[PROJECT NAME]

TRAFFIC NOISE TECHNICAL REPORT

NEPA [Class of Action]

Project Number [XXX-XXX] and Subaccount Number [XXXXX]

[Date of Report (Month Day, Year)]

***Prepared for:***

Colorado Department of Transportation

Region [#]

[Region Address]

[City], CO [Zip Code]

***Prepared by:***

[Firm Name

Address

City, State Zip Code

Phone Number]

***CDOT Reviewer:***

[Name of Primary CDOT Noise Specialist Reviewer]

{REPORT TEMPLATE APPLICABILITY

This report template applies to,:

* **Type I projects that require modeling:** Project has one or more Activity Category A, B, C, D, and/or E receptor (currently in place or permitted as Activity Category B, C, D, or E prior to Date of Public Knowledge) within the Noise Study Zone (either 300 or 500 feet in all directions from the proposed edge of travelled lanes throughout the extent of the project, depending on the type of roadway).
* **Type I projects that require only contour modeling**: Projects that have one or more Activity Category G land uses within the Noise Study Zone but do not have any Activity Category A, B, C, D, and/or E receptors (currently in place or permitted as Activity Category B, C, D, or E prior to Date of Public Knowledge). However, for this project type, this report template should be modified so that only the following sections and figures are used: Chapters 2, 3, 4, 9, 10, and 11 and Figures 1, 2, 3, and 8. Some of these need to be modified to reflect that modeling was done only to develop contour lines.

This report template does not apply to:

* **Type I projects that did not require modeling**: Modeling is not needed if there are no Activity Category A through E receptors (currently in place or permitted as Activity Category B, C, D, or E prior to Date of Public Knowledge) or lands that are Activity Category G within the Noise Study Zone. If there are any Activity Category F receptors in the Noise Study Zone, a memo should be submitted to CDOT to explain why modeling was not required for the Type I project. The memo should have the information from the cover page, a project description, the reason the project is Type I, a map of the project and Noise Study Zone, and a statement that none of the following is present: noise sensitive receptors (Activity Category A-E), permitted but undeveloped noise sensitive receptors (Activity Category A-E), or Activity Category G lands. Activity Category F receptors should be described.
* **Type III projects**: Type III projects do not need to be modeled and will not use this report template. If the project is Type III, a memo is not generally needed unless the project type was debatable (e.g., evaluation was needed to determine that it was not Type I). If a memo is needed, it should include the information from the cover page, a project description, the reason that the project would potentially be considered a Type I project, and the reason that it was determined to be a Type III project.
* **Planning and Environmental Linkages (PEL) process**

This report template (July 2024; Version 3) shall be used on projects that have a Scoping Date that is on or after July 1, 2024, except as described on Page ii under #7, and for any project that will post the project’s final noise report online on or after July 1, 2024. Scoping Date is defined as the earliest of the following:

* Environmental scoping meeting
* Environmental kickoff meeting
* EPB Environmental Clearance Request

For projects that were scoped prior to July 1, 2024, this report template may be used if the project is using the September 2020 CDOT *Noise Analysis and Abatement Guidelines*.

INFORMATION ON USING THIS REPORT TEMPLATE

1. All red text (shown within {braces}) in this report template should be deleted, including the braces, before submitting the first draft of the project traffic noise technical report to CDOT.
2. Text highlighted in grey (shown within [brackets]) should be typed over with the correct text for the project. Then the grey highlight and brackets should be removed.
3. Editorial corrections should be made, if applicable. For example, if the report template is written using a singular term that is plural for the project (or vice versa), change the text accordingly.
4. Most potential situations are addressed by this report template. If the report template does not address something encountered during the noise analysis for a project, either consult with a CDOT noise specialist while preparing the report or prepare the report using best professional judgement and communicate to the CDOT noise specialist the alterations that were needed to best represent the project.
5. If the project has a Preferred Alternative, replace “Proposed Action” with “Preferred Alternative” as appropriate throughout this report template.
6. Some table and/or figure numbers may need to be revised, either by deleting tables or figures that are not needed or by adding tables (e.g., breaking up Table 9 into Table 9a and 9b). If so, references to the figures will also need to be revised.
7. This is the standard CDOT traffic noise technical report template. However, if approval from an Environmental Programs Branch noise specialist CDOT and/or FHWA is obtained, this report template does not have to be used.
8. If desired, add appendices, which would be optional and used to provide information that is not part of the report template, e.g., a page containing names and signatures of report preparers and reviewers.
9. If desired, the consultant’s internal document number may be added to the cover page of the report. If so, add after the consulting company’s phone number.
10. The first time the report is submitted to CDOT, the consultant may not know who from CDOT will review the report. This information can be completed on the cover once the first set of comments is received. The reviewer will comment on this if the incorrect name is used. If more than one CDOT noise specialist reviews the report, only the primary reviewer’s name will be listed.}

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{The acronyms in this list are in the report template. Add acronyms and abbreviations as applicable, including those for EA and EIS. Remove the directional acronyms if not used in the report (e.g., EB, NB, SB, WB).}

CDOT Colorado Department of Transportation

CFR Code of Federal Regulations

dB decibels

dBA A-weighted decibels

EB eastbound

FAQ frequently asked question

FHWA Federal Highway Administration

ft2 square feet

Guidance FHWA’s Highway Traffic Noise: Analysis and Abatement Guidance

ID identification

Leq one-hour equivalent sound level

mph miles per hour

NAC Noise Abatement Criterion

NAAG Noise Analysis and Abatement Guidelines

NB northbound

NEPA National Environmental Policy Act

SB southbound

TNM FHWA’s Traffic Noise Model

WB westbound

Executive Summary

This traffic noise technical report has been prepared in support of the [Project Name] project. An overview of this project’s traffic noise analysis and abatement evaluation is shown in Table 1. {(If abatement was not evaluated because the project doesn’t result in any noise impacts, delete “and abatement evaluation” from the second sentence of this chapter.)}

Table 1 Project Overview

|  |  |
| --- | --- |
| Project Location | This project is on [roadway name(s)] and is located in [City], [County Name] County, Colorado (see Figure 1). {(If the project is on more than one roadway, more than one roadway may be listed. However, Table 1 is an overview, so do not list roadways that were not modeled and that do not substantially affect noise in the area. If the project is not in a city but is near a city, change “located in” to “located near.” If it is not near a city, change “[City], [County Name] County, Colorado” to “[County Name] County, Colorado between milepost [XX] and [XX].” If the roadway does not have mileposts, provide some other way of identifying which section of roadway the project involves, such as a crossroad.)} |
| Type I Status Explanation | This project is Type I because it would include [construction of XXXX].  |
| Reason for Reevaluation Analysis | {(For projects that are reevaluations, provide the reason that the noise analysis needed to be redone/remodeled. If the project is not a reevaluation, delete this row.)} |
| Noise Level and Impact Overview | * Existing condition ([existing year]) modeled noise levels range from [##.#] to [##.#] A-weighted decibels (dBA) at [##] receivers[[1]](#footnote-2), which represent [##] receptors.
* Design year ([design year]) modeled noise levels for the No Action Alternative range from [##.#] dBA to [##.#] dBA at [##] receivers, which represent [##] receptors. {(Delete this bullet if the project does not require a No Action alternative [e.g., Categorical Exclusion projects])}
* Design year ([design year]) modeled noise levels for the Proposed Action range from [##.#] dBA to [##.#] dBA at [##] receivers, which represent [##] receptors. The Proposed Action is expected to impact the following receivers and receptors:

[##] Activity Category A receivers/[##] receptors[##] Activity Category B receivers/[##] receptors[##] Activity Category C receivers/[##] receptors[##] Activity Category D receivers/[##] receptors[##] Activity Category E receivers/[##] receptors{(If the project does not contain any receivers/receptors of a specific Activity Category type, the bullet for that Activity Category type can be deleted. Otherwise, report the number of impacted receivers/receptors even if that number is zero. If the project has receivers/receptors of only one Activity Category, do not use a bullet; instead, change the last sentence of the Design Year modeled noise level bullet text to, “The Proposed Action is expected to impact [XX] Activity Category [X] receivers, which represents [XX] receptors.”)}* [##] receivers, which represent [##] receptors, were added to the model when evaluating noise barriers {(Only include this bullet if it is applicable. This might be when the original receiver list was not as detailed as what is needed when evaluating barriers. For example, a large apartment complex may be modeled using only a limited number of receivers to determine if the complex is impacted. If it is impacted, additional receivers might be added to the model used in the barrier evaluation.)}
 |
| Noise Abatement Considerations and Commitments Overview | Because the Proposed Action will not cause any noise impacts in the design year, noise abatement was not analyzed. {OR} [##] noise barriers were evaluated, as shown on Figure 8. [##] noise barriers were found to be feasible and reasonable and will be recommended, as shown in Table 10. {(Choose the applicable option and delete the other option.)} |
| Information for Local Officials | This project’s Noise Study Zone does not include any land that is unpermitted and undeveloped (i.e., Activity Category G). Therefore, Part 772.17 of Title 23 of the Code of Federal Regulations (23 CFR 772.17) is not applicable and information does not need to be provided to local officials. {OR} This project’s Noise Study Zone includes land that is unpermitted and undeveloped (i.e., Activity Category G). Therefore, Part 772.17 of Title 23 of the Code of Federal Regulations (23 CFR 772.17) is applicable and information needs to be provided to local officials, as described in Chapter 9. {(Choose the applicable option and delete the other option.)} |

PROJECT Introduction

Colorado Department of Transportation (CDOT), in cooperation with the Federal Highway Administration (FHWA), is preparing a [Class of Action]{(e.g., Categorical Exclusion, Environmental Assessment, Environmental Impact Statement; if this noise analysis was done as part of a reevaluation, add that here)} for this project. The improvements, which are described in Table 2 and hereafter called the Proposed Action, constitute a Type I project because [provide reason project is Type I; use language from the definition of Type I project based on both 23 CFR 772 and 2020 CDOT’s *Noise Analysis and Abatement Guidelines (NAAG)*. For example, if the project is Type I because an auxiliary lane longer than 2,500 feet is being added, provide the approximate length and indicate the location of the addition. If the project will halve the horizontal distance, indicate which receptor(s) will have their distance halved.

If the project is a reevaluation, provide the reason that a new noise analysis needed to be done, as described in Chapter 9 of the 2020 NAAG.]

Because the project is Type I and because there is at least one Activity Category A, B, C, D, and/or E receptor within the Noise Study Zone, a noise analysis is needed to determine if receptors will be impacted as a result of building the project.{(If there are no A-E receptors but there is Activity Category G land, replace the previous sentence with, “Because the project is Type I and because the Noise Study Zone contains Activity Category G land, a noise analysis is needed to determine the noise level contour lines for public officials.”)}[Consulting firm name], acting on behalf of CDOT, conducted a noise analysis for the project and prepared this report using the CDOT noise report template. Table 2 includes information about this project and provides context for this traffic noise analysis.

Table 2 Project Background

|  |  |
| --- | --- |
| Project Location | [City] and [County Name] County, Colorado (See Figure 1) {(If the project is not in a city but is near a city, change “[City] and [County Name] County” to “[County Name] County near [City].” If it is not near a city or town, provide the county name and mileposts associated with the project. If the roadway does not have mileposts, provide some other way of identifying which section of roadway the project involves, such as a crossroad.)} |
| Affected Roadways  | [List the roadway(s) that will be physically changed as part of the project] |
| Project Purpose | [Purpose of the project] {(It can be obtained from the Purpose and Need section of the NEPA document. Note that this is the project purpose, not the purpose of the noise analysis.)} |
| Project Need | [Need of the project] {(It can be obtained from the Purpose and Need section of the NEPA document.)} |
| Proposed Action Description | This project would include:* [XXXXXX]
* [XXXXXX]
* [XXXXXX]

{(Provide a narrative description of the Proposed Action, focusing on information that shows how this project will affect noise [e.g., adding a through lane, moving lanes closer to receptors]. Include less detailed information about ancillary improvements, if applicable. The description should include the project length and termini, including mileposts, and a description of the proposed improvements, including the number of lanes and any major structures.)} |
| Other Alternative(s) Description | This project would include:* [XXXXXX]
* [XXXXXX]
* [XXXXXX]

{(This row does not apply to projects that do not have other alternatives [e.g., Categorical Exclusion projects, some EAs]. If not applicable, this row should be deleted.)} |
| No Action Alternative Description | This project would include:* [XXXXXX]
* [XXXXXX]
* [XXXXXX]

{(This row does not apply to projects that do not require a No Action alternative [e.g., Categorical Exclusion projects]. If not applicable, this row should be deleted. In some cases, even if the subject project wasn’t built, another project may be built in the same area, which should be noted here.)} |
| Prior National Environmental Policy Act (NEPA) Approvals | Not applicable. This project is a new action. {OR}This project follows prior efforts completed for:* [XXXXX (e.g., past EIS that included study zone location)]
* [XXXXX (e.g., past EAs if a re-evaluation is underway)]

{(Choose, and complete if applicable, the correct option and delete the other option.)} |

Background

This noise analysis was done as required by 23 CFR 772 in accordance with CDOT’s *Noise Analysis and Abatement Guidelines* (NAAG) (CDOT, 2020) and FHWA’s *Highway Traffic Noise: Analysis and Abatement Guidance* (Guidance) (FHWA, 2011). The analysis determines whether [design year] traffic noise levels from the Proposed Action will exceed applicable impact thresholds at properties (i.e., receptors) within the Proposed Action Noise Study Zone (this zone is described in Section 4.1). Traffic noise abatement is evaluated for any such impacted receptors. The analysis was conducted based on design files provided from [name of company]. The files were received by the noise analyst on [date received]. {(If the level of design the noise analysis was based on is known, such as FIR, 30 percent, or Final Design, include that information here.)}

This noise analysis included the following tasks:

* Conducting field measurements of existing condition sound levels (see Section 4.3)
* Validating an existing condition noise model using field measurement results (see Section 4.4)
* Modeling existing condition noise levels for existing roadways (see Chapter 5)
* Modeling Proposed Action and a design year No Action Alternative noise levels for design roadways (see Chapter 5) {(Delete “and a design year No Action Alternative” if this project is a Categorical Exclusion that doesn’t have a No Action alternative. Replace “Proposed Action” with “design year build alternatives” if the noise analysis considered more than one design year build alternative.)}
* Evaluating noise abatement (see Chapter 6) {(Delete this bullet if noise abatement was not required to be evaluated.)}
* Modeling noise contour lines for unpermitted, undeveloped land (see Chapter 9) {(Delete this bullet if this project doesn’t have Activity Category G lands within the Noise Study Zone.)}

Characteristics of Noise

Fundamental information about noise, such as terminology, how sound travels, and sound intensity, is included in Appendix B of The CDOT NAAG. It is incorporated by reference to supplement this report.

Applicable Regulations, Guidelines, and Tools

The following regulation, guidelines, and tools were used to complete this noise analysis: {(If any applicable regulations, guidance, and/or tools were updated or published after this report template was published, adhere to the update or new resource. Update or add the reference in this section.)}

* ***23 CFR Part 772 (Procedures for Abatement of Highway Traffic Noise and Construction Noise)*** (23 CFR §772, 2010): Federal highway noise standard that must be followed in analyzing and abating highway traffic noise. This regulation required states to adopt state-specific guidelines, which included adopting specific parameters such as the noise reduction design goal.
* **CDOT NAAG** (CDOT, 2020): Fulfilled Federal requirement to adopt state-specific guidelines. Provides Colorado’s procedural and technical requirements for analyzing highway project traffic noise and evaluating noise abatement.
* **FHWA Guidance**(FHWA, 2011): Provides FHWA guidance for applying 23 CFR Part 772 in the analysis and abatement of highway traffic noise.
* ***Noise Measurement Handbook*** (FHWA, 2018): Includes procedures for measuring highway noise.
* **FHWA Traffic Noise Model (TNM) Version 2.5**(FHWA, February 2004):Model used to determine existing condition and design year noise levels. {(TNM 3.0 was released in February 2020. CDOT will issue a memorandum when the use of TNM should shift from version 2.5 to 3.0. If Version 3.0 is used, change the version number and month/year model was approved for use.)}

CDOT Noise Abatement Criteria and Land Use Activity Categories

A traffic noise impact occurs if either of the following conditions is met:

* Predicted design year traffic noise level approaches (i.e., equals) or exceeds CDOT’s Noise Abatement Criteria (NAC) at any receptor
* Predicted design year traffic noise level substantially exceeds the existing condition highway traffic noise level at any receptor. “Substantial” is defined as a noise increase of 10 dB or more between the existing condition and design year noise levels.

Table 3 shows CDOT’s NAC. The CDOT NAAG requires that the one-hour equivalent sound level (Leq) be used in the analysis.

The NAC for Activity Category D applies to interior areas of frequent human use. All other NACs apply to exterior areas of frequent human use. Examples of exterior areas include yards for Activity Category B, park activity areas for Activity Category C, and exterior restaurant dining areas for Activity Category E.

Undeveloped lands for which development has been permitted before the Date of Public Knowledge must be treated as though the development has already been constructed. CDOT considers a proposed development to be permitted when a formal building permit has been issued to the developer.

Table 3 CDOT Noise Abatement Criteria

| ActivityCategory | ActivityLeq (dBA)1, 2 | Evaluation Location | Activity Description |
| --- | --- | --- | --- |
| A | 56.0 | 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. |
| B3 | 66.0 | Exterior | Residential |
| C3 | 66.0 | Exterior | Active sport 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, recreational areas, Section 4(f) sites, schools, television studios, trails, and trail crossings. |
| D | 51.0 | 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. |
| E3 | 71.0 | Exterior | Hotels, motels, time-share resorts4, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F. |
| F | Not Applicable | Not Applicable | Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, ship yards, utilities (water resources, water treatment, electrical), warehousing, malls5, stores5, shops5, and Government managed land.4,6 |
| G | Not Applicable | Not Applicable | Undeveloped lands that are not permitted. |

1. Table 1 of 23 CFR 772 allows state highways agencies to use either Leq(h) or L10(h) on a project, but not both. CDOT uses Leq(h), which is an Hourly A-weighted sound level in dBA.
2. NACs are for impact determination only. They are not design standards for noise abatement measures.
3. Includes undeveloped lands permitted for this activity category.
4. This activity description is not listed in Table 1 of 23 CFR 772.
5. This activity description is not listed in Table 1 of 23 CFR 772, but is in FHWA’s FAQ D7.
6. Areas of frequent human use within the Government (Federal, State, and County) managed land will be treated as the appropriate land use (e.g., a campground would be Activity Category C, as described in Section 3.5.4 of the CDOT NAAG).

Noise Analysis Methods

The noise analysis includes identifying the Noise Study Zone, identifying the land uses within the Noise Study Zone, taking noise measurements within the Noise Study Zone, validating the existing condition noise model, and inputting several parameters into the noise model. These steps are described in this chapter.

Noise Study Zone Identification

{(Section 4.1 should contain one of the following three sentences. The other two sentences should be deleted, as applicable.)}The Noise Study Zone for this project extends 500 feet in all directions from the proposed edge of travel lanes throughout the project extent, as shown on Figure 2. {OR} The Noise Study Zone for this project extends 300 feet in all directions from the proposed edge of travel lanes throughout the project extent, as shown on Figure 2. OR The Noise Study Zone for this project extends 500 feet in all directions from the proposed edge of travel lanes of freeways or expressways and 300 feet for other types of roads, as shown on Figure 2. {(In some cases, the Noise Study Zone may extend beyond 300 or 500 feet, as described in Section 3.3 of the CDOT NAAG. If so, consider discussing the Noise Study Zone boundary with a CDOT noise specialist prior to submitting the noise report. If the Noise Study Zone extends beyond 300 or 500 feet, revise this section to state that and provide an explanation and justification of why it was extended.)}

Land Use Identification

Table 4identifies the land use categories, receivers, and receptors included in the noise analysis. Figure 2identifies land uses in the Noise Study Zone.

Table 4 Land Use Considerations

|  |  |
| --- | --- |
| Receiver Activity Category Summary (see Table 9) | Receivers with the following Activity Categories were modeled in the existing condition and design year scenarios:* Activity Category [X]: [XX] receivers representing [XX] receptors
* Activity Category [X]: [XX] receivers representing [XX] receptors

{(Provide information for each Activity Category that has one or more receptors. If the number of receivers and receptors changes between the existing condition and design year, create separate bullet lists for existing condition and design year scenarios and revise the introductory text to reflect which scenario each bullet list represents. If the number of receivers and receptors changes, add a footnote stating which receiver(s)/receptor(s) will change and why.)} |
| Other Considerations | * The Noise Study Zone contains [XX] receptors that have been permitted but are not yet built. These were modeled as Activity Category [X] and are receivers [XX] and [XX]. {OR} The Noise Study Zone does not contain any permitted receptors that have not been built. {(Choose the appropriate sentence and delete the other. If there are permitted, unbuilt receptors, revise the first sentence as needed and provide more detail about the receptors, as appropriate.)}
* The Noise Study Zone contains Activity Category F activities and Activity Category G land. {OR} The Noise Study Zone does not contain any Activity Category F activities or Activity Category G land. {OR} The Noise Study Zone contains [##] Activity Category F activities but does not have any Activity Category G land. {OR} The Noise Study Zone does not contain any Activity Category F activities but has [##] locations of Activity Category G land. {(Choose the appropriate sentence from the four previous sentences and delete the other three. For Activity Category G land, detail such as calling out specific parcels is not needed. Different locations refers to noncontiguous areas.)} Activity Category F activities and Activity Category G land are not considered noise sensitive, so receivers are not required for these locations. However, contour lines must be provided for Activity Category G lands. These are shown on Figure 9. {(Edit the two previous sentences as appropriate considering they should only be included if applicable to the project; e.g., if the project has such activities and/or land.)}
* The Noise Study Zone has [##] Section 4(f) site(s) with frequent human use, which were modeled as receivers [XX] and [XX]. {OR} The Noise Study Zone does not have any Section 4(f) sites with frequent human use. {(Choose which of two these options is correct and delete the other option. If there is at least one Section 4(f) site, revise the first sentence as appropriate (e.g., “site” or “sites” and include the name of the receiver used in the model.)}
* The Noise Study Zone has [##] Section 106 site(s), which may require noise information for Section 106 purposes, which may differ from highway traffic noise requirements. These are discussed in the Section 106 Technical Report. {OR} The Noise Study Zone does not have any Section 106 sites. {(Choose which of these two options is correct and delete the other option. If there is one or more Section 106 sites, revise the first sentence as appropriate [e.g., “site” or “sites” and include the number of sites].)}
 |

Field Noise Measurements

Field noise measurements performed for this analysis are summarized in Tables 5 and 6. Noise measurements were performed at different locations, as shown on Figure 2, to acquire data for validation of the existing condition model. Associated traffic counts and speeds are listed in Table A-1 of Appendix A. Field noise measurement data sheets are in Appendix A. {(This section of the report template does not address assessing highway traffic noise impacts for new highway construction or determining the worst noise hour. If a new roadway is being built by the project or the worst noise hour needs to be determined, add a description of the field measurements conducted for that situation(s). The existing condition noise model is not validated for roadways that will be new in the design year. If the project only consists of adding a new roadway, the portions of this report template that deal with validation will need to be adjusted.)}

Table 5 Field Noise Measurement Summary

| Measurement Location ID | Location | Date | Start Time (a.m. or p.m.) | Stop Time (a.m. or p.m.) | Length (minutes) |
| --- | --- | --- | --- | --- | --- |
| [XX##] | [XX] | [##/##/##] | [##:##] a.m. {OR} p.m. | [##:##] a.m. {OR} p.m. | [##] |
| [XX##] | [XX] | [##/##/##] | [##:##] a.m. {OR} p.m. | [##:##] a.m. {OR} p.m. | [##] |

{Information for table:

* 1. If reporting more than one measurement at the same location, which would not be common, it is recommended that the Measurement Location ID be essentially the same for each (e.g., M1) followed by “-1”, “-2”, etc. (e.g., M1-1, M1-2).
	2. An analyst may choose to take multiple measurements at a single location. However, data should only be reported in this table if it was used in the validation process. If two or more measurements were taken at one location and only one was used in validation (e.g., the first measurement that was modeled validated the model or the other measurements were not able to validate the model), only report in this table the measurement that was used. However, if the report indicates that multiple measurements at a single location were taken, a footnote should be added that explains how many measurements were taken. For that situation, state whether the measurement(s) not included in the table was not included because it was not modeled or because it could not validate the model.
	3. If the location does not have an address, provide enough information to adequately describe the location.
	4. Add rows as applicable.
	5. If reporting a long-term noise measurement, report the length in hours and minutes (e.g., “24 hr 10 min”)}

Table 6 Field Noise Measurement Details

|  |  |
| --- | --- |
| Number of Field Measurement Locations | [##] |
| Field Measurement Locations | Traffic noise field measurement locations are shown on Figure 2. These measurement locations were selected because [XXXXXX]. {(Provide a bullet and explanation for each location. If the explanation is the same for each location, the reason can be provided once; indicate it applies to all locations.)} |
| Basis for Measurement Length | [XXXXXX] {(Provide brief explanation of why measurements were taken for the length of time that they were taken; for example, refer to traffic volume data.)} |
| Method to Estimate Traffic Volume During Field Measurement | [XXXXXX] {(Explain how traffic was counted; e.g., counting board, pen and paper, videotaping.)}  |
| Method to Estimate Traffic Speed | Used laser gun {OR} Used radar gun {OR} Drove test vehicle through traffic within 30 minutes of noise measurement; traffic was still representative of when measurements were taken {(If drove within a shorter time period of noise measurement, say so. If drove during measurement, say “Drove test vehicle through traffic during noise measurement.”) OR} [alternative method used] {(Choose the correct method from the three listed here or add another method if applicable. More than one method may be used. Delete the other options.)} |
| Weather Conditions Summary (See Appendix A) | Field measurements were made during weather conditions acceptable according to FHWA guidance (FHWA, 2018). Weather conditions, including wind speed, were monitored during the measurements. {(These statements should be true; if they are not, alter the statement and provide the explanation and justification.)} |
| Sound Level Meter Used | [Make and Model]; Type I {OR} II {(Pick whether the meter was Type I or II and delete the other option. If the meter is Class I or II, provide a footnote; see the footnote about ANSI meters in Section 3.7 of the NAAG.)} |
| Sound Level Meter Laboratory Calibration Date | [Month and Year] {(Provide the date the meter had been calibrated by the manufacturer or a certified laboratory most recently prior to using it for this noise analysis. If the meter was used when it was within one month of the one year anniversary of the most recent laboratory calibration, include the complete date of the most recent laboratory cert. For example, if it was certified on July 1, 2016 and it was used on June 14, 2017, include the full date of certification: 7/1/16.)} |
| Field Calibrator Used | [Make and Model]Calibrations traceable to the United States National Institute of Standards and Technology were performed in the field before each set of measurements and checked in the field after each set of measurements. {(This calibration should be conducted. If this statement isn’t true, provide an explanation.)} |
| Height of Noise Measurement Above Grade | [##] feet {(Round to the nearest integer, e.g., 5 feet. If heights varied between measurements, provide the height at each location and an explanation/justification for not using the typical 5 feet.)} |
| Reason for Delay Between Noise Measurements and Modeling | [XXXXXXX] {(This refers to a delay of one year or more. If applicable, provide reason for delay in timing between when noise measurements were taken and when modeling was performed/report was written and justification that the noise measurements are still valid. CDOT and FHWA will need to agree that the justification is sufficient in order for the noise measurements to be used for the project. If there wasn’t such a delay, this row can be deleted.)} |

Validation of Existing Condition Model

Existing condition noise levels were measured in the field, as described in Section 4.3, and compared to computer noise level predictions that were based on traffic data measured in the field. This was done to verify the accuracy of the existing condition noise model. This process is called validation of the existing condition noise model. The model may be described as being an initial existing condition model during the validation process because it is not required to include any receivers except those representing the noise measurement locations.

If predicted and measured noise levels are within ±3.0 dB of each another, the existing condition noise model is within the accepted level of accuracy and is considered to have been validated. Measured noise levels, corresponding modeled noise levels, and the differences between the two are presented in Table 7.

Table 7 Existing Condition Model Validation Summary

| Noise Measurement Location ID  | Location(see Figure 2) | Measured Leq (dBA) | Modeled Leq (dBA) | Difference (dB) |
| --- | --- | --- | --- | --- |
| [XX##] | [XXXX] | [##.#] | [##.#] | [##.#] |
| [XX##] | [XXXX] | [##.#] | [##.#] | [##.#] |
| [XX##] | [XXXX] | [##.#] | [##.#] | [##.#] |

{Information for table:

1. Describe the location by either providing the address or the brief description that was provided in Table 5.
2. Report the measured Leq, modeled Leq, and difference using one decimal place (e.g., +2.4 dB, -2.6 dB, +0.2 dB).
3. Add or delete rows as applicable.
4. An analyst may choose to take multiple measurements at a single location. However, data should only be reported in this table if it was used to validate the model. If two or more measurements were taken at one location and only one of those was ultimately used to validate the existing condition noise model (e.g., the first measurement that was modeled validated the model or the other measurements were not able to validate the model), only report in this table the measurement that was used. However, if the report indicates that multiple measurements at a single location were taken, a footnote should be added that explains how many measurements were taken. For that situation, state whether the measurement(s) not included in the table was not included because it was not modeled or because it could not validate the model.
5. Measurements cannot be averaged. If two or more measurements are taken, each measurement must be modeled individually or not at all.}

Differences between measured and predicted levels are all within the allowable ±3.0 dB tolerance. Therefore, the existing condition noise model is considered to be validated for this project.{(If the difference is not within 3.0 dB, the noise modeler should double-check model inputs, coordinates, and other variables to determine if the discrepancy can be corrected. This effort doesn’t get explained in the report; only report the final outcome. After examination, if the difference still exceeds 3.0 dB, the reason for the difference will be adequately explained in the traffic noise technical report. A CDOT noise specialist must concur with the explanation. If the discrepancy cannot be explained, a consultation with the analyst, project team, and a CDOT noise specialist will be held to determine how to move forward. A second measurement may be required to be taken in some instances. If it is determined that the model can be calibrated, use the method described in FHWA’s Guidance, which is on page 32.)}

TNM Model Inputs

The noise model software being used on this project was TNM Version 2.5. {(TNM 3.0 was released in February 2020. CDOT will issue a memorandum when the use of TNM should shift from version 2.5 to 3.0. If Version 3.0 is used, change the version number and month/year model was approved for use.)} It was used to analyze existing condition ([existing year]) and design year ([design year]) noise levels. As part of the analysis, the model calculated noise levels at receivers that are in the Noise Study Zone. Each receiver represented one or more receptors. {(If each receiver only represented one receptor, delete “or more” and change “receptors” to “receptor.”)} Modeling results represent predicted traffic conditions during worst-hour noise periods. {(If project traffic volumes exceeded those in Table 3 of the CDOT NAAG, also include the following sentence: “Because estimated traffic volumes from the [existing conditions and/or design year] project traffic analysis exceeded the volumes listed in Table 3 of the CDOT NAAG, Table 3 volumes were used.)} Table 8 describes model inputs and methods.

Table 8 TNM Model Inputs and Methods

|  |  |
| --- | --- |
| Noise Sensitive Receptors  | Noise sensitive receptors are defined according to Table 3. Receivers (modeled points) have been selected to represent these receptors within the Noise Study Zone. {(If the noise analysis defined Noise Sensitive Areas (NSAs), add a row to describe them. NSAs may be neighborhoods or other areas that are grouped geographically. Using NSAs does not preclude representing all receptors in the model, although not all receptors need to be modeled as receivers.)} |
| Receivers  | Receivers are listed in Table 9 and shown on Figures 4 and 5. {(Most reports will contain Figures 4 and 5. Some may also contain Figure 6; if so, add that to this list. It is acceptable to provide the information required by Table 9 in Appendix B rather than in Chapter 5, in which case the table number will change and the reference to the table should be revised as appropriate.)} |
| Modeled Roadways | The following roadways were modeled: * [XXXXX]
* [XXXXX] (existing condition; not in Proposed Action scenario)
* [XXXXX] (Proposed Action scenario; not in existing condition)

For the Proposed Action, the analysis included roads that would be changed or newly built by the project, would have substantially different traffic volumes, or would be important local traffic noise sources. {(Of these three statements, choose all that apply and delete the others. Add additional text if appropriate.) (For each modeled roadway: Include a route number, if applicable, as well as the common and/or actual name of the road, if applicable (e.g., I-25, SH 2/Colorado Blvd.). For each roadway that was modeled in both existing condition and design year scenarios, use the first bullet. If either or both of the second two bullets don’t apply, delete them. If the project has other alternatives, revise the text in this row as appropriate. If a road is excluded from the project noise models that could reasonably be expected to be included, an explanation of why the road is being excluded should be provided.)} |
| Differences in How Roadways Were Modeled Between Alternatives | [Describe basic differences in modeled roadways between alternatives. If the only difference in the model between alternatives for the roads were the traffic volumes and/or speeds, state that. Other differences include the number of lanes or a roadway may be in one alternative but not the other (if so, provide the reason)]. |
| TNM Objects and Elevations  | The following objects were modeled: [terrain lines, buildings modeled as building rows, buildings modeled as noise barriers, tree zones, and ground zones]. These are shown on Figure 3. {OR} The only objects that were modeled were receivers and roadways. The Noise Study Zone does not contain any features that would affect noise to a degree that they needed to be included in the model. {(Use text from one of the two options provided. If any objects besides buildings were modeled as noise barriers, such as retaining walls or vertical rock face cut slopes, include that in the list of objects that were modeled. If at least one type of object was modeled besides receivers and roadways, use the first option and tailor the list of modeled objects that is highlighted in grey so that it is correct for the project.)} |
| Existing Noise Barriers | The Noise Study Zone does not contain any existing noise barriers. {OR} [Describe noise barriers that already exist within the Noise Study Zone, if applicable, including the location, material, height, and length. State if the noise barrier will be impacted by the project, and if so, how]. {(Choose an option and delete the other option.)} |
| Modeled Pavement Type | Average {(The default must be used for design year noise models. It is allowable to use a different pavement type for the existing condition noise model, which would include using it in the validation of the existing condition noise model. If this is done, state that here and provide the justification for not using the average pavement in those models.)} |
| Default Ground Type | Lawn {OR} [XXXXX] {(Choose an option and delete the other option. If “lawn” wasn’t used as the default ground type, identify the ground type used and provide the justification for using it.)} |
| Traffic Data (See Appendix B) | * Roadway coordinates generated [provide source, e.g., from CAD and aerial photographs]
* Traffic volumes are from:

[provide source] ([existing year])[provide source] ([design year])* Vehicle mix(es) is/are from:

[provide source] ([existing year])[provide source] ([design year])* [Basis for identifying traffic noise worst-hour]

{(Provide the source of each set of traffic volumes and vehicle mix used in model (e.g., Existing, No Action, Proposed Action, or other alternative(s)). If the source of data is the same for all traffic data and scenarios, a bullet list is not needed; cite the source and list all the traffic data and scenarios for which it was used.)} |

TNM Results

Modeled noise levels for the existing condition and design year scenarios are shown in Table 9. This data was used to identify which, if any, receptors would be impacted as a result of the Proposed Action.

Table 9 Modeled Noise Levels Not Considering Potential New Abatement

| Receiver ID  | Receiver Description | Activity Category / CDOT NAC (dBA) | Number of Receptors Represented by Receiver | Existing Condition ([year])Leq (dBA) | No Action ([year])Leq (dBA) | Proposed Action ([year])Leq (dBA) |  Proposed Action Change From Existing(dB) | Proposed Action Causes Impact?(Yes or No) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [XXX###] | [XXXXXX] | [X / ##] | [#] | [##.#] | [##.#] | [##.#] | [+/-#.#] | [XXXX] |
| [XXX###] | [XXXXXX] | [X / ##] | [#] | [##.#] | [##.#] | [##.#] | [+/-#.#] | [XXXX] |
| [XXX###] | [XXXXXX] | [X / ##] | [#] | [##.#] | [##.#] | [##.#] | [+/-#.#] | [XXXX] |

{Information for table:

1. Receiver Description: Description and associated figure combined must be detailed enough to be able to find the receiver location outside this report and to determine if the appropriate number of receptors per receiver were assigned. For example, addresses can be provided for single-family homes; apartment complexes can be named (e.g., White Tree Townhomes); and non-residential receptors should include a name (e.g., name of school or business) and/or type of receptor (e.g., pool, grill, picnic table) (e.g., Receiver Description could be “pool at Heartbreak Hotel”).
2. Noise levels should be reported using one decimal place in technical reports and NEPA documents.
3. This table can be renumbered to B-2 and moved to Appendix B.
4. If the project does not have a No Action Alternative, delete that column from this table.
5. Additional columns may be used. For example, two columns could be added for each “other alternative,” used to report the Leq in the design year and to report if the alternative causes an impact. Or, instead of adding columns, another table could be added for the “other alternative(s).” Another example of why additional columns might be used: A column could be added to represent a potential developer built noise wall that may have been built by the design year.
6. If more space is needed, either format the page so this table is landscape and/or break the table into more than one table. If splitting up the table horizontally, include the “Receiver ID” and “Receiver Description” columns in each table.
7. For each Activity Category D receiver, provide a footnote indicating whether the noise level represents an indoor or outdoor area. Also provide a footnote to indicate that the noise level was calculated by subtracting the noise reduction factor from Table 2 of the NAAG from the modeled exterior noise level. Otherwise, state that noise levels were measured in the field.}

Existing Conditions Summary

Under existing conditions ([existing year]), modeled noise levels at [##] receivers range from [##.#] to [##.#] dBA. Figure 4 shows the locations of all modeled receivers. Table 9 shows the modeled noise level at each receiver. {(Add the following two sentences only if existing condition noise levels met or exceeded the NACs for any receivers in the existing year:)} Existing conditions are not described as having noise impacts. If the project were not built, the project would not be responsible to mitigate noise via an abatement measure regardless of if existing condition noise levels exceeded NACs.

No Action Alternative Summary

{(Section 5.2 should either contain the first sentence and nothing else or the first sentence should be deleted.)}This project is classified by NEPA as a Categorical Exclusion project and does not have a No Action Alternative. {OR} Under the No Action Alternative ([design year]), modeled noise levels at [##] receivers range from [##.#] to [##.#] dBA. Figure 4 shows the locations of all modeled receivers. Table 9 shows the modeled noise level at each receiver. {(Add the following two sentences only if existing condition noise levels met or exceeded the NACs for any receivers in the existing year.)}No Action Alternatives are not described as having noise impacts. If the project weren't built, the project would not be responsible to mitigate noise via an abatement measure regardless of if No Action Alternative noise levels exceeded NACs.

Proposed Action Summary

{(Use the following paragraph if at least one receptor is impacted; otherwise, delete it. Modify as needed if only one receptor is impacted and/or if there are not any substantial impacts [3rd sentence could be revised by deleting “, representing xx receptors”])}Under the Proposed Action ([design year]), modeled noise levels at [##] receivers range from [##.#] to [##.#] dBA. [##] receivers, representing [##] receptors, would exceed the NAC. [##] receivers, representing [##] receptors, would experience a substantial noise increase of at least 10 db. Therefore, a total of [##] receivers, representing [##] receptors, would be impacted during the [design year] worst-hour noise period (see Figure 5). Table 9shows the modeled noise level at each receiver.

{(Use the following paragraph if no receptors are impacted; otherwise, delete it.)}Under the Proposed Action ([design year]), modeled noise levels at all receivers range from [##.#] to [##.#] dBA. As shown in Table 9, none of the receivers, and therefore receptors, show any impacts during the [design year] worst-hour noise period (see Figure 4).

{(If the Noise Study Zone doesn’t have any impacted Activity Category D receptors, the following paragraph should be deleted.)}Because the Noise Study Zone has an Activity Category D receptor, [Receiver ID], the interior noise level was evaluated. {(If interior noise levels were determined via noise measurements rather than via Table 2 of the NAAG and calculation, revise this paragraph as appropriate.)}This was done using Table 2 of the CDOT NAAG. Interior noise levels were determined by subtracting Table 2 noise reduction factors from the exterior levels for the building in question. The [receptor type, e.g., library] is made with [building material, e.g., masonry (brick)] and has [window condition, e.g., single-glazed] windows. Therefore, the interior noise level was calculated to be [number of dB reduction, from Table 2 of the CDOT NAAG; e.g., 25] dB less than the modeled exterior noise level, which was [##.#] dBA. Therefore, the interior noise level was determined to be [##.#] dBA and [is {OR} is not] considered to be impacted. {(Choose the correct option and delete the other.)}

Other Alternative Summary

{(Section 5.4 should either contain the first sentence and nothing else or the first sentence should be deleted. If the project has more than one other alternative, this section should be copied for each alternative and the section headings should incorporate the other alternative name [e.g., Section 5.5: Other Alternative #2 Summary]. If there is more than one alternative, the alternative name or number should be used in both the section heading and the section itself.)}This project does not have any other alternatives. {OR} Under the other alternative [##orXX] ([design year]), modeled noise levels at [##] receivers range from [##.#] to [##.#] dBA. [##] receivers, representing [##] receptors, would exceed the NAC and [##] receivers, representing [##] receptors, would experience a substantial noise increase of at least 10 db. Therefore, a total of [##] receivers, representing [##] receptors, would be impacted during the [design year] worst-hour noise period (see Figure 6). Table 9shows the modeled noise level at each receiver.

{(If the Noise Study Zone doesn’t have any Activity Category D receptors, the following paragraph should be deleted.)}Because the Noise Study Zone has an Activity Category D receptor, [receiver ID], the interior noise level was evaluated. {(If interior noise levels were determined via noise measurements rather than via Table 2 of the CDOT NAAG and calculation, revise this paragraph as appropriate.)}This was done using Table 2 of the CDOT NAAG. Interior noise levels were determined by subtracting Table 2 noise reduction factors from the exterior levels for the building in question. The [receptor type, e.g., library] is made with [building material, e.g., masonry (brick)] and has [window condition, e.g., single-glazed] windows. Therefore, the interior noise level was calculated to be [number of dB reduction, from Table 2 of the CDOT NAAG; e.g., 25] dB less than the modeled exterior noise levels, which was [##.#] dBA. Therefore, the interior noise level was determined to be [##.#] dBA and [is {OR} is not] considered to be impacted. {(Choose the correct option and delete the other.)}

Noise Abatement Evaluation

{(Chapter 6 should either contain the first two sentences and nothing else OR the first two sentences should be deleted, as applicable.)}As described in Chapter 5, this project will not result in any noise impacts in the design year ([design year]). Therefore, it was not necessary to evaluate noise abatement. {OR} As described in Chapter 5, [##] receptors in the Noise Study Zone would be impacted by noise in [design year] under the Proposed Action. {(If the project has any design year alternatives besides the Proposed Action or Preferred Alternative, add a similar sentence to say how many receptors would be impacted for each alternative.)}Therefore, abatement for the impacted receptors was evaluated in accordance with guidelines from The CDOT NAAG and FHWA’s Guidelines. Although abatement was required to be evaluated, it is only recommended for inclusion in the project when determined to be both feasible and reasonable.

Abatement is feasible if it:

* Provides at least 5 dB of noise reduction for at least three impacted receptors {(Applies to barriers within the minimum and maximum heights as described in Section 4.2.1 of the NAAG*.* For example, it is not necessary to model walls higher than 20 feet high. If there are not at least three impacted receptors that could be behind a barrier, it is not necessary to model the barrier to determine noise reductions.)}
* Does not have any design and construction factors that are “fatal flaw” issues (e.g., safety, barrier height, topography, drainage, utilities, abatement maintenance, maintenance access to adjacent properties, and access to adjacent properties [i.e., arterial widening projects])

If abatement is not feasible, further evaluation is not needed. However, if it is feasible, reasonableness is evaluated. Abatement is reasonable if it:

* Meets the minimum noise reduction design goal of at least 7 dB for at least two benefited receptors
* The Cost Benefit ($/receptor) equals or is less than the Cost Benefit Index ($34,000/receptor)
* Has support from more than 50 percent of the potentially benefited receptors[[2]](#footnote-3)

Noise Abatement Options Considered

Noise barriers (walls and, to a lesser extent, berms) are commonly used as noise abatement and must be evaluated when doing a mitigation analysis for impacted receptors, per 23 CFR 772.13(c)(1). Other mitigation measures may also be considered, including traffic management measures (e.g., traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, modified speed limits, and exclusive lane designations); alteration of horizontal and vertical alignments; and acquisition of real property or interests therein to serve as a buffer zone to preempt development which would be adversely impacted by traffic noise. However, these mitigation measures are generally not feasible and/or reasonable. For this project, noise [walls and/or berms] were the only abatement evaluated. {(If one or more mitigation measure other than a barrier was evaluated, revise the previous sentence and add text about the alternative abatement evaluation. Include a description of the alternative measure(s) and why it/they is/are not feasible and/or reasonable. If noise insulation was evaluated, refer to the evaluation in this section but refer to Section 6.2, which will contain the majority of the discussion.)}

Noise Abatement: Noise Insulation

{(Section 6.2 should either contain the first two sentences and nothing else OR the first two sentences should be deleted, as applicable.)}The Noise Study Zone does not have any Activity Category D receptors. Therefore, noise insulation was not considered as abatement for this project. {OR} The Noise Study Zone has an Activity Category D receptor that does not have an exterior area with frequent human use. Therefore, interior noise was evaluated. [Explain how interior noise levels were calculated. See Section 3.5.5 of the NAAG.]

Because noise insulation is being considered as abatement for Activity Category D receptor [receiver ID], interior noise measurements will be taken for the final noise analysis and abatement design. This will be done outside of this report.

If noise insulation is considered because no other feasible or reasonable noise abatement measures are available, the condition of the structure, its amenities, and overall use characteristics must be thoroughly evaluated. Determinations such as these must be completely documented and are done on a case-by-case basis. Post installation maintenance and operational costs for noise insulation are not eligible for Federal-aid funding.

{(Only include this paragraph if the Noise Study Zone includes an Activity Category D receptor that is a private dwelling.)}The only situation in which noise insulation would be considered for private dwellings is if extraordinary traffic noise impacts are found. Such a situation might exist where the projected exterior noise levels are 75 dBA or greater or where the projected increase over existing condition levels is 30 dB or more and no other possible abatement is reasonable and feasible. Under these conditions, the project may use state and/or local agency funding to implement an insulation abatement solution only if the noise abatement measure meets reasonable and feasible criteria as is required for conventional abatement measures. This determination must be made on a case-by-case basis and in consultation with FHWA and CDOT.

Noise Barrier Evaluation – Proposed Action

{(If the project has more than one build design year alternative, copy this section for each of the alternatives, not including the No-Action Alternative, and add as a new section(s) (e.g., Section 6.4 and 6.5). Tables will need to be renumbered.)}The Proposed Action has [##] impacted areas. Barrier placement for each impacted area was considered in multiple locations. The location determined to be the best performer for each set of impacted receivers was optimized, and those results are described in Table 10. Figure 7shows the best performing evaluated barrier location, as determined by [modeling or describe how it was determined]. Appendix D has [##] CDOT Noise Abatement Determination [Worksheet(s)] (CDOT Form 1209); one was completed for each impacted area. {(If the previous paragraph does not describe the barrier evaluation performed for this project, revise as appropriate so that it does. For example, if there was only one impacted area, the second sentence would say, “Barrier placement for the impacted area was considered in multiple locations.” If a single impacted area has a wall with a break in it, for example due to a driveway, it would be considered one wall with one primary Barrier ID and each section would have a secondary Barrier ID that reflects how many sections it has. For example, the Barrier ID could be “I25E” and the section IDs shown on the second row, which would be added, of Table 10 could be “I25E-a” and “I25E-b.”)} Of these [##] evaluated noise barriers, [##] were found to be feasible and reasonable, as described in Table 10.

{(For any barriers that were determined to not be feasible due to fatal flaws, provide a summary level explanation and justification for that finding in this section and a more detailed explanation and justification in an appendix (i.e., email or memorandum that has been signed off/agreed to by the appropriate specialists, such as a design engineer or utility specialist). The explanation may not be vague, such as “not feasible due to access issues.” Detail should be provided to justify why it is not feasible. Fatal flaws are engineering, safety, maintenance, or ROW related constraints and do not include most access issues. For example, if a wall would be broken up due to driveways, the wall still needs to be modeled in order to show whether it meets acoustical requirements, including allowing room for sight distance. If a wall does not meet the decibel reduction requirements because of the breaks, it would not be feasible for acoustical reasons; the wall breaks themselves are not a fatal flaw.)}

Table 10 Noise Barrier Evaluation[[3]](#footnote-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Barrier ID {(If the barrier has more than one section, add another row below this row called “Section IDs” and list each Section ID)} | [XX##] | [XX##] | [XX##] |
| Barrier Location (general) {(The general location can refer to things such as cross streets and names of neighborhoods. It should indicate if it is on the NB, SB, EB, or WB side of the roadway.)} | [XXXX] | [XXXX] | [XXXX] |
| Barrier Location: Distance from Proposed Edge of Roadway (feet) {(If the barrier location is not approximately the same distance from the roadway at all points, provide the range and state which edge is how far. For example: 10 feet (southern edge) to 15 feet (northern edge).)} | [##] | [##] | [##] |
| Barrier Location Justification {(Provide high level justification for location, including whether or not the location was determined using the model)} | [XXXX] | [XXXX] | [XXXX] |
| Impacted Receiver IDs {(List all IDs if five or less; otherwise, may refer to Figure 7)} | [XX##] | [XX##] | [XX##] |
| Benefited Receiver IDs {(List all IDs if five or less; otherwise, may refer to Table 11)}  | [XX##] | [XX##] | [XX##] |
| Figure # {(Either 7 or 7a, 7b, etc., depending on number of figures showing barriers)} | [##] | [##] | [##] |
| Fatal Flaw(s)? | [Yes] {OR} [No] | [Yes] {OR} [No] | [Yes] {OR} [No] |
| Reduces Noise ≥5.0 dB for ≥3 impacted receptors | [Yes] {OR} [No] | [Yes] {OR} [No] | [Yes] {OR} [No] |
| Reduces Noise ≥7.0 dB for ≥2 benefited receptors | [Yes] {OR} [No] | [Yes] {OR} [No] | [Yes] {OR} [No] |
| Recommended Barrier Height & Length (feet)1 {(If barrier has different heights, list by each section and indicate which section is which; e.g., 8 high x 1204 long, north end; 10 high x 429 long, south end)} | [##] high x [##] long | [##] high x [##] long | [##] high x [##] long |
| Barrier Area2 (square feet) | [#######] | [#######] | [#######] |
| Unit Cost | $45/ft2 | $45/ft2 | $45/ft2 |
| Total Cost3 | [$#######] | [$#######] | [$#######] |
| No. Benefited Receptors | [##] | [##] | [##] |
| Total Decibels of Benefit Provided | [##.#] | [##.#] | [##.#] |
| Average Benefit (dB/receptor) | [#.#] | [#.#] | [#.#] |
| Cost Benefit($/receptor)3 | [#####] | [#####] | [#####] |
| Design year Leq Range Without Abatement (dBA) | [##.# to ##.#] | [##.# to ##.#] | [##.# to ##.#] |
| Design year Leq Range With Abatement (dBA) | [##.# to ##.#] | [##.# to ##.#] | [##.# to ##.#] |
| Feasible?  | [Yes] {OR} [No] | [Yes] {OR} [No] | [Yes] {OR} [No] |
| Reasonable? | [Yes] {OR} [No] | [Yes] {OR} [No] | [Yes] {OR} [No] |
| Recommended? | [Yes] {OR} [No] | [Yes] {OR} [No] | [Yes] {OR} [No] |

*Notes:*

1. The barrier heights and/or lengths listed in this table are rounded. Therefore, if they are used to calculate the barrier area, the resulting area may be slightly different than the reported barrier area due to round-off error.
2. The barrier areas listed in this table are rounded. Therefore, if they are used to calculate the total cost, the resulting cost may be slightly different than the reported cost due to round-off error.
3. The total cost listed in this table is rounded. Therefore, when used to calculate the cost benefit, the resulting cost benefit may be slightly different than the reported cost benefit due to round-off error.

{Information for table beginning with column #2:

1. Each column represents an optimized wall or berm.
2. If the barrier is not feasible, some of the feasibility related cells may say “Not Applicable” and all of the reasonableness cells would say “Not Applicable.” If the barrier is not reasonable, some of the reasonableness cells may say “Not Applicable.”
3. This table can be renumbered and moved to Appendix C. If that is done, renumber it and revise references to the table as needed.
4. The table can be formatted to be landscape.
5. If the round-off error described in footnotes 1 through 3 does not occur for this project, the applicable footnote(s) may be deleted.}

Table 11 Modeled Noise Levels With and Without Potential New Abatement (Barrier ID [Barrier ID])

| Receiver ID (Behind Abatement) | Receiver Description | Number of Receptors per Receiver | Are Receptors Benefited? (Yes or No) | Proposed Action ([year]) Leq Without Abatement (dBA) | Proposed Action ([year]) Leq With Abatement (dBA) | Proposed Action ([year]) Insertion Loss (dB)  |
| --- | --- | --- | --- | --- | --- | --- |
| [XXX###] | [XXXXXX] | [##] | [Yes] {OR} [No] | [##.#] | [##.#] | [##.#] |
| [XXX###] | [XXXXXX] | [##] | [Yes] {OR} [No] | [##.#] | [##.#] | [##.#] |
| [XXX###] | [XXXXXX] | [##] | [Yes] {OR} [No] | [##.#] | [##.#] | [##.#] |

{Information for table:

1. Create one table for each evaluated barrier or add a row for each evaluated barrier containing the name of the barrier and add rows beneath that for the receivers behind that barrier. If new tables are added, renumber the tables (e.g., Table 11A, 11B, 11C, etc.).
2. Number of receptors per receiver: It may be necessary to break up the receivers into more receptors than was done for Table 9, in order to determine the exact number of receptors that are benefitted. For example, if a receiver represented five receptors, the model with the noise barrier may need to have up to five receivers instead of the one receiver that was listed in Table 9.
3. If additional receivers were added to the model for barrier evaluation, indicate which receivers were added (e.g., use a footnote). It should be clear which added receivers are associated with which of the original receivers (e.g, same address listed but different unit number, receiver ID was R5 but are now R5a, R5b, and R5c).
4. Receiver Description: If the receiver has benefited receptors for which noise abatement is recommended, more detailed information about the receptor is needed than what may have been provided in Table 9. Examples: An address must be provided for residential receptors, including the unit number (if applicable). For businesses, the business name must be provided. There must be enough information so that when it is time to send the benefited receptor survey, it can easily be determined where to send the survey.
5. Noise levels should reported using one decimal place (e.g., 66.2 dBA) in technical reports and in NEPA documentation.
6. Additional columns may be needed. For example, add a column to represent a scenario in which a potential developer built noise wall may be built by the design year. “Credit” for this wall cannot be taken in this analysis because the wall might not be built, but the information may be included for informational purposes.
7. If more space is needed, either format the page so this table is landscape and/or break the table into more than one table. If splitting up the table horizontally, include the “Receiver ID” and “Receiver Description” columns in each table and renumber (e.g., Table 11A, 11B, 11C, etc.)
8. This table can be renumbered and moved to Appendix C. If that is done, revise references to the table as needed.
9. If “Leq Without Abatement” values in this table are different than the “Proposed Action (year) Leq (dBA)” values in Table 9, provide an explanation. For example, “Adding a barrier to a TNM model introduces a new terrain line that can affect the unabated noise levels.” However, if the addition of that terrain line would have affected whether a receptor was impacted, it may be appropriate to add a terrain line to the original model and redetermine impacts.}

Statement of Likelihood

{(If the project does not result in any noise impacts, Chapter 7 should contain only the next three sentences. If this is not the situation, delete the next three sentences.)} As described in Chapter 5, based on the most current analysis, this project will not result in any noise impacts in the design year ([design year]). Therefore, it was not necessary to evaluate noise abatement. However, if during final design it is determined that at least three receptors are impacted, abatement measures will be evaluated and may be constructed. A final decision of abatement measure(s) construction will be made upon completion of the project’s final design and the public involvement process. {OR (If the project results in one or more areas where a prospective barrier cannot benefit at least three impacted receptors because there are fewer than three impacted receptors behind the prospective barrier, Chapter 7 should contain only the next four sentences, adjusted for having more than one prospective barriers as applicable. If this is not the situation, delete the next four sentences.)} As described in Chapter 5, based on the most current analysis, this project will result in noise impacts at [###] receptors in the design year ([design year]). Because there would be fewer than three impacted receptors behind the prospective barrier, it was not necessary to evaluate noise abatement. However, if during final design it is determined that at least three receptors behind the prospective barrier are impacted, abatement measures will be evaluated and may be constructed. A final decision of abatement measure(s) construction will be made upon completion of the project’s final design and the public involvement process. {OR (Include the following two sentences)} The noise abatement evaluation for the Proposed Action is described in Chapter 6. [##] receivers, representing [##] receptors, were determined to be impacted by traffic noise in [design year] for the Proposed Action.

Noise abatement was determined to be feasible and reasonable in [##] locations for [##] impacted receptors. Therefore, the following noise walls are recommended to be constructed:

* [Barrier ID]: [Location, general from Table 10], [height] feet high by [length] feet long; Cost Benefit of [Cost Benefit value]; evaluated for impacted receivers [list the receivers if less than five] {and/or} as shown using Figures 5 and 8.

{(Include the previous bullet(s) and paragraph if applicable. If proposing berms instead of walls, revise text as appropriate in this section. If recommending a berm, include the berm height, width, and slope ratio. If the wall or berm height varies, include the range and the average height. Provide the same information listed in this bullet for as many barriers that are recommended. If only one barrier is recommended, the text can be revised to show singular vs. plural.)}

Noise abatement at [##] locations for [##] impacted receptors were determined not to be feasible and/or reasonable, as described in Section 6.3 and Table 10. {(Include this sentence if applicable)}

Note the following {(If bullets 2 and 3 are not applicable to this analysis, delete “Note the following:” and make the first bullet a paragraph)}:

* The final noise abatement decision will be made during the project’s final design. Feasibility and reasonableness determinations for this project may change if there are changes in final design after approval of the NEPA documentation.
* A Benefited Receptor Preference Survey will be conducted at each recommended barrier at the time of final design of the construction project. Abatement won’t be built if the Benefited Receptor Preference Survey results in 50 percent or less support for the abatement. {(Only include this bullet if at least one barrier was determined to be feasible and reasonable in the current analysis)}
* Information for construction contractors as identified in Section 9.8 of the NAAG should be included in all plan sets and/or specifications and clearly documented in the Bid Package. {(Include this sentence for projects with recommended noise abatement)}

CONSTRUCTION Noise

This chapter describes construction noise implications, construction noise mitigation strategies, and whether the project is in an area that is subject to local noise ordinances.

Construction Noise Implications

Properties adjoining project construction may be exposed to noise caused by construction activities of the Proposed Action. Examples of construction equipment noise are shown in Table 12. Construction noise differs from traffic noise in several ways:

* Construction noise lasts only for the duration of construction, with most construction activities in noise-sensitive areas being conducted during hours that are least disturbing to most nearby residents, when feasible.
* Construction activities generally are short term and, depending on the nature of the construction operations, last from seconds (e.g., a truck passing a receptor) to months (e.g., bridge construction).
* Construction equipment noise is intermittent and depends on the type of operation, location, and function of the equipment, as well as the equipment usage cycle.
* As opposed to operational traffic noise, construction noise is not analyzed; there are no FHWA or CDOT construction NACs. However, construction noise is subject to relevant local regulations and ordinances (see Section 8.3).

Table 12 Typical Construction Equipment Noise

| Equipment | Maximum Noise Level (dBA at 50 feet)1 |
| --- | --- |
| Scraper | 89 |
| Dozer (Bulldozer) | 85 |
| Truck (Heavy Truck) | 882 |
| Pickup Truck | 55 |
| Concrete Pump Truck | 82 |
| Backhoe | 80 |
| Pneumatic Tools | 85 |

*Notes:*

1. Noise levels are from Table 9.1 of FHWA’s 2006 [Construction Noise Handbook](https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm) (FHWA, 2006), unless otherwise noted.
2. This noise level is from Table 9.9 of FHWA’s 2006 [Construction Noise Handbook](https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm) (FHWA, 2006), which is taken from Chapter 12 of the FTA Transit Noise and Vibration Guidance Handbook.

Construction Noise Mitigation Strategies

To minimize construction noise levels, typical best management practices will be incorporated into construction contracts, plans, and specifications where it is appropriate to do so. The determination of practices weighs the benefits achieved and the overall adverse social, economic, and environmental effects and costs of abatement measures. These may include: {(This list may be modified to be project specific. Retain at least three examples. Get approval from the project team if including any strategies from this list or any additional strategies that are unusual or highly prescriptive, such as providing a mechanism for complaints or using new equipment.)}

* Notify neighbors in advance when construction noise may occur.
* Keep noisy activities as far from sensitive receptors as possible.
* Keep exhaust systems on equipment in good working order. It should be subject to inspection by the construction project manager to ensure maintenance is being conducted.
* Use properly designed engine enclosures and intake silencers, if appropriate.
* Use new equipment, which is subject to new product noise emission standards. {(If including this strategy, include the year of the equipment that would be considered “new”; e.g., 2018 or newer)}
* Place stationary equipment as far from sensitive receptors as possible.
* Perform construction activities in noise sensitive areas during hours that are least disturbing to nearby residents, generally daytime hours, as feasible.
* Locate haul roads so that that are as least disruptive as possible
* Eliminate tail gate banging
* Provide mechanisms for complaints
* Adhere to a construction noise plan {(if such a plan is being developed; see Section 5.1 of the NAAG)}
* Adhere to a temporary vibration mitigation plan {(if such a plan is being developed; see Section 5.2 of the NAAG)}

Local Noise Ordinances

[State whether local ordinances exist relating to construction noise, and, if so, describe the requirements. Provide the name of the local agency (e.g., El Paso County), number/name of the ordinance, date of the most current version, and a hyperlink to it. If there aren’t any local noise ordinances, state the following: “The project occurs in [city and/or county], which does not have any local noise ordinances. Therefore, [Colorado Noise Statute 25-12-103](https://advance.lexis.com/documentpage/?pdmfid=1000516&crid=8ece0e21-da42-4a73-9935-f42d0d01756e&nodeid=AAZAAHAALAAD&nodepath=%2FROOT%2FAAZ%2FAAZAAH%2FAAZAAHAAL%2FAAZAAHAALAAD&level=4&haschildren=&populated=false&title=25-12-103.+Maximum+permissible+noise+levels.&config=014FJAAyNGJkY2Y4Zi1mNjgyLTRkN2YtYmE4OS03NTYzNzYzOTg0OGEKAFBvZENhdGFsb2d592qv2Kywlf8caKqYROP5&pddocfullpath=%2Fshared%2Fdocument%2Fstatutes-legislation%2Furn%3AcontentItem%3A61P5-WW41-DYDC-J2M5-00008-00&ecomp=6gf59kk&prid=ab11feb3-ac64-4d93-ac30-80939ad4f92f) applies. This means that noise at 25 feet from the project boundary may not exceed 80 dBA from 7:00 a.m. until 7:00 p.m. and 75 dBA from 7:00 p.m. until 7:00 a.m.”] {(This language for the Colorado statute was current when this report template was created; confirm that the statute hasn’t been updated. Revise if needed.) (Although rare, there may be cases where the local ordinance and State statute both apply, if there is overlap. At any given time of day, the more stringent requirement applies. In that case, provide information about both requirements and why they both need to be listed.)}

Information for Local Officials

{(Chapter 9 should either contain the first two sentences and nothing else OR the first two sentences should be deleted.)}This project’s Noise Study Zone does not include any land that is unpermitted and undeveloped (i.e., Activity Category G). Therefore, 23 CFR 772.17 is not applicable and related information does not need to be provided to local officials. {OR} This project’s Noise Study Zone includes land that is unpermitted and undeveloped (i.e., Activity Category G) (see Figure 2). Therefore, 23 CFR 772.17 is applicable and noise related information needs to be provided to local officials to support local land use planning decisions and future development, as described in Section 6.3 of the NAAG.

{(If showing contour lines on a figure, include this paragraph)} Contour lines represent distances from the edge of the nearest travel lane of the highway improvement to where the design year ([design year]) noise levels reach the Activity Category B and C NAC (66 dBA) and Activity Category E’s NAC (71 dBA). These were developed for Activity Category G land within the Noise Study Zone and are shown on Figure 8.

{(If showing contour lines in a table, include this paragraph and create the table. Note that the tables listed as being Table 13 and Table 14 in this report template will need to be renumbered, as will any references to them.)} Distances to the Activity Category B and C NAC (66 dBA) and Activity Category E’s NAC (71 dBA) were developed for the Noise Study Zone and are shown in Table 13.

Distances may vary somewhat over the corridor due to topography and changing road alignments, but, in general, land within approximately [###] feet from the proposed new edge of the nearest travel lane are predicted to exceed 66 dBA during worst-hour traffic noise hours. The distance to 71 dBA for sensitive commercial properties is predicted to be approximately [###] feet from the proposed new edge of the nearest travel lane. Properties developed in those areas would not be compatible with Activity Category B or C (66 dBA) or Activity Category E (71 dBA) uses, respectively.

Each state highway agency is required to identify when the public is officially notified of a proposed highway project location. The CDOT NAAG defines the Date of Public Knowledge as the date on which the final environmental project document is approved (i.e., signed Categorical Exclusion Form 128, Finding of No Significant Impact, or Record of Decision). After this date, CDOT and FHWA will be responsible for analyzing and documenting existing condition and design year noise levels for these lands as part of Type I noise analyses, but will not be required to provide noise abatement for development on these lands if it was permitted after the Date of Public Knowledge. In addition, these areas would not be eligible for Federal-aid participation for Type II projects, if funding to the Type II program were to be reinstated in Colorado. Colorado does not currently have a Type II program. Decisions concerning such noise abatement are left to local government agencies and private developers.

Noise compatible planning concepts should be considered by local agencies. Examples are available in the following documents. Additional material and technical support are available from CDOT, upon request.

* *The Audible Landscape: A Manual for Highway Noise and Land Use* (Urban Systems Research and Engineering, Inc.; 1974),
* *Guidelines for Considering Noise in Land Use Planning and Control* (Federal Interagency Committee on Urban Noise; 1980), and
* *Entering the Quiet Zone: Noise Compatible Land Use Planning* (FHWA brochure; 2002).

{(If contour lines were developed, KMZ files may be submitted with the final noise report. These KMZ files can be provided to the local officials. FHWA’s 2011 Guidance states, “Noise analysts usually develop the noise contours using the Noise Contour function of the FHWA TNM, or by modeling discrete receiver points and extrapolating between them. Either method can result in an inaccurate portrayal of the noise environment. When using the Noise Contour function, users must ensure the grid spacing provides a sufficient resolution to provide good results and when using discrete receivers, the user must ensure the receivers are close enough to enable relatively accurate extrapolation between receiver points.” However, the TNM function does not work well and isn’t used.)}

Impacts and Mitigation Commitments

{(Chapter 10 should either contain the first two sentences and nothing else OR the first two sentences should be deleted.)}This project is a programmatic CatEx. Therefore, it is not necessary to describe impacts and mitigation commitments. {OR} Because this project is a [NEPA classification] {(non-programmatic/documented CatEx, EA, or EIS)}, the following table that describes impacts on noise resources and mitigation commitments for noise resources is being provided. Information from this table is generally copied into the NEPA document table, which lists impacts and mitigation commitments for all resources. {(This table reflects the NEPA report template in use at the time this noise report template was released. If the table template has been revised, use the most recent version.)}

Table 13 Summary of Impacts and Mitigation Table for NEPA Documents

| Impact | Mitigation Commitment | Responsible Branch | Mitigation Timing / Phase |
| --- | --- | --- | --- |
| [xxxx] | [xxxx] | [xxxx] | [xxxx] |

{Information for table:

1. Table 13 is based on the CDOT *NEPA Manual* Table 9-2
2. If the noise analysis recommends at least one noise barrier, include a mitigation commitment of completing the final noise barrier design(s) during final design.}

SOURCES and REFERENCES

CDOT. 2020. *Noise Analysis and Abatement Guidelines*, September.

FHWA. 2006. *Construction Noise Handbook*, August.

FHWA. 2010. *Procedures for Abatement of Highway Traffic Noise and Construction Noise, 23*

*C.F.R. § 772.*

FHWA. 2011. *Highway Traffic Noise: Analysis and Abatement Guidance*, December.

FHWA. 2018. *Noise Measurement Handbook*, FHWA-HEP-18-065, June.

{(Add the reference(s) for the traffic study(ies) used in this noise analysis)}

Figure 1 [Project Name] Project Vicinity

{Include the following, at a minimum, on this figure:

* Existing condition labeled roadway(s) associated with project
* Proposed Action project limits, clearly labeled to show the basis of the Noise Study Zone
* Locator map (e.g., inset showing larger area with project area)
* Scale
* Compass rose or North arrow}

Figure 2 Noise Study Zone, Activity Categories, and Noise Measurement Locations

{Include the following, at a minimum, on this figure:

* Project name
* Existing condition labeled roadway(s) associated with project
* Project limits for Proposed Action
* Noise Study Zone boundary
* Noise measurement locations
* Activity Categories A through E locations/areas, if applicable
* Activity Category F locations/areas, if applicable
* Activity Category G areas, if applicable
* Scale (at a minimum, include 500 feet on the scale)
* Compass rose or North arrow

Information for figure:

1. If all of the information required to be on this figure cannot legibly fit on one page/one figure, create as many figures as needed and number them 2A, 2B, 2C, etc. Consider including a Figure 2 that is “zoomed out” and that shows boundaries of Figure 2A, 2B, 2C, etc.
2. Receivers will be shown on Figure 4 and do not need to be shown on this figure.
3. Areas representing Activity Categories A through G should be identified on this figure (e.g., color/symbol/hashlines). Each type of land use (e.g., Activity Category F) should be clearly distinguishable from other land uses (e.g., Activity Category B).
4. The activity category of all land within the Noise Study Zone must be identified.}

Figure 3 TNM Model Objects for Design Year ([design year]) Proposed Action

{Include the following, at a minimum, on this figure:

* Project name
* Modeled roadway(s)
* Modeled terrain lines, if applicable
* Modeled building rows, if applicable
* Buildings modeled as barriers, if applicable
* Retaining walls or vertical rock face cut slopes modeled as barriers, if applicable
* Modeled existing noise barriers, if applicable
* Modeled tree zones, if applicable
* Modeled ground zones, if applicable

Information for figure:

1. Do not include this figure if the model did not include any objects except for roads and receivers.
2. Only areas of the model that used objects need to be included. For example, if the project is a large corridor with terrain lines in the northern portion and an area where buildings were modeled as building rows in the southern portion, two figures could be shown: Figure 3A zoomed in on the terrain lines and Figure 3B zoomed in on the building rows.
3. This figure can be a screen shot from TNM, although it should be zoomed in enough so that details can be discerned; see #4.
4. If all of the information required to be on this figure cannot legibly fit on one page/one figure, create as many figures as needed and number them 3A, 3B, 3C, etc. Consider including a Figure 3 that is “zoomed out” and that shows boundaries of Figure 3A, 3B, 3C, etc.}

Figure 4 Roadways and Receiver Locations for Existing Condition ([existing year]) and Design Year ([design year]) No Action Alternative

{Include the following, at a minimum, on this figure:

* Project name
* Existing condition roadway(s) associated with project; include names of roadways that were modeled
* Noise Study Zone boundary
* Receiver locations for Activity Categories A through E; label with Receiver IDs
* For projects with No Action Alternatives, identify which receiver(s) are new or will be removed by the design year, if applicable (e.g., a key that uses one color dot to denote a receiver that remains in place or was in the existing condition noise model and another color dot to denote a receiver that will be added or removed for the design year No Action Alternative noise model. It would be helpful to use a dark and light color that can be distinguished when printing the document in black and white).
* Existing noise barriers, if applicable; label and/or include information in figure key
* Scale (at a minimum, include 500 feet on the scale)
* Compass rose or North arrow

Information for figure:

1. If the project does not have a No Action Alternative, remove “and [design year] No Action Alternative” from the figure title.
2. If all of the information required to be on this figure cannot legibly fit on one page/one figure, create as many figures as needed and number them 4A, 4B, 4C, etc. Consider including a Figure 4 that is “zoomed out” and that shows boundaries of Figure 4A, 4B, 4C, etc.}

Figure 5 Roadways and Receiver Noise Levels for Design Year ([design year]) Proposed Action (Impacts Identified)

{Include the following, at a minimum, on this figure:

* Project name
* Existing condition and Proposed Action roadway(s) associated with project
* Noise Study Zone boundary
* Receiver locations for Activity Categories A through E, labeled with Receiver IDs. Use a way to distinguish between receivers that have impacts and those that don’t (e.g., a key that uses one color dot to denote an impacted receiver and another color dot to denote a receiver that was not impacted. It would be helpful to use a dark and light color that can be distinguished when printing the document in black and white).
* Existing noise barriers, if applicable and if will still be in place in the design year; label and/or include information in figure key
* Scale (at a minimum, include 500 feet on the scale)
* Compass rose or North arrow

Information for figure:

1. If all of the information required to be on this figure cannot legibly fit on one page/one figure, create as many figures as needed and number them 5A, 5B, 5C, etc. Consider including a Figure 5 that is “zoomed out” and that shows boundaries of Figure 5A, 5B, 5C, etc.
2. If no impacts were identified for the Proposed Action and if Figure 5 would be the same as Figure 4 (e.g., no new roadways are being built, the number and location of receptors is the same in the design year as the existing condition year), it is acceptable to change the title of Figure 4 to “Roadways and Receiver Locations for Existing Condition ([existing year]) and Design Year ([design year]) Proposed Action” and not include Figure 5.}

Figure 6 Roadways and Receiver Noise Levels for Design Year ([design year]) Other Alternative (Impacts Identified)

{Include the following, at a minimum, on this figure:

* Project name
* Existing condition roadway(s) associated with project
* Noise Study Zone boundary
* Receiver locations for Activity Categories A through E, labeled with Receiver IDs; use a way to distinguish between receivers that have impacts and those that don’t (e.g., a key that uses one color dot to denote an impacted receiver and another color dot to denote a receiver that was not impacted. It would be helpful to use a dark and light color that can be distinguished when printing the document in black and white.
* Existing noise barriers, if applicable and if will still be in place in the design year; label and/or include information in figure key
* Scale (at a minimum, include 500 feet on the scale)
* Compass rose or North arrow

Information for figure:

1. This figure only applies if the project has at least one other alternative. If this figure does not apply, renumber subsequent figures and references to them within the report.
2. If the project has more than one other alternative, add one additional figure per other alternative and renumber subsequent figures and references to them within the report.
3. If all of the information required to be on this figure cannot legibly fit on one page/one figure, create as many figures as needed and number them 6A, 6B, 6C, etc. Consider including a Figure 6 that is “zoomed out” and that shows boundaries of Figure 6A, 6B, 6C, etc.}

Figure 7 Evaluated Noise Barrier Locations

{Include the following, at a minimum, on this figure:

* Project name
* Show locations of all barriers that were evaluated and are listed in Table 10. Figure should use a way to distinguish between barriers determined to be feasible and reasonable and those that weren’t (e.g., a key that uses one color barrier to denote it’s feasible and reasonable and another color barrier to denote it is not). It would be helpful to use a dark and light color that can be distinguished when printing the document in black and white.
* Roadway(s) associated with project that are relevant for the barrier map
* Receiver locations for Activity Categories A through E, labeled with Receiver IDs that are associated with the barrier. Use a way to distinguish between receivers that are benefited and those that aren’t (e.g., a key that uses one color dot to denote a benefited receiver and another color dot to denote a receiver that was not benefited. It would be helpful to use a dark and light color that can be distinguished when printing the document in black and white.
* Existing noise barriers, if applicable and if will still be in place in the design year; label and/or include information in figure key
* Scale (at a minimum, include 500 feet on the scale)
* Compass rose or North arrow

Information for figure:

1. This figure only applies if at least one noise barrier was evaluated. If this figure does not apply, renumber subsequent figures and references to them within the report.
2. If all of the information required to be on this figure cannot legibly fit on one page/one figure, create as many figures as needed and number them 7A, 7B, 7C, etc. Consider including a Figure 7 that is “zoomed out” and that shows boundaries of Figure 7A, 7B, 7C, etc.
3. If existing barriers may be removed and rebuilt as part of this project, include those barrier locations on this figure. Use a method to show a difference between existing barriers and new barriers that were evaluated as part of this noise analysis.
4. If receivers as listed in Table 9 had to be broken out into additional receivers in Table 11, this figure should show the additional receivers.}

Figure 8 Design Year ([design year]) Proposed Action NAC Activity Category G Noise Level Contours

{Include the following, at a minimum, on this figure:

* Project name
* Proposed design year roadway
* Activity Category G area boundaries (include either boundary line or show area as distinct color/hatching)
* Contour lines representing distances from the edge of the nearest travel lane of the highway improvement to where the design year noise levels reach 66 dBA, and 71 dBA for all Activity Category G areas
* Scale
* Compass rose or North arrow

Information for figure:

1. This figure should only be included if the project includes Activity Category G land use and if it made sense to show the distances to NACs on a figure, rather than in a table (e.g., a table would be used if the distances are minimal).
2. If all of the information required to be on this figure cannot legibly fit on one page/one figure, create as many figures as needed and number them 8A, 8B, 8C, etc. Consider including a Figure 8 that is “zoomed out” and that shows boundaries of Figure 8A, 8B, 8C, etc.
3. If using noise contour lines to screen alternatives, add one additional figure per alternative.}

Appendix A Field Noise Measurement Data

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Table A-1 Field Noise Measurement Traffic Volumes and Speeds Used in Validation

| Roadway | Measurement Location ID | Date and Time of Traffic Volume and Speed Measurement | Hourly Traffic Volume1 Cars | Hourly Traffic Volume1 Medium Trucks | Hourly Traffic Volume1 Heavy Trucks | Estimated Vehicular Speed2 (mph) | Posted Speed Limit3 (mph) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| [XXXXX] | [XX##] | [##/##/##] and [##:##] to [##:##] | [###] | [###] | [###] | [###] | [###] |
| [XXXXX] | [XX##] | [##/##/##] and [##:##] to [##:##] | [###] | [###] | [###] | [###] | [###] |
| [XXXXX] | [XX##] | [##/##/##] and [##:##] to [##:##] | [###] | [###] | [###] | [###] | [###] |
| [XXXXX] | [XX##] | [##/##/##] and [##:##] to [##:##] | [###] | [###] | [###] | [###] | [###] |
| [XXXXX] | [XX##] | [##/##/##] and [##:##] to [##:##] | [###] | [###] | [###] | [###] | [###] |
| [XXXXX] | [XX##] | [##/##/##] and [##:##] to [##:##] | [###] | [###] | [###] | [###] | [###] |

*Notes:*

1. Traffic volumes were measured during field noise measurements. These are shown on field data sheets, which are in this appendix. Traffic volumes are converted to an equivalent hourly volume, which are shown in this table.
2. Method[(s)] used to estimate vehicular speed: [xxxxxxxxxxxxxxxxxxxxxxxx]
3. Posted speeds are included for informational purposes. Estimated speeds were used when validating the existing conditions model.

{Information for table:

* 1. Provide the roadway name (e.g., I25, Grand Road) in the “Roadway” column.
	2. When listing traffic for a roadway using more than one row (e.g., breaking up EB vs WB traffic data; listed different segments of the roadway), include information in the “Roadway” column that can be used to identify which roadway section is which and how that section corresponds to the section name used in the model (e.g., EB vs WB, between X and Y streets or exits). The intention is that a reviewer can easily compare data in this table with data in the model.
	3. Posted speeds are included for informational purposes. Speeds must be estimated.
	4. If two or more measurements were taken at one location and only one of those was ultimately used to validate the existing condition noise model (e.g., the first measurement that was modeled validated the model so the second measurement was not even tried or the other measurements were not able to validate the model), only report in this table the measurement that was used in the model submitted to CDOT. In addition, only provide field data sheets for measurements included in this table.
	5. If traffic volumes were counted for buses and motorcycles, add columns for those.
	6. If traffic speeds were measured just before or after the field noise measurement and traffic volume data was collected, indicate when speeds were obtained separately, either within the table or as footnotes.}

{Information for the additional data requirements:

1. Attach field noise measurement field sheets to this appendix.
2. If possible, please provide page numbers for the field sheets. Because the field sheets are generally hand written, it is ok to hand write page numbers on them before scanning them. For example, if Table A-1 is two pages, the page number for the first field sheet would be page A-3.}

Appendix B TNM Noise Modeling Input Data

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Table B-1 Traffic Input Data

Existing Conditions Noise Model Traffic Data ([existing year])1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Roadway  | Number of Lanes | Cars /Lane / Hour | Medium Trucks / Lane / Hour | Heavy Trucks / Lane / Hour | Posted Speed (mph) |
| [XXXX] | [##] | [###] | [###] | [###] | [###] |
| [XXXX] | [##] | [###] | [###] | [###] | [###] |

Design Year No Action Noise Model Traffic Data ([design year])2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Roadway  | Number of Lanes | Cars /Lane / Hour | Medium Trucks / Lane / Hour | Heavy Trucks / Lane / Hour | Posted Speed (mph) |
| [XXXX] | [##] | [###] | [###] | [###] | [###] |
| [XXXX] | [##] | [###] | [###] | [###] | [###] |

Design Year Proposed Action Noise Model Traffic Data ([design year])3

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Roadway  | Number of Lanes | Cars /Lane / Hour | Medium Trucks / Lane / Hour | Heavy Trucks / Lane / Hour | Posted Speed (mph) |
| [XXXX] | [##] | [###] | [###] | [###] | [###] |
| [XXXX] | [##] | [###] | [###] | [###] | [###] |

Design Year Other Alternative Noise Model Traffic Data ([design year])4

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Roadway  | Number of Lanes | Cars /Lane / Hour | Medium Trucks / Lane / Hour | Heavy Trucks / Lane / Hour | Posted Speed (mph) |
| [XXXX] | [##] | [###] | [###] | [###] | [###] |
| [XXXX] | [##] | [###] | [###] | [###] | [###] |

*Notes:*

1. Existing Conditions traffic data source: [xxxxxxxxxxxxxxxxxxxxxxxx]
2. No Action traffic data source: [xxxxxxxxxxxxxxxxxxxxxxxx]
3. Proposed Action traffic data source: [xxxxxxxxxxxxxxxxxxxxxxxx]
4. Other alternative traffic data source: [xxxxxxxxxxxxxxxxxxxxxxxx]

{Information for figure:

1. Provide the roadway name (e.g., I25, Grand Road) in the “Roadway” column.
2. When listing traffic for a roadway using more than one row (e.g., breaking up EB vs WB traffic data; listed different segments of the roadway), include information in the “Roadway” column that can be used to identify which roadway section is which and how that section corresponds to the section name used in the model (e.g., EB vs WB, between X and Y streets or exits). The intention is that a reviewer can easily compare data in this table with data in the model.
3. If project traffic volumes exceeded the volumes shown in Table 3 of the CDOT NAAG, add a column with “Traffic Study Vehicles/Lane/Hour” as the column heading. Provide Table 3 traffic volumes from the CDOT NAAG, broken out by cars, medium trucks, and heavy trucks, in units of vehicles/lane/hour for each applicable Roadway Link. This way, the reader can see how project traffic volumes compare to the Table 3 volumes. Add a footnote that explains that the CDOT NAAG Table 3 volumes were used and why they were used.
4. This table will have between two to four sections for a project: Existing Condition, No Action, Proposed Action, and Other Alternative. All projects will have the Existing Condition and Proposed Action sections.
5. The No Action rows and associated footnote can be deleted if the project is a Categorical Exclusion that does not have a No Action alternative.
6. The Other Alternative rows and associated footnote can be deleted if the project does not have any other alternatives.
7. If the traffic source is the same for one or more scenarios (e.g., Existing, No Action), the footnotes can be consolidated.
8. If typical traffic data sources were not available for the project, explain that and explain how traffic data was developed in Chapter 4 of this report. Typical sources are project-specific traffic studies, travel demand models (by an MPO or CDOT), or CDOT’s Online Transportation Information System (OTIS). If maximum traffic volumes for the worst-noise hour from Table 3 of the NAAG were used, the unused project-specific data must also be presented in Table B-1 to show that it was higher than the CDOT NAAG Table 3 volumes.}

Appendix C TNM Noise Modeling Results

TNM files, which contain model inputs and outputs, were submitted electronically to CDOT

{TNM files should be submitted to CDOT at the same time as the first draft report. If any model changes (e.g., as part of the review process), the revised TNM file(s) must be submitted to CDOT when submitting the revised report.}

Appendix D Noise Abatement Evaluation Worksheet[(s)]

(CDOT Form 1209)

{Note the following for this appendix:

1. One Form 1209 should be filled out for each barrier listed in Table 10.
2. If the noise analysis did not evaluate any barriers, this appendix should be deleted.
3. The most current Form 1209 should be used. It is posted to CDOT’s noise website. At the time this report template was created, the most current form is from September 2020. It is a fillable PDF.
4. Form 1209 is formatted to allow the user to enter the page number. The first Form 1209 of the report would be page number D-1. A page number should be entered onto each form that is completed for the project.}

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1. A receiver is a modeled point that represents one or more receptors. Receptor types are listed in Table 3, in the column titled “Activity Description.” A receiver that represents more than one receptor must represent receptors of the same Activity Category. [↑](#footnote-ref-2)
2. Support determined through Benefited Receptor Preference Survey, which may be conducted after the NEPA process and is documented in a separate report. [↑](#footnote-ref-3)
3. In cases where a prospective barrier cannot benefit at least three impacted receptors because there are fewer than three impacted receptors behind the prospective barrier, the barrier does not need to be modeled to be determined that it is not feasible. These cases should be explained in the text of Section 6.3 for the Proposed Action and applicable sections for other design year action alternatives, but do not need to be included in Table 10. [↑](#footnote-ref-4)