

Memo

Date: Friday, January 27, 2023

Project: Little Cottonwood Canyon EIS

To: UDOT

From: HDR

Subject: Little Cottonwood EIS, Alternatives Cost Adjustments for Materials Price Escalation

Introduction

The estimated capital cost and operating and maintenance (O&M) costs reported in the Final Environmental Impact Statement (EIS) were generally based on 2020 dollars (2020\$). HDR updated cost estimates in November and December 2022 to account for recently (2021–2022) observed inflation and material cost escalations (10% to 25%) which have been higher than historic average annual increases (2.75% to 3.5%). In addition, after publishing the Final EIS, UDOT received several public comments on this topic. This memorandum presents the updated cost estimates and summarizes HDR’s methods for adjusting the capital costs for the different components of the EIS alternatives.

The cause(s) of the significant cost increases were supply chain challenges, construction worker shortages, the war in Ukraine, increasing demand for materials, Utah’s fast population and housing growth, and other factors. How and whether these higher annual increases will continue in the coming years is uncertain. After the Record of Decision, UDOT should examine various forecasting methodologies before establishing a budget for the alternative selected in the project’s Record of Decision and should consider the implementing timeline and risk factors.

HDR’s general approach to adjust the costs was to have our Salt Lake City–based senior cost estimator, Steve Young, work with the design teams to revise the unit costs for the civil components of the alternatives based on current (2022) market conditions. Prices have increased for labor, materials, equipment rates, and fuel. Costs for materials such as concrete, asphalt, and steel have affected overall construction prices significantly over the past couple years.

Summary of Cost and Comparison between Final EIS (2020\$) and Current (2022\$) Costs

Table 1 below summarizes the approximate cost for the alternatives analyzed in the Draft and Final EISs. Table 1 represents a “high range” for the alternatives using the higher-priced sub-alternatives (Wasatch five-lane and snow sheds with realigned road sub-alternatives).

Table 1. Comparison of 2022 to 2020 Cost Estimates for the Little Cottonwood Canyon EIS Alternatives

Alternative	Approximate Current Cost (2022\$)	Final EIS Cost (2020\$)	Change \$	Change %
Enhanced Bus	\$474.0M	\$354.6M	\$119.4M	34%
Enhanced Bus in PPSL	\$643.6M	\$509.6M	\$134.0M	26%
Gondola A	\$734.0M	\$561.3M	\$172.7M	31%
Gondola B	\$729.0M	\$550.7M	\$178.3M	32%
Cog Rail	\$1,239.0M	\$1,064.0M	\$175.0M	16%

Note that the costs in Table 1 are based on quantities generated from conceptual-level designs prepared for the EIS and (for mobility hubs and gondola, in particular) from unit costs obtained from different references and scaled for an application in Little Cottonwood Canyon in order to determine a rough order-of-magnitude cost. A 20% contingency was used across all alternatives to account for the uncertainty in the cost estimating methods. In addition, the cost estimates used a 2050 design year to size the transit mode (bus fleet or number of rail vehicles, for example) and supporting infrastructure.

The alternatives consist of primary alternatives, which are the main components needed to operate the specific transportation mode (bus, gondola, or cog rail and associated stations and parking) and sub-alternatives, which are additional or supporting elements that are common to all primary alternatives (Wasatch Boulevard widening, snow sheds, and trailhead improvements, for example). Table 2 presents the 2022\$ cost estimates by primary and sub-alternatives to help distinguish the main cost differences.

Table 2. 2022 Costs for Primary and Sub-alternatives

Alternative	Cost for Primary Alternative Components (2022\$)	Cost for Sub-alternatives (2022\$)	Total (2022\$)
Enhanced Bus	\$273.7M	\$200.3M	\$474.0M
Enhanced Bus in PPSL	\$443.3M	\$200.3M	\$643.6M
Gondola A	\$526.0M	\$208.0M	\$734.0M
Gondola B	\$521.0M	\$208.0M	\$729.0M
Cog Rail	\$804.9M	\$434.1M	\$1,239.0M

Note that major difference in sub-alternatives between the bus and gondola alternatives (\$200.3M to \$208.0M) and the cog rail alternative (\$434.1M) is because the cog rail would require additional 3,600 feet of snow shed in the upper sections of the canyon through the Hell Gate avalanche zone. Table 3 presents the 2022\$ cost and increases for the sub-alternatives (Wasatch Boulevard, snow sheds, trail heads). See also Table 4 for a breakdown.

Table 3. Comparison of 2022 to 2020 Sub-Alternative Costs

Sub-Alternative	Cost for Sub-alternatives (2020\$)	Cost for Sub-alternatives (2022\$)	Change \$	Change %
Enhanced Bus	\$159.6M	\$200.3M	\$40.7M	26%
Enhanced Bus in PPSL	\$159.6M	\$200.3M	\$40.7M	26%
Gondola A	\$166.3M	\$208.0M	\$41.7M	25%
Gondola B	\$166.3M	\$208.0M	\$41.7M	25%
Cog Rail	\$326.5M	\$434.1M	\$107.6M	33%

Cost Update Methodology

Each of the following sections summarizes the approach and methods HDR used for adjusting the cost estimates to better reflect 2022 costs. Table 4 is a detailed breakdown of all the components that make up a complete alternative.

Enhanced Bus Service Alternatives

Bus Fleet. The Utah Transit Authority (UTA) provided an estimate of the bus fleet required to serve the needed ridership (30% of canyon users taking transit) in 2050.¹ In addition to the capital cost of buses, because of the number of buses needed to serve peak hours in 2050 (about 65 buses for the Enhanced Bus Service Alternative and 45 buses for the Enhanced Bus Service in Peak-period Shoulder Lane Alternative), UTA determined that bus maintenance facilities would need to be expanded or a new facility constructed. A current estimated bus cost of \$600k (compared to \$560k, in 2020\$) was applied.² The cost for a bus maintenance facility was determined as a cost per bus, which was increased by 25% for 2022\$ (\$850k to \$1,062k per bus), an increase that approximately matches the average cost escalation that HDR calculated for the civil components of the sub-alternatives (Wasatch Boulevard widening, snow sheds, and mobility hubs) as described below.

The total capital cost for the approximately 65 buses, which are needed with the Enhanced Bus Service Alternative, is about \$108M, a 13% increase. The 45 buses needed with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative is about \$75M, a 10% increase.

Mobility Hubs. The cost for the mobility hub parking structures was originally estimated at about \$65 per square foot (SF). Costs were updated to \$120 per SF for 2022\$ based on (1) 2021 construction costs for a parking structure at a gondola base station in Breckenridge, Colorado,³ and (2) the average opinion of three HDR's cost estimators.⁴ This change represents a 90% cost increase (about \$99M for 2,500 parking spaces in 2022\$ compared to \$52M in 2020\$ in the Final EIS). Note that HDR assumed that the parking structure size was based on about 330 SF per space. The per-space square footage (layout efficiency) can range from about 300 SF per space to about 400 SF per space (the Breckenridge example was 350 SF per space). At 300 SF per space, 2,500 space would be about \$90M, which was used to determine a low range in the alternative costs.⁵

Resort Bus Stops. The Final EIS allocated about \$5M total for two resort bus stops (one at Snowbird and one at Alta). An HDR senior transit architect, Don Hogan, estimated that a typical transit stop with basic amenities (waiting area, restrooms, and lockers) would be about 6,000 SF and, at \$500 to \$600 per SF, would cost about \$3.0 million to \$3.6 million in 2021\$. HDR escalated this cost by 15% to arrive at the cost of \$3.5M to \$4.14M for a bus stop in 2022\$.

Between the release of the Draft and Final EISs, as UDOT worked with the Town of Alta, the proposed Alta bus stop was moved to a location along S.R. 210 between the Alta Lodge and the Rustler Lodge on an area called the "mine dump." At this new location, the Alta bus stop would be in an avalanche runout path, which would require additional structural design considerations. HDR reviewed work by Ennead Architects, which were evaluating concepts for Alta's proposed community center near the same location as the proposed bus stop. With special structural considerations for avalanche impact pressures, Ennead

¹ Memo from UTA CFO William Greene to the LCC evaluation team, April 22, 2021.

² Email from Autumn Hu of UTA to Josh Van Jura of UDOT, October 24, 2022.

³ Walker Consultants email to Josh Van Jura of UDOT, November 11, 2022.

⁴ John Savage, William Stevenson, and Michael Digregorio of HDR, November 2022.

⁵ *Parking Structure Design Guidelines*, Boise, Idaho, Kimley-Horn, August 2016.

estimated building costs in the range of \$950 to \$1,200 per SF in 2021\$.⁶ At 6,000 SF, the total cost would be about \$5.7M to \$7.2M. HDR also compared this cost to the structural design of the snow sheds (with the added costs for windows and doors, HVAC, electrical, water and sewer, escalators, elevators, and canopies) to estimate the Alta resort bus stop cost of \$5M to \$6M. HDR inflated the cost range for both of these methodologies by 15% and averaged them to determine an Alta bus stop cost of \$6.2M to \$7.7M in 2022\$.

The total cost for two resort bus stops would be about \$9.7M (low end) to \$11.8M (high end), which is about a 136% increase from the original estimate (\$5M).

Wasatch Boulevard Interchange. For the EIS, HDR prepared a preliminary design and generated approximate quantities for an interchange from Wasatch Boulevard to access the gravel pit mobility hub, which is also being planned for mixed-use development. This grade separated interchange would apply to the enhanced bus service alternatives and Gondola Alternative A. In November and December 2022, HDR updated the unit costs for each major item (earthwork, pavement, structure, and drainage) needed to construct the interchange. The result was a 17% increase in the cost for this feature, bringing the total cost for this feature from \$32M (2020\$) to \$37.6M (2022\$).

Land Costs. HDR assumed a 15% increase in land cost and allocated \$17.25M for right-of-way (ROW) (\$15M in the Final EIS) for the mobility hub.

Peak-period Shoulder Lane (PPSL). For the EIS, HDR prepared a preliminary design and generated approximate quantities for bus-only, peak-period shoulder lanes in Little Cottonwood Canyon. HDR updated unit costs for the construction items which included substantial earthwork, retaining walls, soil-nail walls, and drainage features. The result was an 11% increase (\$183M to \$203M in 2022\$) in the cost for this feature of the Enhanced Bus Service in Peak-period Shoulder Lane Alternative.

Gondola Alternatives

Gondola Lift Systems. HDR's subconsultant, EcoTransit, estimated that gondola lift system costs are up 30% since mid-2020 due to inflation, supply chain bottlenecks, and strong demand. HDR applied a 30% increase to the gondola costs. This resulted in a 2022\$ cost for the 7.7-mile Gondola Alternative A of \$329M (\$253M in the Final EIS) and the 8.6-mile Gondola Alternative B of \$370.5M (\$285M in the Final EIS).

Reconfigured Park-and-ride Lot. The Gondola Alternative A base station and Gondola Alternative B's angle station would be located at the existing park-and-ride lot at the entrance to Little Cottonwood Canyon. This parking area would need to be reconfigured to accommodate the gondola components and to maintain some parking for the Alpenbock trail system in this area. Unit costs were updated to reflect 2022\$ prices and a cost of \$7.7M was estimated for this item, a 16% increase from the Final EIS (\$6.65M).

Base Parking Structure. The gondola alternatives each require about 2,500 parking spaces. For Gondola Alternative B, all parking would be at the base station. For Gondola Alternative A, mobility hubs at the gravel pit and at 9400 South and Highland Drive would be used. The approximate cost for 2,500 spaces is about \$99M, as described under the enhanced bus service alternatives section above.

⁶ *Alta Community Center Feasibility Study*, Ennead Architects, et al., April 21, 2021.

Bus Service for Gondola Alternative A. With remote mobility hubs, buses would be used to bring riders to the Gondola Alternative A base station. HDR's estimate in 2020 was that about 30 buses would be needed to bring riders to the gondola base station during the peak hours. The estimated cost for 30 buses, and their required maintenance facility, was \$43M as reported in the Draft EIS. UTA estimated in 2021 that about 26 buses would be needed. To be conservative, the cost for the Final EIS was not adjusted. Assuming 26 buses and inflating bus purchase and maintenance facility costs results in a slight (1%) increase to \$43.25M in 2022\$ for bus service with Gondola Alternative A.

North Little Cottonwood Road Improvements. Access to the Gondola Alternative B (and Cog Rail Alternative) base station parking requires ramps to access multiple levels of the parking structure as well as a North Little Cottonwood Road underpass for vehicles leaving the structure heading northbound. HDR prepared a preliminary design and estimated quantities for this feature. Updating unit costs for 2022 resulted in a 7% increase to \$45.9M (\$43M in the Final EIS)

One-way Access Road. To reduce traffic at the Gondola Alternative B (and Cog Rail Alternative) base station, gondola riders coming from the south (about 40% of traffic heading into the canyon) would access the parking structure via a one-way access road from Wasatch Boulevard. Based on the conceptual design completed between the release of the Draft and Final EISs, and updating unit costs, the result is about a \$5.6M cost for this component in 2022\$. This amounts to a 27% increase, up from \$4.4M in 2020\$.

Sub-alternatives

Wasatch Boulevard. Two Wasatch Boulevard sub-alternatives are being considered: a five-lane alternative (two northbound, two southbound, and a middle turn lane) and an imbalanced-lane alternative (two southbound, one northbound, and a middle turn lane). HDR prepared a conceptual design and generated quantities for the Draft EIS cost estimates. HDR updated unit costs and calculated about a 20% increase for these alternatives. The Wasatch Boulevard Five-lane Alternative would cost about \$75M (\$62M in the Final EIS) and the Imbalanced-lane Alternative about \$71M (\$59M in the Final EIS) in 2022\$.

Snow Sheds. Two snow shed alternatives are being considered for crossing three main avalanche paths (Little Pine, White Pine, and White Pine Chutes). One alternative is a snow shed with berms that can help guide avalanche flows over the top of the structure. The other alternative is longer snow sheds that extends the entire widths of the modeled avalanche zone, which combines the White Pine Chutes and White Pine snow sheds into one structure, and which requires realigning the road. HDR prepared a preliminary design and generated quantities for the Draft EIS. HDR updated unit costs in 2022\$ for the construction materials needed for these structures (concrete, rebar steel, and several layers of steel "tie-backs" to resist the lateral forces of the avalanche flows). This update resulted in an increase of about 27% for this sub-alternative. The total cost in 2022\$ for the snow sheds with realigned road is about \$109M (\$86M in the Final EIS), and the snow shed with berms is about \$91M (\$72M in the Final EIS).

Trailhead Parking. After updating unit costs, the trailhead parking improvements sub-alternatives (at White Pine, Lisa Falls, Gate Buttress, and Bridge) increased about 29% to \$7.5M (\$5.5M in the Final EIS).

Tolling. HDR assumed a 25% escalation for tolling infrastructure. The \$5M allocation from the Final EIS was increased to \$6.25M for 2022.

Cog Rail Alternative

Cog Rail. HDR prepared a conceptual design and generated approximate quantities for the Cog Rail Alternative alignment for the Draft EIS. In August 2020, HDR used a cost estimate template developed for rail transit projects which contained unit costs for typical light rail components (track, stations, support facilities, communications systems, rail vehicles, and typical allocations for professional services common in the rail market sector). Light rail vehicle costs were provided by Stadler Rail after several iterations of Stadler evaluating railcar options for Little Cottonwood Canyon.⁷ Also, because the Cog Rail Alternative would not tie into the existing UTA light rail system, UTA assisted in defining the size (2.7 acres) for a rail operations and maintenance facility for this alternative.

In November 2022, HDR's senior estimator, Steve Young, inspected the unit costs used in 2020 to check that they were applicable to Utah's current market prices. After his review, one of the unit prices for a major construction item, cut earthwork, was decreased to better match local conditions. The result was a 20% decrease in the earthwork cost component. Other cog rail components were increased by about 12% in line with the civil elements of other sub-alternatives (Wasatch Boulevard and North Little Cottonwood Road) and HDR's experience with overall price escalations in 2020 (7.5%) and 2021 (4.5%).

The net result was that, for the 2022 estimate, the rail component of the Cog Rail Alternative increased by 3% to \$651M (compared to \$631M in the Final EIS). Overall, with the increase in the cost for rail snow sheds (both mid-canyon and upper-canyon snow sheds; see below), the base parking structure costs, and the access roads, the total cost estimate for cog rail-specific items is about \$1,140.5M (\$1.141B), which is a 16% increase from the \$983.4M in the Final EIS. The total cost for the Cog Rail Alternative, including the sub-alternatives, would be about \$1.239B in 2022\$ compared to \$1.064B in the Final EIS, which is a \$175M (16%) increase.

Rail Snow Sheds. HDR prepared a conceptual design and generated quantities for snow sheds for the Cog Rail Alternative. The mid-canyon snow sheds would cover both the roadway and the cog rail tracks. The upper-canyon snow sheds would cover only the tracks, since the Alta Bypass Road is available for vehicles. After updating unit costs to reflect 2022 prices, HDR estimated that the mid-canyon road and rail snow sheds would total about \$180M (\$141M in the Final EIS) and the upper-canyon snow sheds about \$155M (\$109M in the Final EIS). The total for avalanche mitigation for the Cog Rail Alternative would be about \$335.6M and represents about a 34% increase from 2020\$.

Detailed Breakdown of the Primary and Sub-alternatives

Table 4 below presents a breakdown of the primary alternative and sub-alternative components that together make up the total cost for the alternatives analyzed in Final EIS. The high range was determined by applying the higher-cost sub-alternatives (primarily the Wasatch Boulevard five-lane sub-alternative, the snow sheds with realigned road sub-alternative, and the cost for higher SF per space spacing assumptions). The low range used the other options (primarily the Wasatch Boulevard imbalanced-lane sub-alternative, the snow sheds with berms sub-alternative, and a smaller per-space SF for the parking structures).

⁷ Email from Matt Sibul, Stadler's Director of Sales, to Vince Izzo, HDR Project Manager, November 4, 2019.

Table 4. Breakdown of the Components of the Primary and Sub-alternatives in 2022\$

Component	Alternative:				
	Enhanced BUS - PPSL	Enhanced Bus	Gondola A	Gondola B	Cog rail
Gondola	-	-	\$328.9M	\$370.5M	-
Cog Rail and Operations and Maintenance Facility	-	-	-	-	\$651.0M
Base Station Parking (2,500 spaces)	-	-	\$99.0M	\$99.0M	\$99.0M
North Little Cottonwood Canyon Road Improvements	-	-	-	\$45.9M	\$45.9M
Wasatch One-way Access Road (Izzo Way)	-	-	-	\$5.6M	\$5.6M
Rail snow removal equipment	-	-	-	-	\$3.5M
Buses and Bus Maintenance facility	\$74.8M	\$108.0M	\$43.3M	-	-
LCC Roadway Widening	\$202.8M	-	-	-	-
Resort Bus Stops	\$11.8M	\$11.8M	-	-	-
Mobility Hubs (330 SF per space, \$39,600 per stall)	\$99.0M	\$99.0M	-	-	-
Mobility Hub Interchange	\$37.6M	\$37.6M	\$37.6M	-	-
Mobility Hub ROW	\$17.3M	\$17.3M	\$17.3M	-	-
Wasatch Blvd Widening (5 Lane)	\$75.0M	\$75.0M	\$75.0M	\$75.0M	\$75.0M
Noise Walls (imbalanced lane)	\$1.7M	\$1.7M	\$1.7M	\$1.7M	\$1.7M
Alternative Noise Walls _outside of WB	\$0.8M	\$0.8M	\$0.8M	\$0.8M	\$0.8M
Snow Sheds (with Realigned Road)	\$109.0M	\$109.0M	\$109.0M	\$109.0M	-
Rail Snow Sheds (mid canyon and upper canyon)	-	-	-	-	\$335.6M
Trailhead Parking	\$7.5M	\$7.5M	\$7.5M	\$7.5M	\$7.0M
Reconfigured P&R lot	-	-	\$7.7M	\$7.7M	\$7.7M
Tolling Infrastructure	\$6.3M	\$6.3M	\$6.3M	\$6.3M	\$6.3M
Total High Range, 2022\$	\$643.6M	\$474.0M	\$734.0M	\$729.0M	\$1,239.0M
Total Low Range, 2022\$	\$610.2M	\$440.6M	\$700.6M	\$695.6M	\$1,221.0M

Operations and Maintenance Costs

Bus Service. Annual O&M costs for bus service were updated by UTA in April 2021 to more closely match UTA’s costing approach.⁸ Note these costs were based on a 2050 level of service. The O&M costs, which were reported in the Final EIS, were as follows:

- **Enhanced Bus Service Alternative.** This alternative would require about 65 buses in the 2050 design year, for an annual O&M cost of \$14M.
- **Enhanced Bus Service in Peak-period Shoulder Lane Alternative.** With a dedicated bus lane facilitating faster transit travel times, this alternative would require about 45 buses in 2050, for an annual O&M cost of \$10.8M.
- **Bus Service for Gondola Alternative A.** This alternative would use remote mobility hubs to shuttle 100% of gondola riders to the gondola base station at the park-and-ride lot at the entrance to the canyon. About 26 buses were needed in 2050, which resulted in an annual O&M cost of \$5.5M.

Gondola. The annual O&M cost to operate Gondola Alternative B was about \$4M in 2020\$, which included labor, major equipment replacement reserves, miscellaneous costs (consumables, insurance, tools, office supplies, and vehicles), and energy costs. UDOT used the same cost for Gondola Alternative A operation. Adding the annual bus service O&M with Gondola Alternative A O&M resulted in a total O&M cost of \$10.4M for Gondola Alternative A in 2020\$.

Cog Rail. UTA estimated the O&M cost based on a light rail cost basis of \$10.73 per vehicle-mile and including a 2× multiplier to account for season adjustments for staff and year-round maintenance-of-way operation.⁹ An annual O&M cost of about \$2.8M in 2020 was calculated for the 8.6-mile cog rail line.

In a discussion on December 13, 2022, UTA suggested a 10% increase to define an O&M cost in 2022\$. As points of reference, according to Utah Department of Workforce Services, labor inflation in 2021 was about 5.6%, and, if another 5% is applied to get to 2022\$, the total adjustment would be about 10.9%.¹⁰ The St. Louis Federal Reserve Bank reports a total wage increase of about 10.7% increase between Q1 2020 and Q3 2022.¹¹ UDOT used a 10% adjustment to estimate annual O&M costs in 2022\$. Table 5 presents the 2020 and 2022 annual O&M costs for the primary alternatives after applying a 10% inflation adjustment.

Table 5. 2020 and 2022 Annual O&M Costs for the Primary Alternatives

Primary Alternative	Annual O&M Costs (2020\$)	Annual O&M Costs (2022\$)
Enhanced Bus	\$14.0M	\$15.4M
Enhanced Bus in PPSL	\$11.0M	\$12.1M
Gondola A	\$9.5M	\$10.4M
Gondola B	\$4.0M	\$4.4M
Cog Rail	\$3.4M	\$3.7M

⁸ Memo from UTA CFO William Greene to the LCC evaluation team, April 22, 2021.

⁹ Email from Autumn Hu of UTA to Josh Van Jura of UDOT, November 13, 2020.

¹⁰ <https://jobs.utah.gov/wi/data/library/wages/annualprofilewages.html>, accessed December 13, 2022.

¹¹ <https://fred.stlouisfed.org/series/ECIWAG>, accessed December 13, 2022.