

Draft Alternatives Development and Screening Report Addendum

Little Cottonwood Canyon Environmental Impact Statement Wasatch Boulevard to Alta

Lead agency:
Utah Department of Transportation

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Contents

1.0	Introduction	1
2.0	Summary of the June 8 Report	1
2.1	Screening Results from the June 8 Report.....	1
2.2	Public and Agency Review of the June 8 Report	1
3.0	Screening Report Addendum	2
3.1	Summary of the Screening Process	2
3.1.1	Summary of the Project Purpose and Need	2
3.1.2	Overview of the Screening Process	3
3.1.3	Definition of the No-Action Alternative.....	5
4.0	Alternative Development and Screening Process	6
4.1	Development of Proposed Alternatives	6
4.2	Alternative Development and Screening Process – Improve Mobility in 2050.....	9
4.2.1	Improve Mobility on Wasatch Boulevard	9
4.2.2	Improve Mobility on S.R. 210 from Fort Union Boulevard to Alta.....	11
4.2.3	Refinement of the Alternatives that Passed Screening from the June 8 Report	42
5.0	Alternatives Carried Forward for Further Evaluation in the Draft EIS.....	47
6.0	References.....	48

Tables

Table 2-1.	Reasonable Alternatives from the June 8, 2020, Draft Alternatives Screening Report.....	2
Table 3-1.	Level 1 Screening Criteria (Purpose and Need)	4
Table 3-2.	Level 2 Screening Criteria (Impacts).....	4
Table 3-3.	Planned and Funded Transportation Improvements in the 2019 to 2050 RTP in the Study Area.....	5
Table 4-1.	New and Refined Alternatives Brought Forward during the Comment Period for the June 8 Report	6
Table 4-2.	Wasatch Boulevard – Travel Demand Analysis by Direction and Segment in the PM Peak Hour in 2050	10
Table 4-3.	Gondola at La Caille Capital Cost Estimate	14
Table 4-4.	Gondola at La Caille Annual O&M Cost Estimate – Winter Operations	15
Table 4-5.	Level 1 Screening Alternatives from the Screening Report Addendum – Improve Mobility on S.R. 210 from Fort Union Boulevard to Alta	36
Table 4-6.	Level 1 Screening Criteria – S.R. 210.....	37
Table 4-7.	Level 1 Screening Results – Improve Mobility on S.R. 210 from Fort Union Boulevard to Alta	38
Table 4-8.	Level 2 Screening Results – Improve Mobility on S.R. 210 from Fort Union Boulevard to Alta	40
Table 4-9.	June 8 Report and Revised Capital Cost Estimates	45

Figures

Figure 3-1. Overview of the Little Cottonwood Canyon EIS Alternatives Development and Screening Process.....	3
Figure 4-1. Gondola at La Caille Alignment	13
Figure 4-2. Earthquake Faults at Gondola Alternative 2 Base Station.....	17
Figure 4-3. Cog Rail - Ski Resort and Bypass Road Alignment.....	25
Figure 4-4. Diesel Cog Rail Minimum Snow Shed Requirements by Alignment.....	26
Figure 4-5. Cog Rail Alignment Starting at La Caille	28
Figure 4-6. Tunnel Alternative	30

Appendixes

- Appendix A. Cog Rail Exhibits
- Appendix B. Cog Rail Snow Removal Operation Considerations

Acronyms and Abbreviations

AEV	autonomous electric vehicle
D.A.V.E.	Dual-mode Advanced Vehicular Endeavor
EIS	Environmental Impact Statement
June 8 Report	<i>June 8, 2020, Draft Alternatives Development and Screening Report</i>
LOS	level of service
O&M	operation and maintenance
OD	origin-destination
Report Addendum	<i>Draft Alternatives Development and Screening Report Addendum</i>
RTP	<i>Wasatch Front Regional Transportation Plan</i>
S.R.	state route
Section 4(f)	Section 4(f) of the Department of Transportation Act of 1966
Section 6(f)	Section 6(f) of the Land and Water Conservation Fund Act of 1965
UDOT	Utah Department of Transportation
UTA	Utah Transit Authority
WFRC	Wasatch Front Regional Council

1.0 Introduction

This *Draft Alternatives Development and Screening Report Addendum* (Report Addendum) for the State Route (S.R.) 210 Project evaluates new alternatives brought forward during the June 8 to July 10, 2020, public and agency comment period for the *June 8, 2020, Draft Alternatives Development and Screening Report* (June 8 Report; UDOT 2020a). The screening process used in this Report Addendum is the same process used to evaluate alternatives in the June 8 Report.

The environmental review, consultation, and other actions required by applicable federal environmental laws for this action (the S.R. 210 Project) are being, or have been, carried out by the Utah Department of Transportation (UDOT) pursuant to 23 United States Code Section 327 and a Memorandum of Understanding dated January 17, 2017, and executed by the Federal Highway Administration and UDOT.

2.0 Summary of the June 8 Report

2.1 Screening Results from the June 8 Report

Based on the screening evaluation in the June 8 Report, UDOT determined that the three action alternatives listed in Table 2-1 were reasonable and would be carried forward for further evaluation in the Little Cottonwood Canyon Draft Environmental Impact Statement (EIS).

Table 2-1. Reasonable Alternatives from the June 8, 2020, Draft Alternatives Screening Report

Alternative	Purpose Element and Associated Options				
	Purpose Element: Improve Mobility		Purpose Element: Improve Reliability and Safety		
	Wasatch Boulevard Options	S.R. 210 from Fort Union Boulevard to Alta Options	Avalanche Mitigation Options	Trailhead Parking Options	Winter Roadside Parking Options
Enhanced Bus Service Alternative	Imbalanced-lane Alternative Five-lane Alternative	Enhanced bus service with mobility hubs at the gravel pit^a and 9400 South/Highland Drive <ul style="list-style-type: none"> • Winter point-to-point bus service from each mobility hub directly to the ski resorts • No summer bus service^b • 24 buses per hour in the peak hour • About 1,008 people on buses in the peak hour • 2,500 new parking spaces divided between two mobility hubs at the gravel pit and 9400 South and Highland Drive • Bus priority on Wasatch Boulevard • Tolling or other management strategies such as no single-occupant vehicles during peak periods 	<ul style="list-style-type: none"> • Snow sheds with berms • Snow sheds and realigned road with no berms 	<ul style="list-style-type: none"> • Trailhead parking improvements with no roadside parking within 0.25 mile • Trailhead parking improvements with no roadside parking from canyon entrance to Snowbird Entry 1 • No trailhead parking improvements with no roadside parking from canyon entrance to Snowbird 	<ul style="list-style-type: none"> • Elimination of winter roadside parking on S.R. 210 adjacent to the ski resorts
Enhanced Bus Service in Peak-period Shoulder Lane Alternative	Imbalanced-lane Alternative Five-lane Alternative	Enhanced bus service with mobility hubs at the gravel pit^a and 9400 South/Highland Drive <ul style="list-style-type: none"> • Winter point-to-point bus service from each mobility hub directly to the ski resorts • No summer bus service^b • 24 buses per hour in the peak hour • About 1,008 people on buses in the peak hour • 2,500 new parking spaces divided between two mobility hubs at the gravel pit and 9400 South and Highland Drive • Bus priority on Wasatch Boulevard • Tolling or other management strategies such as no single-occupant vehicles during peak periods • Winter bus only peak-period shoulder lanes from the North Little Cottonwood Road/Wasatch Boulevard intersection to the Alta Bypass Road; peak-period shoulder lanes would be cyclist and pedestrian facilities in summer 	<ul style="list-style-type: none"> • Snow sheds with berms • Snow sheds and realigned road with no berms 	<ul style="list-style-type: none"> • Trailhead parking improvements with no roadside parking within 0.25 mile • Trailhead parking improvements with no roadside parking from canyon entrance to Snowbird Entry 1 • No trailhead parking improvements with no roadside parking from canyon entrance to Snowbird 	<ul style="list-style-type: none"> • Elimination of winter roadside parking on S.R. 210 adjacent to the ski resorts
Gondola Alternative (at Little Cottonwood Canyon park-and-ride)	Imbalanced-lane Alternative Five-lane Alternative	Gondola from the entrance of Little Cottonwood Canyon to Alta Ski Resort with mobility hubs at the gravel pit^a and 9400 South/Highland Drive <ul style="list-style-type: none"> • Gondola starting at the gondola station at the entrance of Little Cottonwood Canyon with stops at Snowbird ski resort and Alta ski resort only • About 30 gondola cabins per hour • About 1,050 people on gondolas in the peak hour • 2,500-space parking structure at the gravel pit • Enhanced bus service every 2.5 minutes during the peak hour from the gravel pit to the gondola base station at the entrance of Little Cottonwood Canyon (there would be no parking at the base station) • Bus priority on Wasatch Boulevard • Tolling or other management strategies such as no single-occupant vehicles during peak periods 	<ul style="list-style-type: none"> • Snow sheds with berms • Snow sheds and realigned road with no berms 	<ul style="list-style-type: none"> • Trailhead parking improvements with no roadside parking within 0.25 mile • Trailhead parking improvements with no roadside parking from canyon entrance to Snowbird Entry 1 • No trailhead parking improvements with no roadside parking from canyon entrance to Snowbird 	<ul style="list-style-type: none"> • Elimination of winter roadside parking on S.R. 210 adjacent to the ski resorts

^a The gravel pit is located on the east side of Wasatch Boulevard between 6200 South and Fort Union Boulevard.

^b The purpose of the project is to improve winter mobility. Summer mobility was not identified as a project need. Therefore, summer mobility alternatives such as bus and gondola service were not evaluated.

2.2 Public and Agency Review of the June 8 Report

Based on the alternatives brought forward by the public and agencies during the scoping periods, the purpose and need review, and the review of the *Alternatives Screening Methodology Report*, UDOT conducted an alternatives development and screening process. The results of this process were published for agency and public review on June 8, 2020. The review and comment period was from June 8 through July 10, 2020. UDOT sent notification of the release and the public meeting as follows.

- Advertisements were placed in the following publications:
 - *Deseret News*, June 8 and June 15, 2020
 - *The Salt Lake Tribune*, June 8 and June 15, 2020
- Information regarding the public meeting and the comment period was posted on the Little Cottonwood EIS Project website and UDOT social media sites (Facebook, Instagram, and Twitter) on June 4 and June 8, 2020.
- Email notices were sent to the UDOT mailing list on June 4, 8, and 15, 2020.
- A UDOT press release was sent to local media outlets on June 4, 2020, as a reminder of the public meetings on June 22, 23, and 24, 2020.

As a result of the COVID-19 pandemic, UDOT altered the format of the public meeting process to allow for social distancing guidelines as follows.

- **June 22, 2020 – Virtual on-line meeting from 6 to 8 PM.** Notification about the meeting and participant guidelines was posted on the project website and emailed on June 15, 19, and 22, 2020. The meeting format was a presentation followed by a question-and-answer period. About 190 people attended the online meeting, and about 193 comments or discussion topics were submitted during the meeting. UDOT responded to as many of the comments as possible before the meeting ended at 8 PM.
- **June 23, 2020 – Virtual online meeting from 6 to 8 PM.** Notification about the meeting and participant guidelines was posted the project website and emailed on June 15, 19, and June 23, 2020. The meeting format was a presentation followed by a question-and-answer period. About 100 people attended the online meeting, and about 344 comments or discussion topics were submitted during the meeting. UDOT responded to as many of the comments as possible before the meeting ended at 8 PM.
- **June 24, 2020 – In-person meeting from 6 to 8 PM.** This meeting was held for those members of the public who do not have internet access. Notification about the meeting and participant guidelines was posted the project website and emailed on June 15 and 19, 2020. Reservations needed to be made before the meeting, and the meeting size was limited to 50 people. The meeting format was a presentation followed by a question-and-answer period. Two people attended the meeting.

About 295 people attended the three public meetings. During the comment period for the *Alternatives Screening Report*, UDOT received about 6,500 individual comment submissions from the public and agencies.

In addition to the public meetings, UDOT held the following group and council meetings during the comment period for the *Alternatives Screening Report*:

- Cooperating and participating agency meeting – June 4, 2020
- Utah Office of Economic Development – June 4, 2020
- Utah Office of Tourism – June 8, 2020
- Brighton Community Council – June 9, 2020
- Solitude, Brighton, Snowbird, and Alta ski resorts – June 12, 2020
- Save Our Canyons, Wasatch Backcountry Alliance, League of Women Voters, Friends of Alta, Sierra Club, The Nature Conservancy, and Utahns for Better Transportation – June 15, 2020
- Solitude, Brighton, Snowbird, and Alta ski resorts – June 12, 2020
- Central Wasatch Commission – June 15, 2020
- Little Cottonwood Canyons Business Community – June 16, 2020
- Sandy City Community Council – June 16, 2020
- Cottonwood Heights residents – June 29, 2020
- Salt Lake County Executive Committee – June 30, 2020
- Salt Lake County Council – June 30, 2020
- Granite Community Council – July 1, 2020
- Salt City Community Council – July 7, 2020
- Cottonwood Heights Community Council – July 7, 2020
- Town of Alta Community Council – July 8, 2020

3.0 Screening Report Addendum

This section describes the process and evaluation of new or refined alternatives brought forward during the public comment period for the June 8 Report to determine whether each of the new or refined alternatives meets the screening criteria.

3.1 Summary of the Screening Process

3.1.1 Summary of the Project Purpose and Need

The first level of screening, and the primary criterion for determining whether an alternative is reasonable, is whether the alternative reasonably meets the purpose of and need for the project. For the S.R. 210 Project, UDOT’s primary objective for S.R. 210 is to:

- Substantially improve transportation-related safety, reliability, and mobility on S.R. 210 from Fort Union Boulevard through the town of Alta for all users on S.R. 210.

Section 1.2, Summary of the Project Purpose and Need, in the June 8 Report provides more details regarding the need for the project.

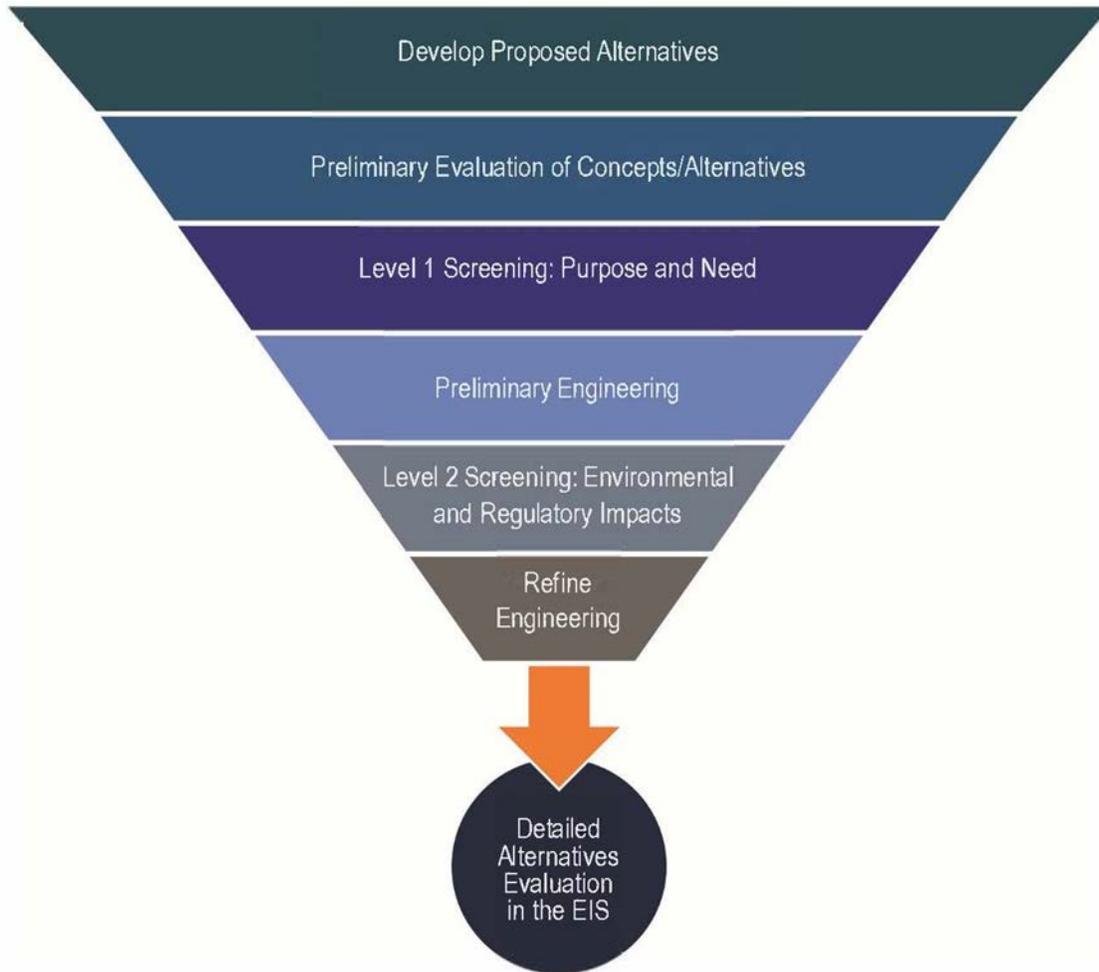
What is a reasonable alternative?

Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than those that are desirable simply from the standpoint of the applicant.

3.1.2 Overview of the Screening Process

Section 1.3, Screening Process Overview, in the June 8 Report provides details about the process for developing and screening alternatives. For this Addendum Report, UDOT used the same process to develop and screen alternatives. Figure 3-1 shows an overview of this process.

Figure 3-1. Overview of the Little Cottonwood Canyon EIS Alternatives Development and Screening Process



The screening process for this Addendum Report used the same criteria as did the June 8 Report. These criteria are listed in Table 3-1 and Table 3-2.

Table 3-1. Level 1 Screening Criteria (Purpose and Need)

Criterion	Measure
Improve mobility in 2050	<ul style="list-style-type: none"> Substantially improve peak-hour per-person (defined as the 30th-busiest hour^a) travel times in Little Cottonwood Canyon for uphill and downhill users in 2050 compared to travel times with the No-Action Alternative in 2050. Meet peak-hour average total person-demand on busy ski days in Little Cottonwood Canyon. Substantially reduce vehicle backups on S.R. 210 and S.R. 209 through residential areas on busy ski days (30th-busiest day). By 2050, meet UDOT's goal of level of service (LOS) D in the weekday AM and PM peak periods on Wasatch Boulevard.
Improve reliability and safety in 2050	<ul style="list-style-type: none"> Substantially reduce the number of hours and/or days during which avalanches delay users. Substantially reduce the avalanche hazard for roadway users. Improve roadway safety at existing trailhead locations. Reduce or eliminate traffic conflicts between motorized and nonmotorized transportation modes at key trailhead locations. Reduce or eliminate roadside parking to improve the safety and operational characteristics of S.R. 210.

^a The travel demand during the 30th-busiest hour in 2050 would be about 1,555 vehicles or about 3,260 people.

Table 3-2. Level 2 Screening Criteria (Impacts)

Criterion	Measure
Cost	<ul style="list-style-type: none"> Alternative's cost compared to other similar alternatives that pass Level 1 screening
Consistency and compatibility with local and regional plans	<ul style="list-style-type: none"> Alternative's consistency with local and regional land use and transportation plans^a Alternative's compliance with the Wilderness Act of 1964 and consistency with the 2003 <i>Revised Wasatch-Cache Forest Plan</i>
Compatibility with permitting requirements	<ul style="list-style-type: none"> Permit requirements
Impacts related to Clean Water Act	<ul style="list-style-type: none"> Acres and types of wetlands and other waters of the United States^b
Impacts to natural resources	<ul style="list-style-type: none"> Acres of floodplain Acres of critical habitat
Impacts to the built environment	<ul style="list-style-type: none"> Number and area of parks Number of community facilities Number of potential property acquisitions including residential and business. Number of Section 4(f)/Section 6(f) uses^c Number of cultural resources (for example, historic and archaeological resources) affected

^a This criterion is a secondary objective that will be used to measure how well an alternative meets local community desires after environmental impacts are considered and to make minor shifts to alternatives' alignments. It will not be used to determine whether an alternative is reasonable or practicable.

^b Based on Clean Water Act requirements, an alternative with a substantially greater amount of wetland impacts could be eliminated from detailed study in the EIS. UDOT will not use the criteria listed in this table to eliminate alternatives from detailed study in the EIS before considering whether the alternatives would comply with the Clean Water Act Section 401(b)(1) Guidelines. Each alternative will be evaluated individually regarding cost, existing technology and logistics before the other criteria in this table are considered.

^c Based on the requirements of Section 4(f) of the Department of Transportation Act of 1966 and Section 6(f) of the Land and Water Conservation Fund Act of 1965, an alternative with substantially greater Section 4(f) or Section 6(f) impacts could be eliminated from detailed study in the EIS.

3.1.3 Definition of the No-Action Alternative

The U.S. Environmental Protection Agency commented that the No-Action Alternative was not defined in the June 8 Report. For the no-action conditions in 2050, UDOT used a socioeconomic forecast for 2050 and assumed that all funded transit and roadway projects in the Wasatch Front Regional Council’s (WFRC) 2019 to 2050 *Wasatch Front Regional Transportation Plan* (RTP) would be in place, except for improvements to S.R. 210 (identified in Table 3-3 as projects T-S-75, R-S-53, R-S-163, and R-S-216). The 2050 no-action conditions do not include the planned improvement to S.R. 210 south of Fort Union Boulevard because those improvements are evaluated in the Little Cottonwood Canyon Draft EIS as part of the alternatives.

Table 3-3. Planned and Funded Transportation Improvements in the 2019 to 2050 RTP in the Study Area

Facility	RTP Identification Number	Limits	Existing Number of Lanes	Future Number of Lanes	Project Type	Needs Phase ^a	Funding Phase ^a
Highway Projects							
Fort Union Blvd.	R-S-38	3000 East to Wasatch Blvd.	3 or 5	5 or 7	Widening	1	1
S.R. 210	R-S-53	Little Cottonwood Canyon Road from Wasatch Boulevard to end of canyon (10.2 miles)	2	3	Widening	2	3
S.R. 209	R-S-56	Eastdell Drive to Wasatch Blvd. (1.6 miles)	2	2	Operational	1	2
Wasatch Blvd.	R-S-163	Bengal Blvd. to S.R. 209 (2.7 miles)	2 or 3	5	Widening	1	1
S.R. 210	R-S-216	Snow shed over Little Cottonwood Canyon Road at White Pine Chutes	NA	NA	New construction	1	3
Transit Projects							
Cottonwood Canyons Transit Hub	T-S-75	Transit hub near Big Cottonwood Canyon	NA	NA	Transit hub	1	3
Little Cottonwood Corridor – Special Service Bus	NA	From mouth of Little Cottonwood Canyon to Alta Ski Resort (8.57 miles)	NA	NA	Transit service	3	Unfunded
Foothill Drive – Wasatch Blvd. Corridor South	NA	From 3900 South to Little Cottonwood Canyon Park and Ride (9.09 miles)	NA	NA	Transit service	3	3
Cottonwood Midvale Corridor Mode: Core Service 15	NA	From Bingham Junction TRAX Station to Little Cottonwood Canyon park-and-ride lot (7 miles)	NA	NA	Transit service	1	2
East Sandy Daybreak Corridor Mode: Core Service 15	NA	From South Jordan Parkway TRAX Station to Little Cottonwood Canyon park-and-ride lot (16.6 miles)	NA	NA	Transit service	1	3
Little Cottonwood Canyon Park-and-Ride	NA	Big Cottonwood Canyon Road (S.R. 190), Wasatch Boulevard	NA	NA	Transit facility	3	3

Source: WFRC 2019

Blvd. = boulevard; NA = not applicable; RTP = Regional Transportation Plan; S.R. = State Route

^a Phase 1: 2019 to 2030; Phase 2: 2031 to 2040; Phase 3: 2041 to 2050. The needs phase is when the project is needed. The funding phase is when money is allocated.

4.0 Alternative Development and Screening Process

4.1 Development of Proposed Alternatives

UDOT reviewed all comments received during the comment period for the June 8 Report. Most comments were either for or against an alternative or were refinements to one of the alternatives, such as adding bicycle lanes.

Based on UDOT's review of the comments, UDOT identified 19 new alternatives and/or refinements to previous alternatives that were not considered in the June 8 Report. Table 4-1 lists the new and refined alternatives that were identified.

Table 4-1. New and Refined Alternatives Brought Forward during the Comment Period for the June 8 Report

Alternative	Description
<i>Improve Mobility on Wasatch Boulevard</i>	
Expand Highland Drive and Include Increase Transit	Currently, Highland Drive is not complete and stops at Dimple Dell Park. This alternative includes building a new segment of Highland Drive through Dimple Dell Park and including transit so that commuters use Highland Drive from Draper instead of Wasatch Boulevard, thus eliminating the need to expand Wasatch Boulevard.
<i>Improve Mobility on S.R. 210</i>	
Gondola from Gravel Pit Directly to Snowbird/Alta	This alternative would include a gondola system from the gravel pit and would go directly over the Wasatch Mountains into Snowbird and Alta.
Gondola Directly to Snowbird without Angle Stations	This alternative would include a gondola alignment directly from the Little Cottonwood Canyon park-and-ride at the S.R. 209/S.R. 210 intersection to Snowbird without an angle station.
Gondola from Gravel Pit to Solitude/Brighton then to Snowbird/Alta	This alternative includes a gondola alignment from the gravel pit to the Solitude and Brighton ski resorts in Big Cottonwood Canyon and then an alignment over to Little Cottonwood Canyon to the Alta and Snowbird ski resorts.
Gondola with No Personal Vehicles Allowed in Little Cottonwood Canyon	This alternative includes providing a gondola system at the entrance to Little Cottonwood Canyon and eliminating personal vehicles from S.R. 210 in Little Cottonwood Canyon.
Gondola at La Caille	The alternative would include a gondola base station at a proposed development south of North Little Cottonwood Road about 0.75 mile northwest of the S.R. 209/S.R. 210 intersection. The alternative would include a 1,500-vehicle parking structure, which is about 1,000 parking spaces fewer than needed for a gondola alternative; therefore, this alternative also includes parking structures at the gravel pit (600 spaces) and the 9400 South/Highland Drive park-and-ride (400 spaces) with bus service to the gondola base station. The bus service from the other parking structures to the base station would be free. An angle station would be required at the Little Cottonwood Canyon park-and-ride lot at the S.R. 209/S.R. 210 intersection.

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Table 4-1. New and Refined Alternatives Brought Forward during the Comment Period for the June 8 Report

Alternative	Description
Gondola at Wasatch Boulevard and North Little Cottonwood Road	This alternative would include a 2,500-vehicle parking structure and gondola base station on North Little Cottonwood Road about 1,000 feet south of the intersection with Wasatch Boulevard (at a site commonly called the Christmas Tree Farm). With the 2,500-vehicle parking structure, users could drive to the gondola base station (no bus service would be required). The gondola alignment would cross North Little Cottonwood Road and run along the north side of S.R. 210 to an angle station at the Little Cottonwood Canyon park-and-ride at the S.R. 209/S.R. 210 intersection.
Summit County Gondola without Parking	This alternative includes a gondola system from Summit County connecting ski resorts at the tops of the Cottonwood Canyons. There would be no parking structure in Summit County. This alternative would work in conjunction with enhanced bus service on S.R. 210 in Little Cottonwood Canyon.
Summit County Gondola with Parking	This alternative includes a gondola system from Summit County connecting ski resorts at the tops of the Cottonwood Canyons. A 2,500-vehicle parking garage would be built near Kimball Junction. Skiers from the Salt Lake Valley would be encouraged to take transit or drive to the parking garage and take the gondola to the resorts in Little Cottonwood Canyon. This alternative could also work in conjunction with enhanced bus service on S.R. 210 in Little Cottonwood Canyon.
Train from Summit County	This alternative includes a train in a tunnel from Summit County to the resorts in Little Cottonwood Canyon. A 2,500-vehicle parking garage would be built near Kimball Junction or another location in Summit County. Skiers from the Salt Lake Valley would be encouraged to take transit or drive to the parking garage and take the train to the resorts in Little Cottonwood Canyon.
Cog Rail Refinement	This alternative includes refining the Cog Rail Alternative eliminated in the June 8 Report. The refinements include more analysis of a single rail line instead of the double rail line considered, an alignment that more closely follows the existing S.R. 210 and 9400 South alignments, an alignment along the canyon floor of Little Cottonwood Canyon, and an alternative that includes a bus system to service the rail system starting at 0.75 mile northwest of the S.R. 209/S.R. 210 intersection. Commenters also suggested looking a diesel-powered train instead of electric power to reduce cost by eliminating overhead electric lines and suggested that snow sheds should be included with the alternative.
Tunnel Alternative with Autonomous Vehicles	This alternative includes a tunnel loop system from the gravel pit to the Snowbird and Alta ski resorts. The tunnel would be placed under S.R. 210 within UDOT right-of-way. Autonomous electric vehicles would operate in the tunnel at speeds of about 60 miles per hour depending on the tunnel curvature and grade.
Reconfigure S.R. 209/ S.R. 210 for Enhanced Bus Service	This alternative includes closing S.R. 209 from the Wasatch Boulevard/9400 South intersection to the S.R. 209/S.R. 210 intersection to through traffic and allowing only buses and local traffic. Buses from the mobility hubs would use the closed portion of S.R. 209 to access Little Cottonwood Canyon. All vehicle through traffic other than buses would use S.R. 210. Traffic from the south portion of the Salt Lake Valley would connect to S.R. 210 at the intersection of Wasatch Boulevard and North Little Cottonwood Road.
Limit Skiers	This alternative includes limiting the number of skiers at Snowbird and Alta instead of making roadway improvements. This would be accomplished by the resorts limiting ticket sales, by UDOT limiting the number of vehicles in the canyon through a reservation system, by UDOT charging a high toll, by the resorts charging a fee for parking at the ski resorts based on vehicle occupancy, by UDOT implementing odd-even license plate days, and/or by UDOT stopping vehicle traffic from taking S.R. 210 into the canyon when the parking lots at the resorts are at capacity.
Autonomous or Semi-autonomous Electric Vehicles	The alternative includes using autonomous or semi-autonomous electric vehicles that can move small groups of people from central parking areas in the Salt Lake Valley to the ski resorts in Little Cottonwood Canyon. UDOT would run the fleet of autonomous or semi-autonomous electric vehicles that could be used to take users to the ski resorts.

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Table 4-1. New and Refined Alternatives Brought Forward during the Comment Period for the June 8 Report

Alternative	Description
Town of Alta Vehicle-free Zone	This alternative includes moving the gondola terminal station at the Alta ski resort to the Albion parking lot and allowing parking only at the Alta Wildcat parking lot before the town of Alta. S.R. 210 through the town of Alta would become a pedestrian-only zone without vehicles.
Additional Ski Resorts	This alternative involves the State of Utah partnering with private partners to build three to five new ski resorts to serve Tooele, the western Salt Lake Valley, and potentially northern Utah County to reduce the number of people going to the ski resorts in Little Cottonwood Canyon.
Eliminate or Limit Parking in Little Cottonwood Canyon	This alternative eliminates or limits all parking in Little Cottonwood Canyon, including ski resort parking.
Dual Mode/TriTrak Motors	This alternative includes using specially designed vehicles on a rail network similar to monorail but with individual vehicles that can be driven on the street and taken home when they are not on the rail system.
<i>Mobility Hubs</i>	
No new or refined alternatives were identified.	
<i>Snow Sheds</i>	
No new or refined alternatives were identified.	
<i>Trailhead Parking</i>	
No new or refined alternatives were identified.	
<i>Winter Roadside Parking</i>	
No new or refined alternatives were identified.	

4.2 Alternative Development and Screening Process – Improve Mobility in 2050

4.2.1 Improve Mobility on Wasatch Boulevard

4.2.1.1 Range of Alternatives

During the comment period for the June 8 Report, a refinement of the Wasatch Boulevard Transit Alternative was suggested. The comment suggested expanding Highland Drive over Dimple Dell Park and including high-capacity transit. The alternative includes building a new segment of Highland Drive through Dimple Dell Park and including transit so that commuters use Highland Drive to and from Draper instead of Wasatch Boulevard, thus eliminating the need to expand Wasatch Boulevard. Some commenters also wanted UDOT to consider transit options on Wasatch Boulevard to eliminate the need to add roadway capacity on Wasatch Boulevard.

4.2.1.2 Preliminary Screening of Alternatives

4.2.1.2.1 *Expand Highland Drive and Increase Transit*

The June 8 Report included an evaluation of a Mass Transit Alternative (see Section 2.2.1.1, Mass Transit Alternative, in the June 8 Report). This evaluation concluded that even with mass transit, additional capacity was needed on Wasatch Boulevard.

As part of the alternatives screening analysis for Wasatch Boulevard, UDOT included the following elements in the travel demand modeling for the baseline conditions (No-Action Alternative):

- Highland Drive as a five-lane arterial through Dimple Dell Park
- Bus Route 313 on Highland Drive from 10600 South/1300 East to the University of Utah
- Express Bus from Little Cottonwood Canyon park-and-ride to 3900 South and Wasatch Boulevard, which connects to bus service from 3900 South to the University Medical Center TRAX Station
- Bus service on 1300 East from 9400 South to South Temple
- Bus rapid transit from the Draper FrontRunner Station to the North Temple FrontRunner Station
- TRAX from the Draper City Center TRAX Station to downtown Salt Lake City

What is a travel demand model?

A travel demand model is a computer model that predicts the number of transportation trips (travel demand) in an area at a given time.

Even with Highland Drive improvements and numerous transit options for Draper, Sandy, and Cottonwood Height residents, the analysis still showed a need for capacity improvements (widening) on Wasatch Boulevard (see Table 4-2).

Table 4-2. Wasatch Boulevard – Travel Demand Analysis by Direction and Segment in the PM Peak Hour in 2050

Alternative	Travel Time from Fort Union Blvd. to North Little Cottonwood Road (minutes)		Level of Service by Segment (Passing Criteria Are LOS A–D)			
	Northbound in AM/PM Peak Hour	Southbound in AM/PM Peak Hour	Fort Union Blvd. to Bengal Blvd.	Bengal Blvd. to 3500 East	3500 East to Kings Hill Drive	3500 East to North Little Cottonwood Road
No-Action Alternative	4:22 / 4:40	3:53 / 10:15	F	E	E	D
Imbalanced-lane Alternative	4:05 / 4:37	3:32 / 4:21	C	C	C	C
Reversible Three-lane Alternative	4:09 / 4:37	8:00 / 4:21	C	D	D	F
Five-lane Alternative	3:51 / 4:00	3:32 / 4:12	C	B	B	C
Multiple Roundabouts Alternative	6:25 / 4:43	4:32 / 10:21	F	D	C	C

Source: Fehr & Peers 2019

Green shading = Meets level of service goal of LOS D or better

Red shading = Does not meet level of service goal of LOS D

WFRC’s 2019–2050 RTP (WFRC 2019) does not include additional transit to downtown Salt Lake City or to the area around the University of Utah since Draper residents have transit options in the existing TRAX line and multiple bus options. Based on the available transit options, the RTP does not recommend more transit for the Draper and Sandy areas.

The Mass Transit Alternative with improvements to Highland Drive alone would not reduce congestion levels on the mainline and at the intersections of Wasatch Boulevard to meet the screening criterion of LOS D or better. For this reason, a standalone mass transit alternative with improvements to Highland Drive was eliminated from detailed consideration.

4.2.1.3 Level 1 and Level 2 Screening

Only one new alternative, Expand Highland Drive and Increase Transit, was brought forward to assess its ability to meet the criterion of improved mobility on Wasatch Boulevard. This alternative did not pass the preliminary screening of meeting the project primary objective for Wasatch Boulevard of LOS D or better and so was not considered in Level 1 and Level 2 screening.

4.2.2 Improve Mobility on S.R. 210 from Fort Union Boulevard to Alta

4.2.2.1 Range of Alternatives

Table 4-1, New and Refined Alternatives Brought Forward during the Comment Period for the June 8 Report, above lists the new and refined alternatives to improve mobility on S.R. 210.

4.2.2.2 Preliminary Screening of Alternatives

4.2.2.2.1 Gondola from Gravel Pit Directly to Snowbird/Alta

This alternative would include a gondola system from the gravel pit and would go directly over the Wasatch Mountains into Snowbird and Alta. This alternative would require gondola towers to be located in a Wilderness Area, and doing so is prohibited. To be implemented, this alternative would require a change of allowable uses in a Wilderness Area by the U.S. Congress. In addition, the cost of constructing this gondola system would likely be greater than the cost of constructing the gondola alternatives that passed screening. The alignment for this gondola alternative would run directly from the gravel pit to Snowbird and Alta and would not be constructed next to an existing road, so it would require greater use of helicopters and specialized equipment. Also, because there would be no nearby road from which to access the alignment, maintaining the system would be difficult. Since there is a reasonable gondola alternative in the June 8 Report that would not impact a Wilderness Area and is located adjacent to S.R. 210, a gondola alternative from the gravel pit directly to Snowbird and Alta was eliminated from further consideration.

What are base, angle, and terminal stations?

As used in this chapter, the term *terminal station* refers to the first and last stations on a passenger's gondola trip. Passengers board and disembark the gondola cabins at the terminal stations.

The *base station* is the terminal station at the bottom of the canyon, and a *destination station* is a terminal station at the top of the canyon.

The gondola alternatives also include *angle stations*, which are needed to adjust the horizontal direction of the cabin; passengers remain in the cabin as it passes through an angle station.

4.2.2.2.2 Gondola Directly to Snowbird without Angle Stations

This alternative would include a gondola alignment directly from the Little Cottonwood Canyon park-and-ride lot at the S.R. 209/S.R. 210 intersection to Snowbird without an angle station. This alternative was eliminated from consideration because it would require placing gondola towers in a Wilderness Area, which is prohibited. To be implemented, this alternative would require a change to allowable uses in a Wilderness Area by the U.S. Congress. In addition, the gondola towers would be placed in major avalanche paths, which might not be technically feasible. Since there is a reasonable gondola alternative in the June 8 Report that does not impact Wilderness Areas and avoids most major avalanche paths, a gondola directly to Snowbird without angle stations was eliminated from further consideration.

4.2.2.2.3 *Gondola from Gravel Pit to Solitude/Brighton then to Snowbird/Alta*

This alternative includes a gondola alignment from the gravel pit to the Solitude and Brighton ski resorts in Big Cottonwood Canyon and then an alignment over to Little Cottonwood Canyon to the Alta and Snowbird ski resorts. The S.R. 210 Project's purpose does not include mobility improvements to S.R. 190 in Big Cottonwood Canyon. In addition, a route to the Big Cottonwood ski resorts over to the resorts in Little Cottonwood Canyon would be about 16 miles long, or double the length of the Gondola Alternative in the June 8 Report. Such a route would have greater travel times (30 additional minutes) and would cost about double the amount to construct. The total gondola travel time to the Snowbird ski resort would be about 75 minutes, which would not meet the screening criteria of substantially improving peak-hour travel time on S.R. 210. Because the travel times would be substantially longer compared to travel times with the Gondola Alternative in the June 8 Report, it would also be less attractive for users wanting to travel to the Snowbird and Alta ski resorts and less likely to be used. Therefore, a gondola alternative in Big Cottonwood Canyon and over to Little Cottonwood Canyon was eliminated from further consideration.

What is the gravel pit?

The gravel pit is an existing aggregate (gravel) mine located on the east side of Wasatch Boulevard between 6200 South and Fort Union Boulevard.

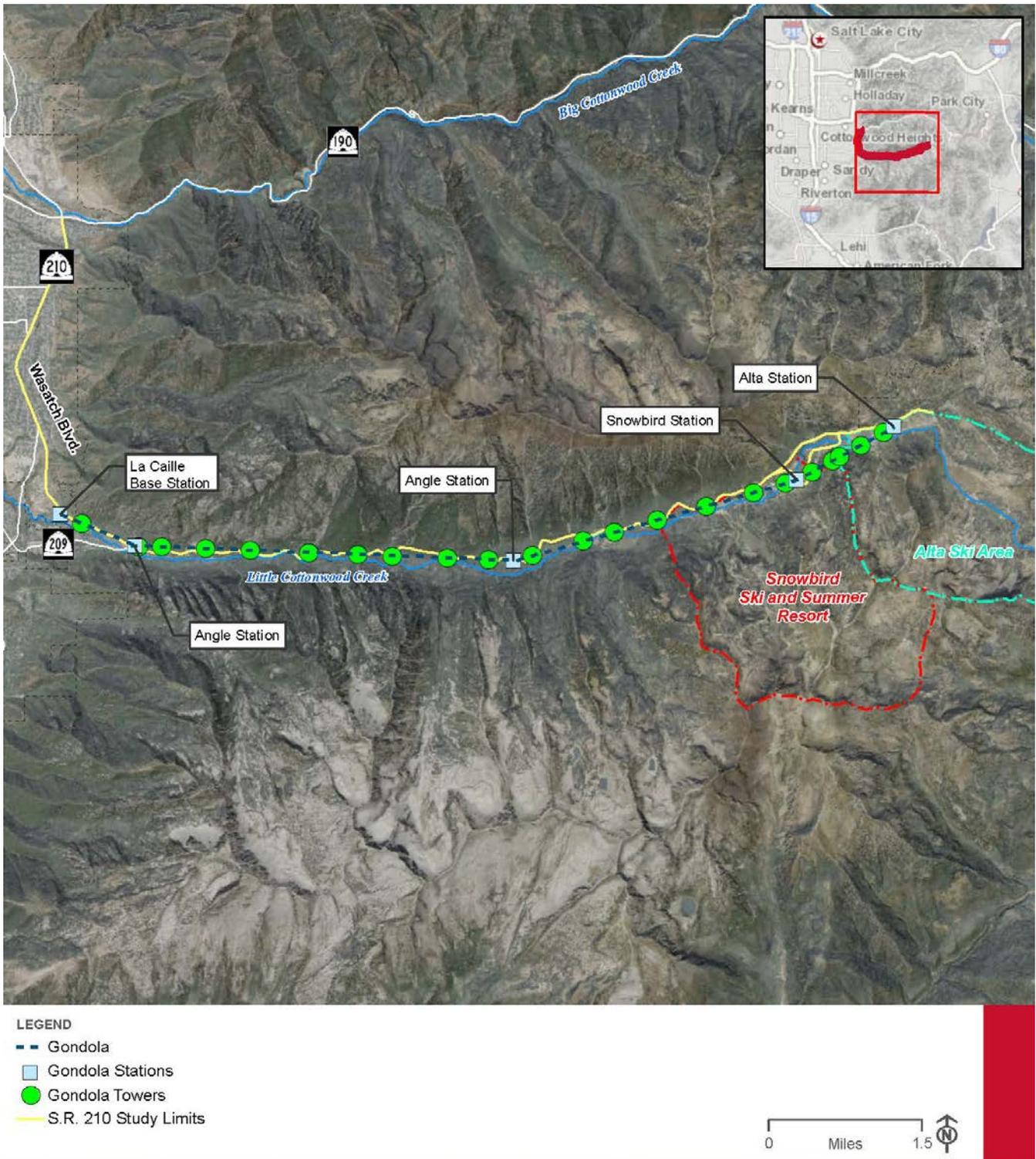
4.2.2.2.4 *Gondola with No Personal Vehicles Allowed in Little Cottonwood Canyon*

This alternative includes providing a gondola system at the entrance to Little Cottonwood Canyon and eliminating personal vehicles from S.R. 210 in Little Cottonwood Canyon. The purpose of the S.R. 210 Project is to substantially improve safety, reliability, and mobility on S.R. 210 from Fort Union Boulevard through the town of Alta for all users on S.R. 210. To improve mobility, about 30% of the personal vehicles need to be removed from S.R. 210. During the peak hour, that is about 1,000 to 1,100 people. The Gondola Alternative in the June 8 Report and its associated parking garage can provide that capacity. There is no need to increase the capacity of the gondola system beyond that of the Gondola Alternative in the June 8 Report to meet the project's purpose. Finally, a parking structure to eliminate all roadway traffic would need to have about 7,000 parking spaces (and would require about 30 acres). There is no location near the entrance to Little Cottonwood Canyon that could reliably handle the volume of traffic associated with such a large parking structure. For these reasons, the gondola alternative with no personal vehicles allowed in Little Cottonwood Canyon was eliminated from further consideration.

4.2.2.2.5 *Gondola at La Caille*

This gondola alternative was proposed by a private developer. This alternative would include a gondola base station just east of the La Caille restaurant at 9565 S. Wasatch Boulevard. The base station would be located at a proposed development south of North Little Cottonwood Road, about 0.75 mile northwest of the S.R. 209/S.R. 210 intersection (Figure 4-1). The alternative would include a 1,500-vehicle parking structure, which is about 1,000 parking spaces fewer than needed for a gondola alternative; therefore, this alternative also includes parking structures at the gravel pit (600 spaces) and the 9400 South/Highland Drive park-and-ride (400 spaces) with bus service to the gondola base station. The bus system would be used when the parking structure at the gondola base station reaches capacity. The bus service from the other parking structures to the base station would be free. Gondola cables must travel in a straight line to operate; therefore, from the La Caille base station the gondola would travel to the entrance of the canyon and would require an angle station at the Little Cottonwood Canyon park-and-ride lot to go into the canyon.

Figure 4-1. Gondola at La Caille Alignment



The travel time from the La Caille base station to Snowbird would be about 27 minutes.¹ For gondola riders continuing to Alta, an additional distance of about 1½ miles, the additional travel time including the transfer at Snowbird would be about 9 minutes, for a total travel time to Alta of about 36 minutes. To provide an equal comparison of travel time between the all of the action alternatives, UDOT included the travel time starting at Fort Union Boulevard and Wasatch Boulevard and also included transfer times from personal vehicles to the transit mode (bus, gondola, or cog rail). For the La Caille gondola alternative, the overall travel time for users parking at the base station would include 6 minutes to drive from Fort Union Boulevard and Wasatch Boulevard to the base station, 12 minutes to transfer from the vehicle to the gondola, and 1 minute to go through the two angle stations, for a total of 19 minutes. Adding this travel time to the gondola travel time would result in a total travel time of about **46 minutes to Snowbird** and, with the transfer to a separate gondola system for the last segment, **about 55 minutes to Alta**.

The alternative with a gondola system at La Caille provides about 1,500 parking spaces. To meet the daily transit demand, an additional 600 parking spaces would be needed at the gravel pit and 400 spaces at the park-and-ride at 9400 South and Highland Drive (referred to as mobility hubs). Those mobility hub users would need to take a bus to the La Caille gondola base station. Using the bus would require an additional 3.5 minutes to transfer from the bus to the gondola. For those gondola users taking a bus from a mobility hub, the total travel time would be about **50 minutes to Snowbird** and, with the transfer to a separate gondola system for the last segment, **about 59 minutes to Alta**.

What is a mobility hub?

A mobility hub is a location where users can transfer from their personal vehicle to a bus.

The total estimated capital cost for the gondola alternative at La Caille is about \$398,200,000 to \$477,840,000. A cost breakdown is provided in Table 4-3.

Table 4-3. Gondola at La Caille Capital Cost Estimate

Component	Units	Cost per Unit (\$)	Component Cost (\$)
Lift system	8.6 miles	18,000,000	154,800,000
Terminal stations	4 stations	11,000,000	44,000,000
Resort interface for terminal stations	3 stations	6,000,000	18,000,000
Angle stations	2 stations	10,200,000	20,400,000
Parking	2,500 stalls	64.77/square foot	135,000,000 ^a
Enhanced bus service	1 lump sum	26,000,000	26,000,000
Total Low Estimate			398,200,000
Contingency (20% of low estimate)	—	—	79,640,000
Total High Estimate			477,840,000

^a Includes parking structure cost plus changes to access from Wasatch Boulevard.

¹ Appendix E, Draft Aerial Transit Concept Initial Feasibility Study, of the June 8 Report provides the assumptions that went into developing travel time, capital cost, and operation and maintenance cost for the gondola alternatives.

This gondola alignment and parking scenario would include operation and maintenance (O&M) costs for both gondola and bus. Table 4-4 presents the estimated total annual O&M cost for the gondola alternative at La Caille. This 8.6-mile gondola alignment with four terminal stations and with express bus service transporting users to the base terminal would cost about \$6.9 million to maintain and operate during the winter season.

Table 4-4. Gondola at La Caille Annual O&M Cost Estimate – Winter Operations

O&M Category	Annual Cost (\$)
Labor costs	1,476,000
Major equipment replacement reserves	585,765
Miscellaneous costs	1,031,900
Energy costs	227,000
Gondola Subtotal	3,320,665
Bus O&M	2,430,000
Subtotal	5,750,665
Contingency (20%)	1,150,133
Total	6,900,798

As part of the preliminary evaluation process, UDOT conducted a traffic analysis to determine whether having a 1,500-vehicle parking structure on S.R. 210 about 0.75 mile northwest of the Little Cottonwood Canyon entrance would cause substantial traffic delays on S.R. 210. The modeling showed that, with two southbound travel lanes on S.R. 210 past the intersection of Wasatch Boulevard and North Little Cottonwood Road south to the La Caille gondola base station, traffic would operate at acceptable levels of congestion of LOS D or better on both Wasatch Boulevard and North Little Cottonwood Road during the morning peak travel period from 7 AM to 9 AM (Fehr and Peers 2020). The gondola alternative at La Caille would not increase vehicle backup lengths from the intersection of S.R. 210 and S.R. 209. In addition, there would be no vehicle backup from the Little Cottonwood Canyon that extends to the La Caille base station. Because the gondola alternative at La Caille would not cause unacceptable travel delays on S.R. 210, it was carried forward into Level 1 screening.

4.2.2.2.6 *Gondola at Wasatch Boulevard and North Little Cottonwood Road*

This alternative is the same as Gondola Alternative 2, Expanded Parking and Base Station 1 Mile from Entrance of Canyon, in the June 8 Report. In that report, Gondola Alternative 2 was eliminated from consideration because, compared to the Gondola Alternative that passed Level 1 and Level 2 screening, Gondola Alternative 2 would:

- Focus traffic on S.R. 210 through Cottonwood Heights
- Build a multilevel parking structure in an area zoned for residential use
- Pose potential privacy concerns from a gondola corridor near existing homes

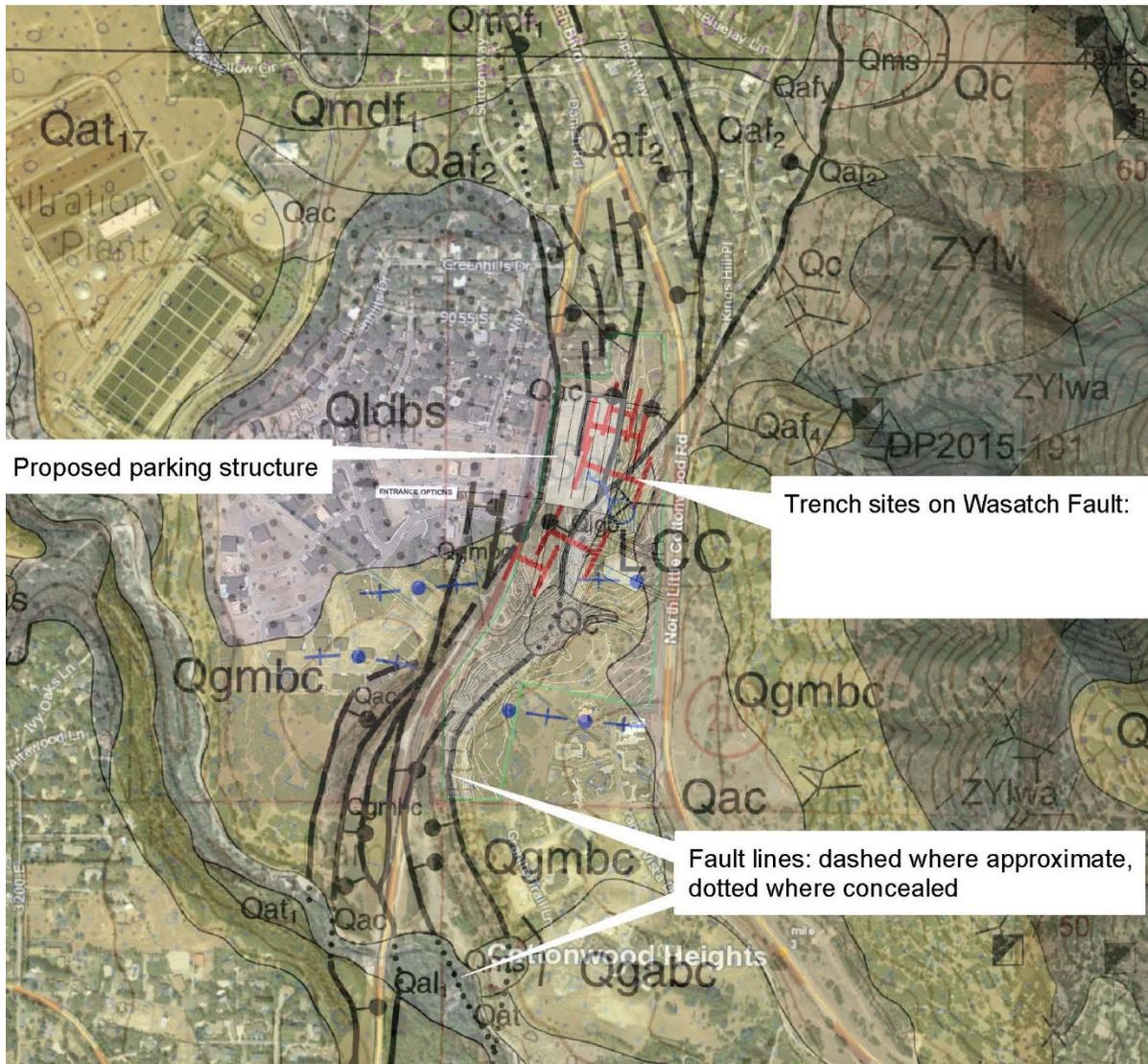
During the comment period for the June 8 Report, UDOT received numerous comments that UDOT should evaluate a gondola alternative that did not require bus service to the base station (had direct personal vehicle access) and that UDOT should re-evaluate Gondola Alternative 2 and conduct a more detailed evaluation of traffic and privacy concerns.

UDOT evaluated a site at about 9100 S. North Little Cottonwood Road (Figure 4-2). This site was chosen because there was land available away from most residential areas. The site would allow traffic to enter the parking structure from both Wasatch Boulevard and North Little Cottonwood Road, so traffic would operate at an acceptable congestion level. However, on reviewing the site conditions, UDOT found that the site was not technically feasible because the parking structure would be located on the Wasatch Fault. A 2002 study that dug trenches on the Wasatch Fault found the following conditions (McCalpin 2002):

- The average vertical tectonic displacement per seismic event is estimated to be between 0.4 and 3 meters (1.3 and 10 feet) at this site.
- This range might represent minimum values, and the actual vertical displacement might be greater.
- There is evidence that multiple seismic events having magnitudes of 6.5 to 7.5 have occurred repeatedly along this segment of the Wasatch Fault.
- At the time of the 2002 study, it was estimated that there was a 16% probability of a magnitude 7 seismic event within the next 100 years.

Vertical displacement at the site could severely affect the proposed parking structure and gondola base station. In addition, with the La Caille base station (Gondola at La Caille Alternative), there is now a gondola alternative that provides a substantial amount of parking at a gondola base station. For these reasons, this site was eliminated from further consideration.

Figure 4-2. Earthquake Faults at Gondola Alternative 2 Base Station



4.2.2.2.7 Summit County Gondola without Parking

This alternative includes a gondola system from Summit County connecting ski resorts at the heads of the Cottonwood Canyons. There would be no parking structure in Summit County. This alternative would work in conjunction with the Enhanced Bus Service Alternative on S.R. 210 in Little Cottonwood Canyon. About 8% of the ski traffic from Park City (see Appendix G, Park City to Little Cottonwood Canyon Traffic Analysis, in the June 8 Report) travels to ski in Little Cottonwood Canyon. The goal with this alternative is to capture this traffic with a gondola from Park City to Little Cottonwood Canyon and use enhanced bus service on S.R. 210 to capture users from the Salt Lake Valley. This alternative is similar to the enhanced bus service alternatives that were determined to be reasonable alternatives, but it would add a gondola system to the alternative.

No specific location was suggested for the alternative in Summit County, so Park City Mountain Resort was selected as providing a location in the center of the resorts in Park City. The gondola alignment would be about 9 miles to Snowbird. The cost of the 8-mile gondola alignment from the entrance to Little Cottonwood Canyon to Alta was about \$260 million, so UDOT assumed that, with the 1 mile of additional length, the gondola alignment from Summit County would be about \$292 million. However, the cost would likely be greater than this since the gondola alignment would not be constructed next to an existing road and would therefore require greater use of helicopters and specialized equipment.

If users took the gondola from Park City instead of driving to Little Cottonwood Canyon, the number of vehicles using S.R. 210 would be reduced by about 500 vehicles per day. Assuming that 500 vehicles would be eliminated, or about 30% (based on tolling incentivizing users to take transit), about 150 of the parking spaces of the proposed 1,500 parking spaces at the gravel pit mobility hub would not be needed. This would reduce the cost of the gravel pit mobility hub by about \$3.2 million. However, some parking would likely be needed in Park City to accommodate users of the gondola system, and the cost would be similar to the \$3.2 million.

In the absence of the gondola alignment from Park City, during the morning peak hour (8 AM to 9 AM), about 90 vehicles would travel from Summit County to Little Cottonwood Canyon on S.R. 210. Assuming that 30% of these vehicles would use the enhanced bus service, about 27 vehicles, or about 60 people (assuming an occupancy of 2.17 people per vehicle), would use the enhanced bus service instead of using their personal vehicles to drive to the ski resorts. The reduction of about 60 people during the peak hour would not change the operational characteristics of the enhanced bus service alternatives and thus would not reduce the capital cost. Given that the gondola alignment from Summit County would cost an estimated \$292 million, the additional cost of adding the gondola system to the enhanced bus service alternatives would be about \$289 million.

As stated in the *Draft Alternatives Development and Screening Methodology and Preliminary Concept Report* (UDOT 2020a), an alternative may be eliminated if it substantially duplicates another alternative; that is, it is otherwise reasonable but offers little or no advantage for satisfying the project's purpose, and it has impacts and/or costs that are similar to or greater than those of other, similar alternatives. The Summit County gondola alternative without parking would meet the purpose of and need for the S.R. 210 Project if it included one of the enhanced bus service alternatives that have been determined to be reasonable. However, adding a Summit County gondola system to the enhanced bus service alternatives already being carried forward would provide very little additional benefit in terms of meeting the project's purpose and need, and it would have a much higher cost (about \$289 million more) and considerably more impacts.

Because the Summit County gondola alternative would add substantial cost and impacts if it were combined with the enhanced bus service alternatives but would provide very little benefit in terms of meeting the project's purpose and need, and because it would largely duplicate the enhanced bus service with gondola combinations already being carried forward, this alternative was eliminated from further consideration.

4.2.2.2.8 Summit County Gondola with Parking

This alternative includes a gondola system from Summit County connecting ski resorts at the tops of the Cottonwood Canyons. A 2,500-vehicle parking garage would be built near Kimball Junction. Skiers from the Salt Lake Valley would be encouraged to take transit or drive to the parking garage and take the gondola to the resorts in Little Cottonwood Canyon. This alternative could also work in conjunction with bus service on S.R. 210 in Little Cottonwood Canyon. To maximize use of existing facilities and to allow space for a parking structure, the start of the gondola alignment was assumed to be at Utah Olympic Park instead of Kimball Junction.

UDOT considered a similar alternative: Aerial Transit or Express Bus from Park City Alternative (see Section 2.2.2.4 in the June 8 Report). This alternative would provide aerial transit or express bus service from Park City to the Snowbird and Alta ski resorts. It assumes that, by providing gondola or express bus service from Park City to the ski resorts in Little Cottonwood Canyon, vehicle traffic would be reduced enough that no additional roadway capacity (widening) would be needed on S.R. 210 in Little Cottonwood Canyon.

To gain a better understanding of vehicle traffic from Park City to Little Cottonwood Canyon, UDOT conducted an origin-destination (OD) study to understand travel patterns from Park City to Little Cottonwood Canyon. OD data showed that about 8% of the morning traffic into Little Cottonwood Canyon is from Park City, or an average of 7.8%. For the mobility screening analysis to determine travel times per person, UDOT is using the 30th-busiest hour in 2050, which is about 1,555 vehicles during the morning peak hour (8 AM to 9 AM) into Little Cottonwood Canyon. If a gondola or express bus system from Park City were built, on average about 90 vehicles could be eliminated from Little Cottonwood Canyon ski traffic during the peak hour, which would reduce peak-hour traffic to about 1,465 vehicles.

UDOT's analysis of a 7.5-minute bus headway option showed that 1,370 vehicles per hour would back up on S.R. 210 and S.R. 209, which would be similar to backups with the No-Action Alternative. Therefore, reducing the peak-hour traffic to about 1,465 vehicles would also result in vehicle backups on S.R. 210 and S.R. 209 similar to the No-Action conditions in 2050. Because the Aerial Transit or Express Bus from Park City Alternative (in the June 8 Report) would cause similar vehicle backups on S.R. 210 and S.R. 209 as the 2050 No-Action Alternative, it was not carried forward for Level 1 screening. It was eliminated because it would not meet the purpose of and need for the project.

The Summit County gondola alternative with parking provided to UDOT suggests that skiers near downtown and around Salt Lake City would be encouraged to drive or take an express bus east on Interstate 80 (I-80) to park and access the gondola and ride it to the Cottonwood Canyons resorts. Driving from downtown Salt Lake City (City Creek Center) to the Utah Olympic Park via I-80 is about 28.3 miles one way and takes about 33 minutes. By comparison, driving from downtown Salt Lake City to the gravel pit mobility hub is about 18.4 miles one way and takes about 23 minutes. The area in Salt Lake City closest to the Utah Olympic Park via I-80 is near the entrance to Parley's Canyon. A trip from the Walmart Supercenter at 2705 Parley's Way to the Utah Olympic Park via I-80 is about 19.5 miles one way and takes about 24 minutes. A trip from the Walmart Supercenter to the gravel pit is about 9.1 miles one way and takes

about 14 minutes. A mobility hub at the gravel pit would be closer and more convenient than one at the Utah Olympic Park for the majority of skiers. There is no incentive for skiers to drive out of direction, especially if it takes longer. In addition, 40% of the traffic into Little Cottonwood Canyon is from the south end of the Salt Lake Valley. The trip to Park City would be about 30 minutes out of direction from users from the southern end of the Salt Lake Valley, making it unlikely they would travel to Park City to then take a gondola back into Little Cottonwood Canyon. If no users from the southern end of the Salt Lake Valley travel to Park City, 50% of the users from the north portion of the Salt Lake Valley would need to travel to Park City to reduce congestion levels on S.R. 210.

A gondola alignment from the Utah Olympic Park to Snowbird with stops at Solitude, Brighton, and Alta would be about 11.8 miles long. The Gondola Alternative in the June 8 Report is about 8 miles long. Evaluating total travel time, the gondola from the Utah Olympic Park would take about 42 minutes, assuming no intermediate base stations at other resorts, which would increase the travel time. Adding a 12-minute transfer from a personal vehicle to the gondola at the parking garage at the base station plus the about 10-minute additional travel time to the Utah Olympic Park from the Salt Lake Valley would result in a total travel time for users of about 64 minutes, or 1 minute more than the Gondola Alternative in the June 8 Report.

The cost including parking and bus service of the Gondola Alternative in the June 8 Report is about \$312 million. A gondola alternative from a Utah Olympic Park parking structure would be similar in length as the 12.5-mile gondola system for Gondola Alternative 3A with a cost of about \$413 million (UDOT 2020c), or about \$100 million more.

The commenter also suggested that a gondola from Summit County could stop at resorts in Big Cottonwood Canyon. This is not part of the purpose of and need for the S.R. 210 Project and would add additional travel time. As travel time increases, transit alternatives become less attractive, and people are more likely to stay in their personal vehicles. The stops at the resorts in Big Cottonwood Canyon would likely add another 7 minutes, for a total trip time of 71 minutes or 8 minutes more than with the Gondola Alternative in the June 8 Report.

As stated in the June 8 Report, an alternative may be eliminated if it substantially duplicates another alternative; that is, it is otherwise reasonable but offers little or no advantage for satisfying the project's purpose, and it has impacts and/or costs that are similar to or greater than those of other, similar alternatives. The Summit County gondola alternative offers little advantage in satisfying the project's purpose and need, and it would have a higher cost (about \$100 million more) and greater impacts associated with the longer distance. Because the Summit County gondola alternative with parking would add additional cost and environmental impacts, would duplicate the Gondola Alternative in the June 8 Report, and has no advantage with regard to satisfying the project's purpose and need, this alternative was eliminated from further consideration.

4.2.2.2.9 Train from Summit County

This alternative includes a train in a tunnel from Summit County to the resorts in Little Cottonwood Canyon. A 2,500-vehicle parking garage would be built near Kimball Junction or another location in Summit County. Skiers from the Salt Lake Valley would be encouraged to take transit or drive to the parking garage and take the train to the resorts in Little Cottonwood Canyon. To minimize congestion on S.R. 224 into Park City and shorten personal drive time, the start of the rail line was assumed to be near the Utah Olympic Park.

The total length of the rail line from the Utah Olympic Park to the Snowbird ski resort via the Alta ski resort would be about 10 miles. Assuming an average rail speed of about 40 miles per hour, the travel time would be about 15 minutes. The travel time would need to include a 5-minute stop at the Alta ski resort to unload passengers before arriving at Snowbird, a 12-minute transfer from a personal vehicle to the train at the parking garage at the base station, plus the approximately 10-minute additional travel time to the Utah Olympic Park from the Salt Lake Valley. The total travel time would be about 42 minutes. This travel time is between the travel times for the enhanced bus service alternatives (36 minutes) and the Gondola Alternative in the June 8 Report (63 minutes).

In 2015, as part of the Uinta Basin Rail Project, UDOT developed a preliminary estimate for constructing a rail tunnel (UDOT 2015). The analysis included a 29-foot-diameter rail tunnel for about 8.5 miles. Based on the analysis, UDOT determined that the cost in 2014 to construct a rail tunnel would be about \$20,000 per linear foot using a drill-and-blast method. A rail tunnel from the Utah Olympic Park to Alta would be about 9 miles, or 47,500 linear feet. In 2014 dollars, a 9-mile tunnel would cost about \$950 million. Assuming a 1.5% annual inflation rate between 2014 and 2020, the cost would be about \$1.04 billion in 2020 for a single tunnel. To meet capacity and time requirements, two tunnels would be necessary because there would be no room for a rail siding inside a single tunnel. This would put the cost for the tunnels at about \$2.08 billion. This estimate does not include rail track and related facilities, a parking structure, train and rail cars, or rail stations. Based on the cost estimate developed for the Cog Rail Alternative, these elements would add another \$700 million to \$800 million to the cost. In this Report Addendum, the Cog Rail Alternative passed screening at a cost of about \$1.05 billion. Because the train from Summit County alternative would cost 3 times more than the cog rail alternative that passed screening without providing any additional benefit in travel time, it was eliminated from further consideration.

4.2.2.2.10 Cog Rail Refinement

Diesel-electric Power

In the June 8 Report, UDOT based the cog rail alignment and cost on electric light-rail vehicles powered by an overhead contact system (overhead catenary), the same as current light-rail systems. UDOT did not consider diesel-electric power in the June 8 Report because a manufacturer stated that the steep grades in the Little Cottonwood Canyon and the weight of the diesel-electric locomotives and associated rail cars could make diesel-electric-powered cog rail not feasible. However, as a result of comments on the June 8 Report, UDOT evaluated using diesel-electric power for the cog rail system.

What is an overhead catenary?

An overhead catenary is a system of overhead wires used to supply electricity to a locomotive, tram (streetcar), or light-rail vehicle.

One benefit of diesel-electric cog rail vehicles is that they might not require an overhead catenary, which would reduce the cost of the cog rail system. Another benefit is that a diesel-electric cog rail system would not need as many snow sheds since there would be no overhead catenary and poles to be protected from damage caused by avalanches, thus further reducing cost.

The disadvantages of diesel-electric power compared to purely electric power are the greater amounts of air pollutant emissions in the canyon and a higher maintenance cost. To reduce the cost of the cog rail system, UDOT evaluated a diesel-electric system.

Canyon Alignment Option – Canyon Floor

UDOT received suggestions for two new cog rail alignments along the floor of Little Cottonwood Canyon. The first suggestion was the Temple Quarry Trail, a historic rail alignment in the canyon, and the second alignment was one developed as part of the Mountain Accord study. This alignment (the Mountain Accord alignment) follows S.R. 210 to just west of Lisa Falls, then runs along the canyon floor to the Snowbird ski resort to avoid high-risk avalanche zones.

Temple Quarry Trail. The suggestion for the Temple Quarry Trail was to using the old rail alignment that is now a hiking/biking trail up the canyon. The trail would be kept in place, with the rail alignment sharing the same path. Because the trail is about 10 feet wide, substantial earthwork would be required to have both the trail and rail in the same path. Locating an active rail line along a heavily used trail would also detract from the natural setting and would require fencing the alignment to keep trail users and mountain bikers from entering the right-of-way of an active rail line. A fence in Little Cottonwood Canyon would restrict wildlife movement as well.

UDOT's review of the Temple Quarry Trail alignment also found that it would closely follow Little Cottonwood Creek for most of the alignment and would crossing the creek at least twice. In some cases, the alignment would be immediately adjacent to the creek. In addition, the alignment would go through the Wasatch Resort residential area.

In the upper part of the canyon, the alignment would go through the Tanner Flats Campground, one of two campgrounds in the canyon, removing about 10 of the 37 campsites. The campsites removed would be the most sought-after sites adjacent to Little Cottonwood Creek. Given the steep topography in the Tanner Flats area, it would difficult to replace the removed campsites in the Tanner Flats Campground location. Given that the creek and wilderness area are to the south and S.R. 210 is to the north of the campground, it would not be possible for a canyon floor alignment to avoid the Tanner Flats Campground area. The USDA Forest Service believes that any loss of campsites would result in a substantial impact to this important recreation resource. The campground is run by a concessionaire, and representatives with the USDA Forest Service stated that the loss of camp sites would result in the concessionaire not being able to operate the site at a profit. The campground is also a Section 4(f) property.

Mountain Accord Alignment. The second alignment that UDOT reviewed, the Mountain Accord alignment, would follow S.R. 210 up the canyon until about Lisa Falls and then would run along the canyon floor. The alignment would be immediately adjacent to Little Cottonwood Creek to avoid being located in a Wilderness Area. In addition, the alignment would go through the Tanner Flats Campground, removing about 10 of the 37 campsites.

What is Section 4(f)?

Section 4(f) is an element of law and FHWA regulations that requires a project to avoid the use of protected historic properties and park and recreation areas unless there is no feasible and prudent alternative to such use or unless the lead agency determines that the impacts would be *de minimis*. If the project would use protected properties, all possible planning must be undertaken to minimize harm to these properties.

Both the Temple Quarry Trail and Mountain Accord alignments would be immediately adjacent to Little Cottonwood Creek for a good portion of the alignment. The 2003 *Uinta-Wasatch-Cache Revised Forest Plan* notes forestwide objectives for watershed, riparian, and aquatic habitat health. These objectives include the following:

- (G12) Locate new actions (such as incident bases, fire suppression camps, staging areas, livestock handling facilities, recreation facilities, roads and improvements including trails) outside of Riparian Habitat Conservation Areas. If the only suitable location for such actions is within Riparian Habitat Conservation Areas, sites will be located to minimize resource impacts.

Little Cottonwood Creek is defined as a Fish-Bearing Stream with a Riparian Habitat Conservation Area that consists of the stream and the area on either side of the stream extending from the edges of the active stream channel to 300 feet slope distance (600 feet, including both sides of the stream channel). Therefore, placing a new rail facility within this corridor along Little Cottonwood Creek would not meet the USDA Forest Service objectives. A canyon floor alignment of the cog rail would be within the Riparian Habitat Conservation Area, would eliminate camp sites from the Tanners Flat Campground, would cause one or more Section 4(f) uses with greater-than-de minimis impacts, and would require relocating segments of the Temple Quarry Trail. For these reasons, and because there is a cog rail alignment that would avoid these impacts and issues, the canyon floor alignment was eliminated from further consideration.

Note that, with the Gondola Alternative in the June 8 Report, some of the gondola towers would be within the riparian corridor of Little Cottonwood Creek. However, there are no other suitable locations for the towers that would avoid avalanches and Wilderness Areas, and none of the towers would be located in riparian habitat. In addition, vegetation would be restored under the towers, thereby minimizing any impacts to the Riparian Habitat Conservation Area.

What is a *de minimis* impact?

For publicly owned public parks, recreation areas, and wildlife and waterfowl refuges, a *de minimis* impact is one that would not adversely affect the activities, features, or attributes of the property. For historic sites, a *de minimis* impact means that FHWA has determined that either no historic property would be affected by the project or that the project would have “no adverse effect” on the historic property.

Canyon Alignment Option – Ski Resort and Alta Bypass Road

Commenters also suggested a cog rail alignment that would follow S.R. 210 and then go through the Snowbird ski resort, connect to the Alta Bypass Road, and connect to the Alta ski resort by the Wildcat parking lot (Figure 4-3). The purpose of this ski resort and Bypass Road alignment is to avoid the Superior/Hellgate avalanche path and the associated cost of a snow shed to protect the tracks (Figure 4-4). For this analysis, UDOT assumed a diesel-electric locomotive to reduce snow shed lengths and thus cost.

UDOT’s evaluation of this alignment found the following:

- The alignment would cross S.R. 210 at Snowbird Entry 1. The cog rail would delay vehicle movement into and out of the Snowbird ski resort and potentially decrease overall mobility on S.R. 210.
- About 200 parking spaces would be eliminated at the Snowbird ski resort, and the alignment would bisect pedestrian movement from the resort and ski area.
- The alignment would bisect ski runs (Bass Highway, Lower Chips Run, and Cliff Lodge access trail along with eight intersecting trails near the Snowbird Center). Overpasses over the cog rail tracks for

skiers to access lifts on the north side of the rail line would need to be built, which would be difficult given the flat terrain at the base of the mountain. The cost of the overpasses was not included in the cost estimate provided by the commenter that developed the alignment.

- The cog rail alignment would be at ground level. The area receives an average of 400 to 500 inches of snow per year. Because snow on the cog rail tracks would need to be pushed or blown to the sides of the tracks, the alignment would be in a snow trench by mid-winter. To prevent skiers from falling into the trench, a temporary safety fence would be installed along both sides of the alignment across the resort. After each snow event, the fence would be re-established to accommodate the changing conditions. An option to avoid this impact is constructing a 2,500-foot-long elevated structure for the cog rail alignment to allow skiers to pass below the cog rail tracks.
- The Alta ski resort would have the same requirement as the Snowbird ski resort with regard to placing a safety fence along the rail alignment, and this fence would bisect resort operations. Additionally, representatives with the Alta ski resort stated that a cog rail alignment south of the Wildcat parking lot would disrupt resort operations by disrupting skiers' access between the Wildcat parking lot and ski lifts, would disrupt the ability of equipment to navigate the resort, and would disrupt snow-removal operations from the Wildcat lot, which is currently in the location of the proposed cog rail alignment and is in the area of major resort utilities.
- UDOT evaluated a cog rail alignment on the Alta Bypass Road that used a single-track design to minimize impacts. With the single-track design, one commercial building and two residential properties would be acquired by UDOT. In addition, accesses to six residential properties would have rail crossings, which might be difficult to regulate. The cog rail alignment would cross S.R. 210 twice, which would disrupt traffic movements and reduce overall traffic mobility. Additionally, the Alta Bypass Road would be realigned to meet the rail turning radius. With the tight curves, the rail design speed through this area would be 10 miles per hour, which would prevent the cog rail from meeting the required 15-minute headways. Finally, about 60 parking spaces associated with the Snowbird Lodge would be eliminated.

Placing the cog rail alignment on the north side of S.R. 210 to avoid the ski resort operations would eliminate the impacts, operations, and logistical issues and other concerns in the list above. Although the alignment on the north side of S.R. 210 would require a snow shed, UDOT decided that the cost of the snow shed would not outweigh the various drawbacks, impacts, and issues described above for the alignment suggested by the commenter.

Figure 4-3. Cog Rail - Ski Resort and Bypass Road Alignment

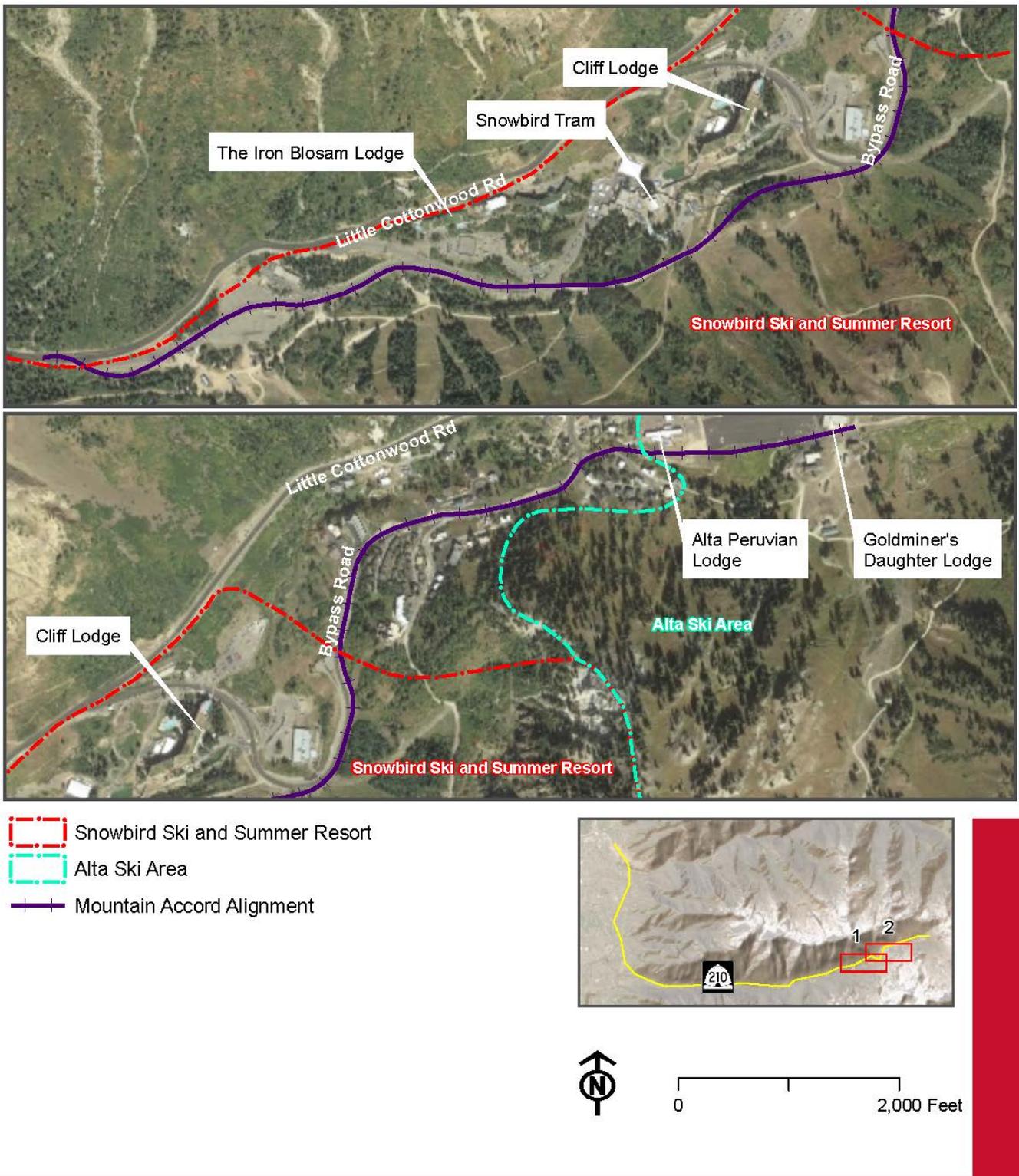
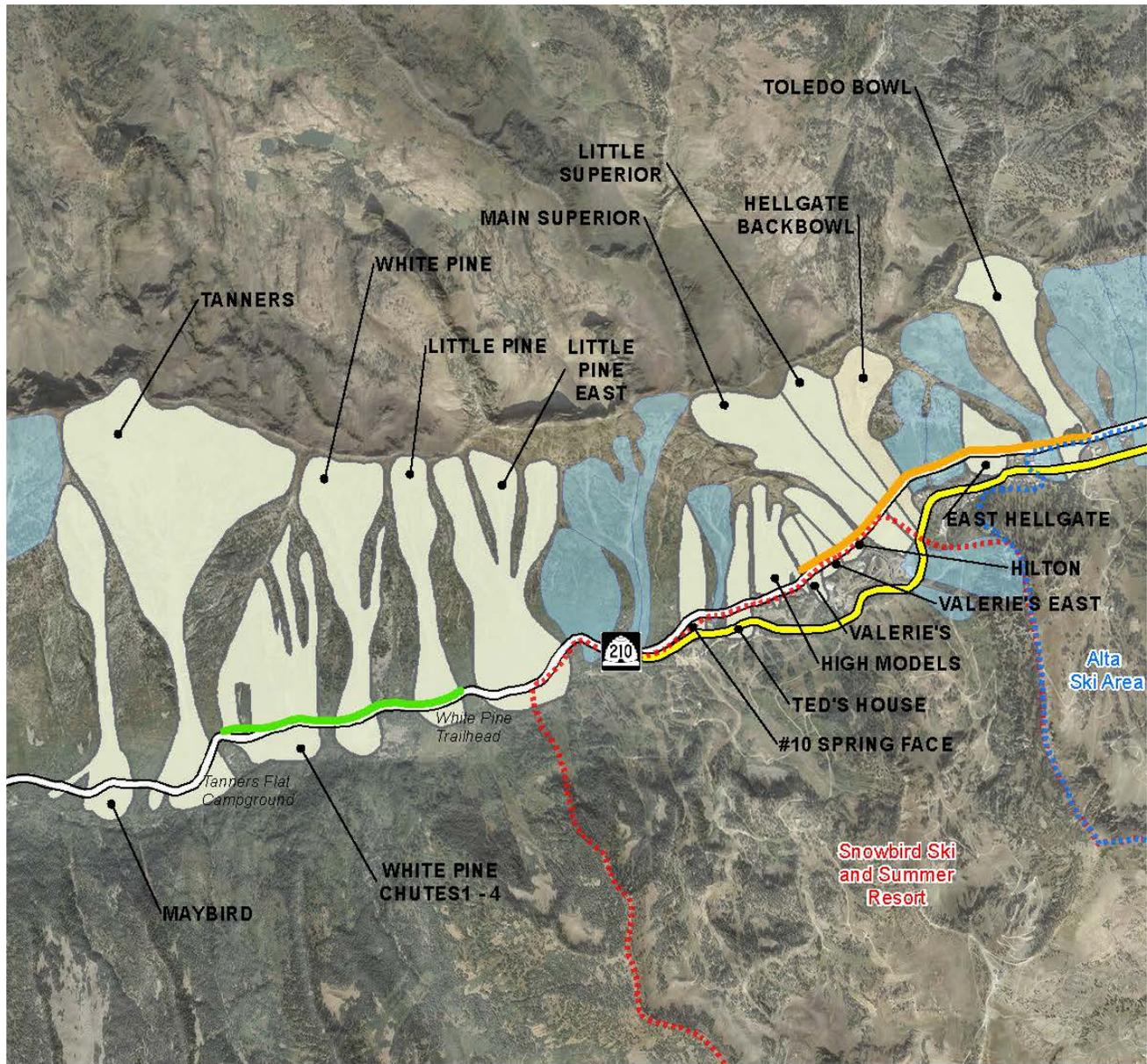
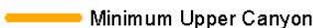
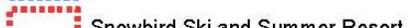
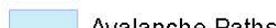
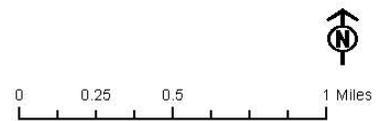


Figure 4-4. Diesel Cog Rail Minimum Snow Shed Requirements by Alignment



LEGEND

- | | |
|--|--|
|  Ski Resort and Bypass Road Alignment | Snow Shed Locations* |
|  S.R. 210 Alignment* |  Minimum Mid Canyon |
| Ski Resort Boundaries |  Minimum Upper Canyon |
|  Alta Ski Area |  Avalanche Paths - High Risk |
|  Snowbird Ski and Summer Resort |  Avalanche Paths |



*Alignments are conceptual and not engineered

Canyon Alignment Option – Cog Rail at Canyon Entrance and on the North Side of S.R. 210

Some commenters suggested that, to reduce the cost of the cog rail system, the cog rail alignment could start at the entrance to Little Cottonwood Canyon at the park-and-ride lot. Because there is not enough land area for a parking structure at this location and because the parking structure would cause substantial traffic impacts at the S.R. 210/S.R. 209 intersection, the parking structure would need to be located away from the canyon entrance and, therefore, a bus system would need to service the cog rail system. Additionally, there would not be enough space for a maintenance facility with the rail station at the entrance to Little Cottonwood Canyon, and finding another location including connecting track in an area with existing residential development would be difficult (UTA 2020). For these reasons, an alignment at the entrance to Little Cottonwood Canyon was eliminated in the June 8 Report.

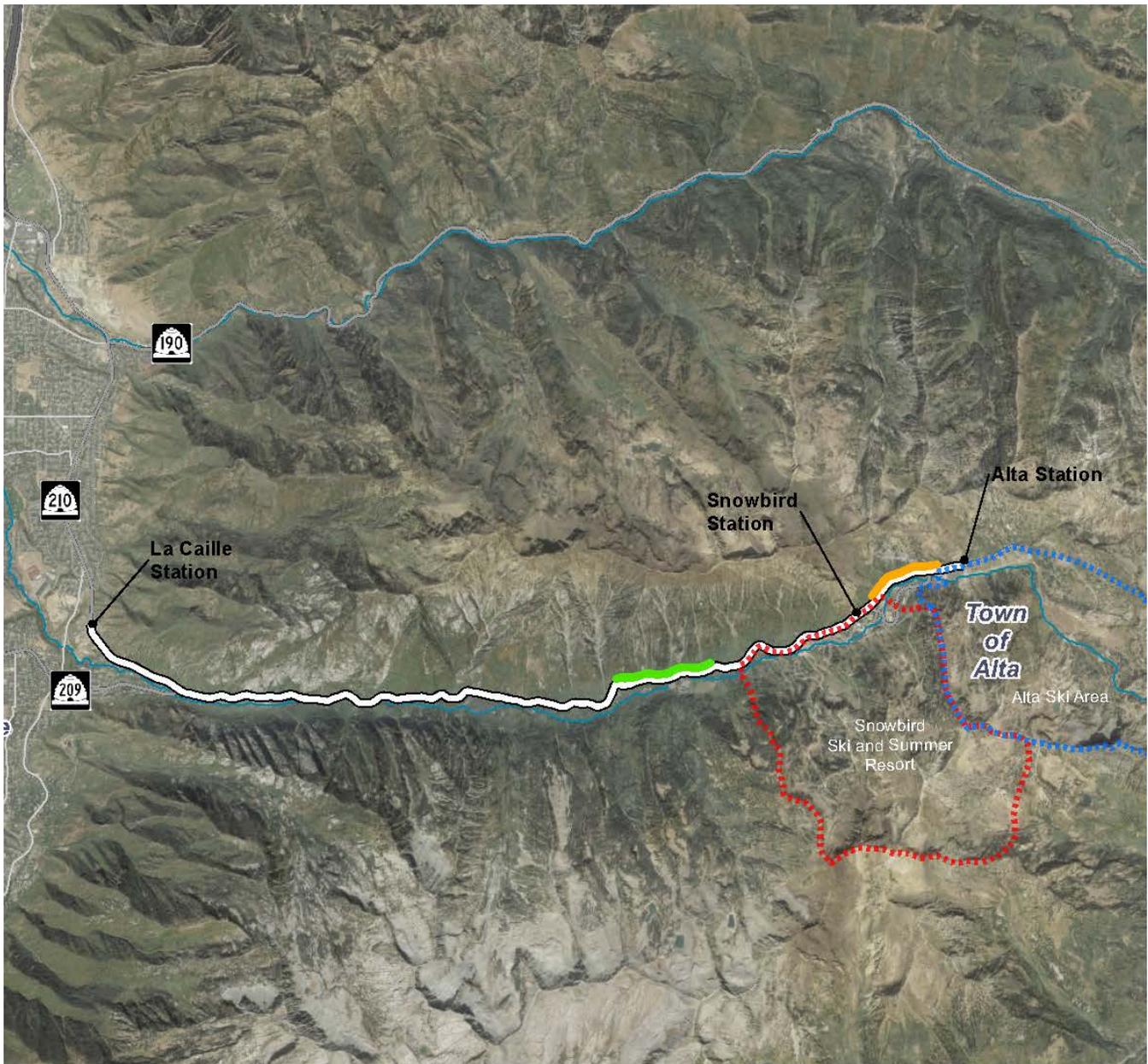
Based on additional evaluation conducted since the release of that report, UDOT determined that a cog rail station could be located at the same location as proposed for the gondola station at La Caille. The 1,500-space parking structure and improvements to North Little Cottonwood Road as proposed for the gondola station at La Caille could be used with a cog rail station located on the east side of S.R. 210. Pedestrian underpasses under North Little Cottonwood Road would allow users to move from the parking area on the west side of the road to access the rail station on the east side. The rail alignment would follow the east side of S.R. 210 as shown in Figure 4-5.

UDOT received a cost estimate from a cog rail proponent indicating that a diesel-electric cog rail system with a rail alignment along S.R. 210 would cost about \$517 million. However, the cost estimate did not include the following key elements:

- Fire suppression, water line, and water quality containment in the snow sheds that would be required with this alignment.
- A snow shed at the Superior/Hellgate avalanche path (see Figure 4-4 above for the location of this upper-canyon snow shed). The cost estimate from the cog rail proponent assumed an alignment through the ski resorts that would not require the snow shed; however, UDOT determined that the alignment through the ski resorts was not reasonable.
- Cost of reconfiguring North Little Cottonwood Road for the 1,500-space parking structure and vehicle access.
- Reconfiguring the Little Cottonwood Canyon park-and-ride lot and trailhead parking areas (Alpenbock, Grit Mill, Gate Buttress, and Lisa Falls Trailheads) to accommodate the cog rail alignment.
- Cost of the detailed engineering, modeling, and cost estimate work needed in connection with the earthwork and supporting walls necessary to build the cog rail system in Little Cottonwood Canyon.
- Cost of 2,500 parking spaces, which was higher with UDOT's estimate (\$52 million versus \$9 million) but was applied equally to all alternatives evaluated (gondola and enhanced bus service).
- Bus service from the mobility hubs to the cog rail base station.

Based on these additional items, UDOT's cost estimate is about \$987 million. This cost does not include widening Wasatch Boulevard.

Figure 4-5. Cog Rail Alignment Starting at La Caille



LEGEND

-  S.R. 210 Alignment*
-  Creek/Stream
- Ski Resort Boundaries**
-  Alta Ski Area
-  Snowbird Ski and Summer Resort
- Snow Shed Locations***
-  Minimum Mid Canyon
-  Upper Canyon



*Alignments are conceptual and not engineered

Other Cog Rail Refinements and Considerations

In the June 8 Report, the cog rail alternative passed Level 1 screening but did not pass Level 2 screening because it would have a large number of home acquisitions, high impacts to Section 4(f) resources, and a high cost compared to the enhanced bus service alternatives and the Gondola Alternative in the June 8 Report. In the June 8 Report, the cog rail alternative connected to the existing UTA light-rail system in Sandy, followed 9400 South to the entrance to Little Cottonwood Canyon, and then ran along the north side of S.R. 210 to Alta. The cog rail alternative was also double track the entire length for two reasons. First, UTA's design criteria state that rail systems with 15-minute or shorter headways should be double track. Second, UDOT's evaluation of single track showed that the cog rail trains could be delayed while waiting on a siding for another train to pass on the mainline, and found issues with placing sidings and switch gear on steep grades (namely that the switch gear could be damaged).

During the comment period for the June 8 Report, UDOT received comments that additional analysis should be performed on single-tracking the rail alignment to minimize impacts to recreation resources [Section 4(f) resources] and that the cog rail alignment should more closely follow S.R. 210 to minimize impacts even though the cog rail trains' travel speeds would be slower because of tighter curves. Another commenter recommended a refinement to use walls to hold back slopes to reduce the width needed for the cog rail alignment along 9400 South and thereby acquire fewer residential properties.

Based on the suggested refinements and to reduce the cost of the cog rail alternative, UDOT refined the cog rail alignment to prevent or minimize the acquisition of recreation areas and to shorten the length of the cog rail alignment by starting the system at La Caille (see Figure 4-5 above). The revised alignment also consisted of using single track for 2.5 miles in Little Cottonwood Canyon to minimize impacts to recreation sites, making the alignment to more closely follow S.R. 210 in Little Cottonwood Canyon to reduce cuts into the canyon walls. This revised alignment is included in Appendix A, Cog Rail Exhibits. Appendix A includes the revised alignment and cost estimate for the refined cog rail alignment. The travel time and capacity of this system would be the same as identified in June 8 Report. The refined cog rail alignment starting at La Caille was moved forward to Level 1 screening in this Report Addendum. The cog rail would likely be operated during the summer if there is a demand.

UDOT also evaluated removing snow from the cog rail tracks and the impacts on the existing snow-removal operations on S.R. 210 (see Appendix B, Cog Rail Snow Removal Operation Considerations). Although UDOT determined that snow-removal operations would not eliminate the cog rail alternative from further consideration, the following issues were identified:

- Snow would need to be removed from the cog rail tracks and pushed or blown onto S.R. 210.
- Removing snow from the cog rail tracks would likely require a blower, which would require S.R. 210 to be closed periodically. The blower could be operated during off-peak travel times on S.R. 210 (such as early morning).
- Once snow is pushed or blown onto S.R. 210 from the cog rail tracks, UDOT would then need to push it to the south side of S.R. 210. The extra snow removal could delay opening S.R. 210 during heavy snow events.
- Removing snow from the cog rail tracks would add to the complex snow-removal operations on S.R. 210, requiring additional equipment and staff-hours.

Another consideration is that cog rail cars departing from the Alta ski resort in the evening could fill up with passengers, thereby preventing any passengers from boarding at Snowbird. Similar to the current bus service, Snowbird users might board the uphill train heading to Alta to get a seat for downhill travel, thereby limiting rail car capacity once the train arrives at Alta. UDOT would develop an evening rail operation plan to provide for equitable use by both Alta and Snowbird users.

Cog Rail Refinement Conclusion

In light of the additional information, analysis, refinements, and considerations described above, UDOT determined that a Cog Rail at La Caille Alternative would be carried forward to Level 1 screening.

4.2.2.2.11 Tunnel Alternative with Autonomous Vehicles

Another suggestion was a tunnel alternative. The tunnel alternative would be a high-speed loop underground transportation system that transports passengers in autonomous electric vehicles (AEV) at speeds of up to 60 miles per hour depending on the tunnel alignment. The type of system would be an all-electric, zero-emissions transportation system. AEVs are battery-powered electric vehicles with guidance systems to enable safe and reliable transport (Figure 4-6). The main benefit of a tunnel alternative is that it would not be affected by winter conditions such as snow on the road, avalanches, or high winds. Currently only one company, The Boring Company, is developing and beginning to implement the alternative considered in this analysis. The evaluation in this section is based on information provided by The Boring Company and from the *Washington, DC, to Baltimore Loop Project, Proposed by The Boring Company, Environmental Assessment (Draft)* (FHWA 2019).

Figure 4-6. Tunnel Alternative



As of October 2020, The Boring Company has no fully operational system open to the public for use. There is an approximately 6,000-foot-long operational test tunnel and a 0.8-mile-long twin tunnel system under construction in Las Vegas, Nevada, at an estimated cost of \$52.5 million (The Verge 2020). The tunnel alternative for the S.R. 210 Project would require a tunnel from the gravel pit to the Alta ski resort (with a stop at the Snowbird ski resort) following S.R. 210 for about 13 miles. This route, under the existing UDOT S.R. 210 right-of-way, was noted as the preferred route by The Boring Company. To meet user frequency and emergency egress requirements, the tunnel concept would likely require a loop system with two tunnels for a total length of about 26 miles. Since there is no tunnel concept by The Boring Company in operation or

under construction at the scale needed for the S.R. 210 Project, it is difficult for UDOT to determine whether such a system would meet the needs of the project or how the system would operate at a larger scale.

The Boring Company stated the tunnel system would operate using existing electric vehicles (5 to 7 seats) since there are currently no electric shuttle vehicles under development with a greater seat capacity. For the tunnel concept to function, it would need to be convenient for skiers and so would need room for skis, boot, and other gear. The current bus system or the proposed Gondola Alternative in the June 8 Report would accommodate easy loading and unloading of skiers with their gear. The 5-to-7-seat vehicles proposed by The Boring Company are similar to standard midsize sedans or sport utility vehicles (SUVs). This would require skiers to mount their skis on an external ski rack and load their gear in the vehicle's trunk, substantially increasing loading and unloading times. Because there are currently no electric shuttle vehicles with a 10-to-12-seat capacity, it is not possible for UDOT to evaluate whether these vehicles would meet the needs of the S.R. 210 Project.

The Boring Company estimates the cost of building the tunnel at about \$10 million to \$12 million per mile. The cost does not include utility relocations, deep shafts, cross passages, or subsurface stations. Because there is no completed tunnel concept at the scale required for the S.R. 210 Project, it is not possible for UDOT to verify the cost or the technology used by The Boring Company to drill 26 miles of tunnel in the granite terrain of Little Cottonwood Canyon. UDOT's review of tunnel cost using standard tunneling techniques found that the cost of constructing a tunnel with a similar 14-foot diameter ranged between \$25 million and \$44 million per mile (Tunnel Business Magazine 2020). This cost does not include a fully operational system, just the cost of constructing the tunnel. The cost differential between The Boring Company's estimate and the standard industry cost for a tunnel leads to uncertainty regarding the actual cost of constructing a tunnel alternative for the S.R. 210 Project since there is no completed Boring Tunnel system at a similar scale as needed for the S.R. 210 Project to use as a comparison.

The tunneling concept would require emergency egress about every 2,500 feet to the ground surface or a side tunnel drilled to the adjacent tunnel. Drilling a side tunnel to the adjacent tunnel would increase the cost to about \$12 million per mile. If egress tunnels to the surface were used, about 16 egress points would be required along S.R. 210 for the 8 miles in Little Cottonwood Canyon. Many of the egress tunnels would need to be located in avalanche zones, requiring some type of hardened structure. The area around the egress tunnels would also need to be frequently cleared of snow to ensure an egress path. The size of the hardened structure would need to be about 30 feet wide by 30 feet deep.

Without a fully operational tunnel system at the scale or vehicle type needed for the S.R. 210 Project, it is not possible for UDOT to verify the cost and operational characteristics of the tunnel alternative and compare the alternative against other alternatives being considered in the EIS. In addition, because The Boring Company has not drilled tunnels at the length required for Little Cottonwood Canyon in similar mountain environment, there is technical uncertainty regarding the boring technology that would be used. For these reasons, UDOT has determined that the tunnel alternative as proposed is not fully developed at a scale to be considered a reasonable alternative at this time and has eliminated the alternative from further consideration.

4.2.2.2.12 Reconfigure S.R. 209/S.R. 210 for Enhanced Bus Service

This alternative includes closing S.R. 209 from the Wasatch Boulevard/9400 South intersection to the S.R. 209/S.R. 210 intersection to through traffic and allowing only buses and local traffic. Buses from the mobility hubs would use the closed portion of S.R. 209 to access Little Cottonwood Canyon. All vehicle through traffic other than buses would use S.R. 210. Traffic from the south portion of the Salt Lake Valley would connect to S.R. 210 at the intersection of Wasatch Boulevard and North Little Cottonwood Road.

The Enhanced Bus Service in Peak-period Shoulder Lane Alternative provides a separate bus-only lane on S.R. 210 without having to implement a traffic-control system to ensure that private vehicles do not use S.R. 209 east of Wasatch Boulevard. Additionally, with the reconfigured S.R.209/S.R. 210 alternative, buses would still need to merge with S.R. 210 traffic at the intersection of S.R. 209 and S.R. 210. Because this alternative does not provide any additional benefit over the Enhanced Bus Service in Peak-period Shoulder Lane Alternative, it was eliminated from further consideration.

4.2.2.2.13 Limit Skiers

This alternative includes limiting the number of skiers at Snowbird and Alta instead of making transportation improvements. This would be accomplished by the resorts limiting ticket sales, by UDOT limiting the number of vehicles in the canyon through a reservation system, by UDOT charging a high toll, by the resorts charging a fee for parking at the ski resorts based on vehicle occupancy, by UDOT implementing odd-even license plate days, or by UDOT stopping vehicle traffic from taking S.R. 210 into the canyon when the parking lots at the resorts are at capacity.

What are odd-even license plate days?

An odd-even license plate policy is a system in which vehicles whose license plates end with an odd or even number would be allowed in the canyon on alternating days.

UDOT does not have the authority to limit ticket sales at the ski resorts or eliminate the use of a specific ski pass. A registration system would not be reasonable since there is no way to prevent vehicles from arriving without a reservation or implement a system to track registered vehicles only. Limiting the number of vehicles in Little Cottonwood Canyon would still result in congestion during the peak hour. The assumption would be to stop vehicles from entering the canyon once the ski resort parking lots are full. This would occur after the peak period and thus would not reduce congestion on S.R. 210 from 7 AM to 10 AM. Finally, UDOT does not have the authority to require ski resorts to implement a time-of-arrival reservation system to limit users during the peak hour.

The reasonable alternatives being considered by UDOT do recommend implementing a toll or vehicle-occupancy restriction to incentivize transit use. UDOT could not implement such a system without providing an alternate mode of transportation as currently proposed by the enhanced bus service and gondola alternatives.

The parking fee strategy would require the ski resorts to implement a parking fee for users at a high enough rate to make transferring to transit an attractive option. However, this strategy might not be effective because UDOT could not require the ski resorts to implement a parking fee in itself or a parking fee at a rate to encourage transit use. Solitude ski resort voluntarily implemented a parking fee for its 2019–2020 ski season, and there was still substantial congestion in Big Cottonwood Canyon requiring S.R. 190 to be closed periodically.

Even though the ski resorts have a limited number of parking spaces, there is still substantial congestion on S.R. 210. Reducing parking overall would not reduce peak-hour travel. Typically, the peak hour occurs between 8 AM and 9 AM when there are parking spaces available at the ski resort parking lots. Reducing parking would affect skiers who typically arrive after the peak hour. Since this strategy would not likely reduce peak-hour traffic, it was eliminated from further consideration as an implementation strategy.

4.2.2.2.14 Autonomous or Semi-autonomous Electric Vehicles

The alternative includes using autonomous or semi-autonomous electric vehicles that can move small groups of people from central parking areas in the Salt Lake Valley to the ski resorts in Little Cottonwood Canyon. For this alternative, a fleet of autonomous or semi-autonomous electric vehicles would need to operate that could take users to the ski resorts from proposed mobility hubs at the gravel pit and at 9400 South and Highland Drive. Currently, the concept of semi-autonomous vehicles working in a platoon is still in the development stage, with numerous manufacturers having different systems. Most systems under development are being tested in locations without snow. Because the technology is still under development, including how such a system would work in winter conditions, UDOT eliminated this alternative from further consideration at this time because of the technical uncertainty. However, if one of the enhanced bus service alternatives is selected, the mobility hubs would be in place to potentially allow the use of autonomous or semi-autonomous vehicles or buses in the future.

Other commenters stated that self-driving vehicles would eliminate the need for improvements in Little Cottonwood Canyon. As with autonomous vehicles, the self-driving vehicle technology is still in its early stages. In addition, to be feasible, the self-driving vehicle alternative would require all users to have this technology. UDOT cannot mandate that users of S.R. 210 have a self-driving vehicle.

4.2.2.2.15 Town of Alta Vehicle-free Zone

This suggested variation on the gondola alternatives includes locating the gondola terminal station in the Albion parking lot and allowing vehicle parking at the Alta ski resort only at the Alta Wildcat parking lot. S.R. 210 through the town of Alta would become a pedestrian-only zone without vehicles except for residents' and employees' vehicles. This alternative would not improve overall mobility on S.R. 210 and therefore was eliminated from further consideration.

4.2.2.2.16 Additional Ski Resorts

This alternative involves the State of Utah partnering with private partners to build three to five new ski resorts to serve Tooele, the western Salt Lake Valley, and potentially northern Utah County to reduce the number of people going to the ski resorts in Little Cottonwood Canyon. UDOT does not have the authority to require private companies to build new ski resorts. In addition, if new ski resort capacity were economically viable, a private developer would likely build a resort. Therefore, this alternative was eliminated from further consideration.

4.2.2.2.17 Eliminate or Limit Parking in Little Cottonwood Canyon

This alternative eliminates or limits all parking in Little Cottonwood Canyon, including ski resort parking. UDOT does not have the authority to limit or eliminate parking at privately owned ski resorts. In addition, limiting the number of parking spaces in Little Cottonwood Canyon would still result in congestion during the

peak hour. The assumption would be to stop vehicles from entering the canyon once the ski resort parking lots are full. This would occur after the peak period and thus would not reduce congestion on S.R. 210 from 7 AM to 10 AM. Therefore, this alternative was eliminated from further consideration.

4.2.2.2.18 *Dual Mode/Tri-track Motors*

The June 8 Report evaluated the Dual-mode Advanced Vehicular Endeavor, or D.A.V.E. This system uses an ordinary automobile (or light truck) adapted with a mounting device so that it can drive on the street network and then be picked up by a fixed guideway and travel above ground. UDOT eliminated this alternative for the following reasons:

- UDOT did not find any examples where a D.A.V.E. concept has been implemented.
- UDOT could not find any examples where either dual-mode transit vehicles or dual-mode personal automobiles have been installed operationally.
- The system would require users to either purchase new vehicles that could be used on the D.A.V.E. guideway system or purchase equipment that would allow their personal vehicles to be used with the D.A.V.E. guideway system.
- UDOT determined that the D.A.V.E. concept would require a technology that does not currently exist and is not commercially or institutionally available.

During the comment period for the alternatives screening report, additional information regarding the D.A.V.E. concept and another concept from TriTrak Motors was provided to UDOT. No specific alternative was provided to UDOT for the dual mode concept such as specific route, person capacity, or operational and maintenance cost. In addition, no manufacturer was identified for the entire system (similar to the gondola, bus, or rail alternatives being considered) including vehicles, specialized equipment, or rail system. Currently, there is no operational dual-mode system at the scale required for the S.R. 210 Project. Without the technical and manufacturer information, UDOT could not develop an alternative to consider in detail. Because a commercial dual-mode system is not available, designing the dual-mode alternative for the S.R. 210 Project would require an extensive and costly research and development process. For these reasons, the dual-mode concept does not meet the logistical, technological, or economic requirements for a reasonable or practicable Little Cottonwood Canyon alternative at this time.

The dual-mode comment did show buses on a rail line. UDOT considered bus alternatives that did not require constructing a costly rail line. The TriTrak dual-mode proposal showed specialized vehicles on a track system. For this system to work, users would need to purchase the specially designed vehicles. UDOT could not require users of S.R. 210 to purchase the specially designed vehicles. Finally, the existing trees beneath the rail alignment would need to be removed and replaced with dwarf trees. Without a specific alignment being available for analysis, it was not clear to UDOT whether construction in a Wilderness Area would be required or whether the system would be affected by avalanches. Based on the information in this section, this alternative was eliminated from further consideration.

4.2.2.3 Level 1 Screening

Based on UDOT's evaluation of the preliminary alternatives for improving mobility on S.R. 210 from Fort Union Boulevard to Alta, the following alternatives were eliminated from further consideration and were not carried forward for Level 1 screening as part of this addendum evaluation:

- Gondola from Gravel Pit Directly to Snowbird/Alta
- Gondola Directly to Snowbird without Angle Stations
- Gondola from Gravel Pit to Solitude/Brighton then to Snowbird/Alta
- Gondola with No Personal Vehicles Allowed in Little Cottonwood Canyon
- Gondola at Wasatch Boulevard and North Little Cottonwood Road
- Summit County Gondola without Parking
- Summit County Gondola with Parking
- Train from Summit County
- Cog Rail Refinement – Canyon Floor Alignment
- Cog Rail Refinement – Ski Resort and Bypass Road Alignment
- Tunnel Alternative with Autonomous Vehicles
- Reconfigure S.R. 209/S.R. 210 for Enhanced Bus Service
- Limit Skiers
- Autonomous or Semi-autonomous Electric Vehicles
- Town of Alta Vehicle-free Zone
- Additional Ski Resorts
- Eliminate or Limit Parking in Little Cottonwood Canyon
- Dual Mode/TriTrak Motors

The two alternatives that were carried forward for Level 1 screening as part of this addendum evaluation are shown in Table 4-5. Both of the alternatives in Table 4-5 include widening Wasatch Boulevard. Both of the alternatives would also include a toll or other travel-management strategy such as a prohibition on single-occupant vehicles during peak travel periods in Little Cottonwood Canyon in order to promote transit use (bus, gondola, or rail).

Table 4-5. Level 1 Screening Alternatives from the Screening Report Addendum – Improve Mobility on S.R. 210 from Fort Union Boulevard to Alta

Alternative	Personal Vehicles in the Peak Hour ^a	Transit Vehicles in the Peak Hour	People in Personal Vehicles in the Peak Hour	People in Transit in the Peak Hour	Total People in the Peak Hour ^b
<i>Additional Roadway Capacity To Wasatch Boulevard with No Additional Capacity on S.R. 210 in Little Cottonwood Canyon Road and Increase Transit (Bus, Gondola, and Train)</i>					
1. Gondola (Base Station at La Caille) <ul style="list-style-type: none"> Wasatch Boulevard – 4 or 5 lanes Little Cottonwood Canyon – One lane in each direction Gondola –30 gondolas (minimum) per hour during the peak period (every 2 minutes) 	1,190	30	2,249	1,050	3,299
2. Cog Rail (Starting at La Caille on North Side of S.R. 210) <ul style="list-style-type: none"> Wasatch Boulevard – 4 or 5 lanes Little Cottonwood Canyon – One lane in each direction Cog rail vehicles – 4 trains per hour during the peak period (every 15 minutes) 	1,190	4	2,249	1,012	3,261

^a Assumes 1.89 people per vehicle during the peak hour based on occupancy counts conducted in 2018.

^b Peak-hour person-demand for any alternative would need to be equal to or greater than 3,250 to meet the demand during the 30th-busiest hour in 2050.

4.2.2.3.1 Level 1 Screening Criteria

The alternatives that were evaluated in Level 1 screening for improving mobility on S.R. 210 were evaluated against the criteria in Table 4-6. The criteria focused on improving overall mobility and reducing congestion on S.R. 210.

Table 4-6. Level 1 Screening Criteria – S.R. 210

Criterion	Measure
Improve mobility in 2050	<ul style="list-style-type: none"> Substantially improve peak-hour per-person (defined as the 30th-busiest hour) travel times in Little Cottonwood Canyon for uphill and downhill users in 2050 compared to travel times with the No-Action Alternative. Meet peak-hour average total person-demand on busy ski days in Little Cottonwood Canyon. Substantially reduce vehicle backups on S.R. 210 and S.R. 209 through residential areas on busy ski days (30th-busiest day).

4.2.2.3.2 Level 1 Screening Results

Table 4-7 shows the per-person travel time (Fort Union Boulevard to Alta ski resort), the S.R. 209 and S.R. 210 vehicle backup lengths, and the results of Level 1 screening for each alternative evaluated. For comparison, Table 4-7 shows the alternatives that were determined reasonable in the June 8 Report and the Level 1 screening alternatives evaluated in this Report Addendum. All alternatives were designed to meet the peak-hour demand of about 3,250 persons traveling eastbound on S.R. 210 and assume a widened Wasatch Boulevard. The analysis shows that all alternatives would substantially reduce travel time compared to the no-action conditions in 2050 and therefore passed Level 1 screening.

Table 4-7. Level 1 Screening Results – Improve Mobility on S.R. 210 from Fort Union Boulevard to Alta

Alternative	Personal Vehicles in Peak Hour ^b	Transit Vehicles in Peak Hour	People in Personal Vehicles in Peak Hour	People in Transit in Peak Hour	Screening Results (Green shading indicates passed screening)				
					Meet Peak-hour Person-demand (total people per hour) ^d	Substantially Improve Peak-hour Travel Time per Person Eastbound/Westbound (minutes) ^e	Substantially Reduce Vehicle Backups at S.R. 209/S.R. 210 Intersection (feet)	Meet LOS A–D in AM and PM Weekday Peak Hour on Wasatch Blvd.	Pass Level 1 Screening? (yes/no)
2050 No-Action (baseline)^a <ul style="list-style-type: none"> Wasatch Boulevard – One lane in each direction Little Cottonwood Canyon – One lane in each direction Transit – 15-minute bus headways 	1,547	8	2,924	336	3,260	80–85/80–85 (80–85 – vehicle and bus)	6300 + (Beyond Signals at 9400 S/Wasatch Boulevard intersection)/8500 + (Beyond Signals at Wasatch Boulevard/North Little Cottonwood Road intersection)	LOS F	N/A
Reasonable Alternatives from June 8, 2020, Draft Alternatives Screening Report									
Enhanced Bus Service Alternative – 24 buses per hour during peak period^c <ul style="list-style-type: none"> Wasatch Boulevard – 4 or 5 lanes with transit priority Little Cottonwood Canyon – One lane in each direction Transit – 24 buses per hour during peak period (every 2.30 minutes entering the canyon or every 5 minutes to each resort) 	1,190	24	2,249	1,008	3,257	45–50 / 45–50 (40–45/40–45 – vehicle) (50–55/50–55 – bus)	1,275/4,300	LOS C/D	Yes
Enhanced Bus Service in Peak-period Shoulder Lane Alternative^c <ul style="list-style-type: none"> Wasatch Boulevard – 4 or 5 lanes with transit priority Little Cottonwood Canyon – bus-only peak-period shoulder lane Transit – 24 buses per hour during peak period (every 2.30 minutes or every 5 minutes to each resort) 	1,190	24	2,249	1,008	3,257	35–40 / 35–40 (35–40/35–40 – vehicle) (35–40/40–45 – bus)	350/3,050	LOS C/D	Yes
Gondola Alternative (at Little Cottonwood Canyon park-and-ride) <ul style="list-style-type: none"> Wasatch Boulevard – 4 or 5 lanes Little Cottonwood Canyon – One lane in each direction Bus to gondola at entrance of canyon –30 gondolas per hour during peak period (every 2 minutes) 	1,190	30	2,249	1,050	3,299	45–50/45–50 (35–40 – vehicle) (60–65 – gondola)	350/3,050	LOS C/D	Yes
Level 1 Alternatives from the Screening Report Addendum									
Gondola at La Caille Alternative <ul style="list-style-type: none"> Wasatch Boulevard – 4 or 5 lanes Little Cottonwood Canyon – One lane in each direction Bus to gondola at entrance of canyon –30 gondolas per hour during peak period (every 2 minutes) 	1,190	30	2,249	1,050	3,299	40–45/45–50 (35–40 – vehicle) (55–60 – gondola)	350/3,050	LOS C/D	Yes
Cog Rail at La Caille Alternative <ul style="list-style-type: none"> Wasatch Boulevard – 4 or 5 lanes Little Cottonwood Canyon – One lane in each direction Double track from Historic Sandy TRAX Station to Alta Cog vehicles – 4 per hour during peak period (every 15 minutes) 	1,190	4	2,249	1,012	3,261	40–45/45–50 (35–40 – vehicle) (55–60 – rail)	350/3,050	LOS C/D	Yes

Green shading indicates measures that passed screening.

^a No-Action Alternative serves as baseline to compare to action alternatives and is not evaluated against screening criteria.

^b Assumes 1.89 people per vehicle during the peak hour based on occupancy counts conducted in 2018.

^c Assumes buses from mobility hubs at both the gravel pit and at 9400 South and Highland Drive. Bus standing capacity of 42 persons.

^d Peak-hour person demand would need to be greater than 3,250.

^e Travel times includes 12-minute vehicle to bus transfer time.

4.2.2.4 Level 2 Screening

As a result of Level 1 screening, the following alternatives were carried forward into Level 2 screening:

- Enhanced Bus Service
- Enhanced Bus Service in Peak-period Shoulder Lane
- Gondola at Little Cottonwood Canyon Park-and-ride
- Gondola at La Caille
- Cog Rail at La Caille

UDOT developed a preliminary engineering design for each alternative in order to evaluate the expected impacts for each Level 2 criterion [see Table 3-2, Level 2 Screening Criteria (Impacts), above]. Table 4-8 shows the results of Level 2 screening.

Table 4-8. Level 2 Screening Results – Improve Mobility on S.R. 210 from Fort Union Boulevard to Alta

Impact Criterion	Unit	June 8 Report Alternatives			Screening Report Addendum Alternatives	
		Enhanced Bus Service	Enhanced Bus Service in Peak-period Shoulder Lane	Gondola (at little Cottonwood Canyon park-and-ride)	Gondola at La Caille	Cog Rail at La Caille
Natural Environment^a						
Wetlands ^b	Acres	0.65	0.65	0.65	0.65	0.65
Streams	Acres	0.03	0.31	0.03	0.03	0.23
Critical habitat	Acres	0.00	0.00	0.00	0.00	0.00
Floodplains	Acres	1.32	2.20	1.64	2.26	2.23
Impacts to wilderness areas	Acres	0.00	0.00	0.00	0.00	0.00
Built Environment^a						
Consistency with USDA Forest Service Plan	Yes/no	Yes	Yes	No	No	No
Consistency with local plans	Yes/no	Yes	Yes	No	No	No
Recreation sites	Number	2	6	2	2	6
Community facilities	Number	0	0	0	0	0
Residential relocations	Number	1	1	1	1	1
Business relocations	Number	0	0	0	0	0
Section 4(f) uses (greater than <i>de minimis</i>) ^f	Number	0	0	0	0	0
Historic properties ^f	Number	7	12	7	8	12
Cost of alternative (in 2019) ^{c,d}	Dollars (millions)	\$334	\$481	\$546	\$576	\$1,056
Annual O&M cost for winter service ^e	Dollars (millions)	\$10.3	\$8.0	\$8.3	\$6.9	\$6.3
Annual O&M cost for summer service ^e	Dollars (millions)	None	None	\$5	\$3	\$2.2

^a The acreage or number of impacts is based on a screening-level design. The actual impacts could decrease or increase based on more-detailed design conducted for the alternatives that pass Level 2 screening.

^b The wetlands are associated with constructed stormwater-management facilities and might not be jurisdictional wetlands. The final determination of wetland jurisdiction will be made by the U.S. Army Corps of Engineers.

^c Cost is in 2019 dollars.

^d All alternative costs include widening Wasatch Boulevard, tolling infrastructure, and snow sheds.

^e The O&M cost for the gondola alternatives and the Cog Rail Alternative includes the cost for enhanced bus service to the gondola base station and to the cog rail base station. The O&M cost for the Enhanced Bus Service in Peak-period Shoulder Lane Alternative includes the bus service and the extra maintenance cost to plow the peak-period shoulder lanes.

^f Section 4(f) use determinations regarding historic properties and impacts to historic properties are based on UDOT's initial determinations. The final determinations might change based on consultation with the Utah State Historic Preservation Office.

4.2.2.4.1 *Level 2 Screening Results*

As shown above in Table 4-8, the Enhanced Bus Service Alternative, Enhanced Bus Service in Peak-period Shoulder Lane Alternative, Gondola at Little Cottonwood Canyon Park-and-ride Alternative, Gondola at La Caille Alternative, and Cog Rail at La Caille Alternative would all have similar impacts to the natural and human environment. The main differences among these alternatives is that the Enhanced Bus Service in Peak-period Shoulder Lane Alternative and the Cog Rail at La Caille Alternative would have four more impacts to recreation sites and five more impacts to historic properties (likely no effects) than the other alternatives. All of the recreation site impacts would be minor, and none of the impacts would affect the attributes of the recreation sites. Because the environmental impacts would be similar and because the costs among the two bus alternatives and the two gondola alternatives were within a similar range (between \$334 million and \$576 million), these four alternatives passed the screening process.

The cost of the Cog Rail at La Caille Alternative is about 2 times greater than the next-most-expensive alternative (\$1.056 billion for the Cog Rail at La Caille Alternative and \$576 million for the Gondola at La Caille Alternative). The cog rail system would provide about the same travel benefits in meeting the project purpose as would the other alternatives being considered but would present some operational concerns regarding snow removal (see the section titled Other Cog Rail Refinements and Considerations on page 29). Typically, if UDOT were evaluating two roadway alternatives that both provided the same benefit in meeting the project purpose with similar impacts but one alternative would have twice the cost, the higher-cost alternative would be eliminated during the screening process. However, the cog rail system provides a completely different travel mode than the enhanced bus service and gondola alternatives that passed the screening process. Therefore, even with the substantially greater cost and operational concerns with snow removal, UDOT decided to carry the Cog Rail at La Caille Alternative forward for further evaluation to provide a reasonable range of transportation modes (bus, gondola, and rail) given the unique circumstances presented by the transportation issues in Little Cottonwood Canyon.

Based on the Level 2 screening, UDOT determined that the Enhanced Bus Service Alternative, Enhanced Bus Service in Peak-period Shoulder Lane Alternative, Gondola at Little Cottonwood Canyon Park-and-ride Alternative, Gondola at La Caille Alternative, and Cog Rail at La Caille Alternative would be considered further in the EIS.

4.2.2.4.2 *Alternatives Carried Forward for Further Evaluation in the Draft EIS*

The following S.R. 210 alternatives will be carried forward for further evaluation in the Draft EIS:

- Enhanced Bus Service
- Enhanced Bus Service in Peak-period Shoulder Lane
- Gondola at Little Cottonwood Canyon Park-and-Ride
- Gondola at La Caille
- Cog Rail at La Caille

4.2.3 Refinement of the Alternatives that Passed Screening from the June 8 Report

The alternatives that passed the screening process from the June 8 Report were refined based on comments provided during the comment period for that report. These refinements included additional analysis regarding electric buses, adding snow sheds to the Gondola Alternative in the June 8 Report, operating the gondola during the summer, and adding the 9400 South/Highland Drive park-and-ride to the Gondola Alternative in the June 8 Report. The revisions to the alternatives also required UDOT to revise the cost estimates for the alternatives in the June 8 Report.

4.2.3.1 Electric Buses

In the June 8 Report, UDOT considered diesel buses, electric buses, and hybrid buses. In the evaluation for that report, UDOT determined that, while electric bus technology is rapidly advancing, electric bus batteries currently have both limited range and performance issues on steep grades. Further, when electric heaters are used in cold weather, the heaters drain the batteries, limiting the range the bus can travel before needing to charge. Based on this evaluation, UDOT determined that diesel buses or hybrid diesel-electric buses would be the best solution for the enhanced bus service alternatives in the short term, but electric buses would be evaluated in the future if a bus alternative were selected as part of the EIS process.

According to UTA and an electric-bus manufacturer, it might be possible to operate electric buses in Little Cottonwood Canyon using current technology, but no long-term road evaluation has been conducted to determine the feasibility. UDOT and UTA would need to conduct a winter test of electric buses to determine the viability. For the EIS analysis, UDOT is assuming the use of diesel buses in the short term but, in cooperation with UTA, UDOT will evaluate electric buses if an enhanced bus service alternative is selected in the Record of Decision.

4.2.3.2 Gondola Alternatives with Snow Sheds

The Gondola Alternative in the June 8 Report did not include snow sheds. The reason for excluding snow sheds was that, if S.R. 210 is closed for avalanche mitigation, road users could take the gondola to access the ski resorts.

Additional refinement of the Gondola Alternative was conducted after the June 8 Report based on comments received that snow sheds should be included with the Gondola Alternative. Commenters stated that a gondola alternative without snow sheds would not meet the following Level 1 screening criteria:

- Substantially reduce vehicle backups on S.R. 210 and S.R. 209 through residential areas on busy ski days (30th-busiest day)
- Substantially reduce the number of hours and/or days during which avalanches delay users

Without snow sheds, S.R. 210 would still need to be closed for avalanche mitigation, and therefore the number of hours and/or days during which avalanche mitigation delays users would not be reduced. In addition, if S.R. 210 is closed, there would be substantial backup on S.R. 210 and S.R. 209 in residential areas during the closure period. Thus, UDOT agrees with the commenters' statement on this issue.

UDOT also determined that, when artillery is being used during avalanche mitigation operations, the gondola would need to be closed. This closure would result in the gondola operation being delayed anytime artillery was being used, thereby reducing the effectiveness of the alternative. With snow sheds, the use of artillery shells could be reduced from an average of 153 shells per ski season to about 31 shells per season (Dynamic Avalanche Consulting 2019). Thus, with the snow sheds, the gondola hours of operation would be less affected by the use of artillery. To meet the screening criteria for reducing vehicle back-ups and increasing reliability on S.R. 210 and improving the operational effectiveness of the Gondola Alternative in the June 8 Report, UDOT decided to include snow sheds with the gondola alternatives.

4.2.3.3 Gondola and Summer Use

Only winter gondola service was included in the alternatives analyzed in the June 8 Report. Although summer gondola service is not required to meet the project purpose, the gondola system would be a large fixed public investment. Operating the gondola in the summer could help pay for the capital cost of the system, and the gondola could become a tourist attraction for those already traveling to Utah to visit other nearby attractions. This tourist attraction could provide an economic benefit to the tourism industry in Salt Lake County. Therefore, UDOT decided to include summer use of the gondola as part of the EIS analysis. Because the gondola system is not necessary to improve summer mobility on S.R. 210, the ticket prices would not be subsidized as planned for winter service, so there would be a higher cost to cover O&M and capital costs. UDOT does not expect that many recreationists from the Salt Lake Valley who are going hiking or visiting the ski resorts for the day would routinely take the gondola because of the higher summer ticket cost and slower travel time compared to personal vehicle use.

Some commenters suggested that UDOT include summer bus service in Little Cottonwood Canyon. Summer bus service is not required to meet the purpose of improving mobility. To pay for the buses' summer operation and maintenance cost and capital cost, the cost of a ticket would need to be increased substantially over the ticket price for the subsidized winter service. In addition, the slower travel time compared to personal vehicles would provide little attraction to summer users. Therefore, UDOT did not include summer bus service on S.R. 210 in Little Cottonwood Canyon.

4.2.3.4 Gondola and 9400 South and Highland Drive Mobility Hub

In the June 8 Report, the Gondola Alternative included a mobility hub at the gravel pit only. Only one mobility hub was selected to improve overall route efficiency and thus reduce the operating cost of the bus service to and from the mobility hub. During the comment period for the June 8 Report, UDOT received comments that the Gondola Alternative should also include a mobility hub for users coming from the southern portion of the Salt Lake Valley. Commenters from the southern part of the Salt Lake Valley said they were less likely to use the Gondola Alternative if they had to travel north of Little Cottonwood Canyon to the gravel pit mobility hub. Therefore, UDOT decided to include the 9400 South/Highland Drive mobility hub and associated bus service with the gondola alternatives.

4.2.3.5 Revised Cost Estimates

Based on public and agency input on the alternatives in the June 8 Report, UDOT has revised the cost estimates. The revisions include the following:

- **Wasatch Boulevard Widening**
 - Revised cost estimate based on current-year dollars.
- **Enhanced Bus Service Alternatives**
 - Revised bus operating cost to reflect 2019 instead of 2018 bus operating cost.
 - Revised cost estimate for the peak-period shoulder lanes.
 - Revised operating cost to include bus driver retention for the entire year in order to retain experienced drivers.
 - Added \$15 million for right-of-way cost for purchasing the gravel pit mobility hub.
 - Added \$32 million for the road interchange from Wasatch Boulevard to the gravel pit mobility hub.
- **Gondola Alternative**
 - Added snow sheds.
 - Revised bus operating cost to reflect 2019 instead of 2018 bus operating cost.
 - Revised bus service. UTA stated that regular buses instead of articulated buses should be used, and the route should include the 9400 South/Highland Drive mobility hub.
 - Added \$15 million for right-of-way cost for purchasing the gravel pit mobility hub
 - Added \$32 million for the road interchange from Wasatch Boulevard to the gravel pit mobility hub.
 - Added \$6.6 million to reconfigure the Little Cottonwood Canyon park-and-ride lot to include the gondola base station.

Table 4-9 shows the capital cost estimates from the June 8 Report and the revised cost estimates.

Table 4-9. June 8 Report and Revised Capital Cost Estimates

In millions of 2020 dollars

Alternative Element	June 8 Report Alternatives			Screening Report Addendum Alternatives				
	Enhanced Bus Service	Enhanced Bus Service in Peak-period Shoulder Lane	Gondola at Little Cottonwood Canyon Park-and-ride	Enhanced Bus Service	Enhanced Bus Service in Peak-period Shoulder Lane	Gondola at Little Cottonwood Canyon Park-and Ride ^b	Gondola at La Caille ^b	Cog Rail at La Caille ^b
Mobility hub(s) – structure/roadway ^a	\$52	\$52	\$52	\$84	\$84	\$84	\$54	\$54
Mobility hub(s) – land cost	—	—	—	\$15	\$15	\$15	\$15	\$15
Wasatch Blvd.	\$76	\$76	\$76	\$61	\$61	\$61	\$61	\$61
Enhanced bus service	\$79	\$55	\$21	\$97	\$69	\$49	\$26	\$26
Peak-period shoulder lanes	—	\$211	—	—	\$175	—	—	—
Snow sheds	\$72	\$72	—	\$72	\$72	\$72	\$72	\$240
Gondola	—	—	\$240	—	—	\$260	\$343	—
Cog rail	—	—	—	—	—	—	—	\$655
Tolling infrastructure	\$5	\$5	\$5	\$5	\$5	\$5	\$5	\$5
Total	\$284	\$471	\$394	\$334	\$481	\$546	\$576	\$1,056

^a The screening report addendum cost includes the cost for interchange on Wasatch Boulevard to the gravel pit mobility hub except for the Gondola and Cog Rail at La Caille Alternatives which would be a signalized intersection because of less traffic at the gravel pit mobility hub.

^b The cost of the gondola and Cog Rail at La Caille Alternatives includes reconfiguring Wasatch Boulevard at the La Caille base station. The cost of both gondola alternatives and the Cog Rail at La Caille Alternative includes improvements to the Little Cottonwood Canyon park-and-ride.

Annual operating cost was revised as follows:

- **Enhanced Bus Service Alternative**
 - June 8 Report – \$9 million
 - Screening Report Addendum – \$10.3 million (cost increased for bus driver retention and updated 2019 bus operating cost)
- **Enhanced Bus Service in Peak-period Shoulder Lane Alternative**
 - June 8 Report – \$6.2 million
 - Screening Report Addendum – \$8.0 million (cost increased for bus driver retention and updated 2019 bus operating cost)
- **Gondola Alternative** (note: includes winter service only in order to equally compare to all alternatives)
 - June 8 Report – \$4.5 million
 - Screening Report Addendum – \$8.3 million (cost increase with revised bus service estimate and additional refinement of gondola operating cost). Summer service is estimated at \$5 million which includes bus service from the mobility hubs to the base station.
- **Gondola at La Caille Alternative**
 - June 8 Report – None
 - Screening Report Addendum – \$6.9 million for winter service (with some parking at base station, less frequent bus service is provided) and \$3 million for summer service. The 1,500 space parking structure at the base station is assume to provide adequate summer parking that no bus service from the gravel pit or 9400 South/Highland mobility hubs would be required.
- **Cog Rail at La Caille**
 - June 8, Report – None
 - Screening Report Addendum – \$6.3 million for winter service (with some parking at base station, less frequent bus service is provided) and \$2.2 million for summer service. The 1,500 space parking structure at the base station is assume to provide adequate summer parking that no bus service from the gravel pit or 9400 South/Highland mobility hubs would be required. Cost also includes cost of removing snow from the cog rail tracks and additional snow removal from S.R. 210 as the result of removing snow from the cog rail tracks.

5.0 Alternatives Carried Forward for Further Evaluation in the Draft EIS

Based on the June 8 Report and this Screening Report Addendum, UDOT is carrying the following alternatives forward for further evaluation in the Draft EIS:

- Enhanced Bus Service
- Enhanced Bus Service in Peak-period Shoulder Lane
- Gondola at Little Cottonwood Canyon Park-and-Ride
- Gondola at La Caille
- Cog Rail at La Caille

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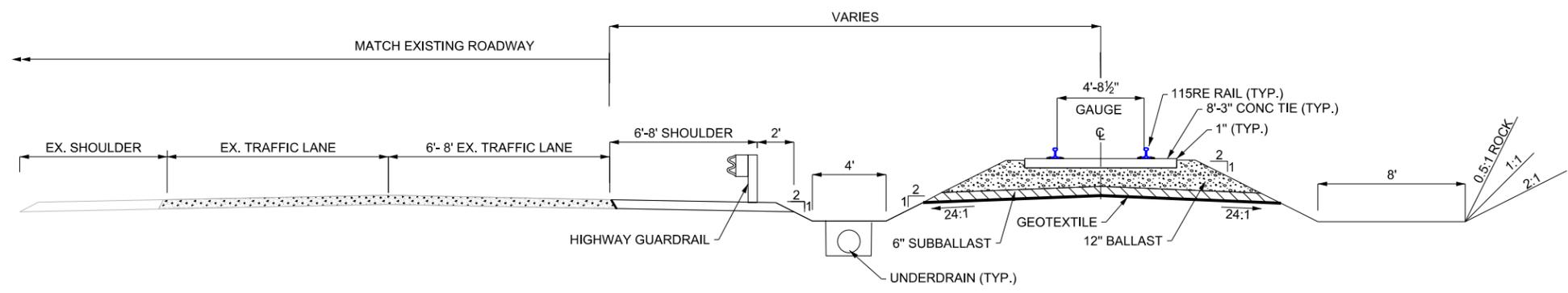
[UTA] Utah Transit Authority

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[WFRC] Wasatch Front Regional Council

2019 2019–2050 Wasatch Front Regional Transportation Plan. https://wfrc.org/VisionPlans/RegionalTransportationPlan/Adopted2019_2050Plan/RTP_2019_2050_ADOPTED.pdf.

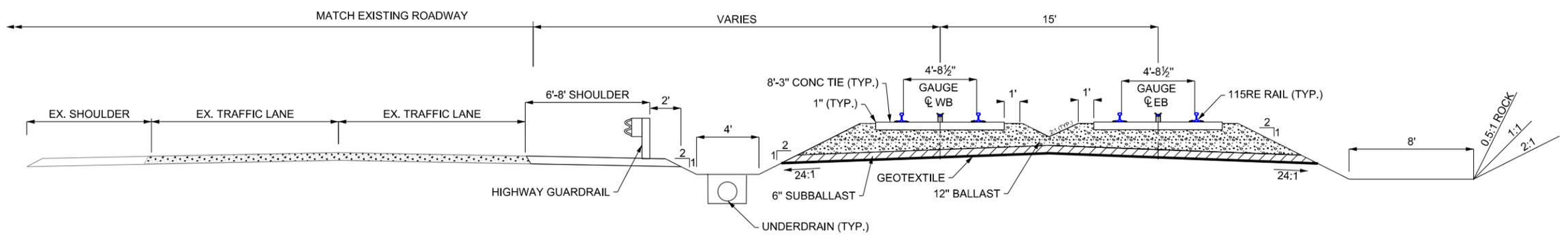
Appendix A. Cog Rail Exhibits



SINGLE TRACK BALLAST ON SIDE LAYOUT

SCALE 1"=1'

A



DOUBLE TRACK BALLAST ON SIDE LAYOUT

SCALE 1"=1'

B

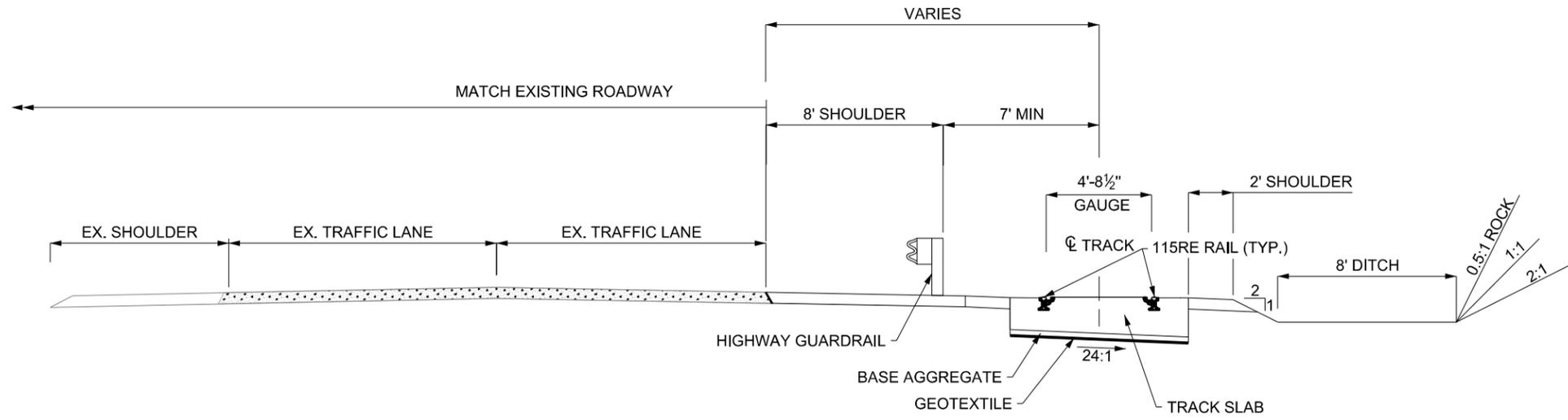
REVISIONS

NO.	DATE	APPROVED BY	REMARKS

UTAH DEPARTMENT OF TRANSPORTATION

DRAWN BY	
QC CHECKED BY	
APPROVED	
PROFESSIONAL ENGINEER	
DATE	

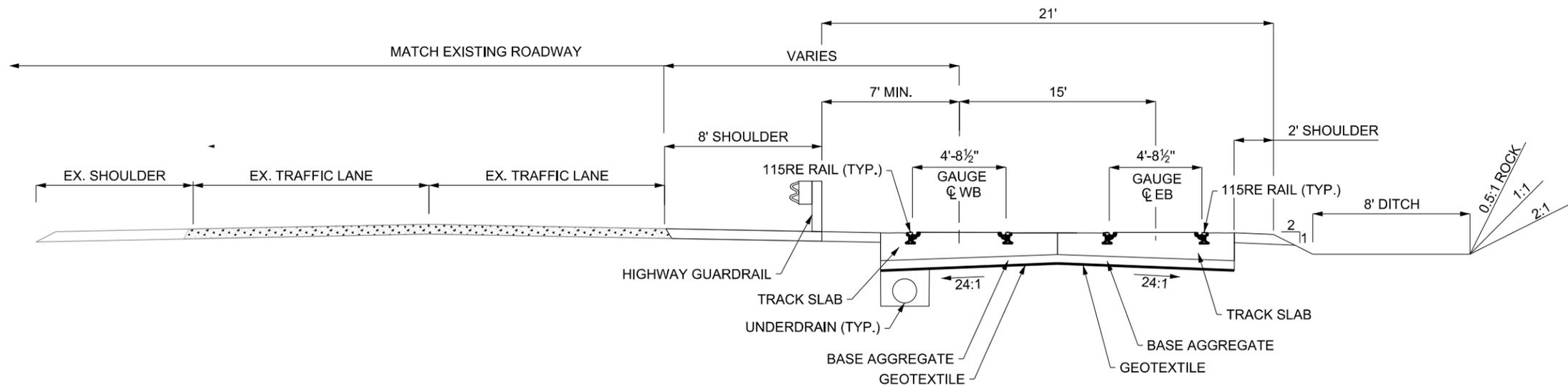
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SHEET NO.	



SINGLE TRACK EMBEDDED ON SIDE LAYOUT

NOT TO SCALE

A



DOUBLE TRACK EMBEDDED ON SIDE LAYOUT

NOT TO SCALE

B

REVISIONS

NO.	DATE	APPROVED BY	REMARKS

UTAH DEPARTMENT OF TRANSPORTATION
HDR

DRAWN BY
QC CHECKED BY

DATE

PROFESSIONAL ENGINEER

LITTLE COTTONWOOD CANYON EIS
TRACK CROSS SECTION EXHIBIT

APPROVED

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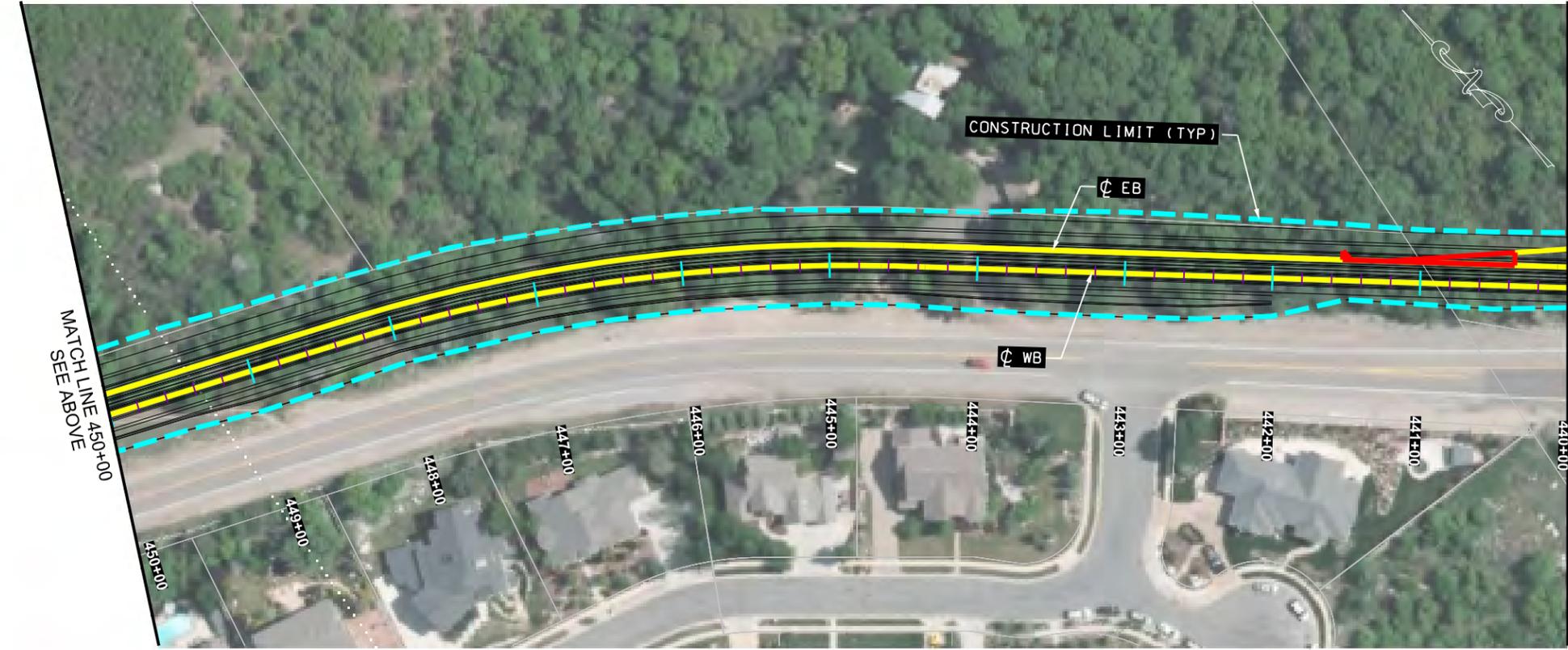
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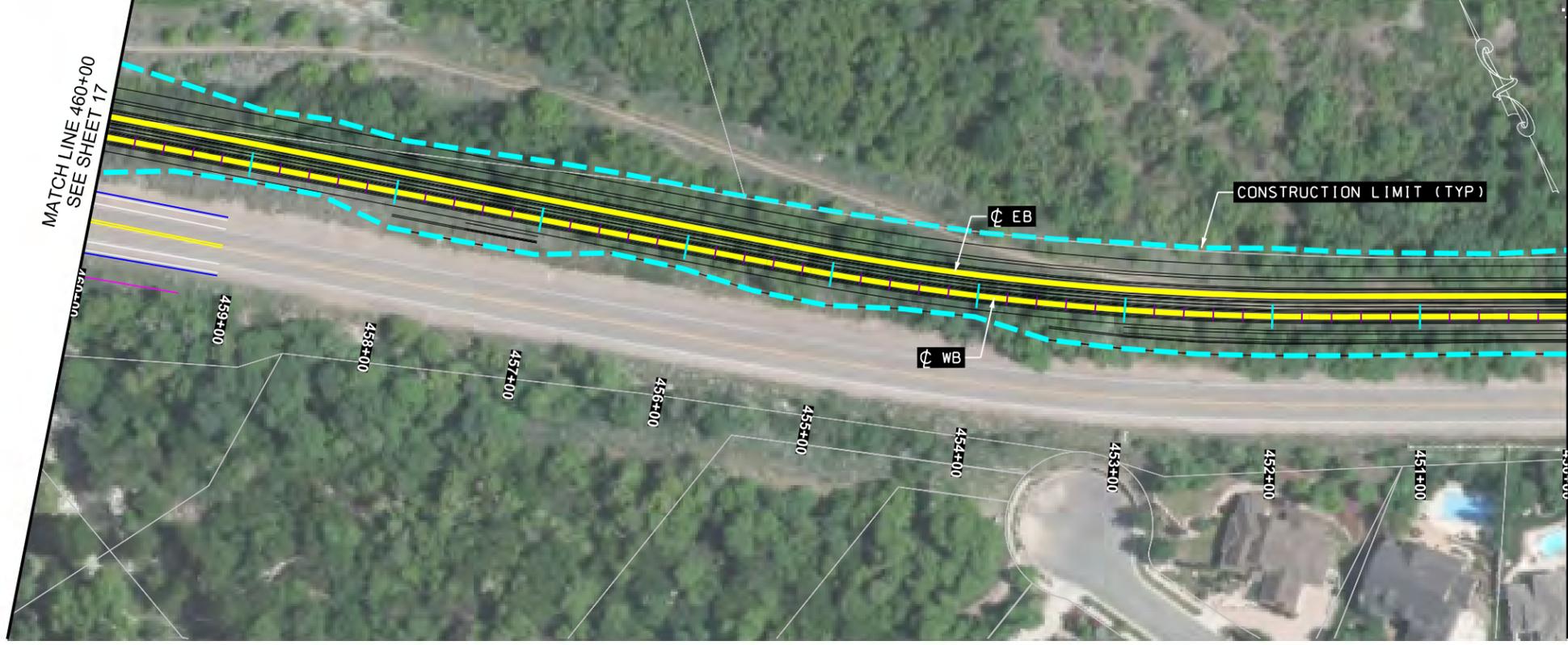
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PROJECT NUMBER

SHEET NO.



MATCH LINE 440+00
SEE SHEET 19



MATCH LINE 450+00
SEE BELOW

PROJECT
LITTLE COTTONWOOD CANYON EIS

PROJECT NUMBER
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UTAH DEPARTMENT OF TRANSPORTATION
HDR

APPROVED

PROFESSIONAL ENGINEER

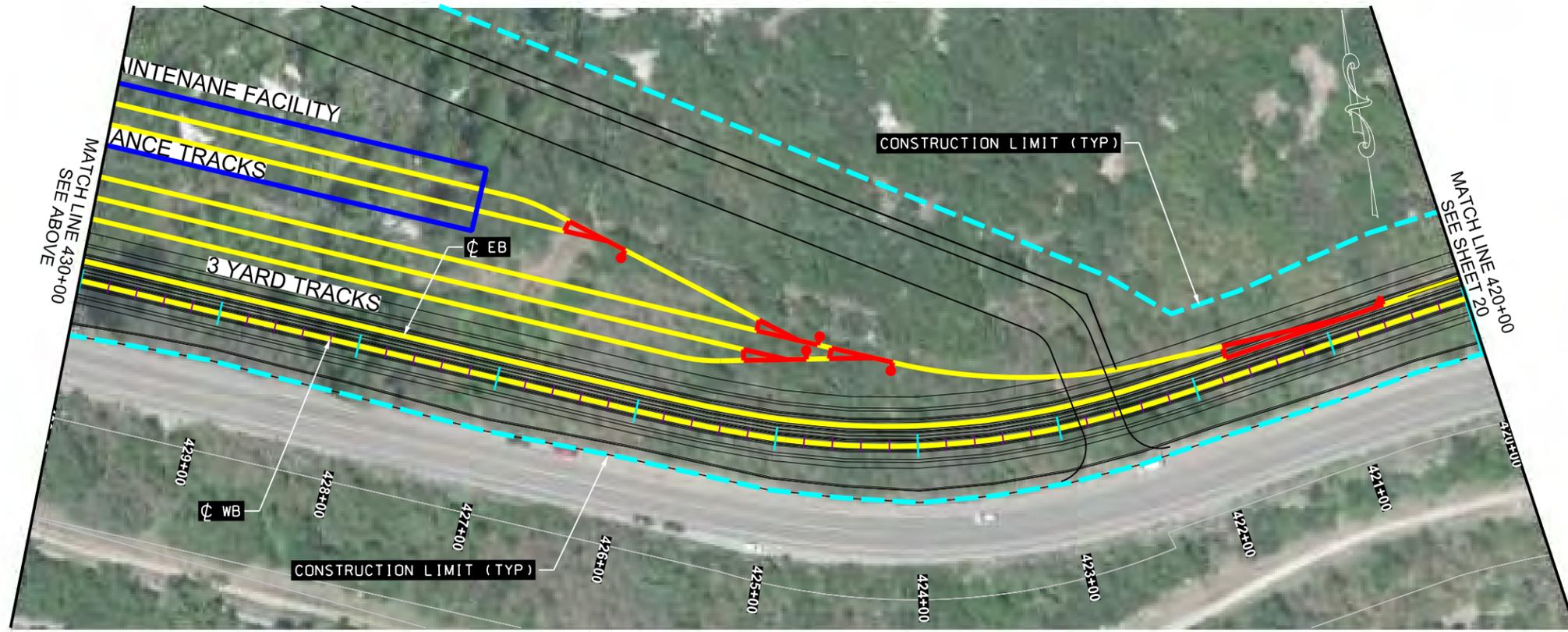
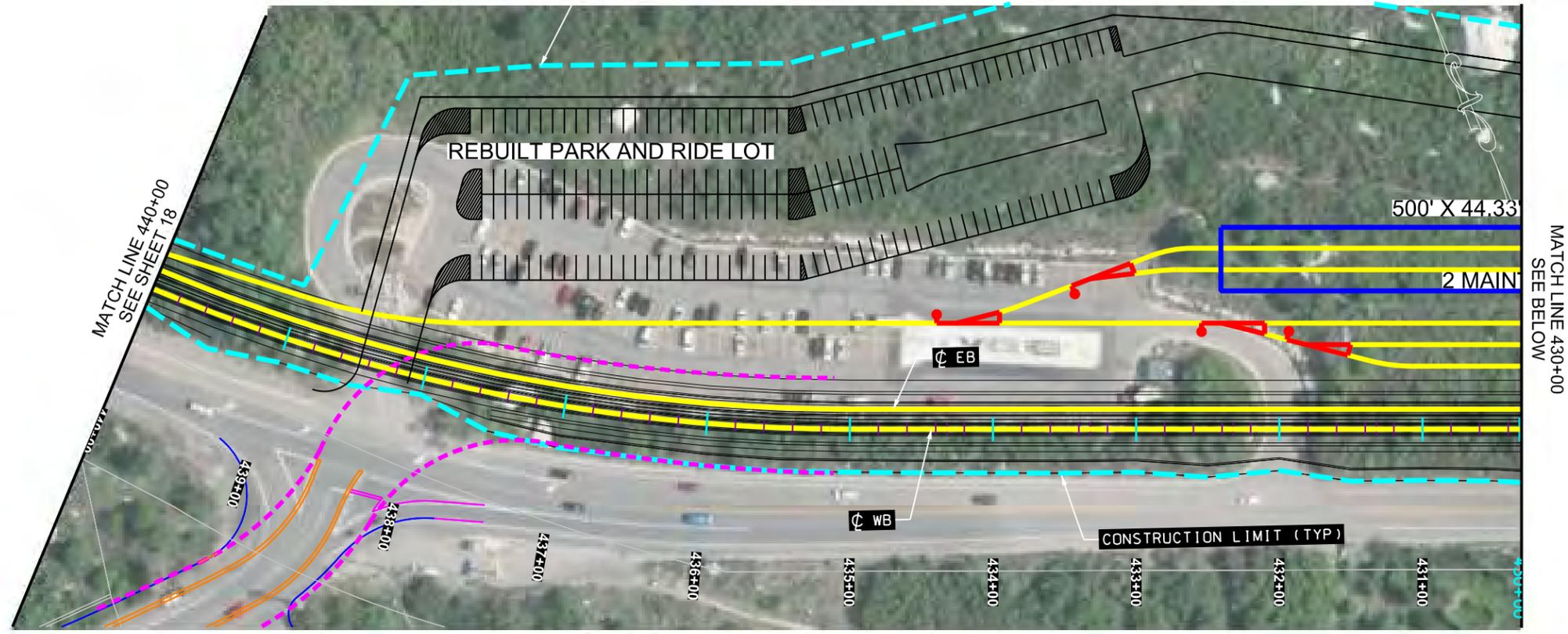
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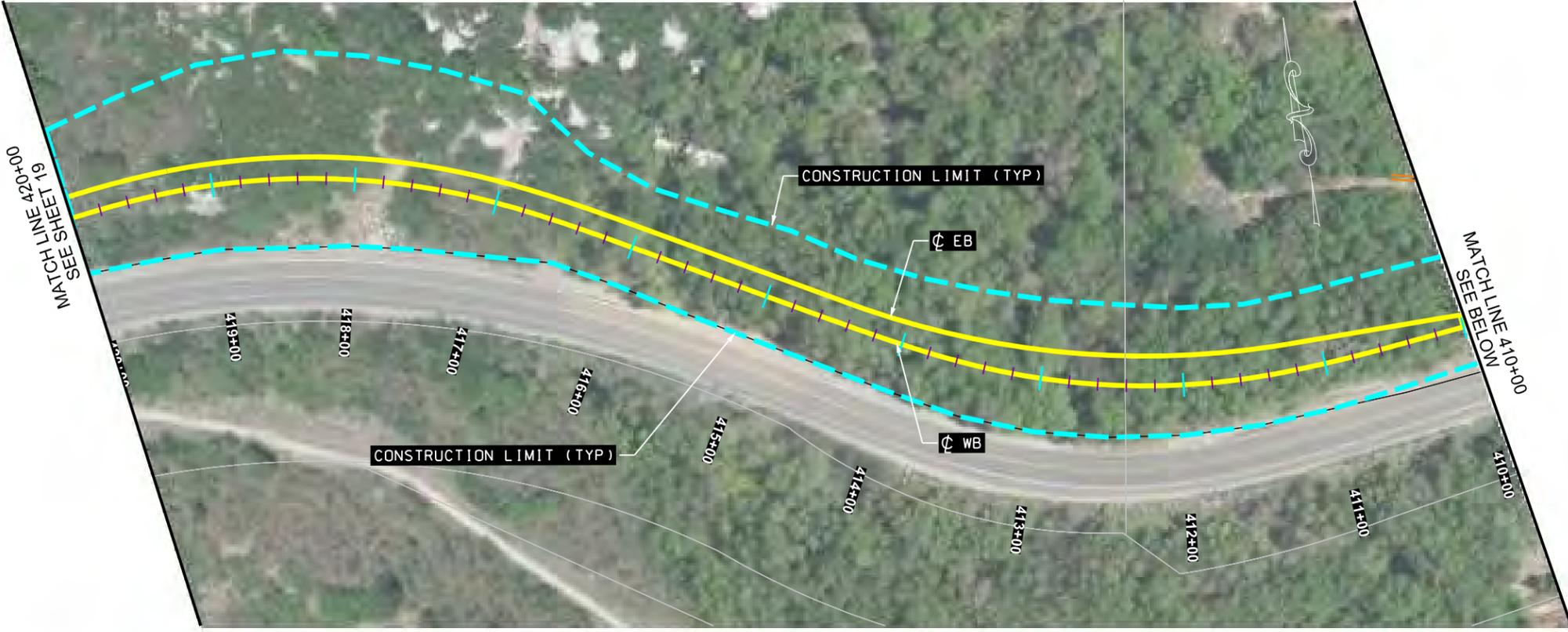
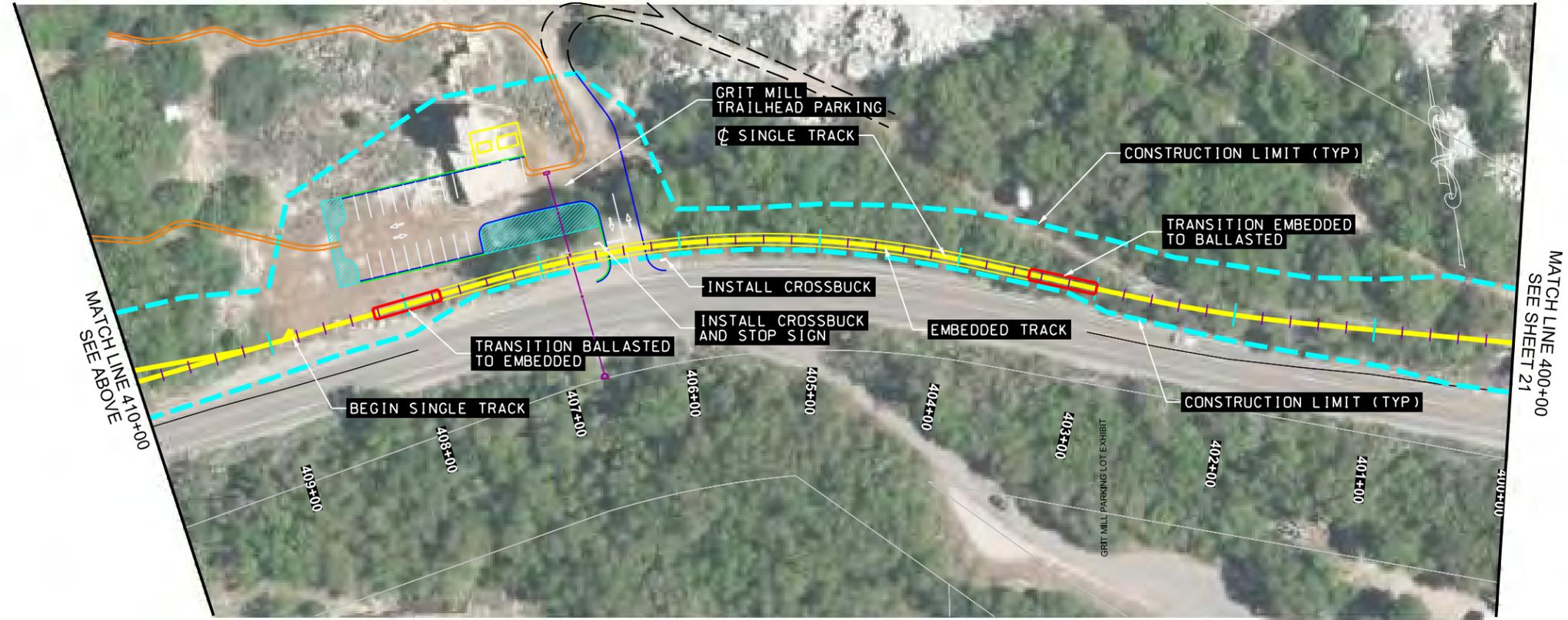
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REVISIONS

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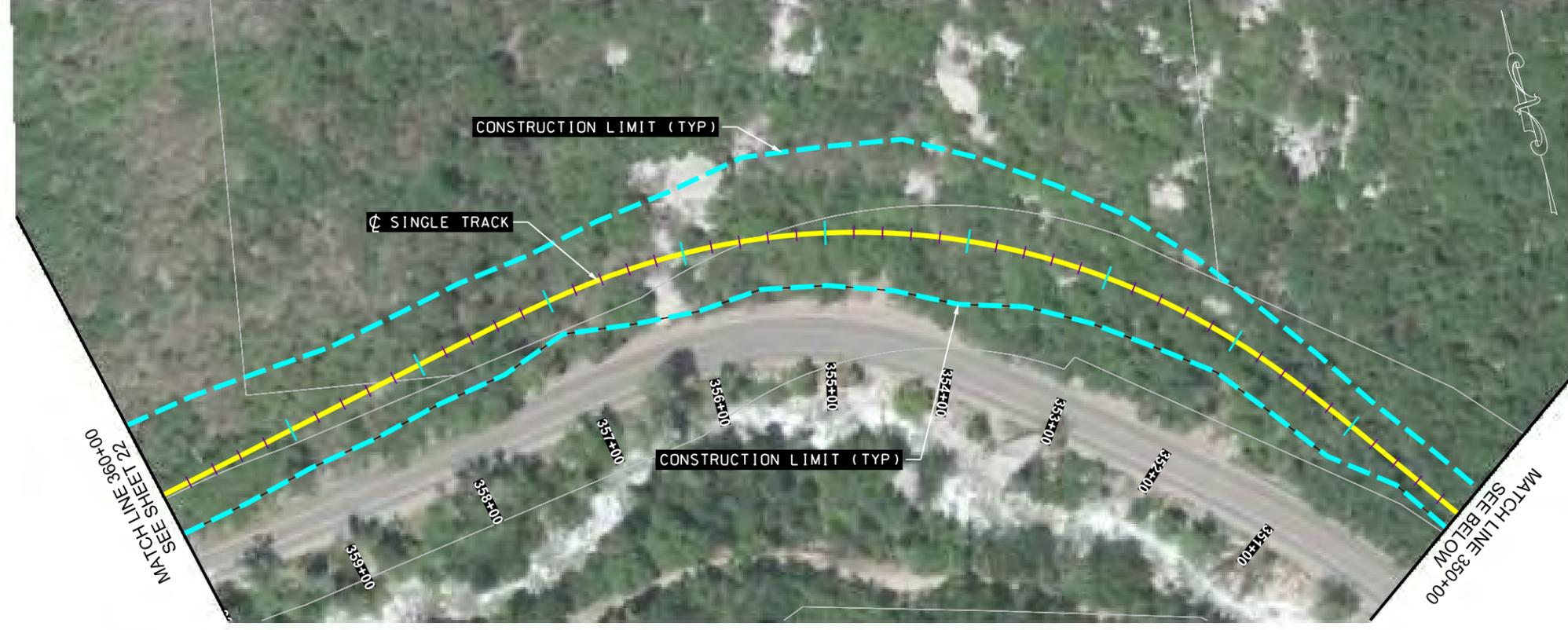
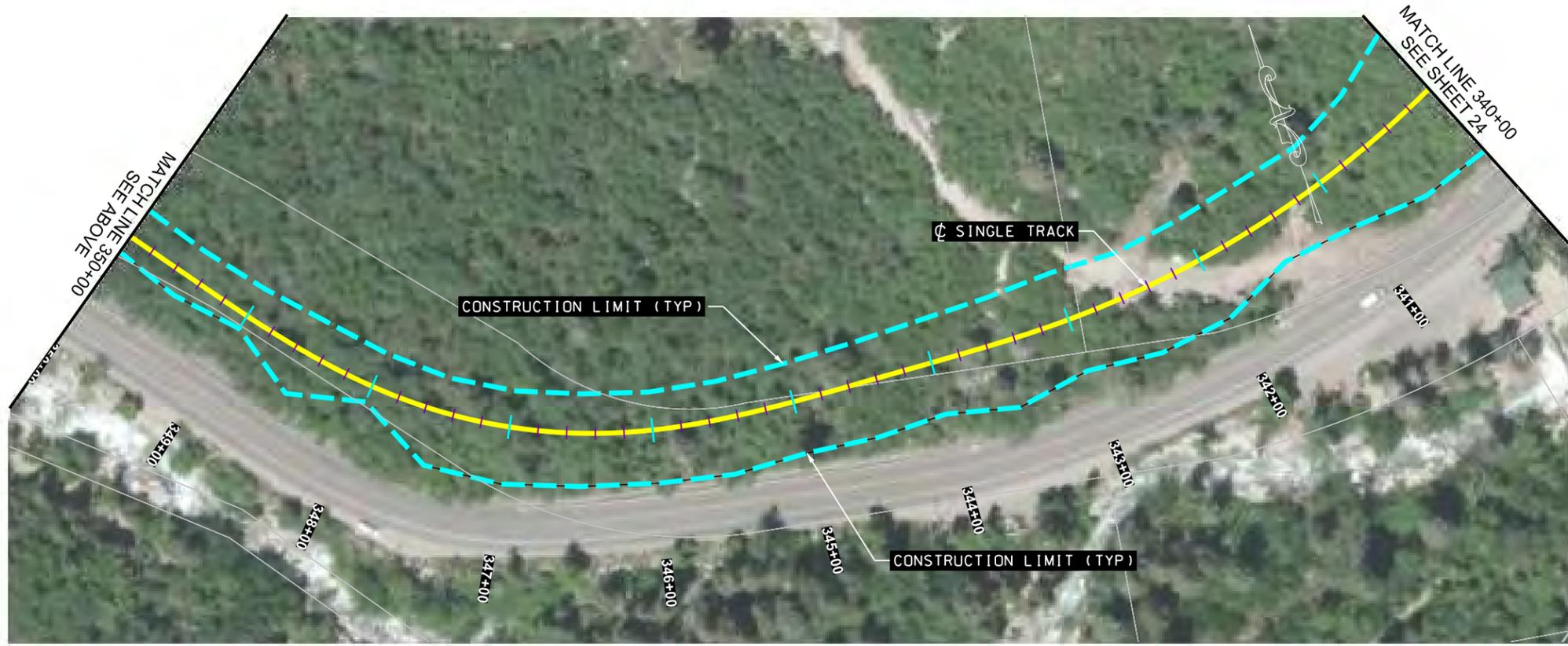
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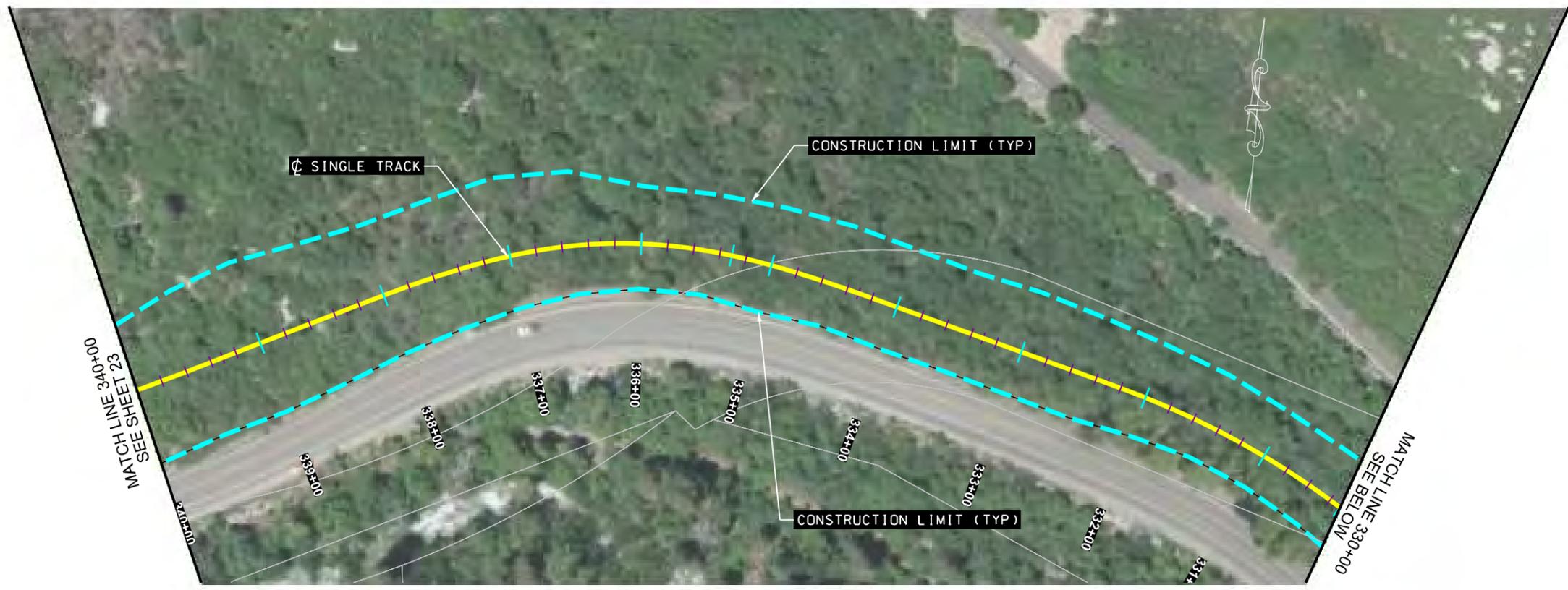
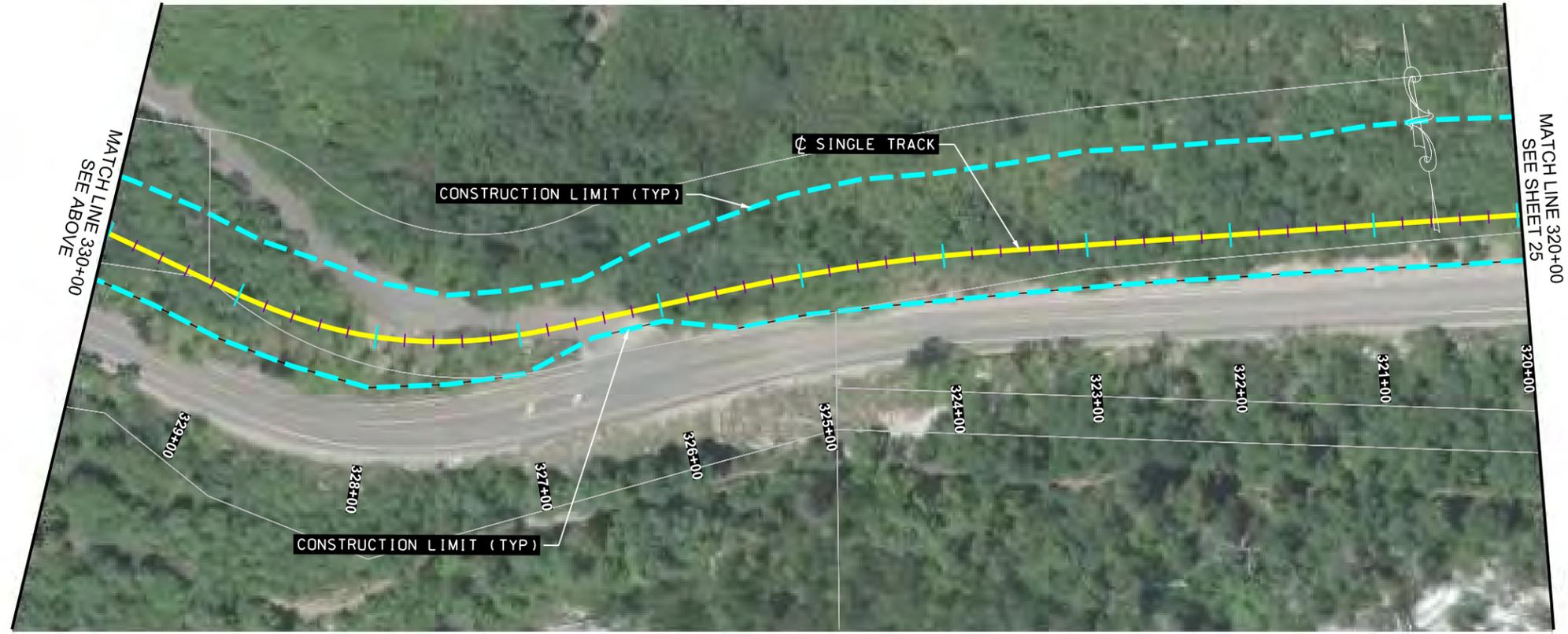
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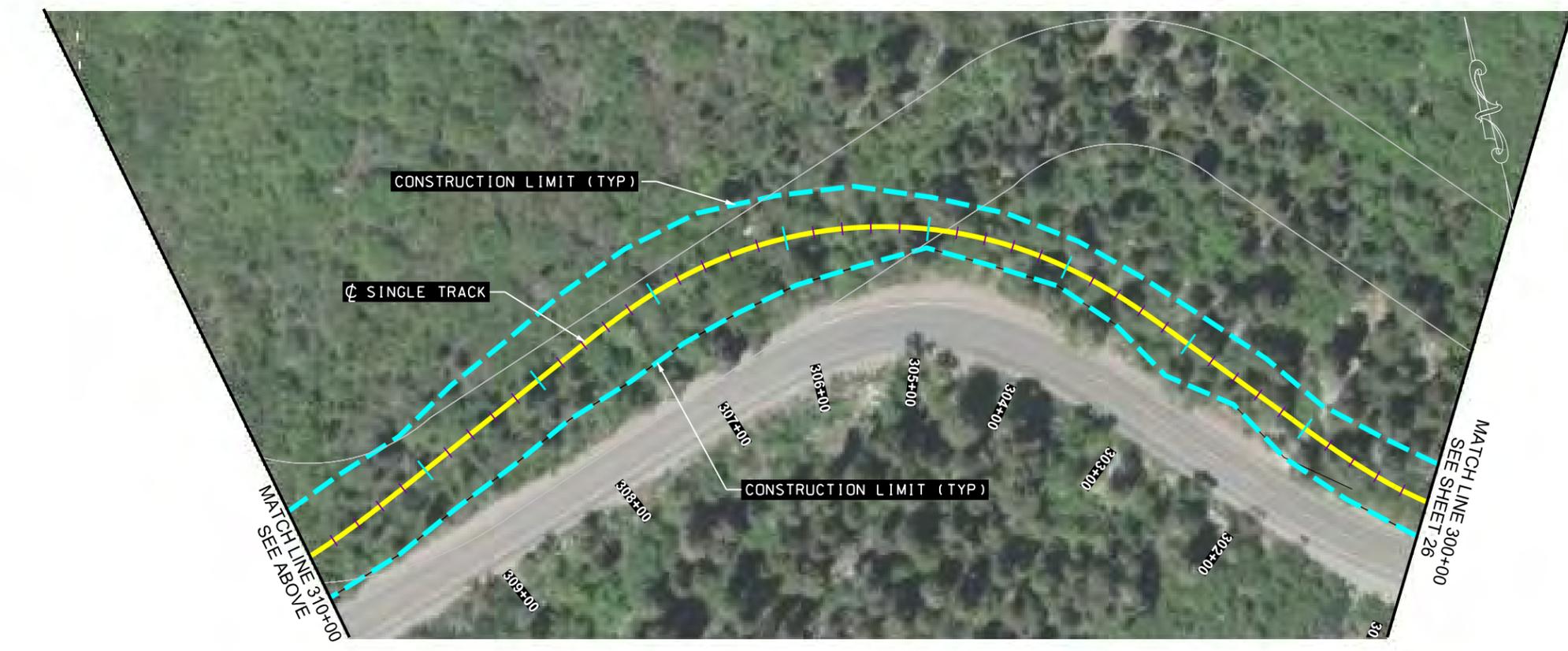
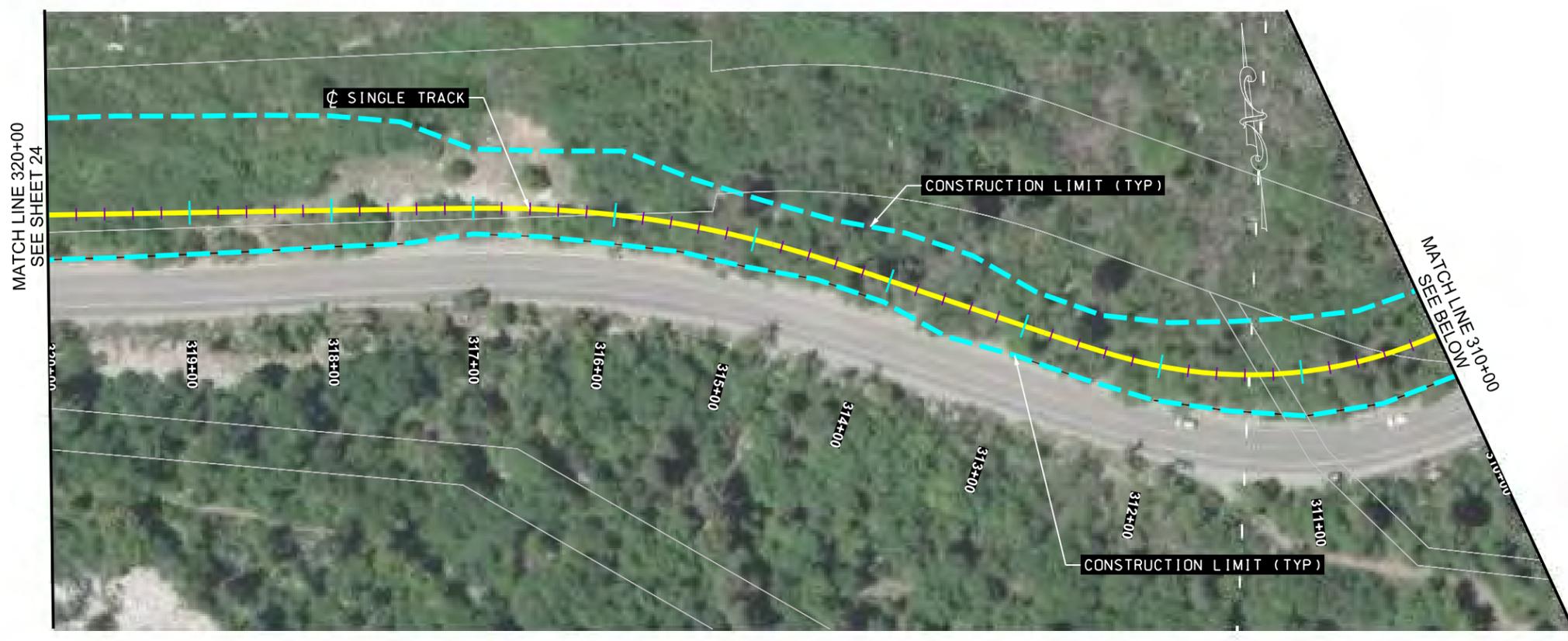
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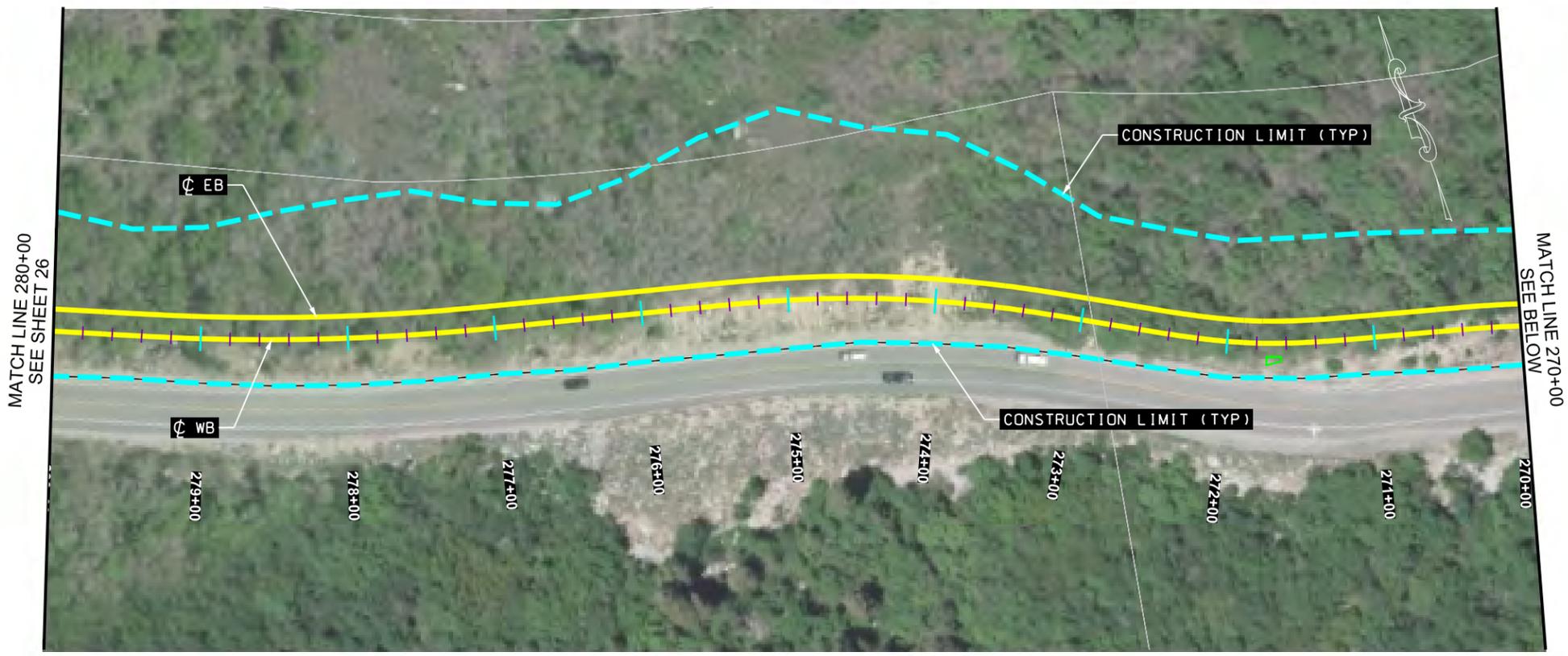
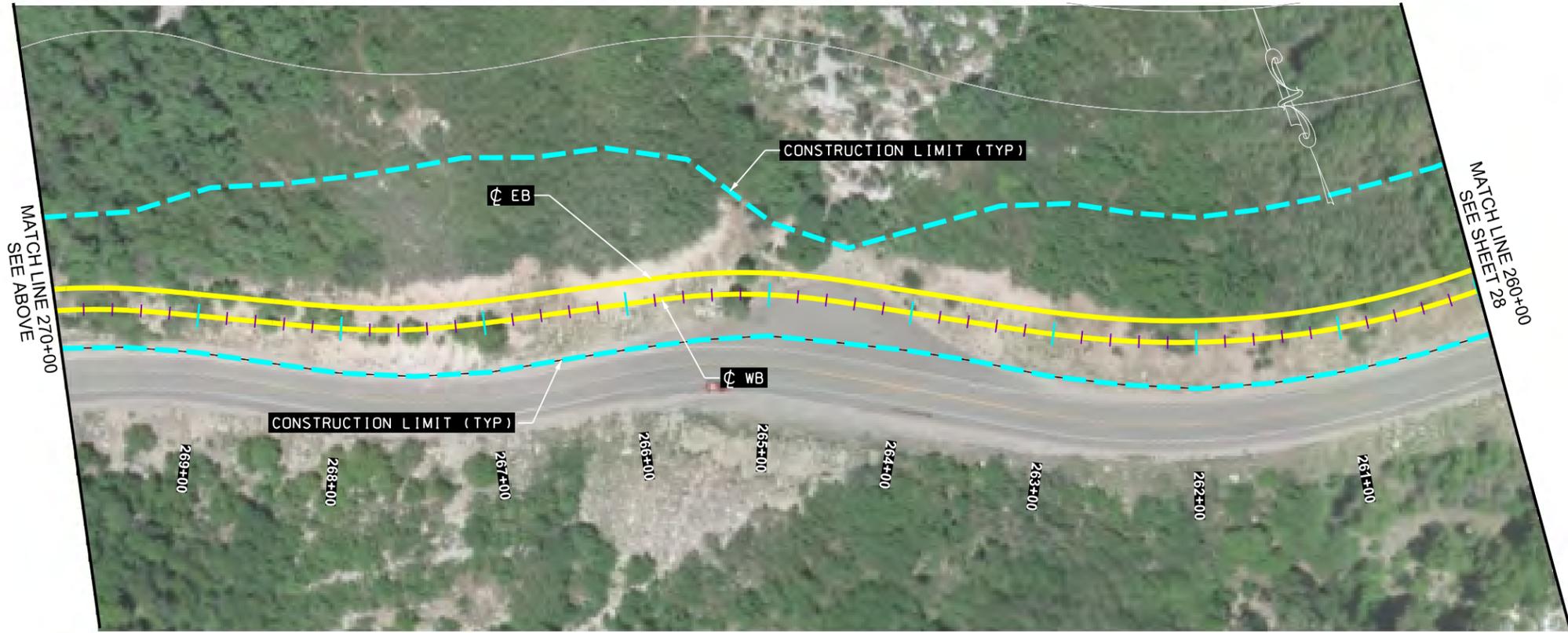
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SHEET NO. 27

LITTLE COTTONWOOD CANYON EIS
 SEGMENT 1 SINGLE TRACK EXHIBIT

UTAH DEPARTMENT OF TRANSPORTATION
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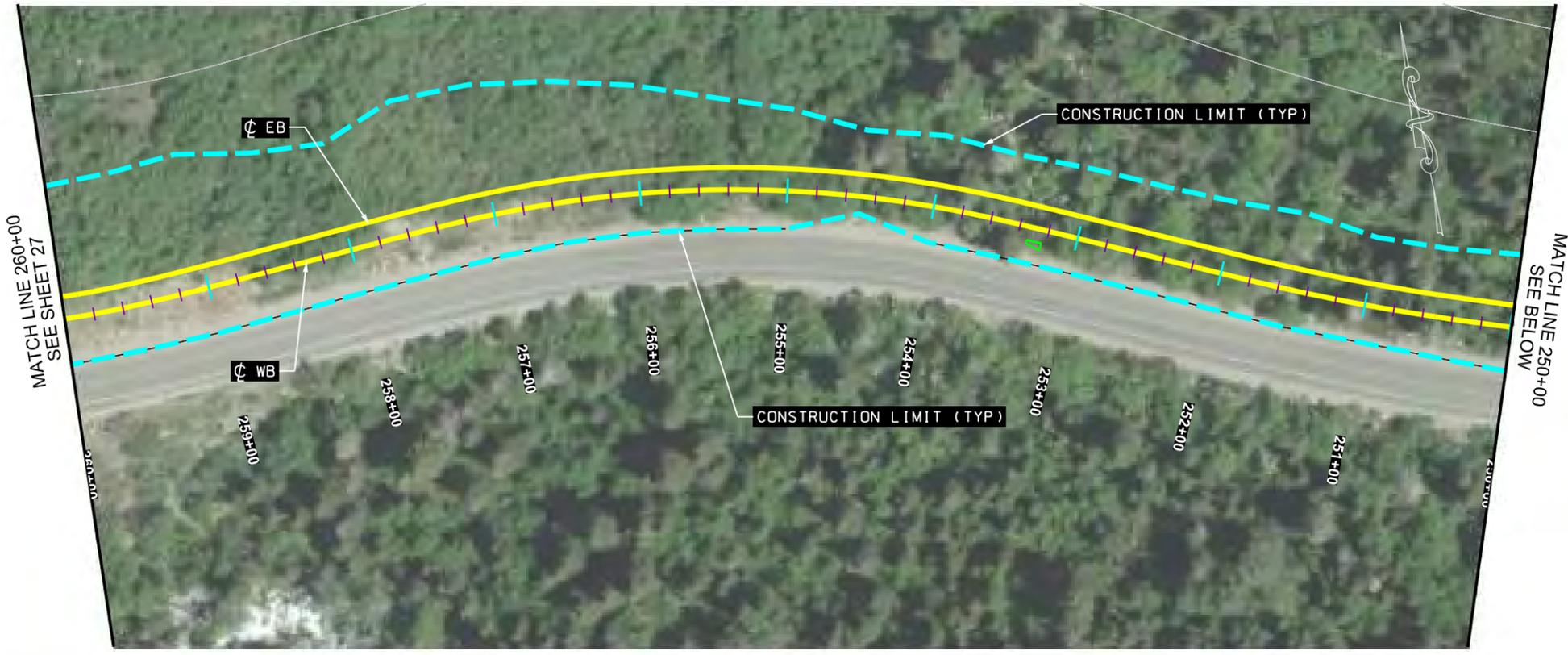
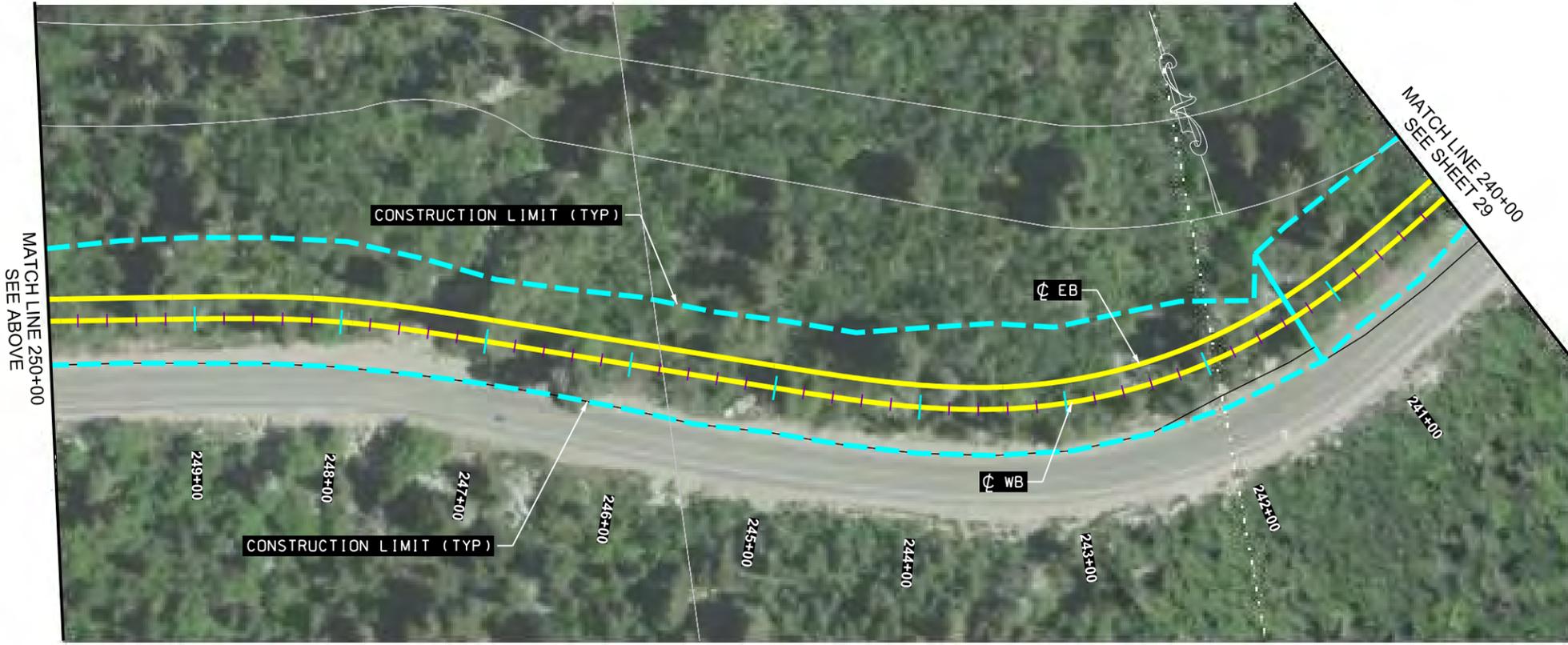
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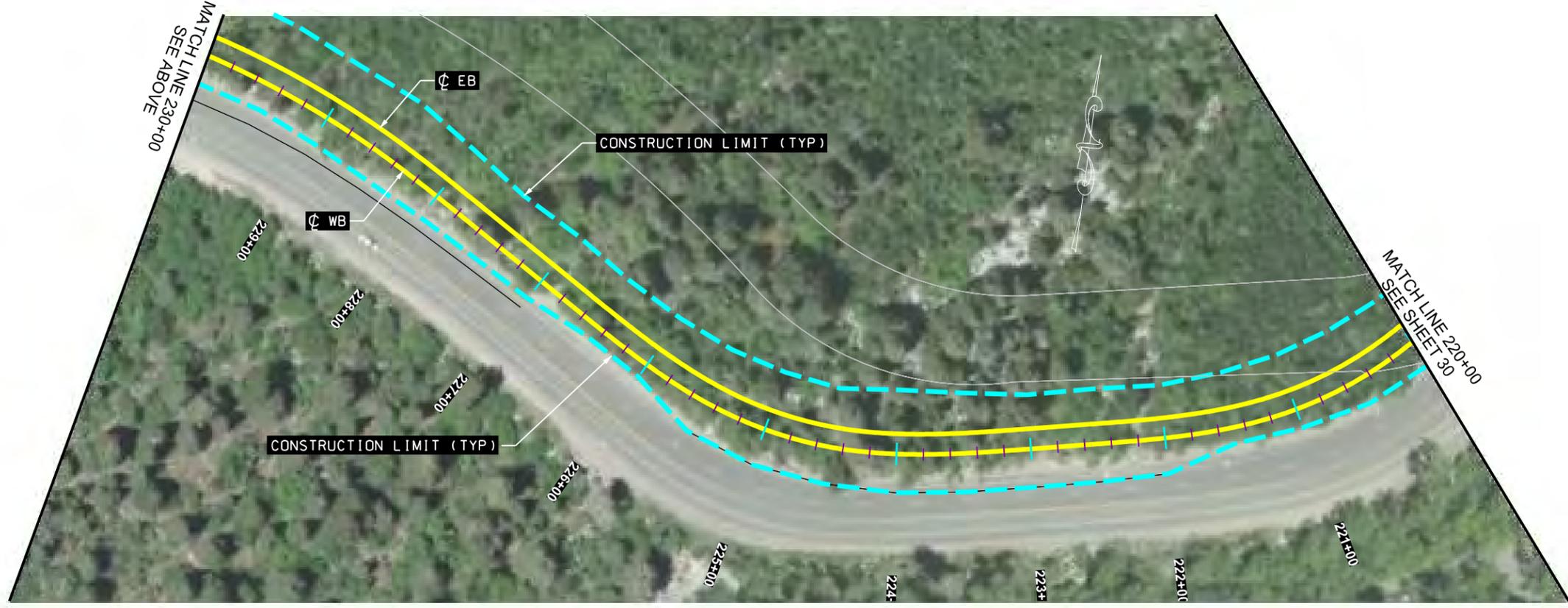
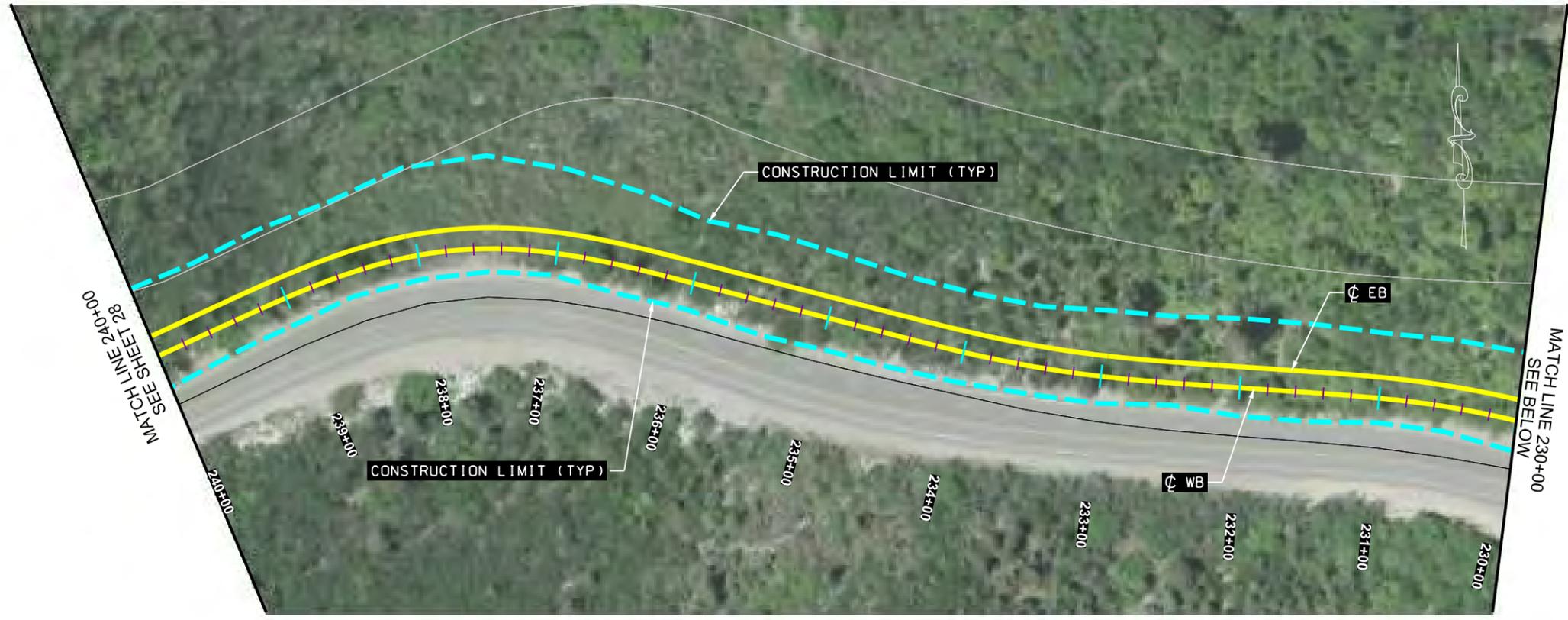
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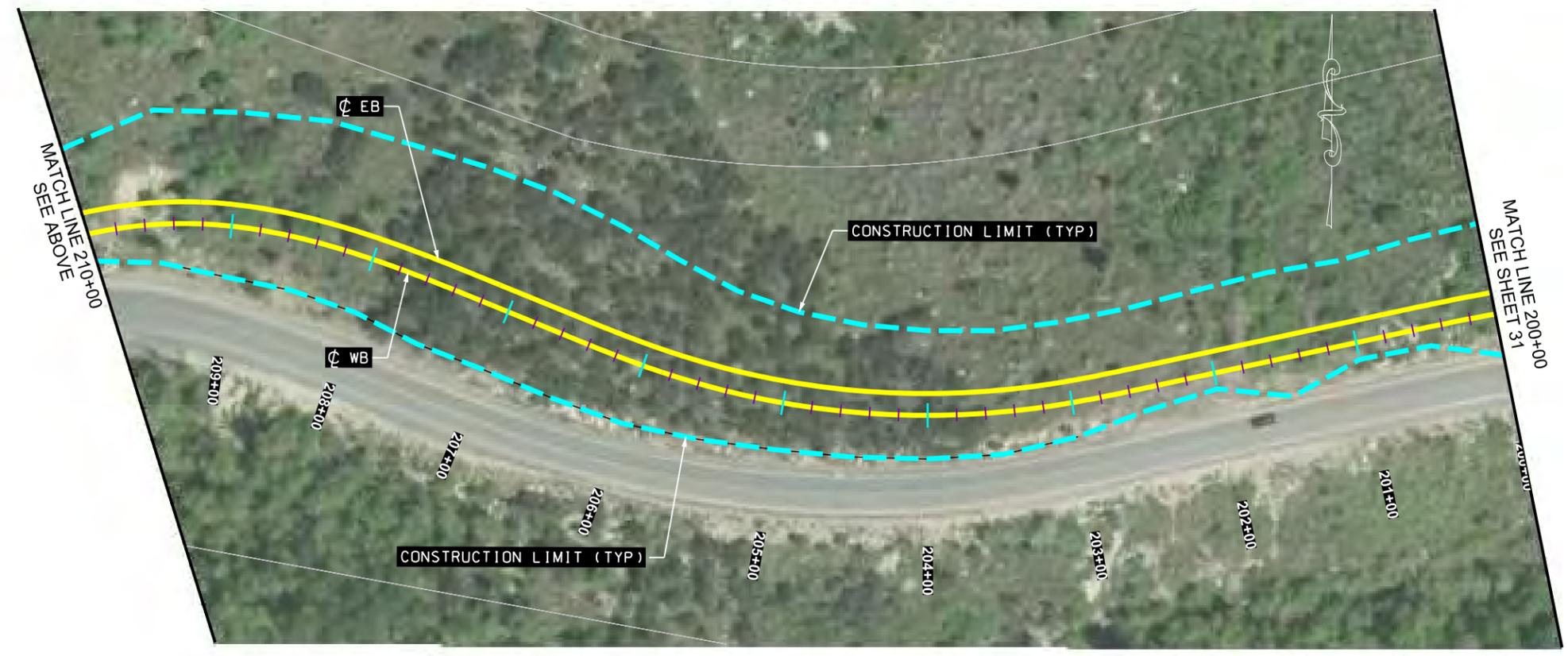
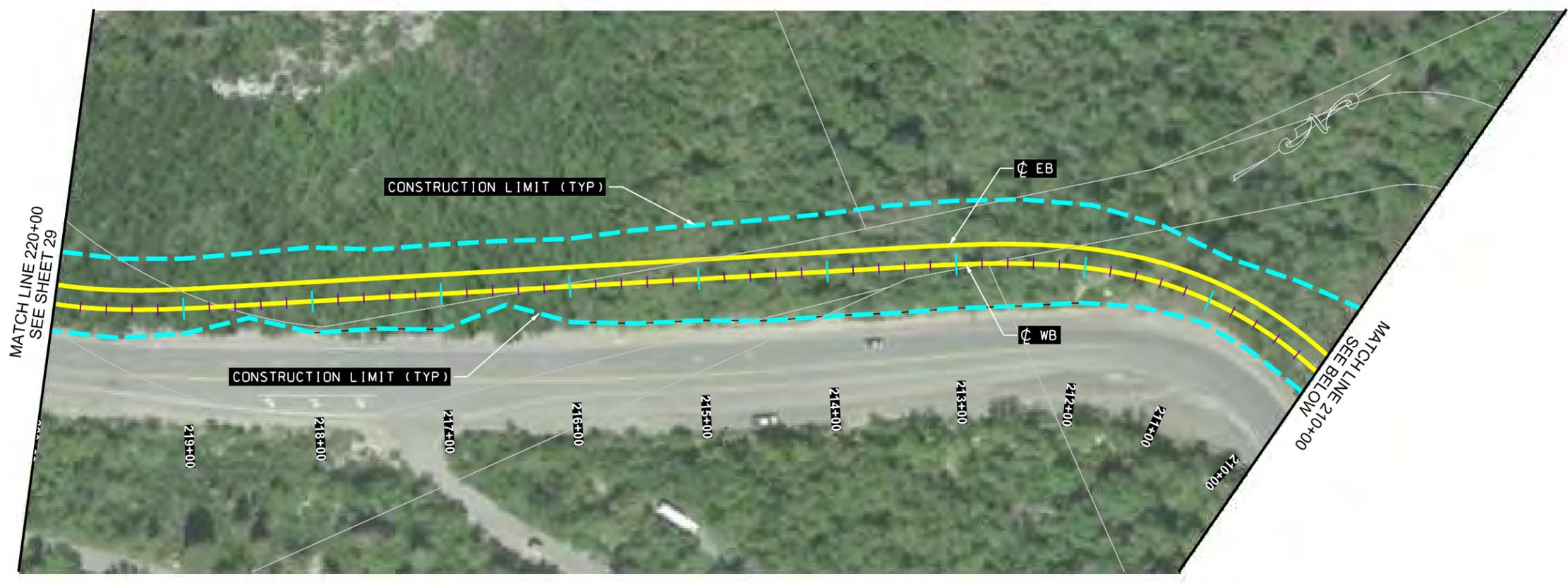
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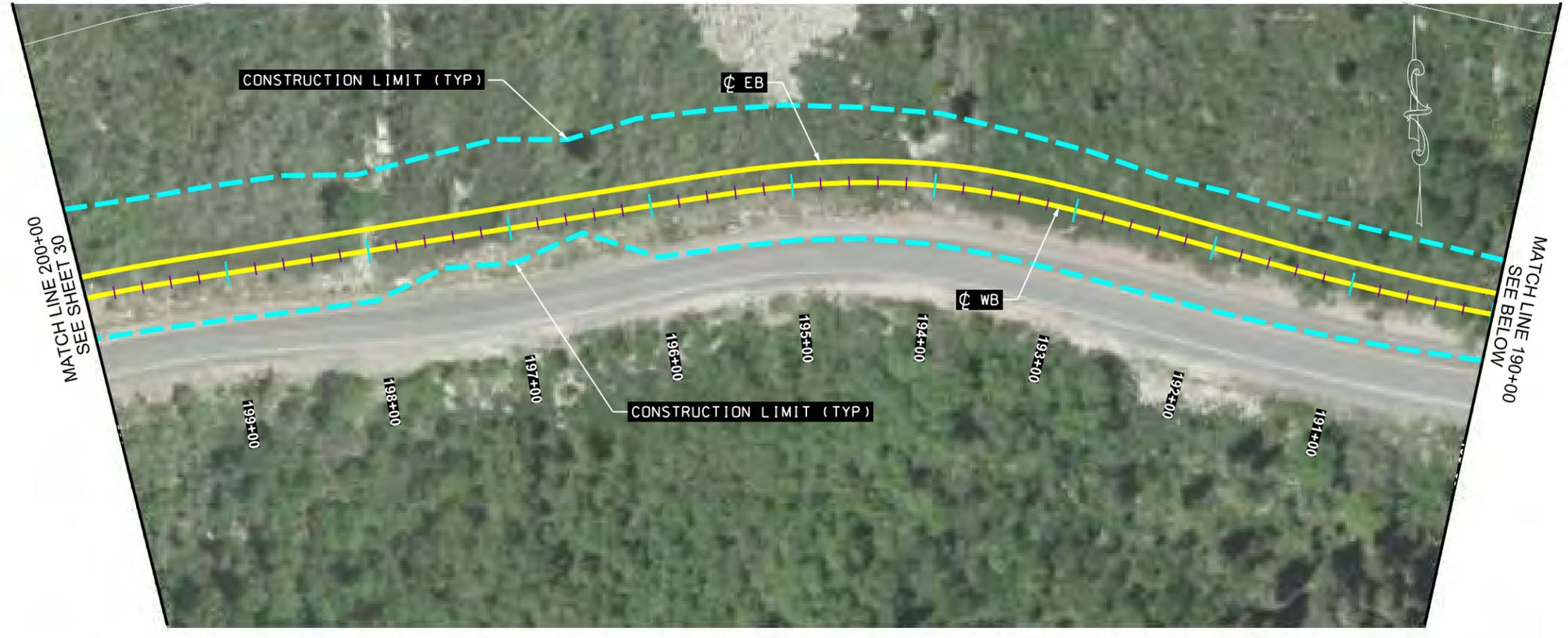
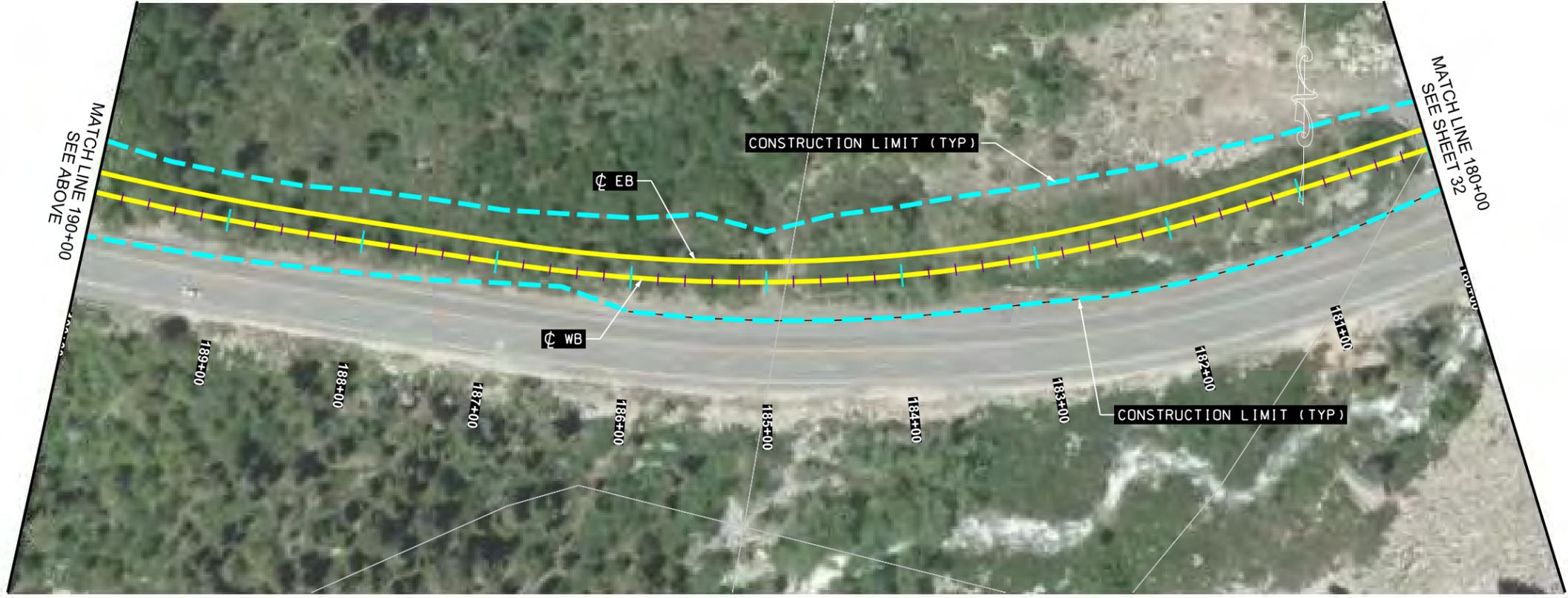
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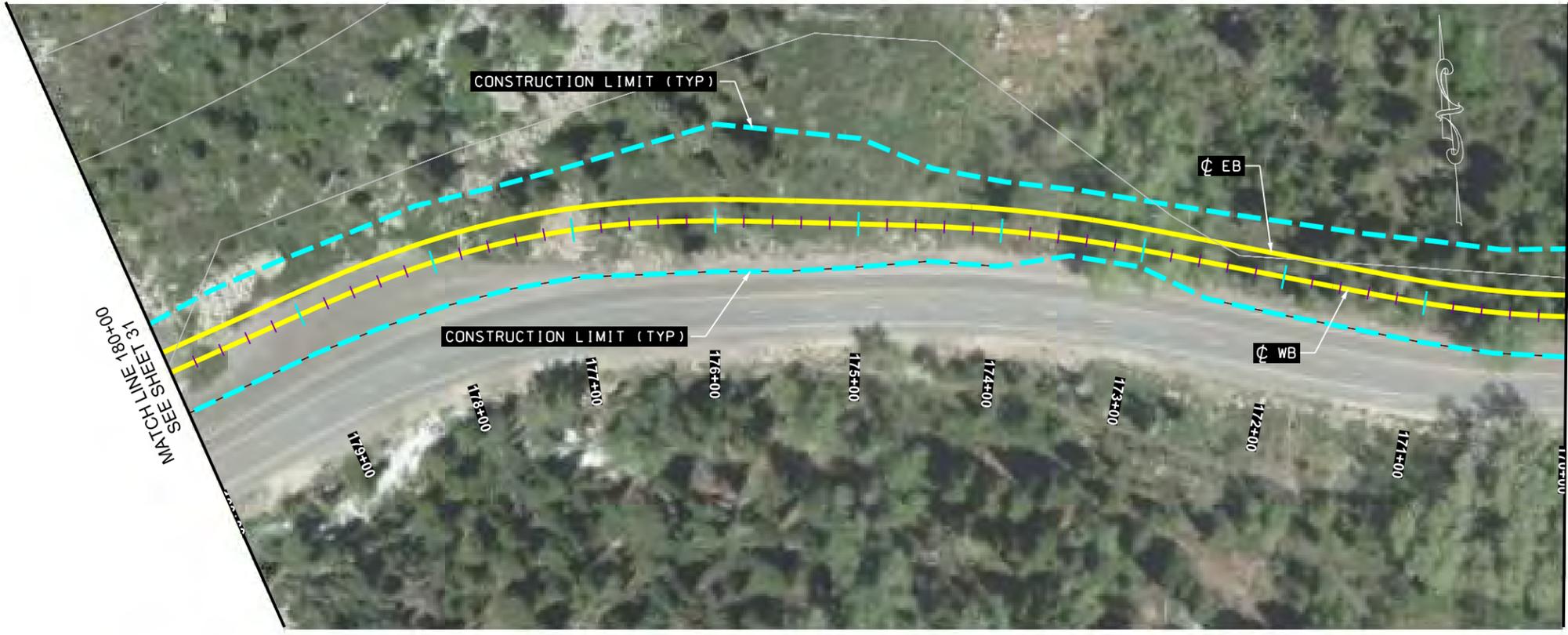
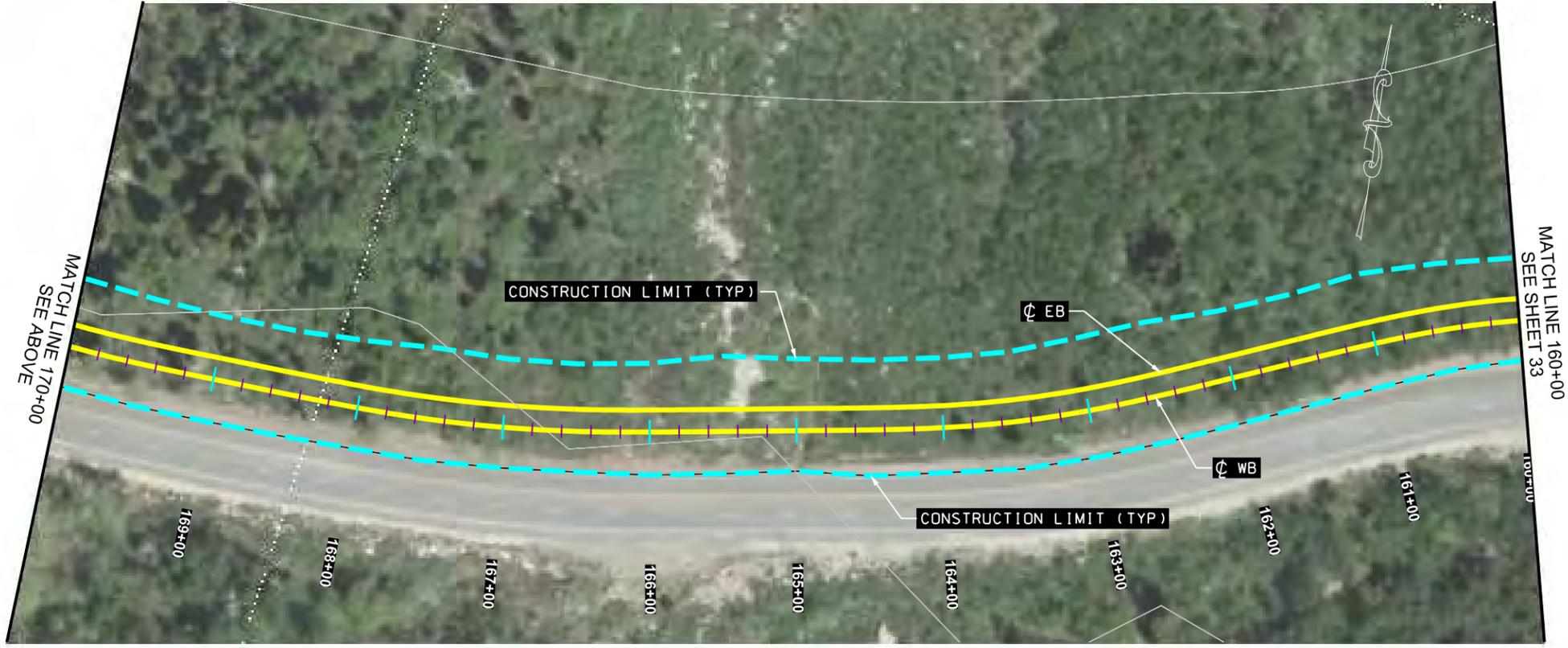
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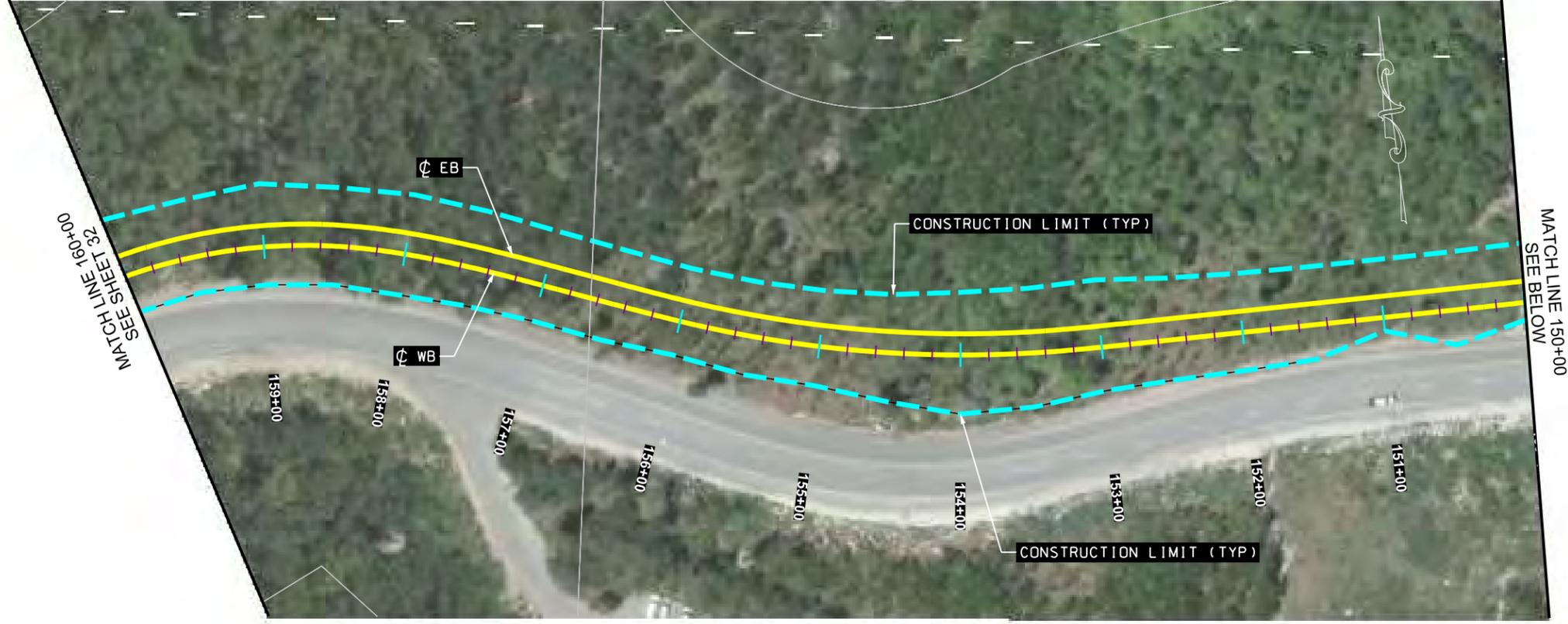
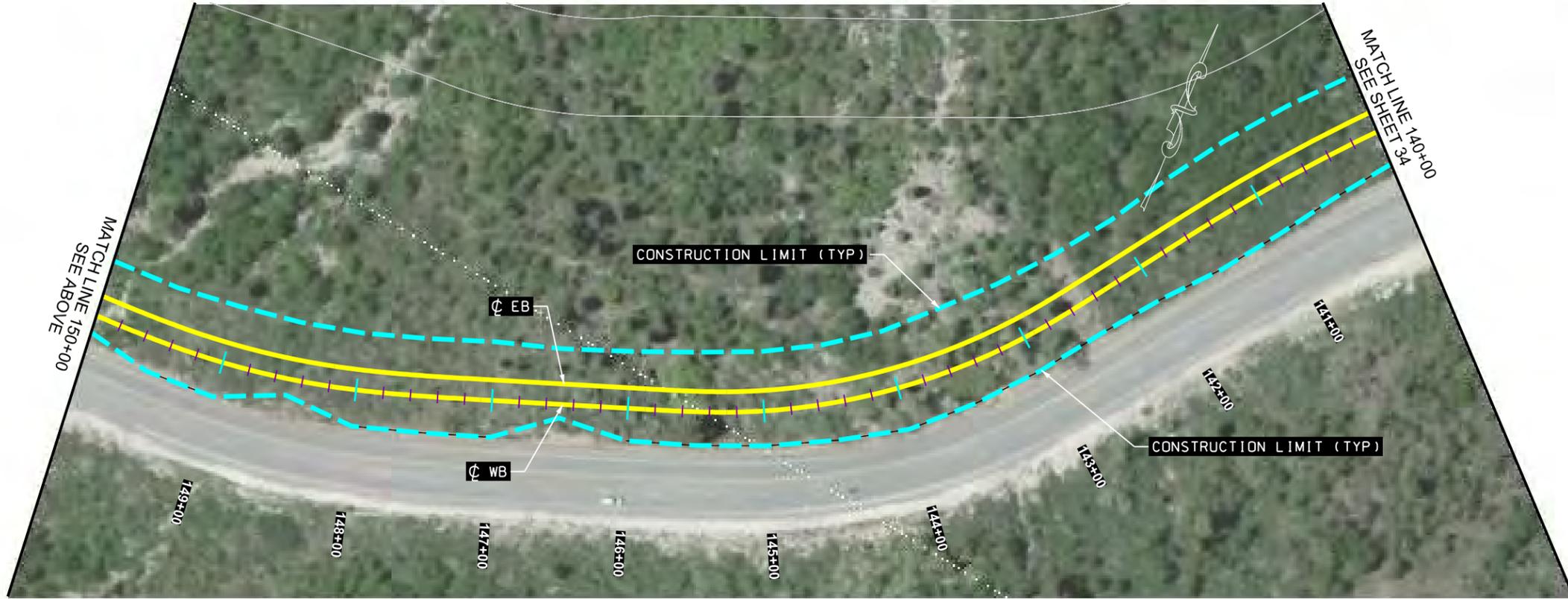
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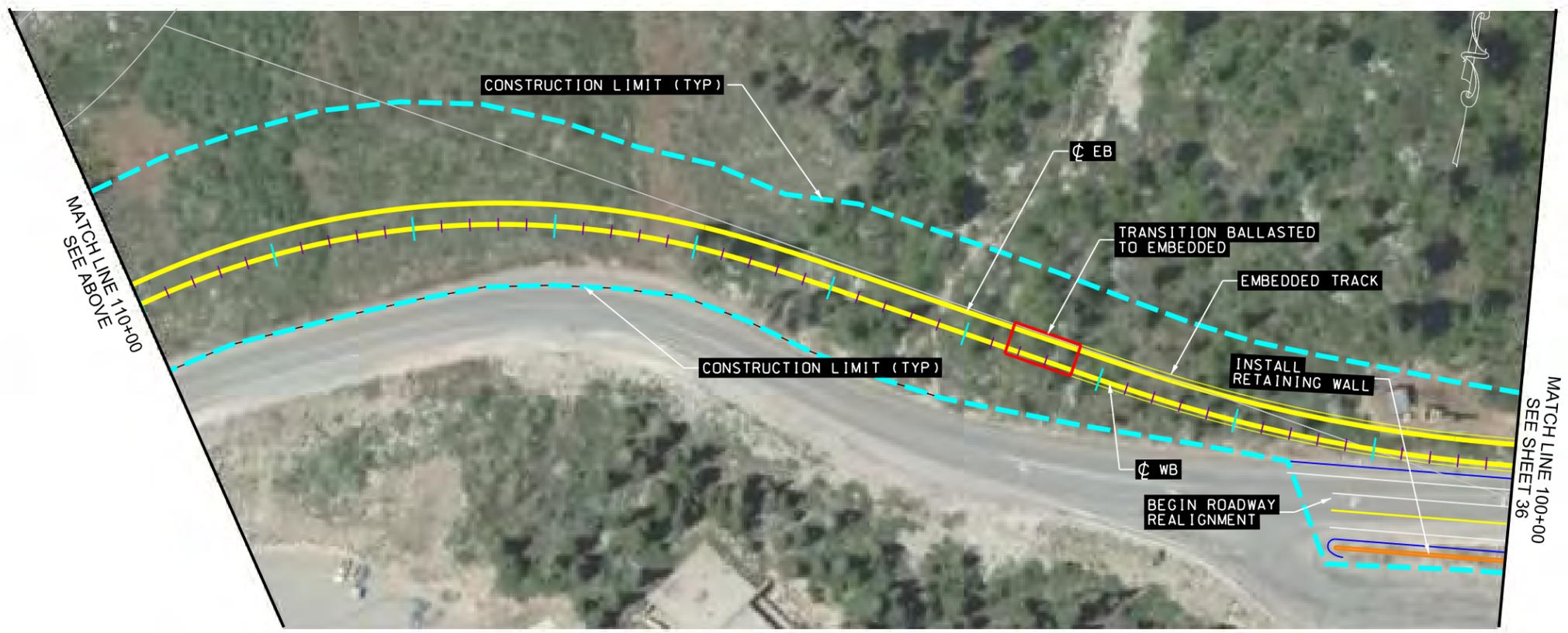
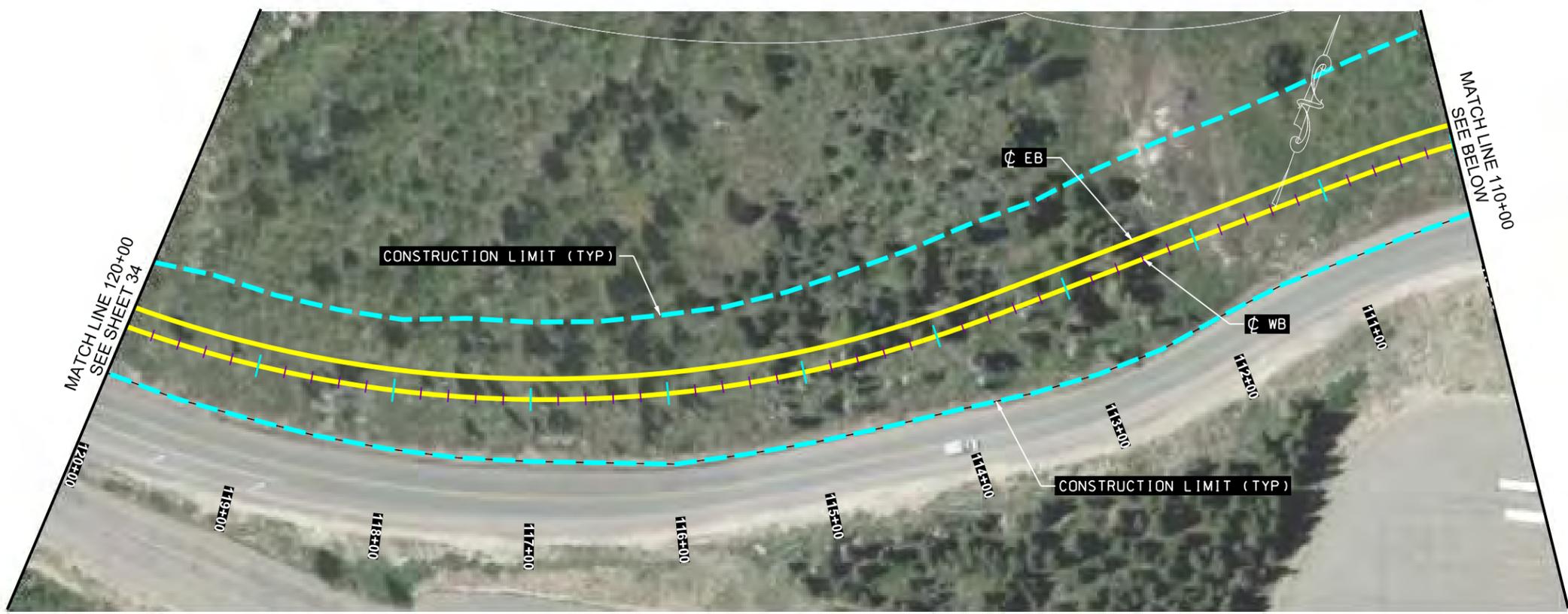
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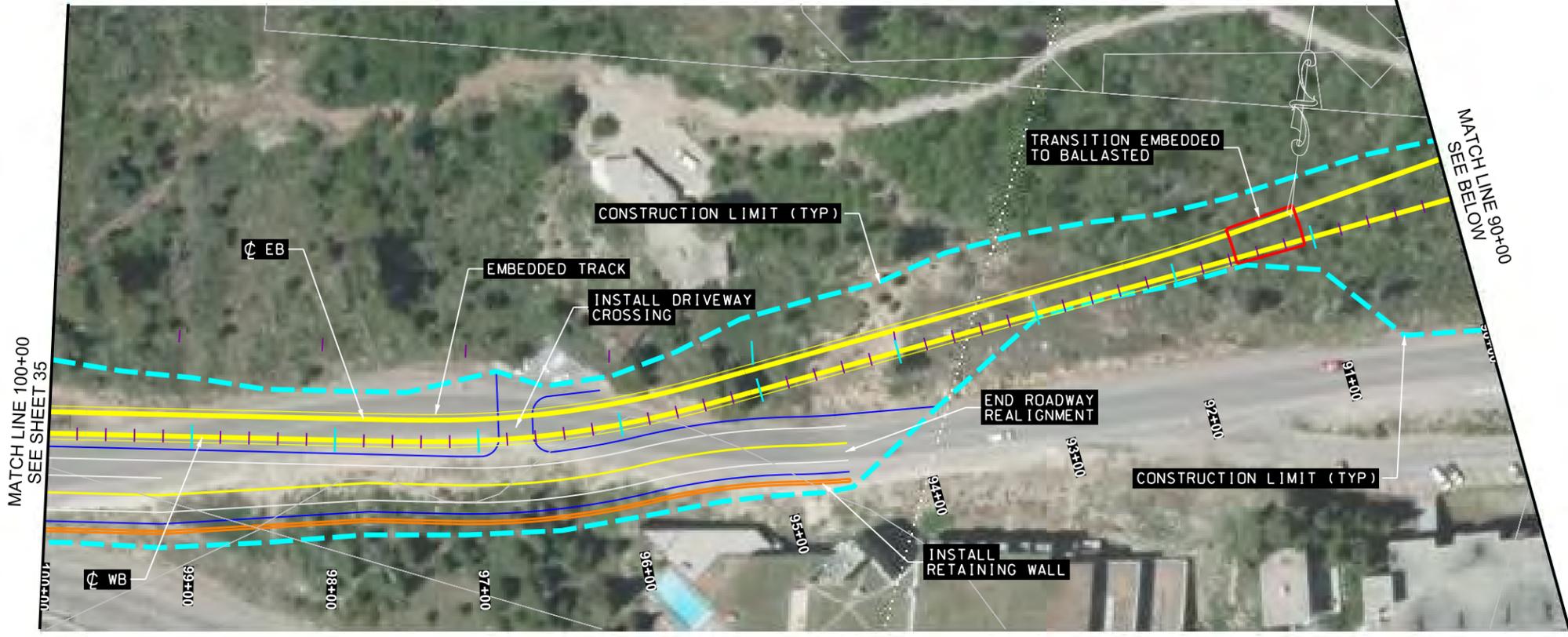
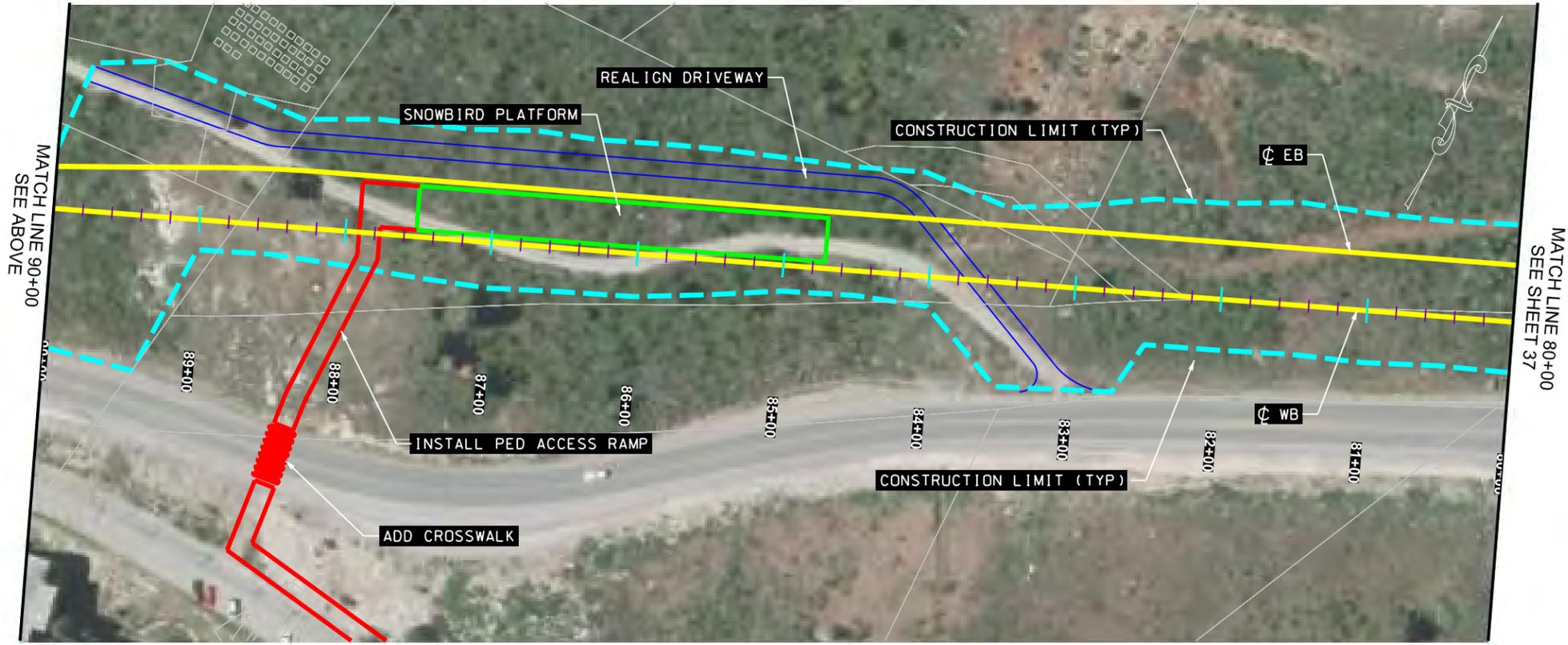
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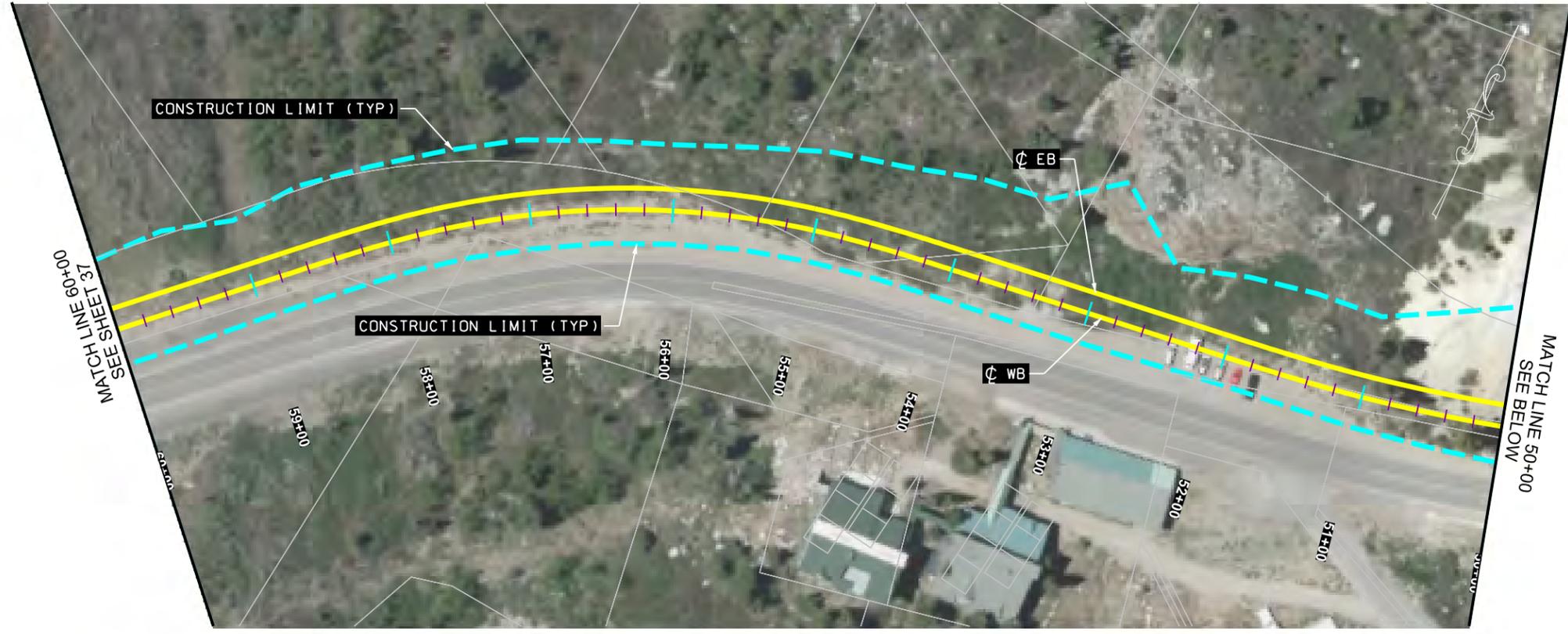
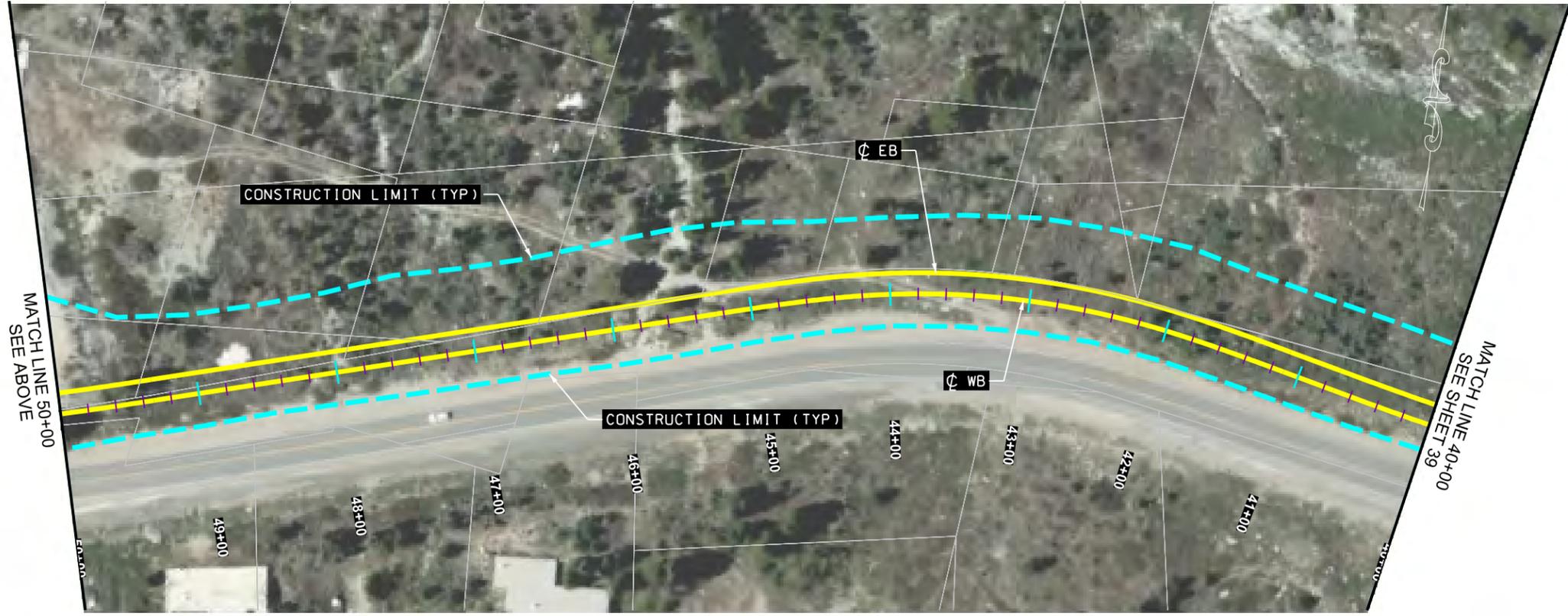
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PROJECT: LITTLE COTTONWOOD CANYON
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 PIN: 16092
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UTAH DEPARTMENT OF TRANSPORTATION
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REVISIONS

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UTAH DEPARTMENT OF TRANSPORTATION
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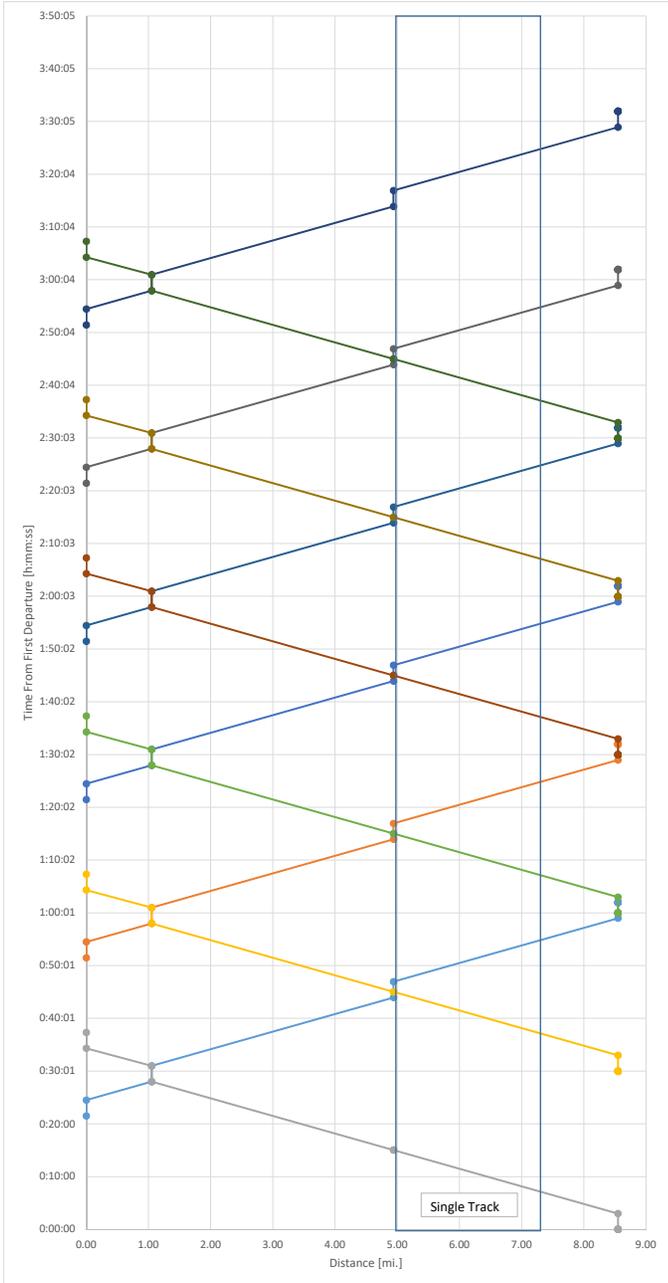
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8.6 Route Miles			LCC - Cog Rail Project	Approximately \$69 Million Per Route Mile (YoE)				Current Year
			Segment 1 Little Cottonwood Canyon					2020.00 (YR)
SCC	SCC Sub	Item #	Item Description	Unit Cost	Quantity	Item Cost	Item Cont.	Subtotal
10			GUIDEWAY & TRACK ELEMENTS (Route Miles)			\$116,046,700	\$23,209,340	\$139,256,040
	10.05		Guideway: Earthwork			\$81,446,500	\$16,289,300	\$97,735,800
	10.10		Track: Embedded			\$1,350,000	\$270,000	\$1,620,000
	10.11		Track: Ballasted			\$22,550,200	\$4,510,040	\$27,060,240
	10.12		Track: Special (switches, turnouts)			\$8,000,000	\$1,600,000	\$9,600,000
20			STATIONS, STOPS, TERMINALS, INTERMODAL (number)			\$10,500,000	\$2,100,000	\$12,600,000
	20.01		At-grade station, stop, shelter, mall, terminal, platform			\$10,500,000	\$2,100,000	\$12,600,000
30			SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS			\$50,000,000	\$5,000,000	\$55,000,000
	30.03		Heavy Maintenance Facility			\$50,000,000	\$5,000,000	\$55,000,000
40			SITWORK & SPECIAL CONDITIONS			\$58,964,940	\$11,792,988	\$70,757,928
	40.01		Demolition, Clearing, Earthwork			\$2,580,000	\$516,000	\$3,096,000
	40.02		Site Utilities, Utility Relocation			\$6,880,000	\$1,376,000	\$8,256,000
	40.04		Environmental mitigation, e.g. wetlands, historic/archeologic, parks			\$1,720,000	\$344,000	\$2,064,000
	40.05		Curb, Sidewalk, Guardrail			\$1,225,000	\$245,000	\$1,470,000
	40.06		Pedestrian / bike access and accommodation, landscaping			\$645,000	\$129,000	\$774,000
	40.07		Roadway Work			\$1,509,000	\$301,800	\$1,810,800
	40.08		Temporary Facilities and other indirect costs during construction			\$44,405,940	\$8,881,188	\$53,287,128
50			SYSTEMS			\$30,924,000	\$6,184,800	\$37,108,800
	50.01		Train control and signals			\$13,900,000	\$2,780,000	\$16,680,000
	50.02		Traffic signals and crossing protection			\$660,000	\$132,000	\$792,000
	50.03		Traction power supply: substations			\$0	\$0	\$0
	50.04		Traction power distribution: catenary system			\$0	\$0	\$0
	50.05		Communications			\$10,320,000	\$2,064,000	\$12,384,000
	50.06		Fare collection system and equipment			\$1,044,000	\$208,800	\$1,252,800
	50.07		Central Control		0	\$5,000,000	\$1,000,000	\$6,000,000
60			ROW, LAND, EXISTING IMPROVEMENTS			\$0	\$0	\$0
70			VEHICLES (number)			\$92,000,000	\$4,600,000	\$96,600,000
	70.01		Cog Rail Vehicles			\$92,000,000	\$4,600,000	\$96,600,000
80			PROFESSIONAL SERVICES (applies to Cats. 10-50)	30%		\$79,930,692	\$14,486,138	\$94,416,830
	80.01		Preliminary Engineering			\$7,993,069	\$1,448,614	\$9,441,683
	80.02		Final Design			\$21,314,851	\$3,862,970	\$25,177,821
	80.03		Project Management for Design and Construction			\$15,986,138	\$2,897,228	\$18,883,366
	80.04		Construction Administration & Management			\$15,986,138	\$2,897,228	\$18,883,366
	80.05		Professional Liability and other Non-Construction Insurance			\$2,664,356	\$482,871	\$3,147,228
	80.06		Legal; Permits; Review Fees by other agencies, cities, etc.			\$5,328,713	\$965,743	\$6,294,455
	80.07		Surveys, Testing, Investigation, Inspection			\$5,328,713	\$965,743	\$6,294,455
	80.08		Start up			\$5,328,713	\$965,743	\$6,294,455
90			UNALLOCATED CONTINGENCY (20%)	20%				\$87,673,266
100			FINANCE CHARGES (\$0)					
Segment Totals (10-100)								Current Year Total
								\$593,412,865

Timetable Chart



	Distance	Alta		Snowbird		Single Track		La Caille		E		F		G	
		0.00	0.00	1.05	1.05	4.94	4.94	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55
RB 1	Time	0:21:30	0:24:30	0:28:00	0:31:00	0:43:58	0:46:58	0:59:00	1:02:00	1:02:00	1:02:00	1:02:00	1:02:00	1:02:00	1:02:00
RB 2	Time	0:51:30	0:54:30	0:58:00	1:01:00	1:13:58	1:16:58	1:29:00	1:32:00	1:32:00	1:32:00	1:32:00	1:32:00	1:32:00	1:32:00
RB 3	Time	1:21:30	1:24:30	1:28:00	1:31:00	1:43:58	1:46:58	1:59:00	2:02:00	2:02:00	2:02:00	2:02:00	2:02:00	2:02:00	2:02:00
RB 4	Time	1:51:30	1:54:30	1:58:00	2:01:00	2:13:58	2:16:58	2:29:00	2:32:00	2:32:00	2:32:00	2:32:00	2:32:00	2:32:00	2:32:00
RB 5	Time	2:21:30	2:24:30	2:28:00	2:31:00	2:43:58	2:46:58	2:59:00	3:02:00	3:02:00	3:02:00	3:02:00	3:02:00	3:02:00	3:02:00
RB 6	Time	2:51:30	2:54:30	2:58:00	3:01:00	3:13:58	3:16:58	3:29:00	3:32:00	3:32:00	3:32:00	3:32:00	3:32:00	3:32:00	3:32:00

	Distance	G		F		E		La Caille		Single Track		Snowbird		Alta	
		8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	4.94	4.94	1.05	1.05	0.00	0.00
LB 1	Time	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:03:00	0:15:02	0:15:02	0:28:00	0:31:00	0:34:20	0:37:20
LB 2	Time	0:30:00	0:30:00	0:30:00	0:30:00	0:30:00	0:30:00	0:30:00	0:33:00	0:45:02	0:45:02	0:58:00	1:01:00	1:04:20	1:07:20
LB 3	Time	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:00:00	1:03:00	1:15:02	1:15:02	1:28:00	1:31:00	1:34:20	1:37:20
LB 4	Time	1:30:00	1:30:00	1:30:00	1:30:00	1:30:00	1:30:00	1:30:00	1:33:00	1:45:02	1:45:02	1:58:00	2:01:00	2:04:20	2:07:20
LB 5	Time	2:00:00	2:00:00	2:00:00	2:00:00	2:00:00	2:00:00	2:00:00	2:03:00	2:15:02	2:15:02	2:28:00	2:31:00	2:34:20	2:37:20
LB 6	Time	2:30:00	2:30:00	2:30:00	2:30:00	2:30:00	2:30:00	2:30:00	2:33:00	2:45:02	2:45:02	2:58:00	3:01:00	3:04:20	3:07:20

Memo

Date: Tuesday, November 10, 2020

Project: Little Cottonwood Canyon EIS

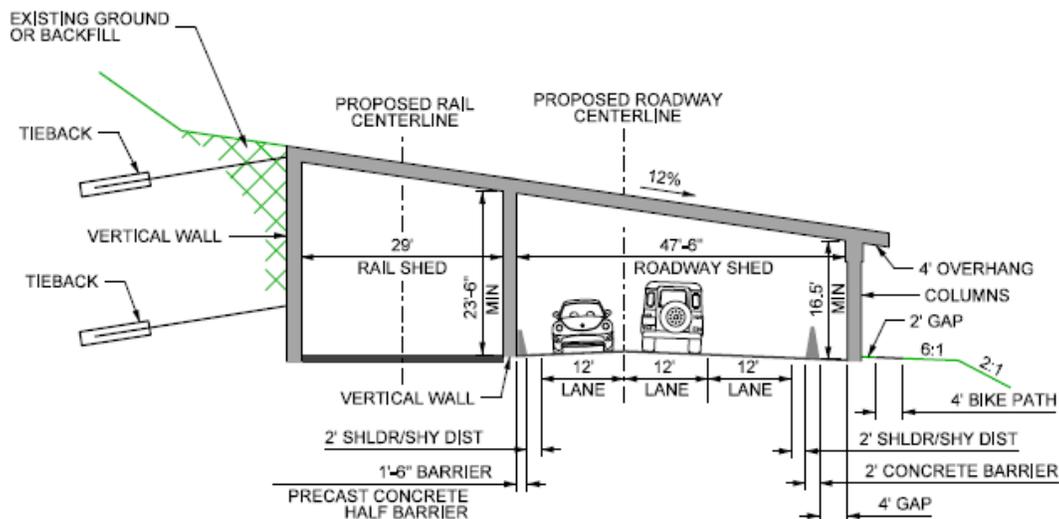
To: Josh Van Jura, UDOT

From: HDR

Subject: **Preliminary Cost Estimate for Rail Snow Sheds**

This memorandum supplements information that HDR provided to the Utah Department of Transportation (UDOT) on October 3, 2018 and November 21, 2019. These memoranda presented a refined structural design approach and summarizes planning-level cost estimates for snow sheds as passive avalanche mitigation for the more active avalanche paths along State Route (S.R.) 210 in Little Cottonwood Canyon.

This memorandum presents information for potential snowsheds for avalanche mitigation assuming a cog rail line is a feasible alternative. The addition of a cog rail alignment requires a **three-lane plus rail snow sheds for the mid-canyon avalanche paths (White Pine Chutes, White Pine, Little Pine)**. Figure 1 presents the preliminary cross section for the mid-canyon snow sheds with rail.



NOTE:
A 4' MINIMUM GAP ALLOWS FOR EGRESS AND MAINTENANCE ACCESS IN THE TUNNEL AND FROM UDOT STANDARD BA-1E, ELIMINATES THE NEED FOR THE COLUMNS TO BE DESIGNED FOR CRASH IMPACTS.

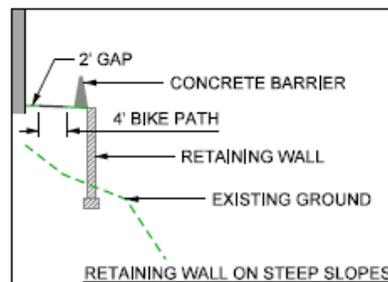


Figure 1. Preliminary Cross Section for a Three-lane plus Rail Snow Shed

In addition, with the cog rail alignment following the north side of S.R. 210, rail snow sheds would likely be required to protect the rail and maintain operational reliability in the upper-canyon avalanche paths. The higher risk/higher return period avalanche paths in the upper canyon are Superior, Little Superior, Hilton, and East Hell Gate. Figure 2 presents the preliminary cross section for the upper-canyon rail snow sheds.

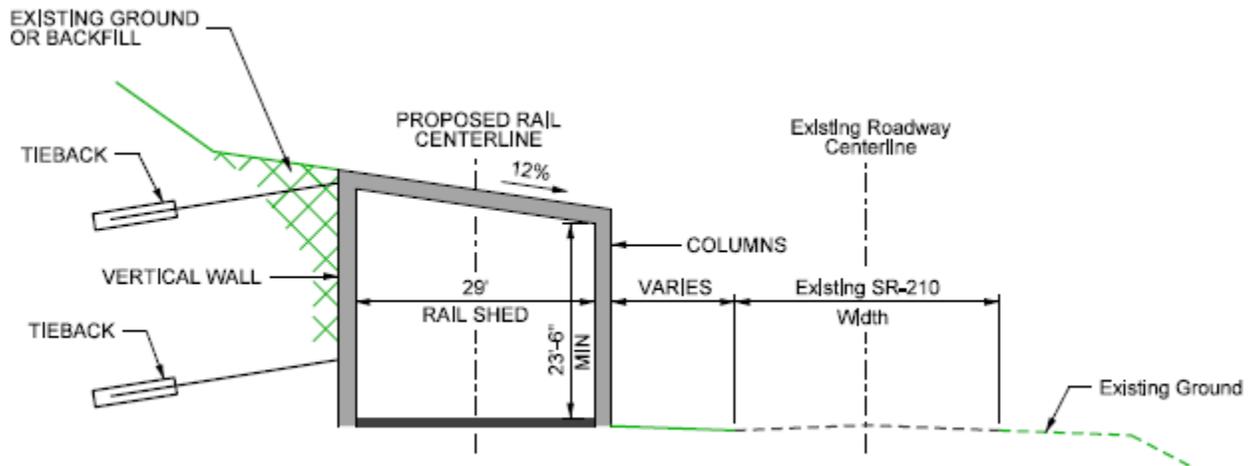


Figure 2. Preliminary Cross Section, Rail Snowshed

The October 2018 memorandum described applicable special design codes, standards, guidance, and recommended practices for snow sheds; listed some site-specific design considerations; and provided planning-level costs for two-lane snow sheds. The November 2019 memo provided more detailed information on the structural design loads considering the approximate avalanche forces. **Dynamic estimated the structural loads for the White Pine Chutes 1–4 snow shed. These loads were applied to all snow sheds.**

Upper Snowshed Length Options

The limits of the upper canyon snow sheds were based on the approximate limits of the avalanche paths. However, no detailed flow modeling has been conducted. Therefore, two options were examined for the upper canyon snow sheds. HDR estimated the following options:

- **Option 1.** A 2,100-foot-long snow sheds would be required in the Superior, Little Superior and Hilton avalanche paths; and one 1,960-foot-long snow shed in the East Hellgate avalanche path.
- **Option 2.** The East Hellgate snow shed would stop at the eastern limits of the bypass road and the length reduced to 1,545 feet. The same 2,100-foot snowshed for Superior, Little Superior and Hilton is assumed.

Exhibit A provides plan view of the snow shed and the approximate backfill limits.

Cost Estimates

HDR estimated the major material quantities on a per-linear-foot basis and applied this unit cost to the lengths of all snow sheds. The November 2019 memo also described two anchoring approaches, anchors in bedrock and anchors in an imported engineered backfill behind the mountainside retaining wall. HDR estimates that the western ½ of the Superior/Little Superior/Hilton snow shed anchors could be embedded in bedrock and the eastern ½ would need to use imported backfill. HDR assumed that all of the East Hellgate path's snow shed would be anchored in bedrock.

HDR's senior cost estimator, Steve Young, prepared an engineer's estimate of probable bid costs, which includes estimates for the contractor's markup, administration, and mobilization. Estimates also include values for mobilization, traffic control, and maintenance of traffic. HDR added contingencies and professional services (design and construction engineering, geotechnical analysis, and insurance, incentives, and stipends). Table 1 summarizes the cost estimate for snow sheds. The bid cost derivations are provided as Exhibit B.

Table 1. Planning-level Cost Estimate Summary

Category		Mid Canyon, Road and Rail Snowsheds, without Berms, Realigned Road ¹	Mid Canyon, Road and Rail Snowsheds, with Berms ²	Upper Canyon Rail Snowshed Option 1 ³	Upper Canyon Rail Snowshed Option 2 ⁴
Total Construction Cost Estimate		104,178,623	96,309,513	89,741,203	80,568,149
Other Items not estimated	4%	4,167,145	3,852,381	3,589,648	3,222,726
Subtotal		108,345,768	100,161,894	93,330,851	83,790,875
Contingency	10%	10,834,577	10,016,189	9,333,085	8,379,087
Construction Subtotal		119,180,345	110,178,083	102,663,936	92,169,962
Environmental Clearances/Permits	4%	4,767,214	4,407,123	4,106,557	3,686,798
PM/Geotech/PE/Procurement	5%	5,959,017	5,508,904	5,133,197	4,608,498
DB/Geotech/Final Design	3%	3,575,410	3,305,342	3,079,918	2,765,099
Construction Eng.	3%	3,575,410	3,305,342	3,079,918	2,765,099
Environmental Mitigation	2%	2,383,607	2,203,562	2,053,279	1,843,399
Insurance/Incentives/Stipend	1.5%	1,787,705	1,652,671	1,539,959	1,382,549
Total (rounded)		141,300,000	130,600,000	121,700,000	109,300,000

¹ Total snowshed length combining White Pine Chutes and White Pine plus Little Pine is about 3,194 feet.

² Total snowshed length is about 2,465 feet.

³ Total snow shed length is about 4,060 feet.

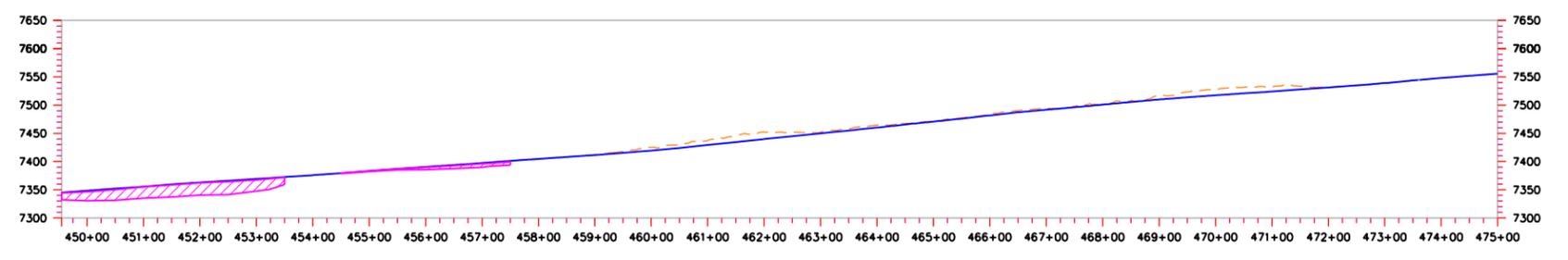
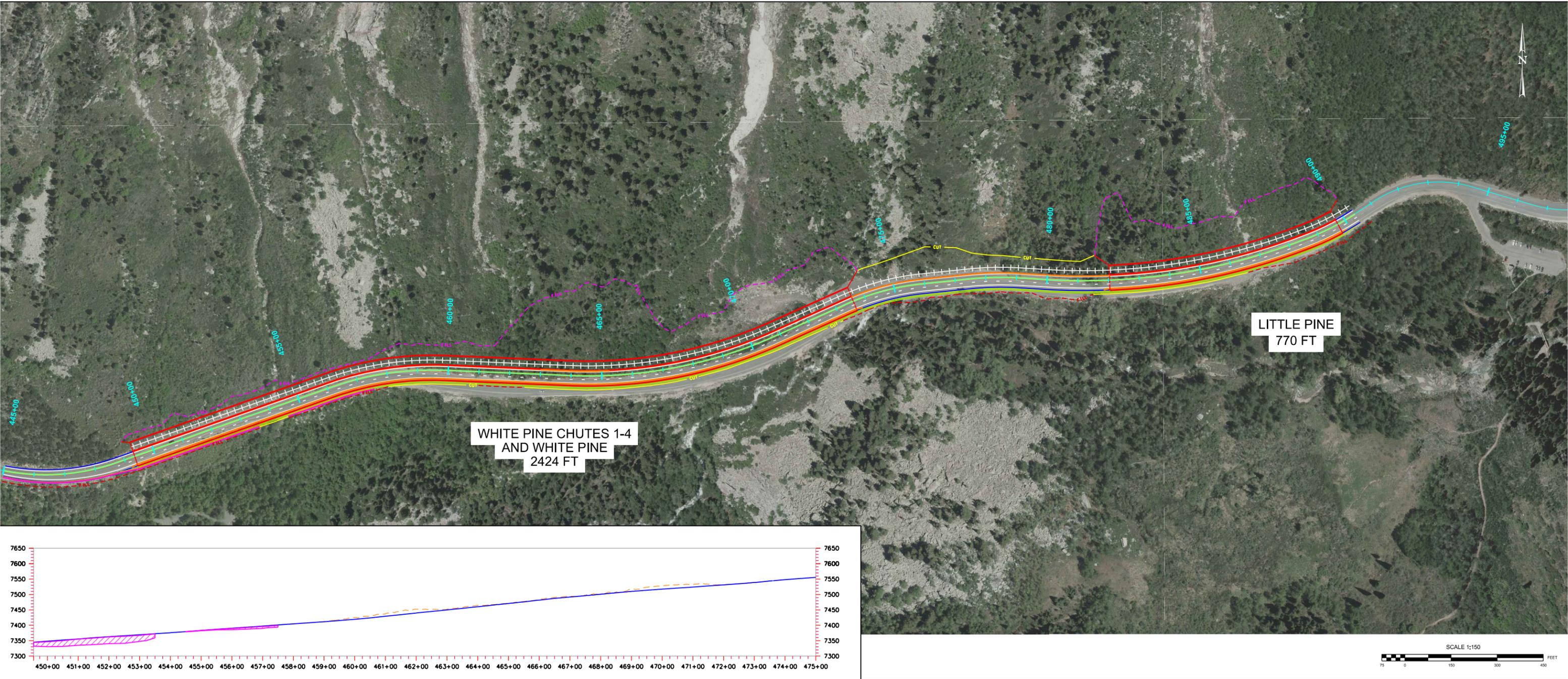
⁴ Total snow shed length is about 3,645 feet. Cost estimated by using the construction cost per linear foot for upper snow shed Option 1 and applying it to the length of Option 2.

The planning-level costs estimates for mid-canyon snow sheds covering both the road and railway is between about \$130.6M to \$141.3M. The estimate for longer, Option 1 rail only snow sheds in the upper canyon is about \$121.7M. The estimate for upper canyon rail snow shed Option 2 is about \$109.3M. Adding the mid- and upper-canyon snow sheds, the total cost would range from about **\$239.9 to \$263.0M**.

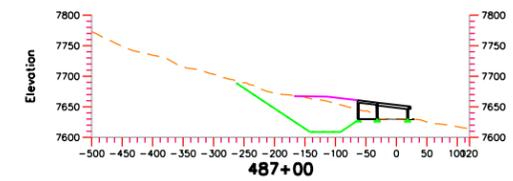
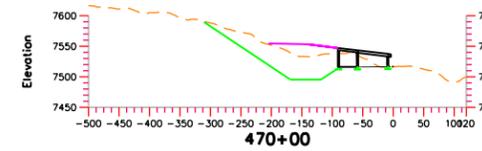
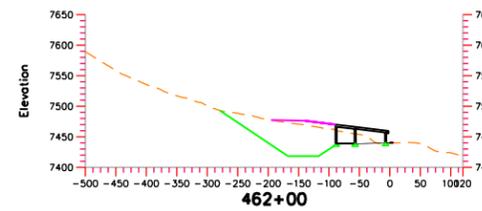
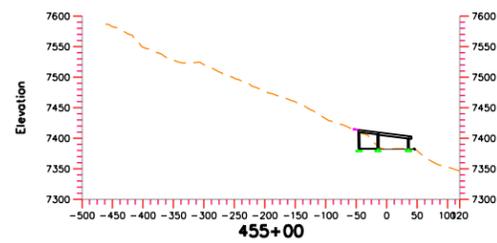
Exhibit A – Rail Snow Sheds

LITTLE COTTONWOOD CANYON SNOWSHEDS

COMBINED ROAD + RAIL WITHOUT BERMS, REVISED SR-210 ALIGNMENT



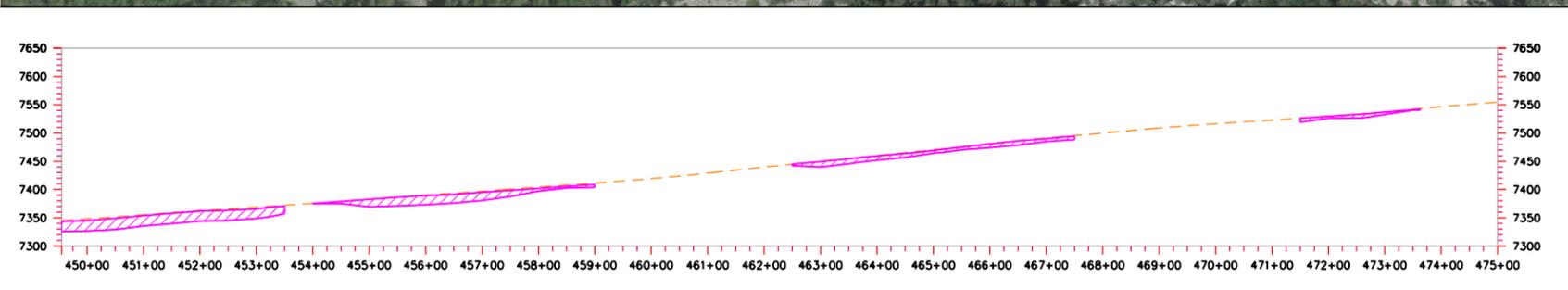
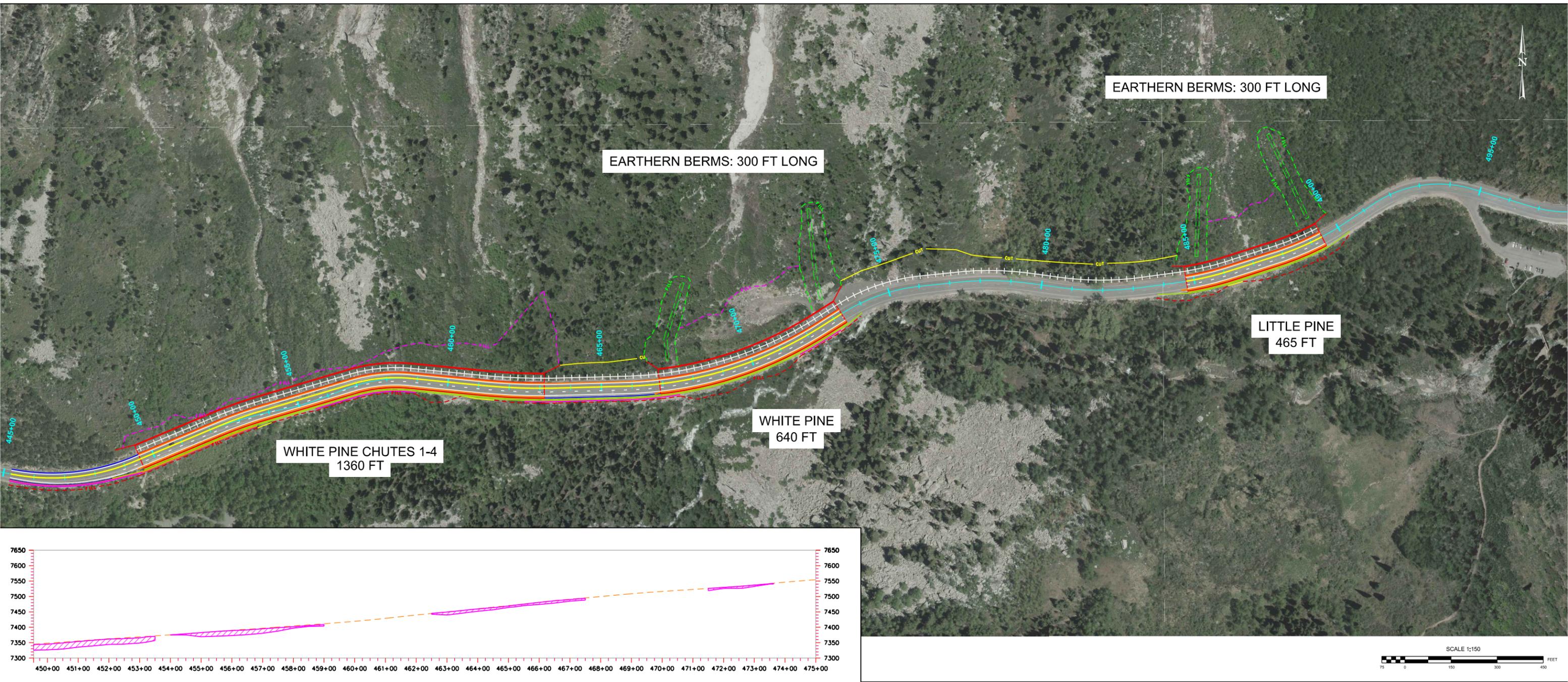
BIKE PATH WALL PROFILE



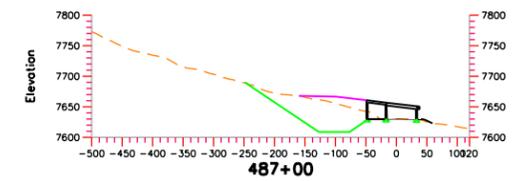
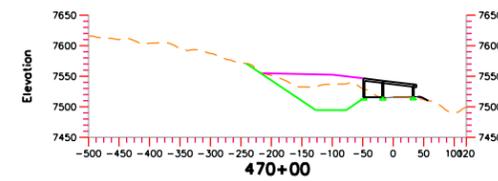
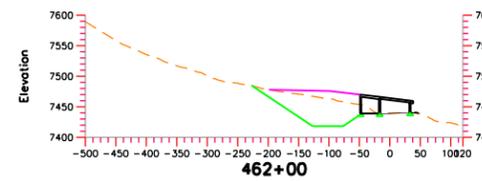
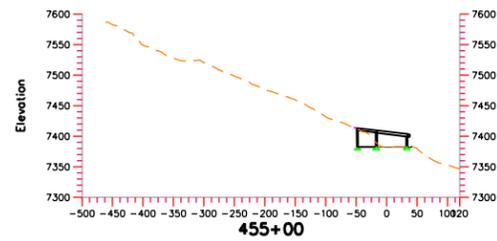
CROSS SECTIONS

LITTLE COTTONWOOD CANYON SNOWSHEDS

COMBINED ROAD + RAIL WITH GUIDING BERMS, EXISTING SR-210 ALIGNMENT

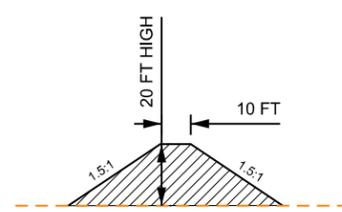


BIKE PATH WALL PROFILE



CROSS SECTIONS

ESTIMATED BERM CROSS SECTION

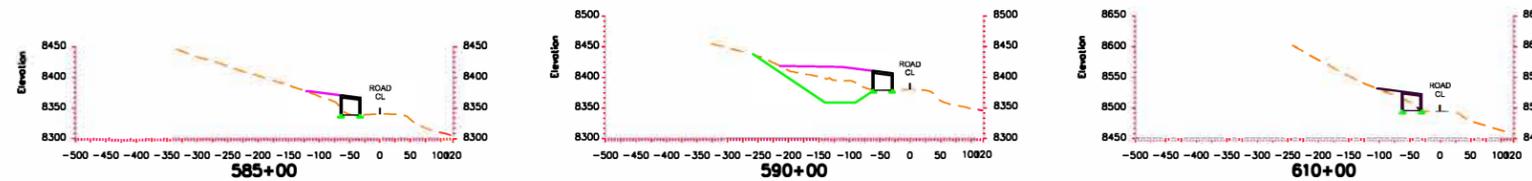


LITTLE COTTONWOOD CANYON SNOWSHEDS

RAIL-ONLY SHED, EXISTING SR-210 ALIGNMENT, OPTION 1

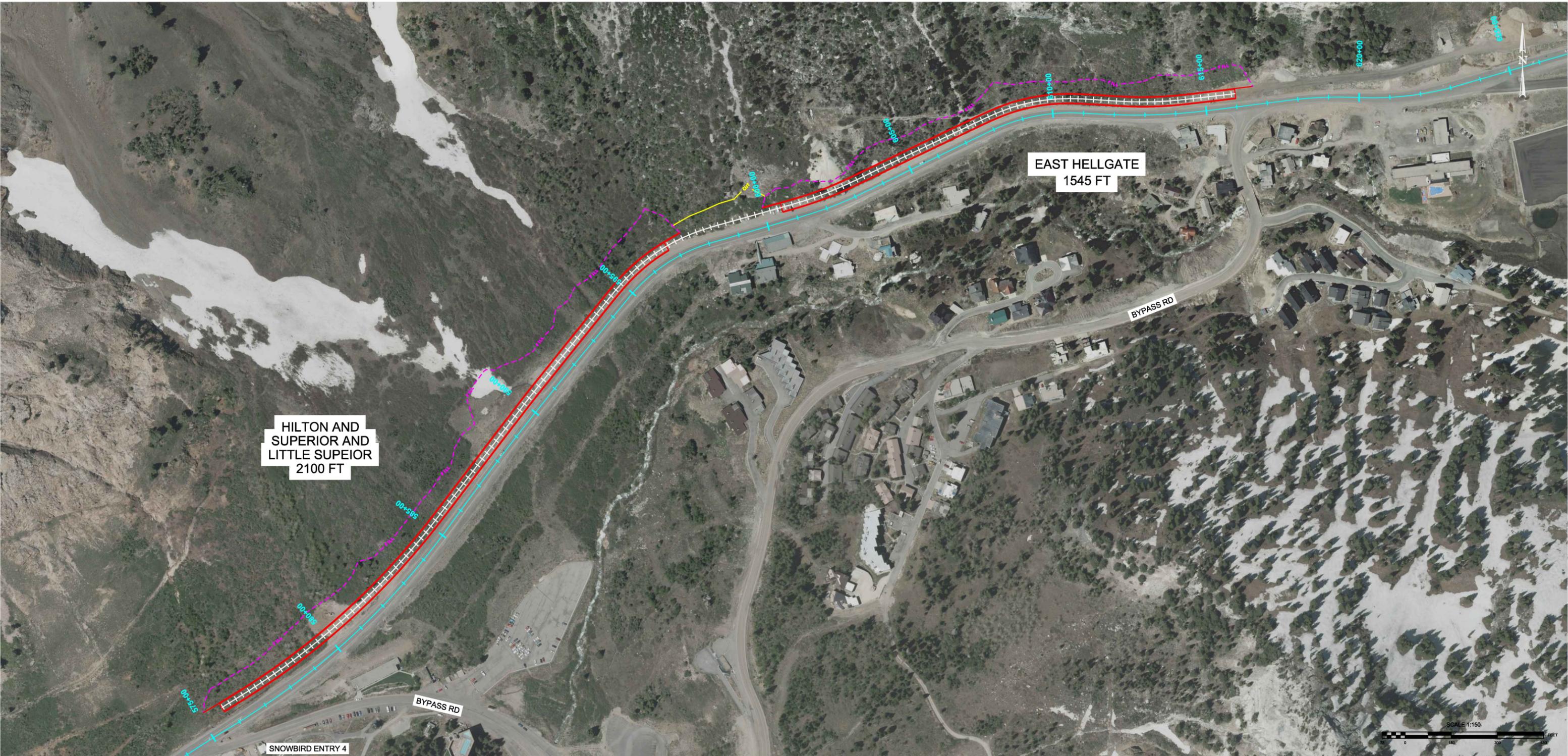


CROSS SECTIONS



LITTLE COTTONWOOD CANYON SNOWSHEDS

RAIL-ONLY SHED, EXISTING SR-210 ALIGNMENT, OPTION 2



CROSS SECTIONS

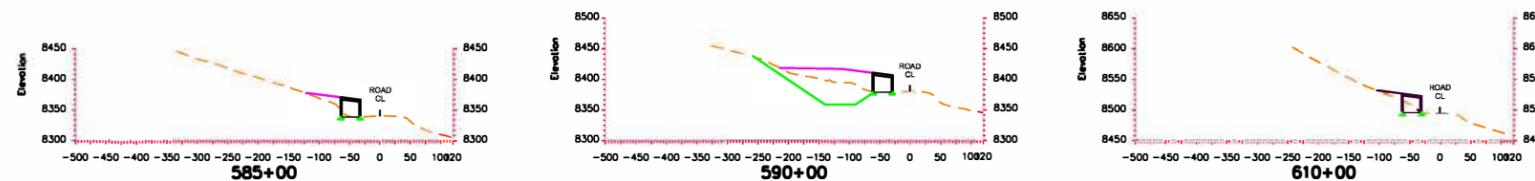


Exhibit B – Bid Estimates

BID PROPOSAL

Biditem	Description	Quantity	Units	Unit Price	Bid Total
10	Mobilization	1.000	LS	7,709,947.45	7,709,947.45
20	Traffic Control	1.000	LS	730,495.25	730,495.25
30	Maintenance of Traffic	1.000	LS	323,030.04	323,030.04
40	Dust Control and Watering	14,000.000	MGAL	19.18	268,520.00
50	Borrow (Plan Quantity)	157,524.000	CY	33.27	5,240,823.48
60	Granular Borrow (Plan Quantity)	254,059.000	CY	29.68	7,540,471.12
70	Clearing and Grubbing	1.000	LS	224,306.47	224,306.47
80	Roadway Excavation (Plan Quantity)	269,665.000	CY	22.35	6,027,012.75
90	Untreated Base Course (Plan Quantity)	5,690.000	CY	34.59	196,817.10
100	Micro-Surfacing	26,065.000	SY	12.10	315,386.50
110	HMA - 1/2 Inch	11,060.000	TON	100.41	1,110,534.60
130	Remove Asphalt Pavement	23,923.000	SY	9.58	229,182.34
140	Pavement Marking Paint	204.000	GAL	281.34	57,393.36
150	Precast Concrete Barrier - 32 Inch (New Jersey Sha	7,800.000	LF	77.82	606,996.00
200	Concrete Drainage Structure 5 ft to 7 ft deep - CB	11.000	EA	4,609.21	50,701.31
210	Retaining Wall	13,145.000	SF	59.86	786,859.70
220	White Pine Chutes + White Pine	2,424.000	LF	20,056.61	48,617,222.64
230	Little Pine	770.000	LF	19,590.13	15,084,400.10
235	Wing Walls	1.000	LS	1,121,351.79	1,121,351.79
280	10" Sewer Line Relocation	4,200.000	LF	84.99	356,958.00
285	4' Manhole Standard	9.000	EA	5,746.54	51,718.86
286	4" Gas Line Relocation	4,200.000	LF	179.58	754,236.00
290	Electrical	4,200.000	LF	31.85	133,770.00
300	Lighting	3,194.000	LF	73.09	233,449.46
310	Communications	4,200.000	LF	35.63	149,646.00
320	Signing	11.000	EA	1,632.55	17,958.05
330	4" Water line	8,450.000	LF	65.67	554,911.50
340	Fixed Water Based Fire Suppression	244,341.000	SF	14.37	3,511,180.17
350	Fire Alarm System	244,341.000	SF	7.78	1,900,972.98
360	Water Standpipes	24.000	EA	3,161.67	75,880.08
370	Portable Fire Extinguishers with Cabinets	24.000	EA	419.02	10,056.48
380	12" Conctete Drain Line	3,194.000	LF	58.37	186,433.78
	Bid Total				\$104,178,623.36

BID PROPOSAL

Biditem	Description	Quantity	Units	Unit Price	Bid Total
10	Mobilization	1.000	LS	7,591,965.51	7,591,965.51
20	Traffic Control	1.000	LS	719,316.80	719,316.80
30	Maintenance of Traffic	1.000	LS	318,086.86	318,086.86
40	Dust Control and Watering	15,000.000	MGAL	18.89	283,350.00
50	Borrow (Plan Quantity)	224,653.000	CY	32.76	7,359,632.28
60	Granular Borrow (Plan Quantity)	300,205.000	CY	29.23	8,774,992.15
70	Clearing and Grubbing	1.000	LS	217,208.31	217,208.31
80	Roadway EX	304,512.000	CY	22.01	6,702,309.12
90	Untreated Base Course (Plan Quantity)	4,388.000	CY	34.06	149,455.28
100	Micro-Surfacing	20,102.000	SY	11.92	239,615.84
110	HMA - 1/2 Inch	8,527.000	TON	98.88	843,149.76
130	Remove Asphalt Pavement	18,483.333	SY	9.43	174,297.83
140	Pavement Marking Paint	158.000	GAL	277.04	43,772.32
150	Precast Concrete Barrier - 32 Inch (New Jersey Sha	7,100.000	LF	76.63	544,073.00
200	Concrete Drainage Structure 5 ft to 7 ft deep - CB	9.000	EA	4,538.68	40,848.12
210	Retaining Wall	15,700.000	SF	58.94	925,358.00
230	White Pine	2,000.000	LF	21,402.57	42,805,140.00
240	Little Pine	465.000	LF	21,293.62	9,901,533.30
245	Wing Walls	1.000	LS	2,393,876.16	2,393,876.16
290	10" Sewer Line Relocation	2,465.000	LF	83.69	206,295.85
295	4' Manhole Standard	5.000	EA	5,658.61	28,293.05
296	4" Gas Relocation	4,200.000	LF	176.83	742,686.00
300	Electrical	4,200.000	LF	31.36	131,712.00
310	Lighting	2,465.000	LF	55.24	136,166.60
320	Communications	4,200.000	LF	35.09	147,378.00
330	Signing	11.000	EA	1,607.56	17,683.16
340	4" Water Line	8,450.000	LF	64.66	546,377.00
350	Fixed Water Based Suppression	188,573.000	SF	14.15	2,668,307.95
360	Fire Alarm System	188,573.000	SF	7.66	1,444,469.18
370	Water Standpipes	20.000	EA	3,112.39	62,247.80
380	Portable Fire Extinguishers and Cabinets	20.000	EA	412.61	8,252.20
390	12" Concrete Drain	2,465.000	LF	57.47	141,663.55
	Bid Total				\$96,309,512.98

BID PROPOSAL

Biditem	Description	Quantity	Units	Unit Price	Bid Total
10	Mobilization	1.000	LS	5,562,996.30	5,562,996.30
20	Traffic Control	1.000	LS	88,960.49	88,960.49
40	Dust Control and Watering	11,500.000	MGAL	19.00	218,500.00
50	Borrow (Plan Quantity)	115,275.900	CY	32.96	3,799,493.66
60	Granular Borrow (Plan Quantity)	130,874.100	CY	29.41	3,849,007.28
70	Clearing and Grubbing	1.000	LS	196,380.98	196,380.98
80	Roadway Ex	205,904.600	CY	22.14	4,558,727.84
220	East Hellgate	1,960.000	LF	16,425.49	32,193,960.40
230	Hilton+Superior+Little	2,100.000	LF	16,552.05	34,759,305.00
231	Wing Walls	1.000	LS	859,267.44	859,267.44
261	Internal Drainage Tunnel	2,060.000	LF	57.83	119,129.80
265	Storm Drain System	1.000	LS	163,436.80	163,436.80
290	Electrical	4,475.000	LF	31.55	141,186.25
300	Lighting	4,060.000	LF	72.31	293,578.60
310	Communications	4,475.000	LF	36.45	163,113.75
315	Fire Suppression Fire Line	2,000.000	LF	65.08	130,160.00
320	Signing	3.000	EACH	1,617.47	4,852.41
340	Fixed Water Based Suppression	117,740.000	SF	14.23	1,675,440.20
350	Fire Alarm System	117,740.000	SF	7.71	907,775.40
360	Water Standpipes	16.000	EA	3,132.37	50,117.92
370	Portable Fire Extinguishers and Cabinets	14.000	EA	415.15	5,812.10
	Bid Total				\$89,741,202.62

Appendix B. Cog Rail Snow Removal Operation Considerations

Memo

Date: Wednesday, October 28, 2020

Project: Little Cottonwood Canyon EIS

To: UDOT

From: HDR

Subject: Cog Rail and Highway Snow Removal

This technical memorandum provides an overview of the likely snow removal operations if a cog rail line were built on the north side of State Route (S.R.) 210 in Little Cottonwood Canyon adjacent to the existing roadway.

Little Cottonwood Canyon Snowfall and Avalanches

The upper portions of Little Cottonwood Canyon receive an average of 350 to 500 inches of snow per year. During the winter seasons of 2007 through 2019, about 29 days per ski season received 5 or more inches of snow in 24 hours and about 12 days per ski season received 10 or more inches of snow in 24 hours.

Because it receives heavy amounts of snow and has steep canyon walls, Little Cottonwood Canyon has one of the highest avalanche risks in North America. UDOT has an active avalanche-mitigation program (artillery and remote avalanche-mitigation systems) in the canyon, and drivers can use of the Alta Bypass Road to avoid the Superior and Hellgate avalanche paths on the north side of S.R. 210. Nevertheless, the avalanche hazard in the canyon is still classified as high.

The most critical avalanche paths with respect to uncontrolled, observed road events and residual avalanche risk are the Tanners, White Pine Chutes, White Pine, and Little Pine avalanche paths. UDOT's active avalanche-mitigation program in these paths consists primarily of using artillery to cause a controlled avalanche release. From 2004 to 2017, an average of 163 artillery shells per ski season were fired into these avalanche paths (Dynamic Avalanche Consulting 2019).

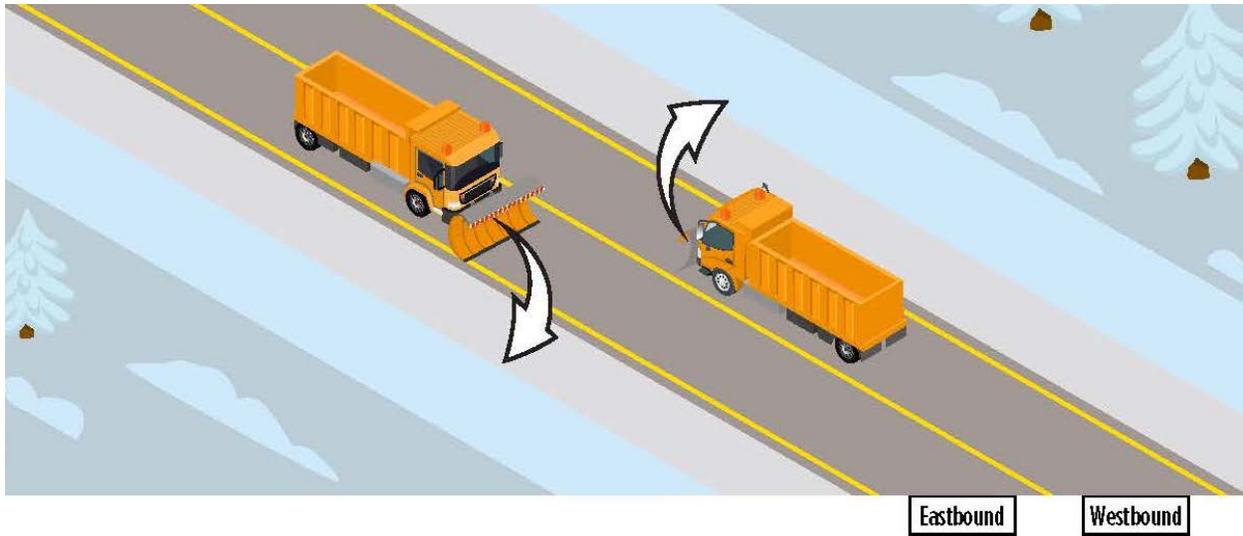
Based on data recorded by UDOT, from 1999 to 2018, UDOT closed S.R. 210 in Little Cottonwood Canyon an average of 10.8 days per ski season for part of the day to conduct avalanche mitigation. During this period, there were an average of 56.3 hours of road closure, or about 5 hours of road closure per avalanche-mitigation event (Dynamic Avalanche Consulting 2018). The greatest number of closures between 1999 and 2018 occurred during the 2008–2009 winter season, which had 21 closure days and a total of 106 hours of closure. Closures are mostly due to controlled avalanche releases.

Current S.R. 210 Snow-removal Operations

UDOT uses primarily snow plows to remove most snow events from S.R. 210. For safety purposes snow removal operations do not occur after 10 pm at night. A snow plow operates between 15 miles per hour (mph) and 25 mph in the travel lane pushes the snow to the right of the plow to avoid pushing snow into oncoming traffic (Figure 1). Snow plows heading up Little Cottonwood Canyon push snow down the south-side embankment into the canyon ravine. Snow plows heading down the canyon push snow toward

the canyon wall. After snow accumulates on the north side of the road, UDOT uses blowers and graders to remove snow from the north side (canyon wall side) of the road to the south side, and the snow is then pushed down the embankment (canyon ravine side). Snow is moved from the north side to the south side of S.R. 210 to prevent snow from building up on the north side, because this snow would eventually encroach onto the vehicle travel lanes. Blowers and graders are typically used during the early morning before peak travel periods.

Figure 1. Typical Snow-removal Operation on S.R. 210



If an avalanche flow hits S.R. 210, UDOT uses plows, front-end loaders, and blowers to remove the snow from the roadway (Figure 2). Some avalanche flows contain debris such as rocks and trees. When an avalanche flow is being removed, S.R. 210 is typically closed.

Figure 2. Avalanche Snow-removal Operation on S.R. 210



Cog Rail Design and Snow Removal

Design

The proposed design of the cog rail line is shown in Figure 3. The design was developed to provide necessary snow storage areas between the roadway and rail line. UDOT recommends using a 36-inch concrete barrier instead of guard rail to make removing snow easier and to avoid pushing roadway snow toward the rail tracks. A barrier is needed between the roadway and rail to prevent vehicles from sliding onto the tracks during icy road conditions, as shown in Figure 3. For about 3,000 feet (1,800 single track and 1,200 feet double track) of the cog rail line, the rail would be embedded into the road to avoid sensitive resources (Figure 4). Embedding the rail reduces the amount of space needed.

Figure 3. Cog Rail Design adjacent to S.R. 210 – Example of Ballast Track, Double

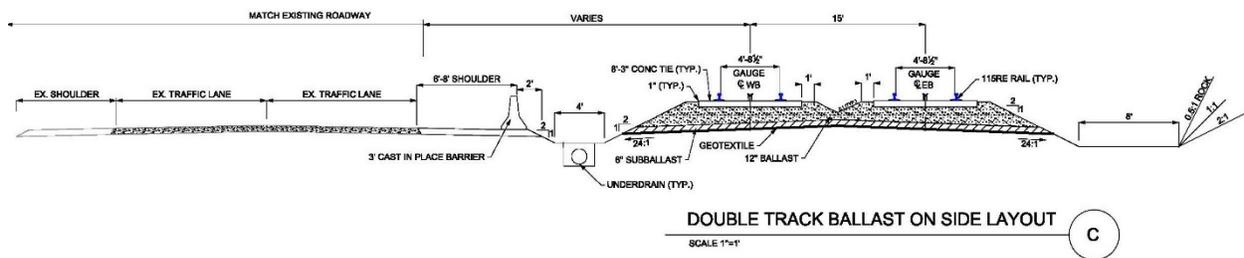
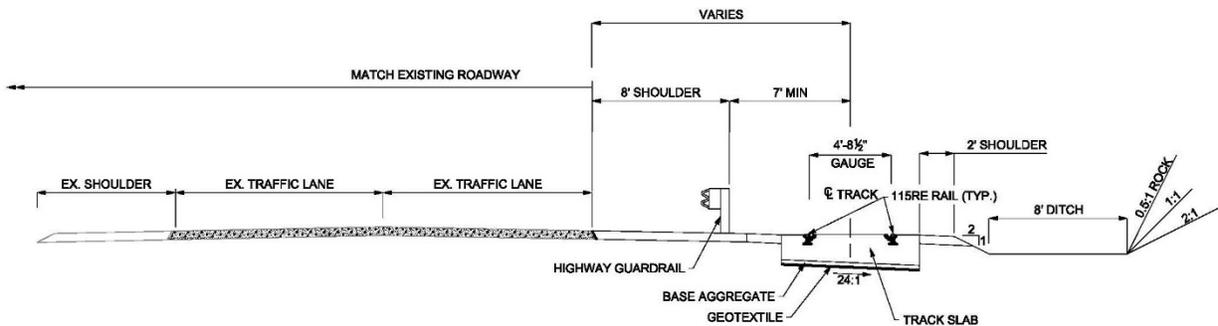


Figure 4. Cog Rail Design adjacent to S.R. 210 – Example of Embedded Track, Single



The design in Figure 3 includes about 6 feet of snow storage between the rail and roadside barrier and about 8 feet of snow storage on the uphill side of the rail. The 8 feet of snow storage is also necessary as an area for capturing fallen rocks (rocks fall onto S.R. 210 frequently). Snow from these storage areas would need to be periodically removed to provide room for subsequent snow events and to prevent rail vehicles from being damaged due to scraping icy embankments.

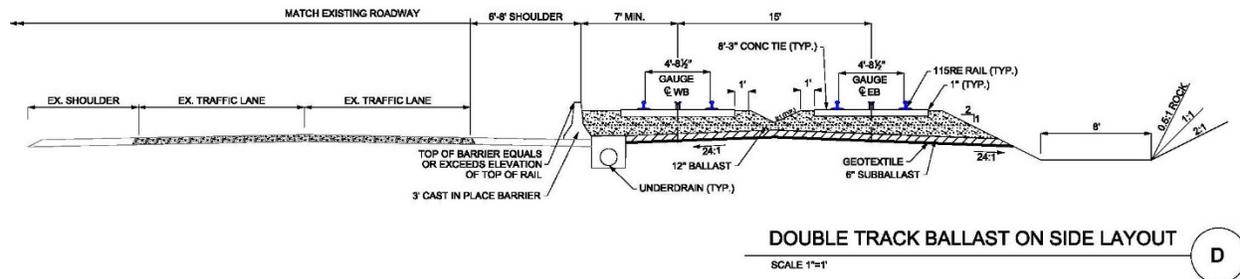
The cog rail design also includes up to 7,200 feet of avalanche sheds in the areas of the greatest avalanche risk. These snow sheds would help reduce the need to remove snow on these sections of S.R. 210.

As shown in Figure 5, an option to the above design is to place the rail alignment on fill to the approximate height of the barrier. This would allow snow to be pushed from the tracks over the barrier onto the road shoulder. This design might make removing snow from the rail line easier and reduce the potential for road closures caused by blowing snow from the rail line onto the road. With this option,

UDOT would need to remove snow from the north side to the south side of S.R. 210 more frequently. Concerns with this design are wildlife crossing a rail alignment that has a 3-foot-high dropoff onto S.R. 210 and the potential for recreationists crossing the track and having to drop the 3 feet onto the road.

Fencing the rail alignment is not possible since the fencing would prevent wildlife from crossing the rail line and would be frequently damaged by avalanches and falling rocks.

Figure 5. Cog Rail Design adjacent to S.R. 210 – Example of Ballast Track at Barrier Height

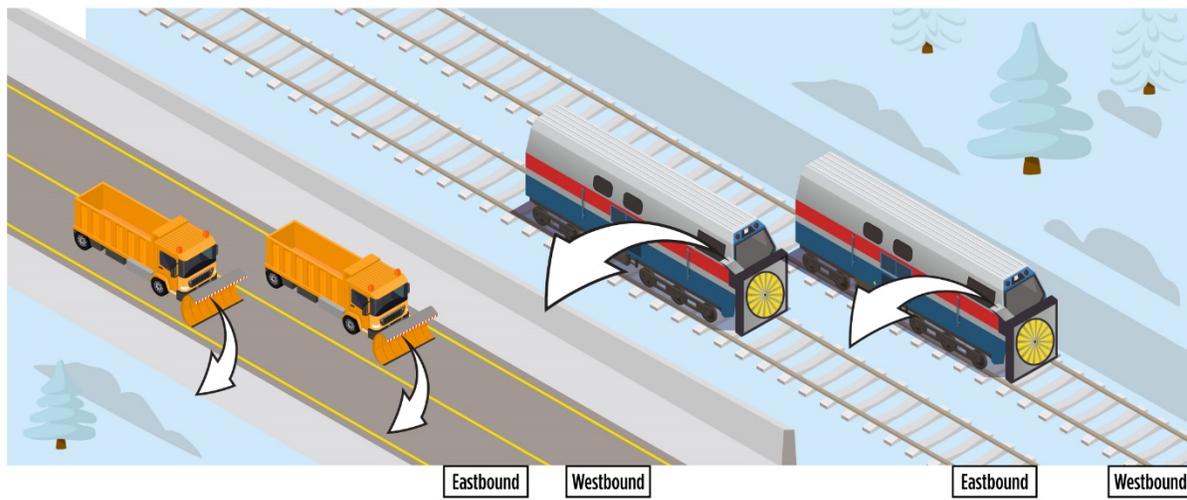


Snow Removal

Staff with UTA have said that snow on the rail line would likely be removed using a rotary snow blower because of the limited space to store snow and to avoid pushing snow onto the opposing track. A rotary blower could be mounted to the lead rail vehicle or could be a rubber-tired blower vehicle that operates on the track.

A rotary snow blower can be positioned to blow snow to one side of the track. However, given that the rail line would be adjacent to the canyon wall, UDOT expects that snow on the rail line would need to be blown by the rotary blower toward the roadway in both the uphill and downhill directions (Figure 6). Blowing snow toward the canyon wall would cause snow to fall back onto the tracks. Figure 6 shows how snow from the cog rail line would be removed with a blower and how UDOT would then remove snow from the road. According to staff with UTA, snow from most events would be removed using rotary blowers in the evenings and mornings when snow builds up before formal rail operations begin at 7 AM. During heavier snow events, the cog rail might run frequently during the evening to keep snow from building up on the tracks. In addition, rotary blowers could be used during the day if necessary. Any time a rotary blower is used, S.R. 210 would need to be closed, since the snow would be blown onto the roadway and would cause be a safety hazard to vehicle traffic.

Figure 6. Rail Rotary Blower and Snow-removal Operations on S.R. 210



UDOT expects that, if built-up snow from the track area needs to be removed, the rail operator could remove it overnight when road traffic is light and that this snow removal could be coordinated with UDOT's road snow removal operators. Built-up snow from the track area would be removed by rubber-tired equipment such as a blower or front-end loader. Snow from an avalanche or snow that has accumulated over a few hours might require heavy, rubber-tired equipment to be brought in to remove snow from the track. Any snow removal on the rail would need to avoid impacting the center cog rail which would be at about the same height as the outer rails.

During larger avalanches, UDOT would need to coordinate snow removal with the rail operator. This coordination of removing snow from the track might delay the opening of S.R. 210.

UDOT Snow Removal with Rail

During snow plow operations on S.R. 210, UDOT's operators would need to take care to not push snow into the rail snow storage area or onto sections of embedded track. If snow must be blown from the rail line to the road side of the canyon, UDOT's operators would need to clear the road following the rail-clearing event. When using the rail rotary blower, UDOT would need to implement a rolling closure of S.R. 210 since snow could not be blown onto S.R. 210 when vehicles are on the road. UDOT believes that this could be done with a rolling closure as the road snow plow follows the rotary plow up or down the canyon.

Overall, the combined snow removal operations would require more time and operational cost to remove snow from both the rail and S.R. 210. This would also likely result in additional road closures, with most occurring during off-peak periods.

Removing avalanche flows from both the rail and road could result in additional closure times for S.R. 210.

References

Dynamic Avalanche Consulting

- 2018 Little Cottonwood Canyon Environmental Impact Statement, Snow Avalanche Hazard Improvement Options Report. October 4.
- 2019 Little Cottonwood Canyon (S.R. 210) EIS – Snow Shed Lengths and Mitigation. April.