Little Cottonwood Canyon ENVIRONMENTAL IMPACT STATEMENT
S.R. 210 | Wasatch Blvd. to Alta

Life Cycle Cost Analysis

Little Cottonwood Canyon Environmental Impact Statement Wasatch Boulevard to Alta

Lead agency:
Utah Department of Transportation

June 14, 2021

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1.0 Introduction

UDOT prepared a life cycle cost analysis (LCCA) for the alternatives presented in the *Draft Alternatives Development and Screening Report Addendum* (November 20, 2020) prepared for the Little Cottonwood Canyon Environmental Impact Statement. The purpose of this analysis was to compare alternatives based on a 30-year period considering estimates for both initial capital expenditures and annual operation and maintenance (O&M) costs.

2.0 Analysis Approach

This LCCA is a simple economic model in that it does not include any revenues generated by the alternatives. The LCCA does not include any salvage value of assets or equipment (buses, light-rail vehicles, or trains, for example) or calculate the remaining service life of a fixed asset (roadway, snow shed, or rail track, for example) after the analysis period. The LCCA also does not quantify temporary user cost or the long-term benefits (travel time savings), nor does it consider environmental benefits or detriments and calculate the monetary value of these factors and the differences among the alternatives.

The LCCA applies cost estimates that were developed or refined for the *Draft Alternatives Development and Screening Report Addendum* (November 20, 2020) based on public comments on the *Draft Alternatives Development and Screening Report* (June 8, 2020). O&M costs have been updated since November 2020 based on ongoing coordination with the Utah Transit Authority (UTA) and other stakeholders. The general approach of the LCCA was to apply an inflationary factor to estimate the year-of-expenditure cost for both capital and winter-season O&M costs and then apply a discount rate to determine the present value of costs (in 2020 dollars) and sum those costs over a 30-year life cycle.

2.1 Alternatives Analyzed

The following are general descriptions of the alternatives analyzed in this LCCA.

- **Enhanced Bus Service Alternative.** The Enhanced Bus Service Alternative includes mobility hubs for about 2,500 cars split between the gravel pit mobility hub and 9400 South/Highland Drive mobility hub with point-to-point bus service to the Snowbird and Alta resorts. Considering the needed bus frequency, dwell time, and end-of-line time, about 65 buses would be needed for this alternative.
- **Enhanced Bus Service in Peak-period Shoulder Lane Alternative.** Same as the Enhanced Bus Service Alternative but with winter-bus-only, peak-period shoulder lanes from the North Little Cottonwood Road/Wasatch Boulevard intersection to the Alta Bypass Road. This alternative would require about 45 buses.
- **Gondola Alternative A (Starting at Canyon Entrance).** Gondola Alternative A is a gondola running from a base station at the entrance to Little Cottonwood Canyon to the Snowbird and Alta resorts. Gondola Alternative A includes mobility hubs for about 2,500 cars split between the gravel pit mobility hub and the 9400 South/Highland Drive mobility hub with bus service to the gondola base station. This alternative includes 26 buses.

- **Gondola Alternative B (Starting at La Caille).** Gondola Alternative B is a gondola running from a base station located about 0.75 mile northwest of the entrance to Little Cottonwood Canyon to the Snowbird and Alta resorts. Gondola Alternative B includes a 1,500-space parking structure near the gondola base station at the La Caille property. The alternative also includes smaller parking structures and mobility hubs at the gravel pit (about 600 spaces) and 9400 South/Highland Drive (about 400 spaces) with reduced bus service to the gondola base station. This alternative would require about 17 buses.
- **Cog Rail Alternative.** The Cog Rail Alterative is a cog rail system (mountain rail or rack rail) from a cog rail base station near the entrance to Little Cottonwood Canyon at the La Caille property. The alignment would be side-running along the north side of State Route (S.R.) 210 in Little Cottonwood Canyon. The Utah Department of Transportation (UDOT) assumes that diesel-powered cog rail vehicles would be used. The Cog Rail Alternative includes a 1,500-space parking structure near the cog rail base station at La Caille. The alternative includes smaller parking structures and mobility hubs at the gravel pit (about 600 spaces) and 9400 South/Highland Drive (about 400 spaces) with bus service to the cog rail base station. This alternative would require about 17 buses.

2.2 Major Assumptions

The following are the major assumptions used in the LCCA.

- **Construction.** Year 2023 was assumed as the first year of construction, and construction costs are assumed to occur over 2 years, in 2023 and 2024. Construction costs include materials, equipment, construction labor, project management, engineering, permitting, and construction management.
- **30-year Life Cycle Cost.** Assuming a start of construction in 2023, year 2053 was used as the end date to capture a 30-year life cycle.
- **Inflation Rate.** Cost estimates are based on 2020 dollars (2020$). A 1.98% annual inflation rate[1] was used to estimate the year-of-expenditure cost.
- **Discount Rate.** A 2.40% nominal discount rate[2] was used to determine the present value (2020$) for year-of-expenditure costs.
- **Days of Operation.** All alternatives assume 140 days of winter operation. UTA currently operates buses about 140 days per winter season.

[1] ENR Construction Index, calendar year 2019.

[2] White House Office of Management and Budget, OMB Circular No. A-94, December 2019.

- **Bus Operations.**
  - 14-year bus service life. Purchase all new buses 14 years after initial purchase at $530k per bus (2020$).
  - Alternatives include a bus maintenance facility sized for the number of buses needed for each alternative.
  - O&M costs for buses include a mid-life bus transmission overhaul ($50k per bus[3]). UDOT annualized this cost by taking the total number of buses and dividing by 7 years to determine an average annual number of buses that would receive an overhaul with each alternative.
  - Operating cost were provided by UTA.[4]
  - Includes snow sheds for three higher-risk avalanche paths in the mid-canyon segment of Little Cottonwood Canyon.[5]
  - The Enhanced Bus Service in Peak-period Shoulder Lane Alternative includes an additional annual cost to remove snow ($250k annually) and to repave the peak-period shoulder lanes every 8 years in the canyon ($4M per repave).
- **Gondola Alternatives.**
  - The winter O&M cost includes labor, energy cost, and an annual reserve (about $600k) for replacing major equipment (cables, cabins, and drive motors).
  - Includes road snow sheds in the three mid-canyon avalanche paths to reduce the use of artillery and reduce gondola closure times.
  - Includes bus service from remote mobility hubs. UTA estimated that 26 and 17 buses would be needed for Gondola Alternatives A and B, respectively.

[3] Communication with UTA, January 25, 2021.
[4] Communication with UTA, April 22, 2021.
[5] White Pine Chutes 1–4, White Pine, and Little Pine.

- **Cog Rail Alternative.**
  - Includes a stand-alone operations and maintenance facility at the reconfigured park-and-ride lot at the entrance to Little Cottonwood Canyon.
  - Includes snow sheds over the tracks and the existing roadway in three mid-canyon avalanche paths. Includes rail-only snow sheds in four of the higher-risk avalanche paths in the upper-canyon segment.[6]
  - Cog rail vehicles would receive a major overhaul after 20 years of service at a cost of one-third of the rail vehicle initial capital cost. This overhaul is recommended to extend the vehicle life to about 40 years total.
  - Operating cost estimate is for winter service only and is based on the cost per revenue-mile for UTA's light-rail fleet.[7] Diesel-powered light-rail vehicles could be different.
  - Includes bus service from remote mobility hubs. UTA estimated that 17 buses would be needed for the Cog Rail Alternative.
  - UDOT assumed 15-minute headways during the peak hours and 30-minute headways during off-peak times. Each cog rail train would have three cars. There would be a total of eight train sets based on coordination with UTA.
  - UDOT added $3M for snow removal equipment purchases. The annual O&M includes an allocation of $600k annually for snow removal.

The LCCA excludes Wasatch Boulevard improvements, noise walls, and tolling infrastructure, which are common to all five alternatives.

[6] East Hellgate, Superior, Little Superior, and Hilton.

[7] UTA's Comprehensive Annual Financial Report 2019, June 2, 2020.

3.0 Results

The estimated initial capital costs used in the LCCA for the five alternatives are presented in Table 1.

Table 1. Initial Capital Costs (2020$)

Alternative	Estimated Initial Capital Cost ($M)[a]	Rank (least cost to highest)
Enhanced Bus Service Alternative	$274	1
Enhanced Bus Service in Peak-period Shoulder Lane Alternative	$433	2
Gondola Alternative A (Starting at Canyon Entrance)	$486	3
Gondola Alternative B (Starting at La Caille)	$509	4
Cog Rail Alternative	$1,036	5

[a] Excludes costs for Wasatch Boulevard, noise walls, and tolling infrastructure, which are common to all five alternatives.

As mentioned in Section 2.2, Major Assumptions, 2023 and 2024 were assumed as the years of construction,[8] and operating costs start in 2025. In Figure 1 below, the slope of the lines after 2025 represents the relative difference in O&M costs among the alternatives. The approximate initial, winter-season O&M costs for each alternative are as follows:

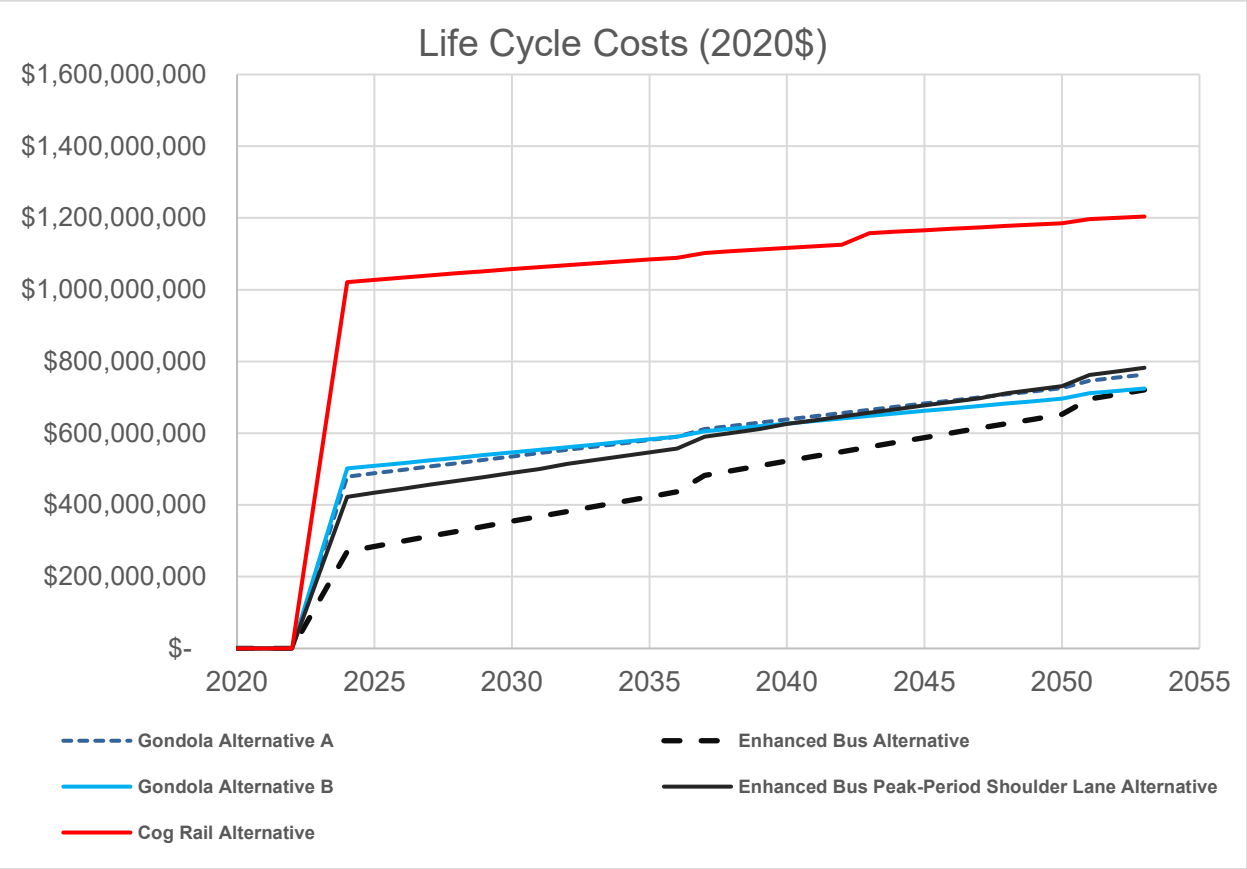
- Enhanced Bus Service Alternative – $14.0M
- Enhanced Bus Service in Peak-period Shoulder Lane Alternative – $11.0M
- Gondola Alternative A (Starting at Canyon Entrance) – $9.5M
- Gondola Alternative B (Starting at La Caille) – $7.6M
- Cog Rail Alternative (Starting at La Caille) – $7.0M

Figure 1 below presents cumulative cost curves for discounted (2020$) year-of-expenditure costs for the five alternatives analyzed in this LCCA. The LCCA inputs and year-of-expenditure cost for each alternative are provided in Attachment A, Life Cycle Cost Inputs and Assumptions.

The Cog Rail Alternative has a higher initial capital cost (about $1,036M) compared to the other alternatives. The annual O&M cost for the Cog Rail Alternative (about $7M annually) is less than the O&M costs for the other alternatives ($7.6M to $14.0M annually), resulting in a flatter cumulative cost curve between 2025 and 2053. However, the annual O&M cost savings for the Cog Rail Alternative over a 30-year period is not adequate to compensate for the much higher initial capital investment.

[8] Half of initial capital costs were applied in 2023 and half in 2024.

Figure 1. Life Cycle Cost, All Alternatives



For all alternatives, the bump or uptick in years 2037 and 2051 is due to new bus purchases. For the Cog Rail Alternative, the uptick in 2043 captures the major cog rail vehicle overhaul (assumed to be one-third of the initial capital cost), which is needed to extend the life of cog rail vehicles to 40 years or more.

Table 2 below presents the present value of the 30-year life cycle cost for each alternative. These values are the cumulative costs in 2053 from Figure 1. Table 2 also presents the ranking (least cost to highest cost) of the alternatives based on the present value of the estimated 30-year costs. In addition, Table 2 presents the initial capital cost ranking for comparison.

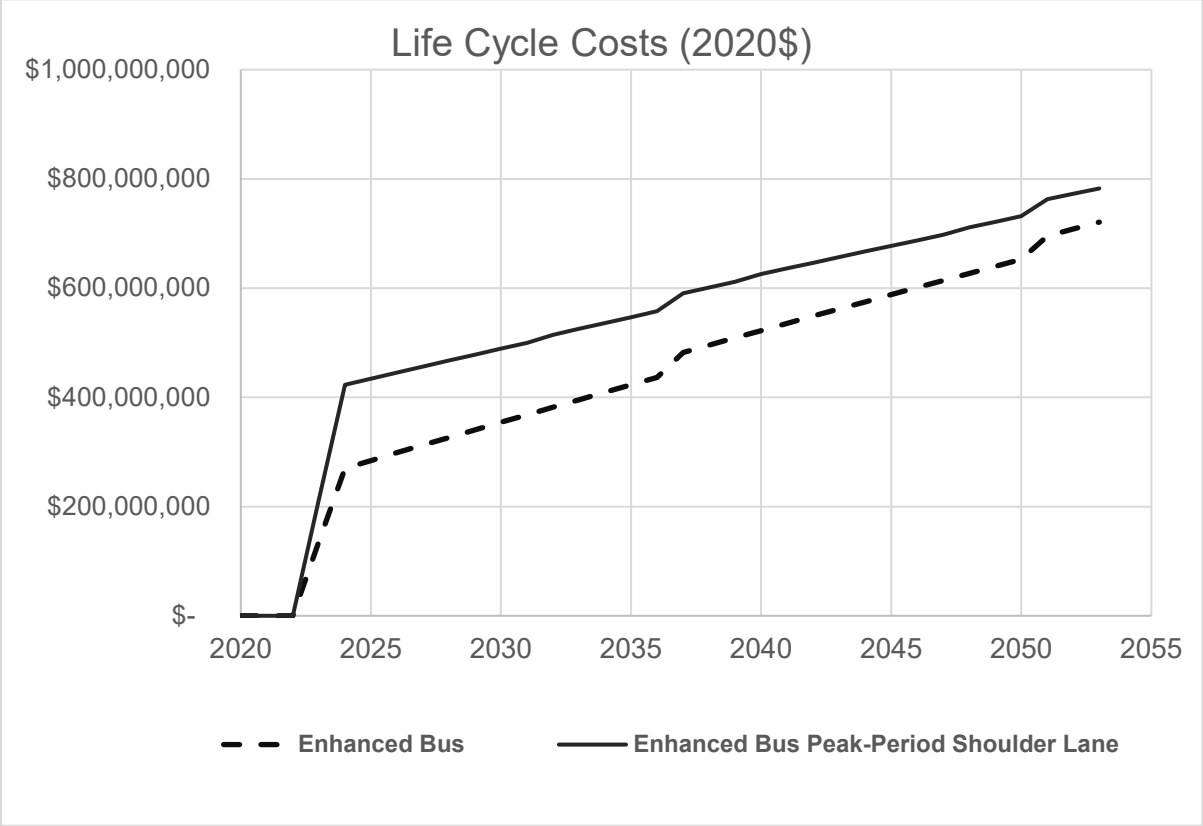
Table 2. 30-year Life Cycle Costs (2020$)

Alternative	Present Value, 30-year Costs ($M)	Present Value Rank (least cost to highest)	Initial Capital Cost Rank (least cost to highest)
Enhanced Bus Service Alternative	$721	1	1
Enhanced Bus Service in Peak-period Shoulder Lane Alternative	$782	4	2
Gondola Alternative A (Starting at Canyon Entrance)	$763	3	3
Gondola Alternative B (Starting at La Caille)	$725	2	4
Cog Rail Alternative	$1,204	5	5

3.1 Results for the Enhanced Bus Service Alternatives

Figure 2 presents the cumulative cost curves for the enhanced bus service alternatives.

Figure 2. Life Cycle Cost, Enhanced Bus Service Alternatives

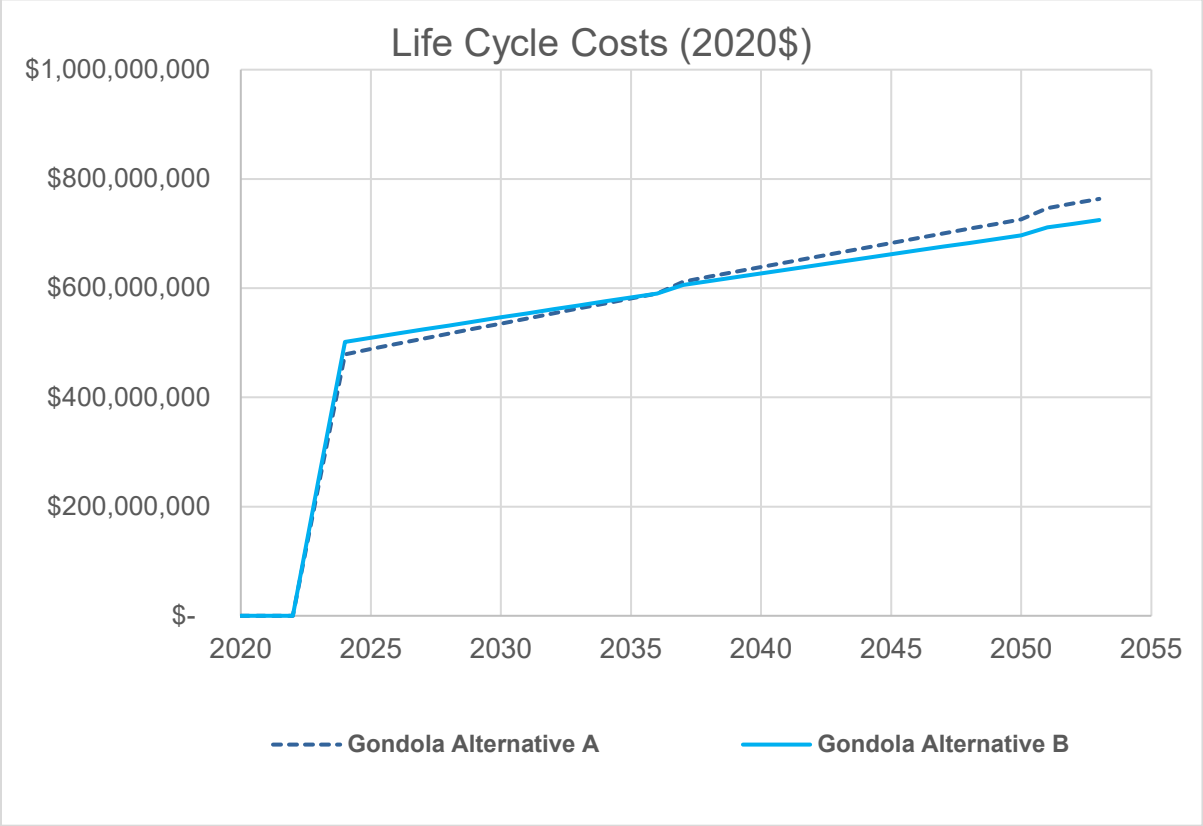


The cost of constructing the peak-period shoulder lanes ($183M) is the primary reason for the higher capital cost of the Enhanced Bus Service in Peak-period Shoulder Lane Alternative ($433M total) compared to the Enhanced Bus Service Alternative ($274M total). However, because of faster travel times, the Enhanced Bus Service in Peak-period Shoulder Lane Alternative requires fewer buses (45 buses at about $23.8M total) than does the Enhanced Bus Service Alternative (65 buses at about $34.5M total). Fewer buses also result in a lower annual O&M cost for the Enhanced Bus Service in Peak-period Shoulder Lane Alternative ($11M) compared to the Enhanced Bus Service Alternative ($14M). Therefore, the gap in cumulative cost curves between these alternatives narrows over time. However, the 30-year life cycle cost for the Enhanced Bus Service Alternative ($721M) is still about $61M lower than the life cycle cost for the Enhanced Bus Service in Peak-period Shoulder Lane Alternative ($782M).

3.2 Results for the Gondola Alternatives

Figure 3 presents the cumulative cost curves for the gondola alternatives.

Figure 3. Life Cycle Cost, Gondola Alternatives

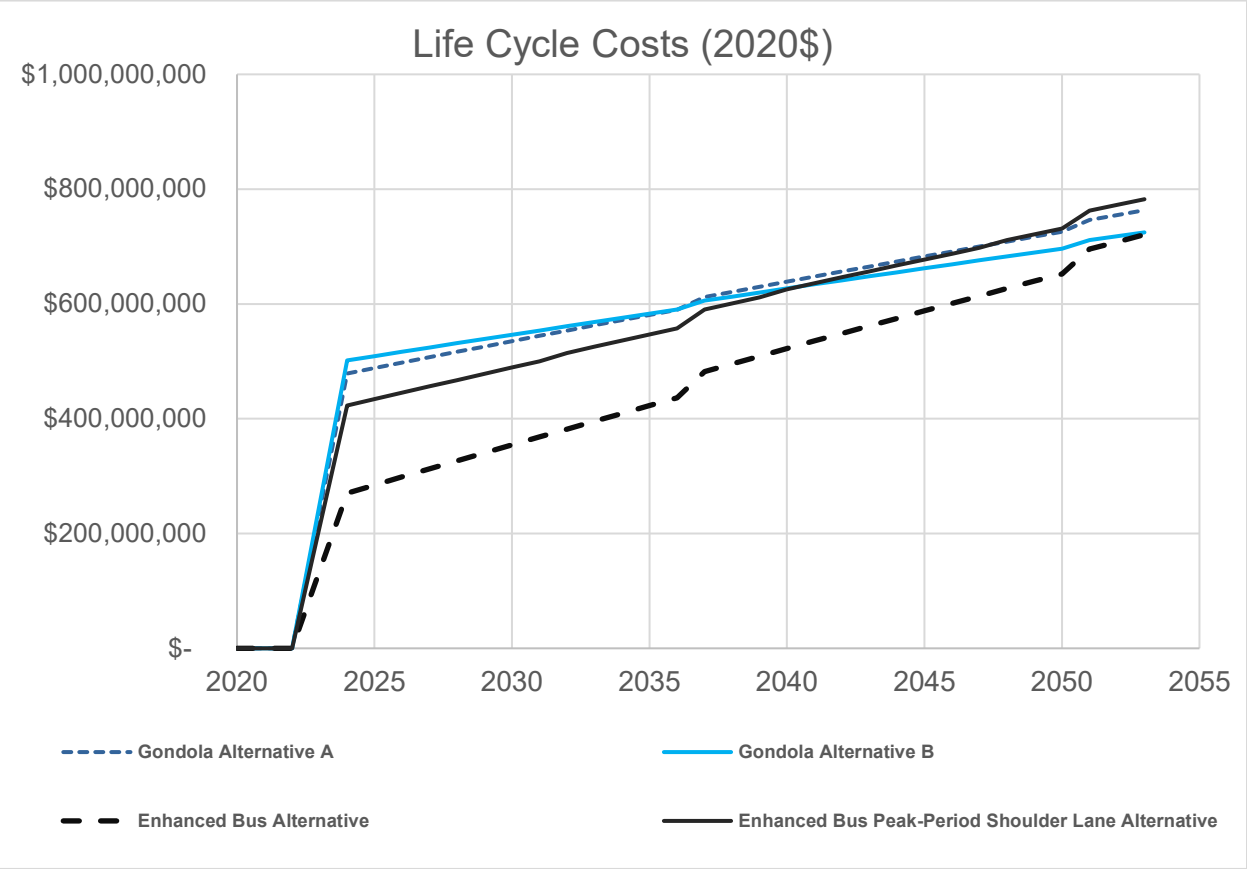


Gondola Alternative A would have a lower initial capital cost ($486M) compared to Gondola Alternative B ($509M), which would be a longer gondola alignment and would require additional improvements to S.R. 210 near the gondola base station to facilitate personal vehicle access to the parking at the base station. Because more gondola riders could park at the base station with Gondola Alternative B, fewer buses (17 buses) would be needed compared to Gondola Alternative A (26 buses), and the annual O&M costs for Gondola Alternative B ($7.6M) would be about $1.9M lower than for Gondola Alternative A ($9.5M). With the lower O&M costs, the cumulative cost becomes less for Gondola Alternative B after about year 2037. After 30 years of operation, the life cycle cost of Gondola Alternative B ($725M) would be about $38M less than that of Gondola Alternative A ($763M).

3.3 Comparison among Enhanced Bus Service and Gondola Alternatives

The 30-year life cycle costs for the enhanced bus service and gondola alternatives are more similar relative to the Cog Rail Alternative. Figure 4 provides the LCCA results for the enhanced bus service and gondola alternatives.

Figure 4. Life Cycle Costs, Enhanced Bus Service and Gondola Alternatives



The following are some comparisons between the bus and gondola alternatives.

- With the higher O&M costs of the bus alternatives (about $11M to $14M annually) compared to the gondola alternatives ($7.6M to $9.5M annually), over time, the cumulative costs of the bus alternatives are closing the initial difference in the cumulative cost curves, which would get established in 2024 by the gondola alternatives' higher initial capital and construction costs.
- The Enhanced Bus Service Alternative, which has the lowest estimated capital cost ($274M), also has the least cumulative cost ($721M) over the 30-year life cycle. The 30-year life cycle cost of Gondola Alternative B ($725M) is about $4M greater. Given the accuracy of the assumptions, these two alternatives have essentially the same 30-year life cycle cost. With a $6.4M higher estimated O&M cost, the cumulative cost of the Enhanced Bus Service Alternative ($14M annually) would likely overtake Gondola Alternative B ($7.6 M annually) within just 1 or 2 more years (2054 or 2055).
- In about 2041, the cumulative costs of the Enhanced Bus Service in Peak-period Shoulder Lane Alternative ($636M in 2041) becomes about $2M higher than Gondola Alternative B ($634M in 2041). The higher operating costs and new bus repurchases (45 buses in 2037) of the Enhanced Bus Service in Peak-period Shoulder Lane Alternative overcomes the cumulative costs of Gondola Alternative B, which has higher initial capital but a lower estimated O&M cost. For comparison, only about 17 buses are needed for Gondola Alternative B.
- Gondola Alternative A ($486M initial capital cost) has a $53M higher estimated capital cost than the Enhanced Bus Service in Peak-period Shoulder Lane Alternative ($433M initial cost). With a higher estimated O&M costs of the Enhanced Bus Service in Peak-period Shoulder Lane Alternative ($11M annually), the cumulative costs of the Enhanced Bus Service in Peak-period Shoulder Lane Alternative exceeds the cumulative costs of Gondola Alternative A ($9.5M annually) in about 2048. Over 30 years, the cumulative cost to purchase and operate 45 buses with the Enhanced Bus Service in Peak-period Shoulder Lane Alternative ($782M) slightly exceeds (+$19M, or +2.5%[9]) the cumulative costs of constructing and operating Gondola Alternative A ($763M) with its 26 buses.

The enhanced bus service alternatives and Gondola Alternative A require more transit riders to transition from their personal vehicles to buses sooner (meaning that the transfer from personal vehicle to transit occurs at mobility hubs that are farther from the entrance to Little Cottonwood Canyon). With these alternatives, more buses would be needed, higher annual O&M costs would be required, and a higher estimated 30-year life cycle cost would result.

4.0 Disclaimer

This LCCA is a simplistic analysis performed to compare the capital versus operating cost differences between fundamentally different alternatives. The costs include many assumptions and uncertainties. Construction costs were based on planning-level design, and O&M costs were based on references that might not account for all aspects of operating the alternatives in the unique setting of Little Cottonwood Canyon. In addition, inflationary factors are dynamic, so year-of-expenditure costs should be expected to be different than what was estimated for this LCCA.

[9] The percent increase (2.5%) equals the cost difference ($19M) divided by the 30-year life cycle cost for Gondola Alternative A ($763M). The calculation is 19 ÷ 763 = 0.025, or 2.5%.

Attachment A. Life Cycle Cost Inputs and Assumptions

Life Cycle Cost Analysis

Assumptions and Inputs

Discount Rate	**2.40%**	Nominal Discount Rate, 2020. Ref. 1
Inflation Rate	**1.98%**	ENR Construction Index, 2019. Ref. 2

Base year 2020
14 year bus life, transmission overhual at about 7 years
40 year rail vehicle life with a major overhaul at 20 years.
Includes annual reserves for gondola equipment replacement
No revenues are included
No salvage value of the equipment
Excludes Wasatch Blvd improvements and tolling infra., which are the same for all alternatives

References:
1. https://www.whitehouse.gov/wp-content/uploads/2019/12/M-20-07.pdf
2. https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/econ/prices/

Cog Rail Alternative, Base (LaCaille) to Alta

	2020$	
Cog Rail Capital	$ 631,500,000	For rail infrastructure, cog rail vehicles, and an operations and maintenance facility (OMF)
North Little Cottonwood Road	$ 43,000,000	Road Improvements (N. LCR only, no Wastach Blvd)
Trailheads	$ 12,400,000	Park and Ride reconfig. ($6.7M) and Trailhead parking ($5.7M) improvements
Mobility Hubs	$ 69,000,000	Includes parking structures ($52M), new interchnage ($2M), and land purchases ($15M)
Road + Rail Snowsheds	$ 250,000,000	Assumes the minimum length (2,465 ft mid-canyon + 3,645 ft upper-canyon) snowsheds
Maintenance Equipment	$ 3,000,000	Needed for snow removal from tracks
Initial Bus System Costs	$ 27,000,000	Includes initial bus purchase, maintenance faciliy, and transit priorty signal control equipment
Future Bus Purchases	$ 9,010,000	17 buses, 14 year replacement cycle, $530k per bus
Rail Vehicles	$ 92,000,000	Rail vehicles; 8 train sets (3 vehicles each) @ $11.5M per set, 40 year life
Rail Vehicle Overhaul	$ 30,360,000	Major rail vehicle overhaul after 20 years service at 1/3 initial capital cost
Bus Overhaul, annualized	$ 121,429	Mid-life Bus transmission overhaul (17 buses / 7 years = 2.4 buses overhauled per year at $50k per)
Rail Operation & Maintenance	$ 2,800,000	Winter Service
Bus O&M	$ 3,600,000	Winter Service, UTA 4/22/21
Additional Snow Removal	$ 600,000	For staging snow removal from rail then road

Net Present Value **$ 1,204,067,211** YOE Cost Discounted to 2020

Year of Expenditure	Years	Capital	Operating and Maintenance	Net Present Value	Cumulative 2020$
2020	0	$ -	$ -	$ -	$ -
2021	1	$ -	$ -	$ -	$ -
2022	2	$ -	$ -	$ -	$ -
2023	3	$ 549,329,422	$ -	$ 511,602,892	$ 511,602,892
2024	4	$ 560,206,144	$ -	$ 509,504,520	$ 1,021,107,412
2025	5	$ -	$ 7,183,228	$ 6,379,988	$ 1,027,487,400
2026	6	$ -	$ 7,196,331	$ 6,241,823	$ 1,033,729,222
2027	7	$ -	$ 7,209,695	$ 6,106,849	$ 1,039,836,071
2028	8	$ -	$ 7,223,322	$ 5,974,992	$ 1,045,811,063
2029	9	$ -	$ 7,237,220	$ 5,846,180	$ 1,051,657,243
2030	10	$ -	$ 7,251,392	$ 5,720,340	$ 1,057,377,583
2031	11	$ -	$ 7,265,846	$ 5,597,404	$ 1,062,974,987
2032	12	$ -	$ 7,280,585	$ 5,477,303	$ 1,068,452,290
2033	13	$ -	$ 7,295,616	$ 5,359,972	$ 1,073,812,262
2034	14	$ -	$ 7,310,945	$ 5,245,346	$ 1,079,057,609
2035	15	$ -	$ 7,326,578	$ 5,133,361	$ 1,084,190,970
2036	16	$ -	$ 7,342,520	$ 5,023,956	$ 1,089,214,925
2037	17	$ 12,574,187	$ 7,358,777	$ 13,319,031	$ 1,102,533,957
2038	18	$ -	$ 7,375,357	$ 4,812,645	$ 1,107,346,601
2039	19	$ -	$ 7,392,265	$ 4,710,623	$ 1,112,057,224
2040	20	$ -	$ 7,409,507	$ 4,610,948	$ 1,116,668,172
2041	21	$ -	$ 7,427,091	$ 4,513,565	$ 1,121,181,736
2042	22	$ -	$ 7,445,023	$ 4,418,420	$ 1,125,600,157
2043	23	$ 47,659,221	$ 7,463,310	$ 31,947,005	$ 1,157,547,162
2044	24	$ -	$ 7,481,960	$ 4,234,639	$ 1,161,781,801
2045	25	$ -	$ 7,500,978	$ 4,145,902	$ 1,165,927,703
2046	26	$ -	$ 7,520,373	$ 4,059,201	$ 1,169,986,903
2047	27	$ -	$ 7,540,152	$ 3,974,489	$ 1,173,961,392
2048	28	$ -	$ 7,560,323	$ 3,891,720	$ 1,177,853,112
2049	29	$ -	$ 7,580,893	$ 3,810,848	$ 1,181,663,960
2050	30	$ -	$ 7,601,871	$ 3,731,829	$ 1,185,395,789
2051	31	$ 16,545,886	$ 7,623,263	$ 11,586,779	$ 1,196,982,568
2052	32	$ -	$ 7,645,080	$ 3,579,179	$ 1,200,561,747
2053	33	$ -	$ 7,667,328	$ 3,505,464	**$ 1,204,067,211**

Gondola Alternative Option A, base station at canyon entrance w/ remote mobility hubs

	2020$	
Gondola Capital	$ 253,000,000	Stations, towers, cabins.
Park & Ride and Trailhead	$ 12,500,000	Reconfigured parking
Initial Bus System Costs	$ 49,000,000	Includes initial bus purchase, maintenance faciliy, and transit priorty control equipment
Future Bus Purchases	$ 13,780,000	26 buses
Road Snow Sheds	$ 72,300,000	Snowsheds with berms (2,465 ft mid-canyon)
Mobility Hubs	$ 99,000,000	Includes parking ($52M), interchange ($32M) and land purchases ($15)
Gondola O&M	$ 3,984,000	Winter Service. Includes annual equipment replacement reserves
Bus O&M	$ 5,500,000	Winter Service
Bus Overhaul, annualized	$ 185,714	Mid-life Bus transmission overhaul (26 buses / 7 years = 3.7 buses overhauled per year at $50k per)
Net Present Value	**$ 763,354,547**	YOE Cost Discounted to 2020

Year of Expenditure	Years	Capital	Operating and Maintenance	Net Present Value	Cumulative 2020$
2020	0	$ -	$ -	$ -	$ -
2021	1	$ -	$ -	$ -	$ -
2022	2	$ -	$ -	$ -	$ -
2023	3	$ 257,615,825	$ -	$ 239,923,433	$ 239,923,433
2024	4	$ 262,716,618	$ -	$ 238,939,372	$ 478,862,806
2025	5	$ -	$ 10,665,683	$ 9,473,030	$ 488,335,836
2026	6	$ -	$ 10,876,864	$ 9,434,175	$ 497,770,011
2027	7	$ -	$ 11,092,226	$ 9,395,481	$ 507,165,492
2028	8	$ -	$ 11,311,852	$ 9,356,944	$ 516,522,436
2029	9	$ -	$ 11,535,826	$ 9,318,566	$ 525,841,002
2030	10	$ -	$ 11,764,236	$ 9,280,346	$ 535,121,348
2031	11	$ -	$ 11,997,168	$ 9,242,282	$ 544,363,630
2032	12	$ -	$ 12,234,712	$ 9,204,374	$ 553,568,004
2033	13	$ -	$ 12,476,959	$ 9,166,622	$ 562,734,625
2034	14	$ -	$ 12,724,003	$ 9,129,024	$ 571,863,649
2035	15	$ -	$ 12,975,938	$ 9,091,581	$ 580,955,230
2036	16	$ -	$ 13,232,861	$ 9,054,291	$ 590,009,521
2037	17	$ 19,231,110	$ 13,494,872	$ 21,867,212	$ 611,876,734
2038	18	$ -	$ 13,762,071	$ 8,980,170	$ 620,856,904
2039	19	$ -	$ 14,034,560	$ 8,943,337	$ 629,800,241
2040	20	$ -	$ 14,312,444	$ 8,906,656	$ 638,706,897
2041	21	$ -	$ 14,595,830	$ 8,870,124	$ 647,577,021
2042	22	$ -	$ 14,884,828	$ 8,833,743	$ 656,410,764
2043	23	$ -	$ 15,179,547	$ 8,797,511	$ 665,208,275
2044	24	$ -	$ 15,480,102	$ 8,761,427	$ 673,969,703
2045	25	$ -	$ 15,786,608	$ 8,725,492	$ 682,695,195
2046	26	$ -	$ 16,099,183	$ 8,689,704	$ 691,384,898
2047	27	$ -	$ 16,417,947	$ 8,654,062	$ 700,038,961
2048	28	$ -	$ 16,743,022	$ 8,618,567	$ 708,657,528
2049	29	$ -	$ 17,074,534	$ 8,583,218	$ 717,240,745
2050	30	$ -	$ 17,412,610	$ 8,548,013	$ 725,788,758
2051	31	$ 25,305,473	$ 17,757,380	$ 20,644,489	$ 746,433,247
2052	32	$ -	$ 18,108,976	$ 8,478,036	$ 754,911,283
2053	33	$ -	$ 18,467,533	$ 8,443,263	**$ 763,354,547**

Gondola Alternative Option B (LaCaille), some parking at the base station w/ smaller remote mobility hubs

	2020$	
Gondola Capital, high range	$ 285,000,000	Stations, towers, cabins.
N Little Cottonwood Rd Impr.	$ 43,000,000	Road improvements near base station
Park & Ride and Trailhead	$ 12,500,000	Paved traiheads
Initial Bus System Costs	$ 27,000,000	Includes initial bus purchase, bus maintenance faciliy, and transit priorty control equipment
Future Bus Purchases	$ 9,010,000	17 buses, 14 year replacement cycle
Road Snow Sheds	$ 72,300,000	Snowsheds with berms (2,465 ft mid-canyon)
Mobility Hubs	$ 69,000,000	Includes parking ($52M), interchange ($2M) and land purchases ($15)
Gondola O&M	$ 3,984,000	Winter, includes annual equipment replacement reserves
Bus O&M	$ 3,600,000	Winter
Bus Overhaul, annualized	$ 121,429	Mid-life Bus transmission overhaul (17 buses / 7 years = 2.4 buses overhauled per year at $50k per)
Net Present Value	**$ 724,662,280**	YOE Cost Discounted to 2020

Year of Expenditure	Years	Capital	Operating and Maintenance	Net Present Value	Cumulative 2020$
2020	0	$ -	$ -	$ -	$ -
2021	1	$ -	$ -	$ -	$ -
2022	2	$ -	$ -	$ -	$ -
2023	3	$ 269,812,540	$ -	$ 251,282,509	$ 251,282,509
2024	4	$ 275,154,828	$ -	$ 250,251,858	$ 501,534,367
2025	5	$ -	$ 8,499,078	$ 7,548,698	$ 509,083,065
2026	6	$ -	$ 8,667,360	$ 7,517,737	$ 516,600,802
2027	7	$ -	$ 8,838,974	$ 7,486,902	$ 524,087,704
2028	8	$ -	$ 9,013,986	$ 7,456,194	$ 531,543,898
2029	9	$ -	$ 9,192,463	$ 7,425,612	$ 538,969,510
2030	10	$ -	$ 9,374,473	$ 7,395,155	$ 546,364,666
2031	11	$ -	$ 9,560,088	$ 7,364,824	$ 553,729,490
2032	12	$ -	$ 9,749,378	$ 7,334,616	$ 561,064,106
2033	13	$ -	$ 9,942,415	$ 7,304,533	$ 568,368,639
2034	14	$ -	$ 10,139,275	$ 7,274,573	$ 575,643,212
2035	15	$ -	$ 10,340,033	$ 7,244,736	$ 582,887,948
2036	16	$ -	$ 10,544,765	$ 7,215,021	$ 590,102,970
2037	17	$ 12,574,187	$ 10,753,552	$ 15,587,389	$ 605,690,359
2038	18	$ -	$ 10,966,472	$ 7,155,957	$ 612,846,316
2039	19	$ -	$ 11,183,608	$ 7,126,606	$ 619,972,922
2040	20	$ -	$ 11,405,044	$ 7,097,376	$ 627,070,298
2041	21	$ -	$ 11,630,864	$ 7,068,266	$ 634,138,564
2042	22	$ -	$ 11,861,155	$ 7,039,275	$ 641,177,839
2043	23	$ -	$ 12,096,005	$ 7,010,403	$ 648,188,242
2044	24	$ -	$ 12,335,506	$ 6,981,649	$ 655,169,891
2045	25	$ -	$ 12,579,749	$ 6,953,014	$ 662,122,904
2046	26	$ -	$ 12,828,828	$ 6,924,495	$ 669,047,400
2047	27	$ -	$ 13,082,839	$ 6,896,094	$ 675,943,494
2048	28	$ -	$ 13,341,879	$ 6,867,809	$ 682,811,303
2049	29	$ -	$ 13,606,049	$ 6,839,641	$ 689,650,943
2050	30	$ -	$ 13,875,448	$ 6,811,587	$ 696,462,531
2051	31	$ 16,545,886	$ 14,150,182	$ 14,715,807	$ 711,178,338
2052	32	$ -	$ 14,430,356	$ 6,755,826	$ 717,934,164
2053	33	$ -	$ 14,716,077	$ 6,728,116	**$ 724,662,280**

Enhanced Bus Service

	2020$	
Initial Bus System Costs	$ 97,000,000	Includes initial bus purchase, maintenance faciliy, and transit priorty control equipment
Future Bus Purchases	$ 34,450,000	65 buses at $530k per
Mobility Hubs	$ 99,000,000	Mobility Hub ($52M), Interchange ($32M), and ROW ($15M)
Trailhead parking	$ 5,800,000	Trailheads
Road Snow Sheds	$ 72,300,000	Snowsheds with berms (2,465 ft mid-canyon)
Bus O&M	$ 14,000,000	per UTA 4/22/21
Bus Overhaul, annualized	$ 464,286	Mid-life Bus transmission overhaul (65 buses / 7 years = 9.3 buses overhauled per year at $50k per)
Net Present Value	**$ 720,823,910**	YOE Cost Discounted to 2020

Year of Expenditure	Years	Capital	Operating and Maintenance	Net Present Value	Cumulative 2020$
2020	0	$ -	$ -	$ -	$ -
2021	1	$ -	$ -	$ -	$ -
2022	2	$ -	$ -	$ -	$ -
2023	3	$ 145,353,021	$ -	$ 135,370,550	$ 135,370,550
2024	4	$ 148,231,011	$ -	$ 134,815,319	$ 270,185,869
2025	5	$ -	$ 15,954,090	$ 14,170,078	$ 284,355,947
2026	6	$ -	$ 16,269,981	$ 14,111,959	$ 298,467,906
2027	7	$ -	$ 16,592,126	$ 14,054,078	$ 312,521,983
2028	8	$ -	$ 16,920,650	$ 13,996,434	$ 326,518,417
2029	9	$ -	$ 17,255,679	$ 13,939,027	$ 340,457,444
2030	10	$ -	$ 17,597,342	$ 13,881,855	$ 354,339,299
2031	11	$ -	$ 17,945,769	$ 13,824,918	$ 368,164,217
2032	12	$ -	$ 18,301,095	$ 13,768,214	$ 381,932,431
2033	13	$ -	$ 18,663,457	$ 13,711,743	$ 395,644,173
2034	14	$ -	$ 19,032,993	$ 13,655,503	$ 409,299,676
2035	15	$ -	$ 19,409,847	$ 13,599,494	$ 422,899,171
2036	16	$ -	$ 19,794,162	$ 13,543,715	$ 436,442,886
2037	17	$ 48,077,774	$ 20,186,086	$ 45,613,309	$ 482,056,195
2038	18	$ -	$ 20,585,771	$ 13,432,842	$ 495,489,037
2039	19	$ -	$ 20,993,369	$ 13,377,746	$ 508,866,784
2040	20	$ -	$ 21,409,038	$ 13,322,877	$ 522,189,660
2041	21	$ -	$ 21,832,937	$ 13,268,232	$ 535,457,893
2042	22	$ -	$ 22,265,229	$ 13,213,812	$ 548,671,704
2043	23	$ -	$ 22,706,080	$ 13,159,614	$ 561,831,319
2044	24	$ -	$ 23,155,661	$ 13,105,639	$ 574,936,958
2045	25	$ -	$ 23,614,143	$ 13,051,886	$ 587,988,844
2046	26	$ -	$ 24,081,703	$ 12,998,353	$ 600,987,197
2047	27	$ -	$ 24,558,520	$ 12,945,039	$ 613,932,236
2048	28	$ -	$ 25,044,779	$ 12,891,944	$ 626,824,180
2049	29	$ -	$ 25,540,666	$ 12,839,067	$ 639,663,247
2050	30	$ -	$ 26,046,371	$ 12,786,407	$ 652,449,654
2051	31	$ 63,263,682	$ 26,562,089	$ 43,062,803	$ 695,512,457
2052	32	$ -	$ 27,088,018	$ 12,681,734	$ 708,194,191
2053	33	$ -	$ 27,624,361	$ 12,629,719	**$ 720,823,910**

Enhanced Bus Service in Peak-Period Shoulder Lane

	2020$	
Peak-Period Shoulder	$ 183,000,000	LCC Roadway widening
Peak-Period Shoulder Repave	$ 4,000,000	Repaving shoulders every 8 years
Initial Bus System Costs	$ 69,000,000	Includes initial bus purchase, maintenance faciliy, and transit priorty control equipment
Future Bus Purchases	$ 23,850,000	45 buses, $530k per bus
Road Snow Sheds	$ 72,300,000	Snowsheds with berms
Mobility Hubs	$ 99,000,000	Mobility Hub ($52M), Interchange ($32M), and ROW ($15M)
Trailhead parking	$ 5,800,000	Trailheads
Bus O&M	$ 10,800,000	UTA 4/22/21
Bus Overhaul, annualized	$ 321,429	Mid-life Bus transmission overhaul (45 buses / 7 years = 6.4 buses overhauled per year at $50k per)
Additional Snow Removal	$ 250,000	Estimated to clear PPSL annually
Bus O&M	**$ 782,446,651**	YOE Cost Discounted to 2020

Year of Expenditure	Years	Capital	Operating and Maintenance	Net Present Value	Cumulative 2020$
2020	0	$ -	$ -	$ -	$ -
2021	1	$ -	$ -	$ -	$ -
2022	2	$ -	$ -	$ -	$ -
2023	3	$ 227,548,272	$ -	$ 211,920,842	$ 211,920,842
2024	4	$ 232,053,728	$ -	$ 211,051,636	$ 422,972,478
2025	5	$ -	$ 12,542,672	$ 11,140,131	$ 434,112,609
2026	6	$ -	$ 12,791,017	$ 11,094,439	$ 445,207,048
2027	7	$ -	$ 13,044,279	$ 11,048,934	$ 456,255,982
2028	8	$ -	$ 13,302,556	$ 11,003,616	$ 467,259,598
2029	9	$ -	$ 13,565,946	$ 10,958,484	$ 478,218,082
2030	10	$ -	$ 13,834,552	$ 10,913,537	$ 489,131,620
2031	11	$ -	$ 14,108,476	$ 10,868,775	$ 500,000,394
2032	12	$ 5,061,044	$ 14,387,824	$ 14,631,702	$ 514,632,096
2033	13	$ -	$ 14,672,703	$ 10,779,800	$ 525,411,896
2034	14	$ -	$ 14,963,223	$ 10,735,586	$ 536,147,482
2035	15	$ -	$ 15,259,494	$ 10,691,553	$ 546,839,035
2036	16	$ -	$ 15,561,632	$ 10,647,701	$ 557,486,735
2037	17	$ 33,284,613	$ 15,869,753	$ 32,844,514	$ 590,331,249
2038	18	$ -	$ 16,183,974	$ 10,560,536	$ 600,891,785
2039	19	$ -	$ 16,504,416	$ 10,517,221	$ 611,409,006
2040	20	$ 5,920,524	$ 16,831,204	$ 14,158,435	$ 625,567,441
2041	21	$ -	$ 17,164,462	$ 10,431,124	$ 635,998,564
2042	22	$ -	$ 17,504,318	$ 10,388,340	$ 646,386,904
2043	23	$ -	$ 17,850,904	$ 10,345,731	$ 656,732,636
2044	24	$ -	$ 18,204,351	$ 10,303,298	$ 667,035,933
2045	25	$ -	$ 18,564,798	$ 10,261,038	$ 677,296,972
2046	26	$ -	$ 18,932,381	$ 10,218,952	$ 687,515,923
2047	27	$ -	$ 19,307,242	$ 10,177,038	$ 697,692,962
2048	28	$ 6,925,964	$ 19,689,525	$ 13,700,476	$ 711,393,438
2049	29	$ -	$ 20,079,378	$ 10,093,726	$ 721,487,164
2050	30	$ -	$ 20,476,949	$ 10,052,326	$ 731,539,489
2051	31	$ 43,797,934	$ 20,882,393	$ 31,007,985	$ 762,547,475
2052	32	$ -	$ 21,295,864	$ 9,970,034	$ 772,517,509
2053	33	$ -	$ 21,717,522	$ 9,929,142	**$ 782,446,651**