

SECTION 4(f) EVALUATION

US 40 Resurfacing, Clear Creek and Jefferson Counties

Project No. STA C510-024

Project Code 17797

January 2016

By the:

United States Department of Transportation

Federal Highway Administration

&

Colorado Department of Transportation, Region 1

Submitted Pursuant to

49 U.S.C. 303

23 U.S.C. 138

Introduction

Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966, as amended, and codified in 49 United States Code (USC) § 303, declares that “[i]t is the policy of the United States Government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites.” FHWA has adopted regulations to ensure its compliance with Section 4(f) (23 Code of Federal Regulations [CFR] 774).

Section 4(f) specifies that:

“The Administration may not approve the use of a Section 4(f) property unless it makes a determination that:

1. There is no feasible and prudent avoidance alternative to the use of land from the property; or
2. The action includes all possible planning to minimize harm to the property resulting from such use.”

Section 4(f) further requires consultation with the Department of Interior and, as appropriate, the involved offices of the U.S. Department of Agriculture and the U.S. Department of Housing and Urban Development, and relevant state and local officials, in developing transportation projects and programs that use lands protected by Section 4(f).

The Preferred Alternative is a transportation project that may receive federal funding and/or discretionary approvals through USDOT; therefore, documentation of compliance with Section 4(f) is required.

This Section 4(f) evaluation has been prepared in accordance with FHWA regulations for Section 4(f) compliance codified at 23 CFR §774. Additional guidance has been obtained from the FHWA Technical Advisory T 6640.8A (1987) and the revised FHWA Section 4(f) Policy Paper (2012). Technical Advisory and Policy Paper will be followed to the extent that they do not conflict with 23 CFR 774.

Purpose and Need

The purpose of the proposed action is to improve road conditions and safety along US 40 from milepost 269.5 to milepost 273.9, a distance of 4.4 miles.

Road Conditions

In response to the Moving Ahead for Progress in the 21st Century (MAP-21) Asset Management requirements, the Colorado Transportation Commission has established that 80% of all transportation surfaces need to have a high or moderate drivability. The drivability of a roadway takes into account how the roadway will perform over a 20-year period and is measured in years. To determine drivability, CDOT uses a Pavement Management Model that identifies deterioration rates based on cracking and the roughness of the road. The model also recommends solutions based on optimum quality from a cost/benefit perspective. Projects are prioritized by roadway volume, with priority being given to high volume roadways.

Within the project area, US 40 is geographically isolated within a mountain corridor and is the only alternate route for I-70 traffic. During peak travel periods, US 40 functions as an overflow route for I-70 traffic and is, therefore, considered a high volume roadway. The pavement on this stretch of road is currently 15 years old with a drivability of 0 years. This was based on the large amount of transverse cracking that occurs along this stretch of the roadway.

Safety

The guardrail between mileposts 269.5 and 271.5, a distance of 2.0 miles, includes the Flexbeam type, which was installed between 1936 and 1938 with the initial construction of the highway. The American Association of State Highway Officials (AASHTO) *Roadside Design Guide* performance requirements for roadside barriers require a barrier system to meet the crashworthiness recommendations contained in the AASHTO *Manual for Assessing Safety Hardware (MASH)*, which has replaced the requirements of the National Cooperative Highway Research Program (NCHRP) Report 350 *Recommended Procedures for the Safety Performance Evaluation of Highway Features*. The Flexbeam guardrail remaining on US 40 does not provide adequate stopping ability and does not provide attenuation functionality to minimize harm to vehicles travelling in both directions. Further, the extant Flexbeam guardrail does not meet current height or set-back requirements. Flexbeam does not meet the federal standards identified in the National Cooperative Highway Research Program Report 350 *Recommended Procedures for the Safety Performance Evaluation of Highway Features (Report 350)*¹ because it does not provide adequate stopping ability nor minimizes harm to cars traveling in both directions. Report 350 may be accessed online at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_350-a.pdf.

Upon impact, Flexbeam is designed to collapse, which has the potential to cause a second collision with a fixed object if a vehicle continues past the guardrail. The guardrail metal is also old and rusted, which causes a loss of structural integrity. When hit, Flexbeam can fold in on itself and cause spearing, which happens when the guardrail punctures vehicle or its engine compartment and causes fatalities or severe injuries. The wrapped ends of the Flexbeam guardrail do not slow down a vehicle's kinetic energy and also have the potential to cause spearing. The height of the Flexbeam guardrail varies between 18" and 24" and does not meet the current height requirements of 27". As a result, there is potential for a vehicle to go over the guardrail upon collision.

Guardrail is intended to be constantly updated and/or replaced. It is installed in a specific location because of an obvious hazard. However, any time it gets hit, the function of the guardrail diminishes because the strength and structural properties become compromised. Once hit, guardrail has a higher potential to fail. Between July 1, 2009 and June 30, 2014 a total of 53 accidents were reported along this stretch of US 40. Twenty-four percent of those accidents occurred with a fixed object. Of those, 31% involved collisions with the guardrail (CDOT 2014). As a result, the guardrail is visibly damaged in several locations along the corridor and is considered a hazard.

¹ Ross, H.E., Jr., D.L. Sicking, R.A. Zimmer, Texas Transportation Institute, Texas A&M University System, J.D. Michie, and Dynatech Engineering Inc. *Recommended Procedures for the Safety Performance Evaluation of Highway Features*. Transportation Research Board, National Research Council. (National Academy Press: Washington, D.C.: 1993).

Proposed Action

The project involves the resurfacing of US 40 from mileposts 270.8 to 273.9 with guardrail replacement between mileposts 269.5 and 271.5. The project on US 40 is located between the base of Floyd Hill to the crossing over Beaver Brook. The project will resurface the highway between mileposts 270.8 to 273.9 with two inches of hot mix asphalt for the full width of the existing highway profile. Expansion joint work will occur on structure F-15-CN (milepost 269.5) over Clear Creek. Concrete deck repair will occur on structure F-15-Q over Beaver Brook (milepost 273.88). Aggregate fill reconditioning to repair shoulder pullouts and riprap fill will be installed at the edge of the roadway in areas with erosion.

Guardrail is subject to replacement between mileposts 269.5 and 271.5 and will be reset with corrosion-resistant rail to improve safety along the top of Floyd Hill. The guardrail replacement is indicated for safety improvements: the existing guardrail has not been crash tested, does not meet contemporary standards, and demonstrates diminished physical integrity in several locations. Though non-historic guardrail is present, sections of the 1935-standard "Flexbeam" rail is also extant, dating to construction of the highway between 1936 and 1938. Flexbeam rail is similar in appearance to contemporary Type 3 W-beam guardrail, which will be used as the replacement material. The historic guardrail will be replaced in its current locations and profiles. The only installation that is slightly different is the northwest corner of bridge structure F-15-CN over Clear Creek where a galvanized guardrail will be installed. The historic highway will maintain its current alignment, profile, and elevation. The new guardrail will be replaced in accordance with Section 606 of the CDOT Standard Specifications for Road and Bridge Construction (2011 edition) and the CDOT Standard Plans M&S Standards (July 2012 Edition).

Section 4(f) Resources

Resource Description

US Highway 40 (5JF2260/5CC171) in portions of Clear Creek and Jefferson Counties is significant for its association with early highway construction through the mountains and New Deal-era construction programs under Criterion A in the areas of Transportation and Politics/Government. It is also significant under Criterion C in the area of Engineering as it represents one of six major highway projects undertaken by the Colorado Department of Highways in the late 1930s. These six projects were designed with new safety standards including wide roadways with shallower curve radii, longer sight distances, and shallow grades of 5-6% or less, with few exceptions. New safety improvements included new designs for guardrail intended to "give" on impact. These new designs were considered technologically advanced for highway features, reflecting increased understanding of safety over earlier designs which were often intended to do little more than mark the edge of the roadway.

The overall resource in Clear Creek and Jefferson counties is eligible for inclusion in the National Register of Historic Places (NRHP) and State Register of Historic Places (SRHP) as an Engineered Highway identified by the Multiple Property Documentation Form (MPDF) Colorado's Roads and Highways. Significant features of the resource include its alignment, width, elevation, and extant original features including sections of original guardrail. The project includes repaving two segments of US 40: 5CC171.7 and 5JF2260.2/5CC171.6. Repaving will not change the features of the highway supporting its historic

significance: alignment, width, and elevation. The highway has been resurfaced many times through its history, and the current pavement material is not considered to support the historic significance of the resource. Guardrail replacement will take place entirely on highway segment 5CC171.7 and does not remove a feature of the highway considered to support its historic significance.

Please see figure 6 in this document for the resource location and Area of Potential Effect (APE).

US Highway 40 (5JF2260.2/5CC171.6): The subject segment of US Highway 40 was constructed in 1937 with federal assistance from the PWA as project PWA 6007-C, bound by US 40 mileposts 271.5 to 274.6, a total distance of 3.1 miles. The subject segment retains a good degree of historic integrity including retention of its historic alignment without sacrificing sections to the construction of I-70, retention of historic highway features, and limited setting intrusions. The resource includes 0.7 miles of highway in Clear Creek County, with the remainder in Jefferson County. The overall resource is considered *eligible* to the NRHP; the subject segment was determined *supporting* of the eligibility of the overall resource in 2013.

US Highway 40 (5CC171.7): 5CC171.7 is a section of US 40 constructed between 1936 and 1938 with assistance from the PWA, a program of the New Deal, as project AW 6007 Unit 1 and Unit 2, and is bound by US 40 mileposts 269.44 and 271.78, a total distance of 2.34 miles. Levels of historic integrity vary along the highway corridor, with greater setting intrusions and lower integrity of design, workmanship, and materials noted as the highway travels closer to Denver. Interstate 70, constructed through the area ca. 1970, is a prominent setting feature throughout the surveyed US 40 corridor, detracting from association with the New Deal-era highway. Features of the highway itself, including width, alignment, elevation are generally intact. Some areas of the highway retain highway features (guardrail, culverts) dating to the original 1930s construction, however areas of replacement are also noted. Sufficient integrity remains for the overall resource to convey significance under Criteria A and C and the overall resource is considered *eligible* to the NRHP; the subject segment is considered *supporting* of the eligibility of the overall resource.

Guardrail Images: US 40 Mileposts 269.5 and 271.5; Area of Replacement



Figure 1 5CC171.7: US 40 022.jpg, east side of guardrail at a curve in the roadway south of Frei Way. View to southeast.



Figure 2 5CC171.7: US 40 026.jpg, east side of highway at approximately mp 269.75 showing section of guardrail that has been damaged, possibly by a vehicle. View to east.



Figure 3 5CC171.7: US40 036.jpg.
Guardrail on east side, view to northeast.



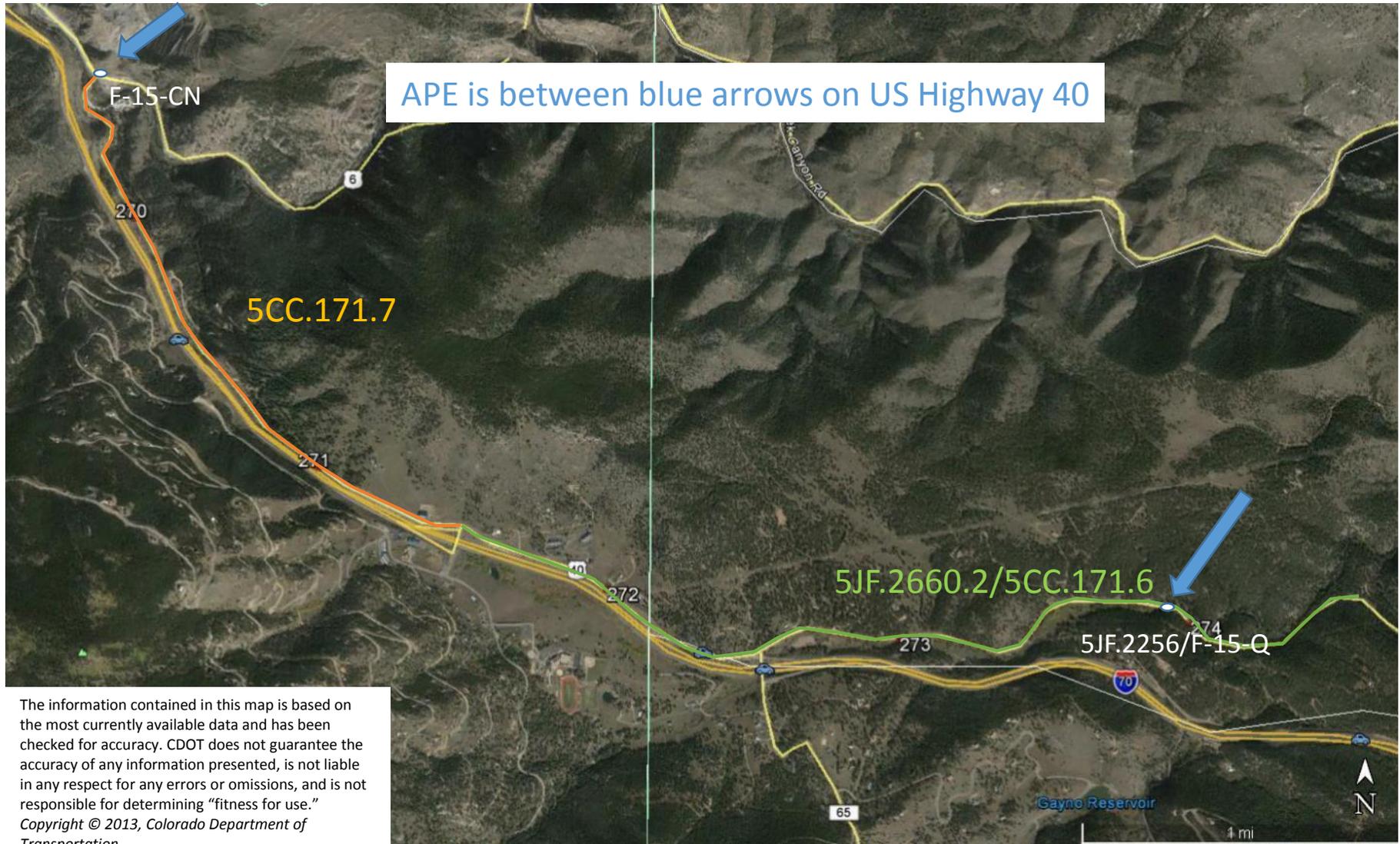
Figure 4 5CC171.7: US 40 041.jpg.
Guardrail on east side, detail view of damaged and broken segment at approximately mp 269.9. View to south/southeast.



Figure 5 5CC171.7: US 40 066.jpg.
East side of US 40. End section of guardrail showing 1930s practice of wrapping guardrail around end post. View to northwest toward Town Valley Drive.

*all photos taken May 28, 2015 by Dianna Litvak, Dill Historians

Figure 6: APE MAP: Project STA C510-024 (17797)
US 40 (5JF2660/5CC171) Guardrail Replacement
Created June 26, 2015



The information contained in this map is based on the most currently available data and has been checked for accuracy. CDOT does not guarantee the accuracy of any information presented, is not liable in any respect for any errors or omissions, and is not responsible for determining "fitness for use."
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Map prepared by Dianna Litvak, Dill Historians

Description of Use

The project will require the removal of Flexbeam-type guardrail on 5CC171.7, originally installed between 1936 and 1938, located between US Highway 40 milepost 269.5 and 271.5 to accommodate replacement guardrail meeting contemporary standards. The Flexbeam rail contributes to the original character of the highway as an early safety feature and its replacement constitutes an *adverse effect* under Section 106 of the National Historic Preservation Act (36 CFR Part 800). This action is considered a use under 23 CFR §774.17.

Alternatives Analysis

Under Section 4(f), if a project alternative uses a 4(f) resource one must determine whether there are any prudent and feasible alternatives that do not use a 4(f) resource. There are two components to the 4(f) alternatives evaluation. First, avoidance alternatives are evaluated to determine if they are prudent and feasible. If a prudent and feasible avoidance alternative exists, it must be selected. The No Action and two Build Alternatives were evaluated as avoidance alternatives using the prudent and feasible criteria of 23 CFR 774.17. None of these alternatives was found to be prudent and feasible. Two other alternatives that use the property were evaluated for least harm according to 23 CFR 774.3(c)(1) to determine the degree to which they have the least overall harm in light of the statute's preservation purpose.

Avoidance Alternatives

- Alternative 1: No Action/No Build Alternative
- Alternative 2: Leave Guardrail in Place Relying on its Ability to Function and Overlay Highway
- Alternative 3: Build Highway on a Different Alignment to Avoid Using Guardrail

Use Alternatives

- Alternative 4: Leave Guardrail in Place by Installing New Guardrail on Inside or Outside of Rail
- Alternative 5 (Proposed Action): Replace Flexbeam Guardrail with Type 3 W-beam Guardrail

Avoidance Alternatives

Alternative 1, No-Action/No-Build: This action would leave the highway in its current condition and not replace the guardrail. The current guardrail presents several significant safety issues for motor vehicles. The metal Flexbeam is rusted, structurally deficient, and has been hit in numerous locations throughout the project corridor. These collisions weaken the guardrail and make it less effective. When it was originally installed, the guardrail was considered to be a state-of-the-art technology, but methods and materials have since changed. Flexbeam guardrail is less rigid and designed to give on impact. As a result, vehicles can keep moving after collision while the current standard guardrail attempts to keep vehicles in place to minimize the danger of vehicles being redirected into oncoming traffic or continuing to hit additional fixed objects. Upon impact, Flexbeam guardrail folds, which can cause spearing, when

the displaced section of guardrail becomes a sharp object that can penetrate the vehicle and its occupants.

Alternative 1 would not address the deficiencies of the guardrail. Guardrail is intended to be replaced as materials and installation methods improve and standards change for highway engineering and design. In addition, this alternative would leave the pavement in its current condition. The pavement on this stretch of road is currently 15 years old and a large amount of transverse cracking occurs along this stretch of the roadway. This would result in unacceptable safety problems and decreased drivability on US 40. This alternative would leave the historic guardrail in place, but it would not meet the purpose and need of the project to improve road conditions and safety in the project corridor. As this alternative does not meet the project's purpose and need, it is not prudent and therefore not a feasible and prudent avoidance alternative.

Alternative 2, Leave Guardrail in Place Relying on its Ability to Function and Repave US 40: This action would leave the guardrail in place but repave the highway. Similar to Alternative 1, this would present several significant safety issues for motor vehicles because the rusted guardrail is structurally deficient and weakened by previous collisions. The semi-rigid Flexbeam guardrail will give on impact, while current standards for Type 3 W-beam guardrail stop the movement of vehicles after impact to minimize collisions with other vehicles or fixed objects.

Under Alternative 2, the pavement issues would be addressed, but the historic guardrail would remain in place. This alternative would not meet the purpose and need of the project to improve road conditions and safety in the project corridor. This would result in unacceptable safety problems and decreased drivability on US 40. As this alternative does not meet the project's purpose and need, it is not prudent and therefore not a feasible and prudent avoidance alternative.

Alternative 3, Build Highway on a Different Alignment to Avoid Using Guardrail: This alternative would construct a new highway on a new alignment, leaving the historic highway and its contributing features in place for an undetermined future use. Alternative 3 would not meet the purpose and need of the project to improve road conditions and safety in the project corridor and would incur significant costs and environmental impacts if the highway were re-aligned to avoid using the guardrail. As this alternative does not meet the project's purpose and need, it is not prudent and therefore not a feasible and prudent avoidance alternative.

Use Alternatives

Alternative 4, Leave Guardrail in Place and Install New Guardrail: This action would leave the guardrail in place but install new guardrail to meet current standards on the inside or outside of the historic rail. A minimum of 3' is required between the guardrail and the travel lane within the shoulder to maintain adequate sight distance and minimize hazards for vehicles traveling too close to the guardrail. There is not enough room in the existing shoulder to install a second guardrail along US 40. Temporary and

permanent easements and right-of-way acquisitions would be required to install guardrail that meets current standards next to the historic guardrail. Drivers would be confused by the design and driver expectation of road conditions would diminish, possibly causing additional accidents. In addition, this alternative would still constitute an adverse effect under Section 106 because it would either cover the contributing feature of the highway or diminish its integrity by installing guardrail behind the historic guardrail. The issue of the guardrail giving upon impact would still be present, causing deflection of vehicles or spearing if the guardrail folds and penetrates the collided vehicle. Alternative 4 would not meet the purpose and need of this project to improve road conditions and safety in the project corridor. As this alternative does not meet the project's purpose and need, it is not prudent and therefore not a feasible and prudent avoidance alternative.

Alternative 5, Proposed Action, Replace Flexbeam Guardrail with Type 3 W-beam Guardrail: The project involves the resurfacing of US 40 from mileposts 270.8 to 273.9 with guardrail replacement between mileposts 269.5 and 271.5. This alternative would replace the historic guardrail with 27" high Type 3 W-beam guardrail, and repave the road with 2 inches of hot mix asphalt. The historic guardrail will be replaced in its current location and profile. End treatments would fix the wrapped sections of the guardrail and replace them with stronger end segments designed to stop a vehicle upon impact. Alternative 5 meets the purpose and need of the project to improve road conditions and safety in the project corridor and is considered both feasible and prudent.

Alternatives Analysis Summary: There are no feasible and prudent avoidance alternatives. Only one alternative (Alternative 5, Proposed Action) is demonstrated to be both prudent and feasible. Because there are no additional feasible and prudent alternatives that use the resource, assessment of least overall harm (23 CFR Part 774.3 (c)(1)) is not required.

Coordination

During the Section 106 process, CDOT determined the project results in an *adverse effect* (36 CFR 800.5) to US Highway 40 (5JF2260/5CC171) due to the removal of an original historic feature. The State Historic Preservation Officer (SHPO) concurred with the finding of *adverse effect* for this resource in correspondence dated August 25, 2015.

All Possible Planning to Minimize Harm

Because there are no prudent and feasible avoidance alternatives to replacement of the 1930s guardrail on US 40, the only means to minimize harm is to mitigate the effects of removal of this original highway feature. The following measures will be included in the project as mitigation commitments to minimize harm to the historic highway.

The in-depth analysis of the highway leads to the recommendation that the historic guardrail should be replaced with modern guardrail that meets current standards. Through Section 106 consultation, SHPO, FHWA, and CDOT, in coordination with the Clear Creek County Planning Department, in the capacity of Section 106 consulting party, determined the mitigation for this adverse effect and measures to minimize harm. These mitigation measures also constitute "all possible planning to minimize harm"

under 4(f). The parties agreed that CDOT would record the highway segment prior to construction so that there will be a permanent record of its present appearance and history.

Summary of Mitigation Commitments

In cooperation with FHWA, SHPO, and the consulting party, a Memorandum of Agreement has been executed (December 17, 2015), which outlines mitigation stipulated for resolution of effects to this resource.

Archival Documentation: The guardrail between US 40 mileposts 269.44 and 271.5 shall be photographed prior to replacement to create a permanent record of its present appearance and setting. Recordation shall consist of archival photographs and a descriptive historic narrative of the roadway segment within the APE. All documentation must be accepted by the SHPO prior to the start of construction. CDOT shall:

- (i) ensure that *US 40 Segment* will be documented in accordance with the standards required for Level II documentation found in *OAHP form #1595, Historical Resource Documentation: Standards for Level I, II, III Documentation*, and
- (ii) ensure that all documentation activities will be performed or directly supervised by, architects, historians, photographers, and/or other professionals meeting the qualification standards for their field in the Secretary of Interior's Professional Qualifications Standards (36 CFR Part 61, Appendix A), and
- (iii) provide originals of the documentation to the SHPO and the Denver Public Library.

Determination

Based upon the above considerations, there is no feasible and prudent alternative to the use of land from US Highway 40 and the proposed action includes all possible planning to minimize harm to the Section 4(f) property resulting from such use.

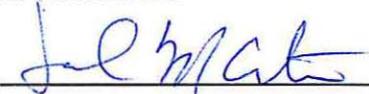
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for Charles Attardo, Region 1 Planning and Environmental Manager
Colorado Department of Transportation

1/7/16
(date)

APPROVED BY:



John M. Cater, P.E.
Division Administrator
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1/11/16
(date)

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