



COLORADO
Department of Transportation
Division of Transportation Development

NOISE PROGRAM BOOK

MARCH 2015



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1. Introduction

The overall purpose of the Colorado Department of Transportation's (CDOT's) Noise Program Book is to provide a single-source reference that identifies the major elements of the Noise Program. The Noise Program Book is intended to give the user the opportunity to assess project-specific needs and provide direction to additional information, as needed.

The mission of the CDOT Noise Program is to:

- Ensure compliance with the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) requirements for Federal and Federal-aid projects.
- Ensure complete evaluations of CDOT projects under the National Environmental Policy Act (NEPA).
- Ensure compliance with CDOT requirements for CDOT and CDOT-administered projects.
- Research and promote innovative best management practices.
- Provide effective noise education and technical support to CDOT staff.
- Facilitate cooperation between CDOT, local municipalities, other state agencies, businesses and the public.

The Noise Program Book supports this mission by providing vital program information in a user friendly format, enabling users, regardless of prior experience with the CDOT Noise Program, to identify the roles and responsibilities that are integral to ensure compliance with all existing regulations.

The Noise Program addresses a wide range of activities, from project planning and design, to construction and maintenance. This manual summarizes the regulatory setting for each distinct area of the noise program, details the roles and responsibilities, tools and techniques, reporting requirements, and interrelationships with other elements of the Noise Program.

This Program Book is intended for use by CDOT staff, consultants, contractors and local entities involved in CDOT-administered projects. This Program Book is intended to aid the user in determining the regulatory setting and general actions required for a given situation with respect to transportation noise. While providing some direction, this Program Book is not a technical guidance document and does not relieve the user of the responsibility to keep abreast of industry specific changes and trends within the regulatory structure for transportation noise.

1.1. Noise Program Book Organization

The remainder of the Noise Program Book is organized in the following fashion:

- Section 2: Regulatory overview of the federal and state laws and regulations that apply to the Noise Program.
- Section 3: Summary of the Highway Project Development Program
- Section 4: Summary of the Construction Noise Program
- Section 5: Summary of the Rail and Transit Project Development Program
- Section 6: Summary of the Maintenance Program
- Section 7: Summary of the Locally-Funded Noise Walls Program
- Section 8: Summary of the Airport Noise Program
- Section 9: Description of the required and/or available training for the noise program.
- Section 10: A list of available resources and references for noise practitioners.



The sections pertaining to specific noise programs (Sections 3 through 8) include the following:

- **Purpose:** An explanation of the overall goals of the program.
- **Regulatory Setting:** A summary of the particular laws and regulations applicable to the program.
- **Interrelationships:** A description of the connections between the various CDOT programs.
- **Roles and Responsibilities:** A list of tasks required to fulfill the goals of the program and person(s) responsible for the task(s).
- **Tools and Techniques:** A list of resources available to support the program.

1.2. Program Book Updates

CDOT will issue updates and changes to the Noise Program Book as needed, based on changes in the regulatory environments at the state and federal levels, as well as in response to user comments. Comments regarding the content of this document are welcome and should be addressed to:

Colorado Department of Transportation
Noise Program Manager
Shumate Building
4201 East Arkansas Avenue
Denver, CO 80222



2. Regulatory Setting and Program Coordination

The important laws and regulations affecting the Noise Program are presented in Table 2-1. In summary, the major regulation that drives the Noise Program is Part 772 of Title 23 of the Code of Federal Regulations (23 CFR 772).

Table 2-1 Summary of Noise Impacts Laws and Regulations

Law or Regulation	Description
Federal-Aid Highway Act of 1970: United States Code Title 23 Chapter 1 Section 109(i) (23 USC 109(i))	Mandated that FHWA develop noise level standards for the mitigation of highway traffic noise. This mandate is accomplished by the regulations promulgated under 23 CFR 772.
23 CFR 771	Includes environmental impact analysis and related procedures for the U.S. Department of Transportation (FHWA and FTA).
23 CFR 772	Includes procedures for noise studies and noise abatement measures, identifies noise abatement criteria, and establishes requirements for information to be given to local officials for use in the planning and design of highways.
23 CFR 772.11	Requires highway agencies to analyze projects for potential traffic noise impacts.
23 CFR 772.13	Presents procedures for analysis of noise abatement, including feasibility and reasonableness.
23 CFR 772.19	Directs highway agencies to: <ul style="list-style-type: none"> • Identify impacted land uses from construction • Determine minimization measures for construction noise for the impacted community • Incorporate minimization measures into the project's plans and specifications. For all Type I and Type II projects.
NEPA: 42 USC 55 §4321-4370 and 40 CFR 1500	These are the law and regulations that enact and implement NEPA, respectively. NEPA is the basic national charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy. It contains "action-forcing" provisions to ensure that federal agencies act according to the letter and spirit of NEPA. NEPA applies for all federal or federally-funded actions.
Federal Aviation Administration Order 5050.4B	Federal NEPA implementing Instructions for actions at airports.
Colorado Department of Transportation	CDOT has several policies and guidelines that relate to transportation noise, including: <ul style="list-style-type: none"> • Environmental Stewardship Guide—this guide documents CDOT's environmental ethic and describes the process by which social, economic, environmental, and engineering considerations are integrated in all aspects of CDOT's decision-making. • NEPA Manual—this manual provides guidance on preparing and processing documents for CDOT that comply with NEPA



Law or Regulation	Description
	<p>and other applicable state and federal environmental laws affecting transportation projects in Colorado.</p> <ul style="list-style-type: none"> • Noise Analysis and Abatement Guidelines—Establishes the written highway traffic noise policy by CDOT for Federal, State, local, and public-private partnership projects overseen by CDOT or requiring CDOT approval. • Policy Directive 1601—Applies to governmental and quasi-governmental projects that require a new interchange or modifications to an existing interchange on an interstate highway. The 1601 process requires that noise be evaluated as a part of the evaluation of environmental impacts. • Noise Mitigation Policy Directive 1900.0—Establishes the Noise Analysis and Abatement Guidelines as the uniform criteria and procedures for determining application of federal and state noise requirements on state highway rights of way. • Roadway Design Manual Chapter 18 Noise- Summarizes roadside design elements and noise mitigation implementation procedures on state highway rights of way. • Manual of Maintenance Procedures—CDOT’s guide for maintenance staff which details maintenance activities such as structures, roadside and vegetation management. The manual includes a section on Sound Barrier Maintenance.
<p>Colorado Revised Statutes (CRS)</p>	<ul style="list-style-type: none"> • CRS 25-12-103—Sets maximum permissible noise levels radiating from property lines. • CRS 43-2-102—Requires CDOT to construct and maintain all roads comprising the state highway system. • CRS 43-2 Part 4—Authorizes applications (from citizens) for noise mitigation measures if several criteria are met, including: <ul style="list-style-type: none"> • A petition signed by no less than 75 percent of households residing 0.4 mile away from the state highway or less • Declares the proposed mitigation measure • Specifies if local government will be providing any funding • CRS 43-2 Part 3—Applies to vacation of highway property or right-of-way. • CRS 43-2 Part 4—Applies to implementation of noise mitigation actions along public highways.
<p>Code of Colorado Regulations (CCR): Title 2 Part 601-17 (2 CCR 601-17)</p>	<p>Establishes guidelines regarding the review, evaluation and approval of requests for the installation of noise mitigation measures that use waste tires on and off state highway rights of way pursuant to CRS 43-2 Part 4.</p>
<p>Colorado General Assembly</p>	<p>In 1974, the General Assembly enacted House Bill 74-1041, which further defined the authority of state and local governments in making planning decisions for matters of</p>



Law or Regulation	Description
	statewide interest. State and federal highways can be matters of statewide interest that fall under the “1041 powers.” The 1041 powers allow local governments to identify, designate and regulate areas and activities of statewide interest through a local permitting process. The general intention of the 1041 powers is to allow local governments to maintain their control over particular development projects even where the development project has statewide impacts. Some local governments have enacted 1041 regulations that may affect highway planning or construction.
Local Ordinances	Some local governments have laws which include restrictions on the amount of noise that can be emitted from a construction operation during certain hours or in certain areas, such as residential neighborhoods.

3. Highway Project Development Program

This program involves evaluations of transportation noise for projects as required under NEPA, CDOT project development processes, or other relevant federal and state mandates for highway projects. NEPA and its implementing regulations (40 CFR 1500) mandate that transportation decisions involving federal funds adhere to these regulations. NEPA requires that federal agencies use a systematic, interdisciplinary approach to decision-making when federal actions may affect the quality of the human environment. In addition, CDOT has committed to complying with the intent and requirements of NEPA for state transportation activities, regardless of whether or not these activities are federally funded.

There are three classes of NEPA actions: Categorical Exclusions, Environmental Assessments (EAs) and Environmental Impact Statements (EISs). NEPA actions involve comprehensive, multi-resource examinations of the potential environmental and social impacts from proposed federal or federal-aid actions. These examinations include noise from transportation sources, to the extent appropriate for the project and project area.

The program involves project-level or corridor-level noise impacts analysis and review, which may be necessary for completion of NEPA projects. The NEPA process only affects some projects, depending on the project type (as defined by 23 CFR 772 and in CDOT's Noise Analysis and Abatement Guidelines [CDOT, 2015]).

There are two main branches within the Highway Project Development Program. First, NEPA noise analyses target formal NEPA processes and may include other analyses needed for NEPA. Second, project development analyses primarily support the intent of CDOT's Environmental Stewardship Guide and include projects that may not be part of a formal NEPA process (e.g., Planning and Environmental Linkages projects).

3.1. Purpose

The purpose of NEPA generally was to declare a national policy that would:

- Encourage productive and enjoyable harmony between man and his environment.
- Promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man.
- Enrich the understanding of the ecological systems and natural resources important to the nation.
- Establish the Council on Environmental Quality (CEQ).

The purposes of CDOT's NEPA analysis program are to facilitate compliance with the CEQ regulations (40 CFR 1500) regarding noise for CDOT/CDOT-administered projects and to ensure complete noise analyses are conducted for projects in compliance with 23 CFR 772. Additionally, the program implements relevant noise impact analyses and project reviews for proposed Type I projects in support of the Environmental Stewardship Guide and ensure the statewide transportation system is constructed and maintained in an environmentally responsible, sustainable, and compliant manner.

This program applies to proposed Type I projects. Type I projects include the following:

- Construction of a roadway on a new location.
- Addition of through-travel lane(s) by new construction or restriping an existing highway. This includes the addition of a through-traffic lane that functions as a high-occupancy vehicle lane, high-occupancy toll lane, bus lane or truck climbing lane.

- Addition to a highway of an auxiliary lane by new construction or restriping, including lanes that function as passing lanes, continuous access lanes, acceleration and deceleration lanes, except for when the auxiliary lane is a turn lane.
- Addition of new interchanges or alterations of existing interchanges. This includes the additions or relocation of ramps, or ramps added to a quadrant to complete an existing partial interchange.
- A project which consists of a substantial change in vertical profile of 5-feet or more.
- A project which removes or alters shielding (either natural or man-made) thereby exposing the line-of-sight between the receptor and the traffic noise source.
- Alteration of highways such that the horizontal distance between the nearest edge of travel lane and existing sensitive receptors is approximately halved.
- Addition of a new or substantial alteration of a weigh station, rest-stop, ride-share lot, or toll plaza.

3.2. Regulatory Setting

This program is primarily regulated under the CEQ regulations in 40 CFR 1500 and through 23 CFR 772. Federal actions must also comply with the requirements of NEPA. In support of those regulations, technical guidance for highway noise was developed and provided through CDOT’s Noise Analysis and Abatement Guidelines. In addition, CDOT has committed to follow NEPA for its non-federal actions; the process for this is described in the CDOT NEPA Manual (CDOT, 2011a). In addition, CDOT has committed to complying with the intent and requirements of NEPA for state transportation activities, regardless of whether or not these activities are federally funded.

3.3. Interrelationships

This program is the fundamental noise program and sets the foundation for much of the noise work undertaken by CDOT. Several of the other noise programs can tie back to the Highway Project Development Program and these are described in Table 3-1.

Table 3-1 Highway Project Development Program Interrelationships with Other Programs

Construction Noise Program
NEPA analyses of noise are common for EAs and EISs. Some include consideration or discussion of construction impacts. In some cases, recommendations, commitments or specific abatement actions for noise are made that must be carried through construction.
Rail and Transit Project Development Program
On multi-modal projects, both highway and rail/transit options may be considered. In such a case, both of these CDOT programs may need to be blended to comprehensively examine the potential noise environment from the transportation improvements.

3.4. Roles and Responsibilities

Many individuals have substantive roles in the Highway Project Development Program, both within and outside CDOT. Those persons include:

- **CDOT Division of Transportation Development (DTD) Environmental Programs Branch (EPB) Noise Program Manager or Specialist**—has primary responsibility for ensuring that appropriate noise analyses and abatement evaluations are completed. May delegate responsibility to Region staff when appropriate. Supports Region staff, as needed.



Responsible for performing the analyses and evaluating abatement measures, or reviewing the analyses by performed by others. May conceive, lead or participate in CDOT-sponsored noise research projects.

- **CDOT Regional Noise Specialist or Contact Person**—may be delegated primary responsibility by headquarters staff for ensuring that appropriate noise analyses and abatement evaluations are completed. May be responsible for performing the analyses and evaluating abatement measures, or reviewing the analyses performed by others. May conceive, lead or participate in CDOT-sponsored noise research projects.
- **CDOT DTD Information Technology Staff**—provides the detailed traffic volume data required for the noise impacts modeling and calculations, for each year and situation being analyzed.
- **FHWA Staff**—participates in interagency scoping, guidance, coordination and consultation discussions on applicable projects, as needed. Reviews technical reports and findings. Ensures that requirements of NEPA are met and provides formal NEPA approval of the project.
- **CDOT Regional Planning and Environmental Manager** - Receive and refer traffic and construction noise complaints to CDOT noise specialists. Coordinate response to complaints.

3.5. Tools and Techniques

NEPA is a process-driven statute, so adherence to correct and appropriate methods and procedures is critical for program success. Often, multiple partnering agencies or affected parties participate in a project, so clear and timely communication among the participants is also critical. NEPA mandates certain public participation requirements, so the proper opportunities for public input are important. An awareness of these general NEPA project concepts is vital to the project technical analyses, including noise.

CDOT invests considerable resources, time and talent in compiling detailed information about environmental issues, conducting environmental analysis, and preparing documents to comply with NEPA. For those reasons, CDOT has prepared the NEPA Manual (CDOT, 2011a) as a resource for CDOT staff, local agency representatives and consultants engaged in these efforts. The NEPA Manual is the guidebook for completing NEPA projects by CDOT and should be referenced for up-to-date policies and procedures affecting the NEPA project analyses. Note that noise is described in Chapter 9.23 of the current NEPA Manual. Detailed examination of traffic noise may not be required for every NEPA project in Colorado.

For detailed information on the requirements of project development analyses, please refer to the current CDOT and related technical guidance (CDOT, 2015). The recommended tools and techniques are specific and complex. This program involves technical calculations and complex computer modeling of noise levels and abatement actions, which are not discussed in detail in this Program Book to avoid potentially conflicting statements with the formal guidance.

FHWA's Traffic Noise Model (TNM) Version 2.5 software is required to be used. TNM software can be downloaded:

http://www.fhwa.dot.gov/environment/noise/traffic_noise_model/tnm_v25/.

At the time of writing, the most relevant project-level analysis guidance documents include:

- CDOT Noise Analysis and Abatement Guidelines (CDOT, 2015)



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- CDOT NEPA Manual (CDOT, 2014)
 - FHWA Highway Traffic Noise: Analysis and Abatement Guidance (FHWA, 2011)
 - 23 CFR 772
 - FHWA Road Construction Noise Model (see Construction Noise Program)
 - Traffic Noise Model User's Guide for Colorado DOT Projects (CDOT, 2015)

4. Construction Noise Program

The Construction Noise Program relates to the construction activities undertaken in support of CDOT projects to improve or maintain transportation facilities. Certain construction equipment and techniques can be noisy or disruptive and need to be addressed when there are nearby noise-sensitive receptors. Typically, the potential impacts are temporary and last only for the duration of the construction element. Construction noise differs from traffic noise in several ways:

- Construction noise lasts only for the duration of the construction event and often construction activities in noise-sensitive areas are conducted during hours that are least disturbing to nearby residents.
- Construction activities generally are short term and, depending on the nature of the construction operations, could last from seconds (e.g., a truck passing a receptor) to months (e.g., constructing a bridge).
- Construction noise is intermittent and depends on the type of operation, location, and function of the equipment, and the equipment usage cycle.

Often, CDOT selects independent, private contractors to perform the construction activities and the contractors usually are given responsibility for construction noise compliance and abatement. However, CDOT does perform some construction and maintenance activities in-house, where CDOT would retain responsibility for noise compliance in these cases. Even in the cases when CDOT is not directly responsible for a construction project, the project may have noise aspects that CDOT staff may review or coordinate, and it is in CDOT's interest to ensure that relevant construction noise obligations for its projects are met and monitored.

4.1. Purpose

The purpose of CDOT's Construction Noise Program is to facilitate and ensure compliance with construction-related noise obligations from the State and/or local governments. The level of effort required is variable, depending on the location, nature and characteristics of the specific project.

4.2. Regulatory Setting

This program is primarily regulated under State and/or local regulations. Construction noise is not regulated or assessed like operational traffic noise; there are no CDOT noise criteria for construction noise. Construction noise is most generally subject to local nuisance noise regulations and ordinances, and any construction activities would be expected to comply with them. These regulations and ordinances are not consistent between municipalities.

The large number of governments or agencies that may have some oversight of CDOT construction projects at some time makes the potential regulatory settings highly variable and dynamic. Actions that were appropriate for one project and jurisdiction may not be appropriate for the next project. These tend to be local issues and should be researched and addressed for each project on a case by case basis.

In some locales, the local governments have enacted ordinances for general construction activities that must be met within their jurisdiction. Also, some local governments have enacted "1041" regulations (Section 2) that may apply to highways and may have noise aspects that require attention—this is highly variable and should be examined case by case.



In some cases, NEPA may be relevant to construction. Potential noise impacts from construction of proposed improvements may be evaluated as part of a NEPA analysis. A NEPA decision may include recommendations or abatement actions for noise during construction that requires attention or coordination. Each project should be reviewed for these commitments.

4.3. Interrelationships

This program is often independent of the other noise programs but may work in conjunction with other programs, such as the Highway Project Development Program (Section 3). The potential relationships are described in Table 4-1.

Table 4-1 Construction Noise Program Interrelationships with Other Programs

Highway Project Development Program
NEPA analyses of noise are common for EAs and EISs. Often the noise analysis includes consideration or discussion of construction impacts. Relevant NEPA documents for a project should be examined for recommendations, commitments or specific abatement actions for noise that must be carried through construction.
Maintenance Program
CDOT is responsible for long-term maintenance of noise abatement actions (i.e., walls) that are installed as part of a highway improvement project. In some cases, this can involve major rehabilitation or reconstruction of a wall or wall segment(s).

4.4. Roles and Responsibilities

Several individuals may have roles in the Construction Noise Program, both within and outside CDOT. CDOT staff may have primary technical roles on internal CDOT projects, but contractor staff most likely will have primary responsibilities on contractor-led construction projects. The Construction Noise Program participants may include:

- **CDOT DTD EPB Noise Program Manager or Specialist**—review and document prior construction noise commitments for the project from environmental impact evaluations. Research and document relevant local construction noise ordinance requirements. Consult on solutions to unexpected construction noise issues that develop on projects. May delegate responsibility to Region staff when appropriate. Supports other CDOT staff, as needed. May conceive, lead or participate in CDOT-sponsored noise research projects.
- **CDOT Regional Noise Specialist** —may be delegated primary construction noise responsibilities from headquarters staff. Review and document prior construction noise commitments for the project from environmental impact evaluations. Research and document relevant local construction noise ordinance requirements. Consult on solutions to unexpected construction noise issues that develop on projects. May conceive, lead or participate in CDOT-sponsored noise research projects.
- **Construction Management Staff**—ensure that construction-related noise obligations and restrictions for the project are known by field staff and being met. Fulfill any monitoring requirements.
- **Construction Field Staff**—be aware of and execute the construction noise control measures or corrective actions for the project.
- **Design Engineering Staff**—design appropriate construction noise control measures or corrective actions, as necessary.



4.5. Tools and Techniques

There are no standard construction noise limits, so formal analysis of construction is not usually required and no standard tools or techniques have been developed. However, FHWA has developed the Road Construction Noise Model and it can be a useful tool. The software is available on the FHWA website

http://www.fhwa.dot.gov/environment/noise/construction_noise/.

CDOT has not developed any noise tools or processes specific to construction noise. CDOT has internal requirements, policies and procedures in place to guide its construction projects. In this vein, several internal CDOT documents can be valuable in locating relevant information and ensuring a robust Construction Noise Program, including:

- Standard Specifications for Road and Bridge Construction
- Environmental Stewardship Guide
- NEPA Manual
- Noise Analysis and Abatement Guidelines
- Prior NEPA documents for the project

Given the range of government agencies that may have some authority over highway construction, the range of potential construction requirements can be immense. Many local governments have adopted nuisance noise ordinances that can affect construction directly, but these can vary greatly. There are not simple tools or techniques that will address every possible situation everywhere in Colorado. However, highway construction, reconstruction and maintenance are fairly frequent and routine activities across the state, so past experience by CDOT staff can be a rich resource for knowledge. Routine communication and mentoring among CDOT staff on best practices and lessons learned can be invaluable in avoiding pitfalls and aiding project streamlining—other CDOT staff and project experience can be important tools to draw upon.

Each local government can set requirements for construction activities within their jurisdiction. This is a very broad and dynamic environment, so it is not practical to itemize all potentially relevant ordinances and regulations. A suggested technique to deal with these considerations is for the appropriate CDOT (or contractor) staff to consult with the appropriate local government staff prior to initiation of construction to discuss relevant construction noise issues. Often, this can occur as part of the normal project consultation between CDOT and the local governments, who typically are partners or interested parties in the construction already. This can happen on a case by case basis, tuned to the specific needs of the project.

5. Rail and Transit Project Development Program

Relatively recently, CDOT has been given responsibility for overseeing and developing multi-modal transportation statewide, including rail and transit systems. This involves different transportation technologies, new to CDOT's jurisdiction, which have different characteristics and concerns than automobiles. This program involves evaluations of transportation noise for rail and transit. Transit noise evaluations are predicated on additive change in noise levels above existing conditions and are weighted to protect the evening noise environment. This is different from standard highway traffic noise analysis which is based on future outdoor human activity area noise volume during loudest noise hour of the day. Assessment of Rail and Transit noise includes the potential vibrations from hard and soft tire modes of transportation (most typically trains).

Trains have a typical set of noise sources, a major one being the locomotive horns that are blown as a public safety action at railroad crossings. The characteristics and analysis of train horn noise is very different from the highway noise that CDOT has traditionally evaluated. Other sources include wheel squeal on rail curves. The methodologies of the FTA and Federal Railroad Administration (FRA) typically are followed for these projects. Because multi-modal transportation corridors are likely to be developed in urban areas (that is where the prospective passengers are), the facilities are likely to be near residential or other sensitive areas.

Traditionally, CDOT facilities and projects have not been major concerns in terms of ground borne vibration. Research has shown that rubber-tired transportation is not a substantive source of vibrations, except in extraordinary cases (e.g., road damage from potholes, rough road atop tall pier structures) that usually can be readily remedied. Road construction occasionally involves methods that are potential vibration sources (e.g., pile driving), but these generally are localized, short term and addressed on a case-by-case basis for the individual circumstances. Therefore, vibration has not been a major focus within CDOT in the past. However, the operation of railroads does present potential ground-borne vibration concerns and may need examination for rail or transit projects.

5.1. Purpose

Typically, the analysis of rail and transit noise and vibration falls under the purview of NEPA. The purpose of NEPA generally was to declare a national policy that would:

- Encourage productive and enjoyable harmony between man and his environment.
- Promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man.
- Enrich the understanding of the ecological systems and natural resources important to the nation.
- Establish the Council on Environmental Quality (CEQ).

A main purpose of CDOT's NEPA analyses is to facilitate compliance with the CEQ regulations (40 CFR 1500) regarding noise for CDOT/CDOT-administered projects. Additionally, the program implements relevant noise impact analyses and project reviews in support of the Environmental Stewardship Guide and ensures the statewide transportation system is constructed and maintained in an environmentally responsible, sustainable, and compliant manner.



5.2. Regulatory Setting

Federal actions must comply with the requirements of NEPA. FTA’s environmental impact regulation is presented in 23 CFR 771. Major capital investment projects are developed initially from a comprehensive transportation planning process (23 CFR 450).

Non-highway transit projects that are undertaken with the sole authority of the FTA should use the accepted methods defined in accordance with 23 CFR 771 (FTA, 2006). High-speed train or other rail projects under the authority of the FRA (primarily under NEPA) should use the methods defined in their guidance (FRA, 2005). Projects involving multiple federal agencies or travel modes should be evaluated by the methodologies selected through consultation with the participating federal agencies.

5.3. Interrelationships

This program works in conjunction with other existing noise programs, primarily the Highway Project Development Program (Section 3). The relationships are described in Table 5-1.

Table 5-1 Rail and Transit Project Development Program Interrelationships with Other Programs

Highway Project Development Program
This program can have an indirect relationship to the Highway Project Development Program. On multi-modal projects, both highway and rail/transit options may be considered. In such a case, both CDOT noise programs may need to be blended to comprehensively examine the potential noise environment from all the transportation improvements.

5.4. Roles and Responsibilities

Several individuals have substantive roles in the Rail and Transit Project Development Program, both within and outside CDOT. Those persons include:

- **CDOT DTD EPB Noise Program Manager or Specialist**—the primary role is in a review capacity for the transit or freight rail noise analyses to ensure appropriate federal agency regulatory application and to conduct FTA/FRA screening level assessment of noise impacts. May conceive, lead or participate in CDOT-sponsored noise research projects.
- **CDOT Regional Noise Specialist**— not yet formally defined.
- **FTA/FRA Staff**— not yet formally defined.

5.5. Tools and Techniques

Most of the rail/transit project will fall under NEPA and NEPA is a process-driven statute, so adherence to correct and appropriate methods and procedures is critical for program success. Often, multiple partnering agencies or affected parties participate in a project, so clear and timely communication among the participants is also critical. NEPA mandates certain public participation requirements, so the proper opportunities for public input are important. An awareness of these general NEPA project concepts is vital to the project technical analyses, including noise.

CDOT invests considerable resources, time and talent in compiling detailed information about environmental issues, conducting environmental analysis, and preparing documents to comply with NEPA. For those reasons, CDOT has prepared the NEPA Manual (CDOT, 2014) as a resource for CDOT staff, local agency representatives and consultants engaged in these efforts. The NEPA Manual is the guidebook for completing NEPA projects by CDOT and should



be referenced for up-to-date policies and procedures affecting the NEPA project analyses. Note that FHWA-focused noise processes are described in Chapter 9.23 of the current NEPA Manual.

At the time of writing, the most relevant rail and transit analysis guidance documents include:

- Transit Noise and Vibration Impact Assessment (FTA, 2006)
- High-Speed Ground Transportation Noise and Vibration Impact Assessment (FRA, 2005)
- 23 CFR 771



6. Maintenance Program

Over the past several decades, CDOT has been responsible for the construction of an inventory of highway noise abatement structures—primarily noise walls and berms. These structures are long-term commitments by CDOT to reduce noise impacts to affected properties. CDOT is responsible for maintaining each of these structures in a condition that allows it to perform its intended function.

The barriers require occasional maintenance or repair for a variety of potential reasons. Some older barriers were made from wood and the wood is susceptible to shrinkage, warping, failure or disintegration. The barrier materials may have long-term durability issues that need attention. Collisions by vehicles can destroy barrier sections that then require reconstruction. Graffiti is a recurring problem on many CDOT facilities including noise barriers. These concerns and more represent a permanent obligation to CDOT for maintenance. This obligation is tied to the Noise Program through structures that are designated noise abatement measures.

6.1. Purpose

The purpose of the Maintenance Program is to keep CDOT’s inventory of noise abatement structures functioning as intended in reducing highway noise to affected receptors.

6.2. Program Regulatory Setting

The primary impetus behind this program is CDOT’s obligation to maintain the state highway system under CRS 43-2-102. In addition, some of the barriers have been built as designated noise abatement actions under NEPA projects. Finally, noise abatement actions from citizens that were successfully petitioned under CRS 43-2-402 may be relevant to this program, depending on the financial agreements that were made.

6.3. Interrelationships

This program is generally independent of the other noise programs but may work in conjunction with other programs in narrow situations. The potential relationships are described in Table 5-1.

Table 6-1 Maintenance Program Interrelationships with Other Programs

Highway Project Development Program
NEPA analyses often include examination of transportation noise. Sometimes the NEPA projects result in commitments to construct (and maintain in perpetuity) specific noise abatement actions. CDOT is obligated to maintain these facilities in a condition that provides the required benefit as long as the affected receptors are present.
Construction Noise Program
CDOT is responsible for long-term maintenance of its noise abatement actions (i.e., walls) that are installed as part of a highway improvement project. In some cases, this can involve major rehabilitation or reconstruction of a wall or wall segment(s) and this would carry the usual responsibilities of a CDOT construction project.

6.4. Roles and Responsibilities

Several individuals may have roles in the Maintenance Program that include:

- **CDOT DTD EPB Noise Program Manager or Specialist** —if needed, inventory, evaluate or recommend replacement wall parameters for a damaged wall needing repair. Coordinate with Regional Noise Specialist or contact person. Update and maintain CDOT’s statewide



inventory of active highway noise abatement facilities (as affected by the Maintenance Program) and submit to FHWA when required. May conceive, lead or participate in CDOT-sponsored noise research projects.

- **CDOT Regional Noise Specialist** –if needed, inventory, evaluate or recommend replacement wall parameters for a damaged wall needing repair. May conceive, lead or participate in CDOT-sponsored noise research projects.
- **Maintenance Management Staff**—ensure that CDOT’s noise abatement facilities are regularly inspected and maintained. Ensure any needed repairs are completed in a timely manner. May conceive, lead or participate in CDOT-sponsored noise research projects.
- **Maintenance Field Staff**—regularly inspect CDOT’s noise abatement facilities. Perform any needed repairs or maintenance in a timely manner. May conceive, lead or participate in CDOT-sponsored noise research projects.
- **Staff Bridge Design Engineering Staff**—if needed, design noise control measures or corrective actions for damaged structures. May conceive, lead or participate in CDOT-sponsored noise research projects. Maintains an asset inventory of all wall structures, inclusive of noise wall barriers.

6.5. Tools and Techniques

OTIS Geographical Information System database for sound barriers.



7. Locally-Funded Noise Wall Program

Local governments or agencies can sponsor noise abatement projects along CDOT-administered roads. The funding for these projects must be at least 50% public sources. These projects must be examined according to the general Highway Project Development Program (Section 3) and the proposed walls must meet CDOT’s feasibility and reasonableness criteria (CDOT, 2015).

7.1. Purpose

The purpose of this program is to permit local agencies to petition CDOT to allow installation of highway noise abatement without a corresponding CDOT Type I project being underway. Otherwise, third-party funding for highway noise abatement has limitations on Federal or Federal-Aid Type I or Type II projects (CDOT, 2011) under typical circumstances.

7.2. Regulatory Setting

This program can support 2 CCR 601-17 in consuming waste tires as described in state statute CRS 43-2 Part 4.

7.3. Interrelationships

This program works in conjunction with other existing noise programs, such as the Highway Project Development Program (Section 3) and the Rail and Transit Project Development Program (Section 5). The relationships are described in Table 7-1.

Table 7-1 Locally-Funded Noise Wall Program Interrelationships with Other Programs

Highway Project Development Program
A CDOT-administered Type I project is not required for a locally-funded noise wall project to be initiated, but the proposed wall must undergo analysis similar to the requirements of a typical Highway Project Development Program project. Several of the technical evaluation methods are shared between the programs.
Rail and Transit Project Development Program
This program has not yet been fully implemented within CDOT but could have an indirect relationship to the Locally-Funded Noise Wall Program. Local governments may seek to provide supplemental noise abatement for a CDOT-administered project beyond what is provided through the FTA/FRA processes.

7.4. Roles and Responsibilities

Several individuals have substantive roles in the Locally-Funded Noise Wall Program, both within and outside CDOT. Those persons include:

- **CDOT DTD EPB Noise Program Manager or Specialist**—the primary role is in a review capacity for the technical analysis prepared by the applicant of the proposed noise abatement action. Is responsible to assist technical preparation and facilitate grant funding applications to CDPHE Recycled Waste Tire Fund for local agency sponsored noise abatement using recycled waste tire materials. May conceive, lead or participate in CDOT-sponsored or local-agency-sponsored noise research projects on noise abatement methods.
- **CDOT Regional Noise Specialist**—may be delegated the review role for the technical analysis of the proposed noise abatement action by headquarters staff. May conceive,



lead or participate in CDOT-sponsored or local-agency-sponsored noise research projects on noise abatement methods.

- **Local government or agency staff**—responsible for preparation of the application and technical analysis in support of the proposed locally-funded noise wall. Acts as the representative government entity liaison to CDOT supporting private noise abatement initiatives on CDOT right-of-way.

7.5. Tools and Techniques

CDOT Noise Analysis and Abatement Guidelines, Chapter 6.3 1.1 Non-CDOT, Non-federally Funded Noise Abatement on Public Right-of-Way - Provides specific guidance to prepare a petition to construct a noise barrier on CDOT rights-of-way outside the standard highway development project process.

Recycled Waste Tire Grant Application Form - Provides applicants with a format to assure that all necessary information needed to apply for grant funding from CDPHE for the construction of noise walls using recycled waste tire sourced materials.



8. Airport Noise Program

The Colorado Division of Aeronautics is the CDOT division charged with overseeing air transportation. The Division is responsible for supporting a multi-modal transportation system, promoting partnering with public and private constituents to enhance aviation safety, aviation education and the development of an effective air transportation system through administration of the Colorado Aviation Fund.

8.1. Purpose

8.2. Regulatory Setting

8.3. Interrelationships

8.4. Roles and Responsibilities

8.5. Tools and Techniques

9. Noise Training

The collection of laws, regulations and agency relationships relating to transportation noise is extensive (Section 2). Several of CDOT's Noise Program tasks include aspects and activities that are very technical and require specific knowledge and tools to implement correctly and efficiently. Some examples include the noise modeling required under the Highway Project Development Program. Therefore, specialized training is needed for the staff that will be engaged in these aspects of the noise programs.

9.1. Noise Training Opportunities

Internally, CDOT has several mechanisms available for training. Novice staff that is new to any of the noise topics can look to mentoring by more senior CDOT staff. This is often an informal process and should be customized to the needs of the personnel and subject area. Employees often accept new roles within CDOT over their careers and their accumulated technical knowledge could otherwise be lost when their duties change, so it is important that CDOT as an institution maintain an awareness of where these potential mentors may be. Informal training is provided via vehicles like the Coffee @ CDOT program and through other ad hoc training opportunities.

Other formal training opportunities within or by CDOT for noise are limited. CDOT does support general environmental training sessions for interested CDOT staff at annual or special meetings and conferences. These tend to include broad coverage of a larger environmental topics list and are geared toward a general, non-specialist audience. CDOT does not have any established noise technical training programs that are provided by CDOT staff to other CDOT staff—often the internal audience for such training would be quite small.

Outside of CDOT there are training opportunities on a variety of noise topics available primarily through National Highways Institutes *Principles of Highway Traffic Noise*, FHWA approved Bowlby & Associates *Traffic Noise Model Training Course*, and . FTA/FRA approved HMMH *Rail and Transit Noise Training*. A number of online/webinar classes are available along with more formal classroom training settings. These opportunities change along with the needs of the noise analysis community, so interested persons are advised to research online the various current offerings. CDOT may sponsor sessions for these technical programs to assist both its technical staff as well as the supporting consultant community. Other agencies and organizations that offer specialized noise training (on a number of topics) include:

- U.S. Department of Transportation (FHWA, FTA, Volpe Center, etc.)
- FHWA Competency Building Program
- National Highway Institute
- Transportation Research Board
- Professional organizations
- Universities
- Private companies (e.g., TNM training classes)

9.2. Staff Training Required for Noise Programs

To accurately and efficiently execute the tasks described above for the various Noise Programs, the participating staff (either CDOT or external) must have an appropriate level of technical training for the tasks they are assigned. The level and availability of training varies by the program and is summarized below.



For the Highway Project Development Program and the Locally-Funded Noise Wall Program, the technical staff (CDOT and external) must have adequate training to complete the necessary modeling and analysis tasks. This includes expertise with the approved noise modeling software. The technical staff performing the noise modeling must have a *certificate of training* in the FHWA-mandated software (currently TNM). Equally important is for the staff to have an understanding of the requirements and methods of NEPA and CDOT environmental policies, to ensure that a defensible process is followed.

For the Construction Noise Program, the technical staff (CDOT or external) should have an understanding of CDOT's standards and specifications, and best management practices in general, for highway construction. Knowledge on the operation of CDOT's sound level meters is essential and the Road Construction Noise Model software is valuable. Any commitments from prior actions (e.g., NEPA) for a project must be known by the field staff and resolved. Any local government requirements for a specific project must also be known.

For the Rail and Transit Project Development Program, the technical staff (CDOT and external) must have adequate training in the applicable FTA and/or FRA methodologies. This includes expertise with the approved screening modeling and impact calculation procedures, as well as the noise abatement evaluation procedures. Equally important is for the staff to have an understanding of the FTA/FRA detailed assessment requirements, NEPA methodologies, and CDOT environmental policies, to ensure that a defensible process is followed.

For the Maintenance Program and Airport Noise Program, no specific noise technical training has yet been identified. Of course, general knowledge on the nature of noise and noise sources and the physics of sound would be beneficial. Working knowledge of noise software tools used for development of airport noise would be useful when estimating potential benefits from specific actions. Good general project management skills are needed. FAA information can be found at https://www.faa.gov/about/office_org/headquarters_offices/apl/noise_emissions/airport_aircraft_noise_issues/.



10. Resources and References

- Colorado Department of Transportation. 1996. Manual of Maintenance Procedures. June.
- Colorado Department of Transportation. 2013. Environmental Stewardship Guide, Version 7. April.
- Colorado Department of Transportation. 2015. Noise Analysis and Abatement Guidelines. January.
- Colorado Department of Transportation. 2014. National Environmental Policy Act Manual, Version 4. October.
- Federal Aviation Administration. 2006. National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions. April.
- Federal Highway Administration. 2011. Highway Traffic Noise: Analysis and Abatement Guidance. December.
- Federal Highway Administration. 2011. Code of Federal Regulations, Title 23. April.
- Federal Railroad Administration. 2005. High-Speed Ground Transportation Noise and Vibration Impact Assessment. October.
- Federal Transit Administration. 2006. Transit Noise and Vibration Impact Assessment. May.
- Office of the Law Revision Counsel of the U.S. House of Representatives. 2010. United States Code.
- State of Colorado. 2011a. Code of Colorado Regulations.
- State of Colorado. 2011b. Colorado Revised Statutes.
- U.S. Council on Environmental Quality. 2011. Code of Federal Regulations, Title 40 Part 1500. July.



11. Abbreviations

CCR	Code of Colorado Regulations
CDOT	Colorado Department of Transportation
CEQ	U.S. Council on Environmental Quality
CFR	Code of Federal Regulations
CRS	Colorado Revised Statute
DTD	CDOT Division of Transportation Development
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPB	DTD Environmental Programs Branch
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
NEPA	National Environmental Policy Act
TNM	FHWA's Traffic Noise Model
USC	United States Code