



# Highway Noise & Historic Properties:

## A National Review of Effects & Mitigation Practices

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Prepared for

**AASHTO Committee on Environment and Sustainability**

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### Disclaimer

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## EXECUTIVE SUMMARY

*Project Goals.* National Cooperative Highway Research Program (NCHRP) Project 25-25, Task 106 provides a resource to assist state Departments of Transportation (DOTs) in establishing standard practices regarding the long-term effects of highway noise on historic properties and to present effective mitigation practices for such noise impacts, in a similar manner as presented for vibration impacts in NCHRP 25-25 Task 72 from 2012. Understanding the challenges and various strategies used by others in addressing long-term highway noise impacts to historic properties will enable state DOTs to adopt or refine their own programs with approaches that have proven successful in other states.

*Project Approach.* As a first step the Task 106 project team conducted a literature review to identify and evaluate available information on the analysis of highway traffic noise and its potential effects upon historic properties within the context of Section 106. This literature review identified some expert practitioners and project case studies.

A stakeholder survey was then conducted to further identify expert practitioners in noise impact analysis and cultural resources. The survey was sent via email to a contact list developed from three Transportation Research Board (TRB) mailing lists (ADC50, ADC40, and ADC10); DOTs, a cultural resource experts list compiled by the team that was comprised of State Historic Preservation Office personnel, members of the AASHTO Noise Working Group, individuals in the private sector, and personnel in multiple federal agencies and offices such as the Advisory Council on Historic Preservation (ACHP), National Park Service (NPS), and Federal Highway Administration (FHWA).

Based upon the findings from the stakeholder survey, the most experienced practitioners were asked to participate in in-depth interviews. Interviewees were asked about the methodologies used to assess highway noise levels and determine if such noise had been determined to be an adverse effect. When adverse effects were identified, interviewees were asked about how such effects were resolved.

Using a list of projects identified during the background research and the interviews, multiple projects were reviewed and summaries prepared for those that considered noise impacts in Section 106 and projects that involved noise mitigation for historic properties. In general these case studies included projects that the team felt could be useful to state DOTs when adopting or refining their own programs.

*Summary of Findings.* During the literature review, stakeholder survey, interviews, and review of case studies, similar key elements emerged that state DOTs may find valuable when establishing standard practices for addressing highway noise effects on historic properties. In general the results of this study support the research problem stated for this project.

Specifically, the typical definition of what constitutes a noise “impact” (23 CFR 772 criteria) may or may not be applicable to effects on historic properties (36 CFR 800 criteria), and mitigation of noise impacts can involve practices that may constitute effects (e.g., construction of barriers may diminish historic setting and feeling).

This study has determined that:

- There is a general lack of experience in addressing highway noise impacts to historic properties.
- Addressing highway noise effects to historic properties is almost always a collaborative effort between the traffic noise and historic resource specialists.
- No Adverse Effect findings occur frequently because traffic noise does not generally alter the characteristics of a resource that make it eligible for the NRHP.
- Context-sensitive aesthetic treatments of noise walls have been successfully used to avoid potential adverse visual effects.
- Traffic noise was almost never an issue that prevented a project from moving forward.

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## **LIST OF ABBREVIATIONS/ACRONYMS**

AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
ADC10	Committee on Environmental Analysis in Transportation (TRB)
ADC40	Committee on Transportation-Related Noise and Vibration (TRB)
ADC50	Committee on Historic and Archaeological Preservation in Transportation (TRB)
ADT	Average Daily Traffic
ANSI/ASA	American National Standards Institute/Acoustical Society of America
ATM	Active Traffic Management
CCCR	Central Colorado Railroad
CDOT	Colorado Department of Transportation
CFR	Code of Federal Regulations
dB	decibel
dB(A)	decibel, A-weighted
DOT	Department of Transportation
EIS	Environmental Impact Statement (PEIS: Programmatic EIS)
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GDOT	Georgia Department of Transportation
HUD	U.S. Department of Housing and Urban Development
ICC	Intercounty Connector (Maryland)
MP	milepost
NAC	Noise Abatement Criteria
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NPS	National Park Service
NRHP	National Register of Historic Places
PennDOT	Pennsylvania Department of Transportation
PPSL	peak performance shoulder lane
ROW	right-of-way
SH	state highway
SHA	State Highway Administration (Maryland)
SHPO	State Historic Preservation Office/Officer
TCP	Traditional Cultural Property
THPO	Tribal Historic Preservation Office/Officer
TNM	Traffic Noise Model
TRB	Transportation Research Board
TxDOT	Texas Department of Transportation
VDOT	Virginia Department of Transportation



## INTRODUCTION

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires federal agencies to take into account the effects of their undertakings on properties listed in or eligible for listing in the National Register of Historic Places (NRHP) (i.e., “historic properties”) and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. According to the regulations at 36 CFR 800.5(a) (2) (v), adverse effects can include the “introduction of visual, atmospheric, or audible elements that diminish the integrity of the property’s significant historic features.” Although Section 106 consultation typically includes the analysis of effects resulting from alteration or diminishment of setting by visual changes, analysis of noise effects on historic properties is less common. Further, the typical definition of what constitutes a noise “impact” under 23 CFR 772 (*Procedures for Abatement of Highway Traffic Noise and Construction Noise*; see Agency Guidance, Federal Highway Administration, below) may or may not be applicable or equivalent to “effects” on historic properties under Section 106, an ambiguity that often characterizes discussion between noise and historic preservation experts at state departments of transportation (DOTs). Finally, mitigation of noise impacts can involve mitigation practices that may themselves constitute effects (e.g., construction of noise barriers may diminish historic setting and feeling).

In 2012 NCHRP 25-25 Task 72, “Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects,”<sup>1</sup> researchers examined the practices used to address the potential effects of construction vibration on historic buildings. Since that time there has been considerable interest in taking a similar approach to examine highway noise impacts on historic properties. The issue has been vetted at workshops and sessions at the Transportation Research Board (TRB) annual meeting and at events co-sponsored by TRB’s Committees on Historic and Archeological Preservation in Transportation (ADC50) and Transportation-Related Noise and Vibration (ADC40); however, there are limited published data related to this topic and no synthesis of effective nationwide practices. Information sources for this study were noise and historic preservation experts with previous experience in the analysis of noise impacts and Section 106 effects on historic properties: professionals from state DOTs, State Historic Preservation Offices (SHPOs), the ACHP, the National Park Service (NPS), the Federal Highway Administration (FHWA), and the private sector (including DOT contractors).

The continuing and exponential increase in properties 50 years of age or greater means that more historic properties will be defined in proximity to all categories of highway projects, resulting in a corresponding increase in instances where highway noise may affect historic properties. Resolving analytical ambiguities between what constitutes a noise impact versus a Section 106 effect on historic properties, and augmenting that analysis with a synthesis of effective mitigation practices, will better prepare state DOTs to successfully address these issues.

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<sup>1</sup> Wilson, Irhig & Associates, Inc., ICF International, and Simpson, Gumpertz & Heger, Inc., NCHRP 25-25 Task 72, *Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects* (Washington, DC: NCHRP, September 2012, [http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25\(72\)\\_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25(72)_FR.pdf)).

The objective of Task 106 is to assist state DOTs in establishing standard practices regarding the long-term effects of highway noise on historic properties and to present effective mitigation practices for such noise impacts, in a similar manner as presented for vibration impacts in NCHRP 25-25 Task 72 from 2012. This project focuses on the current state of the practice of analyzing long-term highway traffic noise impacts to historic properties, excluding analysis of temporary construction noise impacts.

To achieve the Task 106 objective, this project addresses the issue of highway noise impacts for federal-aid projects as defined at 23 CFR 772 and how that regulation relates to the consideration of Section 106 effects, as well as how the regulatory differences are understood by noise impact experts. The study also collected information on methods used by noise analysts. The analysis of existing practices through a series of case studies will help state DOTs understand the range of Section 106 noise impact approaches currently in use on highway projects and identify best practices related to such impact analyses. The report also addresses methods for mitigation of highway noise effects (including barriers and their potential for both mitigating and creating effects), and potential alterations of acoustic characteristics of buildings that comply with the Secretary of the Interior's Standards for Rehabilitation.

## ANNOTATED BIBLIOGRAPHY

This annotated bibliography is based on references from individuals and searching a variety of databases. The primary search words used were *Highway Noise*, and *Noise and: Cultural Resources, Historic Resources*, and *Historic Properties*. Beyond Google, the databases searched were JSTOR, the Avery Index to Architectural Periodicals, Proquest Databases cross search, Proquest Research Library, the Sage Full Text Collection, Scribd, and Questia. Some references were imported directly from the databases.

### AGENCY GUIDANCE

#### Federal Highway Administration

*23 CFR 772 – Procedures for Abatement of Highway Traffic Noise and Construction Noise*. On July 13, 2010, the FHWA published a final rule updating 23 CFR 772. This final rule amends sections 772.1, 772.5 to 772.17, and Table 1–Noise Abatement Criteria (Table 1). This final rule does not amend Sections 772.3 and 772.19. The final rule requires each state DOT to revise its noise policy to be in accordance with this final rule. It should be noted that 23 CFR 772 does not directly mention historic resources or Section 106 properties.

The rule and other information can be accessed at: [https://www.fhwa.dot.gov/environment/noise/regulations\\_and\\_guidance/](https://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/).

**Table 1: Noise Abatement Criteria–23 CFR 772**

LAND USE ACTIVITY CATEGORY	Leq(h)	DESCRIPTION OF LAND USE ACTIVITY CATEGORY
<b>A</b>	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
<b>B*</b>	67 (exterior)	Residential.
<b>C*</b>	67 (exterior)	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
<b>D</b>	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
<b>E*</b>	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A, B, or C.
<b>F</b>	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, ship yards, utilities, (water resources, water treatment, electrical), and warehousing.
<b>G</b>	--	Undeveloped lands that are not permitted.

Leq(h): Hourly Weighted Sound Levels dB(A) For Various Land Use Activity Categories

\* Includes undeveloped lands permitted for this activity category.

## National Park Service

*NPS Director's Order #47: Soundscape Preservation and Noise Management.* This director's order outlines NPS operational policies that address the "protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources." It may be found at <https://www.nps.gov/policy/dorders/dorder47.html>.

*Reference Manual #47: Acoustic Environment Preservation and Noise Management (In Development).* This internal NPS document includes current approaches and knowledge regarding noise management from the Natural Sounds and Night Skies Division of the NPS. The manual includes sections on data collection, characterization of the acoustic environment, planning, and impact assessment among others. It may be found at <https://www.nps.gov/subjects/sound/rm47-1cover.htm>.

*Effects of Noise on Cultural-Historic Resources. Natural Sounds.* U.S. Department of the Interior, National Park Service, Washington, D.C., 2018. The document specifically deals with the acoustical environment of NPS cultural and historic sites and includes the NPS's policy statement on inappropriate sound. It notes that sound is an important part of the setting and helps create meaningful connections for park visitors. It maintains that each part of the national park system is a unique cultural soundscape. It discusses detracting noise sources such as aircraft, vehicles, and construction equipment. This may be found at [https://www.nps.gov/subjects/sound/effects\\_cultural.htm](https://www.nps.gov/subjects/sound/effects_cultural.htm).

G. Randy Stanley (editor), *Annotated Bibliography – Vibroacoustic Studies for NPS Resource Impact Assessment v1.1a*. National Park Service, Intermountain Natural Resources Division, 2014. This annotated bibliography covers more than 30 years of studies, prepared for the Defense Department, USGS, NPS, and others, on the effects of vibration on cultural and natural resources in various national park units and National Historic Landmarks. The cultural resources include historic buildings, bridges, Indian ruins, petroglyphs, and other archaeological sites. Historic buildings can include adobe structures, stone veneer frame structures, monuments, and masonry (mortar or mortar-less) structures of all sizes. Natural structures can include pinnacles, caves, and the stone faces on which petroglyphs are formed.

*Report to Congress: Report on Effects of Aircraft Overflights on the National Park System.* Prepared Pursuant to Public Law 100-91, The National Parks Overflights Act of 1987, September 12, 1994. The report is part of PL 100-91, in which the Secretary of the Interior was directed to answer a set of aircraft noise related questions. Focusing on the noise impacts of overflights of seven parks with an emphasis on the Grand Canyon, it discusses the nature and scope of overflight problem in the national parks, what the proper minimum altitudes are for aircraft overflying national parks, the impairment of visitor enjoyment caused by overflights, and the safety impacts at overflights. This may be found at [hathitrust.org/record/003031124](http://hathitrust.org/record/003031124).

## AASHTO Traffic Noise Summit

On October 21-22, 2015, the Center for Environmental Excellence, a program of the American Association of State Highway and Transportation Officials (AASHTO), hosted a Traffic Noise Practitioners Summit in Baltimore, Maryland. This event brought together noise practitioners from 38 states throughout the country, as well as staff from AASHTO and FHWA, to discuss emerging topics of interest in the field and define a roadmap for the future of noise programs and research. This conference

did not include discussion of Section 106 or impacts to historic properties. Conference and workshop materials can be accessed

at [https://environment.transportation.org/center/products\\_programs/conference/traffic\\_noise\\_practitioners\\_summit.aspx](https://environment.transportation.org/center/products_programs/conference/traffic_noise_practitioners_summit.aspx).

### 2014 TRB Annual Meeting Workshop 153

In January 2014, ADC40, the committee on Transportation-Related Noise and Vibration, and ADC50, the committee on Historic and Archaeological Preservation in Transportation, hosted a half-day workshop on Transportation Noise and Historic Properties during the TRB Annual Meeting in Washington, D.C. This workshop brought together traffic noise practitioners and Section 106 experts from FHWA, state DOTs, and consultants. The workshop attempted to address a fundamental question:

*What noise level is an Adverse Effect?* Discussion topics included an overview of noise basics and Section 106 basics along with several case study examples.

## NOISE EFFECTS AND MITIGATION RESOURCES

Binal, A.

- 2015 An Investigation of Noise Effects on Natural Heritage and Historic Building Materials. In *Engineering Geology for Society and Territory*, Volume 5, edited by G. Lollino, A. Manconi, F. Guzzetti, M. CulMDSHaw, P. Bobrowsky, and F. Luino. Springer. Investigates the physical impacts of high-decibel noise on historic building materials. It finds that very high levels of noise can cause physical damage to ancient stone monuments.

Bruder, Anne E.

- 2014 Constructive Use Case Study: Free Methodist Church Campground, Spencerville, Maryland. PowerPoint presentation from 2014 Transportation Research Board Annual Meeting Workshop 153. Discusses the impacts of a proposed new limited-access highway near a noise-sensitive historic site. The project might have resulted in unresolved traffic noise related adverse effects if an alternative alignment had not been selected. Refer to the case study for this project included in this report.

California Preservation Foundation

- 2013 Sound Advice: Improving the Acoustics of Historic Buildings. Webinar, available at <https://californiapreservation.org/events/chbc-sound-acoustics/>. Includes a discussion of environmental noise. It briefly offers retrofit solutions for mitigating roadway noise.

Cubick, Karel L., and Erica L. Schneider

- 2015 Reduce the Noise/Save the View: Traffic Noise Mitigation for the National Register-listed Shiloh Baptist Church in Columbus, Ohio. PowerPoint presentation from 2015 Transportation Research Board Annual Meeting Workshop 158. Discusses the impact to a noise-sensitive resource of a project adding lanes to Interstate 71; discusses mitigation proposed to alleviate traffic noise. Refer to the case study for this project included in this report.

Feilden, Bernard M.

- 1994 *Conservation of Historic Buildings*. Butterworth, London. This is one of the standard works on building conservation. It briefly addresses the effects of noise on historic buildings but offers very drastic solutions such as shutting down streets or regulating traffic.

Hanson, C.E., K.W. King, M.E. Eagan, and R.D. Horonjeff

- 1991 *Aircraft Noise Effects on Cultural Resources: Review of Technical Literature*. Prepared for the National Park Service by Harris, Miller, Miller & Hanson, Inc. and U.S. Department of the Interior, Geological Survey, Branch of Geological Risk Assessment. NPS Report No. HMMH-290940.04-1. Available as PB93-205300. This study focuses on the impact of aircraft noise, including sonic booms, on cultural resources, including prehistoric sites. Although mostly focusing on aircraft noise impact, there are several good tables and charts that refer to noise impacts from non-aircraft sources. There is also a lengthy discussion of damage resulting from resonant frequencies that can be caused by a variety of sources.

Rainer, J.H.

- 1982 Effect of Vibrations on Historic Buildings: An Overview. *Bulletin of the Association for Preservation Technology* 14(1):2-10. Discusses the impact of a variety of noise and vibration generators. It identifies long-term impacts of traffic noise/vibration on historic buildings and offers a few solutions.

Riedel, Natalie, Heike Scheiner Köckler, and Klaus Joachim Berger

- 2015 Objective exposure to road traffic noise, noise annoyance and self-rated poor health – framing the relationship between noise and health as a matter of multiple stressors and resources in urban neighborhoods. *Journal of Environmental Planning & Management* 58(2-February 2015):336-356. Using methods of socio-environmental epidemiology and psychology, the report looks at traffic noise as a physical stressor as reported by subjective responses to noise. It looks at recreational coping in green areas as mitigation and discusses how environmental planning could aid in reducing noise-related stress.

U.S. Department of Transportation, Federal Highway Administration, and Colorado Department of Transportation [USDOT et al.]

- 2011 *I-70 Mountain Corridor Final Programmatic Environmental Impact Statement*. Available at Colorado Department of Transportation, Denver, <https://www.codot.gov/projects/i-70-old-mountaincorridor/final-peis/final-peis-file-download.html>.

Vogiatzis, Konstantinos

- 2012 Environmental ground borne noise and vibration protection of sensitive cultural receptors along the Athens Metro Extension to Piraeus. *Science of the Total Environment* 439(November 2012):230-237. To avoid the degradation of the urban acoustic environment from ground borne noise, track types and possible mitigation measure were tested. Ground borne noise from special track work were found to exceed the maximum noise level inside historic resources. To mitigate this effect, it was recommended that tracks in sensitive locations be installed on floating slabs.

Wolf, Steven

- 2015 Mitigation Monitoring Plan for a Historic Building adjoining the Subsurface Construction of a Light Rail Transit Project. PowerPoint presentation from 2015 Transportation Research Board Annual Meeting Workshop 158. This presentation focused on monitoring and mitigating the impacts of the project. It specifically relates to mitigation of vibration over noise.

## SOUNDSCAPE AND HISTORIC RESOURCES

Gunderlach, Jonathan

- 2007 Sound: Exploring a Character-Defining Feature of Historic Places. *APT Bulletin: The Journal of Preservation Technology* 38(4-(2007):13-20.



This study presents one approach to examining sound as a character-defining feature of historic places. The Secretary of the Interior's Standards are silent on the subject of sound, although it is clearly a "distinctive feature." The Assessment of Adverse Effect, 36 CFR 800.5(a)(2), includes "visual, atmospheric, or audible intrusions" as examples of adverse effects to historic properties. The NPS's Management Policies explicitly include sound as a cultural resource of the parks. Policy 5.3.1.7, Cultural Soundscape Management, states that "culturally appropriate sounds are important elements of the national park experience" and that the "Service will prevent inappropriate or excessive types and levels of sound (noise) from unacceptably impacting the ability of the soundscape to transmit the cultural and historic resource sounds associated with park purposes." Discusses how sound helps define the character of place, and how to go about preserving sound. It discusses how one can identify significance and integrity of sounds and the best way to document them.

Hedfors, Per

- 2004 Considering the Authenticity of the Garden Soundscape: Preliminary Research Based on Interviews. *Garden History* 32(2-Winter 2004):281-284. Considers soundscape as an essential part of historic gardens and advocates a return, if possible, to original soundscapes.

Kahn, Douglas, and Mark Smith (editors)

- 2004 *Hearing History*. University of Georgia Press, Athens. An introduction to aural history. Includes a section on noise pollution.

Schafer, R.M.

- 1976 *Soundscape*. Destiny Books, Rochester, Vermont. Early discussion of the concept of soundscape. It discusses natural and pre-industrial soundscapes followed by a discussion of post-industrial soundscape. It offers a method of critical analysis for soundscapes and end with a discussion of acoustic design. Good analysis of local noise ordinances in developed countries.

Tourle, Paul

- 2017 White noise: sound, materiality and the crowd in contemporary heritage practice. *International Journal of Heritage Studies* 23(3-March 2017):234-247. Discusses the *Sounds of our Shores*, a joint venture between the National Trust and the British Library that employed a crowdsourcing methodology to create a permanent archive of British coastal sounds.

van Kempen, Elise, Jeroen Devilee, Winn Swart, and Irene van Kamp

- 2014 Characterizing urban areas with good sound quality: Development of a research protocol. *Noise & Health*; Mumbai 16(73-Nov-Dec 2014):380-7. Because of rapid urbanization, the spatial variation between wanted and unwanted sound will decrease. The paper reviews the literature on sound quality in urban areas and on the influence of surroundings on people's perception of urban sound qualities. Literature summarized was published between 2000 and 2013.

## NOISE ABATEMENT RESOURCES

Nelson, J.P.

1978. *Economic Analysis of Transportation Noise Abatement*. Ballenger Publishing Company, Cambridge, Massachusetts. The opening thesis is that economic analyses of federal noise abatement programs are limited by the unavailability of appropriate benefits data, and too little attention has been given to abatement methods other than regulatory performance standards or construction of abatement structures. This book discusses these issues using property-value/noise-pollution data and benefit-cost analysis. At policy levels, optimal noise-abatement standards or

technology are defined for new medium- and heavy-duty trucks, and commercial jet aircraft. It discusses legal issues such as the purchase of noise easements. Alternative abatement methods are also treated, including a decibel emissions tax or resource-use price for aircraft and trucks.

Opperman, Antony F.

2015 Noise Barrier Aesthetics in Historic Yorktown and Current Aesthetic Practices. PowerPoint presentation from 2015 Transportation Research Board Annual Meeting Workshop 158. The Virginia Department of Transportation reconstructed the George P. Coleman Memorial Bridge in Yorktown in the late 1990s. The project involved improvements to an existing roadway and a bridge near a historic district. Noise impacts were identified and noise mitigation (via noise walls) was determined to have no adverse effect because of the aesthetics used on the noise wall. Refer to the case study for this project included in this report.



## STATE OF PRACTICE

### STAKEHOLDER SURVEY

After completion of the literature review, the project team sent out an initial stakeholder survey to identify expert practitioners in the noise impact analysis and cultural resource communities. Understanding the current state of practice of the analysis of highway traffic noise and its potential effects upon historic properties within the context of Section 106 was critical to effectively target agencies, organizations, and individuals with expertise in this area. The following four-question screening survey (using Google Forms) was sent to DOTs, SHPOs, members of the AASHTO Noise Working Group, consultants, federal agencies (including ACHP, NPS, and FHWA), and three TRB mailing lists: ADC50, ADC40, and ADC10 (Environmental Analysis in Transportation).

1. Do YOU have any experience with highway traffic noise analysis or traffic noise mitigation (noise walls, building insulation, etc.) at historic sites or in historic districts?  
Yes \_\_\_\_  
No \_\_\_\_
2. Does your agency/organization/company have experience with traffic noise at historic sites or in historic districts?  
Yes \_\_\_\_  
No \_\_\_\_  
Not Sure \_\_\_\_
3. Does your agency/organization/company have a set policy for determining adverse auditory effects from traffic noise?  
Yes \_\_\_\_  
No \_\_\_\_  
Not Sure \_\_\_\_
4. If you have a set policy, does it specifically address adverse auditory effects to historic properties or appropriate mitigation at historic sites or within historic districts?  
Yes \_\_\_\_  
No \_\_\_\_  
Not Sure \_\_\_\_  
Not Applicable \_\_\_\_

Respondents were given 10 weeks to complete the online survey. Ninety-six responses were received from 634 total emailed surveys. It is the project team's opinion that the 15 percent response rate is related to a general lack of experience with the topic. This issue of lack of experience was mentioned by some DOT and SHPO personnel during informal discussions, and all expressed interest in knowing how it has been successfully resolved in other agencies.

A total of 96 survey responses were received:

- 42 responses from state DOTs, representing 28 DOTs

- 10 responses from SHPOs
- 1 response from another state agency
- 9 responses from 5 federal agencies
- 33 responses from the consultant community
- 1 response from a non-profit organization

The responses from state agencies (DOTs, SHPOs, and the one state agency) represented a total of 31 states. Three SHPOs responded from states where no DOT responded. There were a combined total of 62 state and federal agency responses.

Responses were received from these 31 states:

- |              |                  |                  |
|--------------|------------------|------------------|
| • Arizona    | • Michigan       | • Oklahoma       |
| • Arkansas   | • Minnesota      | • Oregon         |
| • California | • Mississippi    | • Pennsylvania   |
| • Colorado   | • Missouri       | • Rhode Island   |
| • Delaware   | • Montana        | • South Carolina |
| • Georgia    | • New Hampshire  | • Texas          |
| • Idaho      | • New York       | • Utah           |
| • Iowa       | • North Carolina | • Vermont        |
| • Kentucky   | • North Dakota   | • Virginia       |
| • Maryland   | • Ohio           | • West Virginia  |
|              |                  | • Wisconsin      |

## **SURVEY RESULTS**

Practitioners were asked if they had personal experience with highway traffic noise analysis or traffic noise mitigation (noise walls, building insulation, etc.) at historic sites or in historic districts. The majority of respondents, 61 out of 96, had experience with traffic noise analysis or mitigation. A similar question was asked about traffic noise experience in the respondent's agency/organization/company. The positive responses increased slightly to 65 out of 96 (Figure 1).

Forty-five of the respondents with experience with traffic noise analysis were DOTs, just under 50 percent of the total (Figure 2). Consultants made up 28 percent of the respondents with highway traffic noise analysis experience. The remaining organizations with such experience included SHPOs, federal agencies, FHWA, one private organization, and two members of the ACHP.

Although a majority of respondents reported having experience with the subject matter, only 47.9 percent of respondents reported that their agency, organization, or company has a set policy for determining

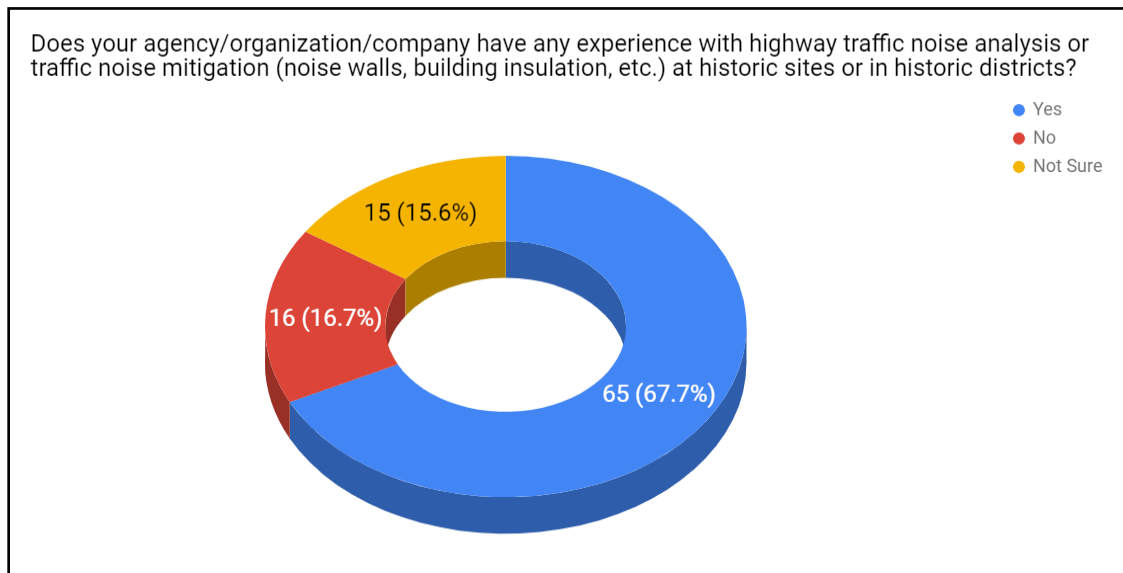


FIGURE 1: Number of Agencies/Organizations/Companies with Traffic Noise Analysis or Mitigation Experience

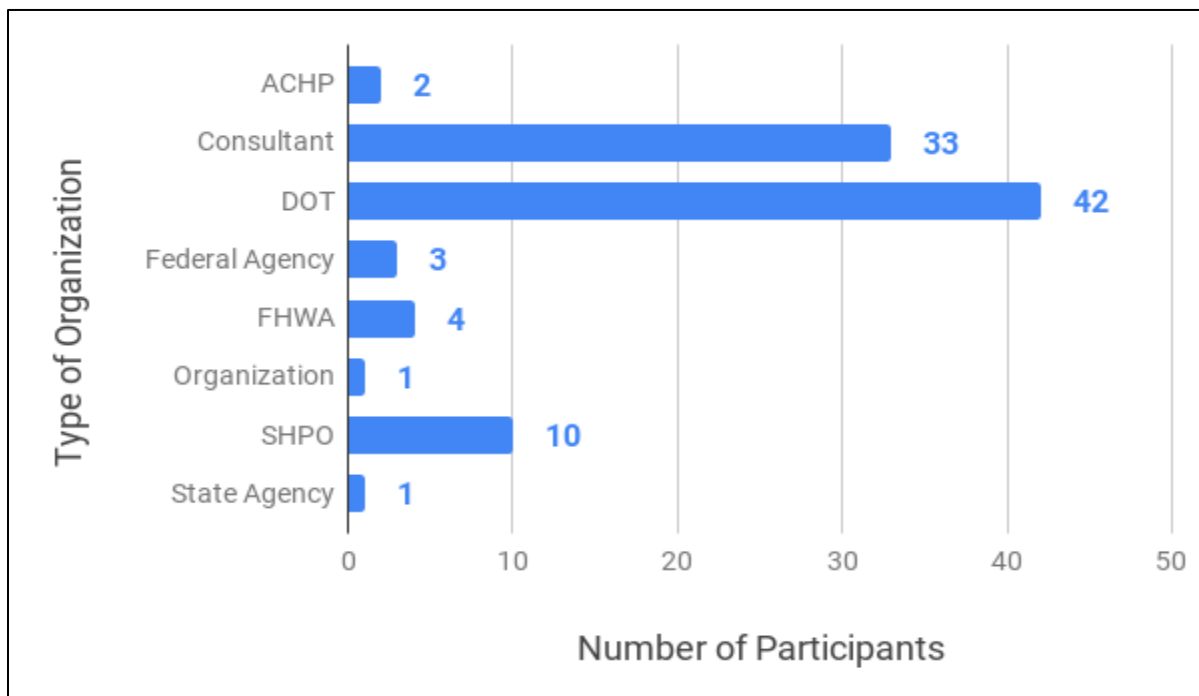


FIGURE 2: Types of Organizations with Traffic Noise Analysis Experience

adverse auditory effects from traffic noise (Figure 3). Along with agencies such as the U.S. Department of Housing and Urban Development (HUD), NPS, and FHWA, DOTs from the following states reported having a set policy.

- |              |                 |                 |
|--------------|-----------------|-----------------|
| • Arizona    | • Michigan      | • Oklahoma      |
| • Arkansas   | • Minnesota     | • Oregon        |
| • California | • Mississippi   | • Pennsylvania  |
| • Colorado   | • Missouri      | • Texas         |
| • Georgia    | • Montana       | • Utah          |
| • Iowa       | • New Hampshire | • Virginia      |
| • Kentucky   | • New York      | • West Virginia |
| • Maryland   | • Ohio          | • Wisconsin     |

Only 17.7 percent of these agencies, organizations, or companies reported having a set policy that specifically addresses adverse auditory effects to historic properties or appropriate mitigation at historic sites or within historic districts. DOTs in Colorado, Georgia, Kentucky, Michigan, Oklahoma, Oregon, Pennsylvania, Texas, and Virginia have a set policy in place that specifically addresses adverse auditory effects to historic properties or appropriate mitigation at historic sites or within historic districts. The NPS, FHWA, and ACHP also have set policies.

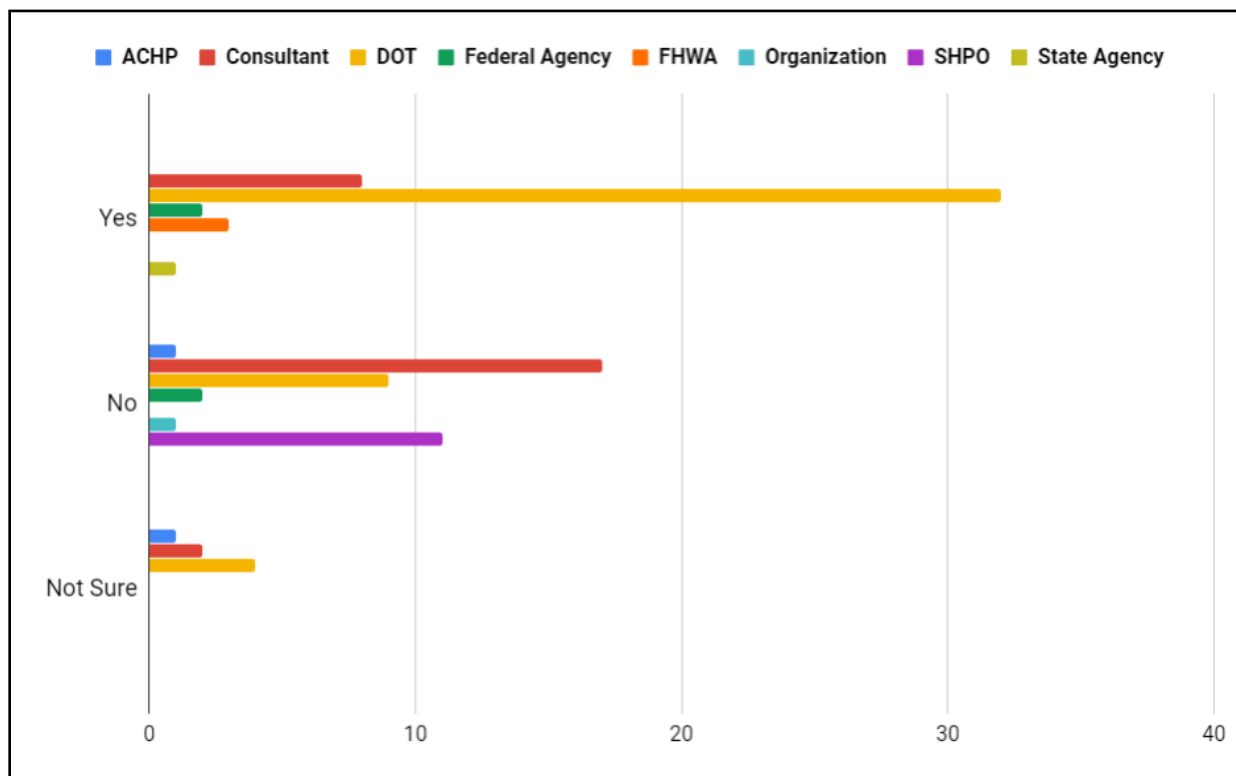


FIGURE 3. Organizations with Set Policies for Traffic Noise Analysis

## AGENCY PRACTICES AND EXPERIENCES

This chapter provides some additional insight as to how state DOTs and SHPOs address the potential effects of highway noise on historic buildings. The information is drawn from interviews conducted with state DOTs and consultants in the fall of 2018.

### INTERVIEWING AGENCIES

The current state of practice in this area and additional literature on the subject were discussed in previous chapters. To learn more about the practices used to address the potential effects of highway noise on historic buildings, in-depth interviews were conducted in the summer of 2018. To determine which respondents might be the best candidates for in-depth interviews, all of the 96 stakeholder survey responses were analyzed. Eleven respondents who had personal experience with traffic noise analysis (Question #1 of the stakeholder survey) and had a set policy that specifically addressed adverse auditory effects to historic properties (Question #4 of the stakeholder survey) were initially identified as potential in-depth interviewees. Further analysis allowed the project team to identify three more potential interviewees. Of the 14 individuals identified, the project team was able to complete 11 interviews.

A draft list of detailed questions for these telephone interviews was developed as part of the project work plan and revised according to panel comments. In September 2018 respondents were contacted via email to ask if they would participate in an approximately 30-minute interview for the project. The final list of questions used for the interviews is located in Appendix A.

### INTERVIEW RESULTS

Below are the results of the in-depth interviews. To clearly present the results, responses are organized by general topic. Answers to general questions are summarized in narratives. When more detailed responses were given, the interview question with respondent's answers in bullets is provided.

#### Traffic Noise Analysis and Adverse Effects

*1. Was the auditory environment considered in the NRHP determination of eligibility and/or NRHP nomination process for any building you investigated for noise impacts?*

Seven respondents indicated that the auditory environment is typically not considered in the NRHP determination. One of these respondents did not have experience with the NRHP evaluation process. Three of these seven respondents provided additional comments on their answer:

- Typically it is not considered. They typically work with the historic division on issues of eligibility. Audible effects are taken into consideration, but are not a major consideration.
- No, however at a Historic Cemetery it was brought up during the consultation process.
- No. Referencing the SH-51 Baron Fork Project in Cherokee County, JP 10437(04), a NRHP eligible building (Hitchcock's Store) was included in the noise study in which a future exterior noise impact was determined (66.1 dB(A)). However, coordination with SHPO resulted in a determination that the proposed project would have a 'no adverse effect'.

The remaining four respondents indicated that the auditory environment was considered. Three provided specifics:

- Yes, for historic parks or a cemetery where setting is a critical feature. Not generally for historic buildings/structures.
- Yes, but not frequently and not always in noise analysis terminology. For example, “quiet contemplation” can be part of the resource integrity.
- Yes. In several examples, but collectively few in time. In one example, we looked at the effects to a NRHP-eligible Grange, and the noise effects to meetings, held in the evening in the summer, when the windows would be open and if our increased dB would impact the meetings. The second has been looking at a designed landscape, which had some design around play and outdoor visiting, thus we argued had built in expectations for noise, but whether the road we are adding which would be an indirect effect (no ROW needed) would be adverse to this attribute of its design. Still pending.

2. *How do you evaluate auditory effects (decibel levels or something else)?*

Ten out of 12 practitioners use decibel levels; two respondents specifically cited the FHWA Noise Abatement Criteria (NAC) as their evaluation method. Two respondents included qualitative methods such as diminishment of historic integrity of setting and feeling as well as quantitative measurements of decibel (dB) levels. The FHWA Traffic Noise Model (version 2.5) was also cited as the means for measuring dB levels.

One respondent from the NPS provided information on a more complex method:

- D-prime is better, but like other agencies, we are forced to use sound levels (in decibels) for reasons of practicality. Overall sound levels in dB aren’t a great way – it’s not the best way to assess audible effects, to see if an increase is audible to the human ear. NPS uses models originally developed by the military. NPS used this for assessment of airplane/helicopter noise at the Grand Canyon and used it to look at noise from oil and gas extraction near Canyonlands Park. These military models are complex and not easy to use. They are spectral based models for audibility. So NPS is mostly using analysis via decibels. But for any impact assessment, investigate audibility (where one can hear noise) and noticeability, which is higher level threshold, where one doesn’t have to be listening hard to notice noise. See Grand Canyon noise zones and audibility definitions in 64 FR 38006.

3. *What criteria do you use to determine adverse auditory effects (decibel levels or something else)?*

The FHWA NAC–23 CFR 772, NAC Table 1 was cited by seven respondents as being used to determine adverse auditory effects (see Table 1). Two respondents also used the FHWA substantial increase criteria. Some respondents provided additional detail regarding other criteria used to determine adverse effects:

- For historic buildings they use 67 dB(A) as the threshold. Assessment is based on a sliding scale. For there to be an impact the noise level has to be 5 dB above 67. If the ambient level is below 67, then it has to be 15 dB to be an effect.

- Both, usually start with decibel levels per FHWA NAC. If decibel levels are excessive, qualitative evaluation of setting and feeling should be included.
- Overall decibel level, increased decibel level. Depends on resource type, setting, and sensitivity of location.
- Diminishment of integrity. The focus should be on the resource's feeling.
- In practice, they tend to use sound levels in decibels for reasons of practicality due to complexity of other method.

4. *If you use decibel levels and a noise impact exceeds the 67-decibel (dB) federal noise abatement criteria (NAC–23 CFR 772), does it also constitute an adverse effect under Section 106?*

Two respondents stated that the increase would have to be 5 dB over 67 for there to be an effect. Three respondents stated that exceeding the 67-dB federal noise abatement criteria does not constitute an adverse effect. One respondent stated that exceeding the 67-dB federal noise abatement criteria would be an adverse effect. Other respondents provided the following comments in response to the question.

- Neither. Noise is not considered an adverse effect.
- From a program approach, yes. But, to date, haven't done in the Oklahoma highway program.
- So far, it would. But we haven't really tested the waters much on this.
- No. Adverse effect is dependent on use, change in use, and diminishment of integrity. Per 36 CFR 800.5 A1 & A2: An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features.
- Especially in quiet areas outside of cities and communities, the Substantial Noise Increase criterion in 23 CFR 772 may be more useful. For measurement of the residual (background) sound level in quiet protected areas with cultural or historic value, useful information may be found in ANSI [American National Standards Institute] S12.100. In general, 67 dB is much higher than what NPS would use at parks and natural areas; – it's intended for use at and in communities. NPS doesn't use day/night sound levels. The substantive noise increase defined in 23CFR 772 is more useful to NPS – an increase of 5-15dB – it's an ambient degradation standard. Should look at what's increasing over existing noise level – look at that for historic properties.

5. *Does an adverse effect occur only when noise levels approach/exceed FHWA NAC (67 dB), or, as one example, is a sliding scale (such as 0-3 dB=no effect, 2-9 dB=no adverse effect, 10 dB=adverse effect) or other methodology utilized in Section 106 analysis?*

Four respondents use a sliding scale methodology with differing scales. Two of these respondents use the same scale: 0-4dB no effect, 5-14 dB no adverse effect, 15 dB adverse effect. Three respondents do not use a sliding scale, using other methodologies explained in the comments below.

- Yes. Furthermore, there is no set policy for qualitative/contextual evaluation.

- No. Case-by-case. Resource-by-resource.
- No. National Park Service’s Quiet Soundscapes or Natural Soundscapes methodology can be appropriate.
- Only when noise levels approach by 1-dB, meet or exceed the NAC ‘C’ or ‘D’ Activity Categories or if there is a substantial increase (15-dB) over existing conditions.
- Haven’t used the sliding scale approach. Just 67.
- No, a sliding scale would be very useful to account for Substantial Noise Increase in 23 CFR 772, as described above. A sliding scale should be flexible to better account for very sensitive sites such as a Traditional Cultural Property [TCP] or situations where the new noise source and existing sound level vary substantially in spectrum.

6. *Is it correct to assume a project-related increase must be discernible by the human ear?*

Seven respondents agreed that the dB increase must be discernible by the human ear. One of these respondents noted, “Yes, this provides some flexibility when utilizing the FHWA NAC.” One respondent’s agency had a different approach, distinct from discernibility, noting that an impact would be one dB less than the federal threshold, at 66 dB. Another noted that the discernible level serves as the threshold. One respondent disagreed with the assumption; another stated that it is generally a correct assumption. The final respondent had the following comment:

- Yes- if we are talking about audible effects under 36 CFR 800.5; the regulation assumes it’s discernable to the human ear. That’s the “person on the street” baseline. Though noise and vibration are related, this question is only for audible effects.

7. *How have you addressed noise-related adverse effects in Section 106 treatment plans?*

One respondent had not addressed noise-related adverse effects in Section 106 treatment plans. Two others stated that they had but that it was a rare occurrence. The remaining respondents had detailed comments about the issue:

- This is a collaborative effort between the noise and historic teams. Noise impacts are preferable to visual impacts. Not involved in noise treatment plans under 106.
- In some cases, other elements of treatment plan, such as street lights, were justified because of noise-related adverse effects. Some historic sites have been given other treatments because of the noise-related effects that could not be reduced.
- For one example the Treatment Plan included monitoring effectiveness of noise mitigation.
- Yes. A programmatic agreement can include treatments for noise such as noise mitigation (walls) because noise can change the experience at a historic site. FHWA encourages creative mitigation – aesthetics and/or landscaping could be options. So could changing the dedicated access route for pedestrians to a historic site. Adjustment to the site’s management plan could also be an option.
- I-70 Programmatic Agreement includes mitigation options for noise effects.
- Addressing adverse effects is always a balancing act resolved through consultation. Examples include work scheduling to avoid weekends and specific dates related to use of the resource.



- Yes, but rarely. It is hard to install walls without visual impacts. If there is vegetation between the historic structure and the wall, adverse effects can be avoided. Hard to put them in historic districts without impact.
- Design. In the case of the Grange, we proposed A/C to provide for meetings that wouldn't be directly impacted by noise level. In short, we were proposing to mitigate down to a no adverse.
- Yes, with a noise berm and noise reducing treatments for specific sources.

8. *Do you have any experience with vibration impact attenuation/mitigation at historic properties, recognizing that highway noise impact sources are producers of both vibration and noise?*

Four respondents did not have this experience. Seven other respondents noted that they did have experience:

- Yes, but rarely. Vibration guidance was from an NCHRP study. One example was a rail bridge, another was construction noise associated with an elevated highway in El Paso.
- Yes, however they are usually separate studies. FHWA has no set policy for vibration studies. Usually triggered by the consultation process with SHPO/THPO (Tribal Historic Preservation Office).
- Yes. Depends on the resource. Focus has been roadway construction vibration.
- Yes, FTA and FRA address operational vibration. FHWA projects usually only involve construction related vibration such as pile driving for bridge construction.
- Yes, but rarely. This had to do with a bridge replacement where the bridge was tight up against a historic building in the Gulch Area in Atlanta.
- Not directly. We have evaluated it for parks (under 4(f) before) – and to a degree with buildings but more about the impact of the vibration on the foundations, etc.

### **Interior Noise Level**

9. *Do you consider interior noise level when evaluating auditory effects at historic properties?*

Four respondents do not consider interior noise levels. One of these respondents stated they would consider interior noise if there was no exterior activity. All of the remaining respondents indicated it depends on the type of property or context:

- Interior noise is considered for non-residential properties. Outdoor areas are considered first, but cases rarely come up. 52 dB(A) is considered interior noise threshold.
- Ideally. This is context driven and related to use of the resource.
- Yes, it is dependent on the type of historic property. For example, interior noise levels can be a consideration at historic churches or theaters.
- Interior noise is considered for Category D buildings under federal regulations.
- Yes, but only if no frequent human activity exterior area exist.
- Yes, but often more concerned about exterior noise levels initially – they work to minimize exterior noise first. But it depends on the use of the property and the type of property.

*10. If yes, what criteria do you use to determine adverse interior auditory effects (decibel levels or something else)?*

Seven respondents used decibel levels as criteria for interior auditory effects. Three of these respondents cited FHWA 23 CFR 772, NAC Activity Category D for interiors. Two respondents stated that the question was not applicable to them. The remaining respondents answered the question as follows.

- Both, usually start with decibel levels per FHWA NAC. If decibel levels are excessive, qualitative evaluation of setting and feeling should be included.
- Adverse effect is dependent on use, change in use, and diminishment of integrity per 36 CFR 800.5 A1 & A2
- American National Standards Institute/Acoustical Society of America [ANSI/ASA] S-12.60 “Classroom Acoustics” is often useful. Interior sound will have decibel analysis too, but this is the accepted standard for classroom noise impact.

*11. If you considered interior noise at historic properties, how did the type of construction and current use of a structure influence the effect determination?*

Six respondents indicated that they have not dealt with interior noise. The remaining respondents described how the construction type and current use influenced the effect determination:

- No instances of dealing with interior noise, but they will consider the effect of structure on an estimated basis.
- The type of building and existing/future use is considered on a case-by-case basis.
- The type of construction is one of the characteristics of the historic property. Adverse effect is dependent on use and possible change in use.
- Use FHWA handbook for noise reduction approximation according to construction type.
- Wooden, uninsulated building with single paned double-hung windows. Wasn’t going to slow it down much.
- Use is important for identification of the appropriate impact or effect criteria.

### **Adverse Effects Determination and Mitigation**

*12. Do you consider potential auditory effects at historic properties related to a temporary or permanent increase in traffic or traffic type changes (more trucks/buses) on older roads?*

Five respondents only consider permanent increases in traffic related noise, one specifically citing that it needs to be a Type 1 project to consider auditory effects. Four respondents stated that they have considered temporary and permanent increases in traffic. One of these respondents stated that only permanent increases would be considered. One respondent said that they have not dealt with this to date but said the question, “Raises a good point.” Two respondents provided additional information:

- Only if there is a Section 106 nexus. This may be an indirect and/or cumulative effect. An example would be tolling an existing interstate highway and associated diversion of traffic to roadways in/near a historic resource.

- Yes, adverse effect is dependent on use, change in use, and diminishment of integrity per 36 CFR 800.5 A1 & A2 not the type of project under consideration.

13. *If yes, what criteria do you use to determine adverse auditory effects (decibel levels or something else)?*

Seven out of 11 respondents used decibel levels as the criteria to determine adverse effects. Three of these specifically cited FHWA 23 CFR 772 NAC-Table 1. Some of the responses qualified the use of decibel level with other factors:

- Both, usually start with decibel levels per FHWA NAC. If decibel levels are excessive, qualitative evaluation of setting and feeling should be included.
- Overall decibel level, increased decibel level. Depends on resource type, setting, and sensitivity of location.
- Adverse effect is dependent on use, change in use, and diminishment of integrity per 36 CFR 800.5 A1 & A2
- Similar to answers above – either Substantial Noise Increase under 23 CFR 772 or a sliding scale, but there has to be a reason for a sliding scale.

14. *How do you consider traffic noise impacts related to the NRHP aspects of integrity (e.g., minimizing effects to integrity via installation of features and/or fabric to a receptor structure)?*

Five respondents stated that they either didn't consider traffic noise impacts related to the NRHP aspects of integrity or that the issue had not come up. One of these respondents considers it in the determination of effect rather than as part of NRHP integrity. Two respondents noted that using a sliding scale for the effect determination was important. Respondents, whether stating they had considered the issue or not, had specific information to contribute on the issue:

- Installation of features would be considered to mitigate interior noise impacts, if they can't be mitigated on the exterior.
- It seems that FHWA noise guidance is used for effect analysis and historic status guides treatment options.
- Consultative process with the Official with Jurisdiction (SHPO). It will be a balance of potential integrity loss with reduced noise levels (adverse effect).
- Noise mitigation (noise walls) could affect setting/feeling of a resource. Need to consider effect on all aspects of integrity.
- Addressing adverse effects is always a balancing act resolved through consultation. Adverse effect is dependent on use, change in use, and diminishment of integrity per 36 CFR 800.5 A1 & A2.
- Not for eligibility, but it is considered in determinations of effect. Use the 15/5 sliding scale effect determination.
- To date, haven't done in the Oklahoma highway program.
- In the case of the historic landscape, since setting and feeling are important, we consider noise an impact. Some felt it was adverse, but FHWA did not. Frankly I don't think we developed dB

numbers for this, based on a low ADT [Average Daily Traffic], but still felt the proximity and being a new road was enough to cause concern. The project is still under consultation with the SHPO.

- This is more under 36 CFR 800 than 23 CFR 772; but they are closely related: consider 36 CFR 800 together with 23 CFR 772. A sliding scale is important, as is substantive noise increase analysis. Can't address situation with a historic property without using both.

*15. How do you consider mitigation measures for traffic noise impacts related to the NRHP aspects of integrity (e.g., minimizing effects to integrity via installation of features and/or fabric to a receptor structure)?*

Three respondents indicated that this question did not apply to them; but one noted, "If it is a public historic site, additions to building fabric might be considered." A fourth respondent did not have any experience with the issue. Two respondents indicated that the issue would be resolved through the Section 106 consultation process:

- Consultative process with the Official with Jurisdiction (SHPO). It will be a balance of potential integrity loss with reduced noise levels (adverse effect).
- Addressing adverse effects is always a balancing act resolved through consultation. Adverse effect is dependent on use, change in use, and diminishment of integrity per 36 CFR 800.5 A1 & A2.

The remaining respondents had varying comments on how to deal with the issue:

- Visual impacts (e.g., a noise wall) are less preferable than noise impacts. This situation has not presented itself.
- Visual aspects should be evaluated.
- Visual impacts (e.g., a noise wall) are less preferable than noise impacts. This situation has not presented itself. Berms may be an acceptable approach.
- Depends. In one case, we talked about A/C (I looked into that more, doesn't sound like they took that alternative so we didn't have to carry that to completion, by the way). We'd probably consider any number of creative solutions if viable – sometimes a sound wall is not going to make things better.
- Building a huge noise wall may not work. Have to consider each situation; each setting and use is unique. Mitigation measures should fit with the character, architecture, and fabric of the historic property.

*16. How have you evaluated potential Section 106 adverse effects when a project does not change the noise level but the level remains above the NAC established by 23 CFR 772?*

This question evoked a wide range of responses. Four respondents have not evaluated potential effects under this scenario. Two participants noted that if the noise level was above NAC, then they would consider it for noise mitigation. One respondent noted that evaluation of effects is only considered when the changes are perceptible. Another respondent notes that the effects would be evaluated, "especially when the highway pre-dates the National Historic Preservation Act of 1966." The remaining respondents provided the following information:

- Yes, example is residential areas. For one on-going example noise level is considered an impact and there is no noise mitigation solution. This example is unresolved with SHPO.
- The assessment of adverse effects is based upon change from the existing condition, so if the noise level doesn't change it would not be an adverse effect (all other things being unchanged).

*17. How have you evaluated potential Section 106 adverse effects when a project reduces noise levels but the levels remain above the NAC established by 23 CFR 772?*

Five respondents have not evaluated potential adverse effects under this scenario. One stated that noise impacts would still need to be considered. Two participants stated that noise mitigation would need to occur or at least be considered. One of these stated that the scenario outlined in the question happens frequently. The remaining three respondents stated that they have evaluated potential adverse effects:

- Yes. It was an imperceptible reduction due to an alignment change resulting in a lower noise level. SHPO concurred with no adverse effect determination.
- Yes, especially when the highway pre-dates the National Historic Preservation Act of 1966.
- The assessment of adverse effects is based upon change from the existing condition, so if the noise level change is beneficial it would not be an adverse effect (all other things being unchanged.)

*18. How are the visual impacts of noise walls balanced with auditory impact mitigation?*

Using the consultation process to balance integrity loss versus reduced noise levels was cited by three respondents, one of which called balancing these factors a “tricky business.” Other respondents provided varying information on the subject:

- Visual impacts take primacy. In some cases noise mitigation (noise wall) is offered, but it is up to the owner to decide to take it. Transparent walls have been considered as well as material and color of a noise wall.
- Yes. Aesthetic options are different than normal. There was a project in Austin where the noise wall location was constrained to the available ROW [right-of-way]. Noise wall workshop was about appropriate aesthetics. Ultimately the wall was voted down because of aesthetic concerns.
- Aesthetic treatments have been context sensitive. Typically use precast concrete with color and texture options.
- This is addressed on a case by case basis.
- Noise walls are considered as part of potential effect of the project.
- A good question. As noted, we do what we can to not create a giant wall in front of an historic property. But we'd look at it, as we have done lots of walls. Generally, walls are often near more recent construction, but those are moving toward 50 plus, so we'll have to wait.
- Berms are least intrusive usually, if not changing character or altering property. Have to balance the needs under the requirements of 36 CFR 800.

*19. How have you evaluated potential Section 106 effects associated with noise wall construction within a historic district or at a historic site?*

Four respondents indicated they have not evaluated potential Section 106 effects associated with noise wall construction. Addressing potential adverse effects through consultation was noted by four respondents. Another three respondents noted that potential visual impacts would need to be evaluated and balanced with noise impact reduction:

- Visual impacts are considered more important than noise impacts. A context sensitive design approach would be undertaken to achieve optimal result.
- Visual aspects are evaluated, especially the setting, feeling, and association, using the consultation process with SHPO and Consulting Parties.
- It was a balance of visual characteristics and noise impact reduction.

*20. Was noise wall construction within a historic district or at a historic site an adverse effect?*

Only one respondent stated that noise walls would be an adverse effect. Most other respondents stated that they would not be an adverse effect and could even be beneficial depending on the use of the resource:

- No. Depends on setting/getting balance of visual/noise concerns.
- Depends on specific location and consultation process.
- This would be done on a case by case basis.
- We always work to avoid adverse effect by construction of noise wall in or near a historic district.

*21. Are there aesthetically designed noise abatement features that could result in a no adverse effect determination? This situation has not come up, but it is not likely that you can design a noise wall that has no adverse effect.*

Ten participants responded positively to this question. The remaining did not provide an answer. Four respondents indicated that acceptable aesthetically designed abatement features could be achieved through the Section 106 consultation process. Two of these respondents cited that a balance of potential integrity loss and reduced noise levels could resolve adverse effect. Other respondents provided additional thoughts:

- Acrylic see-through barriers might achieve a determination of no adverse effect.
- This would be done on a case by case basis. DOT has one type of noise barrier and an aesthetics manual that gives a variety of wall treatments.
- If something less obtrusive can be built, it might result in a finding of no adverse effect.
- Probably. I haven't had to deal with them yet. The A/C is certainly one of them, but not the classic example.
- Yes, planting historic grasses on a noise berm or other shrubs on/around a historic property, creating a natural setting.

*22. After project construction was complete, did you go back to historic properties that were evaluated as noise impacted to verify the impacts or concerns about mitigation aesthetics?*

Only four of the 12 respondents went back to historic properties to verify the impacts. One respondent stated that, “FHWA recommends this be included in Section 106 treatment plan and documented in the project files.” Another noted that case studies involving “before and after noise conditions would be beneficial.” The remaining respondents indicated that they have not revisited historic properties, but one indicated that it might be done in the future. Such revisits are mandated by the NPS, according to one respondent:

- Yes – this is part of our agency [NPS] mandate. This is done by front line staff at project locations – park managers and park staff would be doing those checks.

*23. Have you any experience with mitigation of noise impacts resulting from temporary maintenance of traffic, such as the rerouting of traffic through a historic district during construction?*

Most of the respondents (seven) indicated no experience with mitigation of temporary noise impacts. Several of these respondents commented on the reasons why:

- Noise impacts for temporary projects are not considered.
- Traffic management understands the need to avoid historic districts.
- Temporary noise not mitigated.
- We haven’t yet. But as I noted, we should.

Three respondents indicated that they did have experience with temporary noise impacts:

- Yes. In some cases Heritage Tourism and Economic Viability can be critical considerations. FHWA has also been involved with mitigation during construction. Mitigation can involve restricted schedules or temporary noise walls, such as used near the mall in Washington (this was a NPS project).
- Yes. Studies have been done, no mitigation required because it is a temporary effect. Example is the Grand Avenue Bridge.
- Yes, the investigation included issues other than noise. It was related to a change in use.

*24. If so, can you elaborate on how that issue was addressed and resolved with or at the SHPO?*

Only three respondents could elaborate on how mitigation of noise impacts was addressed and resolved:

- It can be documented in the Section 106 Agreement (treatment plan) and NEPA [National Environmental Policy Act] document.
- SHPO accepted explanation of temporary effect. [Grand Ave Bridge]
- Because these issues can be difficult to resolve with Consulting Parties and SHPOs they are frequently sent to the Advisory Council during consultation.



## CASE STUDIES

Using a list of projects identified during discussions with the project panel, from the background research, and the interviews, multiple projects were reviewed and summaries prepared for those that considered noise impacts under Section 106 and projects that involved noise mitigation for historic properties. In general projects were included if the team felt they could be useful to state DOTs when adopting or refining their own programs. The other projects were determined to be rather unusual and therefore very unlikely to be encountered by state DOTs. Some projects could not be pursued because time, often coupled with changes in personnel, resulted in an inability to locate project files or informants with firsthand experience of the project.

The following six case studies have been included because state DOTs or other practitioners will likely encounter similar project scenarios, and such scenarios could become controversial and delay project development:

1. Colorado – I-70 Eastbound Peak Period Shoulder Lane Project. Case study involves adding a travel lane to an existing interstate highway near NRHP-listed historic districts and historic sites. Noise impacts were identified but were not determined to be adverse effects.
2. Maryland – Intercounty Connector. Case study involves construction of a new limited-access highway near a noise-sensitive historic site. The project might have resulted in unresolved adverse effects if an alternative alignment had not been selected.
3. Ohio – Columbus South Innerbelt. Case study involves improvements to a limited-access highway near a historic site, noise mitigation via building improvements, and a no adverse effect finding.
4. Oklahoma – Baron Fork River Bridge Project. Case study involves improvements to a two-lane road bridge and nearby intersection near a historic site. Noise impacts were identified but were not determined to be adverse effects.
5. Texas – IH 35 W Fort Worth. Case study involves improvements to an existing interstate highway near a noise-sensitive historic district, mitigation via landscaping, and a no adverse effect finding.
6. Virginia – George P. Coleman Bridge. Case study involves improvements to an existing roadway and bridge near a historic district, noise mitigation via noise walls, and a no adverse effect finding because of the aesthetics used on the noise wall.

Table 2 summarizes the six case studies in this chapter.



Table 2. Summary of Case Studies

CASE STUDY	AGENCY	HISTORIC RESOURCE	PROJECT TYPE	NOISE STUDY COMPLETED (Y/N)	NOISE STUDY PROCESS USED	NOISE IMPACTS IDENTIFIED (Y/N)	NOISE ABATEMENT MEASURES	SECTION 106 DETERMINATION	SECTION 106 RESOLUTION
Intercounty Connector	Maryland SHA	Free Methodist Church Camp Grounds	New, limited-access highway	Yes	23 CFR Part 772	Yes	Noise walls were considered.	The traffic noise increase, the installation of a noise wall, and the noise itself would have been an Adverse Effect. Wall would have been a "constructive use" as defined by 23 CFR 774.15(d).	N/A - another alignment for the new highway was chosen so the Adverse Effect was avoided.
Columbus South Innerbelt	Ohio DOT	Shiloh Baptist Church	Highway reconstruction/widening	Yes	23 CFR Part 772	Yes	Noise wall were not desired by residents. Reimbursement for cost of church insulation to reduce interior traffic noise was provided.	No Adverse Effect.	Section 106 MOA included measures to minimize harm (insulation reimbursement) that resulted in the No Adverse Effect determination.
George P. Coleman Bridge	Virginia DOT	Coleman Bridge, Yorktown Battlefield, Yorktown Historic District	Bridge reconstruction	Yes	23 CFR Part 772	Yes	Noise barriers on bridge approach and bridge sections.	Adverse Effect to historic bridge. No Adverse Effect to historic district.	Use of three-dimensional, brick, urban-themed barrier walls avoided a visual Adverse Effect to district.
Interstate 70 Eastbound Peak Period Shoulder Lane Project	Colorado DOT	Three historic districts (one of which is an NHL), three railroad grades, roadway tunnels, two mines, and three individual resources	Shoulder conversion to managed travel lane	Yes	23 CFR Part 772	Yes	No mitigation for noise impacts was proposed for any of these historic properties.	No Historic Properties Affected and No Adverse Effect because traffic noise did not alter integrity of historic resources.	Existing retaining walls and structures combined with new retaining walls and advantages provided by topography jointly created conditions allowing lower level Section 106 effect determinations.
IH 35W Fort Worth	Texas DOT	Oakhurst Historic District	Highway improvements	Yes	TxDOT's <i>Guidelines for Analysis and Abatement of Roadway Traffic Noise</i> (2011)	Yes	No reasonable and feasible abatement alternatives.	Adverse Effect.	Registered Landscape Architect hired to develop landscaping plan near historic district.
Baron Fork River Bridge Project	Oklahoma DOT	Hitchcock Store	Highway realignment and bridge replacement	Yes	23 CFR Part 772	Yes	Noise abatement (wall) was considered and determined to be ineffective owing to physical conditions at the historic property	No Adverse Effect (not based on noise impact).	Effect determination based on no ROW taken from the store property and conditions for protecting the historic property. None of these conditions related to traffic noise.

## **COLORADO – I-70 EASTBOUND PEAK PERIOD SHOULDER LANE PROJECT**

The Colorado Department of Transportation's (CDOT) proposed Interstate 70 Eastbound Peak Period Shoulder Lane project (PPSL) will convert an existing eastbound shoulder of Interstate 70 (I-70) between the I-70/U.S. 40 interchange and East Idaho Springs into a managed travel lane during peak traffic periods, when tourist and commercial traffic causes increased congestion (Figure 4). This 10-mile-long managed lane in a 13-mile-long project area would be used only during these peak periods (defined as Saturdays, Sundays, and holidays) to improve travel times and enhance travel reliability and operations. The lane would also be available during emergency closures of general-purpose lanes during non-peak traffic times. It would not be open if weather conditions indicated that travel would be unsafe. This project is one section of the larger Interstate 70 Mountain Corridor Project study in Colorado.

The managed travel lane would be created primarily from the existing shoulders with the existing mainline roadway restriped from two lanes to three lanes. Improvements associated with the PPSL include some areas of new pavement where the existing lanes and shoulders are not wide enough presently for three lanes. Signage and traffic cameras will be placed along the corridor to manage the PPSL and notify motorists and manage traffic flow and speed. Including signs, the proposed project extends from milepost (MP) 229 to MP 243. From MP 229 to MP 232, and from MP 242 to MP 243, there will be signage improvements only, to notify motorists of the status of the managed lane, entrance and exit points, and cost, as this will be a toll use lane. Between MP 233 and 242, up to 3.5 feet of new pavement would be added to the south shoulder to accommodate the managed lane. Retaining walls would be constructed at 10 locations to support the roadway and ramps (this includes rehabilitation of one existing retaining wall). Other improvements in this project area include water quality treatment measures, up to 14 feet of widening at the State Highway (SH) 103 on-ramp, 4 to 8 feet of widening at all other on-ramps in the corridor, replacement of the existing SH 103 bridge with a new bridge, replacement of the bridge at the East Idaho Springs interchange with a new roundabout just east of the bridge, and construction of two pull-outs for emergency refuge purposes.

The 10 retaining walls range in length from 210 feet to 850 feet, and would be low, ranging from 2.4 to 5.8 feet tall. At the Water Wheel Park in Idaho Springs, a retaining wall will be complemented by improvements to the park itself to improve visitor experience and use, by lowering the level of the park for an enhanced buffer from the interstate. The new overpass at the SH 103 interchange in Idaho Springs would result in a small shift (2 to 4 feet) to the north from the present path of the interstate, improved interchange ramps, and added pedestrian and bicycle improvements.

Multiple historic properties exist along the 13-mile length of this project. For this case study, and using CDOT's effects determination memo<sup>2</sup> as the primary reference, only those properties where noise impacts were considered under Section 106 will be included herein. All Section 106 effect determinations were processed pursuant with the *Interstate 70 Mountain Corridor Project Programmatic Agreement*<sup>3</sup>. The

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<sup>2</sup> CDOT, Effects Determinations, I-10 Mountain Corridor (CDOT: Denver, 2014).

<sup>3</sup> Federal Highway Administration; United States Department of Agriculture, Forest Service, Rocky Mountain Region; Department of the Interior, Bureau of Land Management, Glenwood Springs Field Office; Advisory Council on Historic Preservation; Colorado State Historic Preservation Office, and Colorado Department of Transportation, Programmatic Agreement regarding implementation of The Interstate 70 Mountain Corridor Project

agreement defines the Area of Potential Effects (APE) for each undertaking in the I-70 Mountain Corridor as being “the exterior boundary of the area within which any current and proposed transportation facilities and associated land disturbance can be seen.” This agreement also contains a stipulation that is specific to noise impact analyses for the project. The stipulation includes provisions for evaluation of new noise effects and cumulative noise effects based on past CDOT undertakings. It also includes a provision that allows CDOT to consider adopting other (unspecified) means for evaluating noise effects to historic properties if it is determined that standard noise guidelines are insufficient. The project materials studied for this project do not indicate that CDOT adopted any other means of evaluation.

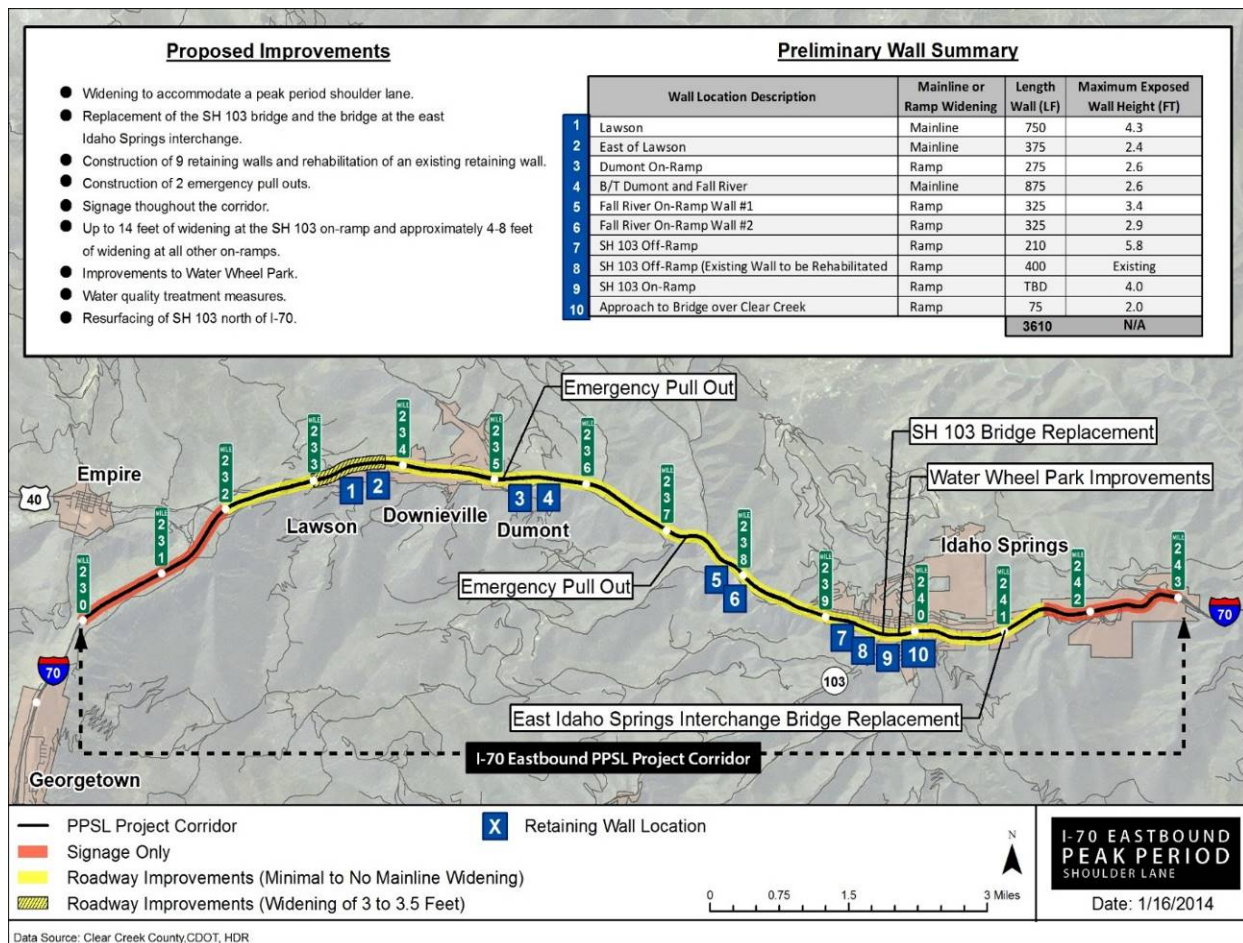


FIGURE 4: Proposed Improvements for the PPSL Project

Detailed traffic noise analyses, following 23 CFR 772, FHWA and CDOT procedures were undertaken in the project study area from 2001 to 2004. The CDOT still considers these readings as representative of noise conditions in the project study area. Most of the measurements were taken at a distance of 250 feet

(2008, [https://www.codot.gov/projects/i-70-old-mountaincorridor/final-peis/final-peis-documents/20\\_App\\_B\\_Section\\_106\\_PA\\_Rev50.pdf](https://www.codot.gov/projects/i-70-old-mountaincorridor/final-peis/final-peis-documents/20_App_B_Section_106_PA_Rev50.pdf)).

from the centerline of Interstate 70. The agency's *I-70 Mountain Corridor PEIS Noise Technical Report*<sup>4</sup> details all of the technical background for the noise analysis for studied areas within the 160-mile project study corridor. These analyses and the subsequent Section 106 effect determinations were conducted for the project Programmatic Environmental Impact Statement (PEIS) so that agencies and stakeholders could compare noise levels among alternatives. The technical report compares and contrasts noise among alternatives in seven representative locations within the project study area. As stated and detailed above, the evaluation of noise impacts to historic properties for this case study was conducted within the 13-mile PPSL project running from milepost MP 229 to MP 243. All of the historic properties discussed below lie within the PPSL project area.

#### *Georgetown-Silver Plume Historic District (5CC.3)*

The APE encompasses the north district boundaries of the Georgetown-Silver Plume Historic District, which is a National Historic Landmark (NHL). Downtown Georgetown is south of and outside the APE. Figure 5 shows the overlap of the PPSL APE with the Historic District boundaries. The north boundary of the historic district is at approximately MP 229.1. The entire district boundary was not included in the APE because there are no direct or indirect effects; however, part of the district is within the overall project limit, so a portion of the boundary was included.

The first roadway sign at the west end of the project area is proposed at MP 229.7, about one-half mile east of the historic district boundary. Because there are no contributing properties or properties meeting the age threshold, the installation of the sign at MP 229.7 (the closest project element to the district) would not constitute a visual change to the historic district, and there are no contributing properties that would be affected by its installation. Based on this, CDOT has determined the PPSL project would result in no historic properties affected with regard to the Georgetown-Silver Plume Historic District.

#### *Lawson Historic District (5CC.2157)*

The Lawson Historic District (Figures 6 and 7) also includes the Lawson School (5CC.181) and W.E. Anderson Store (5CC.2146), both contributing to the historic district and also individually NRHP eligible. Traffic would run slightly (2 to 3.5 feet) closer to the Lawson Historic District because up to 3.5 feet of pavement between MPs 233 and 234 would be added to provide a safe operating roadway width. It also will include a proposed retaining wall approximately 750 feet long that would run from about the middle of Lawson to the east end of Lawson, e.g., from 1967 County Road 308 to 1845 County Road 308. The wall would be built into the current slope on the south side of I-70, with an exposed retaining wall edge approximately 4.3 feet in height.

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<sup>4</sup> Part of *I-70 Mountain Corridor Final Programmatic Environmental Impact Statement* (Denver: CDOT, August 2010, re-issued March 2011, <https://www.codot.gov/projects/i-70-old-mountaincorridor/final-peis/final-peis-file-download.html>).



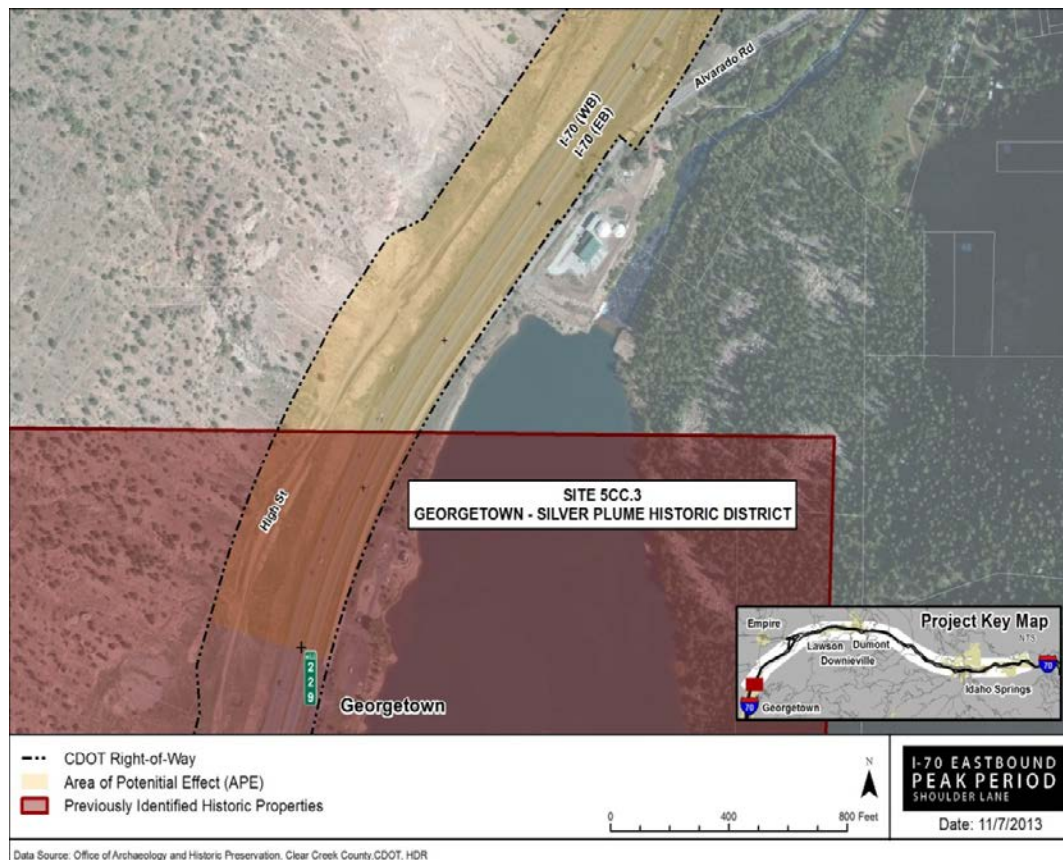


FIGURE 5: Overlap of PPSL APE and Georgetown-Silver Plume Historic District (5CC.3)

The existing auditory environment at the Lawson Historic District is dominated by traffic noise from I-70. Monitored noise levels at this location range from 63 to 71 dB depending on the location of I-70 relative to the location being monitored. Although the PPSL lane would be slightly closer to receptors, little additional noise would be anticipated because the lane would only be in operation during peak periods when the traffic is quite congested and noise levels are therefore lower. The low wall to be added and the existing topography of the historic district buildings relative to the interstate would shield these receptors from highway noise. This is anticipated to reduce noise levels by 2 to 4 dB. Because of this reduction in noise and minimal visual impacts, Colorado DOT has determined that the PPSL project would result in no adverse effect on the Lawson Historic District as a whole and on the Lawson School and the W.E. Anderson Store.

#### *Central Colorado Railroad Grade, Lawson (5CC.427.14)*

This segment of the Central Colorado Railroad (CCRR) supports the NRHP eligibility of the overall CCRR linear resource. No direct or indirect effects to the CCRR grade in Lawson are anticipated from the project. The railroad grade is approximately 500 feet south of I-70 on the north bank of Clear Creek, with two intervening rows of developed parcels with heavy vegetation. The railroad grade would not incur direct construction impacts, visual impacts, or any additional noise impacts. For these reasons, CDOT has determined that the PPSL project results in a finding of no historic properties affected with regard to the CCRR grade at Lawson.

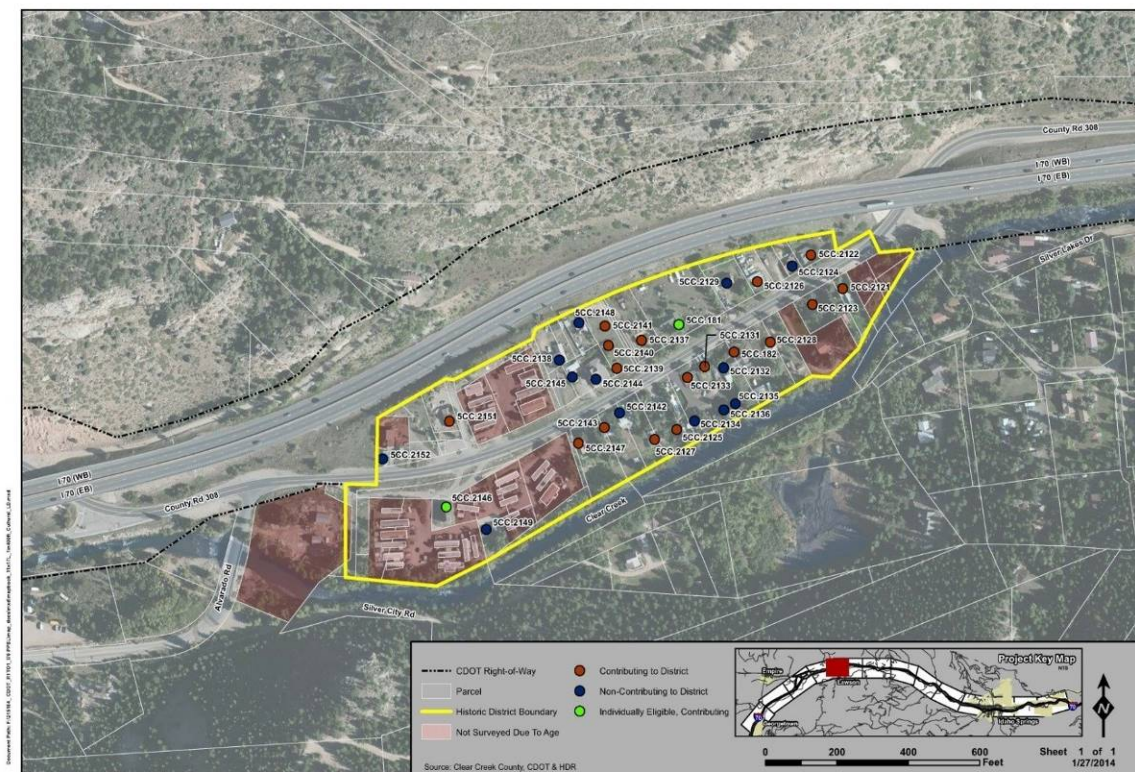


FIGURE 6: Proposed Boundaries and Contributing Elements of the Lawson Historic District (SCC.2157)

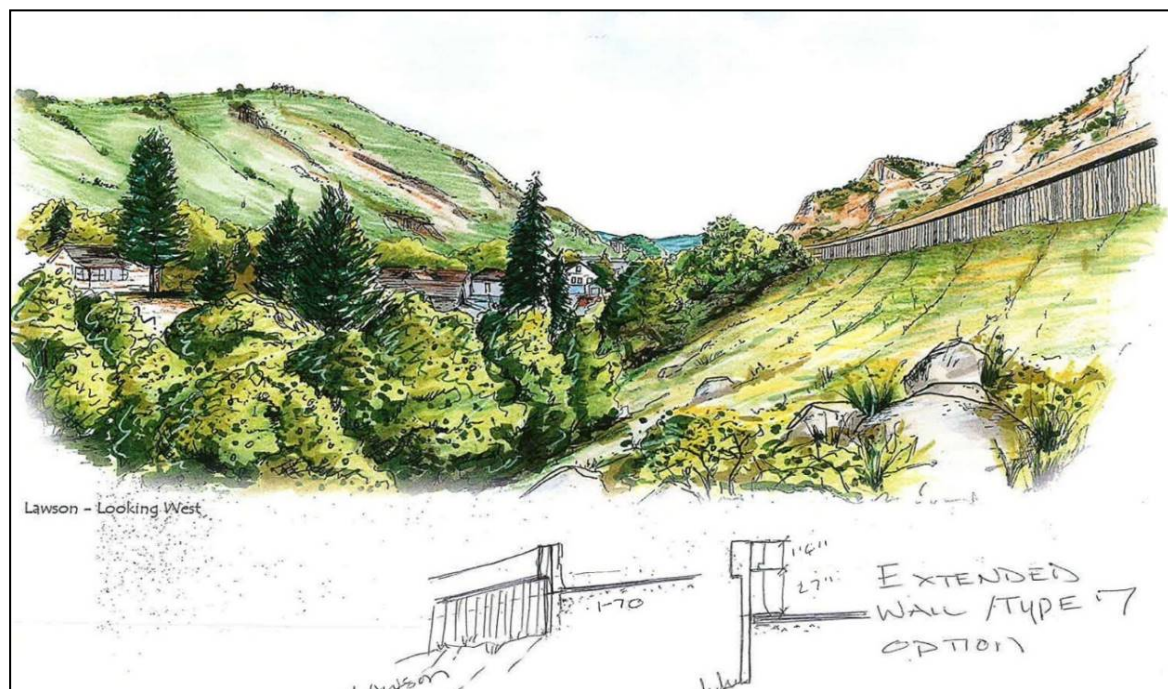


FIGURE 7: Rendering of Proposed Retaining Wall at Lawson (CDOT, Effects Determinations, I-10 Mountain Corridor, Denver: CDOT, 2014)



*Dumont Train Depot, West Dumont Road (5CC.2156)*

The Dumont Train Depot is eligible for the NRHP under Criterion C as a good example of the Queen Anne style. It was relocated to its current site on the south side of I-70 and is no longer in a context or setting associated with the railroad (although it still near its original location in the Dumont area). The depot is over 400 feet south of I-70, so PPSL construction would not directly affect the property. No change in noise levels is expected. No wall is proposed in its vicinity, and there would be little change from current conditions. For these reasons CDOT has determined that the PPSL project would result in no historic properties affected with regard to the Dumont Train Depot.

*Mill City House, 247 County Road 308, Dumont (5CC.313)*

The Mill City House is the only property in Dumont on the north side of I-70 in the APE and is across from the I-70 overpass bridge at MP 235. Because the property is on the north side of the interstate, PPSL project improvements or additional traffic would not be visible from it. No additional noise impacts from the PPSL project would occur to this property. For these reasons CDOT has determined that the PPSL project results in no historic properties affected with regard to the Mill City House.

*Central Colorado Railroad Grade, North Spring Gulch Road (5CC.427.13)*

The segment of the Central Colorado Railroad (CCRR) grade near the intersection of N. Spring Gulch Road and Stanley Road supports the NRHP eligibility of the overall CCRR linear resource. However, the railroad grade is outside the CDOT ROW where construction would occur. No retaining walls or additional pavement is planned for this area. Two Active Traffic Management (ATM) signs are proposed, one at MP 236 and the other at MP 236.5, which would be in addition to the one existing sign at MP 236. The CCRR grade is approximately 220 feet from I-70 on the east end and approximately 380 feet on the west end. All PPSL construction and the two additional signs would not be visible because they are sufficiently distant from the railroad grade and buffered by Clear Creek to the north and dense tree stands. For these reasons CDOT has determined that the PPSL project would result in no historic properties affected with regard to the CCRR Grade, N. Spring Gulch Road segment.

*Maude Munroe Mine/Dona Juanita (5CC.339)*

Two retaining walls are planned to the east of the site near MP 238, but these are 0.2 mile (more than 1,000 feet) from the historic property. The retaining walls would not be visible because of intervening vegetation and the topography of the area near the creek. Two ATM signs are proposed, one at approximately MP 238 and the other at 238.6. They would augment the three existing signs clustered between MP 237.8 and 238.2. Collectively, the existing and proposed signs would not affect the viewshed or viewscapes of the Maude Munroe Mine Site. The setting of structures on the north side would not change substantially because I-70 is already adjacent. For these reasons CDOT has determined that the PPSL project would result in no historic properties affected with regard to the Maude Munroe Mine Site.

*Big Five Mine (5CC.328)*

All of the resources associated with the Big Five Mine site are on the north side of I-70, and a noise barrier wall that is approximately 12 feet tall above the interstate roadway is between the Big Five Mine resources and the I-70 roadway. In the vicinity of the Big Five Mine, PPSL improvements would consist of the installation of a new ATM sign over the eastbound lanes from the median, approximately 340 feet east of the Big 5 boundary. No additional noise is expected from PPSL at the Big Five Mine site because

of the existing noise barrier wall. Based on this, CDOT has determined that the PPSL project would result in no historic properties affected with regard to the Big Five Mine.

*Mt. Evans Road (State Highway 103) (5CC.1151.1/5CC.1151.2)*

Project improvements to the SH 103 overpass and interchange include replacement and widening of the existing overpass, shifting the westbound lanes of I-70 north 2 to 4 feet and the eastbound lanes south 2 to 4 feet, and replacement of a retaining wall on the south side of the interstate adjacent to the eastbound off-ramp. Since the segment of SH 103 in the APE does not contain any resources that contribute to the significance of the NRHP-eligible Mt. Evans Road, CDOT has determined that the PPSL project would result in no historic properties affected with regard to the Mt. Evans Road project.

*Idaho Springs Downtown Commercial District (5CC.201)*

Potential effects of the PPSL project to the NRHP-listed Idaho Springs Downtown Commercial District (Figure 8) as a whole were considered, although only the very southeast edge of the Commercial District overlaps with the PPSL APE for about two blocks. PPSL improvements in this area include the replacement of the SH 103 overpass bridge, the installation of an ATM sign, and a speed limit sign in the median just east of the east boundary of the Commercial District.

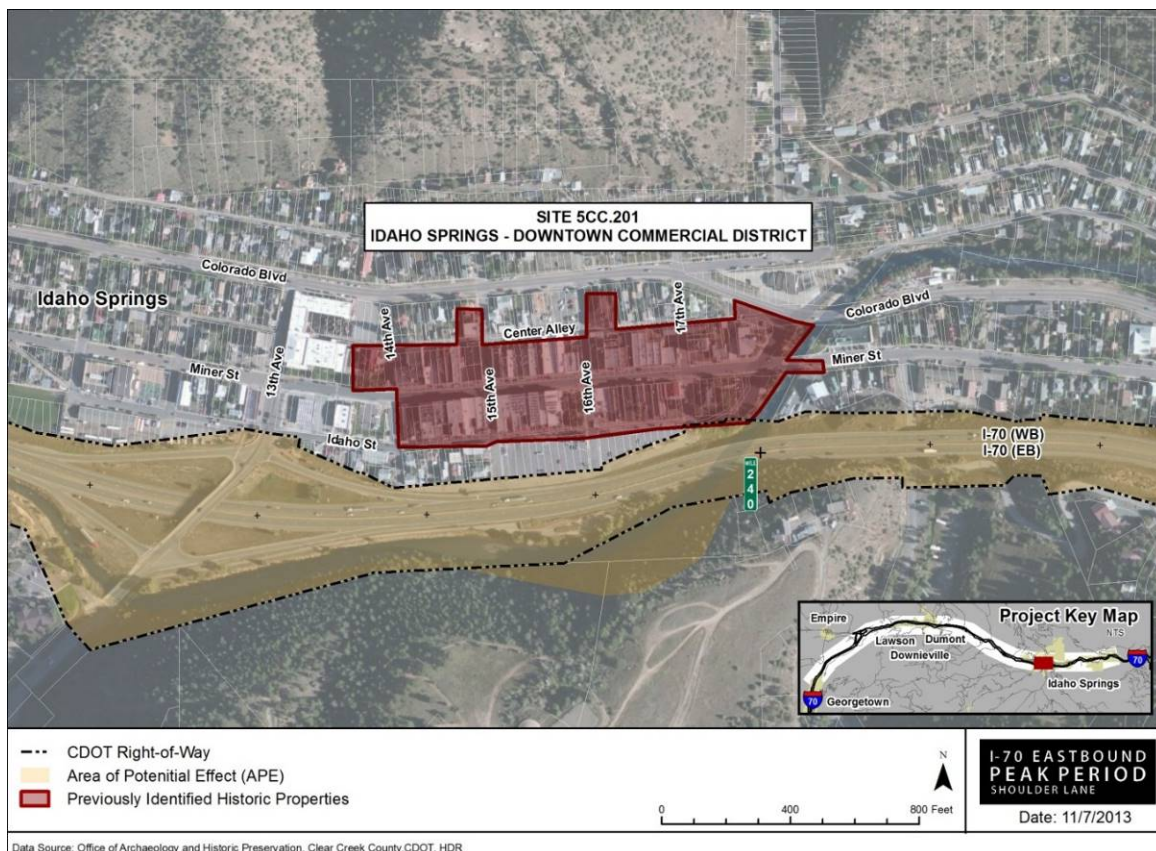


FIGURE 8: PSL APE and the Idaho Springs-Downtown Commercial District



Within the APE the Commercial District consists of parking lots on the south side of Idaho Street at 17th Avenue and to the west. At the intersection of Idaho Street and 17th Avenue is a small park. Historic buildings stand on the north side of Idaho Street beyond the parking lots and west of 17th Avenue. These historic buildings face across the parking lots to I-70 and already experience substantial traffic noise and the visual effects of the interstate.

The replacement of the State Highway 103 (SH 103) overpass bridge may be accompanied by a slight shift of the interstate roadway lanes to the north (westbound) and south (eastbound) to accommodate support piers in the median. The new overpass would be very similar to the existing one but may be slightly higher. The interstate roadway is depressed in this area and is lower than the street level and buildings above. The new overpass would not be appreciably more visible to the historic district buildings or cause additional noise. For these reasons, CDOT has determined that the PPSL project would have no adverse effect on the Idaho Springs Downtown Commercial Historic District.

#### *Charlie Tayler Waterwheel (5CC.229)*

Associated improvements near the Charlie Tayler Waterwheel (Figure 9) include two signs, extension and widening of the SH 103 eastbound on-ramp, and retaining walls incorporated into a redesign of the adjacent park. The widening and extending of the nearby on-ramp will run traffic slightly closer to the waterwheel, but the retaining wall and other park improvements would lower the grade of the park and likely reduce existing noise levels so that a visitor to the park viewing the waterwheel would not



FIGURE 9: Plan View of Improvements to the Water Wheel Park (CDOT, Effects Determinations, I-10 Mountain Corridor, Denver: CDOT, 2014)

experience greater noise than present. Improvements to the waterwheel park, which is located between the waterwheel and the highway, including depressing it so that it is lower relative to I-70.

A visitor to the park would be less affected by noise and the interstate would be less visually apparent than under current conditions. Improvements to the park would affect the setting and surroundings of the waterwheel. In summary, the PPSL project would not directly affect the waterwheel, which would continue to serve as a commemorative object and be visible in its rugged mountain context from I-70 or close-up after completion of the PPSL. Visitors to the park would continue facing toward the waterwheel to the south, away from the interstate. Based on this, CDOT has determined that the proposed PPSL project would result in no adverse effect to the Charlie Taylor Waterwheel.

#### *Interstate 70 Twin Tunnels Vicinity*

Project improvements from MPs 242 to 243 are signage only.

#### *Twin Tunnels/Interstate 70 (5CC.1189.3)*

The only PPSL project elements proposed in the vicinity of the Twin Tunnels would be the installation of signage. An “Express Only” overhead sign is planned for MP 242, just west of the Twin Tunnels. There are currently a number of signs in the vicinity of the Twin Tunnels. Although the additional sign would be visible when approaching the Twin Tunnels from the west, CDOT has determined that the PPSL project would result in no historic properties affected in the area of the Twin Tunnels.

### **Project Noise and Effects Determinations**

The CDOT has stated that highway traffic noise has been an ongoing topic of concern among stakeholders at numerous public, local agency, and state/federal agency meetings since the initiation of the PEIS process. The results of noise measurements, analysis methodologies, analysis results, and mitigation strategies were discussed in detail at approximately 10 public meetings, which were open to all stakeholders, at approximately six individual meetings with local officials, and at a variety of other meetings with stakeholders such as historic site advocates and parks officials.

Pursuant with the Section 106 effect determinations made for the Interstate 70 Mountain Corridor Project under the *Interstate 70 Mountain Corridor Project Programmatic Agreement* (2008) and as detailed in the *CDOT I-70 Mountain Corridor Final Effects Determinations Memo* (2014) (see introductory discussion at beginning of the chapter), with results stated above relative to each historic property, no mitigation for noise impacts was proposed for any of these historic properties along the 13-mile-long PPSL project area.

A noise impact to a historic property does not necessarily or absolutely constitute a Section 106 adverse effect along this PPSL project area. This in no way diminishes the noise concerns held by stakeholders in the project area. These I-70 examples in Colorado show that highway noise and design analyses will support lower-level Section 106 findings of “no historic properties affected” and “no adverse effect.” This project has shown that even though there has been considerable concern about traffic noise from I-70, as evidenced by the numerous meetings held by CDOT to discuss noise issues along I-70, studies and analyses have supported CDOT’s Section 106 effect determinations regarding traffic noise impacts to the properties along the PPSL project area.

This is partly because existing retaining walls and structures can affect the way noise travels and also alter noise levels, and because certain topographic situations (differences in grade, mountain sides, etc.) provide advantages. Noise and design analyses have shown that these factors, combined with the proposed construction of 10 retaining walls (along with associated improvements at the Waterwheel property), have jointly created conditions along the PPSL project that would not result in adverse effect determinations under Section 106. Traffic noise impacts from the proposed PPSL project were therefore found not to significantly diminish the aspects of integrity that qualify each property for eligibility for or inclusion in the NRHP.

Noise impacts leading to Section 106 “adverse effect” determinations regarding historic properties in the areas along I-70 may be more likely where there are related new-location projects and roadway expansion projects, rather than capacity improvements where there no new (or minimal) ROW is needed and where some degree of traffic noise impact already occurs as a result of pre-existing roadway conditions. As noted above, however, provisions in CDOT’s I-70 project programmatic agreement (1) accommodate reevaluations of noise impacts along the corridor, and (2) allow the agency to reevaluate the eligibility of historic properties owing to passage of time, changing perceptions of significance, or incomplete prior evaluations of eligibility. Those tools, used in conjunction with ongoing engagement with stakeholders regarding noise impacts along the project area, allow the agency to move forward in a transparent process.

This case study is included because it involves adding a travel lane to an existing interstate highway near NRHP listed Historic Districts and a verity of NRHP listed historic sites. Noise impacts were identified per 23 CFR 772 but were not determined to be adverse effects. Similar interstate improvement scenarios will likely be encountered by state DOTs or other practitioners.

## **MARYLAND – INTERCOUNTY CONNECTOR**

The Maryland State Highway Administration’s (SHA) Intercounty Connector (ICC) Project was proposed as a new 18-mile-long, six-lane toll highway in Montgomery and Prince George’s counties connecting I-270 in Gaithersburg to U.S. 1 in Laurel, Maryland (Figure 10). Part of the proposed Washington Outer Beltway, it was to improve the flow of interregional traffic, relieve traffic congestion on local roads, spur economic development, and enhance access to the Baltimore-Washington Airport. The alignments retained for detailed studies were common at the western end of the project, but the alignments divided north and south about halfway through the corridor to become two corridors.

SHA defined the APE as 250 feet beyond proposed limits of disturbance to address the physical, visual, and audible impacts. Twenty-seven standing historic properties were identified in the APE, including the Washington Grove Historic District and the Free Methodist Church Camp Grounds. The Washington Grove Historic District stands near the western end of the mainline corridor. When members of the Washington Grove Historic Preservation Commission objected that the historic district was outside the APE and therefore would not be considered as affected, SHA expanded the APE to 1,100 feet to address their concerns. Near the eastern end of the project, the northern alignment passed anywhere from 10 to 50 feet south of the Free Methodist Church Camp Grounds’ NRHP boundary.

Since the ICC was on new alignment, the noise impacts were considered, with effects being considered when dB levels were raised by more than 10 dB(A) (decibels, A-weighted) or that reached 66 dB(A), because that approached 68 dB(A), which is the level required for mitigation by SHA. SHA generally



planned that the mitigation would be a noise barrier. SHA's noise policy followed FHWA's regulations at 23 CFR Part 772 and tested any building that was within 200 feet of the highway. Noise testing was done at Free Methodist Church Camp Grounds because of the proximity of the alignment, but not at Washington Grove.



FIGURE 10: Bird's Eye View of Project Area and Free Methodist Church Campground (Maryland SHA)

Local Free Methodists built a church in Spencerville in 1905 and the camp meeting ground on Peach Orchard Road starting in 1931. The small "tent" cabins are of wood with front-gable roofs and a door opening to a single room. The cabins stand in a semi-circle around the central open tabernacle surrounded by a grove of trees in the southern half of the property. The placement of the cabins around the tabernacle is typical of southern Methodist camps. The Free Methodist Church Camp Ground was determined eligible for inclusion in the NRHP in 1998 by SHA and the Maryland SHPO.

SHA and FHWA determined that the Free Methodist Church Camp Ground met 23 CFR Part 772 Criterion A because it is a religious retreat where quiet is considered to be an important feature of the property (Figures 11 and 12). It was not considered to be an example of Criterion C.

A detailed traffic noise analysis at the Camp Ground revealed that the existing noise level of 48 dB(A) would be raised by 17 dB(A), resulting in a new noise level of 65 dB(A). The new noise level met the requirement for considering a noise barrier, which SHA's preliminary review determined would be reasonable and feasible along the historic property's southern boundary. However, the barrier would be 20 feet high, considerably taller than any of the cabins in the camp ground.

In SHA's opinion, although the barrier would mitigate the noise impact, it increased the visual and physical impacts to the Free Methodist Church Camp Ground. In addition, the new highway introduced visual and physical elements that were out of keeping with the religious and rural character of the property. As a result the ICC project was determined to have adverse audible, visual, and physical impacts on the historic property. The SHPO concurred that this option A for an alignment (and two nearby avoidance options) would be an adverse effect on the historic property.



FIGURE 11: Methodist Tabernacle (Maryland SHA)



FIGURE 12: Methodist Camp Cottages (Maryland SHA)



Although several consulting parties recommended a noise barrier to address the impacts, SHA viewed it as a site where mitigation for the adverse impact might not be possible. As SHA and FHWA discussed the possible barrier, SHA concluded that it might help reduce noise but would have other impacts to the Free Methodist Church Camp Grounds, as the cabins would face the highway and therefore the noise barrier. The enclosing wall in an area that had formerly been open would change the character of the camp because it would introduce a new visual element.

The new highway would also bring visual and physical elements that were out of character with the historic nature of the camp. All of these issues had the potential to alter the camp grounds. After weighing options, SHA determined that construction of the ICC with the subsequent noise levels in this location would prevent the camp from being used as it had been historically, and that there was a constructive use as defined by 23 CFR 774.15(d). However, other proposed alignments were part of the project, and SHA was able to choose the southern alignment, which has now been constructed.

This case study is included because it involves construction of a new limited-access highway near a noise-sensitive historic site. Noise impacts that would be adverse effects were identified and noise barriers were found to be unacceptable. Therefore the project might have resulted in unresolved adverse effects if an alternative alignment had not been selected. Although this scenario is not likely to occur frequently, a similar scenario could become very controversial and potentially delay project development.

## OHIO - COLUMBUS SOUTH INNERBELT

The Ohio DOT's I-70/71 Columbus South Innerbelt Project involved both horizontal and vertical re-alignment and widening of freeway mainlines and the I-71/670 system interchange ramps. It also involved reconstruction of city street bridges over the interstate mainline and construction on new urban avenues along the mainlines. New ramps to I-71 northbound and I-670 eastbound from the city streets were also constructed.

The Shiloh Baptist Church (Figure 13), nominated for the NRHP in 2004 under Criterion A for African-American heritage, was located in the APE for the project. The NRHP boundary of the Shiloh Baptist Church coincides with the Church parcel property lines along Mt. Vernon Avenue, Hamilton Avenue, Grove Street, and I-71. During a series of project specific meetings, representatives from Shiloh Baptist explained that the church sanctuary was not air conditioned and frequently had both windows and doors open during services.



FIGURE 13: Shiloh Baptist Church (Ohio DOT)

Section 106 consultation for the project began in June 2006 with the determination of eligibility and NRHP site boundary for the Shiloh Baptist Church. In April 2008, the

Ohio SHPO concurred with a finding of no adverse effect for historic resources, including the Shiloh Baptist Church, based on a Memorandum of Agreement,<sup>5</sup> which outlined various measures to minimize harm, including construction of a retaining wall to minimize encroachment on the church parcel, limiting construction activity to the temporary construction easement in the church's parking lot, prohibiting construction staging elsewhere on the property, maintaining access to the church at all times during project construction, and reimbursement of cost of building insulation for interior traffic noise reduction. During a series of project specific meetings, representatives from Shiloh Baptist and the Ohio SHPO did not identify any concerns in regard to the effect of the undertaking (Project 1) on the historic characteristics of Shiloh Baptist Church other than those addressed by the measures to minimize harm.

A detailed traffic noise analysis for the project indicated that there would be only a slight change in traffic noise levels (less than 3 dB(A)) at most locations adjacent to the highway. Changes in noise levels of 3 dB(A) or less are considered imperceptible to humans in an outdoor environment; however, the design's 20-year predicted noise levels exceeded ODOT/FHWA noise impact criteria, and therefore noise impacts were identified for the Hamilton Avenue neighborhood east of I-71, including Shiloh Baptist Church.

Noise walls were recommended for that neighborhood, including along the church property line adjacent to I-71; however, during public involvement conducted specifically to determine the neighborhood's desire for the construction of the recommended noise walls, the majority of "First Row" locations including Shiloh Baptist Church did not respond or were not in favor of the noise walls. ODOT therefore decided that noise walls would not be constructed for the project.

In January 2012 Ohio DOT executed a noise mitigation agreement with the Shiloh Baptist Church to reimburse the Church up to \$371,250 for noise abatement work that included installation of central air conditioning, acoustical drapes and/or double-paned windows, and solid core doors or equivalent (Figure 14). The Church selected the contractor to do the work with invoices submitted directly to Ohio DOT, who inspected the work before paying the contractor.

This mitigation solution was the result of a long-term relationship among the highway agency, the representative of the resource, the review agencies (FHWA and



FIGURE 14: Sanctuary Window Suitable for Insulation (Ohio DOT)

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<sup>5</sup> FHWA, ACHP, Ohio SHPO, and Ohio DOT, *Memorandum of Agreement between the Federal Highway Administration, the Advisory Council on Historic Preservation, the Ohio State Historic Preservation Office, and the Ohio Department of Transportation regarding the Federal-aid Highway Improvement of Interstate Route 70 in Central Columbus, Franklin County, Ohio -- FRA-70-8.93, PID 77369* (Columbus: on file, Ohio DOT).

Ohio SHPO) and other project consulting parties. This project was the result of several factors that might not occur in other situations:

- Adjacent residential properties did not desire a noise wall
- Church had no outdoor activity areas, so interior noise levels set criteria
- Policy allowed more costly, clear noise barriers, resulting in a larger amount of available funding for building insulation than would be available if only traditional (concrete or steel) barriers were allowed.

This case study is included because it involves improvements to a limited-access highway near a historic site. Noise impacts were identified and noise mitigation (via building improvements) was developed that resulted in a no adverse effect finding. Similar interstate improvement scenarios will likely be encountered by state DOTs or other practitioners.

## **OKLAHOMA - BARON FORK RIVER BRIDGE PROJECT**

The Oklahoma DOT stated that the purpose of the project was to correct a structurally deficient bridge over the Baron Fork River and to improve the safety and operations of the junction at SH 51 and U.S. Route 62 in Cherokee County, Oklahoma. The Baron Fork Bridge was 24 feet wide with an approach roadway width of 30 feet. The bridge had a sufficiency rating of 20.6 and was structurally deficient. SH 51 had two 12-foot lanes with no shoulders, sharp curves, and limited sight distance with minimal clear zone. The junction of SH 51 and US 62 is a T junction with the through traffic movement on U.S. 62. Eighteen documented accidents took place there from 2008 to 2012, which is three times the state average for collisions. SH 51 and the junction at U.S. 62 were to be built on an offset alignment east of the existing roadway and junction. The proposed junction was planned to change the through roadway movement to SH 51 and add turning lanes.

Located adjacent to SH-51 just west of the SH 51/U.S. 62 junction, the vacant Hitchcock Store building was determined to be eligible for the NRHP in 2014 as a result of consultation between Oklahoma DOT and the Oklahoma SHPO (Figures 15 and 16).<sup>6</sup>

A public meeting was held for the project to provide information about the purpose and need for the project, discuss existing conditions, and allow questions and comments from the attendees on the undertaking. As a result Oklahoma DOT obtained input from the public regarding areas of concern, such as the location and safety of the proposed improvement, and environmental impacts, including the importance of the NRHP-eligible Hitchcock Store to the local community. The two alternatives that best met the purpose and need of the project and had the least environmental impact were presented at the meeting. One alternative had less impact on the adjacent Eldon Hill but would require removal of the historic store. The other kept the store but required removal of some of Eldon Hill. There was a clear preference at the meeting for saving the historic Hitchcock Store building, which had been important in the history of the community. The alignment that preserved the store was chosen as the preferred alignment.

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<sup>6</sup> The primary reference for this source information was: Tori Raines, *Oklahoma Department of Transportation Cultural Resources Survey Report* (Oklahoma City: Oklahoma DOT Cultural Resources Program, 2014, [http://www.okladot.state.ok.us/meetings/a2014/141219/CrosstownEA\\_AppendixF.pdf](http://www.okladot.state.ok.us/meetings/a2014/141219/CrosstownEA_AppendixF.pdf)).





FIGURE 15: The Hitchcock Store at Eldon in the 1940s (Oklahoma DOT 2014)



FIGURE 16: The Hitchcock Store, 2015 (Oklahoma DOT 2015)

The project traffic noise assessment report<sup>7</sup> (Traffic Noise Assessment, SH-51 Over Baron Fork Creek, Cherokee Co. – JP 10437(04); Proposed Bridge Replacement and Intersection Improvements (2015)) examined the potential noise impacts associated with the project. The land uses along the project area are predominantly a mix of scattered residential properties and undeveloped land. The noise-sensitive land uses for this project were considered to be single-family residences and a place of worship. The noise analysis was performed using FHWA's computer model Traffic Noise Model (TNM) version 2.5 in accordance with the FHWA 23 CFR 772 and complies with the Oklahoma DOT Policy Directive Highway Noise Abatement C-201-3 dated July 13, 2011.

Based on a field inspection, aerial maps, and preliminary design plans, 12 model receiver sites were analyzed. Three residential dwellings and the historic (and vacant) Hitchcock Store structure (labeled R-1; Figure 17) exceed the 67 dB(A) Leq(h) for NAC Categories B and C. Based on the proposed project and future traffic volumes, only the historic structure would be impacted with future sound levels approaching the 67 dB(A) Leq(h) for NAC Category C. The future noise levels are expected to range from -9.4 to +6.4 decibels above existing levels (see Figure 17). No receivers will experience a 15-dB increase in noise levels over the current condition, which is considered to be a substantial increase for noise impact determination. Noise mitigation in the form of a freestanding noise wall within the proposed project ROW was considered for the noise-impacted historic structure. This receiver has direct driveway access onto SH 51. Without access control, the gap that would be required for the driveway and roadway connections around the receiver would make noise abatement measures ineffective. Noise mitigation was therefore considered not feasible for this property.

In summary, the Hitchcock Store, within the Baron Fork River Bridge project APE, was identified in the cultural resource survey and found to be eligible for the NRHP through Section 106 consultation. It was considered in design studies, discussed at a public meeting, and included in the project noise study in which a future exterior noise impact was determined to be 66.1 dB(A), thus approaching the 67 dB(A) Leq(h) for NAC Category C. Noise abatement measures to mitigate the noise impact were considered and determined to be ineffective at this property locale because of physical conditions at the historic property. Coordination with SHPO resulted in a determination that the proposed project would have "no adverse effect" based on no ROW take from the store property and conditions from the SHPO for protecting the historic property, which the Oklahoma DOT included in the design plans. None of the conditions was related to current or projected traffic noise, possibly partly because the property was vacant. The end result was that the property was protected during construction and the Section 106 effect determination did not consider the noise impact to be detrimental to the aspects of integrity that qualify the property for eligibility for inclusion in the NRHP. The historic property is important to the local community and the community's wish that it be saved was realized.

This case study is included because it involves improvements to a two-lane road bridge and nearby intersection, near a historic site. Noise impacts were identified but were not determined to be an adverse

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<sup>7</sup> Traffic Noise Assessment, SH-51 Over Baron Fork Creek, Cherokee Co.—JP 10437(04); Proposed Bridge Replacement and Intersection Improvements, Programmatic/Individual Categorical Exclusion document (Oklahoma City: Oklahoma DOT, Environmental Programs Division, August 26, 2015).



effect. Similar roadway improvement scenarios will likely be encountered by state DOTs or other practitioners.

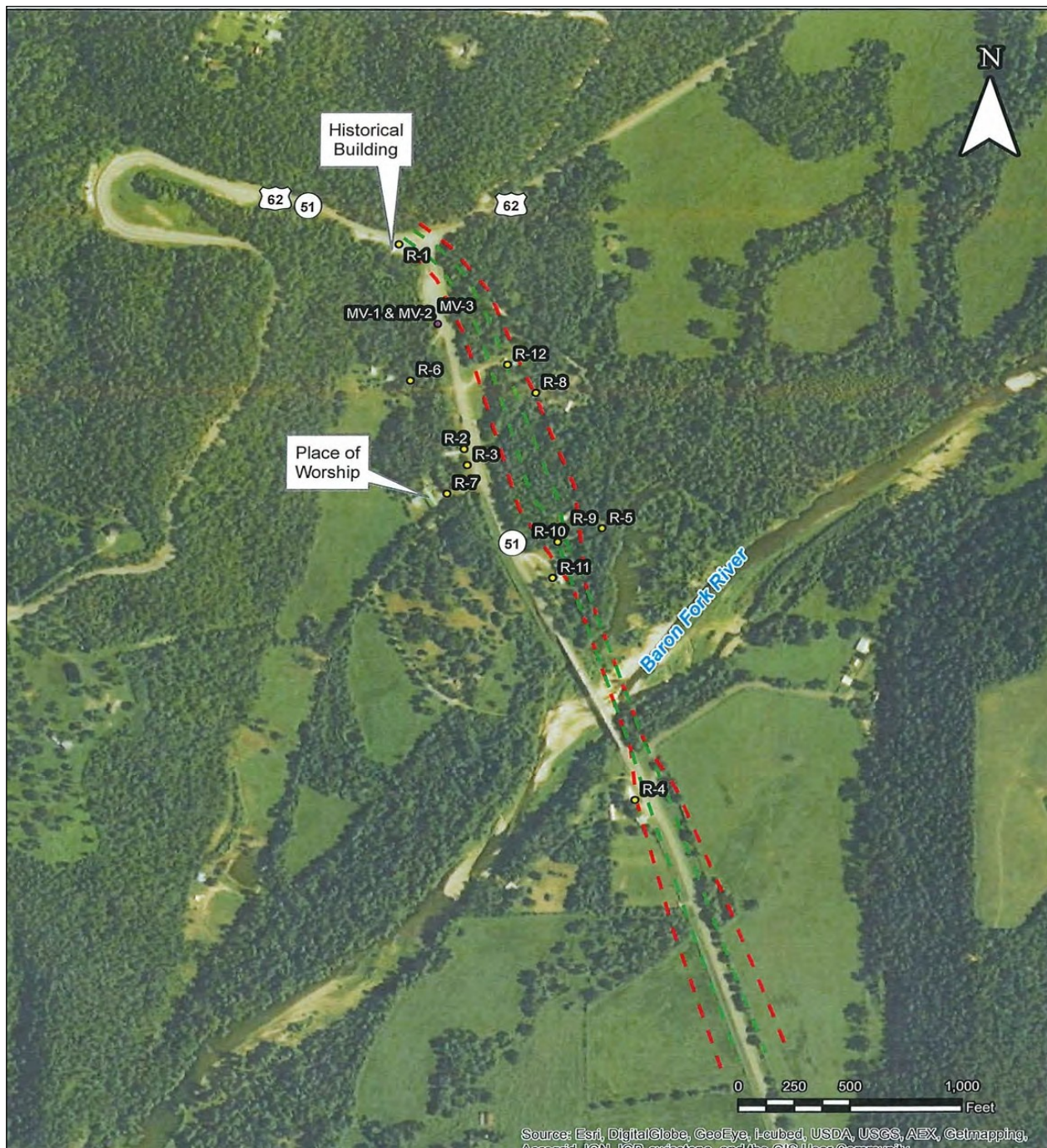


FIGURE 17: Noise Analysis for the Project (Garver USA 2015)



## TEXAS – IH 35 W FORT WORTH

The Texas Department of Transportation (TxDOT) proposed improving IH 35 W from IH 820 to IH 30 in Fort Worth in 2012. The proposed project was needed to meet future travel demands stemming from projected population growth and to improve mobility in the IH 35 W corridor.

The Oakhurst Historic District was constructed between 1924 and 1959 (Figure 18). It consists of both the Oakhurst and Oakhurst West additions. It was determined NRHP-eligible in 2007 by the Texas SHPO under Criteria A: Community Development and C: Design. A suburban middle-class neighborhood, the Oakhurst Historic District features a mix of architectural styles from Bungalow to Ranch houses. The NRHP nomination prepared for the district does not specifically address the auditory qualities of the neighborhood; however, it does establish the neighborhood's bucolic landscape and secluded, country-like qualities.



FIGURE 18: Oakhurst Historic District (Photo: Renelibrary | Wikimedia.org)

The noise study completed for the project using TxDOT's *Guidelines for Analysis and Abatement of Roadway Traffic Noise*<sup>8</sup>, considered the 66-dB contour line as the Area of Potential Effects for noise impacts. That study also showed that four contributing resources were within the 66-dB contour line in the existing condition, and that by the design year 10 contributing resources would be within the 66-dB contour line because of increased traffic on the existing highway. The noise study also showed that 25 contributing resources would be within the 66-dB contour line in the design year with construction of the preferred alternative. The study indicated that FHWA NAC Land Use Category B – Residential (67 dB)

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<sup>8</sup> TxDOT, *Guidelines for Analysis and Abatement of Roadway Traffic Noise* (Austin: TxDOT, March 2011, <http://ftp.dot.state.tx.us/pub/txdot-info/env/toolkit/730-02-gui.pdf>).

applied to the Oakhurst Historic District and impacts would occur when noise approached the NAC (66+ dB).

Because the Oakhurst Historic District was impacted by traffic noise, TxDOT noise specialists reviewed the abatement measures available under 23 CFR 772 and determined that none would be reasonable and feasible. The noise barriers were determined not to be reasonable because the cost of such barriers would exceed TxDOT's reasonable, cost-effectiveness criterion because of the topography—the Oakhurst Historic District is on a bluff overlooking the highway.

Texas SHPO determined that the predicted noise impacts to the Oakhurst Historic District would be adverse under 36 CFR 800.5 as they would impact integrity of feeling of the bucolic landscape and secluded, country-like qualities. Furthermore, SHPO recognized that the abatement measures available under 23 CFR 772 could not be included in the project. During consultation with the consulting parties, including the Oakhurst Neighborhood Association, the Texas Historic Commission accepted a commitment requiring the use of a Registered Landscape Architect in the development of the landscaping plan for the proposed project as sufficient measure to resolve the adverse effect.

This case study illustrates that an NRHP nomination does not specifically need to address the auditory qualities for traffic noise to impact the integrity of a resource's feeling. In addition, the case study shows that the use of landscaping, designed by a Registered Landscape Architect, presumably with the goal of being appropriate for a historic district/neighborhood, can be a means to resolve an adverse effect resulting from increased noise impacts.

This case study is included because it involves improvements to an existing interstate highway near a noise-sensitive historic district. Noise impacts were identified and subsequent mitigation via landscaping appropriate for a historic district/neighborhood resulted in a no adverse effect finding. Similar roadway improvement scenarios will likely be encountered by state DOTs or other practitioners.

## **VIRGINIA – GEORGE P. COLEMAN BRIDGE**

The Virginia Department of Transportation reconstructed the George P. Coleman Memorial Bridge in Yorktown in the late 1990s (Figure 19). Increased traffic over the 3,750-foot-long, double-swing-span bridge necessitated widening the bridge from two to four lanes. The swing span was necessary to provide ship access to military installations, such as the U.S. Navy's Naval Weapon Station in Yorktown. The \$75 million reconstruction of the bridge required replacement of the bridge superstructure with minimal disruption to traffic flow.

Along with the historic George P. Coleman Bridge, the Yorktown Revolutionary Battlefield and Yorktown Historic District–Colonial National Historical Park were within the bridge project APE. Indeed, when the original George P. Coleman Bridge was conceived in the 1950s, the lower height of the bridge and double-swing-span were compromises to limit the visibility of the bridge from the battlefield, which was a significant concern of the NPS.

A noise study was completed for the project using 23 CFR 772. The noise analysis predicted impacts at five non-historic residences at the southern end of the bridge. To lessen the noise impacts on these residences, noise barriers on portions of the bridge and along the bridge approaches were necessary. The project design also limited the noise activities near the Yorktown Historic District to minimize harm.

Virginia DOT, in consultation with the Virginia SHPO, determined that the bridge reconstruction project had no effect on the Yorktown Historic District or Yorktown Battlefield; however, installation of the noise barrier on the George P. Coleman Bridge was considered to be an effect on the historic bridge. Along with the direct effect of the noise barrier on the historic bridge, there was a concern that the proposed noise barriers could be an aesthetic (visual) effect on the nearby historic resources. Multiple aesthetic noise barrier options were considered to minimize the effects of the barriers. The selected three-dimensional, brick, urban-themed barrier wall was determined not to be an adverse effect on any of the project area historic resources (Figure 20).



FIGURE 19: George P. Coleman Bridge (Virginia DOT)



FIGURE 20: Three-dimensional Brick Noise Barrier (Virginia DOT)



This case study illustrates that mitigation of noise impacts could have been a “trade-off,” replacing one kind of effect (setting: auditory) with another (setting: visual). The aesthetics of the noise wall (brick theme on both sides) were very important in determining that the noise wall did not diminish the characteristic of the historic property, thus having no adverse effect.

This case study is included because it involves improvements to an existing roadway and bridge near a Historic District. Noise impacts were identified and noise mitigation (via noise walls) were determined to have no adverse effect because of the aesthetics used on the noise wall. Similar roadway improvement scenarios will likely be encountered by state DOTs or other practitioners.

## SUMMARY OF FINDINGS

During the literature review, stakeholder survey, interviews, and review of case studies, similar key elements emerged that state DOTs may find valuable when establishing standard practices for addressing highway noise effects on historic properties.

- There is a general lack of experience with addressing highway noise impacts to historic properties, but state DOT and SHPO personnel are very interested in having information on how the topic has been successfully resolved elsewhere.
- Less than 20 percent of agencies, organizations, or companies surveyed have a set policy that specifically addresses adverse auditory effects to historic properties or appropriate mitigation at historic sites or within historic districts.
- The auditory environment (soundscape) is not regularly considered in the NRHP determination process.
- Addressing highway noise effects to historic properties is almost always a collaborative effort between the traffic noise and historic resource specialists within state DOTs.
- FHWA NAC–23 CFR 772 Criteria are frequently used as a first step to determine adverse auditory effects at historic sites or within historic districts.
- No Adverse Effect findings occur frequently because traffic noise does not generally alter the characteristics of a resource that make it eligible for the NRHP.
- Non-auditory solutions, such as landscaping, have been successfully used to resolve auditory adverse effects at historic sites or within historic districts.
- Context-sensitive aesthetic treatments of noise walls, such as brick facings, have been successfully used to avoid a potentially adverse visual effect at historic sites or within historic districts.

With the exception of the Maryland case study, noise was never the issue that prevented a project from moving forward in any of the case study projects investigated for this report. The Maryland case study did not involve modification of an existing highway. Instead, it involved constructing a new six-lane highway with two alignments under consideration. Furthermore, the Maryland case study involved an NRHP-eligible site where quiet was considered to be an important feature of the property (23 CFR 772 Category A land use).

## **APPENDIX A: FINAL LIST OF DETAILED QUESTIONS FOR IN-DEPTH INTERVIEWS**

Based upon the comments from all four NCHRP Panel reviewers the following are the Final Interview Questions:

1. Was the auditory environment considered in the NRHP determination of eligibility and/or NRHP nomination process for any building you investigated for noise impacts?
2. How do you evaluate auditory effects (decibel levels or something else)?
3. What criteria do you use to determine adverse auditory effects (decibel levels or something else)?
4. If you use decibel levels and a noise impact exceeds the 67-decibel (dB) federal noise abatement criteria (NAC–23 CFR 772), does it also constitute an adverse effect under Section 106?
5. Does an adverse effect occur only when noise levels approach/exceed FHWA NAC (67 dB), or, as one example, is a sliding scale (such as 0-3 dB=no effect, 2-9 dB=no adverse effect, 10 dB=adverse effect) or other methodology utilized in Section 106 analysis?
6. Is it correct to assume a project-related increase must be discernible by the human ear?
7. How have you addressed noise-related adverse effects in Section 106 treatment plans?
8. Do you have any experience with vibration impact attenuation/mitigation at historic properties, recognizing that highway noise impact sources are producers of both vibration and noise?
9. Do you consider interior noise level when evaluating auditory effects at historic properties?
10. If yes, what criteria do you use to determine adverse interior auditory effects (decibel levels or something else)?
11. If you considered interior noise at historic properties, how did the type of construction and current use of a structure influence the effect determination?
12. Do you consider potential auditory effects at historic properties related to a temporary or permanent increase in traffic or traffic type changes (more trucks/buses) on older roads?
13. If yes, what criteria do you use to determine adverse auditory effects (decibel levels or something else)?
14. How do you consider traffic noise impacts related to the NRHP aspects of integrity (e.g., minimizing effects to integrity via installation of features and/or fabric to a receptor structure)?
15. How do you consider mitigation measures for traffic noise impacts related to the NRHP aspects of integrity (e.g., minimizing effects to integrity via installation of features and/or fabric to a receptor structure)?
16. How have you evaluated potential Section 106 adverse effects when a project does not change the noise level but the level remains above the NAC established by 23 CFR 772?

17. How have you evaluated potential Section 106 adverse effects when a project reduces noise levels but the levels remain above the NAC established by 23 CFR 772?
18. How are the visual impacts of noise walls balanced with auditory impact mitigation?
19. How have you evaluated potential Section 106 effects associated with noise wall construction within a historic district or at a historic site?
20. Was noise wall construction within a historic district or at a historic site an adverse effect?
21. Are there aesthetically designed noise abatement features that could result in a no adverse effect determination?
22. After project construction was complete, did you go back to historic properties that were evaluated as noise impacted to verify the impacts or concerns about mitigation aesthetics?
23. Have you any experience with mitigation of noise impacts resulting from temporary maintenance of traffic, such as the rerouting of traffic through a historic district during construction?
24. If so, can you elaborate on how that issue was addressed and resolved with or at the SHPO?
25. Do you have case studies to support responses to the questions?