

Pikes Peak Conceptual Shuttle Study

Visitation Trends and Scenario Planning



April 2016

Prepared for:
U.S. Forest Service



U.S. Department of Transportation
John A. Volpe National Transportation Systems Center

Volpe

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.			
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 04/15/2016	3. REPORT TYPE AND DATES COVERED Final Report (November 2015-April 2016)	
4. TITLE AND SUBTITLE Pikes Peak Conceptual Shuttle Study: Visitation Trends and Scenario Planning		5a. FUNDING NUMBERS 51VXS4A100 PB066	
6. AUTHOR(S) Benjamin Rasmussen, Christopher Timmel		5b. CONTRACT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Department of Transportation Office of the Assistant Secretary for Research and Technology John A. Volpe National Transportation Systems Center 55 Broadway Cambridge, MA 02142		8. PERFORMING ORGANIZATION REPORT NUMBER DOT-VNTSC-USDA-16-02	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) United States Department of Agriculture United States Forest Service 1400 Independence Avenue, SW Washington, DC 20250		10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION/AVAILABILITY STATEMENT Public Distribution/Availability		12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) This study for the U.S. Forest Service provides a preliminary analysis and set of recommendations to support the agency's work moving forward to implement a shuttle system at Colorado's popular Pikes Peak in Pike and San Isabel National Forests. The purpose of this project is to manage visitation when the Summit House and parking area are closed for reconstruction in the next few years. This report provides an analysis on recent visitation trends, followed by a presentation of two proposed shuttle scenarios: a mandatory service during construction, and a voluntary service after construction. Proposed scenarios includes a vehicle recommendation, description of possible staging areas, and preliminary cost estimates. The report concludes with an initial timeline for implementation and recommended next steps.			
14. SUBJECT TERMS Transit, Alternative Transportation, United States Forest Service, Pikes Peak		15. NUMBER OF PAGES 18	
		16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited

Overview

Pikes Peak, commonly referred to as “America’s Mountain,” is located within Pike and San Isabel National Forests 15 miles west of Colorado Springs, CO. Rising 14,115 feet at the summit, Pikes Peak is one of the tallest mountains on the southern Front Range of the Rocky Mountains, attracting hundreds of thousands of visitors each year.

The summit includes a popular visitors center, including a 200-capacity parking lot, accessible by Pikes Peak Highway, the [Pikes Peak Cog Railway](#), and the Barr Trail for those making the ascent by foot. Due to the weathered condition, age, and small size of the existing visitors center, the building is slated to be replaced with a state-of-the-art summit complex by 2020. While the summit will remain open throughout construction, vehicle access will be limited to only construction and handicap vehicles during the summer seasons. Therefore, the project team, consisting of the City of Colorado Springs, U.S. Forest Service (USFS), U.S. Army Research Institute of Environmental Medicine, and Colorado Springs Utilities, and Cog Railway, is planning to implement a shuttle system to transport visitors to the summit during peak visitation months.

The USFS requested the assistance of the U.S. Department of Transportation Volpe Center (Volpe) to develop a preliminary concept for a shuttle system. Between November 2-4, 2015, Volpe traveled to Pikes Peak to conduct a site visit and meet with project team members to gather important information on visitation, road conditions, and the design concept for the new summit complex.

This report provides a brief analysis on recent visitation trends, followed by a presentation for two shuttle system scenarios – 1) a mandatory service during construction and 2) a voluntary service after construction – with a vehicle recommendation, description of possible staging areas, and preliminary cost estimates. The report concludes with an initial timeline for implementation and next steps.

Existing Conditions

Visitation Trends

In 2015, Pikes Peak reached a record number of visitors: over 415,000 in the calendar year. Figure 1 illustrates the recent trend in visitation, rising 20 percent each year since 2013. Historically, Pikes Peak visitation has risen and fallen since 1948¹, maintaining an average of 263,619 visitors per year. When considering the last seven years, this average is 303,415. Historically, the general trends in visitation are consistent with the cost of gas, where the lower the price per gallon, the higher the annual visitation. More recently, the population within the Colorado Springs, CO, metropolitan area has grown more than 20 percent since 2000, which correlates with higher than average visitation despite the fact that gas prices were at their highest in 2012.

Although historical trends indicate that visitation may drop, the growing regional population and below average gas prices are likely to keep current visitation rates steady, which is important particularly in planning for a shuttle service to be implemented in the near term. Therefore, Volpe used 2015 statistics as the basis for the scenario plans described later in this report.

¹ Visitation data was collected from the City of Colorado Springs.

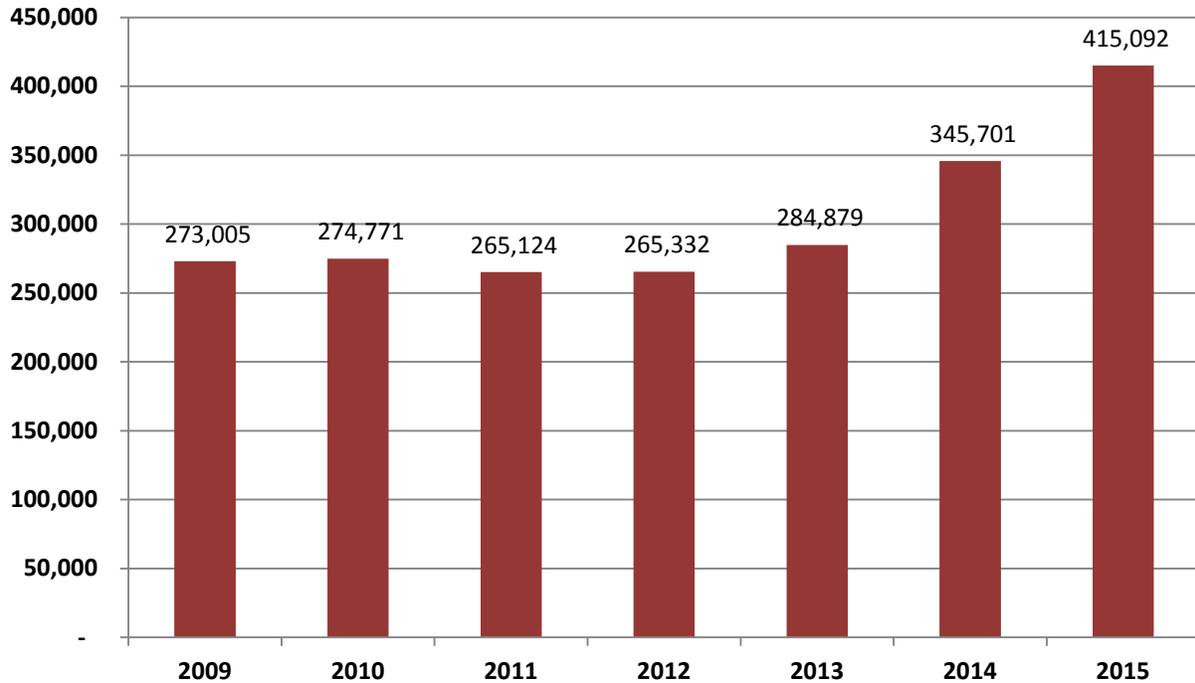


Figure 1: Total Annual Visitation, 2009-2015

Looking at average daily trends for 2015, Figure 2 shows that weekend visitation attracted over 1,700 people/day, while an average weekday attracted just over 900 people. Monday and Friday increase this average with about 1,000 visitors/day.

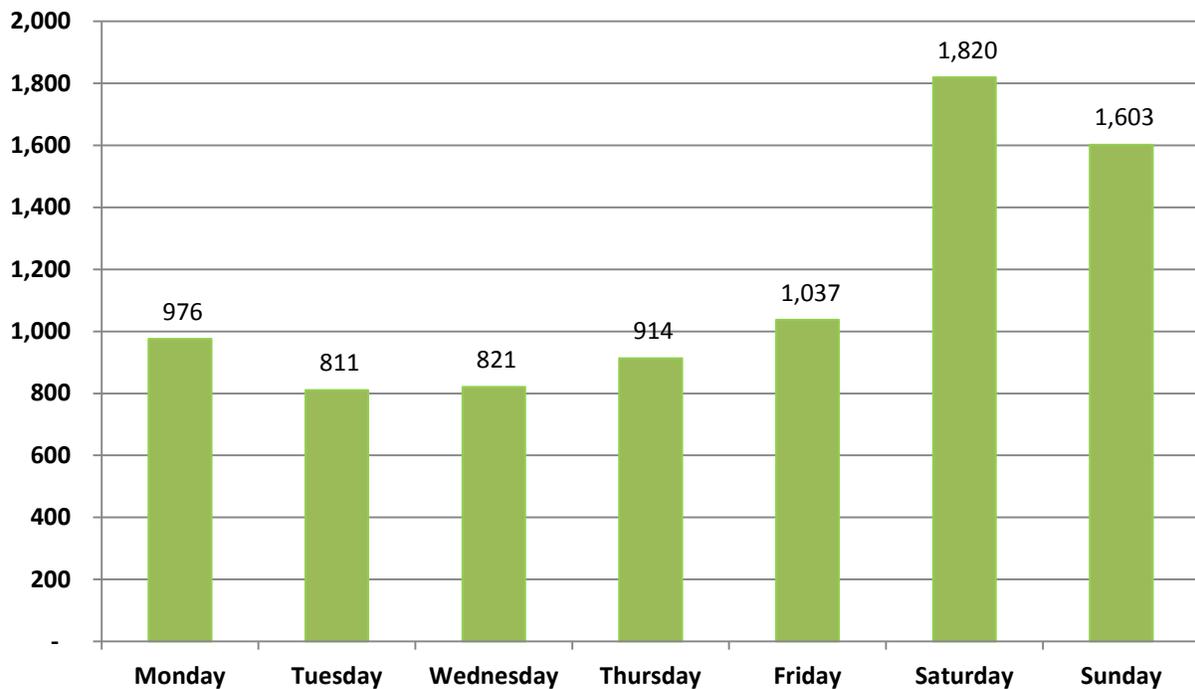


Figure 2: Average Daily Visitation, 2015

Looking at average monthly and seasonal distribution, Volpe organized each calendar month within one of four distinct categories based on average visitation. Figure 3 illustrates the results of this analysis. Summer (June through September) is by far the most popular time to visit Pikes Peak, with a monthly average of 75,000 visitors. The Shoulder Season (May and October) follows with an average of 26,000 visitors per month, while visitation falls by 50 percent consecutively in Early Spring/Late Fall (March, April, and November) and Winter (January, February, and December), with respective averages of 13,500 and 6,000 visitors per month.

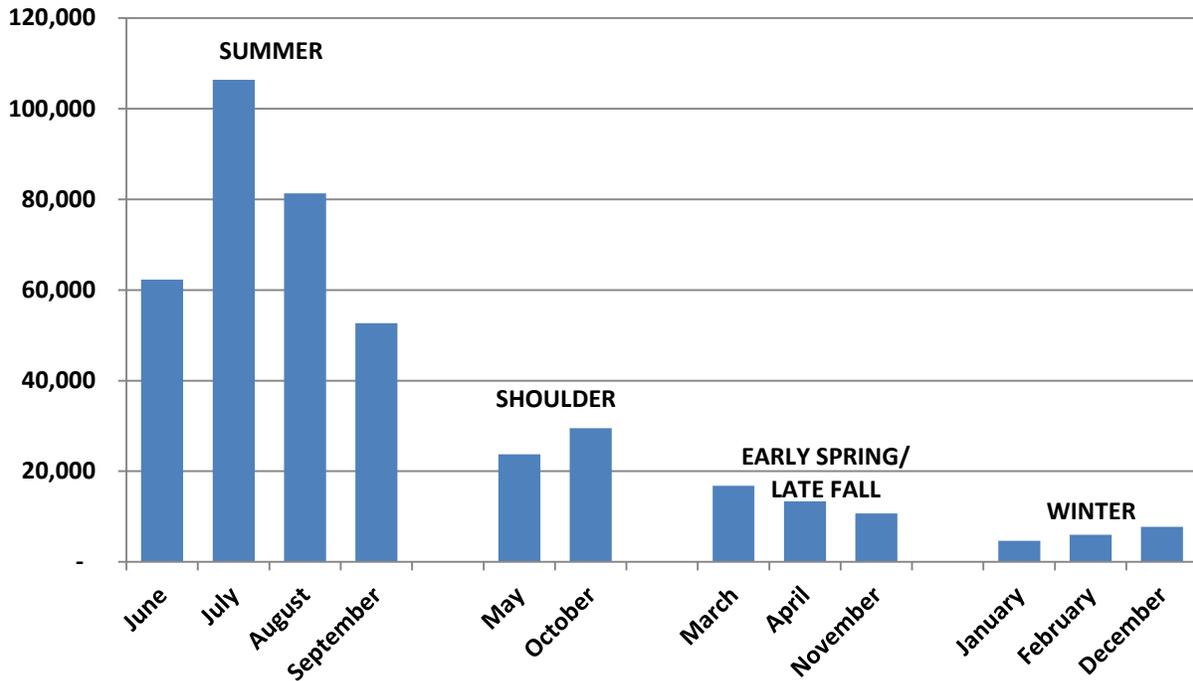


Figure 3: Average Visitation by Month & Season, 2015

Continuing to use a seasonal distribution, Figure 4 presents average daily visitation across the four seasons outlined above. When considering only summer, the average daily visitation rises by 154 percent compared to the annual average statistics displayed in Figure 2. Since the majority of visits occur throughout the summer months, Volpe used summer 2015 data to plan a shuttle system that can manage this peak visitation.

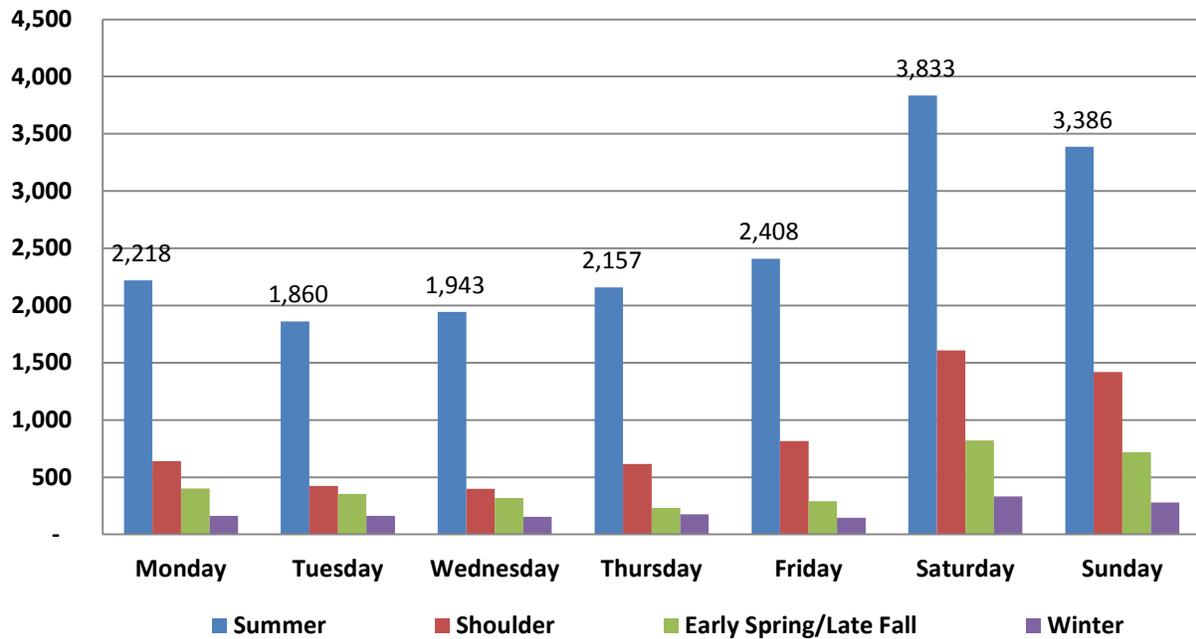


Figure 4: Average Daily Visitation by Day, 2015

Pikes Peak Highway

Pikes Peak Highway, managed by the City of Colorado Springs, is a 19-mile paved, two-lane roadway and the only access road to the summit of Pikes Peak. The roadway leads visitors through beautiful alpine wilderness dotted with many points of interest for visitors to enjoy before reaching the summit, including reservoirs and lakes for fishing, picnic areas, hiking trails, scenic overlooks, and parking facilities of various sizes for public use. Figure 6 presents a map of Pikes Peak Highway, beginning at the entrance gate through the summit and mile marker 20.



Figure 5: Map of Pikes Peak Highway, including amenities and key points of Interest

Description of Scenarios

This study concluded with the development of two shuttle scenarios: 1) A mandatory system during construction and 2) a voluntary system post construction. Volpe worked closely with the Pikes Peak summit complex project team to collect data, input, recommendations, and feedback before presenting the scenarios.

Scenario Assumptions

Beyond the distance and travel time differences, there are several constants between the two shuttle scenarios outlined in Table 1. First, due to the tight switch backs and steep grade at portions of the road, the shuttle is restricted to 24-capacity vehicles, which cost about \$100,000 each. This is a one-time cost for the life of the vehicle (estimated to be approximately 7-10 years). Annual operation and maintenance (O&M) costs include fuel, maintenance, driver salary, and marketing costs to promote the system, especially at its beginning. In either scenario, Volpe planned for an 11 hour service day.

Table 1: Shuttle Scenario Assumptions

Shuttle Type	Medium Duty Shuttle (24 Capacity)
Purchase Cost per shuttle	\$100,000
Round Trip Distance (miles) – <i>Devil's Playground to Summit</i>	7.8 miles
Round Trip Time (minutes) – <i>Devil's Playground to Summit</i>	25 minutes
Round Trip Distance (miles) – <i>Ski Area to Summit</i>	16.2 miles
Round Trip Time (minutes) – <i>Ski Area to Summit</i>	45 minutes
Average Speed	20 MPH
Average Service Day	11 Hours
Average Operation & Maintenance Costs	
Fuel cost per gallon	\$2.10
Fuel cost per mile	\$0.23
Maintenance cost per mile	\$1.10
Marketing costs	\$5,500
Inflation rate	3.0%

Map of Scenarios

Volpe considered two parking areas along Pikes Peak Highway for staging areas. The routes for the two scenarios connect these parking lots to the summit:

1. Devil's Playground (Figure 6): Located at Mile Post 16, this 350-space parking area is the highest capacity facility closest to the summit, with a round trip of 7.8 miles or 25 minutes, making it a critical asset to manage peak visitation under a mandatory scenario during construction.
2. Ski Area (Figure 7): Located just below Mile Post 12, this 200-space parking facility would likely meet the visitation requirements under a voluntary post-construction scenario. This shuttle would take 46.6 minutes to go 16.2 miles.

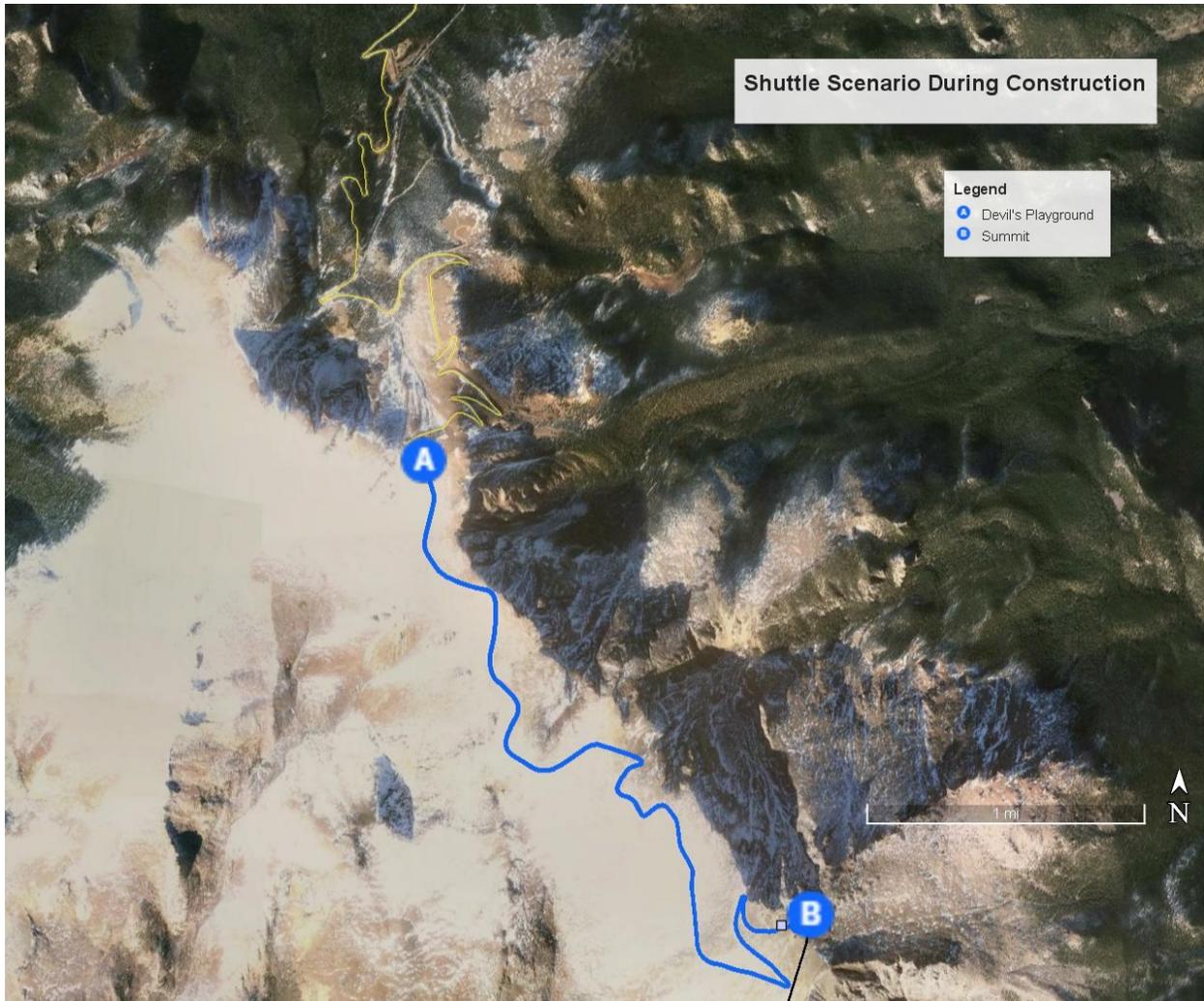


Figure 6: Shuttle Scenario During Construction: Devil's Playground to Summit

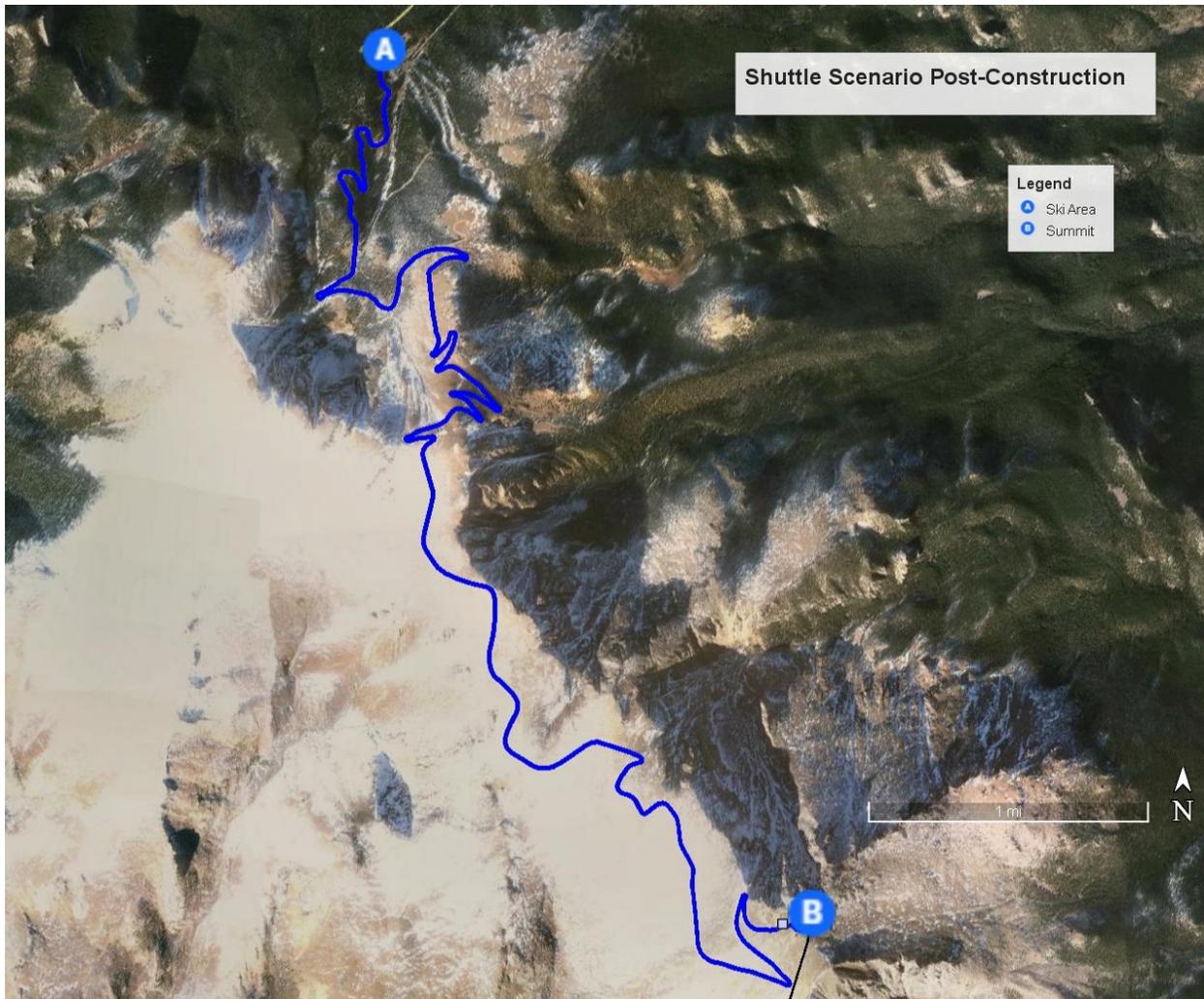


Figure 7: Shuttle Scenario Post-Construction: Ski Area to Summit

Vehicle Recommendation

While mostly composed of straightaways and gradual turns, Pikes Peak Highway includes several tight switchbacks (between Mile Posts 14 and 16) that limits the types of vehicles that can be used. As a result, public vehicle access is currently limited to vehicles with wheelbases less than 19 feet and rear overhangs not exceeding five feet. Longer vehicles may be unable to successfully navigate the roadway's tight turns while remaining in their designated lane, causing potential safety hazards, and the overhang may scrape against the road, thereby causing damage to the roadway and vehicle.

Under the General Services Administration (GSA), the exclusive provider of fleet vehicles for Federal agencies, Volpe recommends Item 346, a 24-passenger shuttle bus that provides for the most passenger capacity while maintaining a wheelbase of less than 19 feet and an overhang less than 8.5 feet. Though this vehicle is longer than what the Highway currently recommends, it should be sufficient since two-way traffic will be limited during construction. Table 2 includes each model offered under Item 346 and

includes pricing for the base vehicle, selected optional equipment (which includes mandatory wheelchair accessibility²), and includes GSA surcharge fees. Prices presented are for one vehicle.

Table 2: Vehicle Recommendation Specs and Costs

	Colonial Startrans Senator HD Ford F 2015	Rohrer Bus Sales, Inc. ChampBus Challenger Ford F550 (Figure 8)	Masters Transportation Goshen Coach G-Force F Series 2016
Capacity	24	24	24
Base Cost	\$77,598	\$76,224	\$81,183
Extras	\$8,531	\$13,922	\$15,689
Total	\$86,129	\$90,146	\$96,872



Figure 8: Champion Bus Challenger F550

Design Day Description

The project team used a 90th percentile design day to develop its conceptual shuttle service plan during and after construction. Using a 90th percentile design day is an industry standard for shuttle planning in public lands. This standard means that the service will meet demand 90 percent of the days the service is in operation. For the remaining 10 percent of the days, the service will be able to meet the demand during some of the operating hours, but there will be periods where the demand for the system exceeds capacity. While not ideal, these periods are rare enough to make this an acceptable practice. The alternative is to design a system that accommodates people on more than 90 percent of the days, which can be expensive but may be worth it if the operator does not want people to wait long during busy times. Accommodating people on more than 90 percent of the days may be necessary in places where people would have to wait outside in an unsafe and/or exposed environment.

During Construction

To design a shuttle service during the construction of the new Pikes Peak summit complex requires developing a scenario that can manage demand on the majority of the busiest days of the year. Designing for a 90th percentile service day means planning to serve 4,831 visitors on a weekend day, and

² Part 38 of the Americans with Disabilities Act, Subpart B_Buses, Vans and Systems, Sec. 38.23 Mobility aid accessibility (http://www.fta.dot.gov/12876_3905.html)

3,363 on a weekday day. These amounts are the 90th percentile busiest days when compared to other 2015 weekend days and weekday days respectively.

During construction, Volpe recommends using Devil’s Playground as the staging area. The close proximity to the summit and larger parking capacity make this ideal. Volpe used this staging area and the inputs below to develop a suggested frequency of service for the conceptual shuttle system (Table 3).

- **June-September (120 Service Days)**
- **Operating hours: 7 AM to 6 PM**
- **90th Percentile 2015 Weekday: 3,364**
- **90th Percentile 2015 Weekend: 4,829**
- **Parking Availability at Devil’s Playground: 350 Spaces**
- **Capacity: 762 visitors/hour**

Table 3: Shuttle Scenario for Peak Weekend and Weekday Service During Construction

	Average Shuttle Runs/Hour	Peak Shuttle Runs/Hour	Average Headway (minutes)	Peak Headway (minutes)	Daily Trips	Shuttles Required	Riders Served
Leveled Weekdays	13	17	5.9	3.6	143	9	3,363
Leveled Weekend Days	19	23	3.7	2.6	209	12	4,831

Considering the shuttle’s estimated round trip travel time and distance, twelve shuttles would be required to run at one time under this scenario for weekend demand, keeping between 2.6 and 3.7 minute headways. For weekday demand, nine shuttles would be required, running less frequently between 3.7 to 5.9 minute headways.

Volpe planned service based on a leveled service day as opposed to a peak service day. Figure 9 illustrates this difference. A peak day, shown as dotted lines, is the pattern that visitation takes when not controlled. With highest visitation in the middle of the service days, it resembles a bell curve. A leveled service day, shown as solid lines, represents an approach to spread out, or level, the peak across the day. The purpose is to place less demand on the vehicle fleet when visitation spikes. By controlling visitation, it not only puts less demand on the fleet, but it requires a smaller vehicle fleet overall, reducing the capital and operation costs for the Highway. Leveling can be accomplished by encouraging visitors, via websites, brochures, and social media, to visit the mountain at earlier and later times of the day to avoid busy times and/or can involve pricing incentives (e.g., by charging \$2 less per car) to encourage people to visit earlier or later in the day.

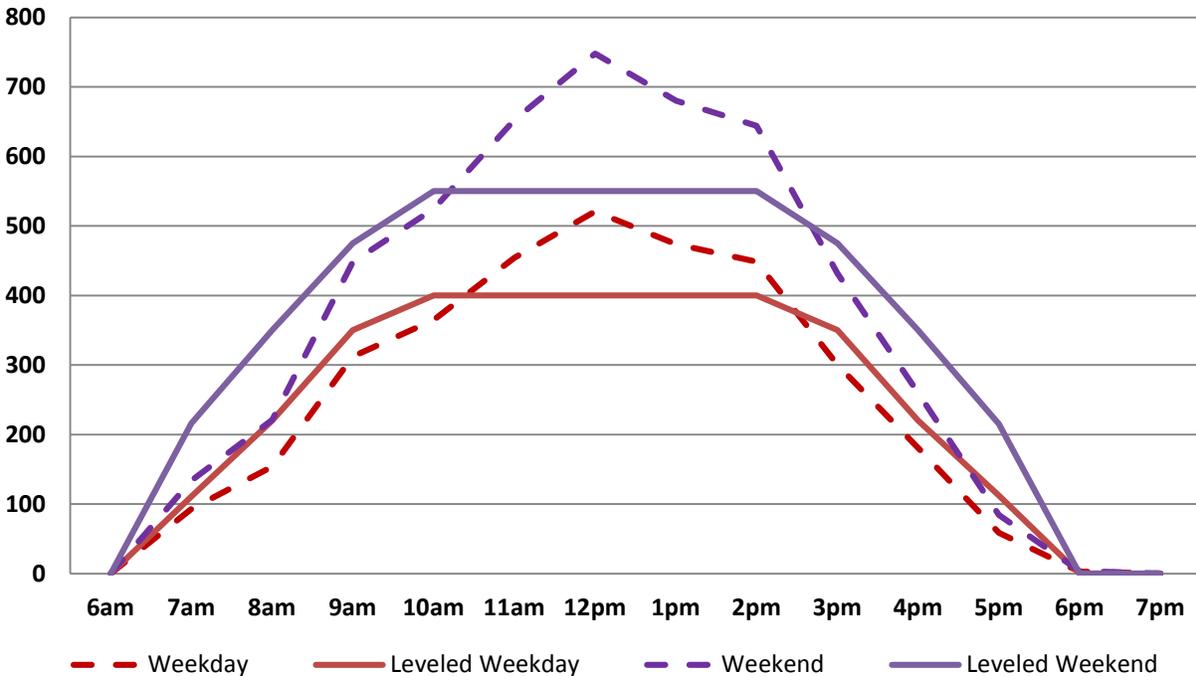


Figure 9: Peak Ridership Distribution Concepts During Construction

Using the leveled weekday and weekend scenario, Volpe estimated the initial capital costs and first year operation and maintenance (O&M) costs for running a shuttle service during construction in Table 4.³ The minimum total capital cost is \$1,216,500, while the first year O&M is \$399,274. Additionally, Volpe recommends purchasing one to two additional vehicles to have as spares in the event that a vehicle needs maintenance. The estimated total first-year cost of \$1,693,902 does not include the purchase of additional vehicles or other costs associated with staffing and amenities for visitors (e.g., parking area bus shelter). Please note that this estimate is for purchasing vehicles; leasing vehicles may be a more affordable option and should be investigated as a next step.

Table 4: Shuttle Scenario Cost Estimates for Peak Service During Construction

	Service Days	Shuttles Required	First Year Capital Cost	First Year O&M	O&M Cost/Rider
Leveled Weekdays	86	9	\$916,500	\$301,008	\$1.76
Leveled Weekend Days	34	12	\$1,216,500	\$176,394	\$1.51
Total	120	12	\$1,216,500	\$477,402	\$1.66

Post Construction

After construction is complete, parking at the summit will likely reopen for personal vehicular access, therefore limiting the demand for a shuttle service. However, the project team is interested in the option of maintaining a voluntary shuttle service to enhance the visitor experience; the shuttle may be

³ Cost estimates do not include profit margins and supervisory/contract management costs, which will vary considerably between non-profit, public, and private operating agencies, depending which the Highway selects.

an attractive option for those who are not comfortable driving the full ascent and/or who would prefer or enjoy an interpretive tour.

Similar to the previous scenario, Volpe planned for a 90th percentile design day. However, there are a few differences between a mandatory and voluntary scenario. First, Volpe proposes shifting the staging area for the shuttle service to the Ski Area, located at Mile Post 12. Volpe believes that the smaller parking area, with 200 spaces, would accommodate the expected reduced demand. Additionally, placing the staging area further down the roadway would not only provide an opportunity for a more involved interpretive experience, but would eliminate the need for visitors to drive along the switchbacks, which is a more dangerous section of the road.

Using the inputs below and the Ski Area as the staging area, Volpe estimated that up to 2,249 passengers could be served if the Ski Area parking is at capacity during the peak noon hour. With 200 spaces, this translates to a maximum of 348 visitors per hour. Assuming this would be a maximum demand for the shuttle on weekend days, Volpe reduced this figure by 30 percent for weekdays to match the difference in weekend and weekday visitation derived under the mandatory scenario. With an estimated 1,574 weekday visitors served, which translates to a maximum of 244 visitors per hour, the Ski Area would comfortably meet the demand. Overall, if all of the parking spaces at the Ski Area are used during the weekend, Volpe expects ridership to decrease by 53 percent compared to the mandatory scenario. If demand exceeds the capacity at the Ski Area, Devil’s Playground can be considered for overflow parking.

- **June-September (120 Service Days)**
- **Estimated 53 percent reduction in ridership**
- **Operating hours: 7 AM to 6 PM**
- **Parking Availability at Ski Area: 200 Spaces**
- **Capacity: 348 visitors/hour**

Since the Ski Area is farther away from the summit than Devil’s Playground, the number of shuttles required (10 instead of 12) does not decrease as much as would be expected if the staging remained at Devil’s Playground. With this longer trip distance and fewer riders, Volpe estimated that average headways would increase to between 5.2 and 9.5 minutes during weekends and to between 8.2 and 12.6 minutes during weekdays (Table 5). As with the mandatory service, Figure 10 illustrates the difference between a peak and leveled service schedule, with the latter saving the Highway capital and operating expense.

Table 5: Shuttle Scenario for Peak Weekend and Weekday Service Post-Construction

	Average Shuttle Runs/Hour	Peak Shuttle Runs/Hour	Average Headway (minutes)	Peak Headway (minutes)	Daily Trips	Shuttles Required	Visitors Served
Leveled Weekdays	6	8	12.6	8.2	66	7	1,574
Leveled Weekend Days	9	12	9.5	5.2	99	10	2,249

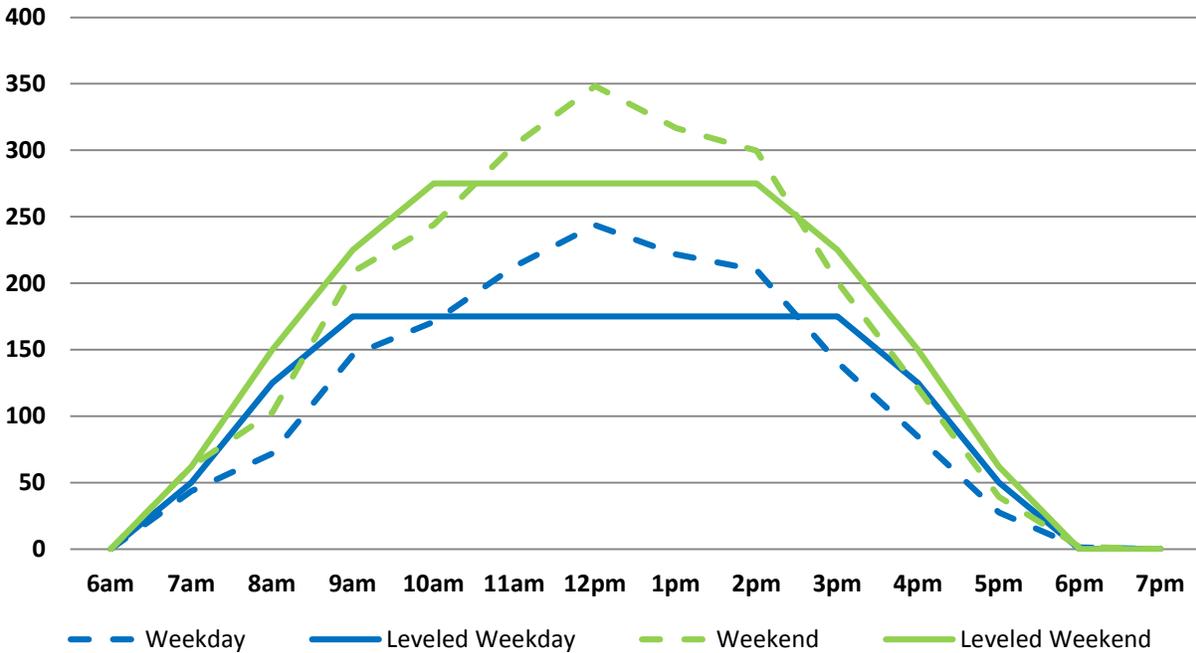


Figure 10: Peak Ridership Distribution Concepts Post-Construction

Table 6 outlines the capital and O&M costs for running a voluntary shuttle post construction.⁴ The minimum total capital cost is \$1,016,500, while the first year O&M is \$441,879. That said, if the Highway decides to purchase vehicles for the mandatory service during construction, the vehicles would already be in possession and this would eliminate the capital costs under this scenario. However, O&M costs would gradually increase each year to account for normal wear and tear and the occasional vehicle overhaul needs. Vehicles are typically replaced every seven years.

Table 6: Shuttle Scenario Cost Estimates for Peak Service Post-Construction

	Service Days	Shuttles Required	First Year Capital Cost	First Year O&M	O&M Cost/Rider
Levelled Weekdays	86	7	\$716,500	\$275,892	\$3.43
Levelled Weekend Days	34	10	\$1,016,500	\$165,987	\$3.03
Total	120	10	\$1,016,500	\$441,879	\$3.27

Scalable Scenarios

The scenarios presented above can be scaled up or down to align with other operating seasons or different visitation and user assumptions. For example, if the summer season of the during construction scenario is baselined at 100 percent, the Highway would need to reduce service by 65, 82, or 92 percent to accommodate visitation levels in the shoulder, early spring/late fall, or winter seasons respectively. For the shoulder season, this would mean that the average number of shuttle runs would be about five

⁴ Cost estimates do not include profit margins and supervisory/contract management costs, which will vary considerably between non-profit, public, and private operating agencies, depending which the Highway selects.

per hour on weekdays and about seven on weekends, which means that shuttles would run approximately every 12 minutes on weekdays and approximately every nine minutes on weekends. Volpe considers these frequencies, and therefore potential maximum wait times, to be adequate, but Volpe does not suggest running the service during the early spring/late fall or winter seasons since the frequency/potential wait time would be too long. Similar scaling could be done performed for the post construction scenario if the Highway feels that 47 percent of visitors is too high of an estimate of visitors who would potentially take the voluntary shuttle.

Next Steps

The Highway is planning on starting shuttle service when construction on the summit complex begins, which will likely be in the summer of 2017. Several next steps should be pursued over the next year:

- Identify potential shuttle providers
- Test potential vehicles to determine how they perform, how much time they need to serve the route, if they are the appropriate size, etc.
- Select vehicles based on test results
- Refine the service plan presented in this report based on route testing results
- Analyze and select an operating model:
 - Leasing vs. purchasing vehicles
 - Operated by city or regional transit authority
 - Run by concessionaire/service contract
 - Run by outfitter and guide
- Create a staffing plan
- Develop and solicit a request for proposals
- Select an operator

Future Expansion Opportunities

Depending on the success of the shuttle service, the City of Colorado Springs and its stakeholders may consider expanding the service in the future. Volpe has identified two options for potential expansion.

1. Connecting to other area destinations: The Colorado Springs area is rich with cultural attractions all within close proximity to Pikes Peak. The City of Colorado Springs may consider including other city-owned sites, as well as partnering with privately-owned businesses, in a regional shuttle service to connect these various destinations. Such a partnership between destinations would share the expense of the system across the partners, reduce parking and traffic congestion, and be an attractive transportation option for visitors. Potential destinations could include Garden of the Gods, Cave of the Winds, Manitou Cliff Dwellings, Red Rock Canyon Open Space, and North Pole Colorado Santa's Workshop.
2. Developing an interpretive service: During initial conversations with the Pikes Peak shuttle stakeholders, there was an interest in developing an interpretive component to the Pikes Peak shuttle if it ends up being a permanent service after construction is completed on the summit complex. The Pikes Peak Cog Rail, owned and managed by the Broadmoor, currently has an interpretive tour component to enhance the visitor's experience, providing an entertaining and educational journey to the summit. The City of Colorado Springs may consider partnering with the Broadmoor to extend and complement this service; doing so could also provide visitors with more flexibility in how they decide to travel between the base and the summit (i.e., by creating

a seamless connection between the shuttle and the Cog Railway). Aramark, the existing concessionaire for the visitors center, could also be considered since they have a history of managing shuttle services on public lands.

Appendix: Stakeholders

U.S. Forest Service, Pike and San Isabel National Forests

- Neal Weierbach, Recreation Program Manager, 719-553-1510, nweierbach@fs.fed.us
- Jeff Hovermale, Lands, Minerals and Special Uses, 719-477-4201, jhovermale@fs.fed.us

City of Colorado Springs

- Jack Glaven, Pikes Peak Division Manager, 719-385-7325, jglavan@springsgov.com
- Sandy Elliott, Parks Operations Administrator, 719-385-7705, selliott@springsgov.com
- Karen Palus, Director of Parks, Recreation, and Cultural Services, 719-385-6501, kpauls@springsgov.com

U.S. Department of Transportation, Volpe Center

- Ben Rasmussen, Community Planner, 617-494-2768, benjamin.rasmussen@dot.gov
- Chris Timmel, Community Planner, 617-494-3831, chris.timmel@dot.gov

RTA Architects

- Stuart Coppedge, Principal, stuart@rtaarchitects.com
- Brian Calhoun, Principal, brian@rtaarchitects.com

DHM Design

- Ellen Kemp, Associate Principal, ekemp@dhmdesign.com

GWWO, Inc. Architects

- Alan Reed, President & Design Principal, areed@gwwoinc.com