APPENDIX A21

TRAFFIC NOISE
TECHNICAL MEMORANDUM

FOR THE
State Highway 9 Iron Springs Alignment
Environmental Assessment

Prepared for
COLORADO DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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ACRONYMS

AADT  Average Annual Daily Traffic
CDOT  Colorado Department of Transportation
dBA   Noise Level - Decibel “A” Weighted
EIS   Environmental Impact Statement
FHWA  Federal Highway Administration
NAC   Noise Abatement Criteria
ROD   Record of Decision
SH 9  State Highway 9
USDA  U.S. Department of Agriculture
USFS  U.S. Forest Service
VPH   Vehicles Per Hour
INTRODUCTION

State Highway (SH) 9 reconstruction, including recommended noise abatement between the Town of Breckenridge and the southern project limit, has been completed. The last phase of SH 9 construction will include the final roadway configuration and recommended noise abatement measures at Frisco Bay and Waterdance condominiums north of the reevaluation project limit. This noise memorandum looks at SH 9 on the new alignment and is, by definition, a Type I noise project requiring traffic noise analysis.

PROPOSED ACTION

As part of implementation of the SH 9 improvements between Frisco and Breckenridge, the Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA) are proposing to realign approximately 1.3 miles of existing SH 9 just south of the Town of Frisco, Colorado (see Figure 1). This stretch of SH 9, which falls between mileposts 93 and 95, would be realigned to provide a four-lane reduced section roadway away from Dillon Reservoir. This Proposed Action, also referred to as the Iron Springs Alignment, would shorten SH 9 by approximately 0.4 mile. The Proposed Action would provide roadway safety benefits, as well as water quality and drinking water protection benefits, as a result of straightening the highway to remove a tight, compound curve (known, as Leslie’s Curve), which is in close proximity to Dillon Reservoir. The existing condition on Leslie’s Curve is considered substandard and contributes to accidents in the area.

The Proposed Action would include realignment of a portion of the existing Frisco-Farmer’s Korner-Blue River Bikeway (also referred to herein for brevity as the Blue River Bikeway or bikeway). This portion of the bikeway would be moved to the alignment currently occupied by SH 9, would be approximately 0.4 mile longer than the existing bikeway, and would be at a gentler grade than the current alignment. In addition, the Dickey Day Use Parking Lot would be moved west to a new parking lot to be constructed as part of the project, with access provided via Recreation Way using the existing signalized intersection at SH 9 and Recreation Way. A new trail connection would be provided to link the proposed parking lot with the realigned bikeway and existing trail, which currently begins at the old Dickey Day Use Parking Lot.

Additional detail regarding the Proposed Action, including typical sections, is provided in the EA main text and the project drawings provided in Appendix A1 of the EA.
Figure 1  Proposed Action
NO ACTION ALTERNATIVE

If the Proposed Action is not selected for implementation, SH 9 would be widened to provide a four-lane reduced section roadway along the existing alignment as previously approved in the SH 9 Frisco to Breckenridge Environmental Impact Statement (EIS) and Record of Decision (ROD) (CDOT and FHWA, 2004a; 2004b) (Figure 2). The 2004 Preferred Alternative is considered the “No Action Alternative” for this EA and is used as a baseline for comparison with the Proposed Action. These improvements would be implemented if the Proposed Action is not selected.

Widening along the existing alignment would require large rock cuts and retaining walls (problematic to design and construct), and the highway would remain in close proximity to Dillon Reservoir. The length of SH 9 would remain the same as that of the existing highway. The tight Leslie’s Curve would not be eliminated; however, safety features such as a barrier between opposing lanes would be installed to improve safety.

With this alternative, approximately 0.8 mile of the existing Blue River Bikeway would be realigned to allow space for the highway widening. The length of bikeway would not change appreciably and the current relatively steep grades on the path would remain.

Additional detail regarding the No Action Alternative, including typical sections, is provided in the EA main text and the project drawings provided in Appendix A1 of the EA.
Figure 2  No Action Alternative (Previously Approved)
NOISE EVALUATION

Changed Conditions

The No Action Alternative evaluated a design year of 2020 using older STAMINA2.0 modeling software. This evaluation used noise regulations 23 Code of Federal Regulations 772 revised in 2010, updated CDOT Noise Analysis and Abatement Guidelines (2013), FHWA approved TNM 2.5 modeling software, existing condition (2013) traffic, and design year 2035 traffic.

Because this evaluation will result in a new National Environmental Policy Act decision document, all existing and permitted receptors along the reevaluation corridor will be incorporated into this evaluation under federally compliant guidance of the CDOT Noise Analysis and Abatement Guidelines (2013).

Noise Model Validation

TNM Version 2.5 noise modeling software was used to predict hourly-averaged equivalent (Leq) traffic noise levels. A calibrated, integrating-type sound level meter meeting American National Standards Institute Type II specifications was deployed for 2012 field measurements. The noise monitoring results were used to validate the TNM model by comparing the predicted (modeled) and measured noise levels at monitoring locations using the traffic count data obtained during the measurement periods. The model is considered valid when the difference between noise readings and modeled noise levels are within 3 A-weighted decibels (dBA) as shown in Table 1.

Table 1  Validation Model Results

<table>
<thead>
<tr>
<th>Validation Reading Site</th>
<th>Noise Level (dBA)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measured</td>
<td>Modeled</td>
</tr>
<tr>
<td>Summit County Medical Center M1 Located 75 feet from EOP along Medical Center Road</td>
<td>67.4</td>
<td>67.0</td>
</tr>
<tr>
<td>School Road M2 Located 80 feet from SH 9</td>
<td>64.3</td>
<td>63.4</td>
</tr>
</tbody>
</table>

Traffic Data

Traffic volumes and composition for the predictive 2011 and 2035 analyses were taken from CDOT Statewide Traffic Data Tables. Table 2 summarizes the traffic data used in the evaluation.

Table 2  Traffic Data used in Analyses

<table>
<thead>
<tr>
<th>Roadway Milepost</th>
<th>2011 AADT</th>
<th>Directional 2011 (VPH)</th>
<th>2035 AADT</th>
<th>Directional 2035 (VPH)</th>
<th>Speed (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Auto</td>
<td>MT</td>
<td>HT</td>
<td></td>
</tr>
<tr>
<td>90-92.8</td>
<td>21,000</td>
<td>1013</td>
<td>21</td>
<td>16</td>
<td>36,372</td>
</tr>
<tr>
<td>92.8-95.9</td>
<td>18,000</td>
<td>953</td>
<td>25</td>
<td>13</td>
<td>31,392</td>
</tr>
<tr>
<td>95.9-96.0</td>
<td>22,000</td>
<td>1172</td>
<td>24</td>
<td>14</td>
<td>38,368</td>
</tr>
</tbody>
</table>

Source: CDOT, 2013a

Note: AADT=Average Annual Daily Traffic. VPH=Vehicles per Hour. MT=Medium Trucks-2 axle. HT=Heavy Duty Trucks with more than 2 axles. MPH=Miles per Hour.

Noise Receptors

The St. Anthony’s Summit County-Peak One medical complex (C1), a private residence referred to locally as Antler House (B6), Summit County High School (C7), and a mobile home park (B8) were identified as noise sensitive receptors within the project area. Recreational noise sensitive receptors were also identified for the nearest point along an vehicle track/informal trail at the
Frisco Adventure Park (C2), trailhead at Dickey Day Use Parking Lot (C3), at two localities along the existing Blue River Bikeway (C4, C5a), and at trail crossings for the proposed Iron Springs alignment (C5b, C5c). These receptors are noted on the aerial photograph (Figure 3). Please note Points M1 and M2 are locations for field measurements, and C5c is located in the same area as C5a.

Figure 3 Noise Receptor Locations and Identification Numbers

Noise Impacts

Existing Condition

Noise levels today range from 51.9 to 70.2 dBA at the identified noise sensitive receptors. Many changes have occurred to the USDA-USFS Peninsula Recreation Area landscape since the Final EIS was completed. Timber salvage as a result of mountain pine beetle kill has changed the focus of the Frisco Nordic Center (now the Frisco Adventure Park) and Peninsula Recreational Area to a more built outdoor recreational environment, while a portion of National Forest land was converted to house the new St. Anthony’s Summit County Medical Center and Peak One medical complex. Table 3 includes current 2012 noise levels for Noise Abatement Criteria (NAC) residential (B) and special activity use (C) receptors. The Antler House B6, mobile home park B8, and segments of the Blue River Bikeway adjacent to SH 9 at C4 and C5a are impacted under current conditions.
Table 3: Noise Analysis Results

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>West side of St. Anthony’s Summit County &amp; Peak One Medical Complex</td>
<td>66</td>
<td>C1</td>
<td>51.9</td>
<td>NA</td>
<td>54.6</td>
<td>54.6</td>
<td>2.7</td>
<td>No</td>
</tr>
<tr>
<td>Frisco Adventure Park</td>
<td>66</td>
<td>C2</td>
<td>65.0</td>
<td>NA</td>
<td>66.2</td>
<td>65.8</td>
<td>0.8</td>
<td>Yes</td>
</tr>
<tr>
<td>Blue River Bikeway crossing at MP 94.6</td>
<td>66</td>
<td>C5b</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>64.0</td>
<td>NA</td>
<td>No</td>
</tr>
<tr>
<td>Dickey Day Use Trailhead</td>
<td>66</td>
<td>C3</td>
<td>57.2</td>
<td>NA</td>
<td>60.2</td>
<td>42.4</td>
<td>-14.8</td>
<td>No</td>
</tr>
<tr>
<td>Blue River Bikeway near Lake Dillon</td>
<td>66</td>
<td>C4</td>
<td>67.6</td>
<td>NA</td>
<td>NA</td>
<td>38.7</td>
<td>-28.9</td>
<td>No</td>
</tr>
<tr>
<td>Blue River Bikeway crossing at MP 93.2</td>
<td>66</td>
<td>C5a</td>
<td>70.2</td>
<td>NA</td>
<td>NA</td>
<td>64.0</td>
<td>-6.2</td>
<td>No</td>
</tr>
<tr>
<td>Antler House (Originally identified as B94)</td>
<td>66</td>
<td>B6</td>
<td><strong>69.7</strong></td>
<td><strong>71.6</strong></td>
<td><strong>73.4</strong></td>
<td><strong>66.5</strong></td>
<td><strong>‐3.2</strong></td>
<td>Yes</td>
</tr>
<tr>
<td>Summit High School</td>
<td>66</td>
<td>C7</td>
<td>54.4</td>
<td>NA</td>
<td>57.5</td>
<td>56.1</td>
<td>1.7</td>
<td>No</td>
</tr>
<tr>
<td>North side of Mobile Home Park (Originally identified as B92b)</td>
<td>66</td>
<td>B8</td>
<td><strong>67.3</strong></td>
<td>65.6</td>
<td><strong>69.8</strong></td>
<td><strong>69.7</strong></td>
<td><strong>2.4</strong></td>
<td>Yes</td>
</tr>
</tbody>
</table>

¹ Noise impact is defined as a noise level (rounded to the nearest whole dBA) equal to or exceeding the NAC. Noise levels equal to or exceeding the NAC are shown in bold in this table.

NAC=Noise Abatement Criteria. dBA=decibel “A” weighted.
NA = Not appropriate, as this feature either did not exist at the time of the SH 9 EIS or was not evaluated in the SH 9 EIS (CDOT and FHWA, 2004a).
No Action Alternative

The existing alignment of SH 9 would be expanded to four-lanes under the No Action Alternative. Noise sensitive activity areas along the corridor are residential and recreational. Noise sensitive receptors were identified within the reevaluation area as shown in Figure 3 and summarized in Table 3.

Future 2035 noise levels ranged from 54.6 to 73.4 dBA. In the Peninsula area, the Blue River Bikeway would be relocated over Iron Spring Hill culminating at a juncture with the existing trail adjacent to the high school and would experience noise levels between 56 to 58 dBA. Impacts would be experienced at Antler House B6 and the mobile home park B8, which consists of two separate dwelling units. Because the noise levels at these receptors would be above the NAC B threshold of 66 dBA, mitigation must be considered (see the Mitigation section for more detail).

Please note that the Antler House has been identified as a full property acquisition for the No Action Alternative, due to access constraints. This would remove this residence and the associated noise impacts. The need for full acquisition will be reviewed and confirmed in final design. The house has been included in this impact evaluation in case final design details do not confirm the need for full acquisition.

Proposed Action

The new alignment would cross undeveloped National Forest land that has not been managed for developed recreation. Future 2035 noise levels ranged from 38.7 to 69.7 dBA. The Blue River Bikeway would be relocated to the old SH 9 alignment between mileposts 93.1 and 94.6 and cross the new alignment through underpasses at the west and east termini of the new alignment. Noise impacts were assessed at points 50 feet away from these new highway crossings at receptors C5a (east) and C5b (west). Noise levels were below the NAC C threshold of 66 dBA. Notable benefit to the Dickey Day Use Parking Lot and bikeway recreational facilities is derived from the new alignment. Noise levels for trailheads and bikeway locations previously adjacent to the old SH 9 alignment would be reduced under the Proposed Action between -6.2 and -28.9 dBA.

Impact would remain at Antler House B6 and the mobile home park B8. Mitigation options for the Proposed Action would not be feasible or reasonable, similar to those discussed under the No Action Alternative.

Please note that the Antler House has been identified as a full property acquisition for the Proposed Action due to access constraints. This would remove this residence and the associated noise impacts. The need for full acquisition will be reviewed and confirmed in final design. The house has been included in this impact evaluation in case final design details do not confirm the need for full acquisition.
MITIGATION

As discussed in the previous section, predicted design-year noise levels equal or exceed CDOT’s NAC at six Category B and one Category C locations. Per CDOT policy, the feasibility and reasonableness of constructing noise mitigation measures for these impacted receptors was analyzed.

Feasibility of abatement reviews the physical consideration and concerns with the construction of an acoustically effective noise barrier at a particular site. These criteria include:

- Does the proposed mitigation measure provide at least 5 dBA of noise reduction to a front row receptor?
- Are there any “fatal flaw” safety or maintenance issues involved with the proposed mitigation measure?
- Are there any obvious constructability issues with the proposed mitigation measure?

Reasonableness of abatement evaluates the combination of environmental, economic, and social factors associated with noise abatement measures. Reasonableness criteria include:

- Does the proposed mitigation measure provide a minimum of 7 dBA for one benefitted receptor?
- Is the proposed mitigation cost-reasonable? Is the cost benefit index (cost per receptor per decibel of reduction) no more than $6,800?
- What are the desires of benefitted residents and owners?

C2 Frisco Adventure Park Trail

This informal trail is a dirt wheel track that runs parallel to the existing SH 9 within the park boundary. At this time the trail is a vehicle track and has no designated recreational use. However, if a future recreational trail at or near this location is developed, noise impacts will be reevaluated and mitigation considered. The proposed Dickey trail connection (see Figure 1) would be farther from the proposed SH 9 alignment than receptor location C2 and, therefore, would have a lower noise level that would not exceed the NAC.

B6 Antler House

As described previously, the Antler House has been identified as a full property acquisition for both the No Action Alternative and the Proposed Action. If the full acquisition is confirmed through final design, the residence and associated noise impacts will be removed. However, mitigation has been considered in this evaluation in case final design details do not confirm the need for full acquisition.

Noise walls were the only mitigation remedy considered at Antler House due to the close proximity of the roadway to the home (Figure 4). The noise barrier was situated along the outside shoulder of the roadway and would shift the driveway access south to accommodate the proposed noise barrier. A feasible noise barrier, 6 feet tall and 217 feet long, provided the required 7.0 dBA design goal reduction. However, the cost benefit ratio for the optimized dimensions was $8,382 per receptor per decibel reduced, exceeding the $6,800 reasonableness threshold (Table 4). Therefore, noise abatement at this location does not meet the reasonable and feasible criteria for providing noise abatement under FHWA compliant CDOT Noise Analysis and Abatement Guidelines (2013) and no noise abatement is recommended.
Table 4  Cost Benefit Index Calculations for Noise Abatement Measure at Receptor B6

<table>
<thead>
<tr>
<th>Wall Height In Feet</th>
<th>Wall Length In Feet</th>
<th>Unit Cost per SF</th>
<th>Wall Cost</th>
<th>Reduction In dBA</th>
<th>Cost Benefit Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>357</td>
<td>$45</td>
<td>$160,852</td>
<td>9.5</td>
<td>$16,932</td>
</tr>
<tr>
<td>10</td>
<td>281</td>
<td>$45</td>
<td>$126,393</td>
<td>9.3</td>
<td>$13,591</td>
</tr>
<tr>
<td>6</td>
<td>281</td>
<td>$45</td>
<td>$75,836</td>
<td>7.5</td>
<td>$10,111</td>
</tr>
<tr>
<td>6</td>
<td>217</td>
<td>$45</td>
<td>$58,672</td>
<td>7.0</td>
<td>$8,382</td>
</tr>
</tbody>
</table>

Note: SF=Square Feet

Figure 4  Location of B6 Antler House Noise Wall

B8 Mobile Home Park

Due to accessibility constraints within the mobile home park and at School Road, only a noise wall was considered for noise abatement at this site (see Figure 5). The noise barrier would be situated along the internal access road within the mobile home park property, not at the roadway edge due to intervening property activity. A feasible wall under CDOT guidelines cannot be more than 20 feet in height. A wall 20 feet tall and 180 feet long would not provide the five front row trailers within the mobile home park feasible noise reduction. Therefore, a wall at this locality is not feasible and reasonable under FHWA compliant CDOT Noise Analysis and Abatement Guidelines (CDOT, 2013b) and no wall is recommended.
CONCLUSIONS

The realignment of SH 9 will reduce noise levels and provide benefit to several recreational facilities. Although two residential receptors B6 and B8 are impacted by noise associated with the Proposed Action and No Action Alternative alignments, noise abatement measures were evaluated and determined to not be feasible and reasonable. Therefore, no noise mitigation is recommended.

REFERENCES

http://dtadapps.colorado.dot.info/Otis/TrafficData


Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA). 2004a. State Highway 9 Frisco to Breckenridge Final Environmental Impact Statement and 4(f) Evaluation. February. [Note: This document is an abbreviated Final EIS which incorporates the Draft EIS, constituting the complete Final EIS.]

Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA). 2004b. State Highway 9 Frisco to Breckenridge Record of Decision. May.