

Supplement to the Noise Impact and Abatement Analysis Technical Memorandum

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The attached Technical Memorandum supersedes the Noise Impact and Abatement Analysis Technical Memorandum dated March 11, 2011.

NOISE TECHNICAL REPORT ADDENDUM

To: Jill Schlaefer – CDOT EPB
Lisa Steisfeld – CDOT Region 2

DATE: September 15, 2011

FROM: Mike Hankard – HEI

MEMO REF: ---

SUBJECT: Noise Impacts and Mitigation
Re-Analysis Results

PROJECT: US 24 West Corridor

cc: Dave Watt – CDOT Region 2
Mary Jo Vobejda - CH2M Hill
Jeff Cerjan – HEI

This memorandum describes the results of the re-analysis of noise impacts and mitigation for the *US 24 West Corridor Project* according to the Colorado Department of Transportation's (CDOT) *Noise Analysis and Abatement Guidelines*, March 2011. A previous analysis of noise impacts and mitigation was carried out according to CDOT's 2002 *Noise Guidelines*, which have now been superseded. The results of the noise analysis conducted using the 2002 guidelines are documented in the *US 24 West Corridor Project's Noise Technical Report* (Hankard Environmental, March 2010) and the *US 24 West Environmental Assessment and Draft Section 4(f) Evaluation* (draft, June 2011). The following sections of this document describe the changes between the analyses using the 2011 versus 2002 *Noise Guidelines*, the results of the re-analysis of noise impacts, and the results of the re-analysis of noise mitigation. Attached are revised CDOT Noise Abatement Determination forms for the project.

1. Changes Made to *Noise Guidelines* and Resulting Affect on Noise Analysis

1. The 2011 *Noise Guidelines* change the categorization of land use and, correspondingly, the Noise Abatement Criteria (NAC) for some land uses. The changes applicable to the US 24 West noise study are: the re-categorization of hotels/motels and the change of their NAC from 66 dBA to 71 dBA, the definition of the number of receptors to be assigned to parks, and the re-categorization of some commercial receives as not requiring mitigation consideration. The affect of these changes on the US 24 noise study are discussed in the following sections.
2. The 2011 *Noise Guidelines* also change how to evaluate the feasibility and reasonableness of proposed noise abatement measures. Specific changes include:
 - a. Noise walls are to be designed using a Noise Reduction Goal of 7 dBA (vs. 5 dBA). This is to be achieved at a minimum of one receptor.
 - b. A 'benefitted receptor' is defined as one receiving at least 5 dBA of noise reduction from the proposed wall (vs. 3 dBA).

- c. The cost of a noise wall is to be calculated using a standard unit cost of \$45 per square foot (vs. \$30).
- d. The calculation of cost-benefit is to utilize the cost and benefit values just described, and compare the result to a limit of \$6,800 per benefitted receptor per decibel of reduction (vs. \$4,000).
- e. The 2011 *Noise Guidelines* require that the residents affected by proposed noise walls be surveyed during the NEPA process and again during final design. This can include, but is not limited to, open houses, public hearings, mailers, etc. During open houses, a noise station should be present to solicit and receive votes from benefitted receptors. The solicitation of benefitted receptors will be conducted during the draft EA open houses.
- f. A Statement of likelihood is to be provided in the EA describing the noise mitigation measures (walls) that are proposed for inclusion in the Project. This will be based on the analysis results described herein. Benefitted persons desires will be incorporated into the mitigation consideration after the open houses.

2. Re-Analysis of Noise Impacts

There were two hotels considered impacted under the 2002 noise guidelines that are not impacted under the 2011 *Noise Guidelines*, as their predicted noise level under the Proposed Action is 67 dBA, and the 2011 Noise Abatement Criterion for hotels is 71 dBA.

The 2011 *Noise Guidelines* state that one receptor should be placed in each active use area in a park, such as a pavilion or playground. Vermijo Park, located near 26th Street, is the only park impacted by noise on this project. Noise receptors were placed in the park according to the 2011 *Noise Guidelines*.

Table 1, below, summarizes the results of the noise impact re-assessment. These results compare to those in the *Noise Technical Report* as follows:

1. In the *Noise Technical Report*, a similar table (5-3) showed average and maximum noise levels. This brought about some confusion, so the table now shows only the noise levels at the loudest receptor in each area. Regardless, this table is only a summary of the results. All mitigation decisions were made from the predicted noise levels at individual receptor locations.
2. The sections beyond Manitou Avenue are no longer part of the study.
3. The two impacts associated with the hotels are no longer shown as such.

Note that predicted noise levels at individual receptor locations did not change, and are all listed in Attachment C of the *Noise Technical Report*. Figures showing the receptor numbers are attached to this report (receptor numbers were not included in the figures in the *Noise Technical Report*).

Finally, with regard to noise impacts to ‘commercial’ receptors, the 2011 *Noise Guidelines* create a number of new commercial land use categories for determining noise impacts. Commercial receptors have been separated into three categories with corresponding noise abatement criterion: (1) 66 dBA for radio stations, churches, schools, etc. (as they can benefit from noise control), (2) 71 dBA for hotels/motels, restaurants, and offices, and (3) no mitigation considered for industrial uses and for undeveloped lands. These changes affect the two hotels discussed above, and the two businesses near I-25 that were identified as impact in the *Noise Technical Report*. These receptors fall into the category for which there is no abatement criterion, and therefore they are no longer considered impacted.

TABLE 1: SUMMARY OF NOISE IMPACT ASSESSMENT AT RESIDENCES (REVISED 2011)

Location	Distance From Front Row to Center of US 24 (feet)	Existing One-Hour Noise Level (dBA)	Proposed Action One-Hour Noise Level (dBA)	One-Hour Noise Level Increase (dBA)	Number of Residences and Parks Where One-Hour Noise Level > 66 dBA	Areas Where There is Noise Impact at Residences and Parks
I-25 to 8 th St. (N side of US 24)	475	65	67	2	2	8 th Street and Colorado
8 th St. to 15 th St. (N side of US 24)	275	64	67	3	3	12 th Street and Vermijo
8 th St. to 15 th St. (S side of US 24)	275	63	66	3	1	A-1 Mobile Home Park
15 th St. to 21 st St. (N side of US 24)	125	61	66	5	1	18 th Street and Sheldon
21 st St. to 31 st St. (N side of US 24)	250	63	66	3	2	26 th Street and US 24
21 st St. to 31 st St. (S side of US 24)	275	64	67	3	0	---
31 st St. to Manitou (N side of US 24)	100	62	62	0	0	---
31 st St. to Ridge Rd. (S side of US 24)	150	69	70	1	21	Red Canyon Place and Palisade Circle

3. Noise Mitigation

Noise mitigation measures were considered for each of the impacted receptors according to CDOT's 2011 *Noise Guidelines*. A summary of the results of each analysis is provided below, including the reasons for any differences compared to the analysis using the 2002 noise guidelines. The location of each wall analyzed is shown in the attached figures. The noise level reductions predicted for each noise wall analyzed are attached to this report. A summary of the noise mitigation analyses is provided in Table 2. Noise Abatement Determination forms are attached. As described in the *Noise Technical Report*, noise walls were the only noise abatement option analyzed.

I-25 to 8th St. (N side of US 24)

Noise walls are not considered feasible at the two impacted residences in this area and are not recommended. This is because the residences have direct access onto the roadways they front (one on Colorado and one on 8th Street), as was the case previously.

11th Street to 14th Street (N side of US 24)

This wall is considered reasonable and feasible, as was the case previously.

A-1 Mobile Home Park (S side of US 24)

This wall is considered reasonable and feasible, as was the case previously.

East of 21st Street (N side of US 24)

A wall here is no longer considered reasonable, due to excessive cost versus benefit. The increase in the limit for being considered benefitted (from 3 to 5 dBA) made many receptors at this location not-benefitted. Previously, this wall was considered cost-effective (barely).

East and West of 26th Street

A wall here is no longer considered reasonable, due to excessive cost versus benefit. The increase in the limit for being considered benefitted (from 3 to 5 dBA) made many receptors at this location not-benefitted. Previously, this wall was just considered cost-effective (barely).

Red Canyon Place (S side of US 24)

This wall is considered reasonable and feasible, as was the case previously.

TABLE 2: RESULTS OF NOISE MITIGATION ANALYSES

Location	Height (feet)	Length (feet)	Area (ft ²)	Cost Per Ft ² (\$)	Number of Benefited Receptors	Avg. Noise Reduction At Benefited Receptors (dBA)	Cost Benefit	Meets all Feasibility and Reasonableness Criteria?
11th to 14th Street	18	1490	26,820	\$45	25	7	\$6,800	YES
A-1 Mobile Homes	15	1430	21,450	\$45	64	7	\$2,200	YES
E. of 21st Street	18	1220	21,960	\$45	14	7	\$10,000	no
26th Street	15	1760	26,400	\$45	23	6	\$8,300	no
Red Canyon Place	15	870	13,050	\$45	21	10	\$2,700	YES



B-R28 and B-R29 impacted





B-R101, -108, and -109 impacted

Noise wall analyzed (1490 ft long, 18 feet tall)



- C-R76
- C-R75
- C-R74
- C-R72
- C-R69
- C-R67
- C-R61
- C-R53
- C-R45
- C-R43
- C-R36
- C-R23
- C-R11
- C-R05
- C-R03
- C-R73
- C-R71
- C-R70
- C-R68
- C-R64
- C-R65
- C-R63
- C-R57
- C-R50
- C-R47
- C-R43
- C-R33
- C-R26
- C-R17
- C-R14
- C-R08
- C-R68
- C-R64
- C-R65
- C-R60
- C-R59
- C-R56
- C-R55
- C-R52
- C-R48
- C-R44
- C-R42
- C-R41
- C-R40
- C-R37
- C-R39
- C-R35
- C-R34
- C-R32
- C-R31
- C-R29
- C-R27
- C-R25
- C-R22
- C-R21
- C-R20
- C-R18
- C-R19
- C-R15
- C-R10
- C-R07
- C-R06
- C-R04
- C-R02
- C-R01

24

W Cucharas St

S Limit St

S 8th St

S 8th St

24

Noise wall analyzed (1430 ft long, 15 feet tall)

C-T01

C-C10

C-C09

C-C12

C-C08

C-C11

C-C07



Noise wall analyzed (1220 ft long, 18 feet tall)

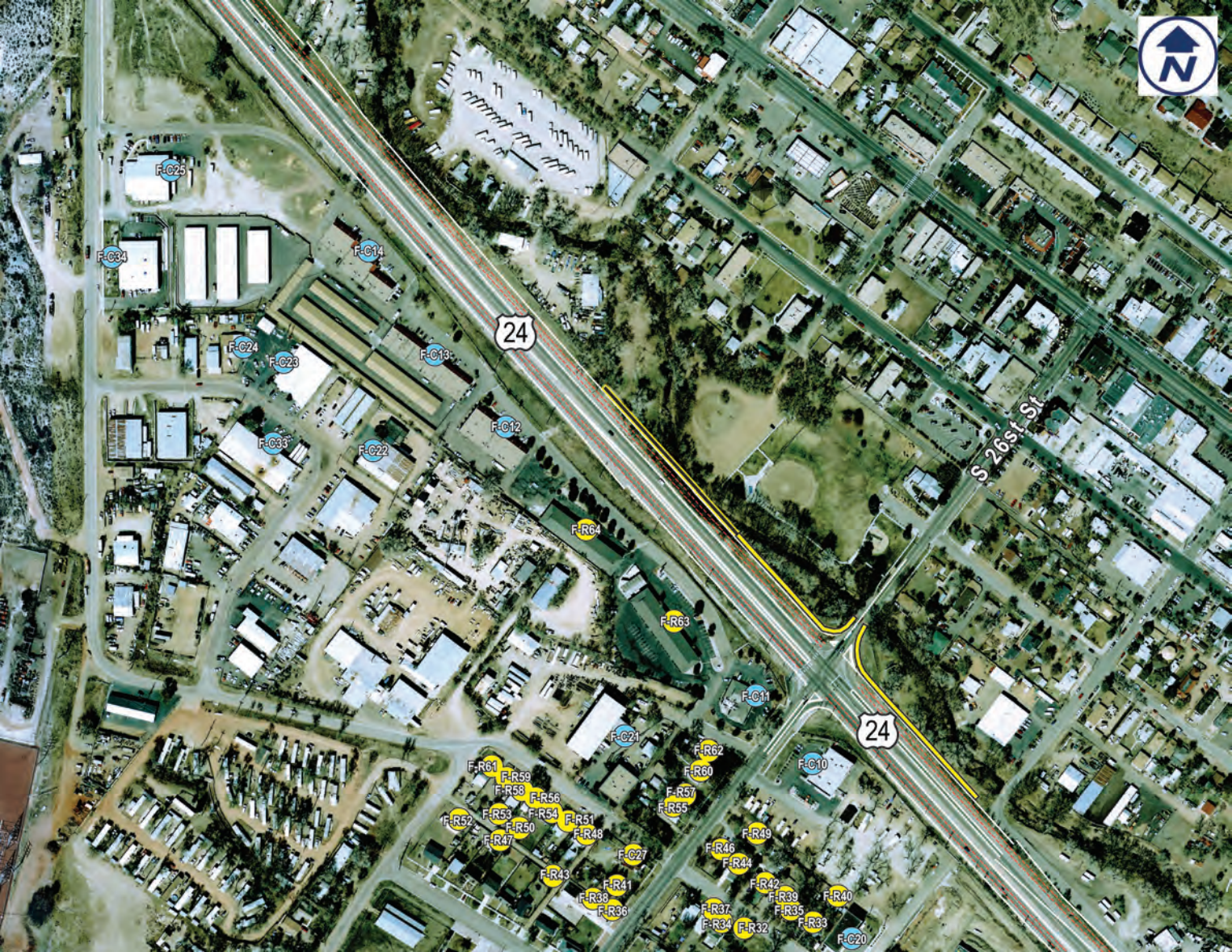


Noise wall analyzed (total length for both sections 1760 feet, and both 15 feet tall).



Wall analyzed was extended to here, as this added more benefited receptors and had a better cost-benefit than the wall analyzed previously.







24

Ridge Rd

H-R45

H-R43

H-R42

H-R41

H-R39

H-R37

H-R32

H-R30

H-R27

H-R24

H-R25

H-R20

H-R17

H-R3

H-R21

H-R40

H-R36

H-R35

H-R33

H-R34

H-R29

H-R28

H-R26

H-R22

H-R19

H-R16

H-R06

H-R18

H-R15

H-R14

H-R10

H-R07

H-R09

H-R08

H-R05

H-R04

H-R03

H-R02

H-R01

H-C01





C-12

G-R67

G-R86

G-R85

G-R84

G-R83

G-R81

G-R82

G-R79

G-R78

G-R74

G-R71

G-R69

G-R67

G-R63

G-R58

G-R52

G-R5

G-R70

G-R63

G-R62

G-R59

G-R80

G-R57

G-R54

G-R51

G-R50

G-R52

G-R53

G-R55

G-R51

G-R48

G-R46

G-R44

G-R43

G-R02

G-R56

G-R47

G-R40

G-R39

G-R45

G-R32

G-R28

G-R33

G-R27

G-R29

G-R49

G-R40

G-R32

G-R31

G-R230

G-R26

G-R23

G-R34

G-R42

G-R27

G-R29

G-R24

G-R22

G-R20

G-R21

G-R13

G-R11

G-R12

G-R05

G-R19

G-R08

G-R07

G-R04

G-R03

Ridge Rd

24



Ridge Rd

Colorado Ave

24

S 31st St

G-R19
G-R08 G-R09
G-R04 G-R07
G-R03

G-R10 G-R08
G-R01

G-C03 G-C08 G-C07

G-C06

G-C05

G-C04

G-C03

G-C02

G-T01

G-C01



Manitou Ave

24

H-R66
H-R65
H-R64
H-R63
H-R61
H-R62

H-R58

H-R59

H-R60

H-R57

H-R55

H-R53

H-R52

H-R56

H-R64

H-R51

H-R49

H-R48

H-R47

H-R46

H-R44

H-R45

H-R38

H-R31

H-R43

H-R41

H-R42

H-R37

H-R39

H-R30

H-R27

H-R32

H-R25

H-R20

H-R24

H-R47

H-R21

Length (ft)	1490
Height (ft)	Reduction
Area (ft ²)	26415
Noise Wall Unit Cost (\$/ft ²)	\$45
Cost (\$)	\$1,188,675
Number of Benefitted Receptors	25
Avg. Noise Reduction @Benefitted Rec.	6.8
Cost-Benefit	\$6,992

Receptor	No Wall (dBA)	With 18 ft Tall (dBA)	Reduction (dBA)	Reduction < 5 (dBA)
B-R01	64	64	0	
B-R02"	64	64	0	
B-R03"	64	64	0	
B-R04"	62	62	0	
B-R05"	61	61	0	
B-R06"	61	61	0	
B-R07"	65	65	0	
B-R08"	64	64	0	
B-R09"	60	60	0	
B-R10"	63	63	0	
B-R11"	62	62	0	
B-R12"	60	60	0	
B-R13"	61	61	0	
B-R14"	62	61	0	
B-R15"	60	60	0	
B-R16"	64	64	0	
B-R17"	61	61	0	
B-R18"	60	60	0	
B-R19"	64	63	1	
B-R20"	65	65	0	
B-R21"	59	59	0	
B-R22"	59	59	1	
B-R23"	63	60	3	
B-R24"	59	59	1	
B-R25"	62	59	3	
B-R26"	59	58	1	
B-R27"	61	59	1	
B-R28"	64	59	6	6
B-R29"	65	65	0	
B-R30"	59	58	1	
B-R31"	60	58	1	

B-R32"	65	59	6	6
B-R33"	65	59	6	6
B-R34"	59	58	1	
B-R35"	65	59	6	6
B-R36"	59	58	2	
B-R37"	61	58	3	
B-R38"	64	58	6	6
B-R39"	60	57	3	
B-R40"	60	57	3	
B-R41"	62	57	5	5
B-R42"	65	58	7	7
B-R43"	60	57	3	
B-R44"	64	57	6	6
B-R45"	59	57	2	
B-R46"	62	57	5	5
B-R47"	65	57	7	7
B-R48"	61	57	5	5
B-R49"	63	57	7	7
B-R50"	63	56	6	6
B-R51"	61	56	5	5
B-R52"	60	56	4	
B-R53"	62	56	6	6
B-R54"	59	55	4	
B-R55"	59	55	3	
B-R56"	61	55	6	6
B-R57"	60	55	5	5
B-R58"	58	55	3	
B-R59"	59	55	4	
B-R60"	58	55	4	
B-R61"	59	55	4	
B-R62"	58	55	3	
B-R63"	58	55	3	
B-R64"	59	54	5	5
B-R65"	58	55	4	
B-R66"	59	54	5	5
B-R67"	58	55	4	
B-R68"	58	54	4	
B-R69"	58	54	3	
B-R70"	59	54	5	5
B-R71"	58	54	4	
B-R72"	57	54	3	
B-R73"	57	54	3	
B-R74"	57	54	3	
B-R75"	57	54	3	
B-R76"	56	53	3	
B-R77"	57	54	3	

B-R78"	57	54	2	
B-R79"	56	54	2	
B-R80"	56	54	2	
B-R81"	56	54	2	
B-R82"	56	54	2	
B-R83"	56	54	1	
B-R84"	57	56	1	
B-R85"	56	54	1	
B-R86"	60	59	0	
B-R87"	56	55	1	
B-R88"	60	60	0	
B-R89"	56	54	1	
B-R90"	56	55	1	
B-R91"	56	55	1	
B-R92"	60	60	0	
B-R93"	57	56	1	
B-R94"	56	56	1	
B-R95"	57	56	1	
B-R96"	58	58	0	
B-R97"	60	60	0	
B-R98"	57	57	0	
B-R99"	59	58	0	
B-R100"	60	60	0	
B-R101"	58	57	0	
B-R102"	58	58	0	
B-R103"	59	59	0	
B-R104"	62	61	0	
B-R105"	62	62	0	
B-R106"	62	62	0	
B-R107"	67	57	10	10
B-R108"	67	57	10	10
B-R109"	67	58	9	9
B-C01"	64	64	0	
B-C02"	66	66	0	
B-C03"	66	66	0	
B-C04"	66	66	0	
B-C05"	66	64	2	
B-C09"	64	64	0	
B-C10"	67	56	11	11
B-C11"	65	55	11	11
B-C12"	53	52	1	
B-C13"	54	54	1	
B-P01"	59	56	4	

Length (ft)	1429
Height (ft)	15
Area (ft ²)	21435
Noise Wall Unit Cost (\$/ft ²)	\$45
Cost (\$)	\$964,575
Number of Benefitted Receptors	64
Avg. Noise Reduction @Benefitted Rec.	7
Cost-Benefit	\$2,216

Receptor	No Wall (dBA)	With 15 ft Tall (dBA)	Reduction (dBA)	Reduction < 5 (dBA)
C-R01	62	58	4	
C-R02	61	57	4	
C-R03	58	55	3	
C-R04	61	56	5	5
C-R05	58	55	3	
C-R06	65	59	6	6
C-R07	64	59	5	5
C-R08	59	55	4	
C-R09	60	55	5	5
C-R10	64	58	6	6
C-R11	58	55	3	
C-R12	61	56	5	5
C-R13	60	55	5	5
C-R14	60	55	5	5
C-R15	64	58	6	6
C-R16	60	55	5	5
C-R17	59	55	4	
C-R18	63	56	7	7
C-R19	64	57	7	7
C-R20	62	56	6	6
C-R21	61	55	6	6
C-R22	60	55	5	5
C-R23	59	55	4	
C-R24	60	55	5	5
C-R25	64	57	7	7
C-R26	59	55	4	
C-R27	63	56	7	7
C-R28	61	55	6	6
C-R29	61	55	6	6
C-R30	61	55	6	6
C-R31	64	57	7	7

C-R32	63	56	7	7
C-R33	60	55	5	5
C-R34	62	55	7	7
C-R35	61	55	6	6
C-R36	59	55	4	
C-R37	63	56	7	7
C-R38	62	56	6	6
C-R39	64	56	8	8
C-R40	62	55	7	7
C-R41	62	55	7	7
C-R42	64	56	8	8
C-R43	60	55	5	5
C-R44	63	55	8	8
C-R45	60	56	4	
C-R46	62	55	7	7
C-R47	62	55	7	7
C-R48	64	55	9	9
C-R49	65	56	9	9
C-R50	61	55	6	6
C-R51	63	55	8	8
C-R52	63	55	8	8
C-R53	60	56	4	
C-R54	65	56	9	9
C-R55	64	55	9	9
C-R56	65	56	9	9
C-R57	62	55	7	7
C-R58	63	55	8	8
C-R59	65	56	9	9
C-R60	64	55	9	9
C-R61	61	56	5	5
C-R62	66	56	10	10
C-R63	62	55	7	7
C-R64	64	56	8	8
C-R65	65	56	9	9
C-R66	63	55	8	8
C-R67	62	56	6	6
C-R68	65	56	9	9
C-R69	62	56	6	6
C-R70	65	55	10	10
C-R71	64	55	9	9
C-R72	63	56	7	7
C-R73	64	55	9	9
C-R74	64	56	8	8
C-R75	64	56	8	8
C-R76	65	57	8	8

Length (ft)	1219
Height (ft)	18
Area (ft ²)	21942
Noise Wall Unit Cost (\$/ft ²)	\$45
Cost (\$)	\$987,390
Number of Benefitted Receptors	14
Avg. Noise Reduction @Benefitted Rec.	7
Cost-Benefit	\$10,617

Receptor	No Wall (dBA)	With 18 ft Tall (dBA)	Reduction (dBA)	Reduction < 5 (dBA)
D-R01	65	65	0	
D-R02	64	64	0	
D-R03	63	63	0	
D-R04	63	63	0	
D-R05	63	63	0	
D-R06	61	61	0	
D-R07	62	62	0	
D-R08	61	61	0	
D-R09	58	58	0	
D-R10	60	60	0	
D-R11	57	57	0	
D-R12	57	57	0	
D-R13	60	60	0	
D-R14	56	56	0	
D-R15	58	58	0	
D-R16	59	59	0	
D-R17	63	63	0	
D-R18	59	59	0	
D-R19	58	58	0	
D-R20	57	57	0	
D-R21	59	59	0	
D-R22	59	59	0	
D-R23	56	56	0	
D-R24	56	56	0	
D-R25	63	63	0	
D-R26	60	60	0	
D-R27	62	62	0	
D-R28	63	63	0	
D-R29	56	56	0	
D-R30	59	59	0	
D-R31	56	56	0	
D-R32	62	62	0	
D-R33	56	56	0	

D-R34	59	59	0
D-R35	58	58	0
D-R36	62	62	0
D-R37	60	60	0
D-R38	57	57	0
D-R39	56	56	0
D-R40	58	58	0
D-R41	63	63	0
D-R42	59	59	0
D-R43	56	56	0
D-R44	57	57	0
D-R45	56	56	0
D-R46	63	63	0
D-R47	60	60	0
D-R48	61	61	0
D-R49	56	56	0
D-R50	57	57	0
D-R51	56	56	0
D-R52	57	57	0
D-R53	60	60	0
D-R54	64	64	0
D-R55	57	57	0
D-R56	60	60	0
D-R58	63	63	0
D-R59	64	64	0
D-R60	62	62	0
D-R61	59	59	0
D-R62	57	57	0
D-R63	56	56	0
D-R64	59	59	0
D-R65	57	57	0
D-R66	56	56	0
D-R67	60	60	0
D-R68	61	61	0
D-R69	56	56	0
D-R70	71	64	7
D-R71	56	56	0
D-R72	57	57	0
D-R73	56	56	0
D-R74	61	61	0
D-R75	57	57	0
D-R76	56	56	0
D-R77	57	57	0
D-R78	57	56	0
D-R79	57	57	0
D-R80	59	59	0
D-R81	56	56	0
D-R82	60	60	0
D-R83	56	56	0

D-R84	61	60	1	
D-R85	59	59	0	
D-R86	63	59	4	
D-R87	57	57	0	
D-R88	59	59	0	
D-R89	56	56	0	
D-R90	57	57	0	
D-R91	56	56	0	
D-R92	71	60	11	11
D-R93	56	56	0	
D-R94	56	56	0	
D-R95	59	58	1	
D-R96	56	56	0	
D-R97	56	56	0	
D-R98	58	58	1	
D-R99	57	57	0	
D-R100	57	56	0	
D-R101	57	57	1	
D-R102	60	58	2	
D-R103	56	56	0	
D-R104	59	58	1	
D-R105	67	58	9	9
D-R106	66	60	6	6
D-R107	56	56	0	
D-R108	56	56	0	
D-R109	59	58	1	
D-R110	57	57	1	
D-R111	65	57	8	8
D-R112	56	56	0	
D-R113	66	59	6	6
D-R114	59	57	1	
D-R115	57	57	1	
D-R116	59	57	2	
D-R117	62	56	6	6
D-R118	57	57	1	
D-R119	56	56	0	
D-R120	65	59	7	7
D-R121	59	57	2	
D-R122	57	56	1	
D-R123	56	56	1	
D-R125	57	56	1	
D-R126	59	57	2	
D-R127	57	56	1	
D-R128	59	57	2	
D-R129	56	56	1	
D-R130	56	56	1	
D-R131	64	58	6	6
D-R132	58	56	1	
D-R133	56	56	1	

D-R134	56	56	1	
D-R135	64	58	6	6
D-R136	58	56	1	
D-R137	59	56	3	
D-R138	56	56	1	
D-R139	63	57	6	6
D-R140	60	56	4	
D-R141	56	55	1	
D-R142	58	56	2	
D-R143	57	56	1	
D-R144	56	56	1	
D-R145	56	55	1	
D-R146	60	56	4	
D-R147	57	55	2	
D-R148	62	57	5	5
D-R149	57	55	1	
D-R150	60	56	4	
D-R151	56	55	1	
D-R152	58	55	2	
D-R153	60	56	4	
D-R154	61	56	5	5
D-R155	57	55	2	
D-R156	56	55	1	
D-R157	60	56	4	
D-R158	57	55	1	
D-R159	56	55	1	
D-R160	58	55	3	
D-R161	57	55	2	
D-R162	59	55	4	
D-R163	57	55	2	
D-R164	60	56	4	
D-R165	58	55	3	
D-R166	60	55	5	5
D-R167	57	55	2	
D-R168	57	55	3	
D-R169	58	55	3	
D-R170	58	55	3	
D-R171	57	55	2	
D-R172	58	55	3	
D-R173	58	55	3	
D-R174	57	55	2	
D-R175	57	55	2	
D-R176	60	55	4	
D-R177	59	55	3	
D-R178	57	56	1	
D-R179	60	56	4	
D-R180	57	55	2	
D-R181	59	55	3	
D-R182	57	55	2	

D-R183	59	55	3
D-R184	57	55	2
D-R185	57	55	2
D-R186	57	55	2
D-R187	59	55	3
D-R188	57	55	2
D-R189	59	55	3
D-R190	58	55	3
D-R191	58	55	3
D-R192	59	55	3
D-R193	58	54	3
D-R194	58	55	2
D-R195	58	55	3
D-R196	59	56	3
D-R197	58	55	3
D-R198	58	55	3
D-R199	58	55	3
D-R200	58	55	3
D-R201	58	56	3
D-R202	58	56	3
D-R203	56	55	1
D-R204	58	56	2
D-R205	58	56	3
D-R206	58	56	3
D-R207	59	56	3
D-R208	58	57	2
D-R209	58	56	2
D-R210	58	57	1
D-R211	59	59	1
D-R212	58	56	2
D-R213	59	56	2
D-R214	60	58	2
D-R215	59	57	2
D-R216	59	57	2
D-R217	59	58	2
D-R218	60	59	1
D-R219	61	60	1
D-R220	61	61	1
D-R221	62	62	0
D-R222	65	64	0

Length (ft)	1762
Height (ft)	15
Area (ft ²)	26430
Noise Wall Unit Cost (\$/ft ²)	\$45
Cost (\$)	\$1,189,350
Number of Benefitted Receptors	23
Avg. Noise Reduction @Benefitted Rec.	6
Cost-Benefit	8376

Receptor	No Wall (dBA)	With 18 ft Tall (dBA)	Reduction (dBA)	Reduction < 5 (dBA)
E-R01	67	67	0	
E-R02	63	63	0	
E-R03	62	62	0	
E-R04	61	61	0	
E-R05	58	58	0	
E-R06	60	60	0	
E-R07	57	57	0	
E-R08	58	58	0	
E-R09	58	58	0	
E-R10	57	57	0	
E-R11	58	58	0	
E-R12	58	58	0	
E-R13	57	57	0	
E-R14	58	58	0	
E-R16	58	58	0	
E-R17	56	56	0	
E-R18	59	59	0	
E-R19	57	57	0	
E-R20	59	59	0	
E-R22	56	56	0	
E-R23	58	58	0	
E-R24	60	59	0	
E-R25	56	56	0	
E-R26	64	63	0	
E-R27	59	59	0	
E-R28	56	56	0	
E-R29	56	56	0	
E-R30	59	59	0	
E-R31	56	56	0	
E-R32	59	59	0	
E-R33	56	56	0	

E-R34	59	59	0	
E-R35	56	56	0	
E-R36	56	56	0	
E-R37	59	59	0	
E-R38	56	55	0	
E-R39	56	56	0	
E-R40	62	61	1	
E-R41	58	57	0	
E-R42	56	55	0	
E-R43	62	61	1	
E-R44	56	56	0	
E-R45	62	61	1	
E-R46	62	61	1	
E-R47	58	57	0	
E-R48	59	59	1	
E-R49	62	61	1	
E-R50	56	55	0	
E-R51	57	57	1	
E-R52	62	61	1	
E-R53	62	61	1	
E-R54	56	55	1	
E-R55	59	58	1	
E-R56	63	62	1	
E-R57	56	56	1	
E-R58	59	58	1	
E-R59	57	56	1	
E-R60	59	58	1	
E-R61	62	60	1	
E-R62	59	58	1	
E-R63	61	60	1	
E-R64	60	59	1	
E-R65	59	58	1	
E-R66	59	58	1	
E-R67	63	58	5	5
E-R68	59	58	1	
E-R69	58	57	1	
E-R70	62	59	4	
E-R71	66	57	9	9
E-R72	60	57	3	
E-R73	63	56	8	8
E-R74	64	55	9	9
E-R75	60	57	3	
E-R76	66	58	8	8
E-R77	61	57	4	
E-R78	58	55	3	
E-R79	61	56	5	5

E-R80	57	54	3	
E-R81	64	56	8	8
E-R82	62	56	6	6
E-R83	60	55	4	
E-R84	57	54	4	
E-R85	62	56	6	6
E-R86	57	53	4	
E-R87	62	55	6	6
E-R88	58	54	4	
E-R89	62	54	8	8
E-R91	61	54	6	6
E-R92	64	57	7	7
E-R93	63	57	6	6
E-R94	63	58	5	5
E-R95	63	58	5	5
E-R96	64	59	5	5
E-R97	62	57	5	5
E-R98	63	58	5	5
E-R99	63	59	5	5
E-R100	62	58	5	5
E-R101	62	57	5	5
E-R102	61	57	5	5
E-R103	60	55	4	
E-R104	60	56	4	
E-R105	59	55	4	
E-R106	59	57	2	
E-R107	60	58	2	
E-R108	60	58	1	
E-R109	60	59	1	
E-R110	61	60	1	
E-R111	62	62	0	
E-R112	60	59	1	
E-R113	60	60	0	
E-R114	60	60	0	

Length (ft)	870
Height (ft)	15
Area (ft ²)	13050
Noise Wall Unit Cost (\$/ft ²)	\$45
Cost (\$)	\$587,250
Number of Benefitted Receptors	21
Avg. Noise Reduction @Benefitted Rec.	10
Cost-Benefit	2731

Receptor	No Wall (dBA)	With 18 ft Tall (dBA)	Reduction (dBA)	Reduction < 5 (dBA)
H-R34	70	56	14	14
H-R33	69	57	12	12
H-R33	69	57	12	12
H-R33	69	57	12	12
H-R33	69	57	12	12
H-R35	68	56	12	12
H-R35	68	56	12	12
H-R35	68	56	12	12
H-R35	68	56	12	12
H-R35	68	56	12	12
H-R35	68	56	12	12
H-R35	68	56	12	12
H-R35	68	56	12	12
H-R29	68	58	10	10
H-R36	66	56	10	10
H-R40	68	58	10	10
H-R28	65	58	7	7
H-R23	63	58	5	5
H-R26	60	55	5	5
H-R22	59	55	4	
H-R19	59	56	3	
H-R16	59	57	2	
H-R13	61	56	5	5
H-R18	61	56	5	5
H-R07	58	55	3	
H-R09	58	55	3	
H-R10	58	55	3	
H-R14	59	56	3	
H-R15	59	56	3	
H-R02	56	54	2	
H-R03	56	54	2	
H-R04	56	54	2	
H-R05	56	54	2	
H-R06	58	56	2	
H-R08	58	56	2	
H-R01	56	55	1	
H-R12	61	60	1	



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 # _____ Date of Analysis: September 2011

Project Name & Location: US 24 West: E. of 21st Street

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 benefited resident/owners in favor of the recommended noise abatement measure?
 YES NO To be determined

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:

E. STATEMENT OF LIKELIHOOD:

- | | |
|--|---|
| 1. Are noise mitigation measures feasible?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | 2. Are noise mitigation measures reasonable?
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO |
| 3. Is insulation of buildings both feasible and reasonable?
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO | 4. Shall noise abatement measures be provided?
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO |

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

A number of different noise walls were analyzed for this location, and none of them were found to meet the cost-benefit criterion. The most effective design has a cost benefit of \$10,000. Presently, a noise wall is not recommended for this location, but this should be reviewed during final design.

Completed by: M. Hankard, Hankard Environmental Date: September 15, 2011



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 # _____ Date of Analysis: September 2011

Project Name & Location: US 24 West: A-1 Mobile Home 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 benefited resident/owners in favor of the recommended noise abatement measure?
 YES NO To be determined

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:

E. STATEMENT OF LIKELIHOOD:

- | | |
|---|---|
| 1. Are noise mitigation measures feasible?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | 2. Are noise mitigation measures reasonable?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |
| 3. Is insulation of buildings both feasible and reasonable?
<input type="checkbox"/> YES <input type="checkbox"/> NO | 4. Shall noise abatement measures be provided?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

A 15 foot tall, 1430 foot long noise wall is considered reasonable and feasible at this location and should be included in the Proposed Action and reviewed during final design.

Completed by: M. Hankard, Hankard Environmental Date: September 15, 2011



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 # _____ Date of Analysis: September 2011

Project Name & Location: US 24 West: 26th Street, north side

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 benefited resident/owners in favor of the recommended noise abatement measure?
 YES NO To be determined

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:

E. STATEMENT OF LIKELIHOOD:

- | | |
|--|---|
| 1. Are noise mitigation measures feasible?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | 2. Are noise mitigation measures reasonable?
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO |
| 3. Is insulation of buildings both feasible and reasonable?
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO | 4. Shall noise abatement measures be provided?
<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO |

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

A number of different noise walls were analyzed for this location, and none of them were found to meet the cost-benefit criterion. The most effective design has a cost benefit of \$8,300. Presently, a noise wall is not recommended for this location, but this should be reviewed during final design.

Completed by: M. Hankard, Hankard Environmental Date: September 15, 2011



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 # _____ Date of Analysis: September 2011

Project Name & Location: US 24 West: 11th to 14th Street

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 benefited resident/owners in favor of the recommended noise abatement measure?
 YES NO To be determined

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:

E. STATEMENT OF LIKELIHOOD:

- | | |
|---|---|
| 1. Are noise mitigation measures feasible?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | 2. Are noise mitigation measures reasonable?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |
| 3. Is insulation of buildings both feasible and reasonable?
<input type="checkbox"/> YES <input type="checkbox"/> NO | 4. Shall noise abatement measures be provided?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

An 18 foot tall, 1490 foot long noise wall is considered reasonable and feasible at this location and should be included in the Proposed Action and reviewed during final design.

Completed by: M. Hankard, Hankard Environmental Date: September 15, 2011



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 # _____ Date of Analysis: September 2011

Project Name & Location: US 24 West: Red Canyon Place Condominiums

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 benefited resident/owners in favor of the recommended noise abatement measure?
 YES NO To be determined

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:

E. STATEMENT OF LIKELIHOOD:

- | | |
|---|---|
| 1. Are noise mitigation measures feasible?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO | 2. Are noise mitigation measures reasonable?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |
| 3. Is insulation of buildings both feasible and reasonable?
<input type="checkbox"/> YES <input type="checkbox"/> NO | 4. Shall noise abatement measures be provided?
<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |

F. ABATEMENT DECISION DESCRIPTION AND JUSTIFICATION:

A 15 foot tall, 870 foot long noise wall is considered reasonable and feasible at this location and should be included in the Proposed Action and reviewed during final design.

Completed by: M. Hankard, Hankard Environmental Date: September 15, 2011