I-25 (US 36 TO 104th AVENUE)
ENVIRONMENTAL ASSESSMENT

TRAFFIC NOISE TECHNICAL REPORT

NEPA Environmental Assessment

Project Number 0253-250 and Subaccount Number 21180

March 2020

Prepared for:

Colorado Department of Transportation
Region 1
2829 West Howard Place
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LIST OF ABBREVIATIONS AND ACRONYMS

CDOT	Colorado Department of Transportation
CFR	Code of Federal Regulations
dBA	A-weighted decibels
EB	eastbound
FHU	Felsburg Holt & Ullevig
FHWA	Federal Highway Administration
ft^2	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	CDOT's Noise Analysis and Abatement Guidelines
NB	northbound
NEPA	National Environmental Policy Act
SB	southbound
TNM	FHWA's Traffic Noise Model
WB	westbound

1 EXECUTIVE SUMMARY

This traffic noise technical report has been prepared in support of the I-25 North—US 36 to 104th Avenue project. **Table 1** includes an executive summary of this project's traffic noise analysis and abatement evaluation.

Table 1 Project Overview

Project Location and Type I Status Explanation	This project is located in Thornton, Northglenn, and Adams County, Colorado (see **Figure 1**). It is a Type I project because it would include construction of new general purpose driving lanes in each direction on I-25 from approximately 80th Avenue to 104th Avenue.

Noise Level and Impact Overview	• Existing (2017) modeled noise levels range from 28.3 to 76.3 A-weighted decibels (dBA) at 119 receivers, which represent 343 receptors.
	• Future (2040) modeled noise levels for the No Action Alternative range from 29.0 dBA to 76.8 dBA at 119 receivers, which represent 343 receptors.
	• Future (2040) modeled noise levels for the Proposed Action range from 29.5 dBA to 76.3 dBA at 116 receivers, which represent 340 receptors. The Proposed Action is expected to impact the following receivers and receptors:
	  ○ Activity Category B: 27 receivers representing 106 receptors
	  ○ Activity Category C: 11 receivers representing 11 receptors
	  ○ Activity Category E: 1 receiver representing 1 receptor

Noise Abatement Considerations and Commitments Overview	Noise impacts were calculated for the Proposed Action in 2040. However, this study concluded that four CDOT noise barrier groups already present along I-25 in the project corridor will still be effective abatement actions and will not be changed—2040 impacts in these areas were not evaluated for further abatement. One noise barrier (CDOT Wall 300) will be removed and replaced with an equivalent barrier. For the other impacted areas, 5 noise barriers were evaluated, as shown on **Figure 6**. No new noise abatement barriers were found to be feasible and reasonable within the Noise Study Zone.
Information for Local Officials	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 does need to be submitted to local officials, as described in Section 9.

2 PROJECT INTRODUCTION

The Colorado Department of Transportation (CDOT), in cooperation with the Federal Highway Administration (FHWA), is preparing an Environmental Assessment for this project. The improvements, which are described in **Table 2** and hereafter called the Proposed Action, constitute a Type I project because the Proposed Action would include construction of a new general purpose driving lane in each direction on I-25 from approximately 80th Avenue to 104th Avenue.

Because the project is Type I and because there are Activity Category A, B, C, D, or E receptors within the Noise Study Zone, a noise analysis is needed to evaluate if noise impacts will result from building the project. A noise analysis was conducted for the project and a report was prepared . **Table 2** includes information about this project and context for this traffic noise analysis.

Table 2 Project Background

Project Location	The project is located in Thornton and Adams County, Colorado (see **Figure 1**).
Affected Roadways	I-25 mainline and ramps; 88th Avenue.
Project Purpose and Need	The Proposed Action is intended to relieve congestion, improve safety, enhance multimodal travel, and replace aging infrastructure on I-25 from approximately 80th Avenue to 104th Avenue, which is an approximately 4-mile-long segment.
Proposed Action Description	This project would include: • Adding one general-purpose lane to the existing three lanes for each travel direction on I-25 from 84th Avenue to Thornton Parkway with the northbound general-purpose lane extending to 104th Avenue • Adding an auxiliary lane to I-25 from 84th Avenue to Thornton Parkway • Replacing the 88th Avenue bridge over I-25 • Widening I-25 inside and outside shoulders to 12 feet throughout • Widening I-25 Express Lane buffers from 2 feet to 4 feet • Accommodating a Regional Transportation District inline I-25 median bus station near 88th Avenue
No Action Alternative Description	No improvements within the Noise Study Zone would be made.
Prior National Environmental Policy Act (NEPA) Approvals	The project follows previous efforts considered under the North I-25 Final Environmental Impact Statement. The corridor also overlaps the North I-25 Express Lanes: US 36 to 120th Avenue project.

3 BACKGROUND

This noise analysis was conducted as required by 23 CFR 772 in accordance with CDOT's *Noise Analysis and Abatement Guidelines* (NAAG) (CDOT, 2015) and FHWA's *Highway Traffic Noise: Analysis and Abatement Guidance* (Guidance) (FHWA, 2011). The analysis determines whether 2040 traffic noise levels from the Proposed Action will exceed applicable impact thresholds at properties (i.e., receptors) near the proposed improvements of the Proposed Action. Traffic noise abatement is evaluated for any such impacted receptors. This noise analysis included the following tasks:

- Conducting field measurements of existing sound levels (see **Section 4.1**)
- Validating a noise model using the field measurement results (see **Section 4.2**)

- Modeling existing noise conditions for existing roadways (see **Sections 4.3** and **Section 5**)
- Modeling future build alternatives and a future no action alternative (see **Sections 4.3** and **Section 5**)
- Completing noise abatement evaluation (see **Section 6**)
- Determining noise contour lines for unpermitted, undeveloped land (see **Section 9**)

3.1 Characteristics of Noise

CDOT's NAAG includes fundamental information about traffic noise, such as terminology, how sound travels, and sound intensity. It is incorporated by reference to supplement this report.

3.2 Applicable Regulations, Guidelines, and Tools

The following regulations, guidelines, and tools were used to complete this noise analysis:

- ***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 that included adopting specific parameters such as the noise reduction design goal.
- **CDOT NAAG** (CDOT, 2015): 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.
- ***Measurement of Highway-Related Noise*** (FHWA, 1996): Includes procedures for measuring highway noise.
- **FHWA Traffic Noise Model (TNM) Version 2.5** (FHWA, February 2004): Model used to determine existing noise levels and design year noise impacts.

3.3 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 for the Proposed Action equals or exceeds CDOT's Noise Abatement Criteria (NAC) at a minimum of one receptor.
- Predicted design year traffic noise level for the Proposed Action substantially exceeds (defined as a noise increase of 10 dBA or more) the existing highway traffic noise level at a minimum of one receptor.

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

The NAC for Activity Category D applies to certain 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" for the Proposed Action 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

Activity Category	Activity L_{eq} (dBA)[1]	Evaluation Location	Description of Land Use Category
A	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[2]	66	Exterior	Residential
C[2]	66	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	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.
E[2]	71	Exterior	Hotels, motels, time-share resorts, vacation rental properties, 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), and warehousing.
G	Not Applicable	Not Applicable	Undeveloped lands that are not permitted for development.

[1] Hourly A-weighted sound level in dBA, reflecting a 1-dBA approach value below 23 CFR 772 values
[2] Includes undeveloped lands permitted for this activity category.

4 NOISE ANALYSIS METHODS

The 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 noise model, and inputting several parameters into the noise model. These steps are described in this section.

4.1 Noise Study Zone Identification

The Noise Study Zone for this project extends 500 feet in all directions from the proposed edge of travel lanes for the Proposed Action throughout the project extent, as shown on **Figure 2.**

4.2 Land Use Identification

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

Table 4 Land Use Considerations

Receiver Activity Category Summary (Appendix C)	Receivers with the following Activity Categories were modeled in the existing condition and 2040 No Action scenarios: • Activity Category B: 93 receivers representing 317 receptors • Activity Category C: 17 receivers representing 17 receptors • Activity Category D: 2 receivers representing 2 receptors • Activity Category E: 7 receivers representing 7 receptors Receivers with the following Activity Categories were modeled in the 2040 Proposed Action: • Activity Category B: 93 receivers representing 317 receptors • Activity Category C: 14 receivers representing 14 receptors • Activity Category D: 2 receivers representing 2 receptors • Activity Category E: 7 receivers representing 7 receptors
Other Considerations	• The Noise Study Zone does not contain any permitted receptors that have not been built. • The Noise Study Zone contains Activity Category F activities and Activity Category G land. 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 for Activity Category G lands are shown on • **Figure** 7. • The Noise Study Zone has 13 Section 4(f) site(s) with frequent human use. These were already identified for Activity Category C. The Proposed Action will remove three of these (**Figure 4**). • The Noise Study Zone has no Section 106 sites.

4.3 Noise Measurements

Table 5 and **Table 6** summarize noise measurement information and procedures used for this analysis. Traffic noise measurements were performed at different locations to acquire data for TNM model validation (**Figure 2**). Traffic counts and speeds, listed in **Table 7**, were collected during the noise measurement periods. **Appendix A** includes noise measurement field data sheets.

Table 5 Noise Measurement Summary

Measurement Location ID	Location (see Figure 2)	Date	Time (a.m. or p.m.)		Length (minutes)
			Start	Stop	
1	Niver Creek Trail	4/12/2017	10:47 a.m.	11:00 a.m.	15
2	Niver Creek Tributary L Trail	4/12/2017	11:30 a.m.	11:45 a.m.	15

Table 6 Noise Measurement Information

Number of Noise Measurement Locations	2
Noise Measurement Locations	These locations were selected because they represent Category C receptors and Category B receptors without existing abatement walls. The Category B areas next to I-25 in the study area already have abatement walls.
Basis for Measurement Length	I-25 is heavily traveled with relatively consistent traffic flow that has traffic noise that stabilizes quickly.
Method to Estimate Traffic Volume During Noise Measurement	FHU staff visually counted each I-25 direction during the measurement and logged information on a field sheet.
Method to Estimate Traffic Speed	Drove test vehicle through traffic shortly after measurements.
Weather Conditions (See Appendix A)	Noise measurements were made during weather conditions acceptable according to FHWA guidance (FHWA, 1996). Weather conditions, including wind speed and direction, were monitored during the measurements.
Sound Level Meter Used	NTI XL2 Type I
Sound Level Meter Laboratory Calibration Date	7/12/16
Field Calibrator Used	NTI CAL200 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.
Height of Noise Measurement Above Grade	5 feet

Table 7 Noise Measurement Traffic Volumes and Speeds Used in Model Validation

Measurement Location ID	Roadway	Equivalent Hourly Traffic Volume			Estimated Vehicle Speed (mph)	Posted Speed Limit (mph)
		Cars	Medium Trucks	Heavy Trucks		
1	I-25 SB	4340	180	312	55	55
1	I-25 NB	4200	184	360	55	55
2	I-25 SB	5188	156	364	55	55
2	I-25 NB	5080	92	320	55	55

4.4 TNM Model Validation

Existing noise levels were measured in the field, as described in Section **4.1**, and compared to computer predictions to verify the accuracy of the computer model. This process is called model validation. If the predicted and measured levels are within ±3 dBA of one another, the model is within the accepted level of accuracy and is considered to have been validated. **Table 8** presents measured noise levels, corresponding modeled noise levels, and the differences between the two.

Differences between measured and predicted levels are all within the allowable ±3 dBA tolerance. Therefore, the noise model is considered to be validated for this project.

Table 8 Noise Measurement Results and Model Validation Summary

Noise Measurement Location ID	Location (see Figure 2)	Measured Leq (dBA)	Modeled Leq (dBA)	Difference (dBA)
1	Niver Creek Trail	71.5	72.5	+1.0
2	Niver Creek Tributary L Trail	60.0	60.4	+0.4

4.5 TNM Model Inputs

The noise model software used on this project was TNM Version 2.5, as required by FHWA. It was used to analyze noise levels for existing (2017) and future (2040) conditions at receivers in the Noise Study Zone. Each receiver represented one or more receptors. The modeling results presented in this report are predicted traffic conditions during peak, worst-hour noise periods. In 2040, some predicted traffic volumes for 2040 No Action and the Proposed Action exceed the hourly lane limits listed in Exhibit 4 of the NAAG (CDOT, 2015). For these lanes, Exhibit 4 volumes were used in the TNM models. **Table 9** describes model inputs and methods.

Table 9 TNM Model Inputs

Noise Sensitive Receptors	Noise sensitive receptors are defined according to CDOT's NAC (**Table 3**). Receivers (modeled points) have been selected to represent these receptors within the Noise Study Zone.
Receivers	Receivers are listed in **Appendix C** and shown on **Figure 4**.
Modeled Roadways	The following roadways were modeled: • I-25—mainline, express lanes, bus lanes, ramps • 84th Avenue • 88th Avenue • Thornton Parkway • 104th Avenue US 36 was not modeled because it is at least 4,500 feet from the nearest model receiver and not a substantive traffic noise source. For the design year conditions, the analyses included roads that would be changed or newly built by the project, would have substantially different traffic volumes because of an alternative, or would be important local traffic noise sources.
Differences in How Roadways Were Modeled Between Alternatives	Between Existing and No Action, the only model differences were traffic volumes. For the Proposed Action, widened I-25 with 2040 traffic volumes were used. The replaced 88th Avenue bridge had no substantive effect on the models. Note: This project does not include building an inline bus station on I-25.
TNM Objects and Elevations	The following types of TNM objects were modeled: terrain lines, buildings as building rows, buildings as barriers, noise barriers, Type 7 barriers and ground zones, as shown on **Figure 3**.
Existing Noise Barriers	The Noise Study Zone contains five existing CDOT noise barriers groups. One near 88th Avenue is expected to be removed and replaced for the Proposed Action.
Modeled Pavement Type	Average
Default Ground Type	Lawn
Traffic Data (See Appendix B)	• Model coordinates generated from aerial photographs and CAD files • Traffic volumes from the traffic study performed for the project (FHU, 2017). • Vehicle mixes from CDOT OTIS reported data. • Worst traffic noise hour for all modeled conditions concluded to be the morning peak due to highest traffic volumes on modeled roads.

5 TNM RESULTS

In the analysis, 119 receivers representing 343 receptors were modeled (**Appendix C**). The resulting modeled noise levels were used to identify which, if any, receptors would be impacted as a result of the Proposed Action.

5.1 Existing Conditions Summary

Under 2017 existing conditions, modeled noise levels at the 119 receivers range from 28.3 to 76.3 dBA. **Figure 4** shows the locations of modeled receivers. **Appendix C-1** has the modeled noise level at each receiver. Existing conditions are not described as having noise impacts. If the project was not built, the project would not be responsible to mitigate noise via an abatement measure regardless of if existing noise levels exceed NACs.

5.2 No Action Alternative Summary

Under the 2040 No Action Alternative, modeled noise levels at the 119 receivers range from 29.0 to 76.8 dBA. **Figure 4** shows the locations of modeled receivers. **Appendix C-1** has the modeled noise level at each receiver. No Action Alternatives are not described as having noise impacts. If the project was not built, the project would not be responsible to mitigate noise via an abatement measure regardless of if No Action Alternative noise levels exceed NACs.

5.3 Proposed Action Summary

Under the 2040 Proposed Action, modeled noise levels at 116 receivers range from 29.5 to 76.3 dBA, and 39 receivers representing 118 receptors were calculated to exceed the applicable NAC. No receivers would experience a substantial noise increase of at least 10 dBA. Therefore, 118 receptors would be impacted during the 2040 peak noise hour (**Figure 5**). **Appendix C-1** identifies the modeled noise level at each receiver.

The Noise Study Zone has two Activity Category D receptors, which by definition do not have exterior areas of frequent human use. The noise level at the exterior of one of these buildings would have an impact for Activity Category C. For thoroughness, the interior noise levels were evaluated following Exhibit 3 of CDOT's NAAG. Interior noise levels were calculated by subtracting the noise reduction factor of 35 dBA (for masonry/double glazed windows) from the exterior noise levels calculated for the buildings. The resulting interior noise levels were calculated to be less than the Activity Category D NAC of 51 dBA. Therefore, none of the Activity Category D receptors were concluded to be impacted.

5.4 Considered Alternative Summary

This project does not have any Considered Alternatives.

6 NOISE ABATEMENT EVALUATION

As described in **Section 5**, noise would impact 118 receptors in the Noise Study Zone in 2040 under the Proposed Action. Therefore, abatement for the impacted receptors was evaluated in accordance with guidelines from CDOT's NAAG and FHWA's Guidelines. Although abatement was required to be evaluated, abatement would be recommended only for inclusion in the project when determined to be both feasible and reasonable.

A noise abatement action is feasible if it:

- Provides at least 5 dBA of noise reduction for at least one receptor
- Does not have any "fatal flaw" issues (e.g., safety, maintenance, access, drainage)
- Does not exceed 20 feet in height

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

- Meets the minimum design goal of at least 7 dBA of noise reduction for at least one receptor
- Equals or costs less than the Cost Benefit Index of $6,800/dBA/receptor of benefit
- Has support from more than 50 percent of the potentially benefitted receptors (determined through Benefited Receptor Preference Survey, which may be conducted after the NEPA process and documented in a separate report)

6.1 Noise Abatement Options Considered

Noise barriers (walls and to a lesser extent berms) are commonly used as noise abatement and must be evaluated for all impacted receptors, per 23 CFR 772.13(c)(1). Other mitigation measures may also be considered, including traffic management measures (such as 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; acquisition of real property or interests therein to serve as a buffer zone to preempt development that may be adversely impacted by traffic noise; and noise insulation (for Activity Category D facilities only). However, non-barrier mitigation measures are generally not feasible and/or reasonable. For this project, noise walls were the only abatement evaluated.

6.2 Discussion of Existing CDOT Noise Barriers

Previous projects installed five groups of existing CDOT noise abatement barriers along I-25 in the Noise Study Zone (**Figure 4**). These barriers were intended to benefit the five main residential areas abutting I-25. Because the Proposed Action is not expected to physically affect four of these barriers, the effectiveness of these barriers with the Proposed Action was evaluated through TNM modeling. All four barriers were found to be effective in 2040 for the Proposed Action without modification. Each barrier would provide noise reductions at or above the CDOT design goal of 7 dBA (**Appendix C-4**). The barriers cover the entire neighborhoods in question. This does not mean that every impacted receptor would benefit or that there are no remaining noise impacts behind the barriers (e.g., upper floors of apartment buildings). But, these four existing noise barriers are effective as-is under CDOT's current protocols. Therefore, no further noise abatement for these areas (**Figure 6**) was evaluated for the Proposed Action because effective noise abatement has already been provided.

One existing barrier (**Figure 5**), will need to be removed for the Proposed Action and rebuilt. The existing barrier is approximately 13 feet tall and 1,275 feet long. A replacement barrier in the same general location will be provided as part of the Proposed Action. The proposed location is on a new retaining wall along I-25 that is up to 18 feet farther east than the existing barrier, closer to the impacted Ashford East 88 Apartments. A wall at this location that is approximately 13 feet tall (above ground on the apartment side) and 1,300 feet long was found to provide similar or better noise-reduction than the existing barrier and is the recommended replacement wall. The barrier would provide noise reductions at or above the CDOT design goal of 7 dBA at multiple receptors, and many front-row receptors were found to benefit with a minimum 5-dBA reduction. This does not mean that every impacted receptor would benefit or that there are no remaining noise impacts behind the barriers (e.g., upper floors of apartment buildings). This barrier is included as a replacement for a demolished noise abatement action from a previous project. Barrier evaluation criteria are presented in **Tables C-2 and C-3** of **Appendix C-2**.

6.3 Noise Barrier Evaluation

The Proposed Action impacts were divided into five abatement evaluation areas (**Figure 6**). Barrier placement in multiple locations was considered for the impacted receptors, exclusive of the areas described in **Section 6.2**. The placement determined to be the best performer for each set of impacted receivers was optimized, and those results are described in **Appendix C-2**. **Figure 6** shows the best performing evaluated barrier location. **Appendix C-3** lists TNM noise level results for these prospective barriers. **Appendix D** includes five CDOT Noise Abatement Determination Worksheets (CDOT Form 1209); one was completed for each evaluated barrier.

Five impacted areas and five potential noise barriers were evaluated for the Proposed Action. Of these evaluated noise barriers, none of the potential barriers were found to be feasible and reasonable (**Figure 6** and **Appendix C-2**).

6.4 Noise Abatement Insulation

The Noise Study Zone has Activity Category D receptors. As discussed in **Section 5.3**, none of these receptors were found to be impacted under the Proposed Action. Therefore, noise insulation is not being considered for the Proposed Action.

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 noise levels are 75 dBA or greater or where the projected increase over existing levels is 30 dBA or more and no other possible abatement is reasonable and feasible. Two third-floor receivers, E2-B-133-3 and E2-B-134-3, were calculated to have 2040 exterior noise levels of 75 dBA or more. These receivers are in the Ashford East 88 Apartments, which will be receiving a noise abatement barrier.

7 STATEMENT OF LIKELIHOOD

Section 6 described the noise abatement evaluation for the Proposed Action. For the Proposed Action, traffic noise in 2040 would affect 39 receivers, representing 118 receptors. Impacted residential areas consisted primarily of the Western Hills, Ashford East 88 Apartments and Northglenn neighborhoods (**Figure 5**). Other impacted locations include a bicycle trail, Civic Center Park, a cemetery, and medical office balconies. Noise abatement at these locations was determined not to be feasible and/or reasonable, as described in **Section 6.3** and **Appendix C-2**. Therefore, no noise barriers are recommended to be constructed. Note that

feasibility and reasonableness determinations for this project may change if there are changes in final design after approval of the NEPA documentation.

8 CONSTRUCTION NOISE

This section describes construction noise implications, construction noise mitigation strategies, and indicates whether the project is in an area with local noise ordinances.

8.1 Construction Noise Implications

Properties adjoining project construction may be exposed to noise from construction activities from the Proposed Action. **Table 10** presents examples of noise from construction equipment. Construction noise differs from traffic noise in several ways:

- Construction noise lasts only for the duration of the construction event, with most construction activities in noise-sensitive areas being conducted during hours that are least disturbing to most nearby residents.
- Construction activities generally are short term and, depending on the nature of the construction operations, could last from seconds (e.g., a truck passing a receptor) to months (e.g., bridge construction).
- Construction 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 10 Typical Construction Equipment Noise

Equipment	Maximum Noise Level (dBA at 50 feet)[1]
Scraper	89
Dozer (Bulldozer)	85
Truck (Heavy Truck)	88[2]
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 (FHWA, 2006), unless otherwise noted.
2. This noise level is from Table 9.9 of FHWA's 2006 Construction Noise Handbook (FHWA, 2006), which is taken from Chapter 12 of the FTA Transit Noise and Vibration Guidance Handbook.

8.2 Construction Noise Mitigation Strategies

To minimize construction noise levels, typical best management practices will be incorporated into construction contracts where it is appropriate to do so and may include:

- 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. Maintain equipment on a regular basis; 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.
- 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.

8.3 Local Noise Ordinances

Three jurisdictions with different regulatory situations are important for the Noise Study Zone. The City of Thornton Code of Ordinances Section 38-441 places limits and requirements on noise levels, including construction activities, that may be referenced for relevant details. The City of Northglenn Municipal Code Article 9-13 places limits and requirements on noise levels, including nighttime construction activities, that may be referenced for relevant details. Adams County does not have any relevant noise ordinances. The Colorado Noise Statute 23-5-12-103 would apply there. 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.

9 INFORMATION FOR LOCAL OFFICIALS

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 submitted to local officials to support local land use planning decisions and future development.

Contour lines, representing distances from the edge of the nearest travel lane of the highway improvement to where the design year (2040) noise levels reach Activity Category B and C's NAC (66 dBA) and Activity Category E's NAC (71 dBA), were developed for several locations in the Noise Study Zone and are shown on **Figure 7**. Distances vary over the corridor due to topography and changing road conditions. In general for Area 1, land within approximately 210 feet from the proposed new edge of the nearest travel lane are predicted to exceed 66 dBA during peak traffic noise hours, and within approximately 175 feet will exceed 71 dBA. In general, for Areas 2 and 3, land within approximately 450 feet from the proposed new edge of the nearest travel lane is predicted to exceed 66 dBA during peak traffic noise hours, and within approximately 230 feet will exceed 71 dBA. In general, for Area 4, land within approximately 350 feet from the proposed new edge of the nearest travel lane is predicted to exceed 66 dBA during peak traffic noise hours, and within approximately 130 feet will exceed 71 dBA. In general, for Area 5, land within approximately 100 feet from the proposed new edge of the nearest travel lane is predicted to exceed 66 dBA during peak traffic noise hours, and the 71-dBA contour would be within the right-of-way. In general, for Area 6, both the 66-dBA and 71-dBA contours would be within the right-of-way. Properties developed within the impacted 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. CDOT's 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 and future noise levels for these lands but will not be required to provide noise abatement for development on these lands if it was permitted after the Date of Public Knowledge. Decisions concerning such noise abatement are left to local government agencies and private developers. 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. Decisions concerning such noise abatement are left to local government agencies and private developers.

10 SUMMARY OF NOISE IMPACTS AND ABATEMENT FINDINGS

The standard CDOT impacts table for noise for this project is presented in **Table 11**. The standard CDOT abatement table for noise for this project is presented in **Table 12**.

Table 11 Summary of Noise Impacts for No Action and Proposed Action

Context	No Action	Proposed Action
Traffic noise is considered in the context of the noise levels at exterior areas of frequent human use at sensitive properties such as homes, schools, parks, etc. There are five existing CDOT noise barriers within the Noise Study Area; two are located south of 84th Avenue on the east and west sides of I-25, one is located just north of 88th Avenue on the east side of I-25, one is located between Thornton Parkway and 104th Avenue on the west side of I-25, and the fifth is located north of 104th Avenue on the east side of I-25. For this noise analysis, 119 receivers representing 343 receptors were modeled. Modeled noise levels at the 119 receivers range from 28.3 to 76.3 dBA.	**Permanent Impacts** Under the 2040 No Action Alternative, modeled noise levels at the 119 receivers range from 29.0 to 76.8 dBA. No Action Alternatives are not described as having noise impacts. If the project was not built, the existing noise barriers would remain and CDOT would not be required to mitigate regardless of if No Action Alternative noise levels exceed Noise Abatement Criteria (NACs).	**Permanent Impacts** An existing noise barrier near 88th Avenue must be removed to construct the Proposed Action. CDOT policy directs that this barrier must be replaced. Under the 2040 Proposed Action, modeled noise levels at 116 receivers range from 29.5 to 76.3 dBA. 118 receptors were calculated to exceed the applicable NAC. No receivers would experience a substantial noise increase of at least 10 dBA. Therefore, 118 receptors would be impacted during the 2040 peak noise hour. **Temporary Impacts** Properties adjoining project construction may be exposed to noise from construction activities from the Proposed Action.

Table 12 Summary of Abatement Actions for Noise Impacts

Impact	Mitigation Commitment	Responsible Branch	Mitigation Timing/Phase
Removal of existing noise barrier and noise impacts from traffic	An existing noise barrier near 88th Avenue must be removed to construct the Proposed Action. A feasible, reasonable replacement barrier has been identified and will be constructed. Five potential new noise barriers were evaluated for the 118 impacted receptors. None of the barriers were found to be feasible and reasonable, so no new noise barriers are recommended for the Proposed Action.	CDOT Construction	Construction
Noise impacts from construction activities on adjoining properties	To minimize construction noise levels, typical best management practices will be incorporated into construction contracts where it is appropriate to do so and may include: • 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. Maintain equipment on a regular basis; 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. • 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.	CDOT Construction	Construction

11 SOURCES AND REFERENCES

Colorado Department of Transportation (CDOT). 2015. *Noise Analysis and Abatement Guidelines*, January.

Felsburg Holt & Ullevig. 2017. *Traffic Analysis, I-25 North, US 36 to Thornton Parkway Project*, May.

Federal Highway Administration (FHWA). 1996. *Measurement of Highway-Related Noise*, May.

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

Procedures for Abatement of Highway Traffic Noise and Construction Noise, 23 C.F.R. § 772 (2010).

Figure 1 I-25 North US 36 to 104th Avenue Project Vicinity

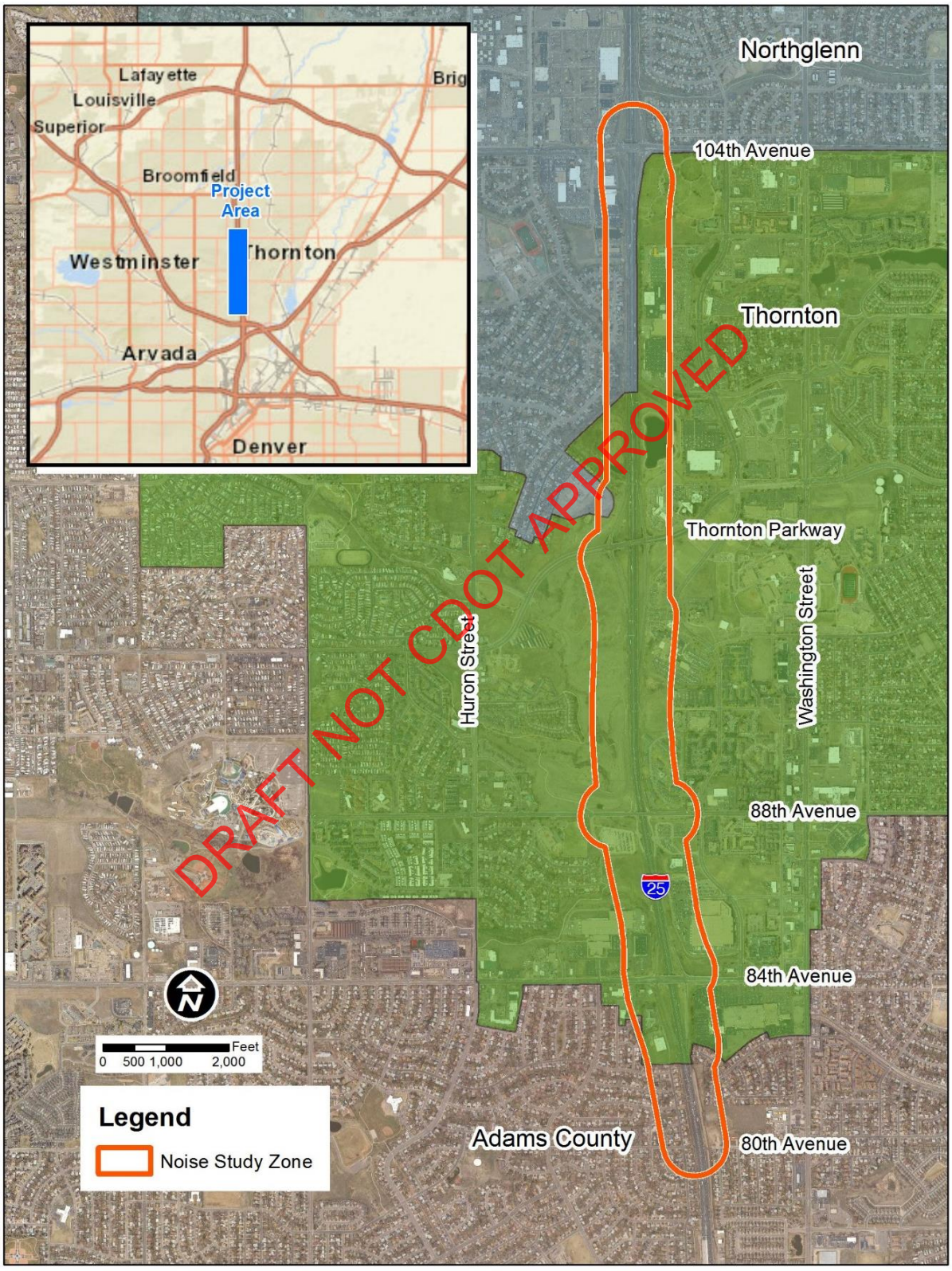


Figure 2 Noise Study Zone, Activity Categories and Noise Measurement Locations

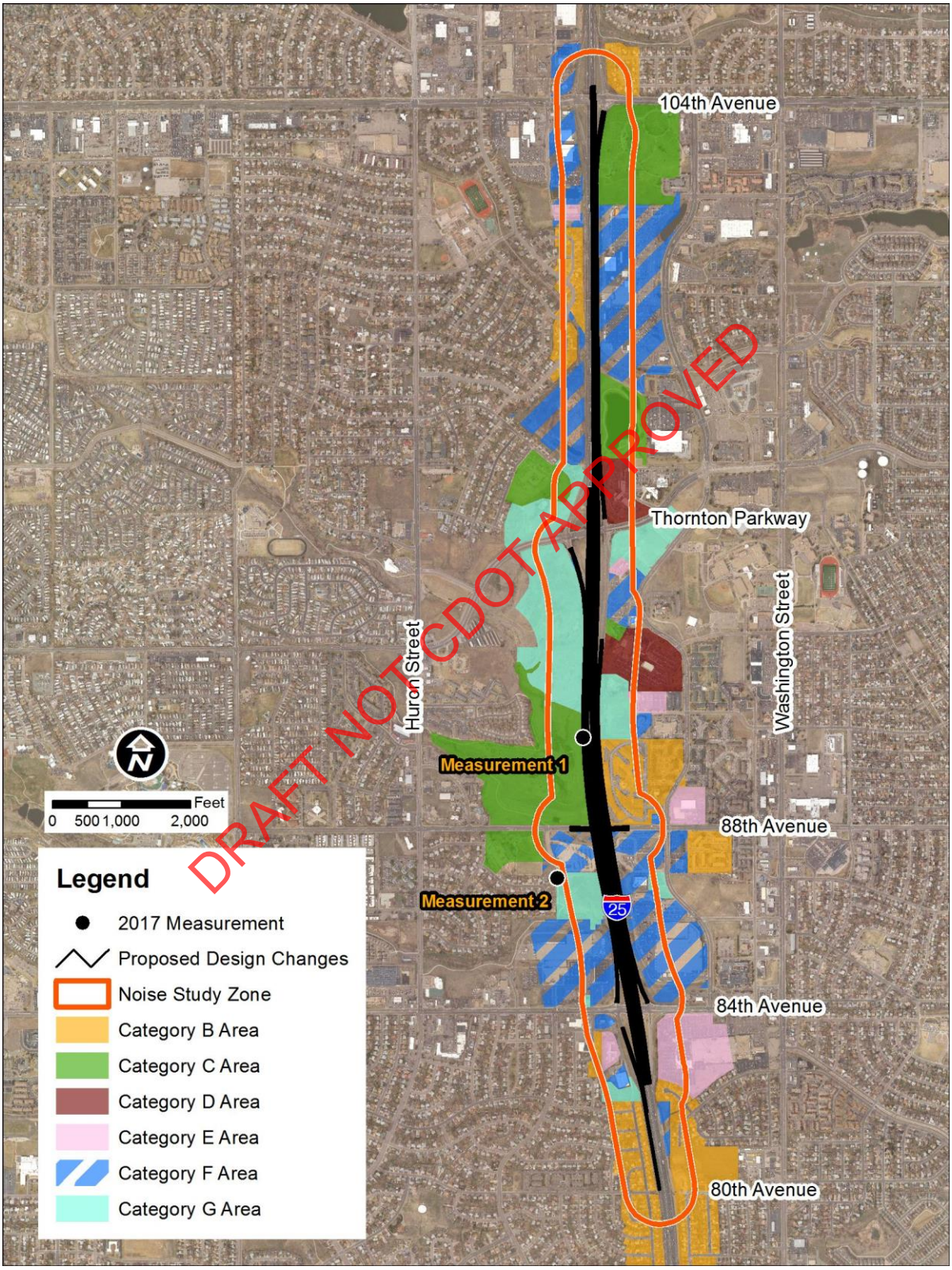


Figure 3 TNM Model Objects in Noise Study Zone for Existing Conditions

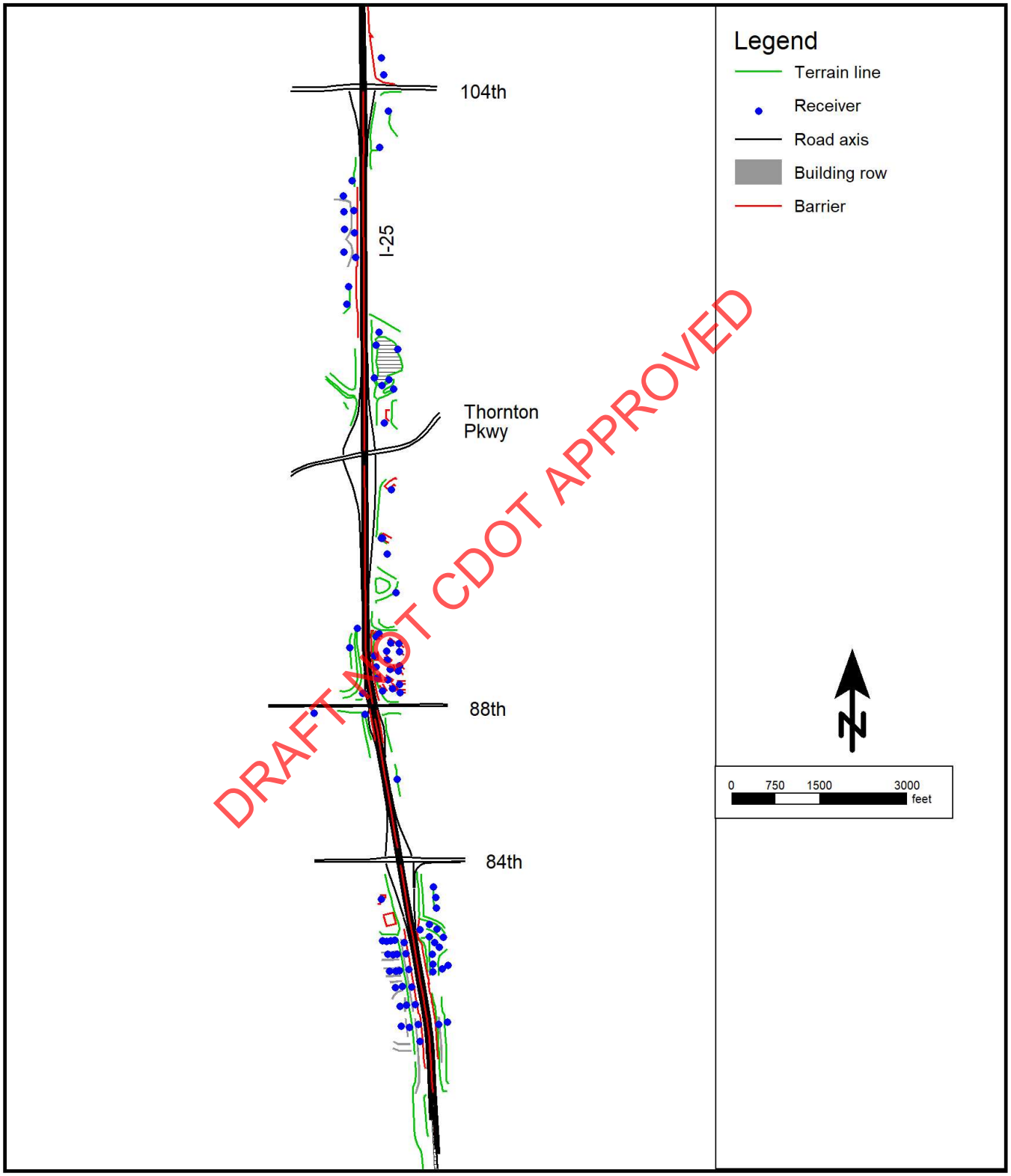


Figure 4 Receiver Locations for Noise Study Zone—Existing and 2040 No Action

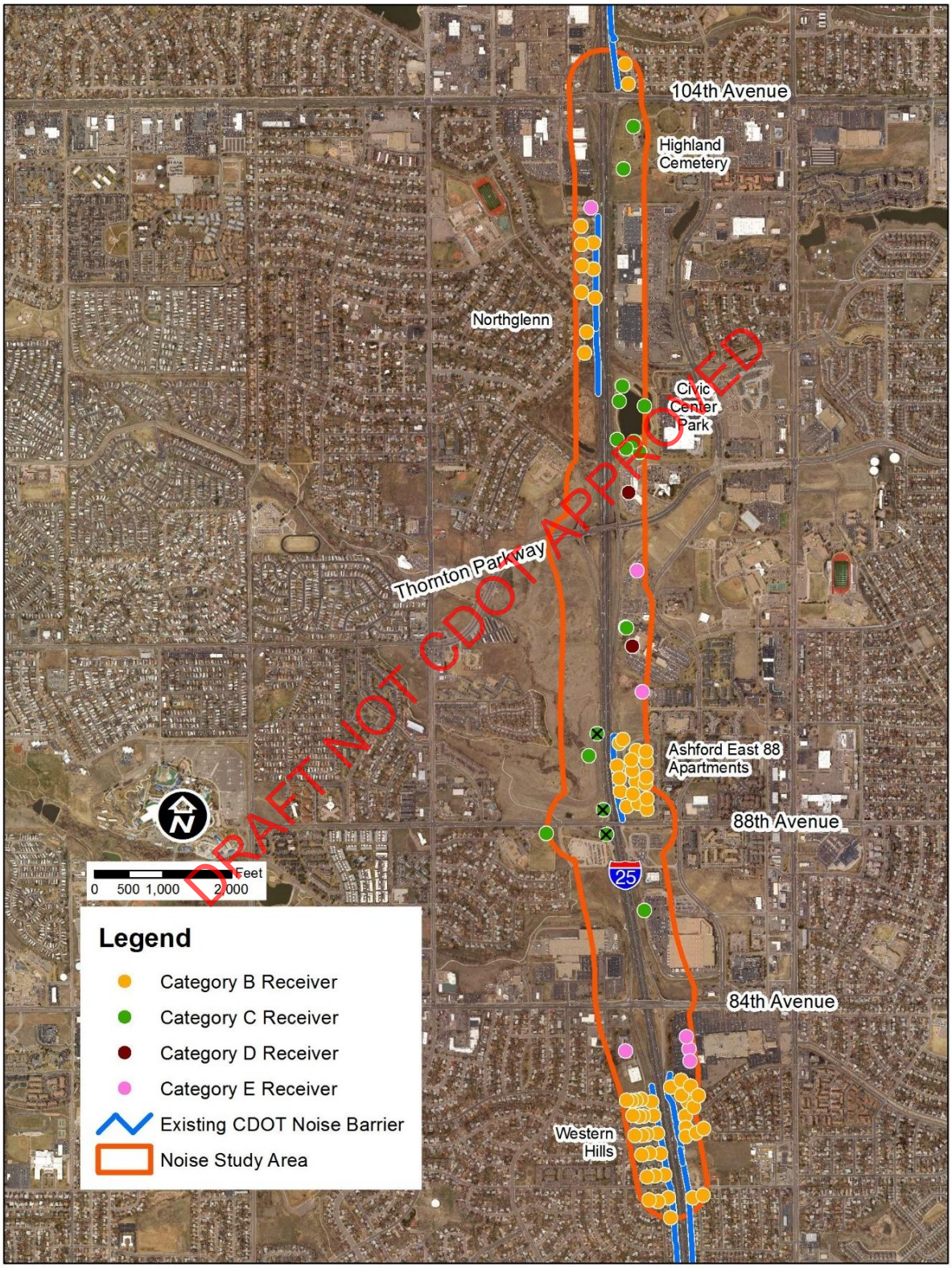


Figure 5 Roadways and Impacted Receivers for 2040 Proposed Action

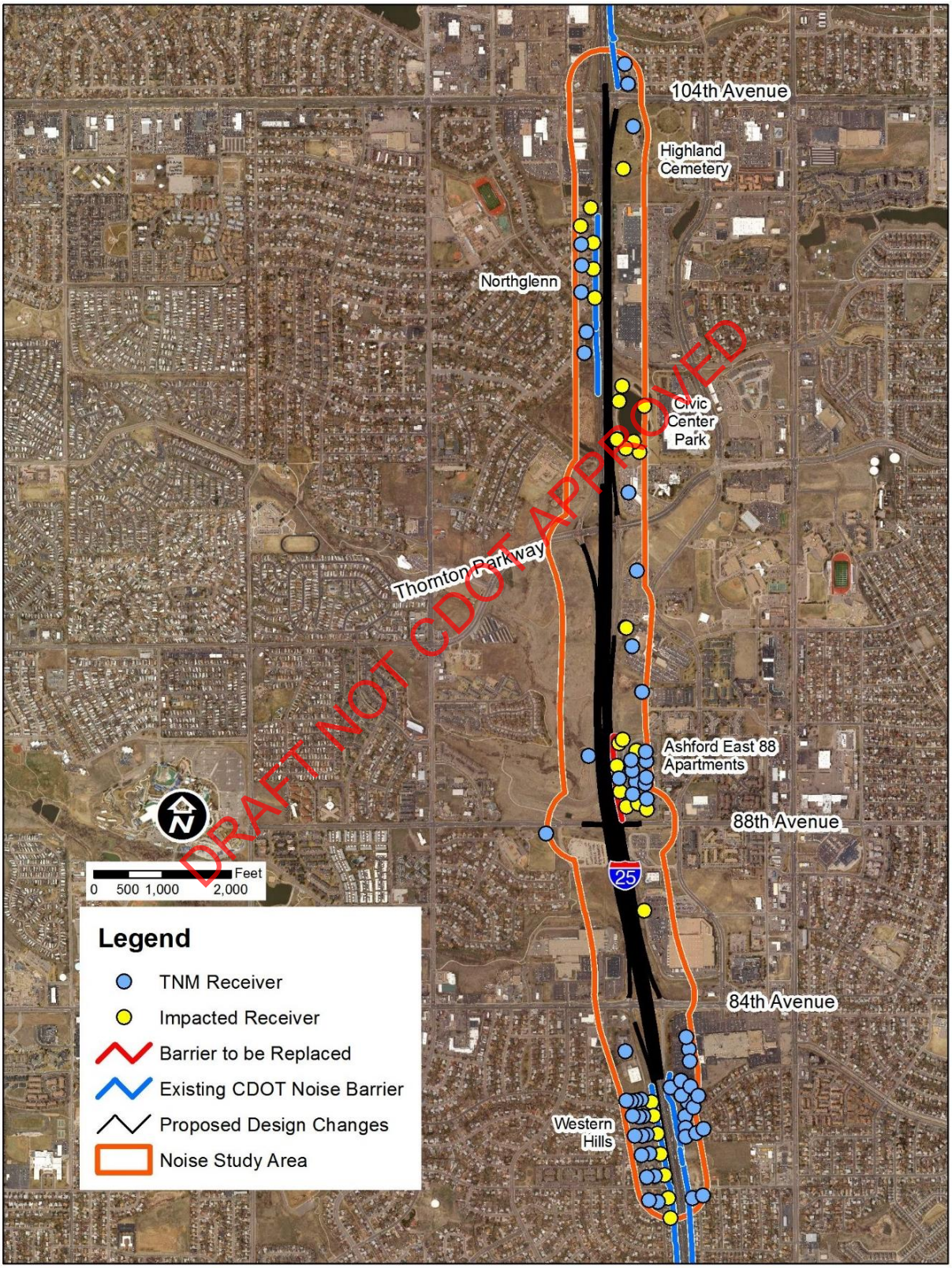


Figure 6 Noise Abatement Barrier Locations Evaluated

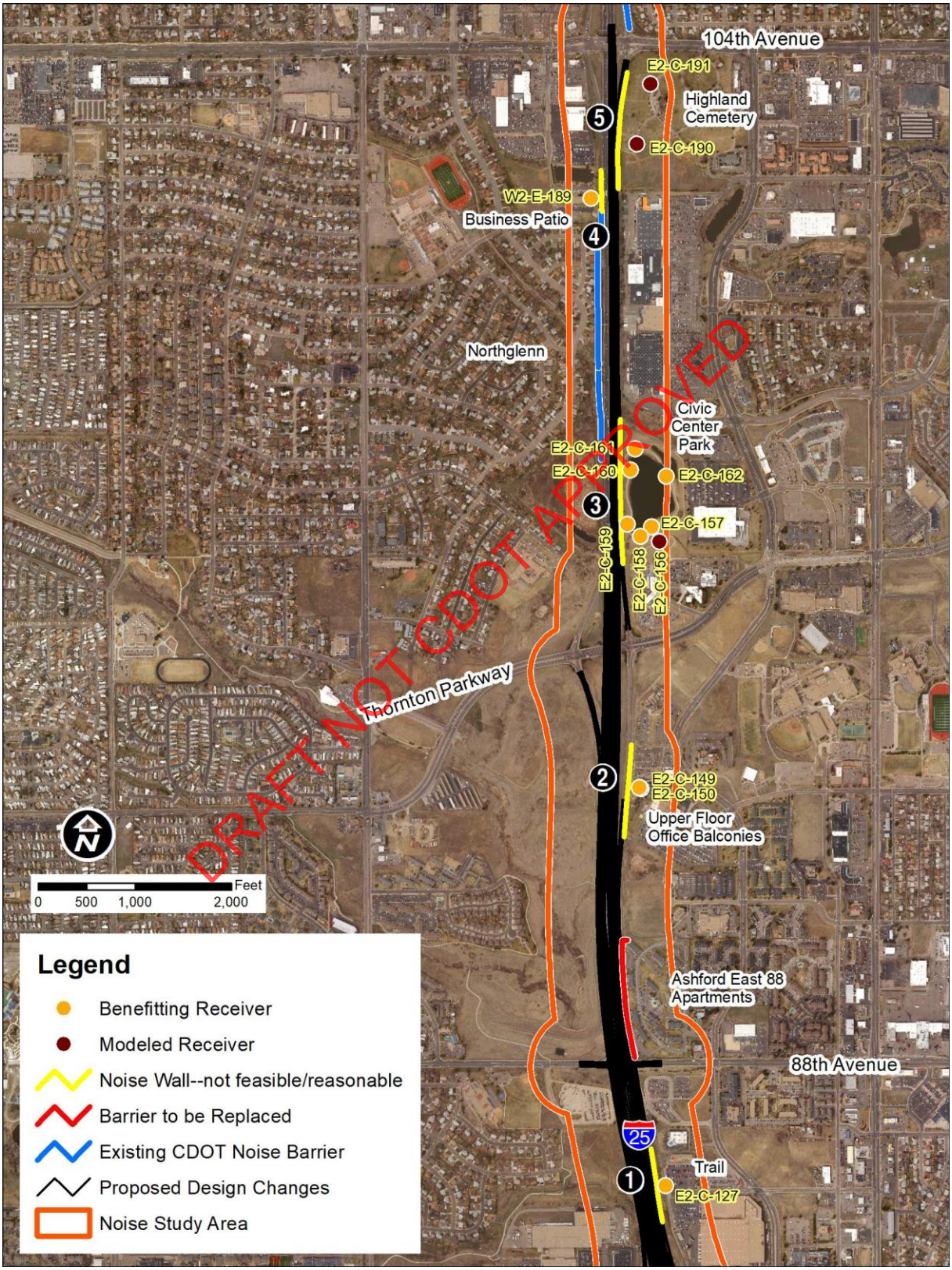
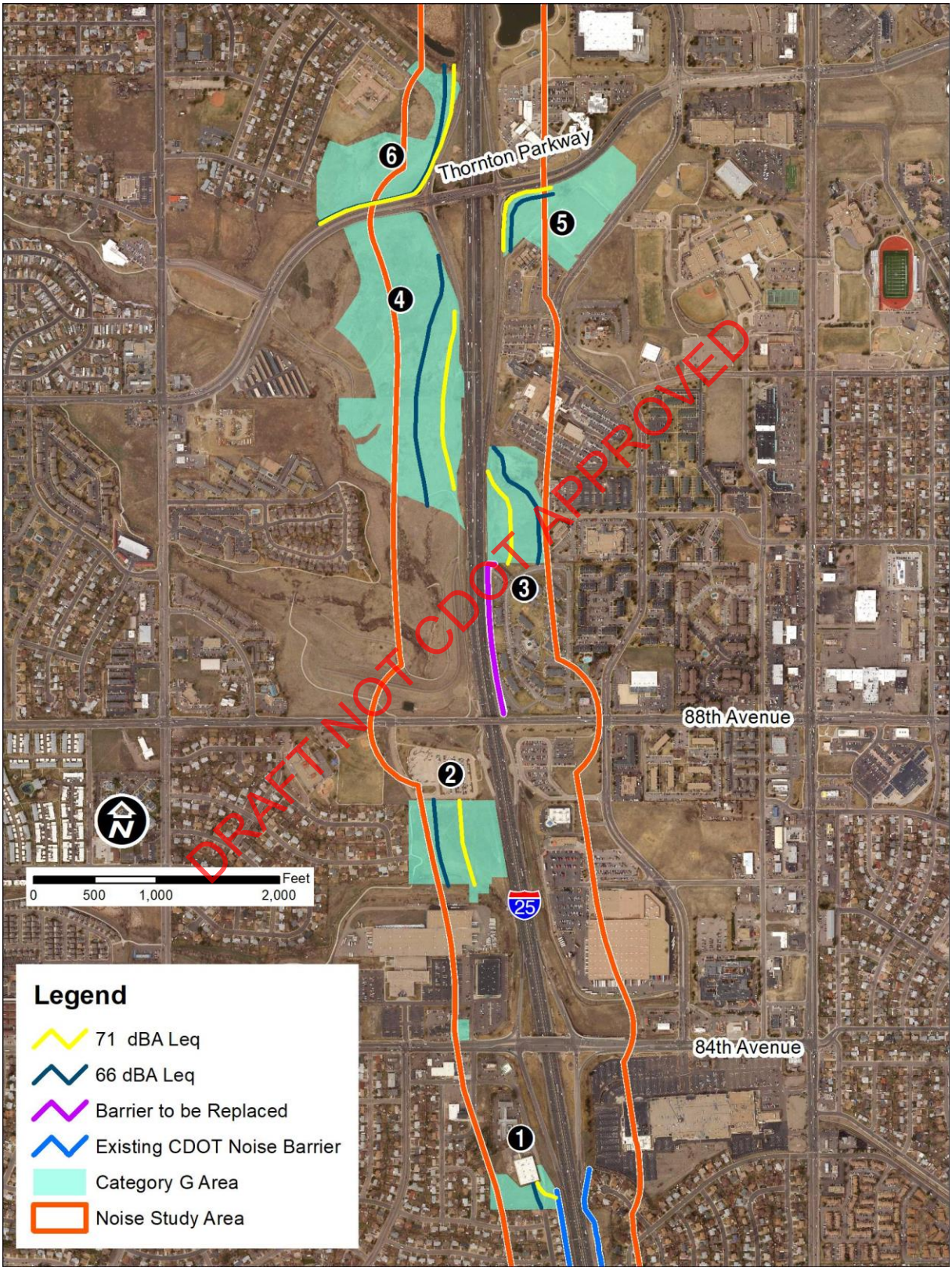


Figure 7 2040 Proposed Action NAC Noise Level Contours



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APPENDIX A NOISE MEASUREMENT DATA

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FELSBURG HOLT & ULLEVIG
connecting and enhancing communities

6300 S. Syracuse, Suite 600
Centennial, CO 80111
Ph. 303.721.1440

#1

Date: 4/12/2017

Project #: 115385

Noise Measurement Worksheet

Meter: ☒ NTI XL2 (S/N A2A-04345-D1)
(check box) ☐ NTI XL2 (S/N A2A-06663-EO)

Project: North I-25 Thornton Pkwy to US 36 Pre-Check: 114.0 dBA
Measurement by: Dale / Jodie Post-Check: 114.2 dBA

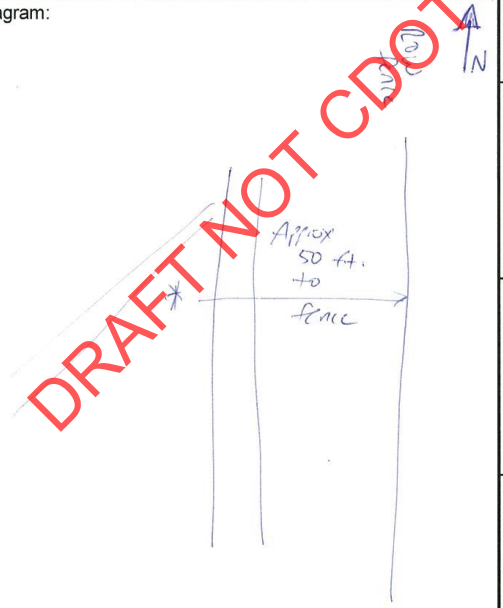
Start Time	Duration	Leq	Maximum	Minimum
10:47 AM	15 min	71.5 / dBA	80.5 / dBA	~~63.3~~ / 65.8 dBA

Avg/Max Wind	Wind Direction	R. Humidity
5.6 / 11.7 mph	NE	17 ~~25~~ %

UTM Coordinates: 13 0501015 4412208
Temp. 67 ~~73~~

Data Files: – 000

Site Diagram:



Traffic Counts

Cars	Med. Truck	Hvy. Truck
50 50 50 50 / 50 50 50 50 / 50 50 50 50 / 50 50 50 50 / 50 50 50 50	IIII / IIII / IIII / IIII / IIII	IIII IIII / IIII IIII / IIII IIII / IIII IIII / IIII IIII
50 35 1085	IIII IIII 45	IIII IIII / IIII IIII / III 78
NB I-25 1050	46	90

SB I-25

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site #2

FELSBURG HOLT & ULLEVIG
connecting and enhancing communities
6300 S. Syracuse, Suite 600
Centennial, CO 80111
Ph. 303.721.1440

Date: 4/12/17
Project #: 115388

Noise Measurement Worksheet

Meter: (check box)
☒ NTI XL2 (S/N A2A-04345-D1)
☐ NTI XL2 (S/N A2A-06663-EO)

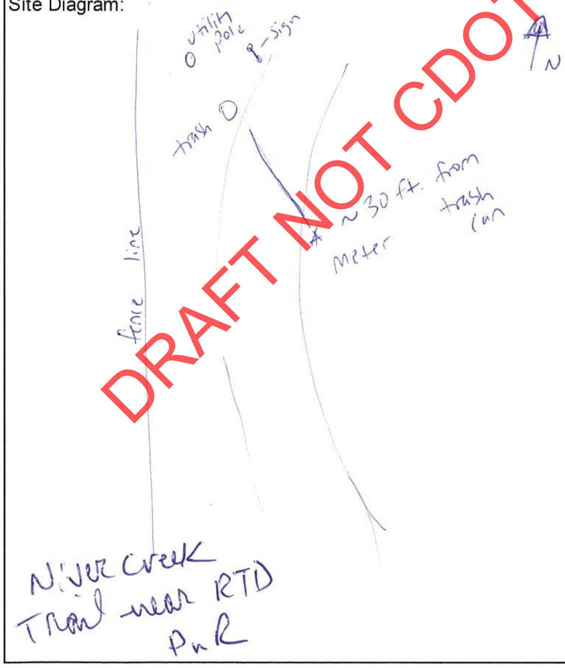
Project: North I-25 - Thornton Pkwy to US 36 Pre-Check: 114.0 dBA
Measurement by: Dale / Jodie Post-Check: 114.0 dBA

Start Time	Duration	Leq	Maximum	Minimum
11:30 AM	15 min	60.0 / dBA	66.3 / dBA	56.8 / dBA

Avg/Max Wind	Wind Direction	R. Humidity
4.9 / 12.6 mph	E	19 %

UTM Coordinates: 13 S 0500897 4411588
Temp. 65
Data Files: _0001

Site Diagram:



Traffic Counts

	Cars	Med. Truck	Hvy. Truck
NB I-25	50 50 50 50 / 50 50 50 / 50 50 50 50 / 50 50 50 50 / 50 50 50 50	卌 卌 / 卌 ||| / 卌 卌 / 卌 ||| / |||	卌 卌 / 卌 卌 / 卌 卌 / 卌 卌 / 卌 卌
	50 50 50 50 / 50 50 47 / 1297	39	卌 卌 / 卌 卌 / 卌 卌 / 卌 卌 /	
side road	卌 卌 / Motorcycle - 1		91
	SB I-25 / 1270	23	80

bugs bike

APPENDIX B TNM NOISE MODELING INPUT DATA

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Figure B-1: TNM Receivers, South of 86th Avenue

Figure B-2: TNM Receivers, 86th Avenue to Thornton Parkway

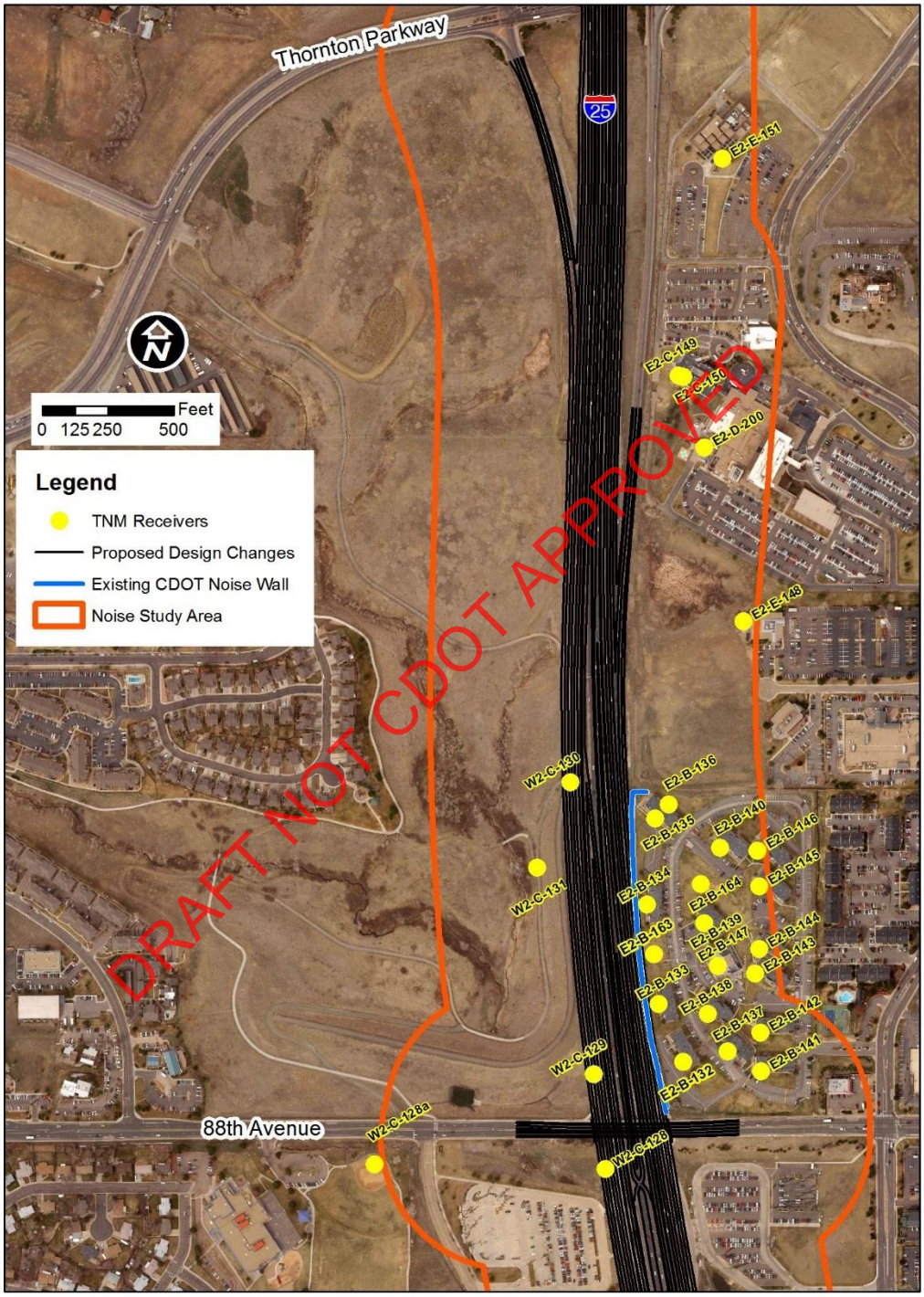

Figure B-3: TNM Receivers, North of Thornton Parkway

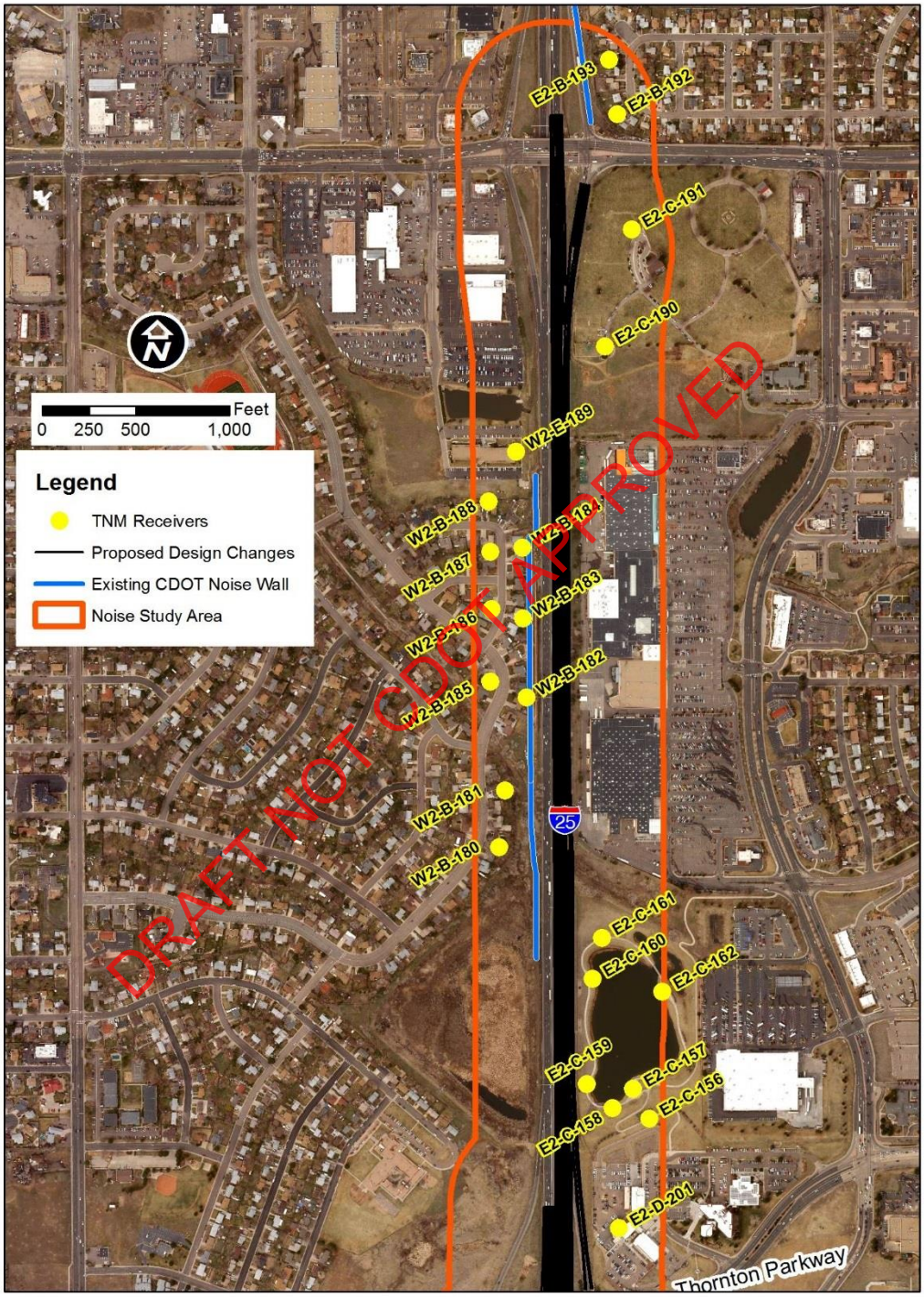

Table B-1: Traffic Input Data[1]

Roadway Link	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)	Traffic Study Vehicles/ Lane/Hour[3]
Existing Conditions Model Traffic Data (2017)[1]						
104 EB	4	371	8	4	35	
104 NB ON	2	252	16	15	45	
104 off	2	319	21	18	40	
104 SB ON	2	371	24	21	45	
104 WB	4	509	11	5	35	
84 EB RT	1	478	30	27	30	
84 NB OFF	2	125	8	7	30	
84TH EB	2	626	13	7	35	
84TH EB-2	2	582	12	6	35	
84TH NB OFF	1	727	46	42	40	
84TH NB ON	2	261	17	15	30	
84TH NB ON-METER	1	522	33	30	55	
84TH SB OFF	1	294	19	17	40	
84TH SB ON	2	591	38	34	30	
84TH SB ON-meter	1	1181	76	68	55	
84TH WB	2	907	19	10	35	
84TH WB-2	2	490	10	5	35	
88TH EB	1	786	16	8	40	
88TH WB	1	786	16	8	40	
I-25 NB A2	1	1181	76	68	55	
I-25 NB A3	1	1313	84	75	55	
I-25 NB A4	1	1487	95	85	55	
I-25 NB A5	1	1301	83	74	55	
I-25 NB A6	1	1445	92	83	55	
I-25 NB A7	1	1237	79	71	55	
I-25 NB B2	1	1181	76	68	55	
I-25 NB B3	1	1313	84	75	55	
I-25 NB B4	1	1487	95	85	55	
I-25 NB B5	1	1301	83	74	55	
I-25 NB B6	1	1445	92	83	55	
I-25 NB B7	1	1237	79	71	55	
I-25 NB C2	1	1181	76	68	55	
I-25 NB C3	1	1313	84	75	55	
I-25 NB C4	1	1487	95	85	55	
I-25 NB C5	1	1301	83	74	55	
I-25 NB C6	1	1445	92	83	55	
I-25 NB C7	1	1237	79	71	55	
I-25 NB D2	1	1181	76	68	55	
I-25 NB D4	1	0	0	10[2]	35	
I-25 SB A-0	1	1362	87	78	55	
I-25 SB A-1	1	1516	97	87	55	
I-25 SB A-2	1	1452	93	83	55	

Roadway Link	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)	Traffic Study Vehicles/ Lane/Hour[3]
I-25 SB A-3	1	1717	110	98	55	
I-25 SB A-4	1	1619	103	93	55	
I-25 SB A-5	1	1510	96	86	55	
I-25 SB B-0	1	1362	87	78	55	
I-25 SB B-1	1	1516	97	87	55	
I-25 SB B-2	1	1452	93	83	55	
I-25 SB B-3	1	1717	110	98	55	
I-25 SB B-4	1	1619	103	93	55	
I-25 SB B-5	1	1510	96	86	55	
I-25 SB C-0	1	1362	87	78	55	
I-25 SB C-1	1	1516	97	87	55	
I-25 SB C-2	1	1452	93	83	55	
I-25 SB C-3	1	1717	110	98	55	
I-25 SB C-4	1	1619	103	93	55	
I-25 SB C-5	1	1510	96	86	55	
I-25 SB D-5	1	1510	96	86	55	
RTD NB	1	0	0	10[2]	35	
RTD SB	1	0	0	10[2]	35	
TEL NB1A	1	70	0	10[2]	55	
TEL NB2	1	180	0	10[2]	55	
TEL NB3	1	165	0	10[2]	55	
TEL SB0	1	845	0	10[2]	55	
TEL SB1	1	1160	0	10[2]	55	
TEL SB2	1	1250	0	10[2]	55	
THORNTON EB1	3	391	8	4	40	
THORNTON EB2	3	317	7	3	40	
THORNTON EB3	3	365	8	4	40	
THORNTON NB OFF	2	230	15	13	40	
THORNTON NB ON	2	216	14	13	30	
THORNTON NB ON-METER	1	432	28	25	55	
THORNTON SB OFF	1	187	12	11	40	
THORNTON SB ON	2	437	28	25	30	
THORNTON SB ON-meter	1	874	56	50	55	
THORNTON WB1	3	572	12	6	40	
THORNTON WB2	3	532	11	5	40	
THORNTON WB3	3	356	7	4	40	
No Action Alternative Model Traffic Data (2040)[1]						
104 EB	4	454	9	5	35	
104 NB ON	2	346	22	20	45	
104 off	2	337	22	20	40	
104 SB ON	2	395	25	23	45	
104 WB	4	626	13	7	35	
84 EB RT	1	754	48	43	30	

Roadway Link	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)	Traffic Study Vehicles/ Lane/Hour[3]
84 NB OFF	2	152	10	9	30	
84TH EB	2	730	15	8	35	
84TH EB-2	2	687	14	7	35	
84TH NB OFF	1	843	54	48	40	
84TH NB ON	2	261	17	15	30	
84TH NB ON-METER	1	575	37	33	55	
84TH SB OFF	1	304	19	17	40	
84TH SB ON	2	694	45	40	30	
84TH SB ON-meter	1	1387	89	79	55	
84TH WB	2	956	20	10	35	
84TH WB-2	2	556	12	6	35	
88TH EB	1	999	21	10	40	
88TH WB	1	999	21	10	40	
I-25 NB A2	1	1454	93	83	55	
I-25 NB A3	1	1543	99	88	55	
I-25 NB A4	1	1735	111	99	55	
I-25 NB A5	1	1477	94	84	55	
I-25 NB A6	1	1677	107	96	55	
I-25 NB A7	1	1472	94	84	55	
I-25 NB B2	1	1454	93	83	55	
I-25 NB B3	1	1543	99	88	55	
I-25 NB B4	1	1735	111	99	55	
I-25 NB B5	1	1477	94	84	55	
I-25 NB B6	1	1677	107	96	55	
I-25 NB B7	1	1472	94	84	55	
I-25 NB C2	1	1454	93	83	55	
I-25 NB C3	1	1543	99	88	55	
I-25 NB C4	1	1735	111	99	55	
I-25 NB C5	1	1477	94	84	55	
I-25 NB C6	1	1677	107	96	55	
I-25 NB C7	1	1472	94	84	55	
I-25 NB D2	1	1181	76	68	55	
I-25 NB D4	1	0	0	10[2]	35	
I-25 SB A-0[4]	1	1784	114	102	55	2325
I-25 SB A-1[4]	1	1784	114	102	55	2333
I-25 SB A-2[4]	1	1784	114	102	55	2047
I-25 SB A-3[4]	1	1784	114	102	55	2428
I-25 SB A-4[4]	1	1784	114	102	55	2293
I-25 SB A-5[4]	1	1784	114	102	55	2096
I-25 SB B-0[4]	1	1784	114	102	55	2325
I-25 SB B-1[4]	1	1784	114	102	55	2333
I-25 SB B-2[4]	1	1784	114	102	55	2047
I-25 SB B-3[4]	1	1784	114	102	55	2428
I-25 SB B-4[4]	1	1784	114	102	55	2293
I-25 SB B-5[4]	1	1784	114	102	55	2096

Roadway Link	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)	Traffic Study Vehicles/ Lane/Hour[3]
I-25 SB C-0[4]	1	1784	114	102	55	2325
I-25 SB C-1[4]	1	1784	114	102	55	2333
I-25 SB C-2[4]	1	1784	114	102	55	2047
I-25 SB C-3[4]	1	1784	114	102	55	2428
I-25 SB C-4[4]	1	1784	114	102	55	2293
I-25 SB C-5[4]	1	1784	114	102	55	2096
I-25 SB D-5[4]	1	1784	114	102	55	2096
RTD NB	1	0	0	10[2]	35	
RTD SB	1	0	0	10[2]	35	
TEL NB1A	1	380	0	10[2]	55	
TEL NB2	1	200	0	10[2]	55	
TEL NB3	1	525	0	10[2]	55	
TEL SB0	1	1165	0	10[2]	55	
TEL SB1	1	1535	0	10[2]	55	
TEL SB2	1	1650	0	10[2]	55	
THORNTON EB1	3	466	10	5	40	
THORNTON EB2	3	391	8	4	40	
THORNTON EB3	3	438	9	5	40	
THORNTON NB OFF	2	299	19	17	40	
THORNTON NB ON	2	303	20	18	30	
THORNTON NB ON-METER	1	606	39	35	55	
THORNTON SB OFF	1	437	28	25	40	
THORNTON SB ON	2	511	33	29	30	
THORNTON SB ON-meter	1	1022	65	58	55	
THORNTON WB1	3	647	13	7	40	
THORNTON WB2	3	597	12	6	40	
THORNTON WB3	3	459	9	5	40	
Design Year Proposed Action Model Traffic Data (2040)[1]						
104 EB	4	449	9	5	35	
104 NB ON	2	328	21	19	45	
104 ON	2	413	27	24	45	
104 WB	2	1242	26	13	35	
104-2 EB	4	455	10	5	35	
104-2 WB	2	1261	26	13	35	
84 NB OFF	2	125	8	7	30	
84 NB ON	2	353	23	20	30	
84 NB RAMP	2	353	23	20	55	
84 SB OFF	1	522	33	30	35	
84 SB ON	2	602	39	35	30	
84 SB RAMP	1	1204	77	69	55	
84TH EB	1	1353	28	14	35	
84TH EB-2	2	410	9	4	35	
84TH NB OFF	1	744	48	43	45	

Roadway Link	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)	Traffic Study Vehicles/ Lane/Hour[3]
84TH WB	2	912	19	10	35	
84TH WB-2	2	560	12	6	35	
88 EB	1	980	20	10	40	
88 WB	1	980	20	10	40	
EB 84 RT	1	495	32	28	30	
I25 NB 1A	1	1530	98	88	55	
I25 NB 1B	1	1530	98	88	55	
I25 NB 1C	1	1530	98	88	55	
I25 NB 1D	1	1530	98	88	55	
I25 NB 2A	1	1277	82	73	55	
I25 NB 2B	1	1277	82	73	55	
I25 NB 2C	1	2555	163	146	55	
I25 NB 2D	1	1277	82	73	55	
I25 NB 3A	1	1142	73	65	55	
I25 NB 3B	1	1142	73	65	55	
I25 NB 3C	1	1142	73	65	55	
I25 NB 3D	1	1142	73	65	55	
I25 NB 4A	1	1549	99	89	55	
I25 NB 4B	1	1549	99	89	55	
I25 NB 4C	1	1549	99	89	55	
I25 NB 4D	1	713	46	41	45	
I25 SB 1A[4]	1	1784	114	102	55	2325
I25 SB 1B[4]	1	1784	114	102	55	2325
I25 SB 1C[4]	1	1784	114	102	55	2325
I25 SB 2A[4]	1	1784	114	102	55	2353
I25 SB 2B[4]	1	1784	114	102	55	2353
I25 SB 2C[4]	1	1784	114	102	55	2353
I25 SB 3A	1	1448	93	83	55	
I25 SB 3B	1	1448	93	83	55	
I25 SB 3C	1	1448	93	83	55	
I25 SB 3D	1	1448	93	83	55	
I25 SB 4A	1	1602	102	92	55	
I25 SB 4B	1	1602	102	92	55	
I25 SB 4C	1	1602	102	92	55	
I25 SB 4D	1	1602	102	92	55	
I25 SB 4D-2	1	2330	149	133	55	
TEL NB 1	1	300	0	10[2]	55	
TEL NB 2	1	500	0	10[2]	55	
TEL NB 3	1	595	0	10[2]	55	
TEL SB 1	1	1165	0	10[2]	55	
TEL SB 2	1	1505	0	10[2]	55	
TEL SB 3	1	1595	0	10[2]	55	
THORNTON EB1	3	456	9	5	40	
THORNTON EB2	3	327	7	3	40	
THORNTON EB3	3	448	9	5	40	

Roadway Link	Number of Lanes	Cars / Lane / Hour	Medium Trucks / Lane / Hour	Heavy Trucks / Lane / Hour	Speed (mph)	Traffic Study Vehicles/ Lane/Hour[3]
THORNTON NB OFF	2	364	23	21	55	
THORNTON NB OFF-2	2	364	23	21	35	
THORNTON NB ON	2	225	15	13	30	
THORNTON NB RAMP	1	450	29	26	55	
THORNTON SB OFF	1	187	12	11	55	
THORNTON SB OFF-2	2	94	6	6	35	
THORNTON SB ON	2	609	39	35	30	
THORNTON SB RAMP	1	1217	78	70	55	
THORNTON WB1	3	648	13	7	40	
THORNTON WB2	3	627	13	6	40	
THORNTON WB3	3	388	8	4	40	

Notes:

1. Traffic data from project traffic study (FHU, 2018)
2. Heavy truck volumes listed are for buses in the TNM model
3. Total traffic volume per lane from project traffic study, if the NAAG Exhibit 4 limit is ignored
4. Traffic volumes used the Exhibit 4 limit for the traffic conditions

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APPENDIX C TNM NOISE MODELING RESULTS

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

Table C-1: Modeled Noise Levels Without Abatement

Receiver ID	Receiver Description	Activity Category / CDOT NAC (dBA)	Number of Receptors	Existing (2017) Leq (dBA)	2040 No Action Leq (dBA)	2040 Proposed Action Leq (dBA)	Proposed Action Causes Impact? (Yes or No)	Proposed Action Change From Existing (dBA)
E1-B-102	7969 PATRICIA DR	B/66	4	61.9	62.7	63.2	No	1.3
E1-B-109	7976 PATRICIA DR	B/66	4	59.6	60.4	60.9	No	1.3
E1-B-113	8141 GRANT ST	B/66	2	59.7	60.4	60.9	No	1.2
E1-B-114	8121 GRANT ST	B/66	2	61.0	61.7	62.4	No	1.4
E1-B-115	8111 GRANT ST	B/66	2	61.7	62.4	63.0	No	1.3
E1-B-117	194 GRANT WAY	B/66	2	62.4	63.1	63.5	No	1.1
E1-B-118	262 GRANT WAY	B/66	2	58.6	59.3	59.8	No	1.2
E1-B-119	8161 GRANT ST	B/66	2	59.4	60.0	60.6	No	1.2
E1-B-120	202 GRANT WAY	B/66	2	60.6	61.3	61.8	No	1.2
E1-B-121	191 GRANT WAY	B/66	2	62.9	63.6	64.0	No	1.1
E1-B-122	221 GRANT WAY	B/66	2	61.1	61.8	62.0	No	0.9
E1-B-123	261 GRANT WAY	B/66	3	58.5	59.2	59.6	No	1.1
E1-B-124	8112 GRANT ST	B/66	5	59.7	60.4	61.1	No	1.4
E1-B-125	330 E 82ND DR	B/66	5	58.0	58.7	59.3	No	1.3
E1-E-126	500 E 84TH AVE	E/71	1	58.0	58.7	58.9	No	0.9
E1-E-126a	500 E 84TH AVE	E/71	1	57.0	57.7	58.0	No	1.0
E1-E-126b	500 E 84TH AVE	E/71	1	58.5	59.3	59.0	No	0.5
E2-B-132-2	388 E 88TH AVE FLOOR 2	B/66	4	67.0	67.6	67.8	Yes	0.8
E2-B-132-3	388 E 88TH AVE FLOOR 3	B/66	4	69.8	70.3	72.7	Yes	2.9
E2-B-133-2	388 E 88TH AVE FLOOR 2	B/66	4	67.3	67.8	68.4	Yes	1.1
E2-B-133-3	388 E 88TH AVE FLOOR 3	B/66	4	74.9	75.3	75.0	Yes	0.1
E2-B-134-2	388 E 88TH AVE FLOOR 2	B/66	4	69.4	69.9	68.2	Yes	-1.2
E2-B-134-3	388 E 88TH AVE FLOOR 3	B/66	4	76.3	76.8	76.3	Yes	0.0
E2-B-135	388 E 88TH AVE	B/66	4	62.5	62.9	65.6	Yes	3.1
E2-B-135-2	388 E 88TH AVE FLOOR 2	B/66	4	68.4	68.8	71.8	Yes	3.4
E2-B-135-3	388 E 88TH AVE FLOOR 3	B/66	4	73.0	73.4	73.2	Yes	0.2
E2-B-136	388 E 88TH AVE	B/66	4	64.5	65.1	66.3	Yes	1.8
E2-B-136-2	388 E 88TH AVE FLOOR 2	B/66	4	67.6	68.1	68.7	Yes	1.1
E2-B-136-3	388 E 88TH AVE FLOOR 3	B/66	4	68.9	69.4	69.6	Yes	0.7
E2-B-137	388 E 88TH AVE	B/66	4	59.7	60.4	60.0	No	0.3
E2-B-137-2	388 E 88TH AVE FLOOR 2	B/66	4	64.0	64.7	64.2	No	0.2
E2-B-137-3	388 E 88TH AVE FLOOR 3	B/66	4	65.5	66.2	66.0	Yes	0.5
E2-B-138	388 E 88TH AVE	B/66	4	55.9	56.5	56.8	No	0.9
E2-B-138-2	388 E 88TH AVE FLOOR 2	B/66	4	59.4	60.0	60.0	No	0.6
E2-B-138-3	388 E 88TH AVE FLOOR 3	B/66	4	61.2	61.8	62.0	No	0.8
E2-B-139	388 E 88TH AVE	B/66	4	56.1	56.6	56.9	No	0.8
E2-B-139-2	388 E 88TH AVE FLOOR 2	B/66	4	58.4	58.9	59.5	No	1.1
E2-B-139-3	388 E 88TH AVE FLOOR 3	B/66	4	61.2	61.6	63.8	No	2.6
E2-B-140	388 E 88TH AVE	B/66	4	58.7	59.1	61.0	No	2.3
E2-B-140-2	388 E 88TH AVE FLOOR 2	B/66	4	61.4	61.9	64.0	No	2.6
E2-B-140-3	388 E 88TH AVE FLOOR 3	B/66	4	63.3	63.7	66.0	Yes	2.7
E2-B-141	388 E 88TH AVE	B/66	4	61.8	62.6	62.2	No	0.4
E2-B-141-2	388 E 88TH AVE FLOOR 2	B/66	4	64.7	65.5	65.8	Yes	1.1

Receiver ID	Receiver Description	Activity Category / CDOT NAC (dBA)	Number of Receptors	Existing (2017) Leq (dBA)	2040 No Action Leq (dBA)	2040 Proposed Action Leq (dBA)	Proposed Action Causes Impact? (Yes or No)	Proposed Action Change From Existing (dBA)
E2-B-141-3	388 E 88TH AVE FLOOR 3	B/66	4	66.0	66.8	67.0	Yes	1.0
E2-B-142	388 E 88TH AVE	B/66	4	51.0	51.7	51.8	No	0.8
E2-B-142-2	388 E 88TH AVE FLOOR 2	B/66	4	54.6	55.3	55.8	No	1.2
E2-B-142-3	388 E 88TH AVE FLOOR 3	B/66	4	59.7	60.3	60.7	No	1.0
E2-B-143	388 E 88TH AVE	B/66	4	52.2	52.7	52.9	No	0.7
E2-B-143-2	388 E 88TH AVE FLOOR 2	B/66	4	57.2	57.6	58.5	No	1.3
E2-B-143-3	388 E 88TH AVE FLOOR 3	B/66	4	59.7	60.2	61.6	No	1.9
E2-B-144	388 E 88TH AVE	B/66	4	53.4	53.9	55.0	No	1.6
E2-B-144-2	388 E 88TH AVE FLOOR 2	B/66	4	56.6	57.0	58.6	No	2.0
E2-B-144-3	388 E 88TH AVE FLOOR 3	B/66	4	58.3	58.7	61.0	No	2.7
E2-B-145	388 E 88TH AVE	B/66	4	55.3	55.7	57.7	No	2.4
E2-B-145-2	388 E 88TH AVE FLOOR 2	B/66	4	58.2	58.6	60.9	No	2.7
E2-B-145-3	388 E 88TH AVE FLOOR 3	B/66	4	59.4	59.9	62.5	No	3.1
E2-B-146	388 E 88TH AVE	B/66	4	53.6	54.1	56.7	No	3.1
E2-B-146-2	388 E 88TH AVE FLOOR 2	B/66	4	56.5	56.9	59.1	No	2.6
E2-B-146-3	388 E 88TH AVE FLOOR 3	B/66	4	58.6	59.1	60.8	No	2.2
E2-B-147	388 E 88TH AVE	B/66	1	55.8	56.2	56.8	No	1.0
E2-B-163	388 E 88TH AVE	B/66	1	64.3	64.8	65.1	No	0.8
E2-B-164	388 E 88TH AVE	B/66	1	58.5	58.9	60.4	No	1.9
E2-B-192	10433 LINCOLN CT	B/66	4	59.7	60.7	60.7	No	1.2
E2-B-193	10473 LINCOLN CT	B/66	4	60.5	61.6	61.6	No	1.3
E2-C-127	TRAIL	C/66	1	69.2	69.8	72.0	Yes	2.8
E2-C-149	9195 GRANT ST FLOOR 3	C/66	1	72.0	72.7	73.2	Yes	1.2
E2-C-150	9195 GRANT ST FLOOR 4	C/66	1	71.7	72.4	72.9	Yes	1.2
E2-C-156	CIVIC CENTER PARK	C/66	1	65.5	66.2	67.0	Yes	1.5
E2-C-157	CIVIC CENTER PARK	C/66	1	66.0	66.7	68.0	Yes	2.0
E2-C-158	CIVIC CENTER PARK	C/66	1	67.4	68.0	69.3	Yes	1.9
E2-C-159	CIVIC CENTER PARK	C/66	1	73.3	74.0	75.6	Yes	2.3
E2-C-160	CIVIC CENTER PARK	C/66	1	70.1	70.8	73.5	Yes	3.4
E2-C-161	CIVIC CENTER PARK	C/66	1	68.3	68.9	71.6	Yes	3.3
E2-C-162	CIVIC CENTER PARK	C/66	1	64.1	64.8	66.1	Yes	2.0
E2-C-190	10375 LOGAN ST	C/66	1	64.2	65.1	65.8	Yes	1.6
E2-C-191	10375 LOGAN ST	C/66	1	62.3	63.2	63.5	No	1.2
E2-D-200*	9141 GRANT ST HOSPITAL	D/51	1	28.3	29.0	29.5	No	1.2
E2-D-201*	THORNTON POLICE	D/51	1	28.6	29.4	30.6	No	2.0
E2-E-148	9065 GRANT ST	E/71	1	65.3	65.9	66.1	No	0.8
E2-E-151	9351 GRANT ST	E/71	1	58.8	59.6	60.5	No	1.7
W1-B-020	7936 SHERMAN ST	B/66	4	65.7	66.4	67.0	Yes	1.3
W1-B-021	7976 SHERMAN ST	B/66	4	66.1	66.9	67.6	Yes	1.5
W1-B-022	8174 SHERMAN ST	B/66	2	66.4	67.0	67.9	Yes	1.5
W1-B-023	8154 SHERMAN ST	B/66	4	65.3	65.9	66.8	Yes	1.5
W1-B-024	8114 SHERMAN ST	B/66	4	64.5	65.2	66.3	Yes	1.8
W1-B-025	8064 SHERMAN ST	B/66	4	64.1	64.8	65.7	Yes	1.6
W1-B-026	8014 SHERMAN ST	B/66	4	65.1	65.8	66.8	Yes	1.7
W1-B-047	7975 SHERMAN ST	B/66	5	62.1	62.9	63.5	No	1.4

Receiver ID	Receiver Description	Activity Category / CDOT NAC (dBA)	Number of Receptors	Existing (2017) Leq (dBA)	2040 No Action Leq (dBA)	2040 Proposed Action Leq (dBA)	Proposed Action Causes Impact? (Yes or No)	Proposed Action Change From Existing (dBA)
W1-B-048	7984 SHERMAN WAY	B/66	4	59.5	60.2	60.9	No	1.4
W1-B-049	8025 SHERMAN ST	B/66	3	61.8	62.5	63.1	No	1.3
W1-B-050	8026 SHERMAN WAY	B/66	3	59.0	59.7	60.4	No	1.4
W1-B-051	8065 SHERMAN ST	B/66	2	59.9	60.6	61.7	No	1.8
W1-B-052	8057 SHERMAN WAY	B/66	5	56.9	57.6	58.5	No	1.6
W1-B-053	147 E 81ST AVE	B/66	2	59.9	60.6	61.5	No	1.6
W1-B-054	127 E 81ST AVE	B/66	2	58.5	59.2	60.1	No	1.6
W1-B-055	88 E 81ST PL	B/66	4	56.6	57.3	58.2	No	1.6
W1-B-056	129 E 81ST PL	B/66	2	60.9	61.5	62.5	No	1.6
W1-B-057	109 E 81ST PL	B/66	2	59.6	60.2	61.1	No	1.5
W1-B-058	80 E MARIGOLD DR	B/66	4	57.6	58.3	59.0	No	1.4
W1-B-059	111 E MARIGOLD DR	B/66	1	63.2	63.8	64.7	No	1.5
W1-B-060	91 E MARIGOLD DR	B/66	1	61.1	61.7	62.3	No	1.2
W1-B-061	71 E MARIGOLD DR	B/66	1	59.1	59.7	60.3	No	1.2
W1-B-062	51 E MARIGOLD DR	B/66	1	58.5	59.2	59.7	No	1.2
W1-E-063	6 W 83RD PL	E/71	1	59.3	59.9	60.4	No	1.1
W2-B-180	9830 MELODY DR	B/66	4	64.4	65.1	65.4	No	1.0
W2-B-181	9860 MELODY DR	B/66	3	64.2	65.0	65.2	No	1.0
W2-B-182	9960 MELODY DR	B/66	5	66.0	66.8	66.8	Yes	0.8
W2-B-183	10020 BRIGITTE DR	B/66	5	68.1	68.8	68.8	Yes	0.7
W2-B-184	10070 BRIGITTE DR	B/66	4	67.8	68.5	68.5	Yes	0.7
W2-B-185	9971 MELODY DR	B/66	3	61.8	62.5	62.7	No	0.9
W2-B-186	10011 BRIGITTE DR	B/66	3	64.1	64.8	64.9	No	0.8
W2-B-187	242 BRIGITTE DR	B/66	2	64.3	65.0	65.0	No	0.7
W2-B-188	243 BRIGITTE DR	B/66	2	64.9	65.7	65.7	Yes	0.8
W2-C-128	TRAIL	C/66	1	73.1	73.6	NA	No	NA
W2-C-128a	NORTHSTAR PARK	C/66	1	64.1	65.0	64.0	No	-0.1
W2-C-129	NIVER CREEK	C/66	1	76.0	76.4	NA	No	NA
W2-C-130	NIVER CREEK	C/66	1	73.6	73.9	NA	No	NA
W2-C-131	NIVER CREEK	C/66	1	57.9	58.3	62.7	No	4.8
W2-E-189	10190 BANNOCK ST	E/71	1	72.5	73.3	73.2	Yes	0.7

NA—Not applicable; receiver removed by Proposed Action

Rows shaded blue are receivers located behind existing noise walls

**--Category D noise level calculated by subtracting 35 dBA from TNM exterior level (CDOT, 2015)*

Table C-2 Noise Abatement Barrier Evaluation Data

Barrier ID	1	2	3	4	5	Ashford East 88 Apts.
Barrier Location (general)	Bike trail; 86th	Hospital balconies	Civic Center Park	West of I-25; 102nd	Cemetery; 104th	Replacement of CDOT Barrier 300
Barrier Location: Distance from Proposed Edge of Roadway (feet)	6	10	5	18	5	4
Benefited Receiver IDs	See Table C-3	See Table C-3	See Table C-3	See Table C-3	See Table C-3	See Table C-3
Figure	6	6	6	6	6	6
Evaluated Barrier Height & Length (feet)[1]	12 x 104 (south) 16 x 511 12 x 152 (north)	20 x 960	12 x 241 (south) 14 x 793 8 x 461 (north)	20 x 425	20 x 1213	13 x 1306
Barrier Area (square feet)[1]	11,256	19,193	17,676	8,500	24,262	16,980
Unit Cost	$45/ft^2	$45/ft^2	$45/ft^2	$45/ft^2	$45/ft^2	$45/ft^2
Total Cost	$506,521	$863,693	$795,406	$382,513	$1,091,779	$764,082
No. Benefited Receptors	1	1	6	1	0	27
Total Decibels of Benefit Provided	7.0	6.3	44.8	6.8	0	227.0
Average Benefit (dBA/receptor)	7.0	6.3	7.5	6.8	0	8.4
Cost Benefit ($/dBA/receptor)	72,360	137,094	17,755	56,252	Not applicable	3,366
Design year Leq Range Without Abatement (dBA)	71.3	72.9 to 73.2	66.2 to 75.6	73.4	63.7 to 65.9	Not applicable
Design year Leq Range With Abatement (dBA)	64.3	66.9 to 70.4	60.9 to 66.5	66.6	Not applicable	51.5 to 75.4
Feasible?	Yes	Yes	Yes	Yes	No	Yes
Reasonable?	No	No	No	No	No	Yes
Recommended?	No	No	No	No	No	Yes, replaces current barrier

[1] *For reporting, TNM rounds some values to whole numbers so there can be minor discrepancies when calculating quantities.*

Table C-3 Modeled Noise Levels With and Without Abatement Barriers

Benefited Receiver ID	Receiver Description	Number of Benefited Receptors per Receiver	Proposed Action (2040) (dBA)		
			L_{eq} Without Abatement	L_{eq} With Abatement	Insertion Loss
Barrier 1—Bike Trail (Figure 6)					
E2-C-127	TRAIL	1	72.0	65.0	7.0
Barrier 2—Hospital balconies (Figure 6)					
E2-C-149	9195 GRANT ST FLOOR 3	1	73.2	66.9	6.3
E2-C-150	9195 GRANT ST FLOOR 4	1	72.9	70.4	2.5
Barrier 3—Civic Center Park (Figure 6)					
E2-C-156	CIVIC CENTER PARK	1	67.0	63.7	3.3
E2-C-157	CIVIC CENTER PARK	1	68.0	60.9	7.1
E2-C-158	CIVIC CENTER PARK	1	69.3	61.3	8.0
E2-C-159	CIVIC CENTER PARK	1	75.6	64.5	11.1
E2-C-160	CIVIC CENTER PARK	1	73.5	65.0	8.5
E2-C-161	CIVIC CENTER PARK	1	71.6	66.5	5.1
E2-C-162	CIVIC CENTER PARK	1	66.1	61.1	5.0
Barrier 4— West of I-25; 102nd (Figure 6)					
W2-E-189	10190 BANNOCK ST	1	73.2	66.4	6.8
Barrier 5—Cemetery; 104th (Figure 6)					
E2-C-190	10375 LOGAN ST CEMETERY	1	65.8	61.3	4.5
E2-C-191	10375 LOGAN ST CEMETERY	1	63.5	61.8	1.7
Ashford East 88 Apartments / CDOT Barrier 300 replacement (Figure 6)					
E2-B-132-2	388 E 88TH AVE FLOOR 2	4	72.6	67.5	5.1
E2-B-132-3	388 E 88TH AVE FLOOR 3	4	74.3	72.2	2.1
E2-B-133-2	388 E 88TH AVE FLOOR 2	4	77.8	67.2	10.6
E2-B-133-3	388 E 88TH AVE FLOOR 3	4	78.9	74.5	4.4
E2-B-134-2	388 E 88TH AVE FLOOR 2	4	78.6	67.0	11.6
E2-B-134-3	388 E 88TH AVE FLOOR 3	4	79.1	75.4	3.7
E2-B-135	388 E 88TH AVE	4	72.6	64.0	8.6
E2-B-135-2	388 E 88TH AVE FLOOR 2	4	75.3	71.5	3.8
E2-B-135-3	388 E 88TH AVE FLOOR 3	4	75.9	72.8	3.1
E2-B-136	388 E 88TH AVE	4	66.2	66.2	0.0

Benefited Receiver ID	Receiver Description	Number of Benefited Receptors per Receiver	Proposed Action (2040) (dBA)		
			L_{eq} Without Abatement	L_{eq} With Abatement	Insertion Loss
E2-B-136-2	388 E 88TH AVE FLOOR 2	4	68.6	68.6	0.0
E2-B-136-3	388 E 88TH AVE FLOOR 3	4	69.5	69.5	0.0
E2-B-137	388 E 88TH AVE	4	60.6	59.6	1.0
E2-B-137-2	388 E 88TH AVE FLOOR 2	4	65.0	63.9	1.1
E2-B-137-3	388 E 88TH AVE FLOOR 3	4	67.0	65.9	1.1
E2-B-138	388 E 88TH AVE	4	58.6	56.0	2.6
E2-B-138-2	388 E 88TH AVE FLOOR 2	4	63.2	59.5	3.7
E2-B-138-3	388 E 88TH AVE FLOOR 3	4	64.4	61.6	2.8
E2-B-139	388 E 88TH AVE	4	64.2	56.4	7.8
E2-B-139-2	388 E 88TH AVE FLOOR 2	4	65.7	58.8	6.9
E2-B-139-3	388 E 88TH AVE FLOOR 3	4	66.5	62.8	3.7
E2-B-140	388 E 88TH AVE	4	64.8	60.6	4.2
E2-B-140-2	388 E 88TH AVE FLOOR 2	4	66.2	63.2	3.0
E2-B-140-3	388 E 88TH AVE FLOOR 3	4	67.3	65.6	1.7
E2-B-141	388 E 88TH AVE	4	62.5	62.1	0.4
E2-B-141-2	388 E 88TH AVE FLOOR 2	4	66.0	65.6	0.4
E2-B-141-3	388 E 88TH AVE FLOOR 3	4	67.6	66.8	0.8
E2-B-142	388 E 88TH AVE	4	51.8	51.5	0.3
E2-B-142-2	388 E 88TH AVE FLOOR 2	4	55.7	55.6	0.1
E2-B-142-3	388 E 88TH AVE FLOOR 3	4	60.6	60.3	0.3
E2-B-143	388 E 88TH AVE	4	56.5	52.4	4.1
E2-B-143-2	388 E 88TH AVE FLOOR 2	4	62.3	57.9	4.4
E2-B-143-3	388 E 88TH AVE FLOOR 3	4	63.4	61.0	2.4
E2-B-144	388 E 88TH AVE	4	58.6	54.3	4.3
E2-B-144-2	388 E 88TH AVE FLOOR 2	4	62.6	57.9	4.7
E2-B-144-3	388 E 88TH AVE FLOOR 3	4	63.3	60.4	2.9
E2-B-145	388 E 88TH AVE	4	60.9	57.2	3.7
E2-B-145-2	388 E 88TH AVE FLOOR 2	4	62.5	60.1	2.4
E2-B-145-3	388 E 88TH AVE FLOOR 3	4	63.3	62.2	1.1
E2-B-146	388 E 88TH AVE	4	57.3	56.4	0.9

Benefited Receiver ID	Receiver Description	Number of Benefited Receptors per Receiver	Proposed Action (2040) (dBA)		
			L_{eq} Without Abatement	L_{eq} With Abatement	Insertion Loss
E2-B-146-2	388 E 88TH AVE FLOOR 2	4	59.6	58.9	0.7
E2-B-146-3	388 E 88TH AVE FLOOR 3	4	61.2	60.6	0.6
E2-B-147	388 E 88TH AVE	1	64.0	56.4	7.6
E2-B-163	388 E 88TH AVE	1	75.2	64.6	10.6
E2-B-164	388 E 88TH AVE	1	65.9	59.5	6.4

Table C-4 Evaluation of Effectiveness of Existing Undisturbed Barriers

Modeled Receiver ID	Receiver Description	Number of Receptors per Receiver	Proposed Action (2040) (dBA)		
			L_{eq} Without Barrier	L_{eq} With Barrier	Insertion Loss
E1-B-102	7969 PATRICIA DR	4	71.3	63.2	8.1
E1-B-117	194 GRANT WAY	2	71.3	63.5	7.8
W1-B-023	8154 SHERMAN ST	4	76.7	66.8	9.9
W2-B-183	10020 BRIGITTE DR	5	75.5	68.8	6.7

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APPENDIX D NOISE ABATEMENT DETERMINATION WORKSHEETS (CDOT FORM 1209)

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DEPARTMENT OF TRANSPORTATION

Noise Analysis and Abatement Guidelines

COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # 21180 Date of Analysis: 8-6-18

Project Name & Location: N. I-25 US36 Wall 1 Trail

A. FEASIBILITY:
1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
   ☒ YES ☐ NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
   ☐ YES ☒ NO
3. Can a noise barrier or berm less than 20 feet tall be constructed?
   ☒ YES ☐ NO

B. REASONABLENESS:
1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
   ☒ YES ☐ NO
2. Is the Cost Benefit Index below $6800 per receptor per dBA?
   ☐ YES ☒ NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?
   ☐ YES ☐ NO Not applicable

C. INSULATION CONSIDERATION:
1. Are normal noise abatement measures physically infeasible or economically unreasonable?
   ☒ YES ☐ NO
   If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D?
      ☐ YES ☒ NO
   b. If yes, is it reasonable and feasible to provide insulation for these buildings?
      ☐ YES ☐ NO Not applicable

D. ADDITIONAL CONSIDERATIONS:
None

E. STATEMENT OF LIKELIHOOD:
1. Are noise mitigation measures feasible?
   ☒ YES ☐ NO
2. Are noise mitigation measures reasonable?
   ☐ YES ☒ NO
3. Is insulation of buildings both feasible and reasonable?
   ☐ YES ☒ NO
4. Shall noise abatement measures be provided?
   ☐ YES ☒ NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:
This is for a bike trail. The cost benefit is too high at $72,360 and is not reasonable.

Completed by: Dale Tischmak Date: 8-6-18

CDOT Form #1209 Revised 02/15

DEPARTMENT OF TRANSPORTATION

Noise Analysis and Abatement Guidelines

COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # 21180 Date of Analysis: 8-6-18

Project Name & Location: N. I-25 US36 Wall 2 Hospital

A. FEASIBILITY:
1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
   ☒ YES ☐ NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
   ☐ YES ☒ NO
3. Can a noise barrier or berm less than 20 feet tall be constructed?
   ☒ YES ☐ NO

B. REASONABLENESS:
1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
   ☐ YES ☒ NO
2. Is the Cost Benefit Index below $6800 per receptor per dBA?
   ☐ YES ☐ NO NA
3. Are more than 50% of responding benefited resident owners in favor of the recommended noise abatement measure?
   ☐ YES ☐ NO NA

C. INSULATION CONSIDERATION:
1. Are normal noise abatement measures physically infeasible or economically unreasonable?
   ☒ YES ☐ NO
   If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D?
      ☐ YES ☒ NO
   b. If yes, is it reasonable and feasible to provide insulation for these buildings?
      ☐ YES ☐ NO NA

D. ADDITIONAL CONSIDERATIONS:
20 ft wall could not achieve a 7-dBA reduction.

E. STATEMENT OF LIKELIHOOD:
1. Are noise mitigation measures feasible?
   ☒ YES ☐ NO
2. Are noise mitigation measures reasonable?
   ☐ YES ☒ NO
3. Is insulation of buildings both feasible and reasonable?
   ☐ YES ☒ NO
4. Shall noise abatement measures be provided?
   ☐ YES ☒ NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:
The 7-dBA reduction could not be achieved and the wall is not reasonable.

Completed by: Jake Tischmak Date: 8-6-18

CDOT Form #1209 Revised 02/15

DEPARTMENT OF TRANSPORTATION

Noise Analysis and Abatement Guidelines

COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # 21180 Date of Analysis: 8-6-18

Project Name & Location: N. I-25 US36 Wall 3 Park

A. FEASIBILITY:
1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
   ☒ YES ☐ NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
   ☐ YES ☒ NO
3. Can a noise barrier or berm less than 20 feet tall be constructed?
   ☒ YES ☐ NO

B. REASONABLENESS:
1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
   ☒ YES ☐ NO
2. Is the Cost Benefit Index below $6800 per receptor per dBA?
   ☐ YES ☒ NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?
   ☐ YES ☐ NO NA

C. INSULATION CONSIDERATION:
1. Are normal noise abatement measures physically infeasible or economically unreasonable?
   ☒ YES ☐ NO
   If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D?
      ☐ YES ☒ NO
   b. If yes, is it reasonable and feasible to provide insulation for these buildings?
      ☐ YES ☐ NO NA

D. ADDITIONAL CONSIDERATIONS:
None

E. STATEMENT OF LIKELIHOOD:
1. Are noise mitigation measures feasible?
   ☒ YES ☐ NO
2. Are noise mitigation measures reasonable?
   ☐ YES ☒ NO
3. Is insulation of buildings both feasible and reasonable?
   ☐ YES ☒ NO
4. Shall noise abatement measures be provided?
   ☐ YES ☒ NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:
This is for Civic Center Park. The cost benefit is to high at $17,755 and is not Reasonable.

Completed by: Dale T. Schmidt Date: 8-6-18

CDOT Form #1209 Revised 02/15

DEPARTMENT OF TRANSPORTATION

Noise Analysis and Abatement Guidelines

COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # 21180 Date of Analysis: 8-6-18

Project Name & Location: N. I-25 US36 Wall 4 Patio

A. FEASIBILITY:
1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
☒ YES ☐ NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
☐ YES ☒ NO
3. Can a noise barrier or berm less than 20 feet tall be constructed?
☒ YES ☐ NO

B. REASONABLENESS:
1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
☒ YES ☐ NO
2. Is the Cost Benefit Index below $6800 per receptor per dBA?
☐ YES ☒ NO
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?
☐ YES ☐ NO NA

C. INSULATION CONSIDERATION:
1. Are normal noise abatement measures physically infeasible or economically unreasonable?
☒ YES ☐ NO
If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D?
☐ YES ☒ NO
b. If yes, is it reasonable and feasible to provide insulation for these buildings?
☐ YES ☐ NO NA

D. ADDITIONAL CONSIDERATIONS:
A 20 ft wall gave a 6.8 dBA reduction, which was accepted as 7 dBA for this evaluation.

E. STATEMENT OF LIKELIHOOD:
1. Are noise mitigation measures feasible?
☒ YES ☐ NO
2. Are noise mitigation measures reasonable?
☐ YES ☒ NO
3. Is insulation of buildings both feasible and reasonable?
☐ YES ☒ NO
4. Shall noise abatement measures be provided?
☐ YES ☒ NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:
This is for a commercial patio area. The cost benefit is too high at $56,250 and is not reasonable.

Completed by: Dale Tischmak Date: 8-6-18

CDOT Form #1209 Revised 02/15

DEPARTMENT OF TRANSPORTATION

Noise Analysis and Abatement Guidelines

COLORADO DEPARTMENT OF TRANSPORTATION
NOISE ABATEMENT DETERMINATION WORKSHEET

Instructions: To complete this form refer to CDOT Noise Analysis Guidelines

STIP # 21180 Date of Analysis: 8-6-18

Project Name & Location: N. I-25 US 36 Wall 5 Cemetery

A. FEASIBILITY:
1. Can a 5dBA noise reduction be achieved by constructing a noise barrier or berm?
   ❒ YES ☒ NO
2. Are there any fatal flaw drainage, terrain, safety, or maintenance issues involving the proposed noise barrier or berm?
   ❒ YES ☒ NO
3. Can a noise barrier or berm less than 20 feet tall be constructed?
   ❒ YES ☒ NO

B. REASONABLENESS:
1. Has the Design goal of 7 dBA noise reduction for abatement measure been met for at least one impacted receptor?
   ❒ YES ☒ NO (NA)
2. Is the Cost Benefit Index below $6800 per receptor per dBA?
   ❒ YES ❒ NO (NA)
3. Are more than 50% of responding benefited resident/owners in favor of the recommended noise abatement measure?
   ❒ YES ❒ NO (NA)

C. INSULATION CONSIDERATION:
1. Are normal noise abatement measures physically infeasible or economically unreasonable?
   ☒ YES ❒ NO
   If the answer to 1 is YES, then:
2. a. Does this project have noise impacts to NAC Activity Category D?
      ❒ YES ☒ NO
   b. If yes, is it reasonable and feasible to provide insulation for these buildings?
      ❒ YES ❒ NO

D. ADDITIONAL CONSIDERATIONS:
A 20ft wall only provided a 4.5 dBA reduction. It did not reach the necessary 5 dBA or 7dBA and is infeasible.

E. STATEMENT OF LIKELIHOOD:
1. Are noise mitigation measures feasible?
   ❒ YES ☒ NO
2. Are noise mitigation measures reasonable?
   ❒ YES ☒ NO
3. Is insulation of buildings both feasible and reasonable?
   ❒ YES ☒ NO
4. Shall noise abatement measures be provided?
   ❒ YES ☒ NO

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:
A 20ft wall provided insufficient noise reduction. This wall is not feasible.

Completed by: Dale T. Schmale Date: 8-6-18

CDOT Form #1209 Revised 02/15