MOUNTAIN ACCORD

Mountain Accord Cottonwood Canyons Long Term Transportation Solutions Technical Memorandum

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1 Introduction

Growth in visitation to the Cottonwood Canyons has steadily increased in recent years, and has highlighted the need for year-round transportation solutions to alleviate congestion and single-occupant vehicle travel. Winter visitation, which is primarily destined for ski resorts, creates a slow-moving line of cars that stretch nearly the length of each canyon on busy winter days. In the summer, however, multiple destinations such as trailheads, picnic areas, and fishing spots create a more dispersed pattern of use in each canyon. Additionally, summer visitors access the canyons on bike and as pedestrians, sharing the roadways and shoulder areas with auto users. Over the next 20 years, this pattern of use is expected to intensify and further strain the sensitive natural environment of the canyons as well as transportation infrastructure. The following seeks to evaluate potential long term transportation solutions that will meet the diverse needs of canyon users while reducing the impact of users within the canyons.

Long range transportation solutions in the Cottonwood Canyons achieve a number of significant goals of the Mountain Accord. The proposed solutions, described in the following memo, will accommodate and manage growth in use and the varied travel markets while maintaining positive recreation experiences and minimizing impacts to natural resources. For the purpose of this memo, “long range” is intended to be the year 2040. This planning horizon is adequate to understand the impact of and plan for potential infrastructure investments in the Cottonwood Canyons.

2 Long Range Alternative Screening

Transportation solutions for the Cottonwood Canyons have been the subject of a number of previous studies. A range of transportation solutions, from minor operational and low cost capital improvements to significant infrastructure investments, were discussed in these studies. The "universe" of the significant transportation infrastructure investments serve as the basis for the following evaluation. The full universe of solutions may be found in Appendix A.

The following first includes a Tier 1 evaluation which suggests that transportation alternatives that include high impact, high cost design and operational challenges are not appropriate long term solutions. The Tier 1 evaluation process and results draw on findings from previous studies which found some alternatives to be infeasible in the canyons. From this analysis, a smaller set of alternatives emerge. A second phase, a Tier 2 evaluation, is then conducted on the smaller set of alternatives. The goal of the Tier 2 evaluation is to refine the project definition, cost, and service plans in sufficient detail to update the existing project definition in Wasatch Front Regional Council (WFRC) Long Range Plan (LRP), and to further regional planning discussions.

2.1 Tier 1 Evaluation Methodology

Nearly 130 short and long term transportation solutions have been proposed and evaluated in 47 previous studies. The intent of this effort and the Tier 1 analysis is to summarize the findings and categorize feasible solutions already established for further study. A detailed review of these studies and alternatives is included as Appendix A. The alternatives presented in Section 3 below reflect findings and serve as the starting point for this memo and analysis.

2.2 Tier 2 Evaluation Methodology

Once the Tier 1 universe of alternatives were evaluated, the Tier 2 evaluation process analyzed the recommended alternatives using both qualitative and quantitative measures. This process of evaluation considered the following criteria.

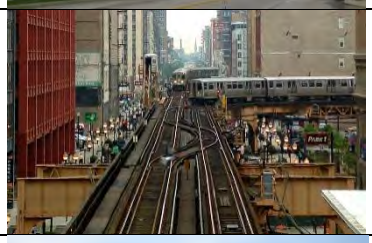
- Cost: The capital/operating cost – this measure calculates the capital cost, annual operations and maintenance costs, and lifecycle costs for each alternative and connection.
- Transit: Transit ridership for canyon access – forecasted ridership for each alternative and connection. Average daily canyon-wide boardings have been estimated in both existing (2016) and forecasted (2040) conditions.
- Cars: The number of single-occupancy vehicles (SOVs) accessing the canyons – this measure estimated the number of single occupant vehicles that enter the Canyons daily.
- Parking: Reduced demand for parking in and near the canyons - This measure allows an assessment of the number of SOVs removed from the canyon roads due to the implementation of each alternative
- Environment: The qualitative impacts to water, lands, and environment within the identified footprint – this measure provides an estimate of the size of impact each alternative may have in the canyons. This is a simple measurement of the number of square feet affected by the project's footprint.

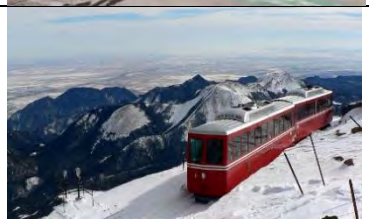
Data was collected and analyzed for each of the five evaluation criteria. Detailed findings for each alternative are presented in Section 4.

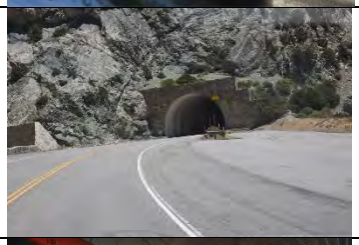
3 Tier 1 Alternatives

Due to the large number of long-term infrastructure investments proposed, Table 1 presents a summary of each transportation "mode" or category as well as recommendation for each.

Table 1: Summary of Tier 1 Long Range Alternatives, Recommended Action

Mode	Example	Characteristics	Recommendation
Maglev		• Uses magnetic levitation • Exclusive guideway • Very high speed	• Not feasible for sharp curves and steep grades found in canyons. • Not recommended
Cable Liner		• Accommodate grades between 10-15%. • Top speed 30 MPH. • Optimal for corridors from .3 to 1.8 miles	• Not feasible for corridors over 6 miles • Not recommended
Heavy Rail		• Exclusive guideway • Utilizes "third rail" infrastructure	• Not feasible along steep grades found in canyons • Not recommended
Commuter Rail		• Exclusive guideway • Railroad-type operations	• Not feasible for sharp curves and steep grades found in canyons. • Not recommended
Monorail		• Exclusive, elevated guideway	• Not feasible along steep grades found in canyons • Not recommended

Mode	Example	Characteristics	Recommendation
Funicular		• Top speed 30 MPH • Operates on steep grades for short distances	• Small service capacity not appropriate for corridors longer than 2 to 3 miles. • Not recommended
Light Rail		• Fixed guideway • High capacity vehicles	• Not feasible for grades exceeding 6% for lengths in excess of 1500' • Not recommended
Cog Rail		• Feasible for steep grades • High capacity vehicles • Adequate speed • Large environmental footprint • High capital costs • Limited by sharp horizontal curves	• Recommended for further consideration
Hyperloop		• Very high speed 650 MPH • Exclusive, elevated guideway	• Not appropriate for sharp curves; radius necessary for top speeds approach 57,000' • Not recommended
Funifor		• Top speed: 30 MPH	• Operational limitation • Not recommended
Gondola 3S – Aerial Tram		• Medium range capital costs • Small environmental footprint • High operating costs • Top speed 17 MPH – high travel time • Visual impacts	• Long travel time up canyons • Limited access • Not recommended

Mode	Example	Characteristics	Recommendation
Bus Rapid Transit (BRT)		• Medium range capital cost • Large environmental footprint w/dedicated lane • Adequate speed in canyons • Good capacity	• Recommended for further consideration
Enhanced Bus		• Expansion of existing service • Low capital costs • Low operating costs • Small environmental footprint • Adequate speeds • Good capacity	• Recommended for further consideration
Widen Roadways		• Medium range capital costs • Large environmental footprint • Adequate speeds	• Considerable environmental footprint • Not recommended
Limitations on Vehicles – Transit Only		• High capital and operating costs to accommodate visitation • Adequate speed in canyons • Good capacity	• High capital cost • High operating costs • Not recommended
Tunnel – Little Cottonwood Canyon		• Tunnel along entire length of LCC • Limited access	• High capital cost • High operating costs • Not recommended
Tunnel – Alta to Brighton (Transit Only)		• High capital costs • High operating costs • Increases transit ridership capacity	• Recommended for further consideration in conjunction with additional transit investment

Mode	Example	Characteristics	Recommendation
Aerial connection – Alta to Brighton		• High capital costs • High operating costs • Requires transfer from other modes	• Recommended for further consideration in conjunction with additional transit investment

3.1 Recommended Alternatives

Based on Tier 1 evaluation of the universe of solutions, the following alternatives were selected for further consideration. It should be noted that while there are three modal (ie: bus, rail, etc) alternatives, additional infrastructure and design alternatives are considered in conjunction with the modal alternatives. Thus, the transit-only tunnel and aerial connections between Alta and Brighton ski resorts are considered and evaluated in conjunction with rail and bus alternatives in the canyons. The consideration of the connections expands the total number of Tier 2 alternatives to nine. These alternatives include:

Alternative 1: Enhanced Bus: This option provides bus services with 15-minute headways in both canyons.

Option 1A: Enhanced Bus + Bus Tunnel: This option builds on the enhanced bus service by creating a bus-only tunnel connection between the bases of Alta and Brighton ski resorts.
Option 1B: Enhanced Bus + Aerial Connection: This option builds on the enhanced bus service by creating an aerial connection between the bases of Alta and Brighton ski resorts.

Alternative 2: BRT: This option provides bus service on exclusive bus lanes in Little Cottonwood Canyon (LCC). Headways are projected at 30 minutes.

Option 2A: BRT + Bus Tunnel: This option builds on the BRT bus service by creating a bus-only tunnel connection between the bases of Alta and Brighton ski resorts.
Option 2B: BRT + Aerial Connection: This option builds on the BRT service by creating an aerial connection between the bases of Alta and Brighton ski resorts.

Alternative 3: Cog Rail: This option provides cog rail service on an exclusive, fixed railway in LCC. It is recognized that a light rail line is feasible in the Valley, and thus a design alternative includes the consideration of a light rail alternative in the Valley and a cog rail alternative in LCC. However, for the purposes of this evaluation, one continuous rail line from the Valley into LCC is assumed. Headways are projected at 30 minutes.

Option 3A: Cog Rail + Rail Tunnel: This option builds on the cog rail infrastructure by creating a rail-only tunnel connection between the bases of Alta and Brighton ski resorts.
Option 3B: Cog Rail + Aerial Connection: This option builds on the cog rail by creating an aerial connection between the bases of Alta and Brighton ski resorts.

4 Tier 2 Alternatives

As a part of the overall evaluation and feasibility analysis for solutions, it was decided that major-capital long-term improvements would be proposed for LCC over BCC due to several reasons. These include:

- Currently, UTA reports higher ridership in LCC
- Geography in BCC makes rail construction more expensive
- Year-round destination for visitors
- Seasonal attractions and destinations

4.1 Travel Forecast Methodology and Assumptions

A sketch-level model was developed to forecast the 2040 ridership for each of the Tier 2 alternatives and connection options. The model was developed using a straightforward technical approach and grounded in existing travel model input and 2015, 2016 observed data. The model was developed using the existing WFRC travel demand model and calibrated toward all types of recreation. The results from this model provide a conservative estimate, using the best available information currently available. Given additional data set(s), the model would likely show improved results. However, there are limitations in understanding the travel markets outside of the canyons. Further studies and work should be done to better understand the travel markets in the valley. Additional detail on the development of the travel demand model, as well as its abilities and limitations, are provided in Appendix B.

Table 2 below presents an overview of the data utilized to create this model. A more detailed methodology report for the forecasting efforts is included in Appendix B. Results from the sketch model are included for each alternative in the following sections, with more detailed results also included in Appendix B.