II. Alternatives

A. INTRODUCTION

This chapter of the Guanella Pass Road FEIS presents the alternatives evaluated during the EIS process for this project. The alternatives in the FEIS are carried forward from the *June 1999 Guanella Pass Road Draft Environmental Impact Statement (DEIS)* and the *November 2000 Guanella Pass Road Supplemental Draft Environmental Impact Statement (SDEIS).*

The alternatives being considered are:

- Alternative 1: No Action Alternative
- Alternative 2: Reconstruct and Pave
- Alternative 3: Reconstruct to Existing Surface Type
- Alternative 4: Partially Reconstruct and Pave
- Alternative 5: Partially Reconstruct and Pave/Partially Rehabilitate
- Alternative 6: The Preferred Alternative

The build alternatives (Alternatives 2-6) are described in Section B and are those that were identified to be reasonable alternatives to address the purpose and need of the project, and to some degree respond to the project objectives stated in **Chapter I: Purpose and Need**. The Preferred Alternative is Alternative 6. Section C provides a comparison of the six alternatives described in Section B. Section D describes options that could be implemented in any of the build alternatives discussed in Section B (Alternatives 2-6). Section E discusses other alternatives that were considered but were determined to not be reasonable alternatives. As a result, they were eliminated from any further evaluation. Finally, Section F discusses issues for the final design.

B. DESCRIPTION OF ALTERNATIVES

1. Alternative 1 – No Action Alternative

Under Alternative 1, construction activities will not occur and forest highway funds would not be spent for improvements to Guanella Pass Road. Maintenance will continue to be funded and performed by the counties. Alternative 1 does not adequately address the project objectives stated in **Chapter I: Purpose and Need**. Alternative 1 neither impacts nor improves the quality of the environmental resources in the area. Although Alternative 1 addresses Project Objective VIII, it neither diminishes nor enhances the rural and scenic character in the corridor. There will be no construction costs.

Traffic volumes along the corridor are projected to increase above present levels by approximately 1.5 percent per year (a 56 percent increase over a 30-year period from the years 1995 to 2025) under Alternative 1. As traffic volumes increase in response to regional population growth and increased recreational use of Guanella Pass Road and the surrounding NF lands (*Guanella Pass Road Traffic Study, Traffic Volume Projections* (MK Centennial 1995)) the

existing problems described in **Chapter I: Purpose and Need** will become worse. This includes dust and erosion impacts, deterioration of the road surface, operational and safety problems, and the difficulty and cost of proper roadway maintenance. The road would likely deteriorate to the point that the maintaining agencies would either have to perform significant reconstruction work when they have the funding, time, and personnel available to perform such work, or the maintaining agencies would have to restrict road access to avoid liability issues.

2. Alternative 2 (Figure II-1)

Guanella Pass Road would be reconstructed (full reconstruction) and paved with asphalt along its entire length. The roadway alignment will generally follow the existing alignment with some horizontal and vertical improvements. The road will be reconstructed and widened where necessary to achieve a consistent width of 7.2 meters (24 feet) to include a 3-meter (10 feet) lane and a 0.6-meter (2 feet) shoulder in each direction. Drainage, pavement strength, safety, slope stability, vegetation, culvert, and small stream crossing improvements are included.

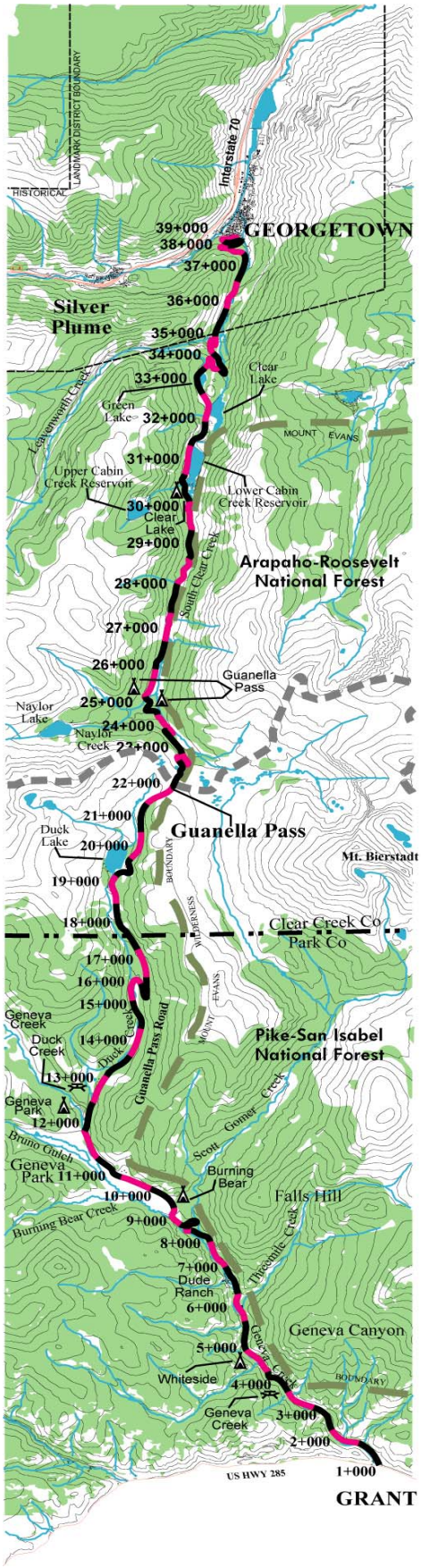
Alternative 2 addresses Project Objectives I, II, III, IV, V, VI, and VII, and partially addresses Project Objective VIII (see **Chapter III.E: Comparison of Alternatives to the Project Objectives**). Throughout the entire route, the horizontal and vertical alignment will be corrected to substantially improve traveler safety and operational conditions; drainage problems are addressed and corrected; roadside parking and access are upgraded and controlled; signs, pavement striping, and guardrail are upgraded to meet current practice; and existing and new slopes are stabilized and revegetated. Guardrail will be placed along 15.7 kilometers (9.8 miles) of the road. This alternative will cost approximately $46.1 million to construct. See **Chapter III.B.6b: Construction Cost** for more information on this topic.

Traffic volumes are expected to increase over the No Action Alternative projected increases as a result of the construction of Alternative 2. The year 2025 increases are estimated to be between 40 percent and 80 percent above the year 2025 No Action Alternative traffic volumes at the summit. See **Chapter III.B.1b: Traffic Volumes** for more information on projected traffic volume increases.

3. Alternative 3 (Figure II-2)

Guanella Pass Road will be reconstructed (full reconstruction) and resurfaced to its existing surface type. Those portions of Guanella Pass Road that are currently paved would be resurfaced with an asphalt surface and those portions of the road that are currently dirt/gravel would be resurfaced with a gravel or stabilized gravel surface. The roadway alignment generally follows the existing alignment, with the same horizontal and vertical improvements as in Alternative 2. The road will be reconstructed to a consistent width of 7.2 meters (24 feet) to include a 3-meter (10 feet) lane and a 0.6-meter (2 feet) shoulder in each direction. Drainage, structural, safety, slope stability, vegetation, culvert, and small stream crossing improvements are included. Under Alternative 3, the entire road undergoes full reconstruction with 52 percent gravel/stabilized gravel surface and 48 percent paved. This alternative will cost approximately $44.6 million to construct. See **Chapter III.B.6b: Construction Cost** for more information on this topic.

Alternative 3 addresses Project Objectives I, II, III, V, and VI, and partially addresses Project Objectives IV, VII, and VIII. Alignment, safety, drainage, access control, slope stability, and revegetation improvements would be constructed along the entire length of the roadway. Guardrail will be placed along 15.7 kilometers (9.8 miles) of the road. Traffic volumes on the



Legend

- Full Reconstruction (Paved)
- Georgetown - Silver Plume National Historical Landmark District Boundary
- Mount Evans Wilderness Boundary
- Pike-San Isabel/Arapaho-Roosevelt National Forest Boundary
- Picnic Area
- Campground

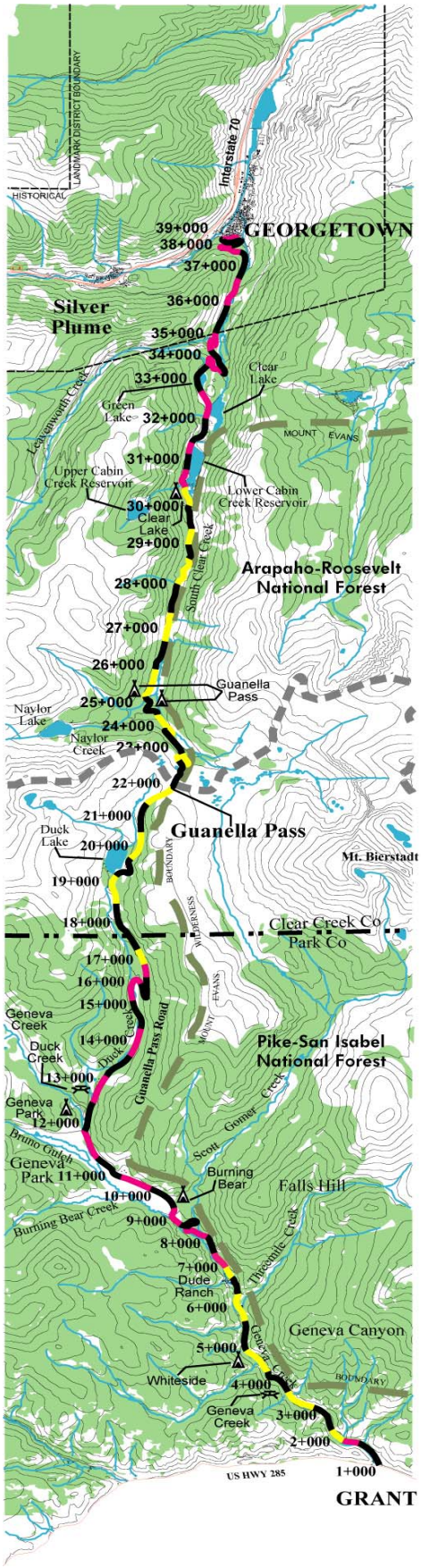
N

0 1500 3000 6000 meters

Approximate Scale
1: 120,000
1" = 10,000'

Contour Interval
12 meters (40 feet)

Figure II-1
Alternative 2



Legend

- Full Reconstruction (Paved)
- Full Reconstruction (Gravel w/Dust Palliative)
- Georgetown - Silver Plume National Historical Landmark District Boundary
- Pike-San Isabel/Arapaho-Roosevelt National Forest Boundary
- Picnic Area
- Campground

N

0 1500 3000 6000 meters

Approximate Scale
1: 120,000
1" = 10,000'

Contour Interval
12 meters (40 feet)

Figure II-2
Alternative 3

roadway are expected to increase over the No Action Alternative projected increases as a result of the construction of Alternative 3. The year 2025 increases are estimated to be approximately 35 percent above the year 2025 No Action Alternative traffic volumes at the summit.

4. Alternative 4 (Figure II-3)

Four sections of Guanella Pass Road will be reconstructed (full reconstruction) and paved with asphalt to the same standard as Alternative 2. The four improvement segments are shown in Figure II-3. The four sections proposed for improvement in this alternative are in the greatest need of reconstruction. They include the Falls Hill area, the area along Duck Creek over the summit to Lower Cabin Creek Reservoir, the Green Lake area, and the Georgetown terminus.

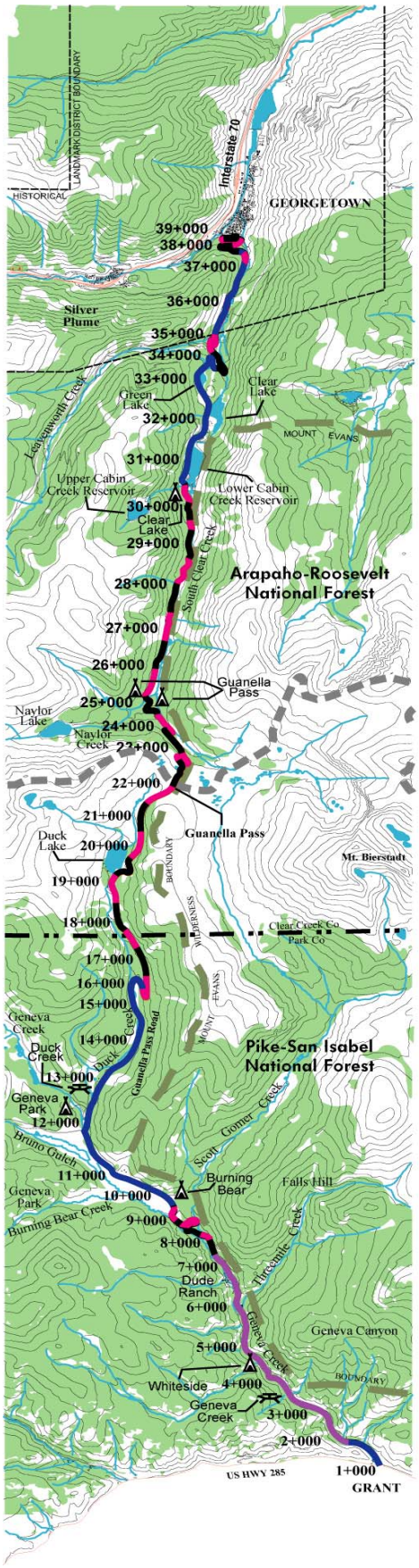
The sections identified as having the greatest need of reconstruction include one or more of the following deficiencies:

- numerous substandard or unsafe geometric features
- insufficient width for design vehicles to safely pass in opposite directions
- limited sight distance
- excessive maintenance costs
- severe environmental degradation
- severe slope stability problems
- insufficient ditch width and drainage problems
- hazardous and steep roadside conditions
- steep roadway gradients

Drainage, structural, safety, slope stability, vegetation, culvert, and small stream crossing improvements are included along the four sections. Guardrail will be placed along 10.3 kilometers (6.4 miles) of the road. The remainder of the road will be left unchanged. Under Alternative 4, 50 percent of the road undergoes full reconstruction and is paved, 36 percent is left unchanged with a paved surface, and 14 percent is left unchanged with a gravel/stabilized gravel surface. This alternative will cost approximately $29.2 million to construct. See **Chapter III.B.6b: Construction Cost** for more information on this topic.

Alternative 4 partially addresses Project Objectives I, II, III, IV, V, VI, VII, and VIII. Each project objective is only partially met because the intent of Alternative 4 is to reconstruct only areas most deficient and in the greatest need. The sections not reconstructed under Alternative 4 do not meet most of the project objectives. However, they are not considered to be nearly as deficient as the sections of the route that are reconstructed.

Traffic volume increases over the No Action Alternative projected increases are expected to result from the construction of Alternative 4. The year 2025 increases are estimated to be between 40 percent and 80 percent of the year 2025 No Action Alternative traffic volumes at the summit. This increase is similar to the increase forecasted for Alternative 2 because approximately 85 percent of the road (including the summit) is paved under Alternative 4.



Legend

- Existing-No Action (Gravel)
- Existing-No Action (Paved)
- Full Reconstruction (Paved)
- Georgetown - Silver Plume National Historical Landmark District Boundary
- Mount Evans Wilderness Boundary
- Pike-San Isabel/Arapaho-Roosevelt National Forest Boundary
- Picnic Area
- Campground

N

0 1500 3000 6000 meters

Approximate Scale
1: 120,000
1" = 10,000'

Contour Interval
12 meters (40 feet)

Figure II-3
Alternative 4

5. Alternative 5 (Figure II-4)

Guanella Pass Road will be reconstructed (full reconstruction) and paved in a manner similar to Alternative 4 and the remainder of the road will be rehabilitated. The same four sections of the road that are reconstructed in Alternative 4 would be reconstructed and paved with asphalt in Alternative 5. Drainage, structural, safety, slope stability, vegetation, culvert, and small stream crossing improvements are included in these four sections. Guardrail would be placed along 10.3 kilometers (6.4 miles) of the road. The rehabilitation sections are the same as those sections left unchanged in Alternative 4. The rehabilitation sections will receive the following improvements: a pavement overlay or gravel/stabilized gravel overlay consistent with the existing surface type, drainage improvements, and revegetation of barren (existing) slopes to the extent possible without changing the existing slope angle. The rehabilitated sections of Guanella Pass Road will match the existing roadway widths. Under Alternative 5, 50 percent of the road undergoes full reconstruction and is paved, 36 percent is rehabilitated with asphalt pavement, and 14 percent is rehabilitated with a gravel/stabilized gravel surface. This alternative will cost approximately $35.9 million to construct. See **Chapter III.B.6b: Construction Cost** for more information on this topic.

Alternative 5 only partially meets project objectives I, II, IV, VI, VII, and VIII. Because the intent of this alternative is to reconstruct only four sections and rehabilitate the rest of the road, only project objectives III and V (access and drainage) are met completely.

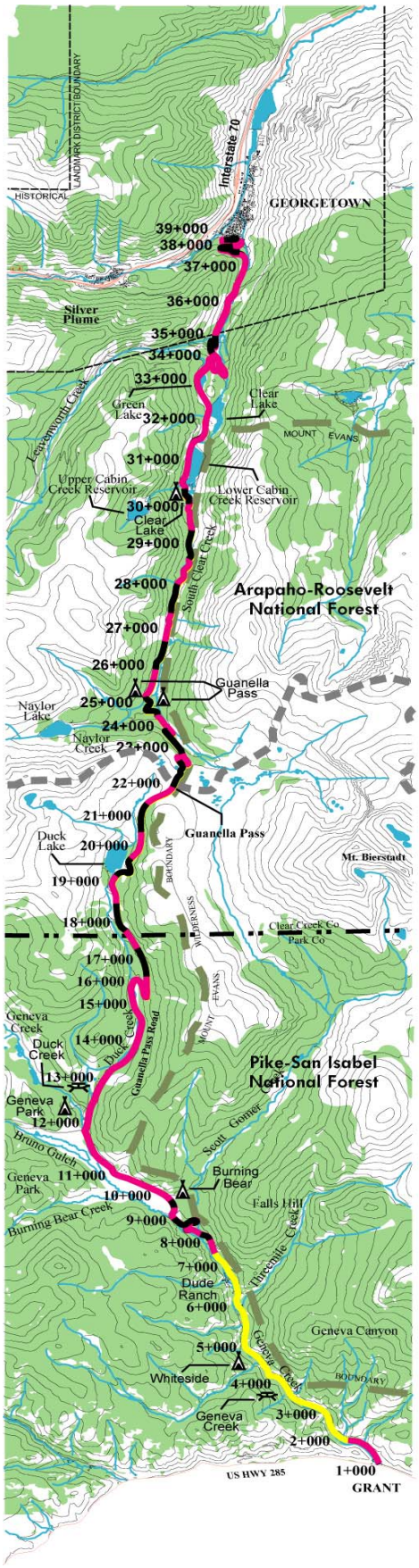
Traffic volume increases over the No Action Alternative projected increases are expected to result from the construction of Alternative 5. The year 2025 increases are estimated to be between 40 percent and 80 percent of the year 2025 No Action Alternative traffic volumes at the summit.

6. Alternative 6 – The Preferred Alternative (Figure II-5)

In the SDEIS Alternative 6 was divided into 36 segments. Each segment was defined by a level of construction (rehabilitation, light reconstruction, and full reconstruction), and surface type. Since the release of the SDEIS an alternative surface type has been identified as preferred to gravel on certain existing gravel sections of the road. This resulted in increasing the number of segments from 36 to 38. The locations of these segments are indicated in **Chapter II.D.1: Proposed Improvements by Segment**.

Approximately 63 percent of the roadway improvement will include rehabilitation, 18 percent will include light reconstruction and 19 percent will include full reconstruction. These proposed portions might be slightly modified as the design for the road is further developed. Figure II-5 shows Alternative 6 and the different levels of construction that are proposed. Figure II-6 illustrates the approximate limits of construction for rehabilitation, light reconstruction, and full reconstruction of the roadway (see **Chapter II.D.4e: Typical Cross Sections** for more detail). This alternative will cost approximately $28.9 million to construct. See **Chapter III.B.6b: Construction Cost** for more information on this topic.

Road surface, safety, drainage, access control, slope stability, and revegetation improvements are proposed for construction along the roadway. Guardrail and/or guardwall (includes stand-alone guardrail, guardrail on Mechanically Stabilized Earth [MSE] walls, and concrete guardwalls) is proposed along 8.6 kilometers (5.3 miles) of the road.



Legend

- Rehabilitation (Paved)
- Rehabilitation (Gravel w/Dust Palliative)
- Full Reconstruction (Paved)
- Georgetown - Silver Plume National Historical Landmark District Boundary
- Mount Evans Wilderness Boundary
- Pike-San Isabel/Arapaho-Roosevelt National Forest Boundary
- Picnic Area
- Campground

N

0 1500 3000 6000 meters

Approximate Scale
1: 120,000
1" = 10,000'

Contour Interval
12 meters (40 feet)

Figure II-4
Alternative 5

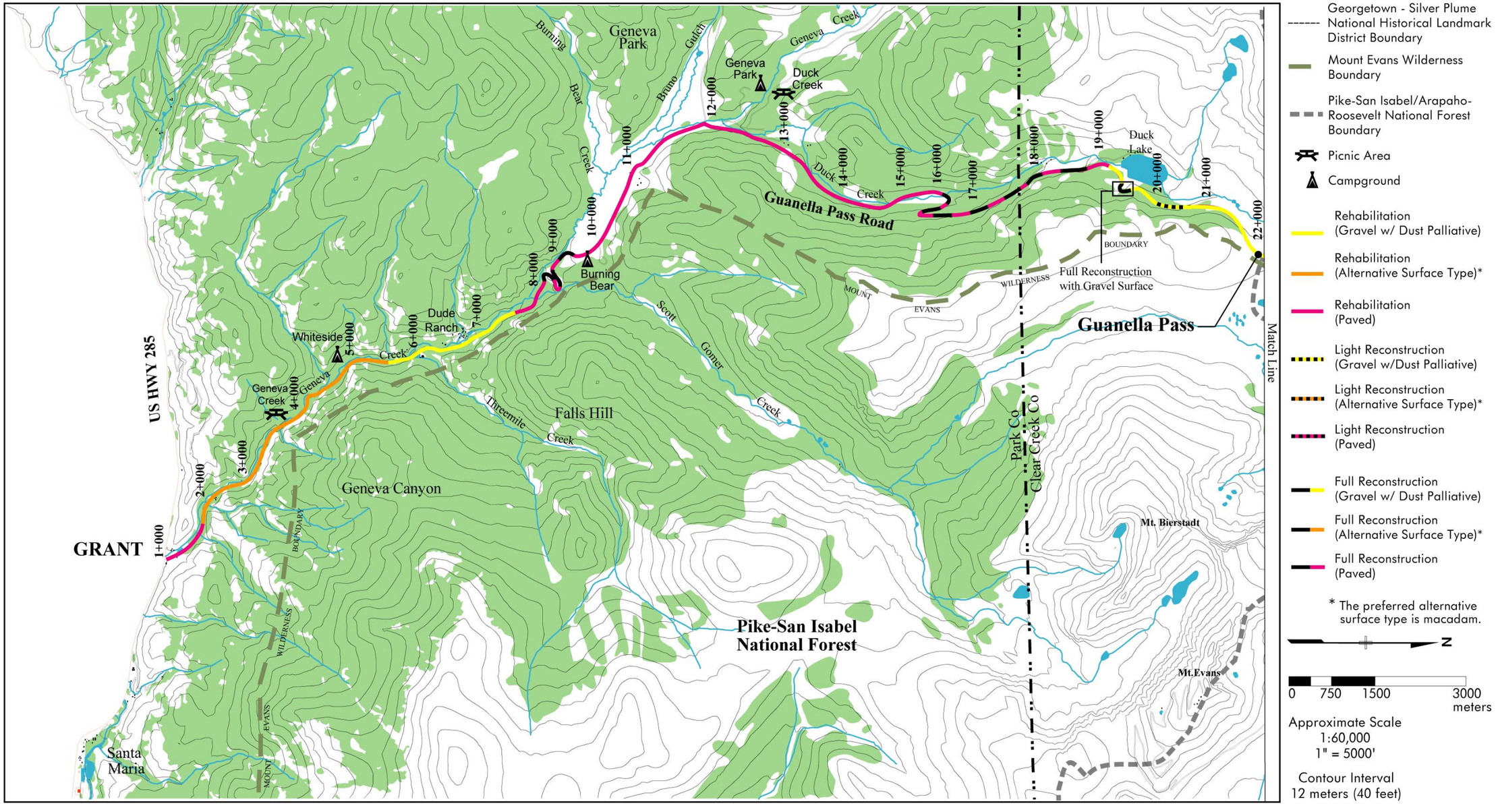


Figure II-5 Alternative 6 (The Preferred Alternative)

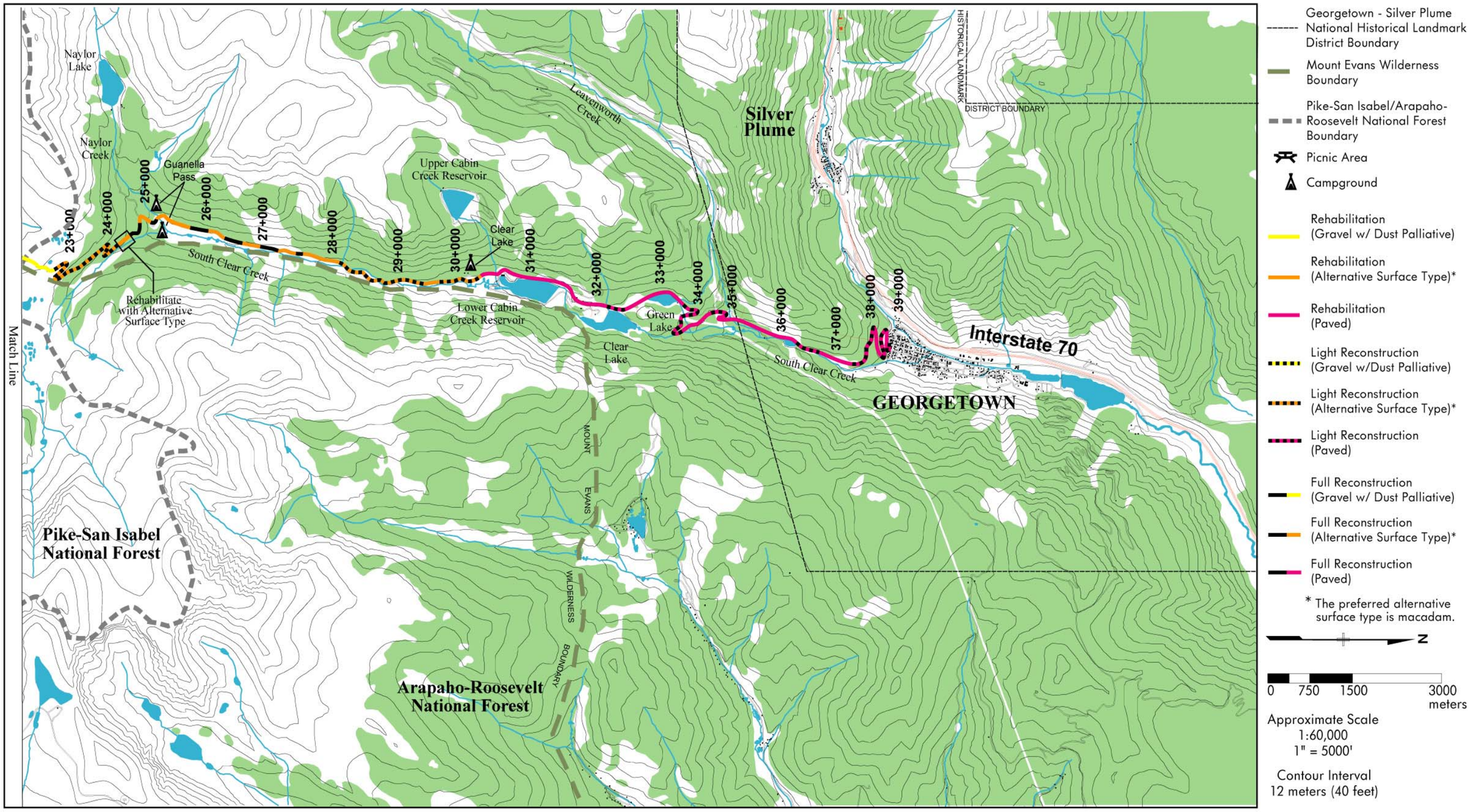


Figure II-5 (cont.) Alternative 6 (The Preferred Alternative)

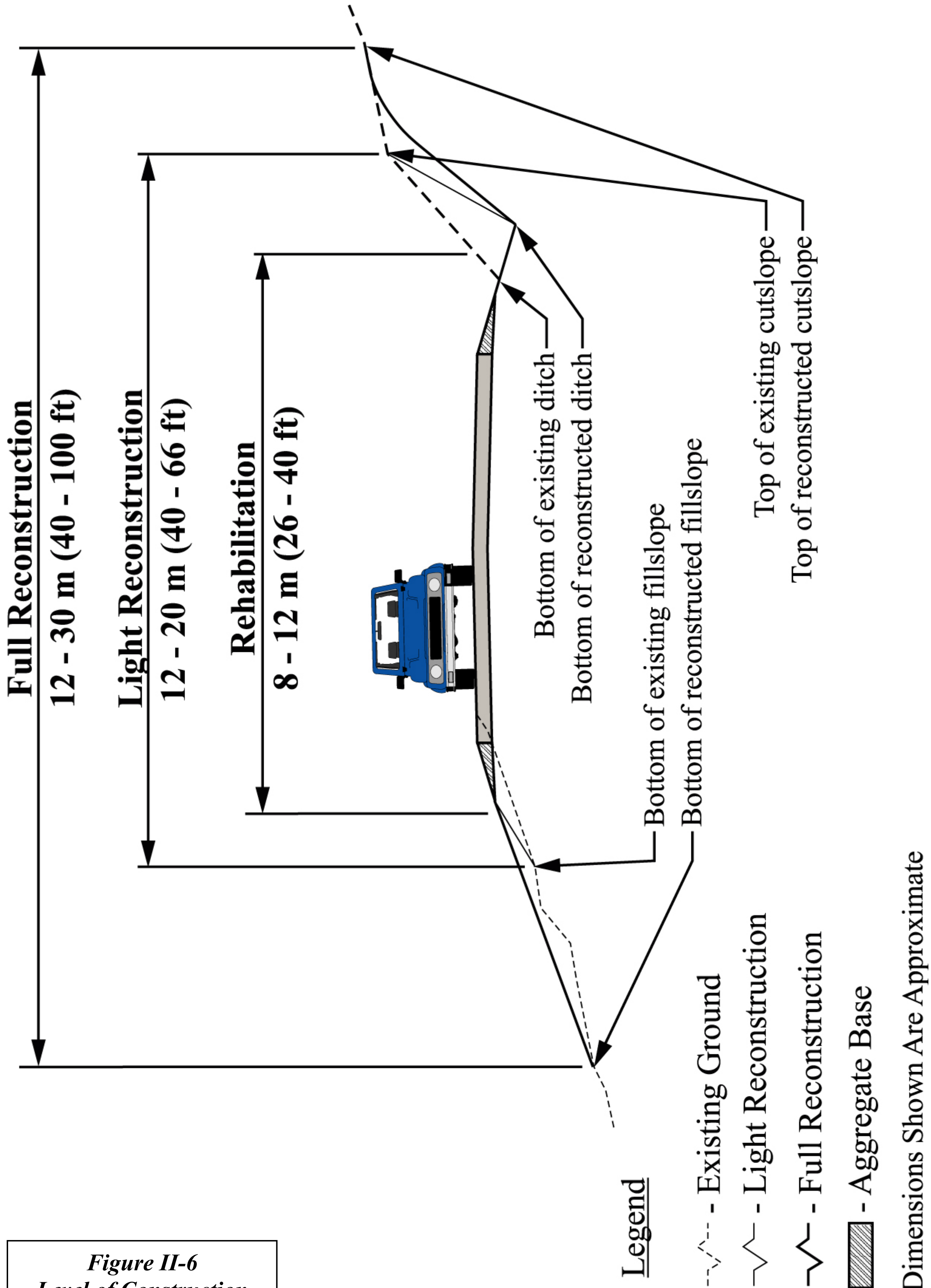


Figure II-6
Level of Construction

In Alternative 6 the road is given a new functional classification of a rural local road, as described in **Chapter II.D.4a: Functional Classification**. This classification allows for the design of a roadway containing relatively sharp switchback curvature. This permits Alternative 6 to more closely follow the existing footprint of the road.

Traffic volume increases over the No Action Alternative projected increases are expected to result from the construction of Alternative 6. The traffic increases for Alternative 6 in the year 2025 are estimated to be about 20 percent above the year 2025 No Action Alternative traffic volumes at the summit. Design standards were selected based on AADT. A maximum of 600 vehicles per day (vpd) is allowable for the design standards selected. Alternative 6 traffic projections are not expected to exceed 600 vpd. See **Chapter III.B.1b: Traffic Volumes** for more information on projected traffic volumes.

Based on the information given in **Chapter III.E: Comparison of Alternatives to the Project Objectives**, Alternative 6 addresses Project Objectives I, III, and V, and partially addresses Project Objectives II, IV, VI, VII, and VIII.

Several alternative surface types were proposed to replace existing gravel surfacing for about 30 percent of the route. These surface types are evaluated in this document, and macadam has been selected as preferred. Macadam was identified as the preferred alternative surface type because it best provided the rustic appearance and rough ride that much of the public requested to preserve while at the same time providing a more hardened surface that reduces sediment runoff which is a concern for the FS and the counties. Although the decision on surface type will not be made until publication of the ROD, "macadam" has been identified as the preferred surface type.

In Alternative 6, the roadway will be resurfaced with asphalt with chipseal, and a stabilized gravel of either macadam or gravel with a dust suppressant. In general, the existing paved sections of the road will be resurfaced using asphalt pavement or asphalt pavement with chip seal. The existing gravel sections will be surfaced with either gravel and a dust suppressant or macadam. There is one section that is currently a gravel surface that is proposed to be paved with an asphalt surface. This location is a 3.0 kilometer (1.8 mile) section of road near the Park County and Clear Creek County line (Shelf Road - station 16+140 to 19+140). This section is proposed to be surfaced with asphalt at the request of the maintaining agency (Park County) to reduce costs associated with maintenance of the road.

The decision to use a combination of roadway surfaces is in response to the needs and concerns expressed by the FS, Park County, Clear Creek County, and the Town of Georgetown. These needs and concerns include erosion and sedimentation control, minimizing maintenance efforts and costs, and maintaining a rustic and rural character to the road. Guanella Pass Road was evaluated to determine the best surface type to address the most substantial issues for several sections of the road. Discussions between the FHWA, the FS, Park County, Clear Creek County, and the Town of Georgetown yielded the results shown in Table II-1.

6a. Surfacing Options

The local communities and agencies involved have expressed concern over the erosion and sedimentation problems created by the combination of poor drainage with the gravel surface on Guanella Pass Road. Clear Creek County and Park County also feel that the gravel surface is a maintenance cost issue and are searching for an alternative to minimize anticipated costs for road maintenance. Nevertheless, the local communities have expressed a desire for the gravel surface because the look and feel of this surface contributes to the rustic character of the road. Because

Table II-1
Roadway Surfacing – Alternative 6

Beginning Station	Length	Surface Type	General Location
1+000	0.77 km (0.48 mi)	Pave with chip-seal	Grant
1+770	3.73 km (2.32 mi)	Alternative Surface Type*	Geneva Canyon
5+500	2.00 km (1.24 mi)	Gravel w/dust suppressant	Geneva Canyon
7+500	11.64 km (7.23 mi)	Pave with chip-seal	Geneva Park (Falls Hill, Shelf Road)
19+140	3.31 km (2.06 mi)	Gravel w/dust suppressant	Guanella Pass
22+450	2.91 km (1.81 mi)	Alternative Surface Type*	Upper Clear Creek Switchbacks
25+360	2.78 km (1.73 mi)	Alternative Surface Type*	Upper South Clear Creek
28+140	1.26 km (0.78 mi)	Alternative Surface Type*	Middle South Clear Creek
29+400	0.82 km (0.51 mi)	Alternative Surface Type*	Lower South Clear Creek
30+220	8.58 km (5.33 mi)	Pave with chip-seal	Cabin Creek
38+800	0.40 km (0.25 mi)	Pave	Georgetown Switchbacks
**The preferred alternative surface type is macadam.*			

of these conflicting concerns, the FHWA is considering five gravel stabilizing options in addition to gravel. The alternative surface types stabilize the gravel road surface, provide better structuralintegrity and maintainability than a gravel surface, and provide a more rustic appearance and texture than asphalt pavement. In addition, the FHWA is considering a chip seal surface over asphalt to give the paved sections of the road a more rustic appearance. While alternative surface types are discussed under Alternative 6, various elements of the different build alternatives, including the alternative surface types, could be combined in the ROD.

The optional surface types and/or treatments analyzed include:

1. Magnesium Chloride/PennzSuppress D
2. Macadam Construction
3. Road Oyl
4. Permazyme
5. Recycled Asphalt
6. Chip Seal over Asphalt

As part of the continuing effort to address public concerns regarding the Guanella Pass Road Improvement project, the FHWA constructed road surfacing test strips on Guanella Pass Road south of the Cabin Creek hydroelectric power plant during the summer of 2001. The purpose of the test strips was to provide a demonstration of the five different gravel alternative surface types being considered for use on most of the existing gravel portions of the road. In addition to the five gravel alternatives, an asphalt with chip seal test strip was installed, as this surface is being considered for use on the paved sections of the road.

Each of the optional surface types has a longer structural life than an untreated gravel road surface and requires less maintenance than a gravel road surface. Each optional surface type is described below based on appearance, surface characteristics, dust suppression, and scattering characteristics. Table II-2 compares roadway surfacing alternatives. A full analysis of the maintenance costs and life expectancy is included in **Chapter III.C.11: Maintenance Costs**.

(i) Magnesium Chloride/PennzSuppress D

$MgCl_2$ and PennzSuppress D are binding agents used for stabilizing gravel. The products can be combined with water and sprayed into a gravel surface. The product emulsion is mixed with the gravel and compacted onto a gravel base. The mixture binds the soil and gravel particles to hold the road together.

Table II-2
Roadway Surfacing Alternatives

Surface Type	Construction Costs	Expected Life	Requires Striping?	Maintenance Schedule	Maintenance Effort	Pros	Cons
Gravel	Low	1-2 years	No	2-3 times a year	Replace gravel as it is lost, regrade	Inexpensive construction	Dusty, very high maintenance from beginning
Gravel with Magnesium Chloride ($MgC1_2$)	Low	1-2 years	No	2-3 times a year	Replace gravel, regrade, reapply $MgC1_2$	Inexpensive, less dusty than plain gravel	Very high maintenance from the beginning; remains "soggy" long after precipitation.
Macadam	Medium	10 years	Yes	Every 2-3 years	Fill potholes, restripe	Easy construction, lower cost with reasonable design life, low maintenance	Not as durable as asphalt
Road Oyl	Low	2-5 Years	No	Yearly to twice a year	Fill potholes and cracks	Provides a smoother surface compared to gravel.	High maintenance, not as durable as asphalt
Permazyme	Low	2-5 years	No	Yearly to twice a year	Fill potholes and cracks	Provides a smoother surface compared to plain gravel.	High maintenance, not as durable as asphalt
Recycled Asphalt Pavement	Low	2-5 years	No	Yearly to twice a year	Replace recycled asphalt, regrade	Inexpensive, holds together better than gravel	High maintenance from the beginning, asphalt scatters immediately adjacent to the road
Single Layer Surface Treatment (Chip Seal)	Medium	5-7 years	Yes	Yearly to twice a year	Fill potholes, restripe	Provides a smoother surface compared to plain gravel.	Short design life, requires maintenance from the beginning
Asphalt	High	20 years	Yes	Every 2-3 years	Fill potholes and cracks, restripe	Durable, little to no maintenance needed for first 5 years	Requires more maintenance later in the pavement life

This emulsified petroleum resin is characterized as having a thick, milky, dark-brown appearance. It is soluble in water, and has a specific gravity of 1.0254 (heavier than pure water). Because this product contains water, it is non-flammable and safe during use. It is also considered to be non-toxic to aquatic life. See Figure II-7 for an example of $MgCl_2$/PennzSuppress D.

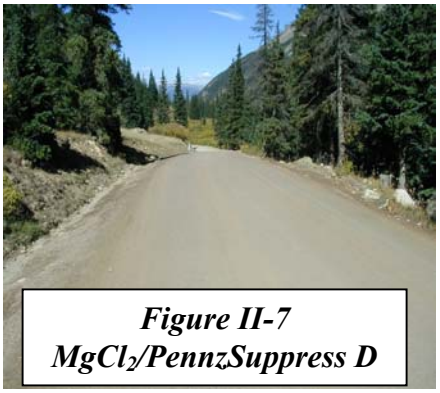


Figure II-7
$MgCl_2$/PennzSuppress D

The combination product is useful for the treatment of road aggregate. PennzSuppress D is used to stabilize road base aggregate materials, reducing soil erosion and protecting vegetation from blowing dust and sand. As a general rule, the rate of penetration is rapid in sandy soil, moderately fast in silty soil and slow in clayey soil.

This product is spread directly on the road surface and is specifically made for dust control. PennzSuppress D contains binding agents to hold soil particles together and prevent them from being dispersed into the air. It is normally diluted to a 4:1 ratio (80% water, 20% product). Product may be diluted in different concentrations depending on the specific site needs. An independent study in the Mojave Desert found that PennzSuppress D was only 10% effective in reducing emissions of particulate matter less than ten microns in diameter (PM 10).

As mentioned above, the product is diluted with water. This means that the product would have to be reapplied often since it is water-soluble and tends to wash away whenever it rains or snows. The Guanella Pass Road test strip survey revealed that scattering of the gravel surface began shortly after application. This product must be applied during a season when temperatures remain above freezing.

(ii) Macadam Construction

The construction of a macadam surface begins with a prepared subgrade. The subgrade is overlaid with crushed rock, which is then covered with liquid asphalt that is allowed to penetrate. This process is repeated with successively smaller rock - a kind of asphalt and rock sandwich. See Figure II-8 for an example of a macadam surface.

Figure II-8
Macadam

Maintenance is similar to a chip seal surface. The surface is not as durable as chip seal over pavement, and it will not withstand stress such as turning traffic or snow plowing as well as a paved surface with chip seal.

Since this process involves asphalt oil placed with layers of rock, there should be minimal amounts of dust. Therefore, dust suppression should not be a factor with macadam.

Macadam tends to "bleed" during hot weather. This would produce a tar like substance on the roadway. This in turn would most likely end up on vehicles, including maintenance trucks, driving on the roadway surface. The test strip survey performed on Guanella Pass Road indicated that macadam withstood traffic well, with relatively little material scattering.

(iii) Road Oyl

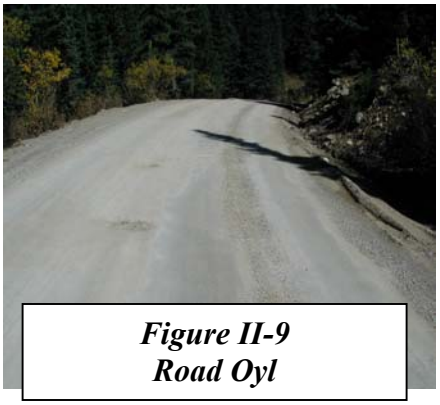


Figure II-9
Road Oyl

This is a proprietary product made from natural tree resins. The Road Oyl emulsion is mixed into the top layer of a new gravel surface and compacted onto a gravel base. The tree resin binds the gravel surface together to create a hardened surface. See Figure II-9 for an example of Road Oyl.

This product is usually applied in a liquid form. One advantage of this product is that it is applied cold. This eliminates the need for heated storage and transport that is needed for most asphalt based surfaces. This product is usually applied to the aggregates on the roadway surface and then compacted. The result is a roadway that retains the characteristic coloration of the constituent aggregate materials. Also, the surface remains cool during the summer.

This product is well suited for general dust control requirements. It bonds the surface so that dust is minimized. This product was evaluated against the PennzSuppress D brand. Road Oyl had a 30 percent effectiveness rating at reducing PM (10) emissions (PennzSuppress D had a 10 percent effectiveness rating). Next to acrylic copolymers, Road Oyl was the most effective during the testing. [1]

Product is applied to the road surface, which then becomes "tacky" for a period of time. The curing process for this product may take over a week, during which time it should not be driven on. This product dries into the roadway, minimizing scattering. This product is claimed to be appropriate for use even in close proximity to wetland areas and other areas of extreme environmental sensitivity. The test strip survey revealed scattering of this road surface after a short period of time.

(iv) Permazyme

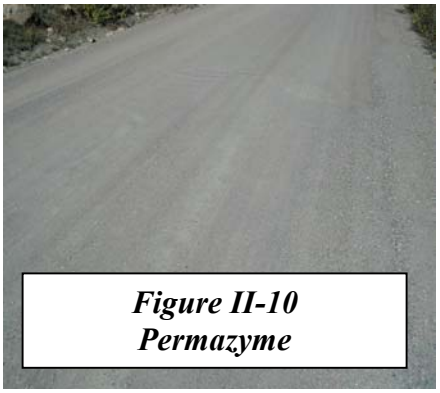


Figure II-10
Permazyme

Permazyme contains an enzyme that reacts with the clay particles in a gravel roadbed. The product is mixed with water and sprayed into the gravel surface. The gravel and product are then blended together and compacted onto a gravel base. As the product dries, it binds the clay and gravel particles together and creates a hardened surface. This product is in a liquid concentrate form, which is added to water before final application. It is non-toxic, non-corrosive, and totally biodegradable. See Figure II-10 for an example of Permazyme.

This product bonds the roadway materials together, providing for a non-permeable condition that reduces road wear. This product helps to control dust by eliminating a soft surface and dust created from traffic. This product is marketed more for the roadway stability and durability and not dust control. No tests were found concerning this product.

[1] Saunders, Mark. "Just Say 'No' to Dust…Maybe." http://www.forester.net/gec_0005_just.html (18 Sept. 2001).

Since this product is applied beneath the roadway surface, the scattering is minimal. As with Road Oyl, this product requires a curing period of at least one week, during which time it should not be driven on. Since the product helps form a water barrier, the product would most likely not wash away. If some of the product is dissolved by weathering or runoff, it will not harm humans, animals, fish or vegetation under normal use.

(v) Recycled Asphalt

A special machine called a milling machine breaks up asphalt as it is removed from old roads. The old asphalt is then pulverized into smaller pieces for use as a subbase or base material in new roadways. It can also be used as a surface course. The recycled material contains some residual asphalt. The recycled asphalt is mixed with locally occurring crushed rocks and other aggregate. When the recycled material is bladed and compacted into place onto a strong subgrade, the residual asphalt acts as a binder to the crushed pieces and creates a hardened surface. Any recycled asphalt used on Guanella Pass Road will need to be hauled in from another site. See Figure II-11 for an example of Recycled Asphalt.

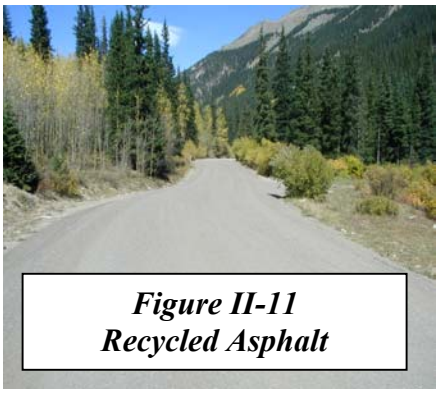


Figure II-11
Recycled Asphalt

When recycled asphalt is used as a new surface material, the surface looks similar to a gravel road. The material is not loose, as it would be with gravel. Since the recycled asphalt is compacted into a hardened surface, the roadway should produce minimal amounts of dust and scattering should not be a concern. Even after the roadway wears down, it should not produce any dust. After some normal use though, the surface allows some loosening of materials that get pushed to the side of the travel way.

(vi) Chip Seal over Asphalt

The new asphalt paved surface is covered with a coat of liquid asphalt. This is followed by a layer of coarse aggregate about 1.9 centimeters (0.8 inches) in diameter. See Figure II-12 for an example of Chip Seal.

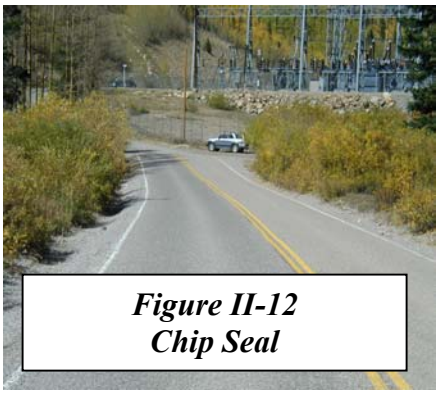


Figure II-12
Chip Seal

A chip seal is an application of liquid asphalt followed with small pea-size chips of gravel; however, coarser sizes of aggregate can be used to provide a rougher, more rustic surface. Chip seals are used to retard pavement deterioration, improve skid resistance and waterproof the old pavement. In a single chip seal, an asphalt binder is sprayed on the pavement, then immediately covered by a single layer of uniformly sized chips. A double chip seal is sometimes used to convert a gravel road to a hardened road. This helps reduce maintenance costs on roads where traffic volumes quickly cause the gravel road to "washboard" and pothole as well as providing a nearly dust-free driving surface.

Chip seals improve safety by improving the skid resistance for vehicles as compared to plain asphalt. Chip seals also waterproof the surface and seals small cracks and imperfections.

Since chip seals are essentially hard pavement surfaces, there would be no dust associated directly with the surface treatment. Therefore, chip seals are a very effective means of controlling dust.

Chip seals are applied directly to the surface of the existing roadway. Since chip seals are a hardened surface, there should be no scattering of the surface material. The Guanella Pass test strip survey confirmed this.

C. SELECTION OF THE PREFERRED ALTERNATIVE

The FHWA has selected Alternative 6 as its preferred alternative. The preferred alternative has been selected based on environmental studies addressed in this FEIS and consultation with the public, Town of Georgetown, Clear Creek County Commissioners, Park County Commissioners, State of Colorado, FS, US Fish and Wildlife Service (USFWS), USACE, EPA, and local tribes. The preferred alternative best balances efforts to address the Purpose and Need for the action while at the same time minimizing social, economic, and environmental impacts.

Alternative 6 would address the Purpose and Need for this project by:

- Improving the road structure and surface to accommodate projected traffic volume and road users for the next 20 years.
- Correcting the majority of the existing roadway deficiencies although some design exceptions would be needed, most notably for tight curves in the switchback sections of the roadway.
- Providing access needed to allow the FS to more effectively protect and manage the two Forests' natural resources and recreational opportunities.
- Implementing slope stabilization measures where feasible, providing a hardened surface to portions of the road located near streams, and improving drainage all for the purposes of addressing current soil erosion and sedimentation problems associated with the condition of the existing road surface, unvegetated cut slopes, and poor drainage.
- Improving the road so that projected future costs to effectively maintain the road are greatly reduced in comparison with the projected future costs to effectively maintain the road it its current condition.
- Surfacing the road with asphalt pavement with chip seal, gravel with dust suppressant, or alternative hardened surface type to reduce dust and sediment runoff.

Of the alternatives evaluated, the preferred alternative has been selected for implementation for the following reasons:

- Alternative 6, to the greatest extent among the proposed build alternatives, would match the footprint of the existing road thereby minimizing social, economic, and environmental impacts.
- Alternative 6 would result in the smallest increase in future traffic over the No Action Alternative.

- Alternative 6, to the greatest extent among the proposed build alternatives, would maintain the rural character of the road.

D. COMPARISON OF ALTERNATIVES

Alternatives 2-6 differ in several ways including: the number of segments identified for the level of improvements, the length of paved sections, the proportion of rehabilitation, the type of reconstruction, the design criteria, the typical roadway cross section width, and special sections.

1. Proposed Improvements by Segment

The number of segments for Alternative 6 is greater than for Alternatives 2-5. Guanella Pass Road is divided into 38 segments to identify different surface types and more locations where rehabilitation is appropriate. For the purpose of comparison, Table II-3 breaks Alternatives 1-5 into the same 38 segments as Alternative 6. A justification for the type of improvements proposed for each of the segments (as presented in the SDEIS) in Alternative 6 is provided in **Appendix C: Rationale for the Design Criteria and the Proposed Improvements**. For more information on rehabilitation and reconstruction, see **Chapter II.D.4e: Typical Cross Sections**.

Table II-3
Identification of Proposed Improvements*

Segment	Station	Length km (mi.)	Existing	Alternative 1 – No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Grant	1+000 to 1+770	0.77 (0.48)	Paved	No Action	**Full Reconstruct & Pave****	**Full Reconstruct & Pave****	No Action	*Rehabilitate & Pave***	*Rehabilitate & Pave***
Geneva Canyon A	1+770 to 5+500	3.73 (2.32)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	No Action	*Rehabilitate with Gravel*	*Rehabilitate with Alt. Surface Type*****
Geneva Canyon B	5+500 to 7+000	1.50 (0.93)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	No Action	*Rehabilitate with Gravel*	*Rehabilitate with Gravel****
Falls Hill A	7+000 to 7+500	0.50 (0.31)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate with Gravel****
Falls Hill B	7+500 to 8+100	0.60 (0.37)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate & Pave*
Falls Hill C	8+100 to 9+380	1.28 (0.80)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**
Geneva Park	9+380 to 16+140	6.76 (4.20)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	No Action	*Rehabilitate & Pave*	*Rehabilitate & Pave*
Shelf Road – Park Co.	16+140 to 17+800	1.66 (1.03)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**
Shelf Road – Clear Creek Co.	17+800 to 19+140	1.34 (0.83)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**
Duck Lake A	19+140 to 19+440	0.30 (0.19)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate with Gravel****

Segment	Station	Length km (mi.)	Existing	Alternative 1 – No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Duck Lake B	19+440 to 19+530	0.09 (0.06)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel*** **
Duck Lake C	19+530 to 20+080	0.55 (0.34)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate with Gravel****
Above Duck Lake	20+080 to 20+480	0.40 (0.25)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Light Reconstruct with Gravel*** **
Above Duck Lake to Pass	20+480 to 21+870	1.39 (0.86)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate with Gravel****
Pass to Upper Switchbacks	21+870 to 22+450	0.58 (0.36)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate with Gravel****
Upper Switchbacks	22+450 to 24+180	1.73 (1.08)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Light Reconstruct with Alt. Surface Type*****
Upper Clear Creek	24+180 to 24+480	0.30 (0.19)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate with Alt. Surface Type****
Naylor Creek	24+480 to 25+360	0.88 (0.55)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct with Alt. Surface Type*****
South Clear Creek A	25+360 to 25+700	0.34 (0.21)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate with Alt. Surface Type****
South Clear Creek B	25+700 to 27+560	1.86 (1.16)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct with Alt. Surface Type*****
South Clear Creek C	27+560 to 28+140	0.58 (0.36)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate with Alt. Surface Type****
South Clear Creek D	28+140 to 29+400	1.26 (0.78)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Light Reconstruct with Alt. Surface Type*****
South Clear Creek E	29+400 to 29+700	0.30 (0.19)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate with Alt. Surface Type****
South Clear Creek F	29+700 to 30+220	0.52 (0.32)	Gravel	No Action	**Full Reconstruct & Pave**	**Full Reconstruct with Gravel**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Light Reconstruct with Alt. Surface Type*****
Cabin Creek	30+220 to 32+260	2.04 (1.27)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	No Action	*Rehabilitate & Pave*	*Rehabilitate & Pave*

Segment	Station	Length km (mi.)	Existing	Alternative 1 – No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Clear Lake	32+260 to 32+400	0.14 (0.09)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	No Action	*Rehabilitate & Pave*	**Light Reconstruct & Pave**
Green Lake	32+400 to 33+580	1.18 (0.73)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	No Action	*Rehabilitate & Pave*	*Rehabilitate & Pave*
Switchbacks	33+580 to 34+300	0.72 (0.45)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	No Action	*Rehabilitate & Pave*	**Light Reconstruct & Pave**
South Clear Creek	34+300 to 34+680	0.38 (0.24)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate & Pave*
Waldorf Road	34+680 to 34+920	0.24 (0.15)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Light Reconstruct & Pave**
Silverdale A	34+920 to 36+320	1.40 (0.87)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	No Action	*Rehabilitate & Pave*	*Rehabilitate & Pave*
Silverdale B	36+320 to 36+600	0.28 (0.17)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	No Action	*Rehabilitate & Pave*	**Light Reconstruct & Pave**
Silverdale C	36+600 to 37+200	0.60 (0.37)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	No Action	*Rehabilitate & Pave*	*Rehabilitate & Pave*
Georgetown Switchbacks A	37+200 to 38+060	0.86 (0.53)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Light Reconstruct & Pave**
Georgetown Switchbacks B	38+060 to 38+300	0.24 (0.15)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate & Pave*
Georgetown Switchbacks C	38+300 to 38+640	0.34 (0.21)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Light Reconstruct & Pave**
Georgetown Switchbacks D	38+640 to 38+800	0.16 (0.10)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	*Rehabilitate & Pave*
Georgetown Switchbacks E	38+800 to 39+200	0.40 (0.25)	Paved	No Action	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Full Reconstruct & Pave**	**Light Reconstruct & Pave**

* The information provided in this table may be subject to minor modification as the final design is further developed.
** All paved sections may also be surfaced with a chip seal over the asphalt pavement.
*** All gravel sections may also be surfaced with one of the five alternative surface types identified in **Chapter II.B.6a: Surfacing Options**.
**** The preferred alternative surface type is macadam.
FONT KEY: Red = Gravel; Blue = Macadam; Black = Paved; *Italics = Rehabilitate*; **Bold = Reconstruct**

2. Percentage of Pavement Sections

Alternative 2 results in paving the entire length (100 percent) of Guanella Pass Road. Alternative 3 is the only build alternative that completely returns the road to the existing surface type so that 48 percent would be paved and 52 percent would be gravel. For Alternative 4, the

existing paved sections (36 percent) will remain paved and additional new paved sections are constructed (50 percent), totaling 86 percent pavement. The other 14 percent will remain as a gravel surface. Alternative 5 is similar to Alternative 4, except that the existing pavement sections (36 percent) and existing gravel sections (14 percent) will be rehabilitated to their respective surface type. Alternative 6 maintains the existing paved surfaces with asphalt pavement or asphalt pavement with chip seal and uses gravel or a stabilized gravel surface in gravel areas with one exception. This exception consists of a 3.0 kilometer (1.8 mile) section of road near the Park County and Clear Creek County line (Shelf Road - station 16+140 to 19+140). This section is proposed to be surfaced with asphalt at the request of the maintaining agency (Park County) to reduce costs associated with maintenance of the road. As a result, Alternative 6 includes 56 percent pavement/chip seal, 14 percent gravel surface with a dust suppressant, and 30 percent macadam/alternative surface type. Table II-4 shows the percentage of paved/chip seal surfaces, gravel surfaces with dust suppressant, and surfaces with alternative surface types for each alternative.

Table II-4
Percentage of Paved/Chip Seal, Gravel, and Alternative Surface Types*

	Alternative 1 – No Action	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**	**Alternative 6**
Paved/Chip Seal	48%	100%	48%	86%	86%	56%
Gravel w/dust suppressant	52%	0%	52%	14%	14%	14%
Alt. Surface Type**	0%	0%	0%	0%	0%	30%
Total	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
** The information provided in this table may be subject to minor modification as the final design is further developed.* *** The preferred alternative surface type is macadam.*						

3. Percentage of Rehabilitation and Reconstruction

Alternative 5 and Alternative 6 are the only alternatives that include rehabilitation of portions of the road. Under Alternative 5, 50 percent of the road is rehabilitated and 50 percent is reconstructed and paved. Alternative 6 increases the total amount of rehabilitation to 63 percent of the road. Alternative 6 also includes 18 percent light reconstruction and 19 percent full reconstruction. Table II-5 shows the mix of improvement work for each alternative. For more information on rehabilitation and reconstruction, see **Chapter II.D.4e: Typical Cross Sections**.

4. Design Criteria and Typical Cross Section

The decisions on design criteria (design speed, road curvature, maximum grade, etc.) are made by an evaluation of the individual characteristics and surroundings of the road and are different for every road. The characteristics of the road must be considered as a whole when making such decisions. Several roads in the region may have steeper grades, narrower widths, tighter curvature, and smaller design vehicles, because a comparison of these roads to Guanella Pass Road is an unequal comparison. These other roads have evolved under different criteria and may have different maintaining authorities. The following discussion is provided to explain why certain design criteria or characteristics were chosen or modified for Alternatives 2-6. Alternative 1 is the No Action Alternative; therefore, existing conditions are not altered.

Table II-5
*Mix of Improvement Work**

	Alternative 1 - No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
No-Action	*100%*	*0%*	*0%*	*50%*	*0%*	*0%*
Rehabilitate						
Rehabilitate & Pave**	0%	0%	0%	0%	36%	37%
Rehabilitate – Gravel	0%	0%	0%	0%	14%	13%
Rehabilitate – Alt. Surface Type***	0%	0%	0%	0%	0%	13%
Rehabilitation Total	*0%*	*0%*	*0%*	*0%*	*50%*	*63%*
Light Reconstruction						
Light Reconstruct & Pave**	0%	0%	0%	0%	0%	8%
Light Reconstruct – Gravel	0%	0%	0%	0%	0%	1%
Light Reconstruct - Alt. Surface Type***	0%	0%	0%	0%	0%	9%
Light Reconstruction Total	*0%*	*0%*	*0%*	*0%*	*0%*	*18%*
Full Reconstruction						
Full Reconstruct & Pave**	0%	100%	48%	50%	50%	11%
Full Reconstruct – Gravel	0%	0%	52%	0%	0%	1%
Full Reconstruct – Alt. Surface Type***	0%	0%	0%	0%	0%	7%
Full Reconstruction Total	*0%*	*100%*	*100%*	*50%*	*50%*	*19%*
Total	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

** The information provided in this table may be subject to minor modification as the design is further developed.*
*** The paved sections may be chip seal on asphalt pavement.*
**** The preferred alternative surface type is macadam.*

4a. Functional Classification

Functional classification identifies streets and highways according to the character of service provided. Roads classified as rural collectors are defined as serving through traffic within local areas. Compared to collectors, rural local roads primarily provide access to land adjacent to the collector network and serve travel over relatively short distances. The rural local road system contains all roads not classified as arterial or collector roads.

For Alternatives 2-5, Guanella Pass Road was classified as a rural collector road. Discussion with the local agencies and additional analysis by the FHWA indicate that the primary use of Guanella Pass Road is to provide access to adjacent properties (public and private). This fits the classification as a rural local road. Neither the existing nor proposed Guanella Pass Road is intended to function as a collector to link through traffic between major arterials (I-70 and US 285). Therefore, the functional classification for Alternative 6 was modified to a rural local road. This classification combined with the relatively low design speed, steep grades, and tight curve radii permit the proposed alignment to follow more closely the existing curves, and therefore, make the road slow-going for anyone using it to travel between these two major highways.

4b. Design Speed

The design speed of Alternative 6 varies between 30 and 50 kilometers/hour (km/h) (20 to 30 miles per hour [mph]). This is 10 km/h (6 mph) less than the 40-60 km/h (25 to 40 mph) design speed for Alternatives 2-5. Exceptions to the design speed are made at the various switchbacks

where the design speeds are reduced to 20 km/h (13 mph). The lesser design speed allows a curvilinear alignment that more closely follows the existing roadway.

For Alternatives 2-5, the design speed for the first 9.3 kilometers (5.8 miles) from Grant to the south end of Geneva Park is 50 km/h (30 mph), except for the Falls Hill area where the design speed is 40 km/h (25 mph). The next 6.4 kilometers (4.0 miles) extending through the Geneva Park area to the base of the switchbacks at station 15+700 has a design speed of 60 km/h (40 mph). For the next 6.2 kilometers (3.8 miles) up to the summit, the design speed is 50 km/h (30 mph). For the remaining 17.3 kilometers (10.7 miles) from the summit to Georgetown, the design speed is 40 km/h (25 mph). As a result, about 50 percent of the road is designed at 40 km/h (25 mph), 35 percent at 50 km/h (30 mph), and 15 percent at 60 km/h (40 mph). Switchbacks require design speed exceptions to reduce the speed to 20 km/h (13 mph).

For Alternative 6, the design speed for the first 9.3 kilometers (5.8 miles) from Grant to the south end of Geneva Park is 40 km/h (25 mph), except for the Falls Hill area where the design speed is 30 km/h (20 mph). The next 6.4 kilometers (4.0 miles) extending through the Geneva Park area to the base of the switchbacks at station 15+700 has a design speed of 50 km/h (30 mph). For the next 6.2 kilometers (3.8 miles) up to the summit, the design speed is 40 km/h (25 mph). For the remaining 17.3 kilometers (10.7 miles) from the summit to Georgetown, the design speed is 30 km/h (20 mph). As a result, about 50 percent of the road is designed at 30 km/h (20 mph), 35 percent at 40 km/h (25 mph), and 15 percent at 50 km/h (30 mph). Switchbacks require design speed exceptions to reduce the speed to 20 km/h (13 mph).

4c. Design Vehicle

The design vehicle used for Alternatives 2-5 was a single-unit truck with a wheelbase of 6.1 meters (20 feet). The design vehicle for Alternative 6 is reduced to a Class C recreational vehicle with a wheelbase of 5.2 meters (17 feet) (Figure II-13). The design vehicle for Alternative 6 was chosen to represent a designated class of vehicle that the road is intended to accommodate and is not necessarily the majority of vehicles using the road.

Reducing the wheelbase of the design vehicle allows a design that more closely follows the existing roadway. As a result, the minimum switchback radius for Alternative 6 is 12 meters (40 feet) and better matches the radii of the existing switchbacks, as compared to 15 meters (50 feet) for Alternatives 2-5.

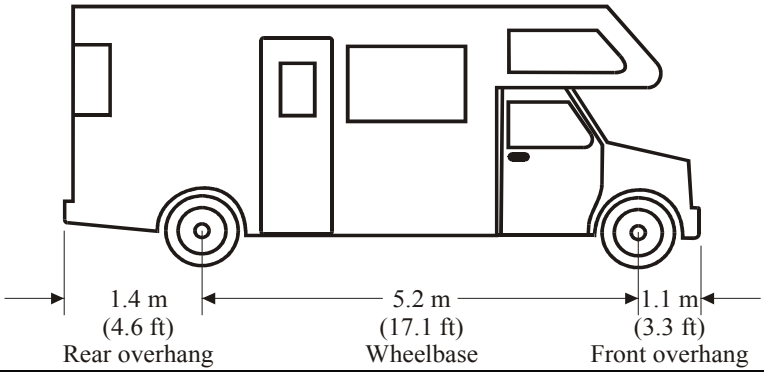


Figure II-13
Design Vehicle – Class C Recreational Vehicle

4d. Design Grade

The maximum design grade for Alternatives 2-6 is nine percent. This design grade maximum was selected because the majority of the road is within this specification, it provides a consistent expectation for the road user, and it is flat enough to accommodate vehicle use in icy and snowy roadway conditions. In addition, a maximum grade of nine percent is the steepest grade that can effectively hold a gravel surface or stabilized gravel surface without a substantially accelerated loss of surface material.

Approximately 3.8 kilometers (2.4 miles) or one-tenth of the road has a grade greater than nine percent. Rehabilitation and light reconstruction areas will generally match the existing grade, even if it exceeds nine percent. If full reconstruction is proposed in areas where the grade exceeds nine percent, the grade would be reduced to a grade at or below nine percent. For Alternatives 2 and 3, approximately 3.8 km (2.4 miles) of road would be reduced in grade. For Alternatives 4 and 5, approximately 2.8 km (1.8 miles) of road would be reduced in grade. For Alternative 6, approximately 1.0 km (0.6 miles) would be reduced in grade.

4e. Typical Cross Sections

The discussion of typical cross sections for the different types of construction activities (rehabilitation, light reconstruction, and full reconstruction) uses some terms to describe the roadway cross sections that may not be familiar to the reader. Figure II-14 is provided to aid the reader in understanding these terms. Specifically, some of the definitions used in this section include:

- traveled way = travel lanes only
- roadway = travel lanes plus shoulders
- platform = roadway plus the adjacent ditches and foreslopes
- roadside = area immediately outside of the shoulders to the edge of construction disturbance including the foreslopes, ditches, cutslopes, and fillslopes.
- construction limits = the area within the limits of disturbance – approximately 1.0 meter (3.0 feet) beyond the bottom of the fillslope to 3.0 meters (10 feet) beyond the top of the cutslope.
- foreslope = aggregate area immediately outside of the shoulders.

The typical cross section for Alternative 6 differs from Alternatives 2-5 in the width of the roadway and ditch. Alternative 6 is based on the rural local road functional classification for mountainous terrain and an AADT of less than 600 vpd. The American Association of State Highway and Transportation Officials (AASHTO) design guidelines indicate that the minimum width of a traveled way with an AADT of less than 600 vpd for this roadway classification and terrain is 5.4 meters (18 feet). This is 0.6 meters (2 feet) narrower than Alternatives 2-5. The minimum width for each shoulder is 0.6 meters (2 feet). Therefore, the roadway width for Alternative 6 is 6.6 meters (22 feet). The predominant platform width for the typical section is 7.8 to 9.8 meters (26 to 32 feet). Alternatives 2-5 have a minimum traveled way width of 7.2 meters (24 feet).

Because of the new design criteria, the minimum ditch width for Alternative 6 is up to 0.6 meters (2 feet) narrower than the ditch width for Alternatives 2-5 to further minimize impacts.

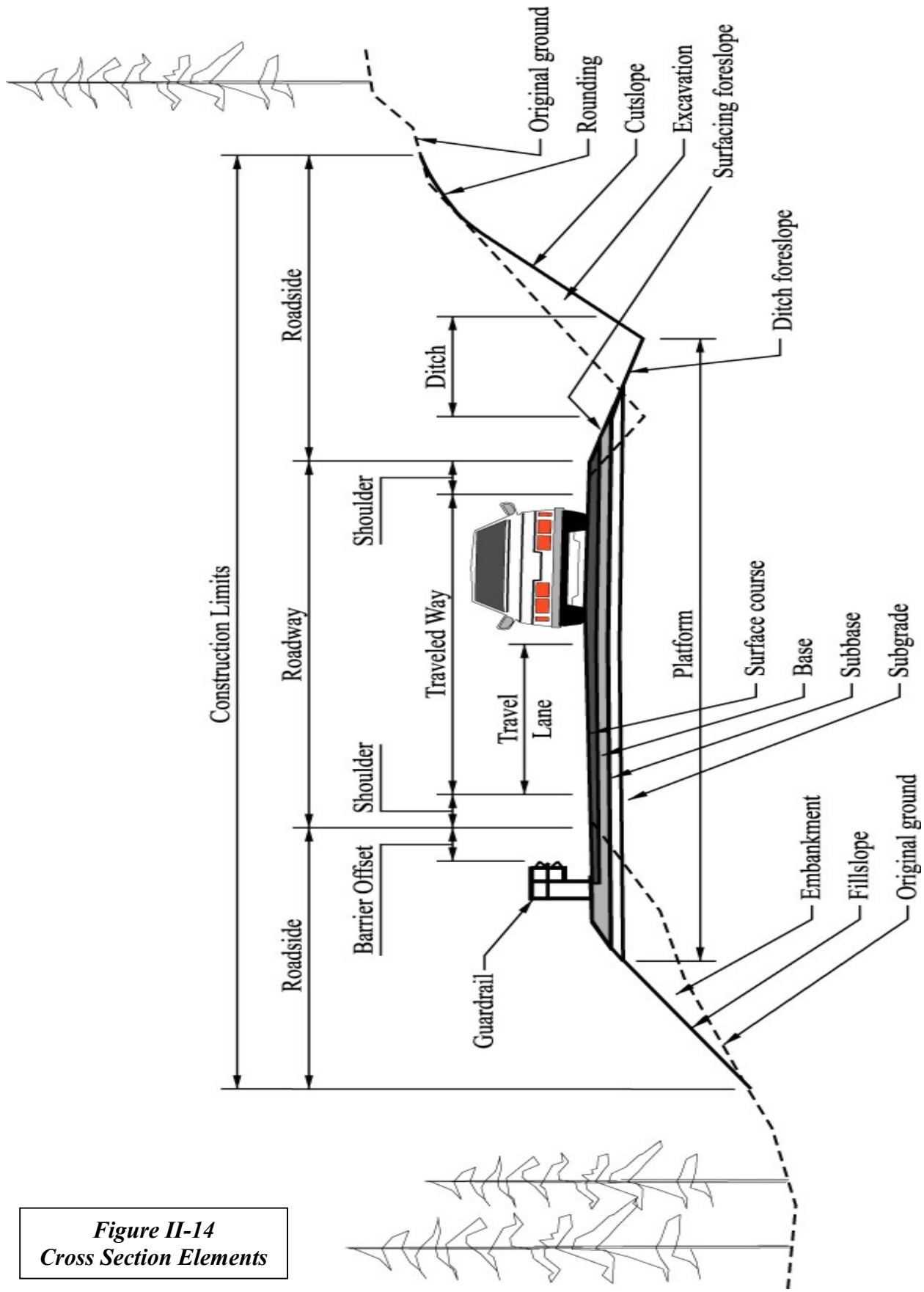


Figure II-14
Cross Section Elements

The discussion below provides an explanation of the activities involved in each type of construction (rehabilitation, light reconstruction, and full reconstruction) and the typical extent of construction impacts for all of the build alternatives. Figures II-15a, II-15b, and II-15c show the typical roadway cross sections for rehabilitation, light reconstruction, and full reconstruction. For a more detailed segment by segment analysis of the construction limits please see **Appendix C: Rationale for the Design Criteria and the Proposed Improvements**. Note that all estimates of extent of impacts are subject to minor modification as the design is further developed.

(i) Rehabilitation

Rehabilitation, also known as Resurfacing, Restoration, and Rehabilitation (3R), is used to extend the service life of an existing road and enhance safety. Rehabilitation is work that corrects a roadway that has deteriorated to some minimum acceptable level of performance. Performance considerations include, but are not limited to, functional performance and structural performance. The structural performance of a road surface relates to its physical condition (i.e., cracking, rutting, raveling, and potholing) that adversely affects the load carrying capability or requires maintenance.

Rehabilitation is normally applied to a functionally adequate road when its structural performance has seriously deteriorated. One of the goals of rehabilitation is to improve the road to a "better than existing" condition to upgrade the level of riding quality provided to the travelling public. Rehabilitation work is limited to the roadway platform, with exceptions to include work on severely eroding slopes, drainage structures, bridges, existing retaining walls, and landslides. Work that is often undertaken in 3R projects includes:

- Resurfacing (milling, recycling, and overlaying) existing paved or gravel surfaces.
- Reshaping, regravelling, and compacting existing aggregates.
- Excavating and replacing failed base material and poor subgrade materials.
- Replacing, upgrading, or relocating deteriorated, undersized, or poorly located drainage structures.
- Rehabilitating ditches and adding new culverts for proper drainage.
- Minor widening of the roadway into the existing shoulder, realigning intersections, adding turn lanes, intersection islands, or pullouts, or adjusting curve superelevation (curve banking) if the work can be accomplished on the existing road platform.
- Repairing, rehabilitating, or replacing existing retaining walls.
- Repairing and/or stabilizing landslides, severely eroding slopes, or failing slopes.
- Removing or pulverizing existing pavement to convert a road to an aggregate surface.
- Replacing, upgrading, or adding pavement markings and signage to address changing traffic patterns, new uses or safety problems, as well as to meet current practice.
- Replacing signage or pavement markings due to age, damage, or deterioration.
- Adding new sections of guardrail or guardwall as needed to meet current safety standards.

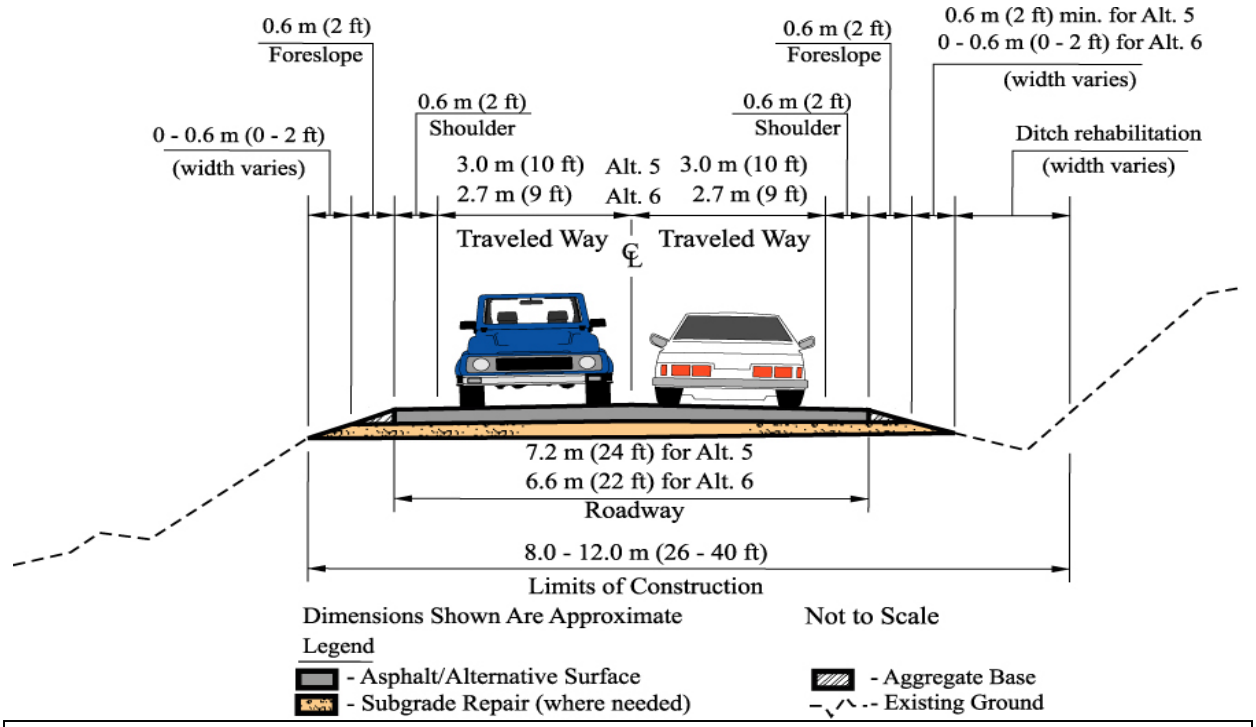


Figure II-15a
Typical Rehabilitation Section

- Bridge work often includes rehabilitation of the roadway embankment approaching the bridge, superstructure (deck, rails & girders) replacements, abutment and foundation repairs, installation or replacement of abutment slope protection (e.g. rip-rap), foundation scour repair and protection work to prevent undermining of bridge structure by river/creek, and piling replacements.

- Upgrading existing roadside appurtenances (e.g. signs, delineators) to meet current policies.

Alternatives 2-4 do not involve rehabilitation. For Alternatives 5 and 6, the typical rehabilitation cross section (Figure II-15a) consists of a 7.2 meter (24 foot) roadway width for Alternative 5 and a 6.6 meter (22 foot) roadway width for Alternative 6 plus minor repair work on drainage structures and ditches. Existing cut and fill slopes are not affected except to repair erosion areas and plant native vegetation on barren areas. Construction limits for approximately 24.3 kilometers (15.1 miles) of the rehabilitation areas are approximately between 8.0 and 9.0 meters (26 and 30 feet). Construction limits for other segments, like Georgetown Segment D (see **Chapter II.D.1: Proposed Improvements by Segment**), may extend up to 12 meters (40 feet) depending on existing ditch width.

(ii) Light Reconstruction

Light reconstruction work is a compromise between rehabilitation and full reconstruction. Light reconstruction is usually considered on roadways that are both structurally and functionally inadequate, but require only minor widening and/or geometric modifications, or where full reconstruction is not possible due to cost or environmental restrictions. The work takes place within the original limits of the existing roadway construction disturbance. The roadway is designed to address improvement of as many of the 13 principal design elements as possible, within the limits of the existing road's original construction disturbance. The 13 principal design

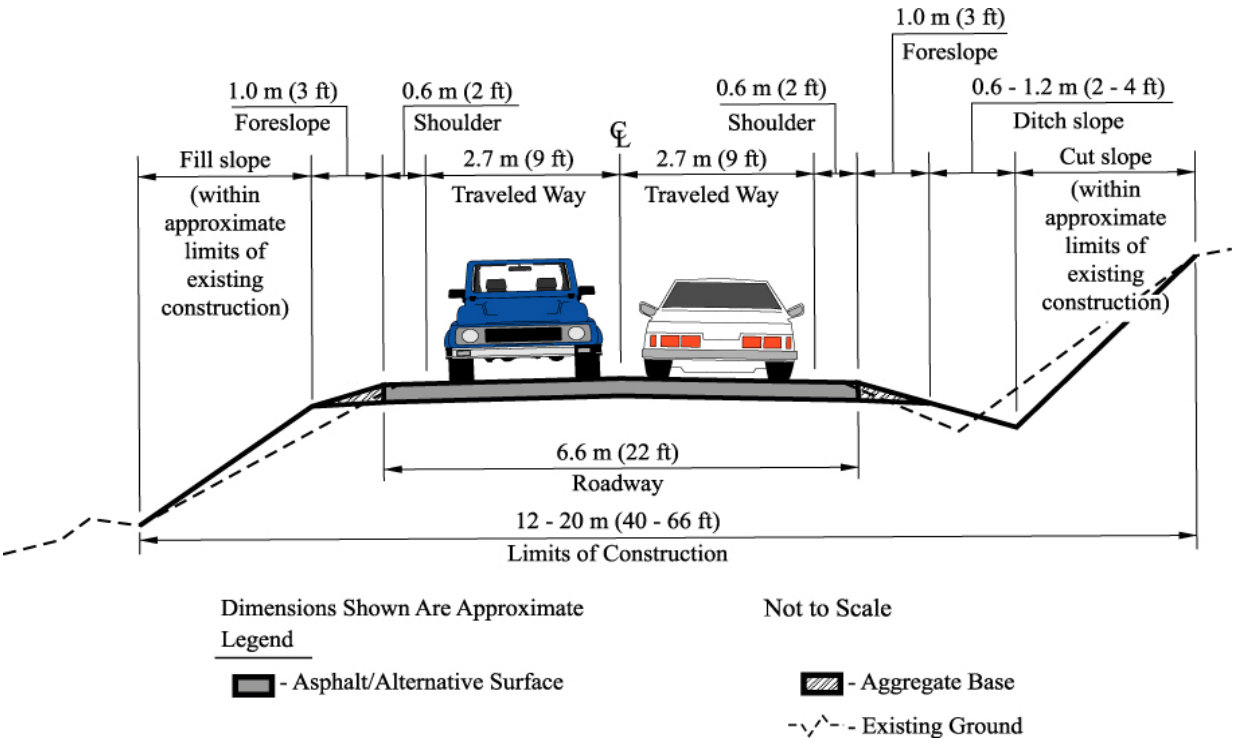


Figure II-15b
Typical Light Reconstruction Section for Alternative 6

elements are: design speed, lane width, shoulder width, bridge width, structural capacity, horizontal curvature, vertical curvature, gradient, stopping sight distance, cross slopes, superelevation, horizontal clearance to structures (tunnels and bridge underpasses), and vertical clearance.

Light reconstruction work can include all of the activities listed under rehabilitation as well as the following activities as long as the work occurs within the existing road's approximate original construction disturbance:

- Reconstruction of the cross-section elements to the appropriate cross-section shown in Figure II-15b.
- Replacing the existing structural section (surface course, base, and subbase)
- Reconstructing the cross-section elements to a specific standard.
- Replacing, upgrading, or relocating deteriorated, undersized, poorly located drainage structures. Adding drainage structures as needed.
- Reconstructing the subgrade with quality materials and proper construction techniques.
- Adding retaining walls as needed.
- Rebuilding severely eroding or failing slopes.
- Bridge work including modification or replacement of existing structures.

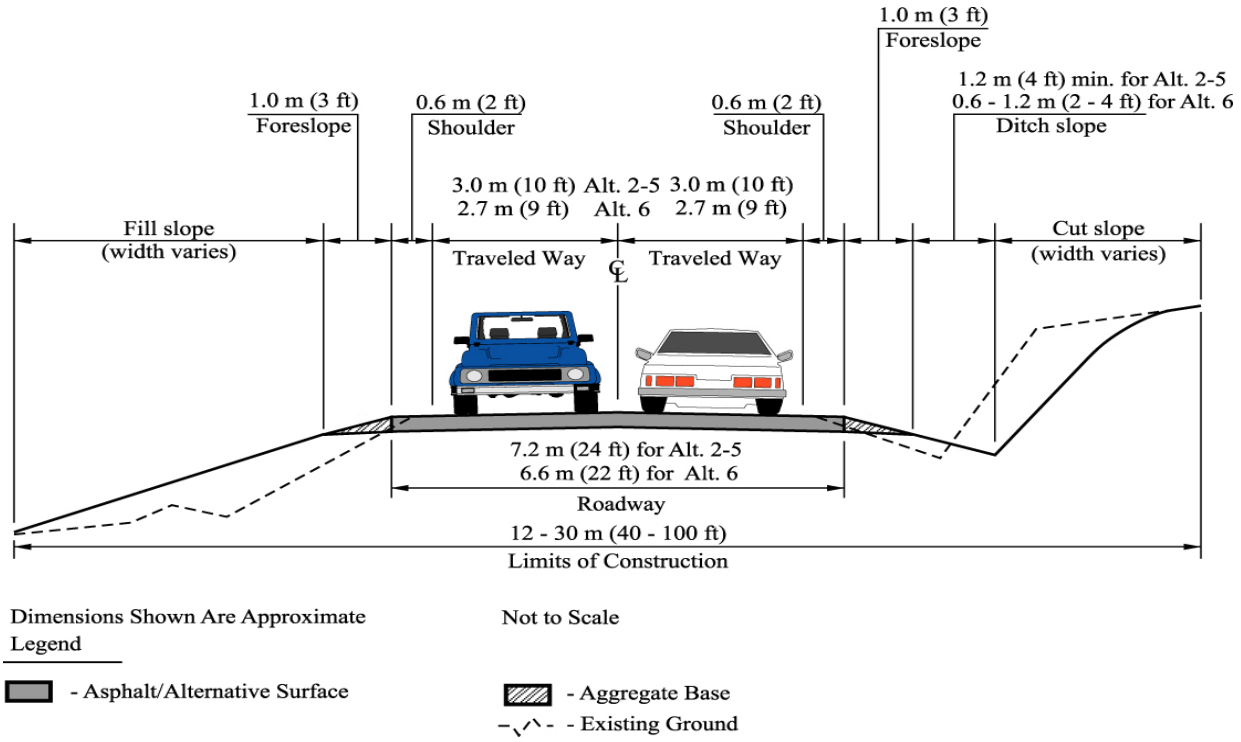


Figure II-15c
Typical Full Reconstruction Section

The typical light reconstruction cross-section (Figure II-15b) for Alternative 6 consists of the 6.6-meter (22 feet) roadway width plus reconstruction of foreslopes, ditch slopes, and portions of the cut slopes, and fill slopes within the approximate limits of the original roadway construction. The other build alternatives, Alternatives 2-5, do not involve light reconstruction. Construction limits for approximately 5.3 kilometers (3.3 miles) of the light reconstruction areas are approximately between 12 and 15 meters (40 and 50 feet). The construction limits for the remaining 1.6 kilometers (1.0 mile) extend approximately between 16 and 20 meters (51 and 66 feet).

(iii) Full Reconstruction

Full reconstruction work is the most extensive type of reconstruction. Full reconstruction involves a major change to the existing road within the same corridor. Full reconstruction is considered on roadways that are seriously inadequate for their intended purpose. Work will take place outside the original disturbed limits of the existing roadway. The roadway will be designed to correct the 13 principal design elements, listed under Light Reconstruction, and to fully meet specific operational and safety standards. Full reconstruction will address all of the necessary improvements related to alignment, profile, roadway width, side slopes, drainage, roadway appurtenances, etc.

The limits of full reconstruction for each of the build alternatives (Figure II-15c) are approximately between 12 and 30 meters (40 and 100 feet) wide. Under Alternative 6, approximately 2.8 kilometers (1.7 miles) of the roadway designated for full reconstruction has construction limits between 12 and 18 meters (40 and 60 feet) wide. The remaining 4.1

kilometers (2.5 miles) of roadway designated for full reconstruction has construction limits from approximately 18 to 30 meters (60 to 100 feet). The full reconstruction areas with construction limits up to 30 meters (100 feet) include the South Clear Creek area, the Shelf Road area, Falls Hill, and Naylor Creek.

Each of the build alternatives, Alternatives 2-6, involves full reconstruction to some extent. See **Chapter II.D.1: Proposed Improvements by Segment** for a detailed breakdown of each alternative and the full reconstruction areas within each alternative.

(iv) Summary of Typical Sections

Table II-6 summarizes the amount of typical sections as a percentage of the entire route for each of the build alternatives.

Table II-6
Percentage of Route of Typical Sections

	Full Reconstruction Typical	Light Reconstruction Typical	Rehabilitation Typical
Alternative 2	49	0	0
Alternative 3	49	0	0
Alternative 4	22	0	0
Alternative 5	22	0	49
Alternative 6	12	5	55
Note: Typical Sections do not add up to 100 percent due to portions of the route that require Special Sections.			

5. Special Sections

Special sections, instead of typical sections, are used in areas where additional safety measures are needed or in areas where the proposed geometry of the road is not easily accommodated by the existing roadway conditions. Below is a general discussion of special sections that are proposed for the Guanella Pass Road. Refer to **Appendix C: Rationale for the Design Criteria and the Proposed Improvements** and **Appendix D: Locations of Special Cross Sections** for a detailed description of the length and location of these special sections. Note that all estimates provided may be subject to minor modification as the design is further developed.

5a. Guardrail Sections (Figure II-16a)

Guardrail is constructed in areas where steep drop-offs or other roadside hazards exist. Guardrail requires 2.2 meters (7.5 feet) of width (for guardrail support) beyond the shoulder (left half of Figure II-16a). This width includes 1.6 meters (5.5 feet) of width for the guardrail and support and a 0.6-meter (2 feet) offset from the edge of the shoulder to the face of the guardrail. Therefore, construction of guardrail special sections requires a wider platform than the light or full reconstruction typical sections, adding 1.4 meters (4.5 feet) to the width of the platform. This additional widening has a paved or alternative surface only to the front of the guardrail post. Because of the protection provided by the guardrail, the foreslope in these areas is constructed at 1:2 (vertical:horizontal) to keep the fillslope width as narrow as practical to reduce impacts but still provide a slope that can be revegetated. This does not include the guardrail used along MSE wall sections (further addressed in **Chapter II.D.5b: Mechanically Stabilized Earth Retaining Wall Sections**). The materials to be used for guardrail construction will be determined during the final design of the project (see **Chapter II.G.3: Guardrail Design and Materials**).

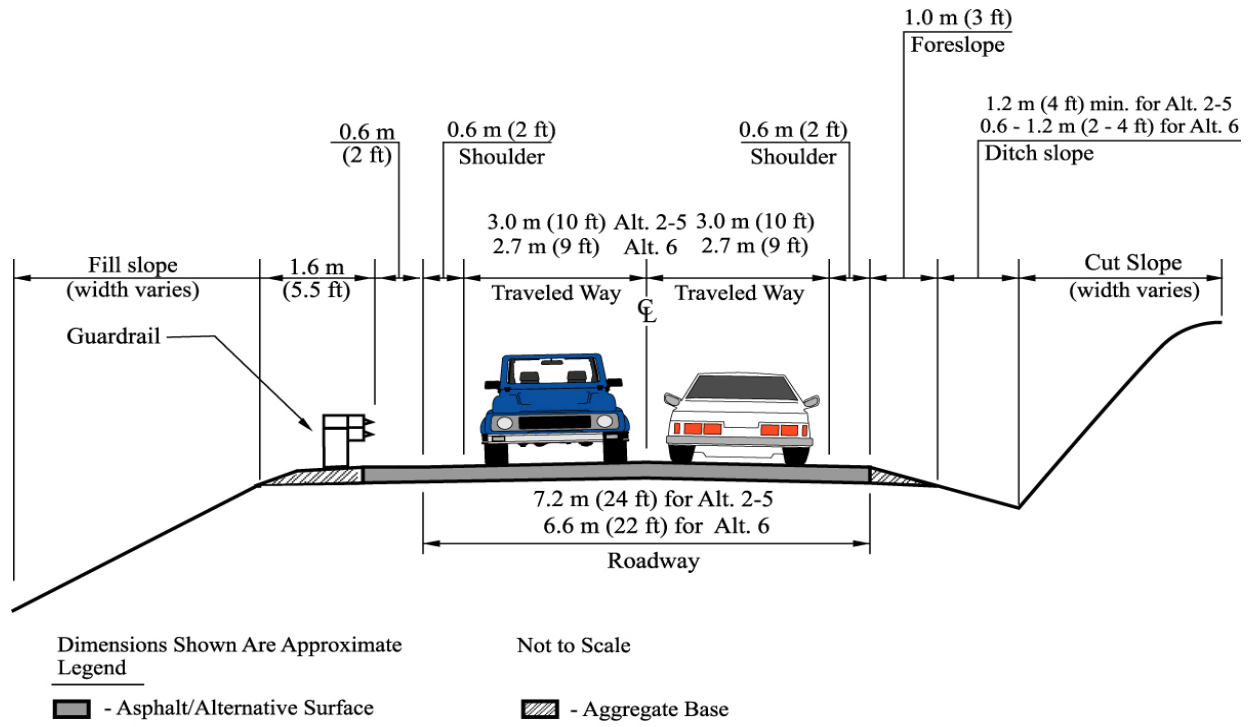


Figure II-16a
Guardrail Special Section

Refer to **Chapter II.D.5h: Summary of Special Sections** for a detailed breakdown of guardrail sections for each alternative (as a percentage of the entire route).

5b. Mechanically Stabilized Earth Retaining Wall Sections (Figure II-16b)

MSE retaining walls (left half of Figure II-16b) are used in areas where it is necessary to elevate the road (particularly when adjacent to creeks) or widen the road on a down-sloping hillside where an embankment fill slope is not appropriate. They are also used in areas where fill-side retaining walls are needed and the additional width needed to build this type of wall is available.

There are several areas that are proposed to have MSE retaining wall including, but not limited to, the following locations:

- the Shelf Road area
- above Duck Lake
- the upper switchbacks in Clear Creek County
- along South Clear Creek above the Clear Lake Campground
- north of Green Lake
- below the Waldorf Road cutoff

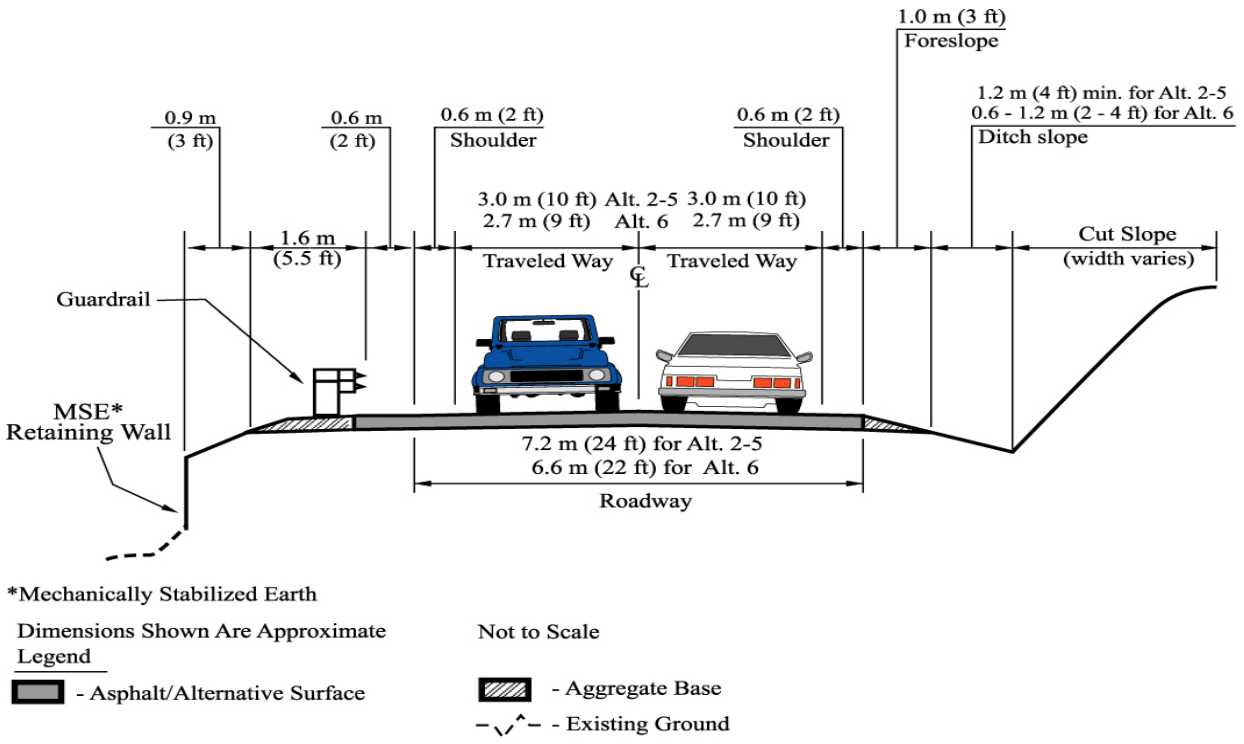


Figure II-16b
MSE Wall Special Section

Construction of MSE walls requires a wider platform area than the light or full reconstruction typical sections (Figures II-16b), adding 2.1 meters (7.5 feet) to the width of the platform. All MSE wall locations include the installation of guardrail. MSE walls are less expensive to build than most other types of slope stabilization options; therefore, they are used whenever possible to reduce land impacts.

The materials to be used for the retaining walls will be determined during the final design (see **Chapter II.G.1: Retaining Wall Design and Slope Treatments**). All retaining walls will be designed to accommodate the use of heavy (22,700 kilograms [50,000 pounds]) fire emergency equipment (water pumpers) to access the water reservoir.

Refer to **Chapter II.D.5h: Summary of Special Sections** for a detailed breakdown of MSE retaining wall sections for each alternative (as a percentage of the entire route).

5c. Paved Ditch Sections (Figure II-16c and Figure II-16e)

In especially steep or confined areas, paved ditches reduce the width of the foreslope and ditch by approximately 0.4 meters (1.3 feet) as compared to a Typical Full Reconstruction Section (Figure II-16c). The paved ditch section for Alternative 6 is up to 0.6 meters (2 feet) narrower than Alternatives 2-5 in select locations (additional culverts will be required for proper drainage). The reduced ditch can be used in combination with either a cut slope or a cut-side retaining wall (right half of Figure II-16e).

Refer to **Chapter II.D.5h: Summary of Special Sections** for a detailed breakdown of paved ditch sections for each alternative (as a percentage of the entire route).

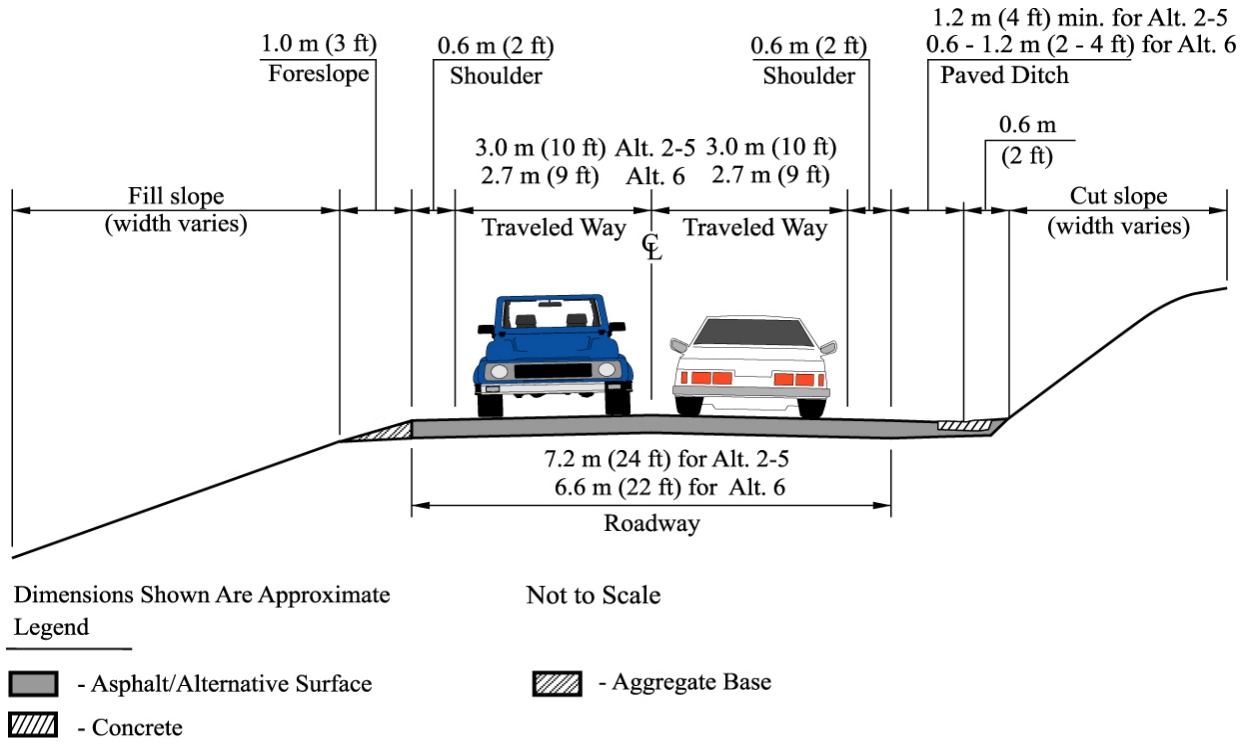


Figure II-16c
Paved Ditch Special Section

5d. Cut-Side Retaining Wall (Figure II-16d and Figure II-16e)

Cut-side retaining walls are used in areas where steep slopes exist. This type of retaining wall stabilizes the slope and minimizes the amount of excavation and disturbance. The Geneva Canyon, Falls Hill area, and the Georgetown switchbacks are among the areas proposed to have cut-side retaining walls. The materials to be used for retaining wall construction will be determined during the final design of the project (see **Chapter II.G.1: Retaining Wall Design and Slope Treatments**) and will take into account visual sensitivity and context of the proposed location.

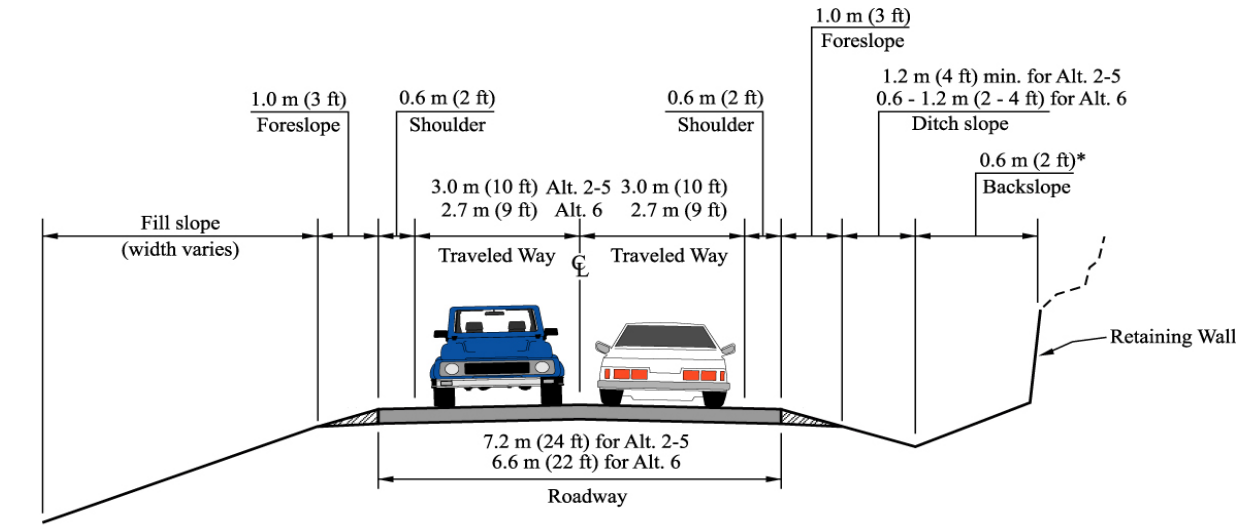
Refer to **Chapter II.D.5h: Summary of Special Sections** for a detailed breakdown of cut-side retaining wall sections for each alternative (as a percentage of the entire route).

5e. Concrete Wall (Figure II-16f)

Concrete retaining walls (left half of Figure II-16f) are used to provide a narrower section on a down-sloping hillside than an MSE wall or embankment fill slope. They are also used in areas where fill-side retaining walls are needed and the width in the corridor is restricted. A concrete wall section is presently not proposed for Alternative 6, but may be considered as an option to MSE wall during final design if necessary.

Concrete walls are more expensive to build than most other types of wall; therefore, they are used only where necessary and because of the visual sensitivity of the roadway, would typically only be used where they would not be highly visible.

Refer to **Chapter II.D.5h: Summary of Special Sections** for a detailed breakdown of concrete wall sections for each alternative (as a percentage of the entire route).



*Back slope section occurs only in the Shelf Road area.

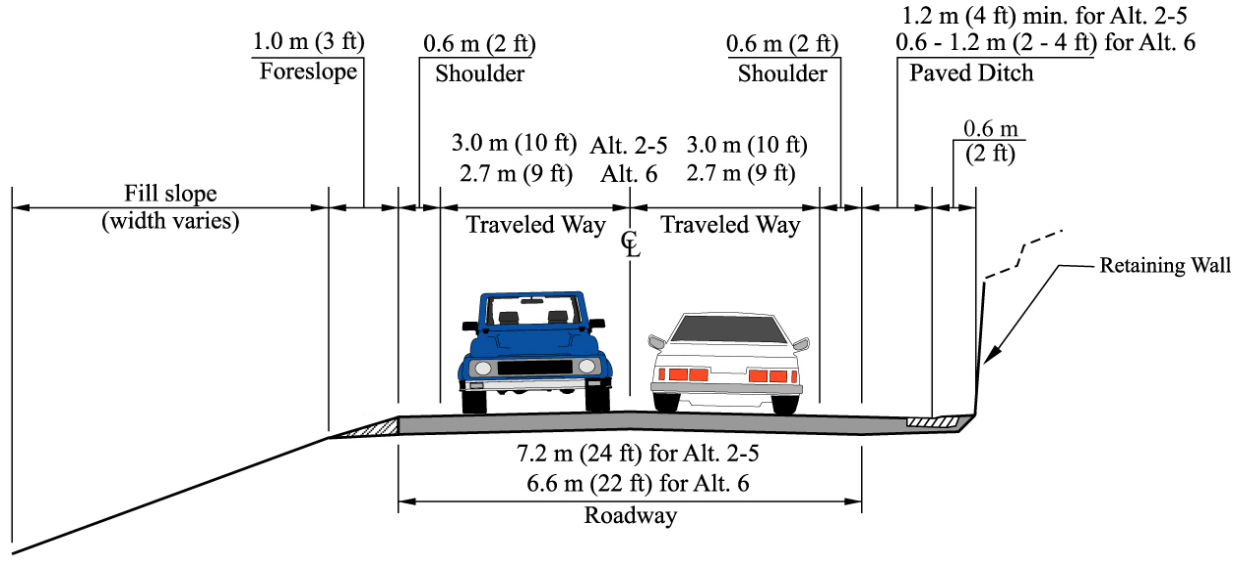
Dimensions Shown Are Approximate

Not to Scale

Legend

- Asphalt/Alternative Surface
- Aggregate Base
- Existing Ground

Figure II-16d
Cut-Side Retaining Wall Special Section



Dimensions Shown Are Approximate

Not to Scale

Legend

- Asphalt/Alternative Surface
- Concrete
- Aggregate Base
- Existing Ground

Figure II-16e
Paved Ditch & Cut-Side Retaining Wall Special Section

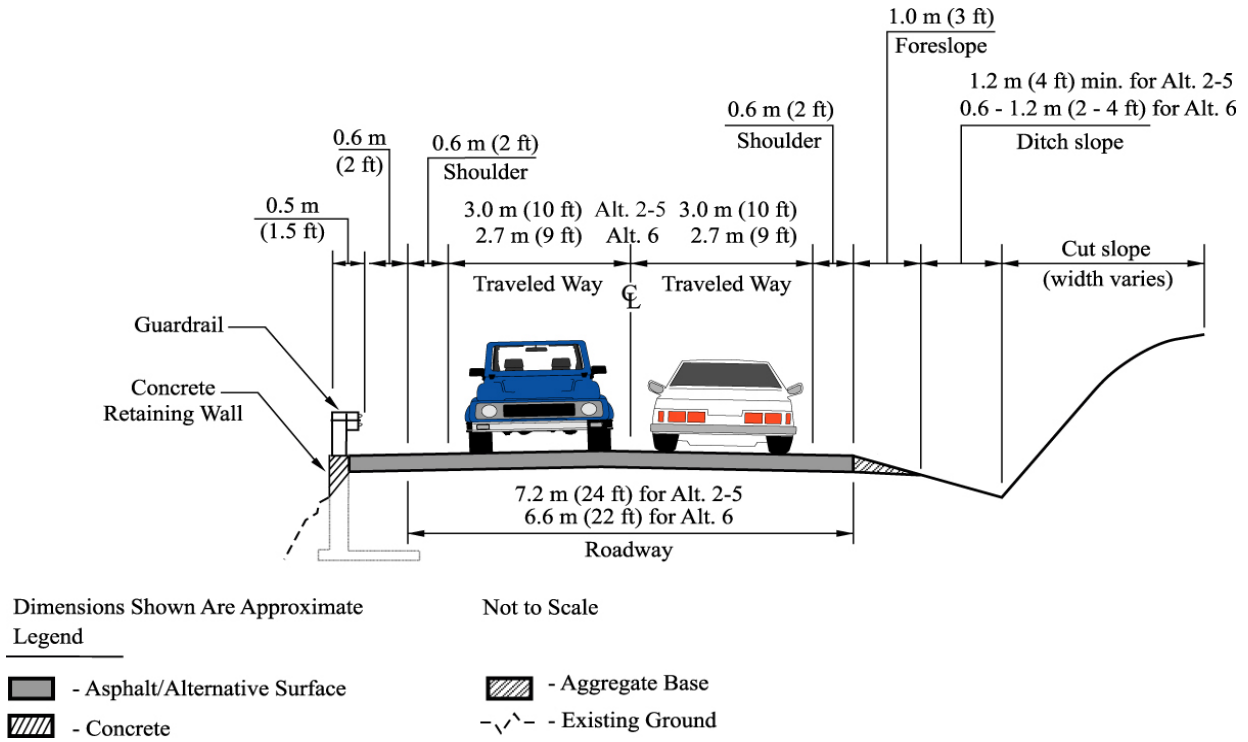


Figure II-16f
Concrete Wall Special Section

5f. Rockfall Ditch (Figure II-16g)

A wider ditch than the typical section is proposed for the Shelf Road area (Station 16+250 to 18+650) where high rockfall potential and steep slopes exist. The ditch is designed to catch falling rocks. Under this variation, a ditch 1.8 meters (6 feet) wide is added to create the rockfall ditch (see right half of Figure II-16g).

Refer to **Chapter II.D.5h: Summary of Special Sections** for a detailed breakdown of rockfall ditch sections for each alternative (as a percentage of the entire route).

5g. Georgetown Area (Figure II-16h)

Figure II-16h shows the special section proposed for the top of the switchbacks into Georgetown. This area is in steep terrain along Leavenworth Mountain and is particularly sensitive to visual impacts as it forms the backdrop for Georgetown within GSPNHLD. Changes to the standard typical section through this area were sought by Georgetown officials and agreed to by the FHWA. These changes, described below, minimize widening, vegetation removal, and visual impacts.

On the cut (up-hill) side of the road, the paved ditch (right half of Figure II-16h) is similar to that shown in the right half of Figure II-16c except that the distance between the shoulder edge and the bottom of the paved ditch is limited to 0.6 meters (2 feet).

On the fill (down-hill) side of the road, a guardwall and retaining wall is proposed (left half of Figure II-16h). This results in considerably less widening and more improved screening of the wall by existing trees and other vegetation.

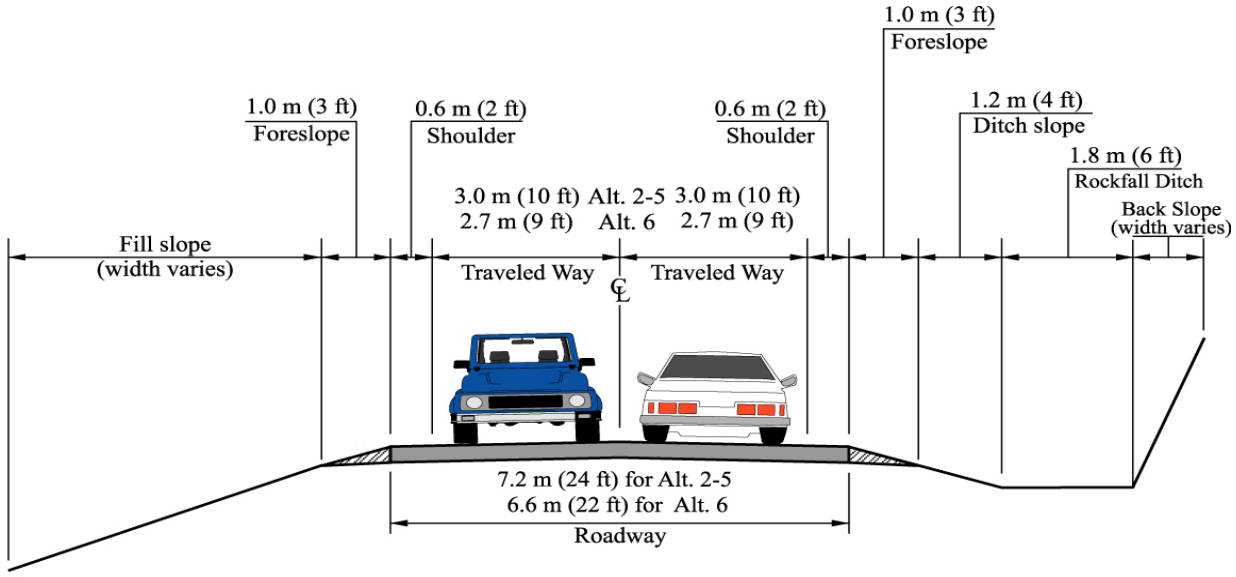


Figure II-16g
Rockfall Ditch Special Section

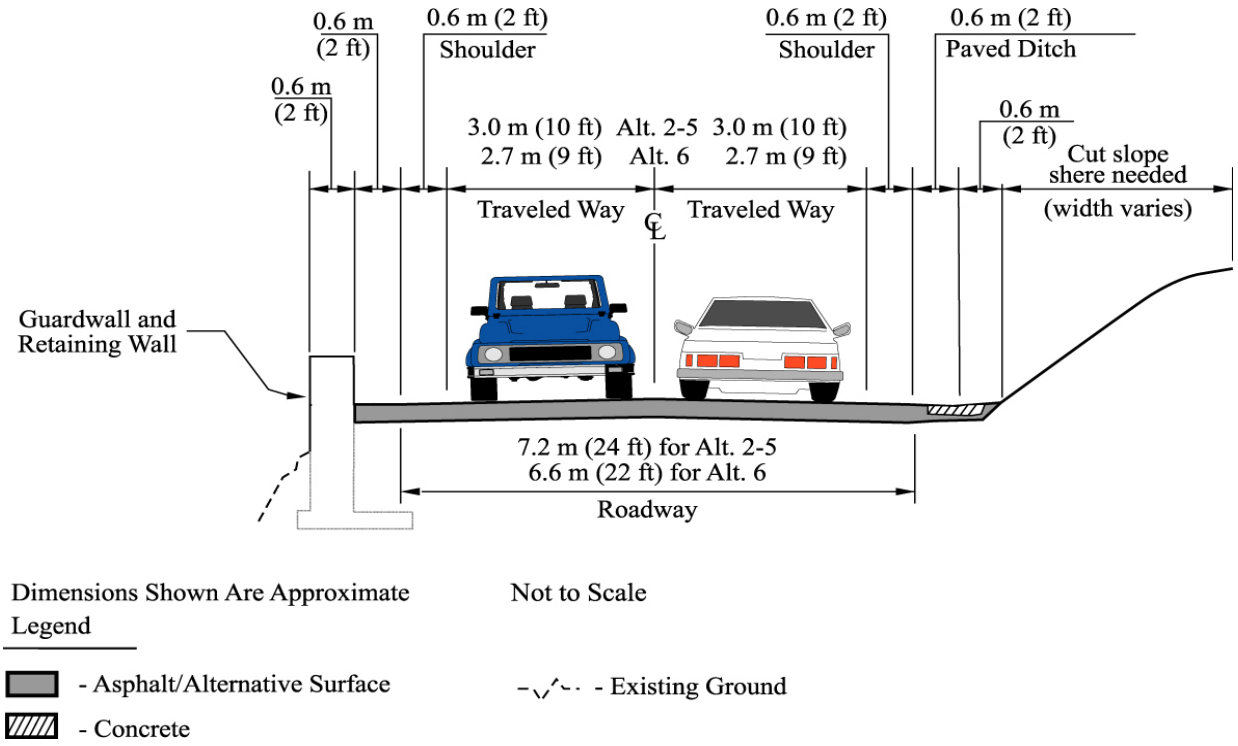


Figure II-16h
Georgetown Switchbacks Special Section

Overall, the proposed special section in the Georgetown area reduces the platform width compared to the MSE wall and standard ditch section by up to 1.9 meters (6.2 feet). The structural and drainage elements associated with this narrower typical section are more expensive to construct and create a more developed setting. The materials to be used for retaining wall construction will be appropriate for the visual sensitivity and context of the proposed location.

Refer to **Chapter II.D.5h: Summary of Special Sections** for a detailed breakdown of the special sections proposed for the Georgetown area for each alternative (as a percentage of the entire route).

5h. Summary of Special Sections

Table II-7 summarizes the amounts of special sections as a percentage of the entire route for each of the build alternatives. **Appendix D: Locations of Special Cross Sections** provides a detailed description of lengths and locations for the special sections.

Table II-7
Percentage of Route for Each Special Section Type

	Paved Ditch	Cut Wall	MSE Wall*	Concrete Wall	Guardrail	Rockfall Ditch	Georgetown Reduced Paved Ditch	Georgetown Guardwall and Retaining Wall*
Alternative 2	34	3	26	3	7	6	5	5
Alternative 3	21	3	26	3	7	6	5	5
Alternative 4	13	1	20	0	2	6	5	4
Alternative 5	19	1	20	0	2	6	5	4
Alternative 6	17	2	14	0	5	6	2	4

** MSE and concrete wall sections and Georgetown Terminus sections include guardrail and/or guardwall.*
NOTE: The work for the rehabilitated special sections will remain within the existing platform and include foreslopes and ditches.

6. Management Responsibilities

The cooperation of the local agencies (Clear Creek County, Park County, and the Town of Georgetown) is needed for the management of Alternative 6 due to the new functional classification and design criteria. The change in the functional classification, the smaller design vehicle, and the incorporation of more rehabilitation into the design requires commitments and policy decisions from the local agencies as well as the FS. These commitments translate into management responsibilities that, when implemented, allow the road to continue to function as a rural local road. These management responsibilities are outlined in Table II-8.

Winter closure, discussed in **Chapter II.E.3: Winter Closure**, is not necessary for Alternative 6 to be a viable alternative. Winter closure is an option for Clear Creek County, Park County, and the Town of Georgetown to pursue. If winter closure is implemented by the maintaining authorities, additional responsibilities fall upon the maintaining authorities that do not specifically relate to Alternative 6. More specific management responsibilities have not been identified at this time. Additional coordination with the managing agencies and more definition of the responsibilities is needed if winter closure of the road is selected as an option.

E. OPTIONS COMMON TO ALL BUILD ALTERNATIVES

Five options are presented for consideration in this FEIS. These could be considered appropriate for any of the build alternatives. These options include improving existing or building new parking areas, locating the material source sites, closing Guanella Pass during the winter, building and improving an equestrian trail, and constructing minor road realignments in three areas.

Table II-8
Management Responsibilities

New Design Criteria	Management Responsibility
More Rehabilitation Change rehabilitation sections from the 0-50 percent range for Alternatives 2-5 to 64 percent for Alternative 6.	Clear Creek County, Park County, and the FS acknowledge that more rehabilitation will compromise the safety enhancements and long-term service life to minimize environmental impacts and maintain the existing character of the road. Maintenance cost and effort will be greater than if the additional rehabilitated areas were reconstructed as proposed in the DEIS.
Functional Classification Change from a rural collector road to a rural local road.	Clear Creek County, Park County, and the FS will ensure that any future land development activities acknowledge the limitations of the roadway design and will manage the road for local traffic rather than to accommodate substantial through traffic or commercial traffic.
Roadway Width Change from 7.3 meters (24 feet) to 6.7 meters (22 feet).	Clear Creek County, Park County, Georgetown, and the FS will cooperatively manage the vehicle size limitations, and do not intend to accommodate large RV's, buses, or commercial truck traffic, except under some form of special permit system with special advisory signing. FHWA is recommending that a permit be required for any vehicles over 7.6 meters (25 feet) in length and that advisory signs be placed at the beginning of Guanella Pass Road or at the entrance to Georgetown off of I-70.
Design Vehicle Change from a single-unit vehicle with a 6.1- meter (20-foot) wheel base to a Class C motor home with a 5.2-meter (17-foot) wheel base. With respect to towed vehicles, a pick-up truck having a 7m (23 ft) boat/trailer would comply with this Class C motor home dimension.	
Switchback Radius Change from a minimum radius of 15 meters (50 feet) to 12 meters (40 feet).	
Design Speed Change from 40-60 km/h (25-37 mph) to 30-50 km/h (19-31 mph).	Clear Creek County, Park County, and Georgetown will manage the operating speeds.

1. Parking Areas

The FS is proposing to improve parking areas to help manage and contain the use of vehicles in the recreation areas of the forest and ensure compliance with FS Visual Quality Objectives (VQOs). Figure III-20 in **Chapter III: Affected Environment and Environmental Consequences** discussed future parking demands and displays the locations of existing and proposed parking areas along the corridor. The proposed improvements included in all of the build alternatives are listed below:

- Geneva Creek Picnic Ground (station 4+000) – The existing parking area, which accommodates 5 vehicles, will be retained but decreased in size to accommodate 3 vehicles.
- Grant Byway Entrance (station 4+100 to 4+150) – This new parking area will provide parking for approximately 15 vehicles.
- Whiteside Campground (station 4+820 to 4+870) – The existing parking area, which holds 10 vehicles, will be retained.
- Threemile Creek Trailhead (station 5+500 to 5+550) – The existing parking area, which currently holds 4 vehicles, will be retained.

- Burning Bear/Abyss Trailhead (station 9+350 to 9+400) – The existing parking area, which accommodates 40 vehicles, will be rehabilitated and a new area created that will meet VQOs. There will be parking for approximately 40 vehicles and 5 horse trailers.

- Duck Creek Picnic Ground (station 12+300; Winter Closure Site) – This parking area is an expansion of the existing picnic area, parking area, and turnaround. There will be parking for approximately 10 vehicles and 4 horse trailers.

- Guanella Pass (station 21+750 to 21+950) – Formalized parking areas are proposed on both the eastern and western sides of the pass. The existing northern summit parking area will be reclaimed and the southern parking area will be expanded. All informal parking along the road will be eliminated. Two alternative entrance roads to the western parking area have been proposed, to avoid disturbing a lithic scatter that may be eligible for the National Register of Historic Places (NRHP). The FHWA is committed to performing biological surveys of the two new entrance roads prior to construction, in addition to addressing comments from Native American groups regarding potential impacts to Traditional Cultural Properties (TCPs). The west parking area will hold approximately 60 vehicles and will be closed by the FS in the winter. The east parking area will hold approximately 50 vehicles.

- Clear Creek Winter Closure Site (station 24+600) – This new parking area is located in an existing switchback south of the intersection with Naylor Lake Road. There will be parking for approximately 35 vehicles.

- Cabin Creek Hydro Station (station 30+710 to 30+770) – The existing gravel pullout, which holds 10 vehicles, will be improved and paved. There will be parking for approximately 6 vehicles after improvements.

- Clear Lake Parking Lot (station 32+000) – The existing parking area, which accommodates 45 vehicles, will be retained.

- Waldorf/Kirtley Mine Parking Area (station 35+000) – This existing parking area will be retained.

- Silverdale (station 35+750 to 35+800) – The existing parking area is proposed for expansion to include the Scenic Byway entrance facilities. This area will require a grade change including additional fill and the relocation of a powerline. There will be parking for approximately 20 vehicles.

2. Material Source Locations

Roadway design will attempt to balance the material taken from cuts with the amount used in fills. Where this is not possible, borrow material will be obtained from sites near the construction areas.

The first proposed site is near Duck Lake just south of Guanella Pass at station 19+200 on the east side of Guanella Pass Road. This location was probably used as the materials source for the construction of the Geneva Basin Ski Area parking lot and access road. Initial testing of the material on the Duck Lake site has indicated that it is suitable for use as a road base and surface course for either a paved or gravel road.

The second proposed site is the Geneva Basin Ski Area parking lot. The access road to the site is located at station 18+250. Because of its location, size, and layout, this site can be used for more than just a materials source. The site has the potential to be used as a staging area for equipment and for a hot-mix asphalt plant. Like the Duck Lake site, initial testing of the material has indicated that it is suitable for use as a road base and surface course for either a paved or gravel road.

3. Winter Closure

3a. Background

The decision to close or not maintain Guanella Pass Road during the winter lies with the agencies that have legal jurisdiction of the road: Park County, Clear Creek County, the FS, and the Town of Georgetown. The option for winter closure or no winter maintenance is presented in response to comments made regarding the economic and ecological costs of maintaining the road year-round (winter closure would reduce annual maintenance costs as well as the amount of maintenance-associated sediment).

Winter closure of Guanella Pass Road is an option that has been raised by Clear Creek County, Park County, and the Town of Georgetown as a means to lower maintenance costs. *Winter closure* of the road means that a physical barrier restricts access to the road. Another option under consideration is not to maintain the road in certain sections. The option of *no maintenance* of the road means that the Counties do not physically block the road, but instead, the Counties do not remove any snow accumulation from the road during the course of the winter. This option is opposed by the FS due to associated problems with illegal off-road use and search and rescue efforts.

The Clear Creek County and Park County Commissioners have discussed the potential closure of Guanella Pass Road and generally feel that it is a viable option for the winter. The Georgetown Town Council and the Georgetown Planning Commission held a public hearing on May 3, 2000 and discussed the winter closure proposal. They recommended the closure from Guanella Pass Campground to the summit and recommended a no maintenance policy from Clear Lake Campground (near Cabin Creek where the paved section ends) to Guanella Pass Campground. The Clear Creek County Commission held a public hearing regarding the issue on May 23, 2000 and agreed that there would be no negative economic impact to the County by a closure of Guanella Pass Road in the winter. Park County has approved closure contingent upon Clear Creek County approving closure. However, the Clear Creek County Commissioners have stopped short of approving the closure proposal and have no immediate plans to make a final decision on winter closure. If the agencies decide to implement winter closure, any necessary environmental reviews will be performed at that time.

At this time, the counties have concluded that no specific closing and opening dates would be set, but rather the road will be closed when weather requires and opened when weather permits. By not setting any specific opening and closing dates, the counties may save money on plowing by not having to meet established opening and closing dates.

The potential road closure will not be considered as mitigation for environmental impacts to any threatened and endangered species. However, winter closure could result in a beneficial reduction of potential impacts to wildlife in the Guanella Pass area. The action that the current

County Commissioners take cannot bind a future Board of Commissioners and, therefore, cannot guarantee the benefit provided by a potential road closure. See **Chapter III.D: Environmental Impacts of Winter Closure** for more information.

3b. Assumptions about Winter Closure

In the discussion of the environmental impacts of winter closure in **Chapter III: Affected Environment and Environmental Consequences**, this FEIS assumes that winter closure can be implemented by agreement between FS and Clear Creek County, Park County, and the Town of Georgetown. In addition, the evaluation of impacts assumes the following:

- The location of the road closure in Clear Creek County is proposed to be south of Naylor Lake Road (Station 24+600 near the switchback). A parking area with about 35 parking spaces and turnaround is needed at this location, regardless of winter closure, to accommodate the winter recreationists using Naylor Lake Road.

- Currently, Park County plows to a point about 11.5 kilometers (7.1 miles) north of Grant. The County does not officially close the road; however, the road is not maintained beyond this point. For this evaluation, the road closure for Park County is assumed to be at station 12+300, near Duck Creek Picnic Ground, or about 11.0 kilometers (6.8 miles) north of Grant. This area will be an expansion of the exiting picnic area, parking area, and turnaround. There will be parking for approximately 10 vehicles and 4 vehicles with trailers.

- Neither county will allow use of recreational vehicles (snowmobiles, etc.) on closed portions of the road, except by special permit from the appropriate county.

4. Equestrian Trail Segments

It was determined that constructing additional equestrian trail segments is a viable option for all build alternatives. The equestrian trail would be included as a safety measure.

Most of the trail already exists, and is currently used by hikers and equestrians. The trail is also frequently used by the local dude ranch. Construction of additional segments would provide a safer trail for hikers and horseback riders away from the traffic on Guanella Pass Road. Currently, for portions of the trail, equestrians are forced to ride along the shoulder of the road. This is shown in Figure II-17.

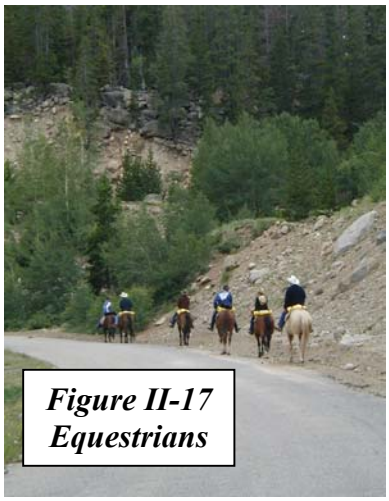


Figure II-17
Equestrians

The preliminary location of the equestrian trail has been identified. The FHWA will coordinate efforts to finalize the equestrian trail location with possible users of that trail. It is anticipated that the majority of the proposed equestrian trail will use existing trails. Where a new trail needs to be developed, the FHWA will conduct all appropriate environmental evaluations prior to the development of the equestrian trail.

5. Minor Road Realignments

Generally, the proposed road under all build alternatives matches the existing alignment, with three exceptions. These exceptions are located at stations 18+900 to 19+200 (Duck Lake Access Road), stations 19+447 to 19+622 (Duck Lake Switchback), and stations 24+500 and 25+235 (Lower Guanella Pass Switchbacks). These areas of the existing Guanella Pass Road alignment are not up to current safety and design standards. The proposed realignments are aimed at addressing and correcting these issues while at the same time retaining the visual quality and character of the road. Wherever the existing alignment is abandoned, the original contours of the land form are regraded and revegetated with native plant species to help preserve the visual quality and character of the area. See **Chapter III.B.3: Visual Quality** for more information.

F. OTHER ALTERNATIVES CONSIDERED AND ELIMINATED

1. Permanent Road Closures

Several alternatives have been discussed that require permanent closure of the road either completely or partially. These alternatives include:

- Close road to through traffic and keep open only for bicyclists.
- Close road permanently at the top of the pass.

These alternatives were eliminated from consideration because they do not meet the objectives of the Guanella Pass Road project. In addition, they do not support the activities of the FS and do not meet the FS goals of providing mobility within the project corridor and access for the general public to forest resources. These are not alternatives that fall under the FHWA's jurisdiction, as this decision must be made by the road management agencies.

2. Remove All Pavement

Alternatives that remove all pavement from the road surface were eliminated from consideration because they do not meet the specific objectives of the project to address environmental concerns, maintain the existing character of the road, and reduce maintenance costs to Clear Creek County and Park County. Gravel roads typically are more expensive to maintain than paved roads. Reducing the amount of pavement would only serve to increase the amount of damage done to sensitive environmental areas adjacent to the road. Gravel lost from a roadway surface due to erosion and maintenance activities is cast into the adjacent ditches, wetlands, riparian, and aquatic habitats.

3. Designate Road as a 4-Wheel Drive Road Only

This alternative was eliminated from consideration because it does not meet the FS objective of accommodating access to FS facilities located within the Guanella Pass corridor. The volume and type of traffic on the road suggests that more than just 4-wheel drive enthusiasts are interested in using the road.

4. Additional Widening for Pedestrians and Bicycles

Three bicycle/pedestrian facility options were considered as an addition to the Guanella Pass Road improvements. These options included constructing:

- A shoulder 1.2 meters (4 feet) wide on each side of the road.
- A shoulder 2.4 meters (8 feet) wide on one side of the road.
- A 2.4-meter (8-foot) wide bicycle path on a separate alignment.

Each of these was eliminated because of the additional environmental impacts (particularly to wetlands and riparian areas) that result and the amount of cut and fill areas that are required for additional width. Over 14 hectares (34 acres) of additional habitat take is required to accommodate the additional 2.4 meters (8 feet). In addition, the separate bike path alignment results in loss (due to fragmentation) of the habitat area between the bike path and the road. Other impacts include additional cuts and fills, erosion, and visual impacts.

5. Use Federal Funds for Maintenance and Repair

Park and Clear Creek Counties have already set aside maintenance funds for use in the upkeep of the road. Over the past years, the funds available for maintenance of the road have dwindled. The lack of maintenance has led to numerous problems on the road including a complete loss of the surface course and subbase materials (in some areas).

As discussed earlier in **Chapter I: Purpose and Need,** the FHWA funds for this project come from the Forest Highway Program. The Forest Highway Program provides federal funding for capital improvements of a special category of public roads that directly serve NF lands nationwide. The roadway system is on the Forest Highway Road system. Decisions for use of the federal funding that is allocated annually for the Forest Highway Program within Colorado are made jointly by the FHWA, the FS, and the CDOT (the program agencies).

Although federal funds can be used for the Guanella Pass Road reconstruction project, these funds cannot be used for the annual maintenance of the road. In accordance with CFR Title 23, the maintenance and control of the road remains the responsibility of Clear Creek County, Park County, and Georgetown.

6. Silver Plume Bypass Realignment

The project team considered several realignment options for the Georgetown terminus of Guanella Pass Road (for more information about the options studied see the *Guanella Pass Road, Georgetown Terminus Options Traffic Study*). The options studied included a realignment of Guanella Pass Road from the third switchback above Georgetown into Silver Plume. This realignment was eliminated from consideration because of significant impacts resulting from new construction through environmentally sensitive areas.

In addition, realignment options that bypass Georgetown have received substantial criticism from the Georgetown business community (see **Chapter II.F.9e-g**). The Georgetown business community has expressed concern over the negative economic impact the bypass would create. As a result, the Silver Plume Bypass Realignment was eliminated from further consideration.

7. Passing Lanes

The provision of passing lanes along Guanella Pass Road was considered but eliminated because of the additional environmental impacts (particularly to wetlands and riparian areas) that result and the amount of cut and fill areas that are required for the increased width. In addition, it is not the intention of this project to provide for a fast trip over the road or to promote or encourage higher speeds.

8. Sierra Club Alternative

The Rocky Mountain Chapter of the Sierra Club submitted a build alternative for consideration. This alternative does not widen any sections of Guanella Pass Road. This alternative rehabilitates the road in an attempt to mitigate current environmental problems and improve the roadway surface, materials, and drainage. Those portions of Guanella Pass Road that are currently paved are resurfaced with an asphalt surface and those portions of the road that are currently dirt/gravel are resurfaced with a gravel surface. Many erosion, sedimentation, and some drainage problems are addressed. However, several existing drainage problems are not addressed because the existing ditches are narrow or non-existent in most areas, and would require reconstruction and widening to be installed.

The Sierra Club believes that the above proposal is a reasonable safety improvement considering the degree of environmental impacts associated with widening. However, the existing roadway width for those sections proposed for reconstruction under the build alternatives is already narrower than recommended AASHTO guidelines. The roadway width proposed in Alternative 6 is the minimum allowed under the FHWA Central Federal Lands Highway Division (CFLHD) guidelines for the level of traffic, and the minimum that is supported by the FS for reconstruction of this type of forest road (**Chapter II.D.4a-e**).

In accordance with 23 CFR Part 625.2, the FHWA is responsible for providing a facility that will "adequately serve the existing and planned future traffic of the highway in a manner that is conducive to safety, durability, and economy of maintenance…" It is not considered a wise investment of public funds to expend limited resources to perform road improvements that soon will become inadequate or inappropriate. Further reduction of the proposed width, resurfacing the road without widening the narrowest portions, or not correcting the most deficient alignment and geometric inconsistencies leaves un-addressed the most hazardous conditions of the road and may leave the Counties, FS, and the FHWA with a facility having many operational, maintenance, and safety liabilities.

Many of the environmental enhancements recommended as part of the Sierra Club Alternative are included in Alternative 6. These include slope stabilization, use of aesthetically appropriate retaining walls, revegetation of denuded areas, improving drainage, stabilizing roadway surfacing, and use of natural bottom culverts or bridges for fish and riparian wildlife passage. Alternative 6 provides the closest solution to the Sierra Club Alternative concerns while addressing much needed operational, maintenance and safety concerns. The Sierra Club Alternative was eliminated because it failed to adequately address these concerns.

9. Realignment Options Considered and Eliminated

During initial design studies, several realignment options were analyzed for improvements to Guanella Pass Road. As a result of environmental evaluation and discussion with cooperating agencies, the following realignment options were dropped from consideration.

9a. Realignment Option A: Duck Creek Realignment

The Duck Creek Realignment is approximately 3.28 kilometers (2.04 miles) in length. This is the only major realignment proposed in Park County. This realignment leaves the existing alignment at approximately station 15+700. The realignment follows Duck Creek for approximately 0.5 kilometers (0.3 miles) at which point it shifts away from Duck Creek with a pair of switchbacks. The realignment passes the abandoned Geneva Basin Ski Area and rejoins the existing alignment near station 19+000 after two additional switchbacks.

The purpose of the Duck Creek Realignment is to avoid the unstable slopes along the existing route between station 16+300 and station 17+900. This area has some of the most severe ice flow, rockfall, and maintenance problems on the entire route. Extensive retaining walls, guardrail, and wider ditches for rockfall collection would be needed if the roadway were improved along the existing alignment in this area.

A major reason for this realignment is to remove the road from the rock slide area. The realignment, however, does not sufficiently remove it from the rockslide area and the hazardous condition remains. The roadway realignment crosses undisturbed woodlands, wetlands, and boreal toad habitat. The alignment encroaches on Duck Creek in some areas. This is a major issue since protection of the creek and the water resources is a key issue stated in the project objectives. As a result of these deficiencies, the Duck Creek Realignment was eliminated from further consideration.

9b. Realignment Option B: Upper Clear Creek

The Upper Clear Creek Realignment is approximately 1.88 kilometers (1.17 miles) in length. This realignment leaves the existing alignment near station 23+200, just before the second set of switchbacks north of the summit. The realignment reestablishes these switchbacks in more favorable terrain, allowing for greater turning radii and more separation between the adjacent upper and lower segments of the switchbacks. The realignment parallels the existing alignment at a higher-grade beginning at the existing switchback located at approximately station 24+100. The realignment then runs above the existing alignment until approximately station 25+000, where it connects back to the existing roadway.

The purpose of the Upper Clear Creek Realignment is to provide a less severe set of switchbacks and avoid a snow slide/avalanche area. The FS has expressed concern over the impact the realignment has on key “old growth” forest and lynx habitats. It was determined that the additional impacts on the environment created by this realignment are unacceptable given the issue it is intended to resolve.

9c. Realignment Option D: Cabin Creek Realignment

The Cabin Creek Realignment is approximately 1.87 kilometers (1.16 miles) in length. This realignment leaves the existing alignment at approximately station 30+100. The realignment then follows the east side of Lower Cabin Creek Reservoir, crosses over south Clear Creek below the dam, and ties into the existing alignment at approximately station 31+900. The Cabin Creek Realignment is paved.

The purpose of the Cabin Creek Realignment is to avoid the potentially hazardous, steep, and unstable existing cut slopes located along the existing roadway and to avoid interference with the power plant, power transmission lines, and other utilities.

This realignment came from the need to remove the existing alignment from an unstable slope. The roadway realignment sits at the bottom of an unstable slope. The Cabin Creek Realignment Option places the road in a shady area during the winter and may present a safety hazard. The roadway scar left by the existing alignment on the western slope near the Cabin Creek Reservoir will be visible from the realignment. In addition, the realignment crosses an important boreal toad migration corridor and impacts a big horn sheep use area. As a result of these deficiencies, the Cabin Creek Realignment was eliminated from further consideration.

9d. Realignment Option E: Green Lake Bypass Realignment

The Green Lake Bypass Realignment is approximately 1.86 kilometers (1.16 miles) in length. This realignment leaves the existing route at approximately station 32+400 and deviates to the east along Clear Lake. It proceeds northerly along the South Clear Creek drainage and rejoins the existing alignment at the northwest side of the switchbacks located at station 35+000.

The purpose of the Green Lake Bypass Realignment is to eliminate a set of sharp switchbacks north of Green Lake and to eliminate the portion of the existing alignment that passes less than a meter (a few feet) from the edge of Green Lake. The Green Lake Bypass Realignment is shorter than the existing alignment it bypasses.

The Green Lake Bypass Realignment crosses South Clear Creek two times and infringes on a popular waterfall location at the south end of the realignment. In addition, the realignment impacts boreal toad habitat. The protection of water resources and wildlife is a key issue stated in the project objectives. As a result of these deficiencies, the Green Lake Bypass Realignment was eliminated from further consideration.

9e. Realignment Option Fa: Georgetown Side-Hill Bypass Realignment

The Georgetown Side-Hill Bypass Realignment leaves the existing alignment at approximately station 38+700, crosses Clear Creek on a new bridge, and ties into Loop Drive on the outskirts of Georgetown, creating a bypass of downtown. The side-hill alignment lies around the front of a rock outcropping located at the second switchback above Georgetown. The alignment removes a portion of the rock. The alignment is approximately 0.46 kilometers (0.29 miles) in length.

The purpose of the bypass is to reduce the through traffic volume in downtown Georgetown, thereby easing congestion during peak periods. This is accomplished by providing an alternate route between the Interstate 70 frontage road and Guanella Pass Road. This alternate route allows drivers not wanting to stop in Georgetown to bypass the historic central business district.

The Side-Hill Bypass Realignment is visually intrusive to the character of the community due to highly visible cut slopes on Leavenworth Mountain. In addition, the bypass realignment has received substantial criticism from the Georgetown business community. The Georgetown business community has expressed concern over the negative economic impact the bypass would create. As a result, the Georgetown Side-Hill Bypass Realignment was eliminated from further consideration.

9f. Realignment Option Fb: Georgetown Tunnel Bypass Realignment

The Georgetown Tunnel Bypass Realignment leaves the existing alignment at approximately station 38+700, crosses Clear Creek on a new bridge, and ties into Loop Drive on the outskirts of Georgetown, creating a bypass of downtown. The tunnel alignment passes through a rock

outcropping located at the second switchback above Georgetown. The tunnel is approximately 137 meters (450 feet) long. The total realignment is approximately 0.42 kilometers (0.26 miles) in length.

The purpose of the bypass is to reduce the through traffic volume in downtown Georgetown, thereby easing congestion during peak periods. This is accomplished by providing an alternate route between the Interstate 70 frontage road and Guanella Pass Road. This alternate route allows drivers not wanting to stop in Georgetown to bypass the historic central business district.

The Tunnel Bypass Realignment is visually intrusive to the character of the community due to highly visible cut slopes on Leavenworth Mountain. In addition, the bypass realignment has received substantial criticism from the Georgetown business community. The Georgetown business community has expressed concern over the negative economic impact the bypass would create. As a result, the Georgetown Tunnel Bypass Realignment was eliminated from further consideration.

9g. Realignment Option Fc: Georgetown Through-Cut Bypass Realignment

The Through-Cut Bypass Realignment of Georgetown leaves the existing alignment at approximately station 38+700 and ties into Loop Drive on the outskirts of Georgetown, creating a bypass of downtown. This option uses an open cut to go through the rock outcropping located at the second switchback above Georgetown. The cut slopes reach 32 meters (105 feet) high.

The purpose of the bypass is to reduce the through traffic volume in downtown Georgetown, thereby easing congestion during peak periods. This is accomplished by providing an alternate route between the Interstate 70 frontage road and Guanella Pass Road. This alternate route allows drivers not wanting to stop in Georgetown to bypass the historic central business district.

The Through-Cut Bypass Realignment is visually intrusive to the character of the community due to highly visible cut slopes on Leavenworth Mountain. In addition, the bypass realignment has received substantial criticism from the Georgetown business community. The Georgetown business community has expressed concern over the negative economic impact the bypass would create. As a result, the Georgetown Through-Cut Bypass Realignment was eliminated from further consideration.

9h. Realignment Option G: Naylor Creek Realignment

The Naylor Creek Realignment is approximately 1.55 kilometers (0.96 miles) in length. It leaves the existing alignment near station 24+500 and curves around the west side of the Guanella Pass Campground. The realignment rejoins the existing alignment at approximately station 26+100. The realignment is paved if it is included in Alternatives 2, 4, or 5, and gravel if included in Alternatives 3 and 6.

The purpose of the Naylor Creek Realignment is to provide a safer intersection with Naylor Lake Road (the existing intersection is currently located on a severe bend in the road with minimal sight distance), reduce the grade of the road, eliminate three switchback curves, and unite the two halves of Guanella Pass Campground, which are currently bisected by the existing alignment.

The realignment also moves the road out of an area of wetlands that exist along the current alignment of road. However, the FS has expressed concern over the impact the realignment has on key forest and other wetland habitats. The FS indicates that “the proposed realignment will

result in new impacts to old growth forest, associated wetland and interior forest habitats (fragmenting and reducing). These impacts are in addition to already existing impacts that will remain in the vicinity of the (Guanella Pass) campground and along the existing road after being revegetated." Because of these impacts, the Naylor Creek Realignment was eliminated from further consideration.

10. Temporary Construction Bypass Bridge

A construction traffic only bypass bridge was considered between the Loop Road and the Georgetown switchbacks over Clear Creek. This bypass bridge would have been for construction traffic only and was intended to reduce the impact of the construction activities on the Town of Georgetown. However, this option was eliminated because the Town of Georgetown did not wish to pursue this option due to right-of-way concerns.

11. Material Sources

Other material sources along Guanella Pass Road were considered but eliminated. Those include:

- Switchback near Naylor Lake – Eliminated because the quality of the material was inadequate.
- Private Property near Silverdale – Eliminated because of possible impacts to the watershed protection area and the viewshed of the GSPNHLD. Access to test the material at this site was denied.
- Oakley Recreation Area – Eliminated because of difficult access that would require reconstruction and additional impacts.

G. ISSUES FOR FINAL DESIGN

An important consideration in the design of improvements to Guanella Pass Road is to maintain flexibility in decision making. Committing to specific final design elements early in the NEPA process limits future design considerations to the extent that future design cannot address different issues and concerns that may arise during the NEPA process and after the process has been completed.

1. Retaining Wall Design and Slope Treatments

Portions of the roadway will require either retaining structures or cut slopes on the uphill side and retaining structures or fill slopes on the downhill side. Various methods exist for stabilizing cut and fill slopes. Most of these methods involve providing sufficient vegetation to control erosion. A cut slope or fill slope that is revegetated looks more natural than a retaining wall, but in most cases requires a greater amount of earth to be disturbed to create the slope. Although retaining walls can look unnatural in some cases, new types of walls have been created that blend in with the natural setting for a more aesthetic appearance. The retaining walls chosen for this project will comply with the FS VQO's.

The switchbacks above Georgetown already have natural rock retaining walls that are about 2.4 to 3.0 meters (8 to 10 feet) high. To minimize the impact of cut slopes and blend with the

existing conditions, this area will use retaining walls extensively. In designing the retaining walls, the goal is to keep structures under 3.0 meters (10 feet) high.

Two important factors for the appearance of a retaining wall are the use of tiering (multiple walls) and the selected building materials. The benefit of tiering walls is that vegetation can be planted on the slopes in between, camouflaging the walls. The shorter walls also create a safer, more accessible environment for wildlife. Tiering, however, requires more of the land to be disturbed because the total slope is cut back farther. The benefit of a single structure is that the slope is not cut back excessively. However, a high single wall can detract from the visual quality of the area.

Cutside walls are more visible from the road than fillside walls. Fillside walls up to 4.0 meters (13 feet) in height can typically be screened with vegetation and therefore are less visible to users of the road. Because of their greater visibility, cutside walls normally require special considerations and more treatment to mitigate visual impacts. As a result, fillside walls tend to be less expensive than cutside walls.

Several options exist for materials used in the construction of retaining walls. The following options are under consideration.

1a. Concrete form-liners – stained

This method involves the use of a form-liner inside a concrete retaining wall form. The form liner is in the shape of a natural-rock, masonry wall. Once the concrete inside the retaining wall form is set, the form and form-liner are removed to expose the simulated rock face. The simulated rock face is then stained to resemble a natural-rock, masonry wall. See Figure II-18.

1b. Modular blocks

Modular blocks are similar to those used in landscaping. The blocks are layered to form the retaining wall. The modular block faces can be rough and colored to partially resemble a natural-rock, masonry wall. See Figure II-19.

1c. Dry-Stack

This method involves the use of native, natural materials to create the retaining wall. Local material sources provide the large rock that is stacked to form the wall. The rocks are not mortared together, hence the term dry-stack. The dry-stack wall uses gravity to stay together and is typically wider at the base than at the top. The large rock is fitted together tightly using interlocking pieces with the front side typically more vertical than the back side. See Figure II-20.

Figure II-18

Form-liner, stained-concrete retaining wall

Figure II-19

Modular block retaining wall

Figure II-20

Dry-stack retaining wall

1d. Stone façade – mortared rock

This type of retaining wall is built of concrete and faced with a real rock surface to give the appearance of a stacked rock or stone-mortar retaining wall. The concrete retaining wall is "veneered" with a layer of large rock that is mortared into place. This type of wall can be used instead of the stained, form-liner concrete wall mentioned above in areas where pedestrian traffic is heavy, because the stone façade retaining walls have an even more natural appearance. See Figure II-21.

1e. Shot-crete – sculpted and stained

The cut slope is covered with a wire mesh. The shot-crete is then sprayed into place over the wire mesh. The shot-crete material is than sculpted into the shape of a rock and stained to resemble a rock face. See Figure II-22.

Figure II-21

Stone façade, mortared rock retaining wall

Figure II-22

Stained, sculpted shotcrete retaining wall

2. Drainage Structures

Two drainage issues for the final design of the Guanella Pass Road project are related to the major stream crossings and the runoff from Leavenworth Mountain into Georgetown. These issues require more design than is available in the EIS process, but are important to address in at least a general way as part of the environmental considerations.

Specific water quality related issues that are of concern are addressed in **Chapter III.B.2a: Water Quality**. These sections address the concerns over drainage as related to sediment containment, erosion control, and Best Management Practices (BMPs) for each of the alternatives.

2a. Major Stream Crossings

The environmental setting of Guanella Pass Road provides habitat for many kinds of wildlife. The wetland, riparian, and creek channel areas are especially suitable for the livelihood of numerous waterfowl, fish, and other small aquatic life such as salamanders and toads. Each of the alternatives cross major drainages. Special consideration will be given to the design of the major stream crossings or any water channel that has continuous flow. The crossing structures will be oversized and have a natural bottom to facilitate the protection and passage of fish and other small aquatic life. In certain locations, the structures will provide a small pathway to allow small and medium-sized mammals to cross underneath the road.

2b. Runoff from Leavenworth Mountain

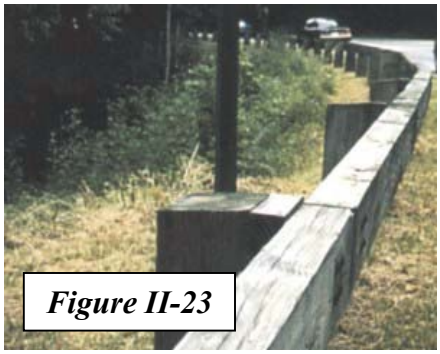
The runoff from Leavenworth Mountain, southwest of Georgetown, currently flows onto Guanella Pass Road and follows the alignment into Georgetown. The flow generally enters town at Second Street between Taos Street and Argentine Street and regularly floods the streets and adjacent properties. The Town of Georgetown has requested that the design of Guanella Pass Road include some drainage facilities that eliminate or reduce the amount of flow following the alignment into town.

If the Georgetown segments of the road are included in the selected alternative, the FHWA will provide a storm drain system between the third and fourth switchback above Georgetown (station 37+850 to 38+300) to intercept the runoff from Leavenworth Mountain. The design of the storm drain could be either a surface channel that collects water above ground (like a ditch system) or an underground culvert that collects water in storm drains and passes the water in a closed system to the outlet. The system design could include erosion control and permanent sediment collection facilities that require a maintenance commitment from the maintaining authority. Also, the Town of Georgetown has requested drainage capacity improvements to some existing streets (specifically, Rose Street and possibly Argentine Street) as part of the mitigation for construction vehicle impacts on town streets if construction traffic goes through town. This will include construction or repair of curbs and gutters or milling the existing pavement to restore drainage capacity.

3. Guardrail Design and Materials

The need for guardrail is based on the severity of roadside hazards and the risk of vehicles leaving the roadway. Key issues that will be considered for the selection of guardrail materials include location, sensitivity, cost and convenience of maintenance, and visibility. The guardrail design and materials proposed for this project will be in compliance with the FS VQO's.

The following options may be considered for guardrail. For the guardrails described in **3a**, **3b**, and **3c** below, located in gravel/alternative surface sections, a timber curb board will be included to reduce sediment runoff from the road.



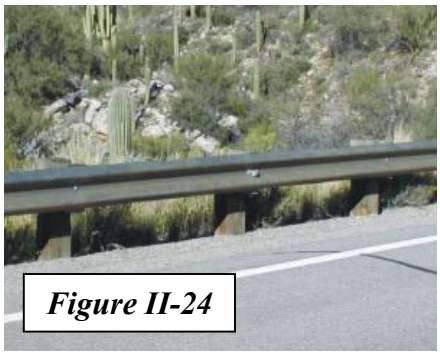
Timber beam, steel-backed guardrail

3a. Timber beam, steel-backed

This type of guardrail has a timber beam facing with steel backing for strength. It has the disadvantage of greater installation costs and maintenance needs but the advantage of a rustic appearance. See Figure II-23.

3b. W-shaped steel beam – galvanized and acid-stained to darken

W-shaped steel beam guardrail is typically used for road construction projects. For this project, the w-shaped galvanized steel would be stained and darkened to create a dull, dark gray rather than shiny appearance. See Figure II-24.



Galvanized, acid-stained guardrail

3c. W-shaped steel beam Cor-ten – corrosion-resistant steel

Cor-ten is corrosion-resistant steel that takes on a rust-colored appearance over time to create a more weathered and rustic appearance. See Figure II-25.

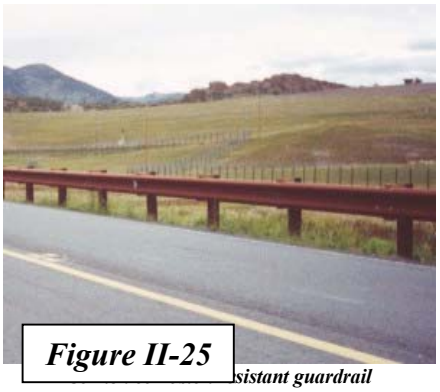


Figure II-25

sistant guardrail

3d. Guardwall

This type of guardrail includes concrete with formliner and stain to simulate stone facing, or concrete with a natural stone veneer. It will be used in areas of especially high visual sensitivity such as the GSPNHLD. This type of guardrail has the disadvantage of being extremely expensive. See Figures II-26 and II-27.

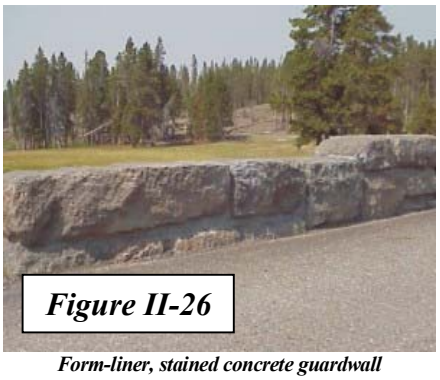


Figure II-26

Form-liner, stained concrete guardwall

4. Other Design Issues

Other final design issues that are of consideration include interpretative signage, and the locations of pullouts and restrooms. These elements will take into consideration the Scenic Byway CMS for Guanella Pass Road. The final design of the roadway facilities will address the issues and recommendations of the approved plan to the maximum extent possible. All final design issues will be coordinated with the FS, Georgetown, and Clear Creek and Park Counties.

Figure II-27

Natural stone veneer guardwall

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