landslide clearing along the entire route except the final 13.8-kilometer (8.6-mile) Federal-aid section west of Red Lodge, which had always been cleared by MDT workers. From 1938 to 1945, BPR, using NPS funds, oversaw the section managed under the park approach act. But in 1945, Congress enacted legislation giving NPS the authority to plow and clear the highway, and thereafter park service crews, using Forest Service funds, maintained the longer section.

## Three Orphaned Sections

In the early years, Wyoming was never expected or formally asked to maintain its 56.3-kilometer (35-mile) section of the Beartooth, a bow-shaped squiggle between the western and eastern ends of the roadway, which



The narrow roadway width and lack of formal pullouts and parking areas create dangerous situations when bicyclists, cars, recreational vehicles, and tour buses converge at the same location, such as at this spot heading west toward Cooke City near Beartooth Butte. Plans call for better designed and more appropriately located pullouts and parking areas.

are both in Montana. (The Wyoming portion would later be designated segments 2, 3, and 4 during the modern reconstruction.) The highway provided little value to Wyoming because it had no connection to the rest of that State's highway system. Similarly, Montana never maintained the 13.5 kilometers (8.4 miles) from the park's northeastern entrance eastward through Cooke City to the Wyoming border (segment 1 during

reconstruction) because the roadway was never incorporated into Montana's highway system due to its remoteness and proximity to the park.

By the late 1950s, this NPS-maintained section of Montana road had fallen into disrepair and become a problem for the agency to maintain. In 1959 NPS proposed turning the section and an "undetermined strip of land" adjacent to the highway into a national parkway



An excavator removes material from a cut section and dumps it into a truck during the segment 1 rehabilitation. Republic Mountain is in the background.

similar to the Blue Ridge Parkway in the southern Appalachian Mountains. This would have put some 80 percent of the Beartooth and the strip of land under NPS jurisdiction, making the corridor eligible for annual congressional maintenance appropriations and subject to the same regulations as any road inside a national park. But the Forest Service and local residents opposed removing the strip of land from Forest Service jurisdiction and limiting its use.

There were also issues with the eastern portion of the highway in Montana, emerging in a northeastward direction from Wyoming and going to Red Lodge. The Federal Government agreed to put most of that section managed under the park approach act into the forest highway system so funds could be allocated from the Forest Highway Program (FHP) for maintenance and repairs. The Forest Service, in collaboration with FLHD, reconstructed some of the flatter sections of the Beartooth between 1963 and 1984

using FHP funds. But that still left some of the more rugged sections in need of repair. Some improvement occurred in 1965, when MDT started maintaining 24.1 kilometers (15 miles) of the eastern section inside Montana due to the expenditure of FHP funds on that section.

In the summer of 1982, Yellowstone's superintendent asked the U.S. Department of the Interior's Office of the Solicitor to determine who had ownership and maintenance responsibility for the Beartooth. The solicitor for the Rocky Mountain region, in an August 1982 opinion, determined that although NPS had no authority to administer the right-of-way or enforce traffic laws, it did have "the responsibility for the usual maintenance actions such as repaving, filling potholes, striping, and even reconstruction of the road." The solicitor's report concluded that a satisfactory division of maintenance responsibilities could only be worked out between NPS and the Forest Service. "Unfortunately, it appears likely that

the present situation will continue for some time," the solicitor wrote.

### A Maintenance Quandary

To this day, about two-thirds of the Beartooth remains unclaimed—the portion in Montana nearest Yellowstone (the later segment 1) and the Wyoming portions (the later segments 2, 3, and 4). Those stretches have served the public for 70 years without a permanent guardian willing and financially able to perform the kinds of repairs and maintenance demanded of a major alpine highway.

A series of recent thin pavement overlays has made the Beartooth appear on the surface to be in decent shape. But serious structural problems have lurked beneath the pavement for decades along some of its more rugged sections. Problems include deteriorating pavement, base, and subgrade; inadequate drainage; inconsistent roadway geometry; crumbling bridges; and insufficient roadway width to accommodate today's larger tour buses and recreational vehicles.



HKM Engineering

These before-and-after photos show the slide debris deposited on the roadway at the Quad Creek crossing and the cleared road. During the slide, the debris flow blocked the culvert, forcing Quad Creek down the Beartooth Highway shoulder. The final project restored the original creek location and reestablished the channel and culvert drainage.

Del McOmie, the Wyoming Department of Transportation's (WYDOT) chief engineer, explains the State's predicament: "The section within Wyoming doesn't meet the minimum design and operating standards required for us to place the highway into our State highway system. The current condition of the highway is poor, and we can't afford the added financial burden to bring the roadway up to an acceptable service level for incorporation into our system."

If these sections of roadway are upgraded to meet current standards, WYDOT will approach the State transportation commission and request that it fold the highway into Wyoming's maintenance portfolio. "We're continuing to work with FHWA and resource agencies to bring the highway up to State standards so these ownership and maintenance issues can be [re]solved," McOmie says.

For its part, MDT is waiting on Wyoming before it acts on Montana's western portion of the road. "Once the highway is up to standards and WYDOT takes over the Wyoming section, there's little reason Montana wouldn't do the same," says MDT Director Jim Lynch.

## Finding Permanent Caregivers

Resolving the Beartooth's ownership and maintenance issues began in earnest in 1994, when NPS asked FHWA to complete an evaluation and needs assessment of the entire Beartooth corridor. In doing the evaluation, FLHD divided the highway into seven segments going west to east, beginning with segment 1 at the park entrance and ending with segment 7 outside Red Lodge. The evaluation determined that segments 2 and 3 in Wyoming and segments 6 and 7 in Montana met minimum State highway standards and were in at least fair condition because of the 1963-1984 rehabilitations. Segment 5, just north of the Montana-Wyoming line in the east and known as the switchback section, was rebuilt to modern standards in the 1970s and is in acceptable condition; however, it has a history of landslides because of its extremely steep terrain.

On the other hand, segment 1 and Wyoming's 29-kilometer (18-mile) segment 4, from the Clay Butte Lookout Road to the summit of

3,337-meter (10,947-foot) Beartooth Pass and the State line, had never been brought up to modern standards. These sections were deemed in poor condition and in need of immediate reconstruction. They became the focus of the overall initiative to rebuild and modernize the Beartooth.

After the evaluation was completed, in 1997, the Montana congressional delegation convened a steering committee comprising representatives from the Forest Service, FHWA, NPS, WYDOT, and MDT to oversee the highway's funding, maintenance, and ownership issues. The committee provided extensive documentation of potential funding sources and established the goal of rebuilding segment 4 to modern standards by 2010. Then Wyoming could consider taking full ownership and maintenance responsibility for its section of the highway.

At about the same time, efforts to improve segment 4 received a

funding boost. USDA designated \$9.8 million for segment 4 from a 1998 congressional appropriation that resulted from a mine settlement (Crown Butte). That same year, Congress listed the Beartooth Highway as a "high-priority" project in the Transportation Equity Act for the 21<sup>st</sup> Century and allowed Montana to spend up to \$19.9 million on any section of the highway, whether in Montana or Wyoming.

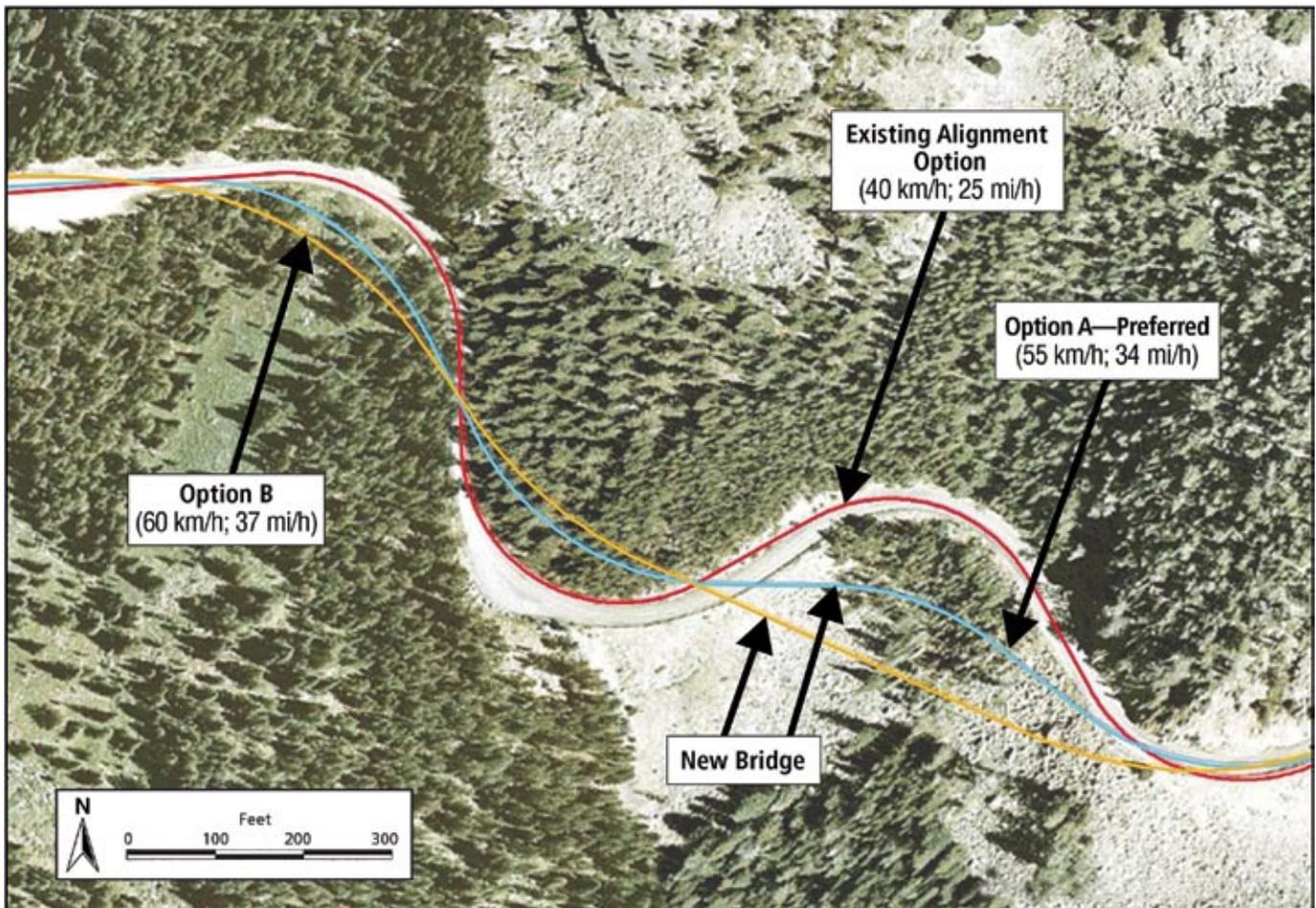
Some of the Crown Butte money was used to install a thin asphalt overlay on segment 4 in 2001 as a temporary preventive measure until the highway could be rebuilt. The money also enabled FLHD to begin design, environmental documentation, and environmental compliance for reconstructing the segment.

## Segment 1 Reconstruction

FLHD secured FHP funds for similar work on segment 1 as well. By August 1997, the WFLHD office in

**The Beartooth's narrow roadway and lack of shoulders leave little or no room to store snow when the road is plowed and opened to traffic in the spring. The resulting high snow banks shown here create an additional safety hazard, but widening the roadway will help alleviate the problem. A common road surface condition, known as "alligator cracking," along segment 4 is also evident in this photo, because pavement breakup caused by poor drainage allowed water to permeate the pavement substructure.**





One of the most unsafe alignment areas along segment 4 and site of numerous crashes is Beartooth Ravine, shown here in an aerial photograph from the EIS depicting the location for the new bridge. The bridge is a three-span steel girder structure that will cost in excess of \$4 million. *Source: FHWA.*

Vancouver, WA, had completed a draft environmental assessment for reconstruction. Public comment and revisions took 5 more years.

The first phase of segment 1 reconstruction, a 3-year, \$11.2 million project stretching about 8 kilometers (5 miles) from Cooke City to the Montana-Wyoming border, began in May 2004. Work during the first two seasons included clearing, earthwork for roadway widening and realignments, roadway subexcavation and backfilling, placement of subbase material, and installation of new drainage structures. Crews will finish phase 1 in summer 2006 by completing work on the realignments and drainage systems, placing the road base, installing more than 3.2 kilometers (2 miles) of guardrail, and completing asphalt paving and striping.

The second phase of segment 1 reconstruction, a 2-year, \$8 million project covering about 5.6 kilome-

ters (3.4 miles) from the park entrance to Cooke City, is scheduled to begin in summer 2007. Phase 2 is smaller in scope but involves similar work, primarily widening the roadway to 8.5 meters (28 feet), making minor realignments, improving drainage, and completely reconstructing the pavement. After completion of phase 2 in fall 2008, the entire western Montana section will meet current highway standards.

### Segment 4 Reconstruction

Reconstructing segment 4, the alpine section that climbs up and over Beartooth Pass, is a complex and difficult project, according to engineering studies. The 1994 environmental impact statement (EIS) concluded, "Segment 4 clearly has the worst conditions of any portion of the route."

One major challenge is the roadway's narrow width and absence of paved shoulders. The 2.7-meter (9-foot) travel lanes are narrower

than standard snowplow blades, making snow removal difficult and unsafe, especially when the road is open to traffic. Also, some of the steeper sections have little or no room to store the plowed snow. Many of today's tour buses and motor homes measure 3.2 meters (10.5 feet) wide including side mirrors. When two such vehicles meet along this section of the highway, one or both must drive off the pavement to avoid a collision. Not only are these conditions unsafe for motorists and bicyclists, they contribute to "edge raveling," erosion of the pavement edge due to insufficient lateral support, which is normally provided by a paved road shoulder.

Other problems on segment 4 include inadequate drainage, causing the pavement to crack and break up in many locations, lack of defined roadside pullouts and parking areas, sharp curves, sudden dips and crests, and deteriorating bridges.

Because of the size and scope of reconstructing segment 4, the CFLHD office in Lakewood, CO, planned the project under an EIS beginning in 1999. During the process, CFLHD developed and evaluated six alternatives, including a “no action” option. The five “build” alternatives looked at the potential social, economic, and environmental impacts of road widening, major road realignments, and pullout construction. After consultation with the public and project partners and stakeholders, alternative 6 was selected and published in a February 2004 record of decision.

Alternative 6 includes widening the road to a width, including shoulders, ranging from 8.5 meters (28 feet) to 9.8 meters (32 feet), depending on location. It also calls for major realignments at five loca-

tions, upgrading drainage structures, constructing and improving parking areas or pullouts, reconstructing four historic bridges, and installing a new asphalt pavement surface. A recent funding analysis estimates the total costs for alternative 6 at \$115 million, including engineering, making for a project timeline of 8 to 9 years for segment 4, based on timely receipt of required fiscal year appropriations beginning in 2007.

### **Mudslides and Funding Remove Focus From Segment 4**

Reconstruction of segment 4, using \$17.5 million of MDT’s \$19.9 million appropriation, began with tree clearing and setup of a contractor work camp in 2004. Actual construction was planned to begin

in summer 2005 at a hazardous location known as Beartooth Ravine, a 0.8-kilometer (0.5-mile) section containing extremely sharp curves. A new bridge and retaining wall are proposed for the area, along with a pullout to view Beartooth Falls and a new geologic and wildlife interpretive site at the western end of the bridge. Because of substantial price increases in the construction industry, however, bids received on the project were too high to allow award, because no other sources of funding were available to supplement the remaining MDT funds.

Also, in the spring of the 2005 construction season, the highway experienced yet another setback. A series of devastating landslides struck the Beartooth Pass and switchback area of Montana’s segment 5 on May 20. A severe

**At the Streck swale turnout, the contractor crushed and reprocessed excess slide material through a sieve and utilized it for slope stabilization and backfill on the wall structures.**



*HKM Engineering*

## Innovative Solutions for a Temporary Setback

After mudslides on parts of segment 5 of the Beartooth Highway in May 2005, the repair work required ingenuity, technical expertise, coordination among engineering disciplines, and management ability. The design and construction team needed to consider the complex hydrologic, geologic, and climatic conditions of the site.

Mountainous terrain, with slopes up to 70 degrees and highly unstable material, presented numerous challenges. Gullies were eroded in places, creating drops of 12.2 meters (40 feet). Construction performance levels—such as the need to protect motorists from future debris flows and the roadway from high repair costs—were established to determine appropriate levels of repair.

In the end, the project team chose debris barrier fences and training berms to control future slide impacts. Training berms improve public safety and facilitate maintenance by redirecting and isolating debris flows, usually at the top of a slope. A Geobrugg® rockfall fencing system was installed at several sites where unstable slopes still had the potential for small slides. The fences are the first of their kind in Montana and the tallest in North America.

Because the damage occurred within the boundaries of a national forest, the contractors used special aesthetic features, such as reusing native rock for armoring at drainage structures, to preserve and protect natural resources and minimize visual impacts. The Forest Service was actively involved throughout the design process.

A major design component was mechanically stabilized earth (MSE) walls. Due to limited access to segment 5 and its narrowness, the contractors needed to modify conventional designs. Workers used truncated, geosynthetic reinforcement (geogrids) to stabilize the multiple wall layers. At 7.9 meters (26 feet) high, they are the tallest geogrid-reinforced MSE walls used on any MDT project. Onsite fabrication reduced construction costs and time. About 557 square meters (6,000 square feet) of walls were constructed to support backfill for new roadway alignments.

Rock bolts anchor the MSE wall system. The contractors increased the number of anchors and steel tiebacks to provide more sacrificial steel and enhance the safety factor. A study indicated that larger steel components and increasing the number of structural elements would raise the safety factor to 1.30, meaning the structures were nearly 1.5 times stronger than the maximum forces expected to be exerted on them in a future event. Higher safety factors are often used during design of geotechnical structures due to difficulty in determining loading parameters.

An oversized, micropile-supported concrete foundation also enhanced stability and provided a higher safety factor. The micropiles are designed to ensure that the MSE walls will withstand large debris storage, resist overturning forces, and result in improved bearing capacity, which is the ultimate load a foundation can support before failure. To protect the walls from erosion, the contractors also filled trenches, ranging from 1.5 to 3.0 meters (5 to 10 feet) deep, at the MSE wall toes with concrete. In addition, rock retention walls were used to contain slide debris at critical locations to facilitate maintenance.

At the top of Beartooth Pass, more than 76,400 cubic meters (100,000 cubic yards) of rock and slope material were blasted and removed to accommodate the roadway widening for the new drainage system. An innovative feature of the project was the reuse of material from blasting and debris flow excess.

Workers screened, sorted, and reused the debris as engineered rockfills on failed slopes, armoring at drainage inlets and outlets, and structural backfill within the MSE walls. Reusing the material expedited the project, minimized haul distances, reduced overall costs, and assisted the Forest Service with reclaiming a former open-pit chromite mine by using debris flow material as fill. In addition, the project restored a major drainage (Quad Creek), which was realigned by the debris flow.

Through effective management, efficient communication, and creative design, the contracting team completed the project ahead of schedule and almost \$4 million under budget. The collaborative spirit exhibited by the stakeholders, community representatives, and the project team was essential to restoring the highway and ensuring enjoyment of the Beartooth for future generations.

spring storm that dropped nearly 22.9 centimeters (9 inches) of rain caused avalanches of mud, rock, and debris to completely sweep away sections of the highway in several places. In all, five major slides damaged 13 portions of the road. MDT had to close the road indefinitely in the slide area—just a week before the Memorial Day weekend and the start of the busy tourist season.

“The closure of the Beartooth Highway was significant to our economy,” says Bev Chatelain, owner of the Big Moose Resort and president of the Cooke City, Colter Pass, Silver Gate Chamber of Commerce. “A survey completed in June 2005 comparing numbers to June 2004 indicated a decrease in business as high as 75 percent for some establishments, the average being about a 20-percent to 30-percent decline.”

She adds: “Our small communities of Colter Pass, Cooke City, and Silver Gate, with 90 year-round residents, offer the most unique access anywhere in the world to Mother Nature’s natural beauty, but then you can see how devastation from Mother Nature can affect us.”

Because of the road’s economic importance to Red Lodge and Cooke City, tremendous effort ensued to reopen it as quickly as possible. Repair costs were estimated at \$15 million to \$20 million. U.S. Transportation Secretary Norman Y. Mineta authorized a quick release of \$2 million in emergency relief funds on June 10, 2005, so MDT could jump-start the process of clearing debris, stabilizing slopes, and installing other safety measures. By using the remaining \$12 million of unspent high-priority project funds for segment 4, MDT obtained enough additional funding for the emergency repairs.

“Our goal was to get the road opened as soon as possible,” says FHWA Montana Division Administrator Jan Brown. “So the money from CFLHD was transferred back to Montana, with the agreement that Montana would return the money as soon as the State received additional emergency relief funds in the future. All the parties involved are working together to make sure this happens.”

The project contract was awarded

June 15, 2005, less than 4 weeks after the landslides. Construction crews, working 24 hours a day, 6 days a week, completed the project in just 4 months, in early October.

## The Road to Adoption

With the Montana section now repaired, the focus has shifted to putting reconstruction of segment 4 back on track. To construct a 1-kilometer (0.6-mile) project containing a new bridge and retaining wall at the highway's worst safety location (Beartooth Ravine), \$4 million is needed in 2007 in addition to the remaining \$12 million in high-priority funds. To advance a 2.8-kilometer (1.6-mile) project from the beginning of segment 4 through Beartooth Ravine, thus taking advantage of economies of scale and better construction sequencing, an additional \$8 million is required.

In support of this funding need, WYDOT has requested additional funding from the Public Lands Highways Discretionary Program in the fiscal year 2007 appropriations bill in the amount of \$5 million. These efforts and others will help advance reconstruction of all of segment 4—and thus set the orphaned Beartooth Highway on the road to adoption.

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Concrete pump and delivery trucks are parked on the temporary alignment during construction of a foundation at an MSE wall on the second Bradshaw Crossing. The uphill slope is overlaid with geofabric and soil bolt anchors inserted as a stabilization measure to prevent slope failure.

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**Bert McCauley** is a project manager with CFLHD in Lakewood, CO. He is currently the agency's project manager for segment 4 reconstruction in Wyoming. He has been in transportation engineering for 34 years in various Federal, State, and local government and university capacities, including 18 years with FHWA. He holds a B.S. in civil engineering from Texas Tech University, completed the graduate curriculum in transportation engineering as a recipient of the FHWA fellowship to the Bureau of Highway Traffic at Pennsylvania State University, and is a registered professional engineer in Wyoming and Texas. He can be reached at 720-963-3726 or bert.mccauley@fhwa.dot.gov.

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*For more information, visit [www.cflhd.gov/projects/wy/beartooth/index.cfm](http://www.cflhd.gov/projects/wy/beartooth/index.cfm) or contact Bert McCauley at 720-963-3726 or bert.mccauley@fhwa.dot.gov. Additional information about the Beartooth Highway can be found at [www.byways.org/browse/byways/2281](http://www.byways.org/browse/byways/2281).*

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