Transit Feasibility Analysis and Recommendations

Arapaho-Roosevelt National Forest Transportation System Alternatives Study

Guanella Pass Road, credit: RSG

June 2015

DOT-VNTSC-FHWA-16-04

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The purpose of the Arapaho-Roosevelt National Forest Transportation System Alternatives Study is to identify and evaluate the feasibility of potential alternative transportation solutions to improve recreation and resource management at three of the most popular recreation sites in the national forest: Brainard Lake Recreation Area (BLRA), Guanella Pass (GP), and Mount Evans Recreation Area (MERA). This study identifies, verifies, and documents transportation, visitor, and resource concerns; assesses user capacity levels where appropriate; and identifies feasible short-term and long-term alternative transportation and congestion management solutions for these three sites.

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Introduction

The US Forest Service (USFS), in partnership with the Federal Highway Administration Central Federal Lands (CFL), is conducting a Transportation System Alternatives Study for the Arapaho-Roosevelt National Forest (ARNF). The purpose of the ARNF Transportation System Alternatives Study is to identify and evaluate the feasibility of potential alternative transportation solutions to improve recreation and resource management at three of the most popular recreation sites in the national forest: Brainard Lake Recreation Area (BLRA), Guanella Pass (GP), and Mount Evans Recreation Area (MERA).

This study will identify, verify, and document transportation, visitor, and resource concerns; assess user capacity levels where appropriate; and identify feasible short-term and long-term alternative transportation and congestion management solutions for the three sites.

The project team has identified transportation, recreation, and resource management-related issues for which alternative transportation solutions are needed at BLRA, GP, and MERA through public input, review of previous studies and planning documents, and onsite data collection and analysis. These issues are described in detail in a technical memorandum entitled Technical Memo 4.1 Need Identification by Site.

As stated in Technical Memo 6.0, the need for alternative transportation solutions is based on data collection and analysis, followed by visitor surveys at each of the three sites and input from both the general public and the agency. The needs include:

- **Active traffic and parking management.** This is based on peak period congestion and parking shortages in entrance areas and parking lots that access key visitor use areas, often leading to unendorsed and unsafe parking along roadways when existing lots are at overflow capacity.
- **Additional trip planning and visitor information.** Visitors are often unaware of congested conditions. This leads to inadequate planning and confusion regarding parking options within recreation sites.
- **Visitor use management.** Designated Wilderness areas experience high visitor use and crowding during peak periods. Resource degradation is becoming more prevalent in high use areas.

Further, the project team has identified potential alternative transportation and visitor use management components to provide the USFS with the tools needed to address transportation, recreation, and resource management-related needs at BLRA, GP, and MERA. These alternative components are described in detail in a technical memorandum entitled Technical Memo 5.1 Alternative Components by Site.

The purpose of this technical memorandum is to define transit components that may address the management needs at each of the three sites. These transit components will be packaged with non-transit components, such as parking management and visitor information, to more comprehensively meet the purposes of the study overall. Due to the unique needs at each site, the transit components are presented separately for BLRA, GP, and MERA.

The project team worked with USFS staff and stakeholders to identify potential transit alternatives, representing a range of costs, potential impacts, and implementation timeframes. Using initial screening from the Evaluation Criteria (see Technical Memo 6.0), the team identified and evaluated

only those transit components that were most likely to meet the study's goals and address USFS's needs. Upon further analysis, some of the evaluated transit components proved to have a combination of high costs and minimal benefits, such that these were deemed unfeasible for implementation. These "unfeasible" transit components are identified in this memo, but the detailed evaluation is only included for the "feasible" components to be bundled with non-transit components.

The remainder of this technical memorandum presents the components evaluated at each site, including a description of each component, ridership estimates, scheduling and operational parameters, vehicle needs, and cost estimates.

Methods

The cost estimates for all scenarios are a combination of the following costs:

1. Transit-supportive infrastructure costs
2. Vehicle purchase or lease
3. Start-up costs
4. Operation costs (annual)
5. Maintenance costs (annual)

Operations and maintenance costs are calculated annually based on fuel costs, vehicle maintenance (related to road and operating conditions), driver salaries, and other fixed-per-mile or -hour expenses. The other costs may either be one-time costs at transit initiation or costs that may be spread over a few years, depending on transit system design. If the USFS elects to do a short-term pilot or lease of vehicles, the upfront infrastructure costs will be less in the short term but may eventually be greater in the long term. Both lease and purchase estimates are included for all scenarios.[1] One-time costs include:

- Transit-supportive infrastructure like bus shelters and benches and
- Start-up costs like vehicle procurement, training, and initial marketing, which is higher in the first year of operations when visitors have no knowledge of the service. Start-up costs are estimated as $20,000 in Year 1.[2]

These one-time costs are shown as aggregated over the life of the purchase, which in most cases is 12 years (the average lifecycle of the proposed transit vehicles). These are simplified because vehicles, transit-supportive infrastructure, staff oversight efforts, and signage may have different lifecycles and replacement needs.

The cost estimates also include a cost per passenger, which includes the following components:

- Annual capital cost, which equals the total capital cost (vehicle purchase or lease, bus shelters, benches, start-up costs) divided by the life of the vehicles and infrastructure (20- and 28-passenger vehicles are calculated with a 12-year lifecycle and 15-passenger vehicles with a 7-year lifecycle) plus…
- Annual operations and maintenance cost, which includes fuel, driver salaries, and annual maintenance, divided by…
- The total number of passengers per season, which is the average number of daily passengers multiplied by the number of service days per year.

[1] The project team was not tasked with evaluating the ownership, leasing, or contracting options available to the USFS for this shuttle service, so this report does not specify what entity would lease or own the vehicles.
[2] Volpe Center. 2011. Bus Lifecycle Cost Model for Federal Land Management Agencies. User's Guide. Accessed 23 April 2015: http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling

Brainard Lake Recreation Area (BLRA)

The Brainard Lake Recreation Area (BLRA) is located approximately 55 miles northwest of downtown Denver and 25 miles northwest of Boulder, Colorado. Brainard Lake Road runs from the Peak to Peak Highway (Colorado 72) 4.8 miles to Brainard Lake and around the lake until it forks with one fork leading to a parking lot at Long Lake Trailhead and the other leading to a parking lot at Mitchell Lake Trailhead. Both of these trailheads access the Indian Peaks Wilderness (IPW). A Courtesy Station (where the parking concessionaire collects a fee) and the Gateway Parking Lot are located on Brainard Lake Road 2.6 miles from the Peak-to-Peak Highway. A campground and the Day Use Parking Lot are located on Brainard Lake Road as it approaches the lake. Brainard Lake Road is closed at the Courtesy Station from mid-October to mid-June, but visitors park at the Gateway Lot during the off-season and hike or cross-country ski in BLRA. The USFS estimates over 100,000 people visit BLRA annually, with the majority of use concentrated between June and October.

In the past, summer visitation volumes led to several undesirable transportation-related safety and natural resource concerns. The USFS recently addressed these concerns by re-engineering and expanding the Day Use Parking Lot, closing a portion of the loop road around the lake, prohibiting roadside parking, and by hiring a concessionaire to actively manage and enforce parking restrictions. Nonetheless a few more minor issues exist today:

- Traffic congestion, idling, and queuing at the Courtesy Station, which has natural resource impacts and can impede access to the Gateway Parking Lot (as noted in Technical Memo 4.1).
- Visitors walking along the road, and therefore conflicting with motor vehicles, between the Gateway Parking Lot and the lake and trailheads.

The project team conducted traffic counts, collected parking accumulation data, collected GPS-tracking of visitor use patterns, and administered visitor surveys to understand traffic and visitor circulation patterns. More details about the existing conditions, needs, and visitor survey results can be found in Technical Memos 3.1, 3.5, 3.6, 3.9, and 4.1.

Relevant Constraints and Needs

Currently, the USFS believes that the current number of visitors accessing the IPW is appropriate. However, the agency also feels that any increase in the number of visitors to the IPW would have negative impacts on visitor's wilderness experience as well as impacts to natural resources, such as erosion and off-trail impacts to the IPW's fragile above tree-line ecosystems. Therefore, a central constraint for the transit system is that it should not result in a net increase of visitors to the IPW.

Proposed Transit Scenarios

Through meetings with USFS staff, stakeholders, and the public, the project team developed the following transit scenarios. This group then determined that the first three scenarios were impractical due to their costs and because they would result in an increase of visitors to the IPW; however, the project team evaluated these scenarios nonetheless because of stakeholder interest expressed before the implementation of recent parking lot and management improvements. The project team believes the fourth scenario is the most practical and would complement these improvements. All of the scenarios assume the current fee collection and parking management operations will continue into the future. Figure 1 illustrates all four BLRA scenarios and Table 1 lists the stops served by each scenario.

Figure 1: BLRA Scenarios

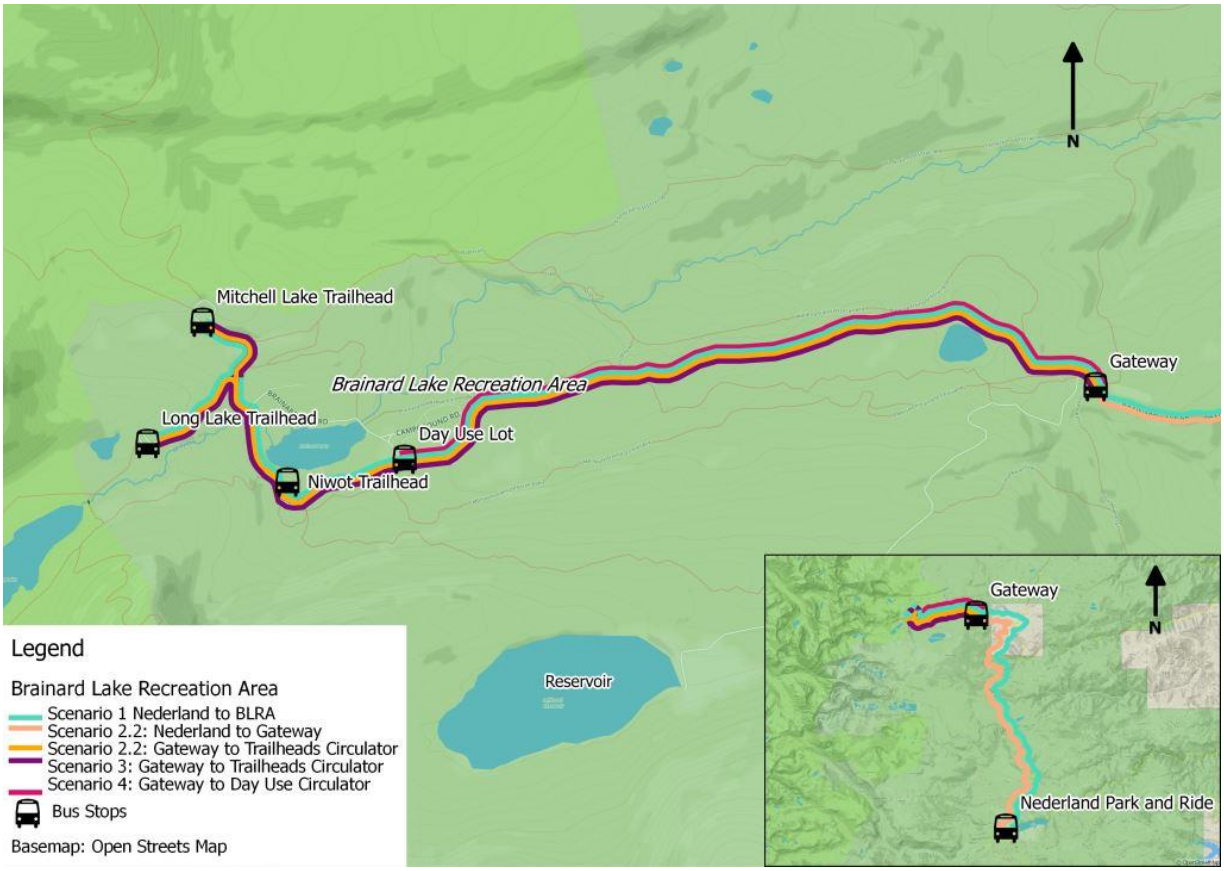

Table 1: Stops Served by Each Scenario

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Nederland	Yes	Yes		
Gateway Lot	Yes	Yes	Yes	Yes
Day Use Lot	Yes	Yes	Yes	Yes
Niwot Mountain TH		Yes	Yes	
Long Lake TH	Yes	Yes	Yes	
Mitchell Lake TH	Yes	Yes	Yes	

1. Shuttle Service from Nederland to Gateway Lot, Day Use Lot, and IPW Trailhead Lots

Shuttle buses would operate between the RTD park-and-ride lot in Nederland, CO, and BLRA with en-route shuttle stops in BLRA at the Gateway Lot, Day Use Lot, Long Lake Trailhead, and Mitchell Lake Trailhead. Existing facilities would be used for shuttle bus loading/unloading areas at the RTD park-and-ride lot in Nederland to the extent possible, and loading/unloading areas would be designated at the en-route shuttle stops in BLRA. Shuttle service would operate on weekends and holidays from Memorial Day weekend through Labor Day. This decision to restrict service to weekends and holidays was driven by BLRA visitation patterns; the BLRA receives on average twice the number of visitors on weekend days than on weekdays during the summer. The hours of operation correspond with peak hours of visitor use in the IPW. The frequency of shuttle service would be operated according to ridership demand and parking capacities.

2. Shuttle Service from Nederland to Gateway Lot with Circulator from Gateway Lot to Day Use Lot and IPW Trailheads

This scenario is composed of two separate shuttle services, requiring visitor transfers in order to access the IPW trailheads. The first shuttle service would operate between the RTD park-and-ride lot in Nederland and the Gateway Lot at BLRA. The second shuttle service would operate within the BLRA with en-route shuttle stops at the Gateway Lot, Day Use Lot, Niwot Mountain Lot, Long Lake Trailhead, and Mitchell Lake Trailhead. Existing facilities would be used for shuttle bus loading/unloading areas at the park-and-ride lot in Nederland to the extent possible, and loading/unloading areas would be designated at the en-route shuttle stops in BLRA. Shuttle service would operate on weekends and holidays from Memorial Day weekend through Labor Day. The hours of operation correspond with peak hours of visitor use/hiking in the IPW. The frequency of shuttle service would be operated according to ridership demand.

3. Circulator from Gateway Lot to Day Use Lot and Indian Peaks Wilderness Trailheads

For this scenario, shuttle buses would operate within the BLRA with en-route shuttle stops at the Gateway Lot, Day Use Lot, Niwot Mountain Lot, Long Lake Trailhead, and Mitchell Lake Trailhead. Loading/unloading areas would be designated at the en-route shuttle stops in BLRA. Shuttle service would operate on weekends and holidays from Memorial Day weekend through Labor Day. The hours of operation correspond with peak hours of visitor use/hiking in the IPW. The frequency of shuttle service would be operated according to ridership demand and parking capacities.

4. Circulator from Gateway Lot to Day Use Lot

For this scenario, shuttle buses would operate within the BLRA with stops at the Gateway Lot and the Day Use Lot. Loading/unloading areas would be designated at these two stops. Shuttle service would operate on weekends and holidays from Memorial Day weekend through Labor Day. The hours of operation correspond with peak hours of visitor use/hiking in the area. The frequency of shuttle service would be operated according to ridership demand, parking capacities, and congestion and queuing at the Courtesy Station.

Table 2 provides a summary of the operations and costs of each of the scenarios and the following sections contain details for each scenario. Note that costs to own are averaged over seven years and do not include start-up costs for marketing or signage, which is estimated to be around $20,000 for each scenario. Scenario 4 is the most cost efficient and would likely improve the congestion and safety concerns at the Courtesy Station more effectively or at least as effectively as any of the other scenarios.

Table 2: BLRA Scenarios Operations and Costs Summary

	Scenario 1	Scenario 2, Component 1	Scenario 3	Scenario 4
Travel Time (Roundtrip)	98 minutes	52 minutes	53 minutes	20 minutes
Distance (Roundtrip)	35.8 miles	28.6 miles	7.2 miles	4.4 miles
Hours of Operation	7am to 7pm	7am to 7pm	7am to 6pm	7am to 6pm
Frequency of Service	20 minutes	30 minutes	20 minutes	20 minutes
Vehicles Required	5	2	3	1
Days in Service	35	35	35	35
Passengers/Day	208	13	195	195
Cost to Own/Year	$136,408	$58,032	$66,604	$25,981
Cost to Own/Year/Rider	$18.74	$127.54	$9.76	$3.81
Cost to Lease/Year	$126,744	$51,422	$67,810	$26,967
Cost to Lease/Year/Rider	$17.41	$113.02	$9.94	$3.95

Scenario 1: Shuttle Service from Nederland to Gateway Lot, Day Use Lot, and IPW Trailhead Lots

This section describes capital and operational elements of transit service from Nederland to BLRA. This includes the route description, ridership demand, service frequency, capital elements (such as staging and vehicle selection), and costs.

Route

The route would start and end at Nederland, making an out-and-back drive to BLRA and the IPW Trailhead Lots with a stop in both directions at the Gateway Parking Lot and Day Use Parking Lot. Table 3 presents the mileage and driving times between stops for this scenario.

Table 3: Mileage and Driving Time between Stops for BLRA Scenario 1

Route segment	Mileage	Driving Time
Nederland to Gateway Lot	14.3 miles	24 minutes
Gateway Lot to Day Use Lot	2.2 miles	6 minutes
Day Use Lot to Long Lake Trailhead	1.1 miles	5 minutes
Long Lake Trailhead to Mitchell Lake Trailhead	0.7 miles	3 minutes
Mitchell Lake Trailhead to Day Use Lot	1.0 miles	5 minutes
Day Use Lot to Gateway Lot	2.2 miles	6 minutes
Gateway Lot to Nederland	14.3 miles	24 minutes
Round Trip Totals	35.8 miles	73 minutes (driving) 98 minutes (with stops)[3]

Ridership Demand

To plan for appropriate service levels and capital investment, the project team first estimated the demand for transit based on current traffic volumes (see Technical Memo 3.6) and results from the visitor survey (see Technical Memo 3.9). The project team's transit ridership estimate assumes that

[3] The total time for each route includes 5 minutes loading and unloading in Nederland and 3 minute stops at all other stops.

two percent of all visitors who currently drive through Nederland on route to and from BLRA would choose to use the optional transit service from Nederland to the Gateway Lot. According to visitors that responded to the survey (Technical Memo 3.9, Figure 25), 76 percent of visitors would elect to take a short transit ride from the Gateway Lot to BLRA hiking destinations, *if this were their only option to visit BLRA* because parking lots were full. (The assumption is that the remaining 24 percent of visitors would not visit BLRA during times that these parking conditions exist.) The estimate is also coupled with the continuance of parking restrictions and management. To translate these percentages to ridership volumes, the project team looked at hourly traffic volumes on a 92nd percentile design day (737 vehicles per day) at an average vehicle occupancy rate of 2.5 people per vehicle.

The resulting estimate is 208 passengers per day (13 passengers from Nederland to BLRA and 195 passengers from the Gateway Lot to the other stops). Most passengers would arrive between 10 a.m. and 1 p.m., and the greatest volume of visitors would be between 11 a.m. and 12 p.m. and between 1 p.m. and 2 p.m.

Service Hours and Frequency

Service hours and frequency are based on ridership demand, passenger safety, and feasibility. Traffic volumes and parking lot counts in Technical Memo 3.6 show that parking demand begins to exceed capacity at Long and Mitchell Lake Trailhead Lots starting around 8 a.m. However, the Day Use Lot does not fill up until 11 a.m., which is when the demand for the transit service is anticipated to be greatest. To ease the crowding in advance of exceeding capacity (for visitors who would prefer to take a shuttle over driving to or within BLRA), the project team recommends beginning transit service at 7 a.m.

Headways are used to describe the average amount of time between vehicles traveling the same transit route; headways indicate the scheduled frequency of transit service. The project team decided to design a system with maximum headways of 20 minutes, which balances convenience and visitor safety with financial and operational feasibility.[4] The system would operate every 20 minutes from 7 a.m. through 7 p.m. (with the last shuttle leaving Nederland at 5:20 p.m.). See Table 4 for a summary schedule of shuttle service for Scenario 1, as well as the vehicle assigned to each trip.

This service schedule would consist of 32 round trips daily and 5 shuttle buses. There would be an average of 7 passengers per trip throughout the day. During peak periods (11 a.m. to 1 p.m.), average ridership would be higher, perhaps up to 12 passengers per trip.

[4] The 20 minute figure is based on previous transit surveys conducted at Marsh-Billings Rockefeller NHP and Muir Woods National Monument. Also, a Center for Urban Transportation Research (University of South Florida) study suggests a maximum wait time of 30 minutes is acceptable for urban transit systems, and the study team estimates that a slightly shorter headway seems appropriate in the recreation context (CUTR study available at http://www.nctr.usf.edu/pdf/77720.pdf)

Table 4: Schedule of Shuttle Runs for BLRA Scenario 1

Departure (Staging)	Arrival (THs)	Arrival (Staging)	Vehicle #
7:00 AM	7:50 AM	8:40 AM	1
7:20 AM	8:10 AM	9:00 AM	2
7:40 AM	8:30 AM	9:20 AM	3
8:00 AM	8:50 AM	9:40 AM	4
8:20 AM	9:10 AM	10:00 AM	5
8:40 AM	9:30 AM	10:20 AM	1
9:00 AM	9:50 AM	10:40 AM	2
9:20 AM	10:10 AM	11:00 AM	3
9:40 AM	10:30 AM	11:20 AM	4
10:00 AM	10:50 AM	11:40 AM	5
10:20 AM	11:10 AM	12:00 PM	1
10:40 AM	11:30 AM	12:20 PM	2
11:00 AM	11:50 AM	12:40 PM	3
11:20 AM	12:10 PM	1:00 PM	4
11:40 AM	12:30 PM	1:20 PM	5
12:00 PM	12:50 PM	1:40 PM	1
12:20 PM	1:10 PM	2:00 PM	2
12:40 PM	1:30 PM	2:20 PM	3
1:00 PM	1:50 PM	2:40 PM	4
1:20 PM	2:10 PM	3:00 PM	5
1:40 PM	2:30 PM	3:20 PM	1
2:00 PM	2:50 PM	3:40 PM	2
2:20 PM	3:10 PM	4:00 PM	3
2:40 PM	3:30 PM	4:20 PM	4
3:00 PM	3:50 PM	4:40 PM	5
3:20 PM	4:10 PM	5:00 PM	1
3:40 PM	4:30 PM	5:20 PM	2
4:00 PM	4:50 PM	5:40 PM	3
4:20 PM	5:10 PM	6:00 PM	4
4:40 PM	5:30 PM	6:20 PM	5
5:00 PM	5:50 PM	6:40 PM	1
5:20 PM	6:10 PM	7:00 PM	2

Bolded runs would not pick up visitors in Nederland such that the last "new" transit visitors arrive via the 4:40 PM shuttle.

Vehicle Selection

Ridership demand estimates show that demand for the shuttle would average seven passengers per trip with a peak of 10 to 12 in the late morning to early afternoon. In considering passenger safety and convenience, the project team chose to institute a 20 minute headway (see Service Hours and Frequency), and with three trips per hour, transit service can meet demand with 12-passenger light-duty shuttle buses. Using smaller vehicles will save some on upfront capital costs, have less of

an impact on the roadway, would not require drivers to hold a CDL, and allow for increased vehicle maneuverability and storage options.

GSA AutoChoice lists several options for light-duty shuttle buses that would meet the needs for BLRA transit service. Since the shuttle service would be a fixed-route system, the vehicle must be "readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs"[5] (Figure 2). Such a vehicle, such as a Goshen Coach Pacer II, which includes a wheelchair lift, will cost about $70,000. Since five of these vehicles are necessary for Scenario 1, the total cost to purchase these vehicles would be $350,000.

Figure 2: Exterior (left) and interior (right) of a Goshen Coach Pacer II[6]

Staging

The project team considered two options for staging transit in Nederland. In both cases, lots are owned by other public agencies and USFS would need to enter into a use agreement with owners. The project team looked at the locations in Table 5 as *preliminary* options for staging. The project team has not spoken with the owners of these lots nor assessed the current status of each lot during peak summer weekend days.

Table 5: Preliminary Options for BLRA Scenario 1 Staging

Location	Capacity	Notes
RTD Park-N-Ride Lot	79 lined spots	Located close to downtown; Park-N-Ride serves buses to/from Boulder and beyond; also serves Hessie Trailhead Shuttle on summer weekends
Nederland Middle-Senior High School	46 lined spots	1.2 miles outside of town

[5] Subpart D. Acquisition of Accessible Vehicles By Public Entities; Sec. 37.71 Purchase or lease of new non-rail vehicles by public entities operating fixed route systems. http://www.fta.dot.gov/12876_3906.html

[6] Source: tescobus.com

Operations and Maintenance Assumptions[7]

The following cost assumptions in Table 6 allow the project team to calculate seasonal operations and maintenance costs. All costs are from the Volpe Bus Lifecycle Cost Model and updated to 2015.

Table 6: Assumptions Driving Costs in BLRA Scenario 1

Transit Element	Cost Assumption
Driver hourly wage	$30
Fuel cost per gallon	$3.50
Maintenance cost per mile (based on condition of Peak-to-Peak Highway and Brainard Lake Rd.)	$0.60
Fueling station and maintenance facility	$0.00 (Assume USFS uses existing stations/facility and does not construct new ones exclusively for transit)

Cost Estimates

This scenario assumes that the transit-supportive infrastructure costs, which include bus shelters and benches, would be negligible since much of this infrastructure already exists at the proposed staging areas and stops. Other general start-up costs include marketing, installation of signage, initial promotion, staff training, etc. These costs are anticipated to be $20,000 in Year 1 and should be added to the purchase and leasing cost estimates below.

Table 7 and Table 8 show the combined cost estimate for a vehicle purchase option. This assumes that USFS or another party purchases five full-size vans. These vehicles can be shared with other sites or used off-site during the remainder of the year when not in use at BLRA. These tables also show an annual maintenance cost, which assumes a three percent increase per year to account for inflation and fluctuation in driver, maintenance, and fuel costs.

Table 7: Capital Cost for Vehicle Purchase in BLRA Scenario 1

Vehicle	Quantity	Cost per Unit	Total
Light-Duty Shuttle Bus	5	$70,000	$350,000

Table 8: Total and Per-Passenger Costs with Vehicle Purchase in BLRA Scenario 1

Costs	Total	Per Passenger
Annual O&M Costs (Season 1)	$78,938	$10.84
Year One Capital Costs	$350,000	$48.08
Costs Per Season (2-7, cumulative)	$525,919	$10.32
Total	$954,856	$18.74

The USFS may also elect to lease vehicles, which may be an attractive option to test the viability of transit service with less up-front capital investment. GSA AutoChoice presents pricing options for light-duty shuttle buses. GSA offers a short-term lease in which the federal agency pays a monthly

[7] All cost references cited in Bus Lifecycle Cost Model (http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling).

lease fee to use the vehicles for a few months at a time.[8] GSA short-term lease rates for vehicles of this size are $3,092 per month, with an estimate cost per season of $12,368 each. Because lease rates include maintenance costs but not fuel or driver costs, the annual operations and maintenance cost is calculated separately. These costs include fuel and drivers only, at a total cost of $64,904 per year for all five vehicles. Table 9 shows the total costs and per passenger costs with a lease option.

Table 9: Total and Per-Passenger Costs with Vehicle Lease Per Year in BLRA Scenario 1

Light-Duty Shuttle Bus	Quantity	Cost per Month	Cost per Season	Total Capital	Total O&M (Fuel & Driver)	Total Costs	Total Per Passenger
One Season[9]	5	$3,092	$12,368	$61,840	$64,904	$126,744	$17.41

The total cost per passenger is similar between the purchase and lease options, with the lease being slightly more expensive.

Due to the relatively low number of passengers using this transit service (208 passengers represent less than eight percent of the approximately 1,843 visitors on a 92nd percentile day), the length of the service in terms of miles and minutes, and the high level of service needed for passenger safety and convenience, the cost per passenger is relatively high in both the purchase- and lease-scenarios. Implementation of this transit scenario would need capital investment from the USFS (or another funding source) for vehicles and infrastructure. This scenario would likely need a subsidy to cover the per-passenger operating cost or charge high fees to passengers.

Scenario 2: Shuttle Service from Nederland to Gateway Lot with Circulator from Gateway Lot to Day Use Lot and IPW Trailheads

This section describes capital and operational elements of transit service from Nederland to BLRA and is divided into two components: the first component is a shuttle service between Nederland and the Gateway Lot (presented below) and the second is a circulator between the Gateway Lot to the Day Use Lot and IPW Trailheads (presented in Scenario 3). This section presents the route description, ridership demand, service frequency, capital elements (such as staging and vehicle selection), and costs for component 1 (with the assumption that component 2, described in Scenario 3, would also be implemented).

Component 1: Shuttle Service from Nederland to Gateway Lot

Route

The route would start and end at Nederland (the Nederland Park-n-Ride is used as the staging area for the analysis below), making an out-and-back drive to the Gateway Lot at BLRA. Table 10 presents the mileage and driving times between stops for this scenario.

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[8] GSA also has leasing options that commit the leaser to a 7 year or 100,000 mile lease, which would be less attractive to the USFS if they were testing transit on a pilot basis. If USFS pursues transit, they are encouraged to work with their regional GSA office for more detailed pricing options. Rates vary by region, but they are unlikely to *exceed* the rates presented here. Short-term lease rates include mileage and preventative maintenance.

[9] The season refers to the three months of transit service described for all scenarios (Memorial Day through Labor Day).

Table 10: Mileage and Driving Time between Stops for BLRA Scenario 1

Route segment	Mileage	Driving Time
Nederland to Gateway Lot	14.3 miles	24 minutes
Gateway Lot to Nederland	14.3 miles	24 minutes
Round Trip Totals	28.6 miles	48 minutes (driving) 52 minutes (with stops)[10]

Ridership Demand

To plan for appropriate service levels and capital investment, the project team first estimated the demand for transit based on current traffic volumes (see Technical Memo 3.6) and results from the visitor survey (see Technical Memo 3.9). Accordingly, the project team's transit ridership estimate assumes that two percent of all visitors who currently drive through Nederland on route to and from BLRA would choose to use the optional transit service from Nederland to the Gateway Lot. To translate this percentage to ridership volumes, the project team looked at hourly traffic volumes on a 92nd percentile design day (737 vehicles per day) at an average vehicle occupancy rate of 2.5 people per vehicle. **The resulting estimate is 13 passengers per day**.

Service Hours and Frequency

As is described for Scenario 1, service hours and frequency are based on ridership demand and feasibility. Accordingly, the project team recommends beginning transit service at 7 a.m.

The project team decided to design a system with maximum headways of 30 minutes, which balances convenience and visitor safety with financial and operational feasibility. The system would therefore operate every 30 minutes from 7 a.m. through 7 p.m. (with the last shuttle leaving Nederland at 6 p.m.). See Table 11 for a summary schedule of shuttle service for component 1, as well as the vehicle assigned to each trip. This service schedule would call for 23 round trips daily and two shuttle buses.

Table 11: Schedule of Shuttle Runs for BLRA Scenario 2, Component 1

Departure (Staging)	Arrival (THs)	Arrival (Staging)	Vehicle #
7:00 AM	7:30 AM	8:00 AM	1
7:30 AM	8:00 AM	8:30 AM	2
8:00 AM	8:30 AM	9:00 AM	1
8:30 AM	9:00 AM	9:30 AM	2
9:00 AM	9:30 AM	10:00 AM	1
9:30 AM	10:00 AM	10:30 AM	2
10:00 AM	10:30 AM	11:00 AM	1
10:30 AM	11:00 AM	11:30 AM	2
11:00 AM	11:30 AM	12:00 PM	1
11:30 AM	12:00 PM	12:30 PM	2
12:00 PM	12:30 PM	1:00 PM	1
12:30 PM	1:00 PM	1:30 PM	2

[10] The total time for each route includes a 4 minute stop at the Gateway Lot.

Departure (Staging)	Arrival (THs)	Arrival (Staging)	Vehicle #
1:00 PM	1:30 PM	2:00 PM	1
1:30 PM	2:00 PM	2:30 PM	2
2:00 PM	2:30 PM	3:00 PM	1
2:30 PM	3:00 PM	3:30 PM	2
3:00 PM	3:30 PM	4:00 PM	1
3:30 PM	4:00 PM	4:30 PM	2
4:00 PM	4:30 PM	5:00 PM	1
4:30 PM	5:00 PM	5:30 PM	2
5:00 PM	5:30 PM	6:00 PM	1
5:30 PM	6:00 PM	6:30 PM	2
6:00 PM	6:30 PM	7:00 PM	1

Bolded runs would not pick up visitors in Nederland such that the last "new" transit visitors arrive via the 4:40 PM shuttle.

Vehicle Selection

The same light-duty shuttle bus used for Scenario 1 should be used for Scenario 2. Since this vehicle would likely cost around $70,000, two vehicles would cost $140,000.

Staging

Staging for BLRA Scenario 2, Component 1 in Nederland is the same as BLRA Scenario 1.

Operations and Maintenance Assumptions[11]

The operations and maintenance assumptions for this scenario is the same as in BLRA Scenario 1.

Cost Estimates

The cost estimates for BLRA Scenario 2, Component 1 are a combination of the following costs:

1. Transit-supportive infrastructure costs
2. Vehicle purchase or lease
3. Start-up costs
4. Operation costs (annual)
5. Maintenance costs (annual)

This scenario assumes that the transit-supportive infrastructure costs, which include bus shelters and benches, would be negligible since much of this infrastructure already exists at the proposed staging areas and stop. Other general start-up costs include marketing, installation of signage, initial promotion, staff training, etc. These costs are anticipated to be $20,000 in Year 1 and should be added to the purchase and leasing cost estimates below.

Table 12 and Table 13 show the combined cost estimate for a vehicle purchase option. This assumes that USFS or another party purchases two light-duty shuttle buses. These vehicles can be shared with other sites or used off-site during the remainder of the year when not in use at BLRA. These tables also calculate an annual maintenance cost, which assumes a three percent increase per year to account for inflation and fluctuation in driver, maintenance, and fuel costs.

[11] All cost references cited in Bus Lifecycle Cost Model (http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling).

Table 12: Capital Cost for Vehicle Purchase in BLRA Scenario 2, Component 1

Vehicle	Quantity	Cost per Unit	Total
Light-Duty Shuttle Bus	2	$70,000	$140,000

Table 13: Total and Per-Passenger Costs with Vehicle Purchase in BLRA Scenario 2, Component 1

Costs	Total	Per Passenger
Annual O&M Costs (Season 1)	$34,744	$76.36
Year One Capital Costs	$140,000	$307.69
Costs Per Season (2-7, cumulative)	$231,479	$72.68
Total	$406,223	$127.54

As is the case with Scenario 1, USFS may also elect to lease vehicles, which may be an attractive option to test the viability of transit service with less up-front capital investment. GSA AutoChoice presents pricing options for light-duty shuttle buses. GSA offers a short-term lease in which the federal agency pays a monthly lease fee to use the vehicles for a few months at a time.[12] GSA short-term lease rates for vehicles of this size are $3,092 per month, with an estimate cost per season of $12,368 each. Because lease rates include maintenance costs but not fuel or driver costs, the annual operations and maintenance cost is calculated separately. These costs include fuel and drivers only, at a total cost of $26,686 per year for both vans. Table 14 shows the total costs and per passenger costs with a lease option.

Table 14: Total and Per-Passenger Costs with Vehicle Lease Per Year in BLRA Scenario 2, Component 1

Light-Duty Shuttle Buses	Quantity	Cost per Month	Cost per Season	Total Capital	Total O&M (Fuel & Driver)	Total Costs	Total Per Passenger
One Season	2	$3,092	$12,368	$24,736	$26,686	$51,422	$113.02

The total cost per passenger is similar between the purchase and lease options, with the lease being slightly more expensive.

Due to the very low number of passengers using this transit service (13 passengers represent less than one percent of the approximately 1,843 visitors on a 92nd percentile day), the length of the service in terms of miles and minutes, and the level of service needed for passenger convenience, the cost per passenger is extremely high in both the purchase- and lease-scenarios. Implementation of component 1 of this transit scenario would need capital investment from the USFS (or another funding source) for vehicles and infrastructure. Component 1 of this scenario would likely need a large subsidy to cover the per-passenger operating cost or charge high fees to passengers and is therefore not recommended for implementation. Analyzing component 2 together with this

[12] GSA also has leasing options that commit the leaser to a 7 year or 100,000 mile lease, which would be less attractive to the USFS if they were testing transit on a pilot basis. If USFS pursues transit, they are encouraged to work with their regional GSA office for more detailed pricing options. Rates vary by region, but they are unlikely to *exceed* the rates presented here. Short-term lease rates include mileage and preventative maintenance.

component is therefore not necessary, so the following transit scenario should only be considered as a standalone scenario.

Scenario 3: Circulator from Gateway Lot to Day Use Lot and IPW Trailhead Lots

This section describes capital and operational elements of circulator transit service in BLRA. This section includes the route description, ridership demand, service frequency, capital elements (such as staging and vehicle selection), and costs for this transit scenario.

Route

The route would start and end at the Gateway Lot, making a circular drive to the IPW Trailhead Lots with stops at the Day Use Lot and Niwot Mountain Lot to and from the Trailhead Lots (Long Lake and Mitchell Lake). Table 15 presents the mileage and driving times between stops for this scenario.

Table 15: Mileage and Driving Time between Stops for BLRA Scenario 3

Route segment	Mileage	Driving Time
Gateway Lot to Day Use Lot	2.2 miles	6 minutes
Day Use Lot to Niwot Mountain Lot	0.5 miles	2 minutes
Niwot Mountain Lot to Long Lake Trailhead Lot	0.7 miles	3 minutes
Long Lake Trailhead to Mitchell Lake Trailhead Lot	0.7 miles	3 minutes
Mitchell Lake Trailhead Lot to Niwot Mountain Lot	0.7 miles	3 minutes
Niwot Mountain Lot to Day Use Lot	0.5 miles	2 minutes
Day Use Lot to Gateway Lot	2.2 miles	6 minutes
Round Trip Totals	7.2 miles	25 minutes (driving) 53 minutes (with stops)[13]

Ridership Demand

To plan for appropriate service levels and capital investment, the project team first estimated the demand for transit based on current traffic volumes (see Technical Memo 3.6) and results from the visitor survey (see Technical Memo 3.9). The transit ridership estimate assumes two percent of all visitors who currently drive through Nederland on route to and from BLRA would choose to use the optional transit service from Nederland to the Gateway Lot. According to visitors that responded to the survey (Technical Memo 3.9, Figure 25), 76 percent of visitors would elect to take a short transit ride from the Gateway Lot to BLRA hiking destinations, *if this were their only option to visit BLRA* because parking lots were full. (The assumption is that the remaining 24 percent of visitors would not visit BLRA during times that these parking conditions exist.) The estimate is also coupled with the continuance of parking restrictions and management. To translate these percentages to ridership volumes, the project team looked at hourly traffic volumes on a 92nd percentile design day (737 vehicles per day) at an average vehicle occupancy rate of 2.5 people per vehicle.

The resulting estimate is 195 passengers per day. Most passengers would arrive between 10 a.m. and 1 p.m., and the greatest volume of visitors would be between 11 a.m. and 12 p.m. and between 1 p.m. and 2 p.m.

[13] The total time for each route includes 4 minutes at each stop.

Service Hours and Frequency

Service hours and frequency are based on ridership demand, passenger safety, and feasibility. Traffic volumes and parking lot counts in Technical Memo 3.6 show that parking demand begins to exceed capacity at Long and Mitchell Lake Trailhead Lots starting around 8 a.m. However, the Day Use Lot does not fill up until 11 a.m., which is when the demand for the transit service would likely be greatest. For feasibility of transit operations, the project team recommends beginning transit service at 7 a.m.

The project team decided to design a system with maximum headways of 20 minutes, which balances convenience and visitor safety with financial and operational feasibility.[14] The system would operate every 20 minutes from 7:00 a.m. through 6:00 p.m. (with the last shuttle leaving the Gateway Lot at 5:00 p.m.). See Table 16 for a summary schedule of shuttle service for Scenario 1, as well as the vehicle assigned to each trip.

This service schedule would call for 31 round trips daily and three shuttle buses. There would be an average of seven passengers per trip throughout the day, but during peak periods (11 a.m. to 1 p.m.), the average would be higher.

[14] The 20 minute figure is based on previous transit surveys conducted at Marsh-Billings Rockefeller NHP and Muir Woods National Monument. Also, a Center for Urban Transportation Research (University of South Florida) study suggests a maximum wait time of 30 minutes is acceptable for urban transit systems, and the study team estimates that a slightly shorter headway seems appropriate in the recreation context (CUTR study available at http://www.nctr.usf.edu/pdf/77720.pdf)

Table 16: Schedule of Shuttle Runs for BLRA Scenario 3

Departure (Staging)	Arrival (THs)	Arrival (Staging)	Vehicle #
7:00 AM	7:30 AM	8:00 AM	1
7:20 AM	7:50 AM	8:20 AM	2
7:40 AM	8:30 AM	8:40 AM	3
8:00 AM	8:30 AM	9:00 AM	1
8:20 AM	8:50 AM	9:20 AM	2
8:40 AM	9:10 AM	9:40 AM	3
9:00 AM	9:30 AM	10:00 AM	1
9:20 AM	9:50 AM	10:20 AM	2
9:40 AM	10:10 AM	10:40 AM	3
10:00 AM	10:30 AM	11:00 AM	1
10:20 AM	10:50 AM	11:20 AM	2
10:40 AM	11:10 AM	11:40 AM	3
11:00 AM	11:30 AM	12:00 PM	1
11:20 AM	11:50 AM	12:20 PM	2
11:40 AM	12:10 PM	12:40 PM	3
12:00 PM	12:30 PM	1:00 PM	1
12:20 PM	12:50 PM	1:20 PM	2
12:40 PM	1:10 PM	1:40 PM	3
1:00 PM	1:30 PM	2:00 PM	1
1:20 PM	1:50 PM	2:20 PM	2
1:40 PM	2:10 PM	2:40 PM	3
2:00 PM	2:30 PM	3:00 PM	1
2:20 PM	2:50 PM	3:20 PM	2
2:40 PM	3:10 PM	3:40 PM	3
3:00 PM	3:30 PM	4:00 PM	1
3:20 PM	3:50 PM	4:20 PM	2
3:40 PM	4:10 PM	4:40 PM	3
4:00 PM	4:30 PM	5:00 PM	1
4:20 PM	4:50 PM	5:20 PM	2
4:40 PM	5:10 PM	5:40 PM	3
5:00 PM	5:30 PM	6:00 PM	1

Vehicle Selection

The same light-duty shuttle bus used for Scenario 1 should be used for this scenario. Since this vehicle would likely cost around $70,000, three vehicles would cost of $210,000.

Operations and Maintenance Assumptions

The operations and maintenance assumptions for this scenario is the same as in Scenario 1.

Cost Estimates

The cost estimates for BLRA Scenario 2, Component 2/Scenario 3 are a combination of the following costs:

1. Transit-supportive infrastructure costs
2. Vehicle purchase or lease
3. Start-up costs
4. Operation costs (annual)
5. Maintenance costs (annual)

This scenario assumes that the transit-supportive infrastructure costs, which include bus shelters and benches, would be negligible since much of this infrastructure already exists at the proposed staging areas and stops. Other general start-up costs include marketing, installation of signage, initial promotion, staff training, etc. These costs are anticipated to be $20,000 in Year 1.

Table 17 and Table 18 show the combined cost estimate for a vehicle purchase option. This assumes that USFS or another party purchases three light-duty shuttle buses. These vehicles can be shared with other sites or used off-site during the remainder of the year when not in use at BLRA. These tables also calculate an annual maintenance cost, which assumes a three percent increase per year to account for inflation and fluctuation in driver, maintenance, and fuel costs.

Table 17: Capital Cost for Vehicle Purchase in BLRA Scenario 2, Component 2/Scenario 3

Vehicle	Quantity	Cost per Unit	Total
Light-Duty Shuttle Bus	3	$70,000	$210,000

Table 18: Total and Per-Passenger Costs with Vehicle Purchase in BLRA Scenario 2, Component 2/Scenario 3

Costs	Total	Per Passenger
Annual O&M Costs (Season 1)	$33,440	$4.90
Year One Capital Costs	$210,000	$30.77
Costs Per Season (2-7, cumulative)	$222,791	$4.66
Total	$466,230	$9.76

USFS may also elect to lease vehicles, which may be an attractive option to test the viability of transit service with less up-front capital investment. GSA AutoChoice presents pricing options for light-duty shuttle buses. GSA offers a short-term lease in which the federal agency pays a monthly lease fee to use the vehicles for a few months at a time.[15] GSA short-term lease rates for vehicles of this size are $3,092 per month, with an estimate cost per season of $12,368 each. Because lease rates include maintenance costs but not fuel or driver costs, the annual operations and maintenance cost is calculated separately. These costs include fuel and drivers only, at a cost of $64,904 per year. Table 19 shows the total costs and per passenger costs with a lease option.

[15] GSA also has leasing options that commit the leaser to a 7 year or 100,000 mile lease, which would be less attractive to the USFS if they were testing transit on a pilot basis. If USFS pursues transit, they are encouraged to work with their regional GSA office for more detailed pricing options. Rates vary by region, but they are unlikely to *exceed* the rates presented here. Short-term lease rates include mileage and preventative maintenance.

Table 19: Total and Per-Passenger Costs with Vehicle Lease in BLRA Scenario 2, Component 2/Scenario 3

Light-Duty Shuttle Bus	Quantity	Cost per Month	Cost per Season	Total Capital	Total O&M (Fuel & Driver)	Total Costs	Total Per Passenger
One Season	3	$3,092	$12,368	$37,104	$30,706	$67,810	$9.94

The total cost per passenger is similar between the purchase and lease options, with the lease being slightly more expensive.

Considering the number of passengers using this service (195 passengers, which represents about 11 percent of the approximately 1,843 visitors on a 92nd percentile day), the length of the service in terms of miles and minutes, and the level of service needed for passenger safety and convenience, the cost per passenger is relatively reasonable, especially for the purchase option. Implementation of this transit scenario would need capital investment from the USFS (or another funding source) for vehicles and infrastructure. This scenario would likely need a subsidy to cover the per-passenger operating cost or charge high fees to passengers.

Scenario 4: Circulator from Gateway Lot to Day Use Lot

This section describes capital and operational elements of circulator transit service in BLRA from the Gateway Lot to the Day Use Lot. This section includes the route description, ridership demand, service frequency, capital elements (such as staging and vehicle selection), and costs.

Route

The route would start and end at the Gateway Lot, making an out-and-back drive to the Day Use Lot. Table 20 presents the mileage and driving times between the stops for this scenario.

Table 20: Mileage and Driving Time between Stops for BLRA Scenario 4

Route Segment	Mileage	Driving Time
Gateway Lot to Day Use Lot	2.2 miles	6 minutes
Day Use Lot to Gateway Lot	2.2 miles	6 minutes
Round Trip Totals	4.4 miles	12 minutes (driving) 20 minutes (with stops)[16]

Ridership Demand

To plan for appropriate service levels and capital investment, the project team first estimated the demand for transit based on current traffic volumes and results from the visitor survey (see Technical Memo 3.6). The estimate is coupled with the continuance of parking restrictions and management which, based on survey results from Technical Memo 3.9, the project team assumes 76 percent of visitors who cannot park in BLRA because lots are full would take transit and the other 24 percent choose to go somewhere other than BLRA. To translate this percentage to ridership volumes, the project team looked at hourly traffic volumes on a 92nd percentile design day (737 vehicles per day) at an average vehicle occupancy rate of 2.5 people per vehicle.

[16] The total time for each route includes 4 minutes at each stop.

The resulting estimate is 195 passengers per day. Most passengers would arrive between 10 a.m. and 1 p.m., and the greatest volume of visitors would be between 11a.m. and noon and between 1 p.m. and 2 p.m.

Service Hours and Frequency

Service hours and frequency is based on ridership demand, passenger safety, and feasibility. Traffic volumes and parking lot counts in Technical Memo 3.6 show that parking demand begins to exceed capacity at Long and Mitchell Lake Trailhead Lots starting around 8 a.m. However, the Day Use Lot does not fill up until 11 a.m., which is when the demand for the transit service would likely be greatest. For feasibility of transit operations, the project team recommends beginning transit service at 7 a.m.

The project team decided to design a system with maximum headways of 20 minutes, which balances convenience and visitor safety with financial and operational feasibility.[17] The system would operate every 20 minutes from 7 a.m. through 6 p.m. (with the last shuttle leaving the Gateway Lot at 5:00 p.m.). See
Table 21 for a summary schedule of shuttle service for Scenario 1, as well as the vehicle assigned to each trip.

This service schedule would call for 33 round trips daily and one shuttle bus. There would be an average of seven passengers per trip throughout the day, but during peak periods (11 a.m. to 1 p.m.), the average would be higher.

[17] The 20 minute figure is based on previous transit surveys conducted at Marsh-Billings Rockefeller NHP and Muir Woods National Monument. Also, a Center for Urban Transportation Research (University of South Florida) study suggests a maximum wait time of 30 minutes is acceptable for urban transit systems, and the study team estimates that a slightly shorter headway seems appropriate in the recreation context (CUTR study available at http://www.nctr.usf.edu/pdf/77720.pdf)

Table 21: Schedule of Shuttle Runs for BLRA Scenario 4

Departure (Gateway)	Arrival (Day Use)	Arrival (Gateway)
7:00 AM	7:10 AM	7:20 AM
7:20 AM	7:30 AM	7:40 AM
7:40 AM	7:50 AM	8:00 AM
8:00 AM	8:10 AM	8:20 AM
8:20 AM	8:30 AM	8:40 AM
8:40 AM	8:50 AM	9:00 AM
9:00 AM	9:10 AM	9:20 AM
9:20 AM	9:30 AM	9:40 AM
9:40 AM	9:50 AM	10:00 AM
10:00 AM	10:10 AM	10:20 AM
10:20 AM	10:30 AM	10:40 AM
10:40 AM	10:50 AM	11:00 AM
11:00 AM	11:10 AM	11:20 AM
11:20 AM	11:30 AM	11:40 AM
11:40 AM	11:50 AM	12:00 PM
12:00 PM	12:10 PM	12:20 PM
12:20 PM	12:30 PM	12:40 PM
12:40 PM	12:50 PM	1:00 PM
1:00 PM	1:10 PM	1:20 PM
1:20 PM	1:30 PM	1:40 PM
1:40 PM	1:50 PM	2:00 PM
2:00 PM	2:10 PM	2:20 PM
2:20 PM	2:30 PM	2:40 PM
2:40 PM	2:50 PM	3:00 PM
3:00 PM	3:10 PM	3:20 PM
3:20 PM	3:30 PM	3:40 PM
3:40 PM	3:50 PM	4:00 PM
4:00 PM	4:10 PM	4:20 PM
4:20 PM	4:30 PM	4:40 PM
4:40 PM	4:50 PM	5:00 PM
5:00 PM	5:10 PM	5:20 PM
5:20 PM	5:30 PM	5:40 PM
5:40 PM	5:50 PM	6:00 PM

Bolded runs would not pick up visitors at Gateway lot such that the last "new" transit visitors arrived via the 5:20 PM shuttle.

Vehicle Selection

The same light-duty shuttle bus used for Scenario 1 should be used for this scenario. This vehicle would likely cost around $70,000. In case this vehicle breaks down, it may be wise for the USFS to purchase or lease a second vehicle to have on hand. Otherwise, service would have to be suspended if a shuttle breaks down. This possibility may be acceptable to the USFS since then visitors would

simply have to walk the relatively short distance instead. Accordingly, only one vehicle is used in the cost estimates below.

Operations and Maintenance Assumptions[18]

The operations and maintenance assumptions for this scenario is the same as in Scenario 1.

Cost Estimates

The cost estimates for BLRA Scenario 4 are a combination of the following costs:

1. Vehicle purchase or lease
2. Transit-supportive infrastructure costs
3. Start-up costs
4. Operation costs (annual)
5. Maintenance costs (annual)

This scenario assumes that the transit-supportive infrastructure costs, which include bus shelters and benches, would be negligible since much of this infrastructure already exists at the proposed staging areas and stops. Other general start-up costs include marketing, installation of signage, initial promotion, staff training, etc. These costs are anticipated to be $20,000 in Year 1.

Table 22 and Table 23 show the combined cost estimate for a vehicle purchase option. This assumes that USFS or another party purchases the light-duty shuttle bus. This vehicle can be shared with other sites or used off-site during the remainder of the year when not in use at BLRA. These tables also calculate an annual maintenance cost, which assumes a three percent increase per year to account for inflation and fluctuation in driver, maintenance, and fuel costs.

Table 22: Capital Cost for Vehicle Purchase in BLRA Scenario 4

Vehicle	Quantity	Cost per Unit	Total
Light-Duty Shuttle Bus	1	$70,000	$70,000

Table 23: Total and Per-Passenger Costs with Vehicle Purchase in BLRA Scenario 4

Costs	Total	Per Passenger
Annual O&M Costs (Season 1)	$14,599	$2.14
Year One Capital Costs	$70,000	$10.26
Costs Per Season (2-7, cumulative)	$97,267	$2.04
Total	$181,866	$3.81

USFS may also elect to lease vehicles, which may be an attractive option to test the viability of transit service with less up-front capital investment. GSA AutoChoice presents pricing options for light-duty shuttle buses. GSA offers a short-term lease in which the federal agency pays a monthly lease fee to use the vehicles for a few months at a time.[19] GSA short-term lease rates for vehicles of

[18] All cost references cited in Bus Lifecycle Cost Model (http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling).

[19] GSA also has leasing options that commit the leaser to a 7 year or 100,000 mile lease, which would be less attractive to the USFS if they were testing transit on a pilot basis. If USFS pursues transit, they are encouraged to work with their regional GSA office for more detailed pricing options. Rates vary by region, but they are

this size are $3,092 per month, with an estimate cost per season of $12,368 each. Because lease rates include maintenance costs but not fuel or driver costs, the annual operations and maintenance cost is calculated separately. These costs include fuel and drivers only, at a cost of $14,599 per year. Table 24 shows the total costs and per passenger costs with a lease option.

Table 24: Total and Per-Passenger Costs with Vehicle Lease in BLRA Scenario 4

Light-Duty Shuttle Bus	Quantity	Cost per Month	Cost per Season	Total Capital	Total O&M (Fuel & Driver)	Total Costs	Total Per Passenger
One Season	1	$3,092	$12,368	$12,368	$14,599	$26,967	$3.95

The total cost per passenger is similar between the purchase and lease options, with the lease being slightly more expensive.

Considering the number of passengers using this service (195 passengers, which represents about 11 percent of the approximately 1,843 visitors on a 92nd percentile day), the length of the service in terms of miles and minutes, and the level of service needed for passenger safety and convenience, the cost per passenger is quite reasonable, especially for the purchase option. Implementation of this transit scenario would need capital investment from the USFS (or another funding source) for vehicles and infrastructure. This scenario would likely need a subsidy to cover the per-passenger operating cost or charge high fees to passengers.

unlikely to *exceed* the rates presented here. Short-term lease rates include mileage and preventative maintenance.

Guanella Pass (GP)

Guenella Pass Road is a National Forest Scenic Byway located approximately 40 miles west of the Denver metropolitan area. The Road is 24 miles in length and connects Georgetown, Colorado, with Grant, Colorado via the 11,669' Guanella Pass. The Guanella Pass Scenic Byway (GP) is within both the Arapaho-Roosevelt National Forest and the Pike National Forest (PNF). As described in Technical Memos 3.3 and 4.1, the primary transportation challenges at GP result from parking congestion at the Mount Bierstadt Trailhead. Guanella Pass is popular among hikers for its relatively easy hiking access to the summit of Mount Bierstadt, which is one of Colorado's 14,000+ foot peaks. Mount Bierstadt is located within the Mount Evans Wilderness.

Guanella Pass has two main parking lots – the Lower Lot has 48 spaces and the Upper Lot has 58 spaces. Most visitors drive from the north (Georgetown) along Guanella Pass Road to access the trailhead, arriving early in the morning on summer days to complete their hike before afternoon thunderstorms arrive. These lots fill to capacity between 6 a.m. and 9 a.m. and remain full until early afternoon. Visitors frequently arrive at the Pass and find all designated spaces full, leaving them with no choice but to park in unendorsed spaces on the roadside or leave. The problem is so severe that nearly twice as many cars are parked in unendorsed spaces (230 vehicles) as in the designated lots (125 vehicles).[20]

The heavy, concentrated visitation leads to several transportation challenges. As summarized in Technical Memo 4.1, these include:

- Unendorsed roadside parking, causing resource impacts and visitor safety risks.
- Extreme crowding on the summit of Mt. Bierstadt during peak periods.
- Off-trail trampling of vegetation and soils in the Mt. Evans Wilderness.
- Recreation-related traffic congestion in Georgetown, CO.

The project team conducted traffic counts and counts of visitors on the summit of Mount Bierstadt, collected parking accumulation data and GPS-tracks of visitor use patterns, and administered visitor surveys to quantify these challenges and understand potential solutions. More details about the existing conditions, needs, and visitor survey results can be found in Technical Memos 3.3, 3.4, 3.7, and 4.1.

Relevant Constraints and Needs

GP's primary challenge that may be addressed through transit is the unendorsed roadside parking near the Mount Bierstadt Trailhead. Since Mount Bierstadt is within a Wilderness area where concentrated visitor use is not appropriate, transit service must be sensitive to visitor volume. Technical Memo 4.1 calls for measures to manage visitor use levels at Guanella Pass according to wilderness management objectives and corresponding user capacities; transportation and management strategies will be necessary to manage these use levels.

The project team recognizes the following constraints at Guanella Pass affecting the types and feasibility of transit systems and how to design transit that would best address the site's challenges:

1. **Unique time constraints of visitor activity**. Nearly all congestion at the trailhead lots is from hiker vehicles that are parked for an average of 4 to 5 hours on weekends, with use concentrated between 6 a.m. and 3 p.m. Also, nearly all hikers are participating in the same

[20] Technical Memo 4.1, P. 15

activity (hiking to the summit of Mount Bierstadt). Transit would need to concentrate on this user group while accommodating variation and uncertainty in hiker schedules.

2. **Peak hours and storms.** The peak hours of use at GP are concentrated to avoid summer afternoon thunderstorms. Transit headways and other operational parameters would need to balance visitor safety during storm events, demand for transit, and crowd control.
3. **Short season**. The busiest hiking season is from Memorial Day through Labor Day. Since congestion and safety risks are greatest on weekends and holidays, the operating season for transit would be only 35 days.
4. **Coupling with parking enforcement needed**. Through the visitor survey, the majority of visitors (68%) would be willing to take a short (15-minute) shuttle "if this was their only option for visiting because parking lots were full." A smaller percentage (41%) would be willing to take a 30 minute shuttle from Georgetown.[21] Therefore, there would need to be some parking enforcement or another method to control unendorsed parking to compel visitors to use transit. Absent such enforcement, ridership would be too low for feasible operation. Additionally, charging a fee for the shuttle (even as low as $1 per person) may have a significant impact on ridership, even with such enforcement in place.[22]
5. **Staging**. The hiker shuttle would attract up to 275 vehicles at one time during peak use periods, which would be a significant constraint for staging and parking. The staging area would only be used 35 days per year, which could allow for greater flexibility in using existing lots or could add considerable expense to acquire or construct parking that would have limited use.

Proposed Transit Scenarios

Through meetings with USFS staff, stakeholders, and the public, the project team developed the following transit scenarios to address parking congestion and resource management needs at Guanella Pass. Each of these scenarios assumes that, and is dependent upon, the USFS enforcing parking in designated parking lots only along the highway. See Figure 3 for an illustration of Guanella Pass scenarios.

[21] Technical Memo 3.7, Figure 25 (page 29)

[22]The visitor survey did not ask about price sensitivity. However, transit ridership demand and its relationship to transit fare is well-documented. Studies show that increasing fares are associated with decreased ridership and that fare-free systems may result in increased ridership: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_95c12.pdf, http://trid.trb.org/view.aspx?id=405875, and http://www.wsdot.wa.gov/research/reports/fullreports/277.1.pdf.

Figure 3: Guanella Pass Scenarios

1. Hiker shuttle from Georgetown to Guanella Pass
Shuttle buses would operate between a designated park-and-ride lot in Georgetown, CO, and Guanella Pass, with en-route shuttle stops by request at the Clear Lake Campground, Guanella Pass Campground, and the Silver Dollar Lake parking area. Hours of operation would correspond with peak hiking hours on the Mount Bierstadt trail and include contingency operating plans for visitor safety in the event of thunderstorms. Shuttle service would operate according to hiker demand coupled with parking enforcement at the Upper and Lower Lots at Guanella Pass and along Guanella Pass Road.

2. **Hiker shuttle service from new lot on Guanella Pass Road to Guanella Pass**
Shuttle buses would operate between a designated park-and-ride lot on Guanella Pass Road (near the Pass), and Guanella Pass, with en-route shuttle stops by request at the Clear Lake Campground, Guanella Pass Campground, and the Silver Dollar Lake parking area. Hours of operation would correspond with peak hiking hours on the Mount Bierstadt trail and include contingency operating plans for visitor safety in the event of thunderstorms. Shuttle service would operate according to hiker demand coupled with parking enforcement at the Upper and Lower Lots at Guanella Pass and along Guanella Pass Road.

3. **Mandatory hiker shuttle service from Georgetown to Guanella Pass (with permit system)**
USFS would institute a wilderness permit system that permitted only 400 hikers per day on weekends and 200 hikers per day on weekdays. All hikers would be required to take a shuttle to Guanella Pass Trailhead, thus decreasing the need for staffing and enforcement at the trailhead. Shuttle buses would operate between a designated park-and-ride lot in Georgetown, CO, and Guanella Pass. Hours of operation would correspond with peak hiking hours on the Mount Bierstadt trail and include contingency operating plans for visitor safety in the event of thunderstorms.

The project team also considered and developed cost estimates for the following scenarios. They were dismissed because the team believed that the costs would exceed the potential benefits.

4. ***Voluntary* Hiker Shuttle Service from Guanella Pass Road to Guanella Pass**.
This shuttle service would be similar to Scenario 2 above but it would not be linked to parking restrictions or enforcement. Instead, all hikers using the shuttle would do so on a voluntary basis. The project team assumed up to five percent of hikers would choose to use the shuttle. With such low ridership (approximately 81 visitors, or five percent of 1,627 visitors on the 95th percentile design day[23]), the costs of instituting a shuttle service would not outweigh the congestion relief benefits. Also, per passenger costs would be prohibitive.

5. **Hiker Shuttle Service coupled with Wilderness Permit System**
This transit scenario envisions that a wilderness permit system is in effect that sets a limit to the number of people that can hike Mount Bierstadt per day. The number of permits is limited such that no more than 15 percent of visitors who hike to the summit would see more than 22 people at one time. The project team found that the total volume of hikers that would receive permits is very close to total number of designated parking spaces at the Upper and Lower Lots (multiplied by vehicle occupancy). The cost, capacity, and safety risks (from waiting for shuttle pick-up during weather events) to run shuttles to serve a small number of "overflow" hikers exceeds the benefits.

[23] Technical Memo 3.3, page 9.

The project team decided instead to limit the permit system to the number of vehicles that will fit in designated spaces at the lot.

Table 25 provides a summary of the operations and costs of Guanella Pass scenarios 1 and 2 and the following sections contain details for each scenario. Note that costs to own are averaged over twelve years, which is the life of the vehicle (if purchased). Scenario 2 is the most cost effective scenario and would relieve congestion at the GP parking lots, but it would require displacing parking to elsewhere on Guanella Pass Road.

Table 25: GP Scenarios Operations and Costs Summary

	Scenario 1	Scenario 2	Scenario 3
Travel Time (Roundtrip)	84 minutes	36 minutes	66 minutes
Distance (Roundtrip)	32 miles	10 miles	22 miles
Hours of Operation	6 a.m. to 7 p.m.	6 a.m. to 7:30 p.m.	6 a.m. to 5 p.m.
Frequency of Service	20-30 minutes	10-20 minutes	15-30 minutes
Vehicles Required	5	5	5
Passengers/Day	414	687	400 (weekends), 200 (weekdays)
Cost to Own/Year	$166,309	$123,955	$234,271
Cost to Own/Year/Rider	$11.48	$5.16	$8.37
Cost to Lease/Year*	$130,315-$144,900	$52,516	$181,790
Cost to Lease/Year/Rider*	$8.99-$10.00	$4.36-$5.17	$6.49

*Cost range reflects addition of transit-supportive infrastructure (bus shelters, benches, etc.) aggregated over 12 years

Scenario 1: Hiker shuttle from Georgetown to Guanella Pass

This section describes the process of planning for the capital and operational elements of transit service from Georgetown to Guanella Pass. This includes the route description, ridership demand, service frequency, capital elements (such as staging and vehicle selection), and costs.

Route

The route would start and end at Georgetown, making an out-and-back drive to Guanella Pass. The shuttle would cater to hikers, who have relatively set schedules and destinations. The survey data indicates that the majority of hikers exclusively visit the Mount Bierstadt trail; therefore, we anticipate that most hikers would not be interested in other destinations along Guanella Pass Road, but the shuttle could make stops by request only at the Clear Lake Campground, Guanella Pass Campground, and the Silver Dollar Lake parking area. For example, if a group of hikers were camping at one of the campgrounds, they could make an advance reservation for shuttle pick up. Because stops at these locations would be infrequent and brief, they are not included in the time estimate totals in Table 26.

Most shuttles would carry passengers in one direction only (from Georgetown to the Pass in the morning and from the Pass to Georgetown in the afternoon), and some of the midday shuttles may carry passengers in both directions.

Table 26: Mileage and Driving Time between Stops for GP Scenario 1

Route segment	Mileage	Driving Time
Georgetown Staging Area to Clear Lake Campground	11 miles	24 minutes
Clear Lake Campground to Guanella Pass Campground/Silver Dollar Lake Parking	3 miles	7 minutes
Guanella Pass Campground to Guanella Pass Trailhead	2 miles	6 minutes
Round Trip Totals	32 miles	74 minutes (driving) 84 minutes (with stops)[24]

Ridership Demand

To plan for appropriate service levels and capital investment, the project team estimated the demand for transit based on current traffic volumes (see Technical Memo 3.3) and results from the visitor survey (see Technical Memo 3.7).

According to the visitors that responded to the survey, 41 percent of visitors (Technical Memo 3.7, Figure 25) would elect to take transit from Georgetown (up to 30 minutes) *if this were their only option to visit GP* because parking conditions prevented them from driving their private vehicles. (The assumption is that the remaining 59 percent of visitors would not visit GP during times that these parking conditions exist.) The estimate is also coupled with the addition of parking restrictions and management. To translate to ridership volumes, the project team looked at hourly traffic volumes on a 95th percentile design day coupled with available parking and likely duration of stay to arrive at a number of visitors *per hour* that would otherwise have to park in undesignated roadside parking if they were to enter GP in their private vehicle.

The resulting estimate is 414 passengers per day. Most passengers would arrive between 6 a.m. and 9 a.m., with departures spaced more regularly throughout the early afternoon and tapering off by late afternoon/evening.

Service Hours and Frequency

Service hours and frequency are based on ridership demand, passenger safety, and feasibility. Traffic volumes and parking lot counts show that parking demand begins to exceed capacity in the Lower Lot starting around 6 a.m. and in the Upper Lot by 9 a.m. Therefore, transit service would begin at 6 a.m.

Figure 9 (Technical Memo 3.3) shows that the distribution of departing vehicles peaks between 12 p.m. and 3 p.m. Figure 10 (Technical Memo 3.7) shows how long visitors report hiking on the Mount Bierstadt Trail. Using these data, the project team estimated the hourly desired departure times relative to hourly parking demand based on arrival times. The resulting volumes show that the greatest demand for transit (to GP) would occur between 6 a.m. and 10 a.m. and the greatest demand for transit (from GP) would be from 12 p.m. to 3 p.m. However, there would be demand for return trips until 7 p.m. Therefore, the last shuttle would leave GP at approximately 6:15 p.m.

The project team decided to design a system with maximum headways of 30 minutes, which balances convenience and visitor safety with financial and operational feasibility. When possible

[24] The total time for each route includes 5 minutes loading (either at Georgetown or at Guanella Pass) and 5 minutes unloading.

and during the highest demand periods, shuttles will operate with 15-20 minute headways. [25] Scheduled departures from Georgetown would better allow hikers to plan for and adapt to 30 minute headways, especially during early morning hours. See Table 27 for a summary schedule of shuttle service for GP Scenario 1, as well as the vehicle assigned to each trip. The schedule allows for some flexibility for a vehicle to be available for extra trips in case of an emergency.

[25] The 20 minute figure is based on previous transit surveys conducted at Marsh-Billings Rockefeller NHP and Muir Woods National Monument. Also, a Center for Urban Transportation Research (University of South Florida) study suggests a maximum wait time of 30 minutes is acceptable for urban transit systems, and the study team estimates that a slightly shorter headway seems appropriate in the recreation context (CUTR study available at http://www.nctr.usf.edu/pdf/77720.pdf)

Table 27: Schedule of Shuttle Runs for GP Scenario 1

Departure (Staging)	Arrival (Pass)	Arrival (Staging)	Vehicle #
6:00 AM	6:42 AM	7:24 AM	1
6:30 AM	7:12 AM	7:54 AM	2
7:00 AM	7:42 AM	8:24 AM	3
7:20 AM	8:02 AM	8:44 AM	4
7:40 AM	8:22 AM	9:04 AM	5
8:00 AM	8:42 AM	9:24 AM	1
8:20 AM	9:02 AM	9:44 AM	2
8:40 AM	9:22 AM	10:04 AM	3
9:00 AM	9:42 AM	10:24 AM	4
9:30 AM	10:12 AM	10:54 AM	5
10:00 AM	10:42 AM	11:24 AM	1
10:20 AM	11:02 AM	11:44 AM	2
10:40 AM	11:22 AM	12:04 PM	3
11:00 AM	11:42 AM	12:24 PM	4
11:20 AM	12:02 PM	12:44 PM	5
11:40 AM	12:22 PM	1:04 PM	1
12:00 PM	12:42 PM	1:24 PM	2
12:20 PM	1:02 PM	1:44 PM	3
12:40 PM	1:22 PM	2:04 PM	4
1:00 PM	1:42 PM	2:24 PM	5
1:20 PM	2:02 PM	2:44 PM	1
1:40 PM	2:22 PM	3:04 PM	2
2:00 PM	2:42 PM	3:24 PM	3
2:20 PM	3:02 PM	3:44 PM	4
2:40 PM	3:22 PM	4:04 PM	5
3:00 PM	3:42 PM	4:24 PM	1
3:20 PM	4:02 PM	4:44 PM	2
3:40 PM	4:22 PM	5:04 PM	3
4:00 PM	4:42 PM	5:24 PM	4
4:30 PM	5:12 PM	5:54 PM	5
5:00 PM	5:42 PM	6:24 PM	1
5:30 PM	6:12 PM	6:54 PM	2

This service schedule would call for 34 round trips daily and 5 shuttle buses. There would be an average of 21 passengers per trip *to* GP and an average of 15 passengers per trip *from* GP.

Vehicle Selection

Ridership demand estimates show that demand for the shuttle would fluctuate between 24 and 86 passengers per hour *to* GP. Due to the high average passengers per trip in the morning (see Service Hours and Frequency), the project team selected 28 passenger vehicles.

One potential option (used for cost estimate purposes) is the light-duty StarTrans Senator HD (2014) (see Figure 4). The StarTrans Senator HD base model can be modified with options to improve performance on steep grade roadways. With these options and a wheelchair lift, the vehicle will cost approximately $100,000, with a total vehicle cost of $500,000 for five vehicles.

Figure 4: StarTrans HD[26]

Staging

The project team considered several options for staging transit in Georgetown. Georgetown offers the benefit of proximity to Interstate 70 and more developed parking lots. However, lots are owned by multiple owners (not USFS) and USFS would need to either purchase and develop a lot (or lots) or enter into a use agreement with its owner. The legal and financial implications for either option could vary considerably.

The staging area would need to hold approximately 130 vehicles. The nature of transit riders coming in the morning and leaving in the afternoon, combined with the average length of stay, means that sharing parking spaces between early and late hikers would not be feasible.

The project team looked at the locations in Table 28 as *preliminary* options for staging. Likely more than one of these would have to be utilized to arrive at sufficient capacity. The project team has not spoken with the owners of these lots nor assessed the current status of each lot during peak summer days.

Table 28: Preliminary Options for GP Scenario 1 Staging

Location	Capacity	Notes
Gateway Visitor Center	TBD	May be full on weekends
County government annex lot	TBD	Potential to use gravel overflow lot
Town hall lot	TBD	Unlined parking, both parallel and standard stalls
Gravel lot near reservoir	TBD	Need to check on status

[26] http://www.goshencoach.com

Operations and Maintenance Assumptions[27]

The following cost assumptions in Table 29 allow the project team to calculate seasonal operations and maintenance costs. All costs are from the Volpe Bus Lifecycle Cost Model and updated to 2015.

Table 29: Assumptions Driving Costs in GP Scenario 1

Transit Element	Cost Assumption
Driver hourly wage	$30
Fuel cost per gallon	$3.50
Maintenance cost per mile (based on good condition of Guanella Pass Road)	$1.00
Fueling station and maintenance facility	$0.00 (Assume USFS uses existing stations/facility and does not construct new ones exclusively for transit)

Cost Estimates

The transit-supportive infrastructure includes bus shelters at Georgetown (2) and the Mount Bierstadt Trailhead (3). Additionally, benches are needed at each stop. The total cost for shelters and benches is $160,000.[28] Other general start-up costs include marketing, installation, initial promotion, staff training, etc. These costs are anticipated to be $20,000 in Year 1.

Table 30 and Table 31 show the combined cost estimate for a vehicle purchase option. This assumes that USFS or another party purchases five 28-passenger shuttles. These can be shared with other sites or used off-site during the remainder of the year when not in use at GP. These tables also calculate an annual maintenance cost, which assume a three percent increase per year to account for inflation and fluctuation in driver, maintenance, and fuel costs.

Table 30: Capital Cost for Vehicle Purchase in GP Scenario 1

Vehicle	Quantity	Cost per Unit	Total
28-passenger shuttle bus	5	$100,000	$500,000

Table 31: Total and Per-Passenger Costs with Vehicle Purchase in GP Scenario 1

Costs	Total	Per Passenger
Annual O&M Costs (Season 1)	$93,060	$6.42
Year One Capital Costs	$680,000	$46.93
Costs Per Season (2-12, cumulative)	$1,227,650	$7.70
Total	$2,000,710	$11.51

USFS may also elect to lease vehicles, which may be an attractive option to test the viability of transit service with less up-front capital investment. GSA AutoChoice presents pricing options for 16-25 passenger vehicles. GSA offers a short-term lease in which the federal agency pays a monthly

[27] All cost references cited in Bus Lifecycle Cost Model (http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling).
[28] Bench and bus shelter costs: http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=2

lease fee to use the vehicles for a few months at a time.[29] GSA short-term lease rates for vehicles of this size are $4,357 per month, with an estimate cost per season of $13,071. Because lease rates include maintenance costs but not fuel or driver costs, the annual operations and maintenance cost is calculated separately. These costs include fuel and drivers only, at a cost of $64,960 per year. Table 32 shows the total costs and per passenger costs with a lease option.

Table 32: Total and Per-Passenger Costs with Vehicle Lease in GP Scenario 1

25-passenger vehicles	Quantity	Cost per Month	Cost per Season	Total Capital[30]	Capital Per Passenger	Total O&M (Fuel & Driver)	Total Per Passenger
One Season	5	$4,357	$13,071	$65,355	$5.27	$64,960	$8.99

The total cost per passenger is similar between the purchase and lease options, with the lease being slightly less expensive. In both cases, capital costs account for approximately half of the total cost.

With a relatively large number of passengers using this transit service (414 passengers) and a long transit route, there are more vehicles required which raises the cost per passenger. Capital investment from the USFS (or another funding source) for vehicles and infrastructure could help reduce the cost-per-passenger.

Scenario 2: Hiker shuttle from new lot on Guanella Pass Road to Guanella Pass

This section describes the process of planning for the capital and operational elements of transit service from a staging area on Guanella Pass Road to Guanella Pass. This includes the route description, ridership demand, service frequency, capital elements, and costs.

Route

The route would start and end at the new staging lot, making an out-and-back drive to GP. The shuttle would also cater to hikers, with the same arrival and departure patterns described in Scenario 1. Similar to Scenario 1, there would be no planned stops other than GP, but hikers could make a reservation or request for pick-up and drop-off at a campground (depending on where the

[29] GSA also has leasing options that commit the leaser to a 7 year or 100,000 mile lease, which would be less attractive to the USFS if they were testing transit on a pilot basis. If USFS pursues transit, they are encouraged to work with their regional GSA office for more detailed pricing options. Rates vary by region, but they are unlikely to *exceed* the rates presented here. Short-term lease rates include mileage and preventative maintenance.
GSA does not offer rates for 28 passenger vehicles. The cost estimate assumes that a similar schedule, service frequency, and operating costs would hold true for 25 passenger vehicles. However, the transit operator would need to make some adjustments, which may affect schedule and costs, to accommodate transit demand during a few peak periods.
[30] Capital costs should also include $180,000 for benches, shelters, and start-up costs. These will remain the same regardless of lease or purchase of vehicles. For calculation purposes, they are not included in Table 33. If this cost were aggregated over 12 seasons and added to the lease capital cost, the capital cost per passenger would be $5.55 and the total cost (capital, operations, and maintenance) would be $10.03.

staging area is located). Because additional stops would be rare, they are not included in the time estimates listed in Table 33.[31] Similarly, shuttles would be mostly full only in one direction.

The staging area is not yet determined (see Staging), but for planning purposes, a staging lot near the Clear Lake parking area is used for distance and time estimates.

Table 33: Mileage and Driving Time between Stops for GP Scenario 2

Route segment	Mileage	Driving Time
Clear Lake Staging Area to Trailhead	5 miles	13 minutes
Round Trip Totals	10 miles	26 minutes (driving) 36 minutes (with stops)[32]

Ridership Demand

To plan for appropriate service levels and capital investment, the project team estimated the demand for transit based on current traffic volumes and results from the visitor survey (see Technical Memo 3.7).

According to the visitors that responded to the survey, 68 percent of visitors (Technical Memo 3.7, Figure 25) would elect to take transit from a lot near the trailhead (up to 15 minutes) *if this were their only option to visit GP* because parking conditions prevented them from driving their private vehicles. (The assumption is that the remaining 32 percent of visitors would not visit GP during times that these parking conditions exist.) The estimate is also coupled with the addition of parking restrictions and management. To translate to ridership volumes, the project team looked at hourly traffic volumes on a 95th percentile design day coupled with available parking and likely duration of stay to arrive at a number of visitors *per hour* that would otherwise have to park in undesignated roadside parking if they were to enter GP in their private vehicle.

The resulting estimate is 687 passengers per day. Most passengers would arrive between 6 a.m. and 9 a.m., with departures spaced more regularly throughout the early afternoon and tapering off by late afternoon/evening.

Service Hours and Frequency

Service hours and frequency is based on ridership demand, passenger safety, and feasibility. As with GP Scenario 1, parking demand begins to exceed capacity in the Lower Lot starting around 6 a.m. and in the Upper Lot by 9 a.m. Therefore, transit service will begin at 9 a.m. The demand for return service to the staging area (calculated based on data from departing vehicles and visitor survey data on length of hike) is the same as GP Scenario 1 (peak demand to GP is from 6 a.m. to 9 a.m. and peak demand from GP is from 12 p.m. to 3 p.m., with service extending until 7 p.m.).

The project team designed a system with maximum headways of 20 minutes, although headways are as frequent as 10 minutes during the morning peak. (See Service Hours and Frequency in GP

[31] It is possible that after transit service is established, there may be increased demand from hikers staying at one of the campgrounds. This may result in slight schedule adjustments but should not significantly alter the overall levels of service or cost estimates included in this analysis for planning purposes. Overall, USFS and the transit provider would need to adjust transit service based on demand after one or two seasons.
[32] The total time for each route includes 5 minutes loading (either at staging area or at Guanella Pass) and 5 minutes unloading.

Scenario 1 for more information on headways). See Table 34 for a summary schedule of shuttle service for GP Scenario 2, as well as the vehicle assigned to each trip. The schedule allows significant flexibility for the fifth vehicle to be available for extra trips in case of an emergency.

This service schedule would call for 49 round trips daily and 5 shuttle buses. The fifth shuttle bus is only needed during peak hours (approximately 7 a.m. through 2 p.m.) but it may help with emergency runs if needed. There would be an average of 14 passengers per trip, although most trips between 6 a.m. and 9 a.m. would operate at or near capacity.

Table 34: Schedule of Shuttle Runs for GP Scenario 2

Departure (Staging)	Arrival (Pass)	Arrival (Staging)	Vehicle #
6:00 AM	6:18 AM	6:36 AM	1
6:20 AM	6:38 AM	6:56 AM	2
6:40 AM	6:58 AM	7:16 AM	3
7:00 AM	7:18 AM	7:36 AM	1
7:10 AM	7:28 AM	7:46 AM	2
7:20 AM	7:38 AM	7:56 AM	4
7:30 AM	7:48 AM	8:06 AM	5
7:40 AM	7:58 AM	8:16 AM	3
7:50 AM	8:08 AM	8:26 AM	1
8:00 AM	8:18 AM	8:36 AM	2
8:15 AM	8:33 AM	8:51 AM	4
8:30 AM	8:48 AM	9:06 AM	5
8:45 AM	9:03 AM	9:21 AM	3
9:00 AM	9:18 AM	9:36 AM	1
9:15 AM	9:33 AM	9:51 AM	2
9:30 AM	9:48 AM	10:06 AM	3
9:45 AM	10:03 AM	10:21 AM	4
10:00 AM	10:18 AM	10:36 AM	5
10:20 AM	10:38 AM	10:56 AM	1
10:40 AM	10:58 AM	11:16 AM	2
11:00 AM	11:18 AM	11:36 AM	3
11:20 AM	11:38 AM	11:56 AM	4
11:40 AM	11:58 AM	12:16 PM	5
12:00 PM	12:18 PM	12:36 PM	1
12:15 PM	12:33 PM	12:51 PM	2
12:30 PM	12:48 PM	1:06 PM	3
12:45 PM	1:03 PM	1:21 PM	4
1:00 PM	1:18 PM	1:36 PM	5
1:15 PM	1:33 PM	1:51 PM	1
1:30 PM	1:48 PM	2:06 PM	2
1:45 PM	2:03 PM	2:21 PM	3
2:00 PM	2:18 PM	2:36 PM	4

Departure (Staging)	Arrival (Pass)	Arrival (Staging)	Vehicle #
2:15 PM	2:33 PM	2:51 PM	1
2:30 PM	2:48 PM	3:06 PM	2
2:45 PM	3:03 PM	3:21 PM	3
3:00 PM	3:18 PM	3:36 PM	4
3:15 PM	3:33 PM	3:51 PM	1
3:30 PM	3:48 PM	4:06 PM	2
3:45 PM	4:03 PM	4:21 PM	3
4:00 PM	4:18 PM	4:36 PM	4
4:20 PM	4:38 PM	4:56 PM	1
4:40 PM	4:58 PM	5:16 PM	2
5:00 PM	5:18 PM	5:36 PM	3
5:20 PM	5:38 PM	5:56 PM	4
5:40 PM	5:58 PM	6:16 PM	1
6:00 PM	6:18 PM	6:36 PM	2
6:20 PM	6:38 PM	6:56 PM	3
6:40 PM	6:58 PM	7:16 PM	4
7:00 PM	7:18 PM	7:36 PM	1

Vehicle Selection

Ridership demand estimates show that demand for the shuttle would fluctuate between 50 and 170 passengers per hour *to* the Pass. Due to the high number of passengers per trip during peak hours (6 a.m. to 9 a.m. and 12 p.m. to 3 p.m.), the project team selected 28 passenger vehicles. The vehicle would be the same as in Scenario 1.

Staging

The project team considered several options for staging transit on Guanella Pass Road. Many sites are constrained by steep slopes, sensitive habitat, and/or existing recreational use. Much of the land is owned by USFS, which would make it easier to develop a lot (or lots).

The staging area would need to hold between 250 and 275 vehicles. The nature of transit riders coming in the morning and leaving in the afternoon, combined with the average length of stay, means that sharing of parking spaces for early and late hikers is not feasible. This represents an area of approximately 2 acres devoted to parking and loading. *Locating and acquiring use of such a site near Guanella Pass Road represents a significant constraint in transit planning.*

The project team looked at the locations in Table 35 as *preliminary* options for staging. These are meant to help the Forest Service examine feasibility of developing permanent or temporary staging areas at these locations. Costs of developing or expanding lots are not calculated.

Table 35: Preliminary Options for GP Scenario 2 Staging

Location	Ownership	Notes
Ski area near Duck Lake	USFS	Plans to develop into campground
Clear Lake Recreation Area	USFS	The 30 spaces currently at Clear Lake frequently fill with anglers
Xcel Energy Amenity Areas	USFS (but under agreement for use by Xcel Energy)	Limited capacity, further from Trailhead
Campgrounds	USFS	Would need to add significant amounts of parking

Operations and Maintenance Assumptions[33]

All operations and maintenance assumptions are the same as GP Scenario 1.

Cost Estimates

The transit-supportive infrastructure includes bus shelters at the staging area (3) and the Mount Bierstadt Trailhead (4). Additionally, benches are needed at each stop. The total cost for shelters and benches is $220,000.[34] Other general start-up costs include marketing, installation, initial promotion, staff training, etc. These costs are anticipated to be $20,000 in Year 1.

Table 36 and Table 37 show the combined cost estimate for a vehicle purchase option. This assumes that USFS or another party purchases five 28-passenger shuttles. These can be shared with other sites or used off-site during the remainder of the year when not in use at GP. These tables also calculate an annual maintenance cost, which assume a three percent increase per year to account for inflation and fluctuation in driver, maintenance, and fuel costs.

Table 36: Capital Cost for Vehicle Purchase in GP Scenario 2

Vehicle	Quantity	Cost per Unit	Total
28-passenger shuttle bus	5	$100,000	$500,000

Table 37: Total and Per-Passenger Costs with Vehicle Purchase in GP Scenario 2

Costs	Total	Per Passenger
Annual O&M Costs (Season 1)	$53,020	$2.21
Year One Capital Costs	$740,000	$30.78
Costs Per Season (2-12, cumulative)	$699,441	$2.64
Total	$1,492,461	$5.17

USFS may also elect to lease vehicles, especially for a pilot test. The least options and prices are the same as those described in GP Scenario 1. Because lease rates include maintenance costs but not fuel or driver costs, the annual operations and maintenance cost is calculated separately. These

[33] All cost references cited in Bus Lifecycle Cost Model (http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling).
[34] Bench and bus shelter costs: http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=2

costs include fuel and drivers only, at a cost of $39,445 per year. Table 38 shows the total costs and per passenger costs with a lease option.

Table 38: Total and Per-Passenger Costs with Vehicle Lease in GP Scenario 1

25-passenger vehicles	Quantity	Cost per Month	Cost per Season	Total Capital[35]	Capital Per Passenger	Total O&M (Fuel & Driver)	Total Per Passenger
One Season	5	$4,357	$13,071	$65,355	$2.72	$39,445	$4.36

The total cost per passenger is effectively identical between the purchase and lease options, when considering the start-up infrastructure costs.

GP Scenario 2 has a very low per-passenger cost, due to the high number of passengers and the low mileage and time of the transit route. However, these costs would likely be augmented significantly by costs to build a staging area that could accommodate up to 275 vehicles.

Scenario 3: Mandatory hiker shuttle from Georgetown to Guanella Pass

This section describes the process of planning for the capital and operational elements of transit service from Georgetown to Guanella Pass, as part of a mandatory transit system for hikers on Mt. Bierstadt. The section includes the route description, ridership demand, service frequency, capital elements (such as staging and vehicle selection), and costs.

Route

The route would start and end at Georgetown, making an out-and-back drive to Guanella Pass. The shuttle would be the only transportation option for hikers to access the Mt. Bierstadt trailhead. Hikers would park at designated lots in Georgetown and would not make any additional stops along Guanella Pass Road except for at the trailhead. Most shuttles would carry passengers in one direction only (from Georgetown to the Pass in the morning and from the Pass to Georgetown in the afternoon), and some of the midday shuttles would carry passengers in both directions. See Table 39 for route description and mileage.

Table 39: Mileage and Driving Time between Stops for GP Scenario 3

Route segment	Mileage	Driving Time
Georgetown Staging Area to Guanella Pass Trailhead	11 miles	28 minutes
Round Trip Totals	22 miles	56 minutes (driving) 76 minutes (with stops)[36]

[35] Capital costs should also include $240,000 for benches, shelters, and start-up costs. These will remain the same regardless of lease or purchase of vehicles. For calculation purposes, they are not included in Table 39. If this cost were aggregated over 12 seasons and added to the lease capital cost, the capital cost per passenger would be $3.54 and the total cost (capital, operations, and maintenance) would be $5.19.

[36] The total time for each route includes 5 minutes loading (either at Georgetown or at Guanella Pass) and 5 minutes unloading.

Ridership Demand

As opposed to using visitation and ridership demands calculated through visitor surveys and traffic counts, Scenario 3 relies on a high-level estimate of "sustainable" weekend and weekend daily hiker volumes on Mt. Bierstadt trail. These estimates are based on visitor survey data using photo simulations (see Technical Memo 3.7) in which the survey asks visitors to respond if they "would feel crowded if you were on the summit of Mt. Bierstadt with the number of people depicted" in a series of simulated photos. Based on these responses, the USFS determined that an appropriate weekend use level could be the point at which 50 percent of visitors think that there are too many people on the summit. This level corresponded to 400 hikers per day. Since the current weekday use level is 200 hikers per day, the USFS proposed holding that number constant so as not to shift visitation increases to weekdays. **The resulting visitation levels are 400 hikers on weekend days and 200 hikers on weekdays.**

Service Hours and Frequency

Service hours and frequency are based on ridership demand, passenger safety, and feasibility. Since all hikers will be required to take the shuttle, USFS can more easily set hours of transit that are based on the most popular times for hiking. The proposed operating hours are 6 a.m. to 5 p.m. These hours correspond with peak hiking hours and allow hikers up to 11 hours to complete their hike.

The transit vehicles would run approximately every 15 minutes from 6 a.m. through 2 p.m., which corresponds with anticipated peak levels of use both to the trailhead and from the trailhead (based on visitor survey and traffic count data). Headways then taper off to 30 minute frequency from 2 p.m. through 5 p.m. Exact headways could be adjusted to accommodate hiker demand and visitor safety. See Table 40 for a summary schedule of shuttle service for GP Scenario 3, as well as the vehicle assigned to each trip. The schedule allows for some flexibility for a vehicle to be available for extra trips in case of an emergency. For weekdays, transit service would operate at approximately 30 minute frequencies throughout the day. The USFS and/or transit operator could determine if higher or lower levels of service would be desirable based on hiker's willingness to schedule their arrivals and safety of hikers upon finishing the hike.

Table 40: Schedule of Shuttle Runs for GP Scenario 3

Departure (Staging)	Arrival (Pass)	Arrival (Staging)	Vehicle #
6:00 AM*	6:38 AM	7:06 AM	1
6:15 AM	6:53 AM	7:21 AM	2
6:30 AM*	7:08 AM	7:36 AM	3
6:45 AM	7:23 AM	7:51 AM	4
7:00 AM*	7:38 AM	8:06 AM	5
7:15 AM	7:53 AM	8:21 AM	1
7:30 AM*	8:08 AM	8:36 AM	2
7:45 AM	8:23 AM	8:51 AM	3
8:00 AM*	8:38 AM	9:06 AM	4
8:15 AM	8:53 AM	9:21 AM	5
8:30 AM*	9:08 AM	9:36 AM	1
8:45 AM	9:23 AM	9:51 AM	2
9:00 AM*	9:38 AM	10:06 AM	3
9:15 AM	9:53 AM	10:21 AM	4
9:30 AM*	10:08 AM	10:36 AM	5
9:45 AM	10:23 AM	10:51 AM	1
10:00 AM*	10:38 AM	11:06 AM	2
10:30 AM	11:08 AM	11:36 AM	3
11:00 AM*	11:38 AM	12:06 PM	4
11:15 AM	11:57 AM	12:39 PM	5
11:30 AM*	12:12 PM	12:54 PM	1
11:45 AM	12:27 PM	1:09 PM	2
12:00 PM*	12:42 PM	1:24 PM	3
12:15 PM	12:57 PM	1:39 PM	4
12:30 PM*	1:12 PM	1:54 PM	5
12:45 PM	1:27 PM	2:09 PM	1
1:00 PM*	1:42 PM	2:24 PM	2
1:15 PM	1:57 PM	2:39 PM	3
1:30 PM*	2:12 PM	2:54 PM	4
1:45 PM	2:27 PM	3:09 PM	5
2:00 PM*	2:42 PM	3:24 PM	1
2:30 PM*	3:12 PM	3:54 PM	2
3:00 PM*	3:42 PM	4:24 PM	3
3:30 PM*	4:12 PM	4:54 PM	4
4:00 PM*	4:42 PM	5:24 PM	5
4:30 PM*	5:12 PM	5:54 PM	1

Runs marked with an asterisk (*) would also run on weekdays. The weekend service schedule would call for 36 round trips daily and 5 shuttle buses. There would be an average of 24 passengers

per trip *to* GP and an average of 21 passengers per trip *from* GP on weekends. Weekday shuttles would have 21 round trips, require 3 vehicles, and have an average of 11 passengers per trip.

Vehicle Selection

Ridership demand estimates show that demand for the shuttle would fluctuate between 55 and 120 passengers per hour *to* GP on weekends (or 30 to 60 passengers per hour on weekdays). Due to the high ridership levels and concentration of use (see Service Hours and Frequency), the project team selected 28 passenger vehicles.

One potential option (used for cost estimate purposes) is the light-duty StarTrans Senator HD (2014) (see Figure 4 in Scenario 1). The StarTrans Senator HD base model can be modified with options to improve performance on steep grade roadways. With these options and a wheelchair lift, the vehicle will cost approximately $100,000, with a total vehicle cost of $500,000 for five vehicles.

Staging

Staging considerations for Scenario 3 are similar to those in Scenario 1. However, USFS would need to identify vehicle parking for weekdays as well as weekends (approximately 80 vehicles on weekdays and 160 vehicles on weekends). As with Scenario 1, hiking patterns and a long average length of stay means that sharing parking spaces between early and late hikers would not be feasible. See Table 28 for staging options in Georgetown.

Operations and Maintenance Assumptions[37]

The following cost assumptions in Table 41 allow the project team to calculate seasonal operations and maintenance costs. All costs are from the Volpe Bus Lifecycle Cost Model and updated to 2015.

Table 41: Assumptions Driving Costs in GP Scenario 3

Transit Element	Cost Assumption
Driver hourly wage	$30
Fuel cost per gallon	$3.50
Maintenance cost per mile (based on good condition of Guanella Pass Road)	$1.00
Fueling station and maintenance facility	$0.00 (Assume USFS uses existing stations/facility and does not construct new ones exclusively for transit)

Cost Estimates

The transit-supportive infrastructure includes bus shelters at Georgetown (2) and the Mount Bierstadt Trailhead (3). Additionally, benches are needed at each stop. The total cost for shelters and benches is $160,000.[38] Other general start-up costs include marketing, installation, initial promotion, staff training, etc. These costs are anticipated to be $20,000 in Year 1.

Table 42 and Table 43 show the combined cost estimate for a vehicle purchase option. This assumes that USFS or another party purchases five 28-passenger shuttles. These shuttles can be shared with other sites or used off-site during the remainder of the year when not in use at GP.

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[37] All cost references cited in Bus Lifecycle Cost Model (http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling).
[38] Bench and bus shelter costs: http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=2

These tables also calculate an annual maintenance cost, which assumes a three percent increase per year to account for inflation and fluctuation in driver, maintenance, and fuel costs.

Table 42: Capital Cost for Vehicle Purchase in GP Scenario 1

Vehicle	Quantity	Cost per Unit	Total
28-passenger shuttle bus	5	$100,000	$500,000

Table 43: Total and Per-Passenger Costs with Vehicle Purchase in GP Scenario 1

Costs	Total	Per Passenger
Annual O&M Costs (Season 1)	$150,525	$5.38
Year One Capital Costs	$680,000	$24.29
Costs Per Season (2-12, cumulative)	$1,985,730	$6.45
Total	$2,816,255	$8.38

USFS may also elect to lease vehicles, which may be an attractive option to test the viability of transit service with less up-front capital investment. GSA AutoChoice presents pricing options for 16-25 passenger vehicles. GSA offers a short-term lease in which the federal agency pays a monthly lease fee to use the vehicles for a few months at a time.[39] GSA short-term lease rates for vehicles of this size are $4,357 per month, with an estimate cost per season of $13,071. Because lease rates include maintenance costs but not fuel or driver costs, the annual operations and maintenance cost is calculated separately. These costs include fuel and drivers only, at a cost of $116,435 per year. Table 44 shows the total costs and per passenger costs with a lease option.

Table 44: Total and Per-Passenger Costs with Vehicle Lease in GP Scenario 3

25-passenger vehicles	Quantity	Cost per Month	Cost per Season	Total Capital	Capital Per Passenger	Total O&M (Fuel & Driver)	Total Per Passenger
One Season	5	$4,357	$13,071	$65,355	$5.27	$116,435	$6.49

The total cost per passenger is slightly less expensive for the lease option. In both cases, capital costs account for approximately one-third of the total cost.

Relative to Scenario 1, which is similar in route and service frequency, the operations costs are higher in Scenario 3 due to the weekday service addition. However, the cost per passenger is less in Scenario 3 since there are many more visitors using the transit service.

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[39] GSA also has leasing options that commit the leaser to a 7 year or 100,000 mile lease, which would be less attractive to the USFS if they were testing transit on a pilot basis. If USFS pursues transit, they are encouraged to work with their regional GSA office for more detailed pricing options. Rates vary by region, but they are unlikely to *exceed* the rates presented here. Short-term lease rates include mileage and preventative maintenance.
GSA does not offer rates for 28 passenger vehicles. The cost estimate assumes that a similar schedule, service frequency, and operating costs would hold true for 25 passenger vehicles. However, the transit operator would need to make some adjustments, which may affect schedule and costs, to accommodate transit demand during a few peak periods.

Mount Evans Recreation Area (MERA)

The Mount Evans Recreation Area (MERA) is located approximately 70 miles southwest of the Denver metropolitan area and 28 miles southwest of Idaho Springs, Colorado. MERA is within both the Arapaho-Roosevelt National Forest and the Pike National Forest (PNF). The Mount Evans Highway runs 14 miles from a USFS Welcome Station to the summit of Mt. Evans. At 14,264 feet, the Mount Evans Highway is the highest elevation paved road in North America. Mount Evans Highway is open from approximately Memorial Day through early October, with the Summit closing after Labor Day. Approximately 120,000 visitors recreate in MERA annually, concentrated between May and October, and visitation is further concentrated at the Summit Lake Park and the Mount Evans summit parking lot.

The heavy, concentrated visitation leads to several transportation challenges. As summarized in Technical Memo 4.1, these include:

- Unendorsed roadside parking, causing resource impacts and visitor safety risks.
- Traffic congestion near Summit Lake and the Mount Evans summit.
- Conflicts between bicyclists and motor vehicles.
- Extreme crowding on the summit during peak periods.
- Traffic congestion at the entrance to MERA during peak periods.
- Steep, narrow, scenic yet deteriorating roadway causes driver safety risks.

The project team conducted traffic counts and visitor counts at the Mount Evans summit, collected parking accumulation data and GPS-tracks of visitor use patterns, and administered visitor surveys to quantify these challenges and understand potential solutions. More details about the existing conditions, needs, and visitor survey results can be found in Technical Memos 3.2, 3.4, 3.8, and 4.1.

Relevant Constraints and Needs

MERA's primary challenge that may be addressed through transit is the significant traffic congestion along Mt. Evans Highway and at parking lots at Mt. Goliath Natural Area, Summit Lake, and the Mount Evans Summit. Additionally, roadway conditions are deteriorating, primarily due to sloughing along stretches of the highway. As described in Technical Memos 3.2 and 4.1, congestion results in frequent parking in undesignated spaces or along roadsides, impacts to roadside vegetation, and significant risks to visitor safety. The project team envisioned that transit components may be effective in replacing vehicles on Mount Evans Highway with transit shuttles, thus allowing similar visitation levels with significant reductions in traffic volumes and parking demand. Reducing traffic volumes would have the added benefit of reducing the risk to visitors of driving on the degraded roadway and reducing the net impact of vehicles on the already-poor road.

The project team recognizes following constraints at Mount Evans that will affect if and what types of transit systems would be feasible and how to design transit that would best address the site's challenges:

1. **Vehicle length**. The maximum vehicle length on Mount Evans Highway is 30 feet due to the sharp curves and steep grade of the road. Transit capacity would be limited to vehicles of this length with a maximum of 28 passengers per vehicle.
2. **Short season**. Mount Evans Road is typically closed from after Labor Day through before Memorial Day. Since congestion and safety risks are greatest on weekends and holidays, the operating season for transit would be only 35 days.
3. **Limited staging**. By nature of its location, Mount Evans has limited nearby spaces to stage transit (or construct a new parking lot to hold the vehicles of transit passengers, as well as a

loading/unloading area and necessary passenger facilities). Idaho Springs similarly lacks a large, unified staging area but may have more capacity in dispersed lots.

4. **Peak hours and storms.** The peak hours of use at MERA also correspond with summer thunderstorms. Transit headways and other operational parameters would need to balance visitor safety during storm events, demand for transit, and crowd control.
5. **Coupling with parking enforcement needed**. Most visitors (90 percent) responding to the survey would prefer to drive their personal vehicle in MERA, but some percentage of visitors responded that they would be willing to take a shuttle to visit MERA "if this was their only option for visiting because parking lots were full."[40] Therefore, there would need to be some parking enforcement or another method to control visitor entry based on total traffic volume on Mount Evans Highway in place to compel visitors to use transit. Absent such enforcement, ridership would be too low to be feasible to operate. Additionally, charging a fee for the shuttle (even as low as $1 per person) may have a significant impact on ridership, even with such enforcement in place.

Proposed Transit Scenarios

Through meetings with USFS staff, stakeholders, and the public, the project team developed the following transit scenarios to address parking congestion and resource management needs at MERA. Each of these scenarios assumes that, and is dependent upon, the USFS enforcing parking in designated parking lots only along the highway.

1. Shuttle service from Idaho Springs to MERA

Shuttle buses would operate between a designated park-and-ride lot in Idaho Springs, CO, and the summit of Mt. Evans, with en-route shuttle stops at Echo Lake, Echo Lake Campground, Mt. Goliath Natural Area, and Summit Lake. Hours of operation would correspond with peak hours of visitor use at MERA and include contingency operating plans for managing surges in ridership demand in the event of thunderstorms. Shuttle service would operate according to ridership demand coupled with parking enforcement along Mt. Evans Highway.

2. Shuttle service from new staging area near Courtesy Station to MERA

Shuttle buses would operate between a newly constructed park-and-ride lot in the vicinity of the MERA Courtesy Station and the summit of Mt. Evans with en-route shuttle stops at Echo Lake Campground, Mt. Goliath Natural Area, and Summit Lake. Hours of operation would correspond with peak hours of visitor use at MERA and include contingency operating plans for managing surges in ridership demand in the event of thunderstorms. Shuttle service would be operated according to ridership demand coupled with parking enforcement along Mt. Evans Highway.

Figure 5 illustrates these Mount Evans Scenarios. On the following page, Table 45 provides a summary of the operations and costs of each of the scenarios and the following sections contain details for each scenario. Note that costs to own are averaged over twelve years. MERA Scenario 2 is the more cost efficient option on a per-passenger basis, but the total ownership and lease costs are similar between the two scenarios.

[40] Technical Memo 3.8, Figure 21 (page 25) and Figure 26 (page 30)

Figure 5: Mount Evans Scenarios

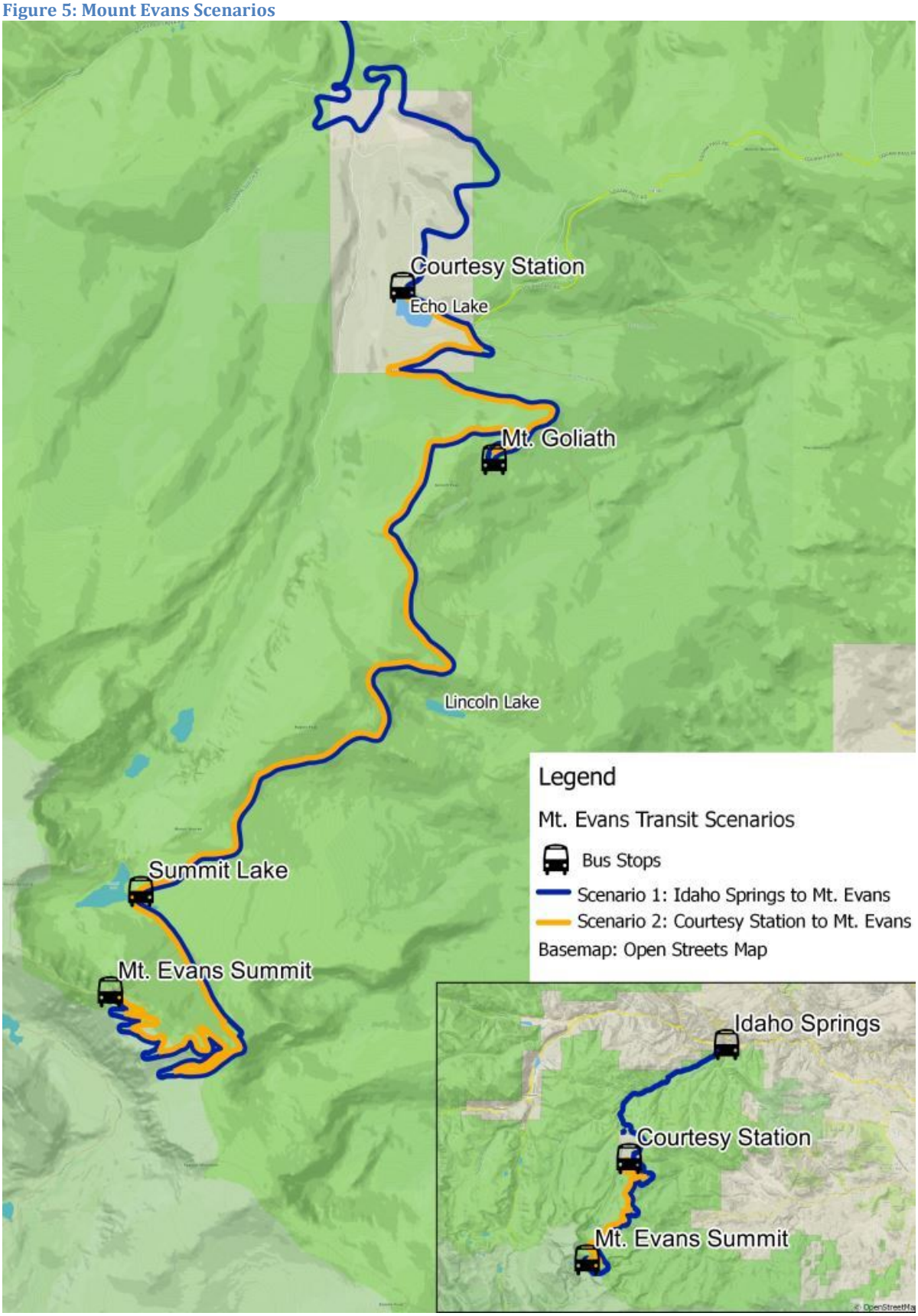

Table 45: MERA Scenarios Operations and Costs Summary

	Scenario 1	Scenario 2
Travel Time (Roundtrip)	160 minutes	108 minutes
Distance (Roundtrip)	55 miles	30 miles
Hours of Operation	10am to 7pm	10am to 8pm
Frequency of Service	20 minutes	12-15 minutes
Vehicles Required	9	10
Passengers/Day	211	552
Cost to Own/Year	$245,954	$269,888
Cost to Own/Year/Rider	$33.30	$13.82
Cost to Lease/Year	$111,012	$112,432
Cost to Lease/Year/Rider	$29.19-$31.38	$11.91-$12.68

Scenario 1: Shuttle Service from Idaho Springs to MERA

This section describes the process of planning for the capital and operational elements of transit service from Idaho Springs to MERA. This includes the route description, ridership demand, service frequency, capital elements (such as staging and vehicle selection), and costs.

Route

The route would start and end at Idaho Springs, making an out-and-back drive to the Mount Evans Summit and stopping in both directions at the Courtesy Station, Mount Goliath Natural Area, and Summit Lake. Table 46 presents the mileage and driving times between stops for this scenario.

Table 46: Mileage and Driving Time between Stops for MERA Scenario 1

Route segment	Mileage	Driving Time
Idaho Springs Staging Area to Courtesy Station	13 miles	21 minutes
Courtesy Station to Mt. Goliath	3 miles	8 minutes
Mt. Goliath to Summit Lake	6.2 miles	15 minutes
Summit Lake to Mt. Evans Summit	5.4 miles	15 minutes
Round Trip Totals	55 miles	118 minutes (driving) 160 minutes (with stops)[41]

Ridership Demand

To plan for appropriate service levels and capital investment, the project team first estimated the demand for transit based on current traffic volumes and results from the visitor survey (see Technical Memo 3.8).

According to the visitors that responded to the survey, 23 percent of visitors (Technical Memo 3.8, Figure 26) would elect to take transit from up to one hour away from MERA if parking conditions prevented them from driving their private vehicles to MERA. (The assumption is that the remaining 77 percent of visitors would not visit MERA during times that these parking conditions exist.) To

[41] The total time for each route includes 5 minutes loading and unloading in Idaho Springs, 3 minute stops at Summit Lake and Mount Goliath in both directions, a 5 minute stop at Courtesy Station in both directions, a 10 minute stop at Mt. Evans Summit, and 59 minutes run time each way.

translate to ridership volumes, the project team looked at hourly traffic volumes on a 90th percentile design day (approximately 1,000 vehicles per day) coupled with available parking and likely duration of stay to arrive at a number of visitors *per hour* that would otherwise have to park in undesignated roadside parking if they were to enter MERA in their private vehicle.

The resulting estimate is 211 passengers per day. Most passengers would arrive between 10 a.m. and 2 p.m., and the greatest volume of visitors would be between 12 p.m. and 1 p.m.

Service Hours and Frequency

Service hours and frequency is based on ridership demand, passenger safety, and feasibility.

Traffic volumes and parking lot counts show that parking demand begins to exceed capacity in some lots starting around 9 a.m. However, the need for additional capacity at 9 a.m. is very low and picks up significantly at 10 a.m. For feasibility of transit operations, the project team begins transit service at 10 a.m.

Table 10 (Technical Memo 3.2) shows the distribution of lengths of stay among visitor groups to MERA. Using these data, the project team estimated the hourly desired departure times relative to hourly parking demand based on arrival times. The resulting volumes show that the greatest demand for transit (in both directions) would occur between 12 p.m. and 5 p.m., but transit demand would remain steady through 7 p.m.

The project team decided to design a system with maximum headways of 20 minutes, which balances convenience and visitor safety with financial and operational feasibility.[42] The system would operate every 20 minutes from 10 a.m. through 8:00 p.m. (with the last shuttle leaving the Mount Evans Summit parking lot at 6:40 p.m.). See Table 47 for a summary schedule of shuttle service for Scenario 1, as well as the vehicle assigned to each trip.

This service schedule would call for 23 round trips daily and 9 shuttle buses. There would be an average of 9 passengers per trip throughout the day, but during peak periods (12 – 5 PM), the average would be much higher.

[42] The 20 minute figure is based on previous transit surveys conducted at Marsh-Billings Rockefeller NHP and Muir Woods National Monument. Also, a Center for Urban Transportation Research (University of South Florida) study suggests a maximum wait time of 30 minutes is acceptable for urban transit systems, and the study team estimates that a slightly shorter headway seems appropriate in the recreation context (CUTR study available at http://www.nctr.usf.edu/pdf/77720.pdf)

Table 47: Schedule of Shuttle Runs for MERA Scenario 1

Departure (Staging)	Arrival (Summit)	Arrival (Staging)	Vehicle #
10:00 AM	11:20 AM	12:40 PM	1
10:20 AM	11:40 AM	1:00 PM	2
10:40 AM	12:00 PM	1:20 PM	3
11:00 AM	12:20 PM	1:40 PM	4
11:20 AM	12:40 PM	2:00 PM	5
11:40 AM	1:00 PM	2:20 PM	6
12:00 PM	1:20 PM	2:40 PM	7
12:20 PM	1:40 PM	3:00 PM	8
12:40 PM	2:00 PM	3:20 PM	9
1:00 PM	2:20 PM	3:40 PM	1
1:20 PM	2:40 PM	4:00 PM	2
1:40 PM	3:00 PM	4:20 PM	3
2:00 PM	3:20 PM	4:40 PM	4
2:20 PM	3:40 PM	5:00 PM	5
2:40 PM	4:00 PM	5:20 PM	6
3:00 PM	4:20 PM	5:40 PM	7
3:20 PM	4:40 PM	6:00 PM	8
3:40 PM	5:00 PM	6:20 PM	9
4:00 PM	5:20 PM	6:40 PM	1
4:20 PM	5:40 PM	7:00 PM	2
4:40 PM	6:00 PM	7:20 PM	3
5:00 PM	6:20 PM	7:40 PM	4
5:20 PM	6:40 PM	8:00 PM	5

Bolded runs would not pick up visitors in Idaho Springs such that the last "new" transit visitors arrive via the 3:40 PM shuttle.

Vehicle Selection

MERA is limited to 30 foot vehicles, and ridership demand estimates show that demand for the shuttle would fluctuate between 13 and 52 passengers per hour. In considering passenger safety and convenience, the project team chose to institute a 20 minute headway (see Service Hours and Frequency), and with three trips per hour, transit service can meet demand with 20 passenger vehicles (rather than 28 passenger vehicles). Using smaller vehicles will save some money on upfront capital costs, have less of an impact on the roadway, and allow for slightly more flexibility in vehicle maneuvering and storage.

GSA AutoChoice lists several options for 20-passenger, light-duty shuttle buses that would meet the needs for MERA transit service. Table 48 shows vehicle options and prices. A 20-passenger vehicle will likely cost around $90,000, with a total vehicle cost of $810,000 for nine vehicles.

Table 48: MERA Scenario 1 Potential Vehicles

Vehicle Model	Year	All-Wheel Drive	Price
Champbus Challenger Ford F550 (Figure 6)	2014	No	$86,895
StarTrans Senator HD Ford	2014	Available as option	$88,711
Goshen Coach GCII FD	2014	Yes	$99,504

Figure 6: Champbus Challenger Ford F550[43]

Staging

The project team considered several options for staging transit in Idaho Springs. Idaho Springs offers the benefit of proximity to Interstate 70 and more developed parking lots. However, lots are owned by multiple owners (not USFS) and USFS would need to either purchase and develop a lot (or lots) or enter into a use agreement with its owner. The legal and financial implications for either option could vary considerably.

The project team looked at the locations in Table 49 as *preliminary* options for staging. The project team has not spoken with the owners of these lots nor assessed the current status of each lot during peak summer days.

Table 49: Preliminary Options for MERA Scenario 1 Staging

Location	Capacity	Notes
Idaho Springs High School or school offices	60 lined spots, 45 lined spots in upper lot	
USFS Visitor Center	TBD	Usually fills on weekends; potential to expand lot with sale of adjacent property
Fairgrounds/rodeo along I-70	TBD	Currently used as storage for CDOT and may not be consistently available during summer weekends.

[43] http://www.rohrerbus.com/bus-sales/choose-your-vehicle/commercial-buses/16-25-passenger-buses/champion-challenger/

Operations and Maintenance Assumptions[44]

The following cost assumptions in Table 50 allow the project team to calculate seasonal operations and maintenance costs. All costs are from the Volpe Bus Lifecycle Cost Model and updated to 2015.

Table 50: Assumptions Driving Costs in MERA Scenario 1

Transit Element	Cost Assumption
Driver hourly wage	$30
Fuel cost per gallon	$3.50
Maintenance cost per mile (based on poor condition of Mount Evans Highway)	$1.50
Fueling station and maintenance facility	$0.00 (Assume USFS uses existing stations/facility and does not construct new ones exclusively for transit)

Cost Estimates

The transit-supportive infrastructure includes bus shelters at Idaho Springs (1), the Courtesy Station (2), Summit Lake (1) and the Mount Evans Summit (2). No shelter is included at Mount Goliath because there is already a Nature Center. Additionally, benches are needed at each stop. The total cost for shelters and benches is $194,000.[45] Other general start-up costs include marketing, installation, initial promotion, staff training, etc. These costs are anticipated to be $20,000 in Year 1.

Table 51 and Table 52 show the combined cost estimate for a vehicle purchase option. This assumes that USFS or another party purchases nine 20-passenger shuttles. These can be shared with other sites or used off-site during the remainder of the year when not in use at MERA. These tables also calculate an annual maintenance cost, which assume a three percent increase per year to account for inflation and fluctuation in driver, maintenance, and fuel costs.

Table 51: Capital Cost for Vehicle Purchase in MERA Scenario 1

Vehicle	Quantity	Cost per Unit	Total
20-passenger shuttle bus	9	$90,000	$810,000

Table 52: Total and Per-Passenger Costs with Vehicle Purchase in MERA Scenario 1

Costs	Total	Per Passenger
Annual O&M Costs (Season 1)	$135,812	$18.39
Year One Capital Costs	$1,024,000	$138.66
Costs Per Season (2-12, cumulative)	$1,791,643	$20.22
Total	$2,951,455	$33.30

USFS may also elect to lease vehicles, which may be an attractive option to test the viability of transit service with less up-front capital investment. GSA AutoChoice presents pricing options for

[44] All cost references cited in Bus Lifecycle Cost Model (http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling).
[45] Bench and bus shelter costs: http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=2

16-25 passenger vehicles. GSA offers a short-term lease in which the federal agency pays a monthly lease fee to use the vehicles for a few months at a time.[46] GSA short-term lease rates for vehicles of this size are $4,357 per month, with an estimate cost per season of $13,071. Because lease rates include maintenance costs but not fuel or driver costs, the annual operations and maintenance cost is calculated separately. These costs include fuel and drivers only, at a cost of $97,941 per year. Table 53 shows the total costs and per passenger costs with a lease option.

Table 53: Total and Per-Passenger Costs with Vehicle Lease in MERA Scenario 1

25-passenger vehicles	Quantity	Cost per Month	Cost per Season	Total Capital[47]	Capital Per Passenger	Total O&M (Fuel & Driver)	Total Per Passenger
One Season	9	$4,357	$13,071	$117,639	$15.93	$97,941	$29.19

The total cost per passenger is similar between the purchase and lease options, with the lease being slightly less expensive. In both cases, capital costs account for approximately half of the total cost.

Due to the relatively low number of passengers using this transit service (211 passengers represent less than 8 percent of the approximately 2,700 visitors on a 90th percentile day), the length of the service in terms of miles and minutes, and the high level of service needed for passenger safety and convenience, the cost per passenger is very high in both the purchase- and lease-scenarios. Implementation of this transit scenario would need capital investment from the USFS (or another funding source) for vehicles and infrastructure. This scenario would likely need a subsidy to cover the per-passenger operating cost or charge very high fees to passengers.

Scenario 2: Shuttle Service from Courtesy Station to MERA

This section describes the process of planning for the capital and operational elements of transit service from the Courtesy Station to MERA. This includes the route description, ridership demand, service frequency, capital elements (such as staging and vehicle selection), and costs.

Route

The route would start and end at Idaho Springs, making an out-and-back drive to the Mount Evans Summit and stopping in both directions at the Courtesy Station, Mount Goliath Natural Area, and Summit Lake. Table 54 presents the mileage and driving times between stops for this scenario.

[46] GSA also has leasing options that commit the leaser to a 7 year or 100,000 mile lease, which would be less attractive to the USFS if they were testing transit on a pilot basis. If USFS pursues transit, they are encouraged to work with their regional GSA office for more detailed pricing options. Rates vary by region, but they are unlikely to *exceed* the rates presented here. Short-term lease rates include mileage and preventative maintenance.

[47] Cost estimates should also include $194,000 for bus shelters, benches, and start-up costs for year one. These are calculated separately. However, if they were included in the least costs and aggregated over twelve years, the capital per passenger cost would be $18.12 in year one and the total per passenger cost would be $31.38.

Table 54: Mileage and Driving Time between Stops for MERA Scenario 2

Route segment	Mileage	Driving Time
Courtesy Station to Mt. Goliath	3 miles	8 minutes
Mt. Goliath to Summit Lake	6.2 miles	15 minutes
Summit Lake to Mt. Evans Summit	5.4 miles	15 minutes
Round Trip Totals	30 miles	76 minutes (driving) 108 minutes (with stops)[48]

Ridership Demand

To plan for appropriate service levels and capital investment, the project team first estimated the demand for transit based on current traffic volumes and results from the visitor survey (see Technical Memo 3.8).

According to the visitors that responded to the survey, 60 percent of visitors (Technical Memo 3.8, Figure 26) would be willing to take transit that originated near the MERA entrance station if parking conditions prevented them from driving their private vehicles to MERA. (The assumption is that the remaining 40 percent of visitors would not visit MERA during times that these parking conditions exist.) To translate to ridership volumes, the project team looked at hourly traffic volumes on a 90th percentile design day coupled with available parking and likely duration of stay to arrive at a number of visitors *per hour* that would otherwise have to park in undesignated roadside parking if they were to enter MERA in their private vehicle.

The resulting estimate is 552 passengers per day. Most passengers would arrive between 10 a.m. and 2 p.m., and the greatest volume of visitors would be between 12 p.m. and 1 p.m.

Service Hours and Frequency

Service hours and frequency is based on ridership demand, passenger safety, and feasibility. Traffic volumes and parking lot counts show that parking demand begins to exceed capacity in some lots starting around 9 a.m. However, the need for additional capacity at 9 a.m. is very low and picks up significantly at 10 a.m. For feasibility of transit operations, the project team begins transit service at 10 a.m.

Table 10 (Technical Memo 3.2) shows the distribution of lengths of stay among visitor groups to MERA. Using these data, the project team estimated the hourly desired departure times relative to hourly parking demand based on arrival times. The resulting volumes show that the greatest demand for transit (in both directions) would occur between 12 p.m. and 5 p.m., but transit demand would remain steady through 7:30 p.m.

The project team decided to design a system with maximum headways of 20 minutes, which balances convenience and visitor safety with financial and operational feasibility.[49] However, due to

[48] The total time for each route includes 5 minutes loading and unloading at the Courtesy Station, 3 minute stops at Summit Lake and Mount Goliath in both directions, a 10 minute stop at Mt. Evans Summit, and 38 minutes run time each way.

[49] The 20 minute figure is based on previous transit surveys conducted at Marsh-Billings Rockefeller NHP and Muir Woods National Monument. Also, a Center for Urban Transportation Research (University of South Florida) study suggests a maximum wait time of 30 minutes is acceptable for urban transit systems, and the

high volumes of passenger demand throughout the day, but especially from 12 p.m. to 5 p.m., the maximum headways for Scenario 2 would be 15 minutes. From 12 p.m. to 4 p.m., shuttles would operate approximately every 12 minutes. The system would operate from 10 a.m. through 8:00 p.m. (with the last shuttle leaving the Mount Evans Summit parking lot around 7:00 p.m.). See Table 55 for a summary schedule of shuttle service for Scenario 2, as well as the vehicle assigned to each trip.

This service schedule would call for 37 round trips daily and 10 shuttle buses. There would be an average of 15 passengers per trip throughout the day, but during peak periods (12 – 4 PM), the average would be much higher and several shuttles would likely operate at capacity.

Table 55: Schedule of Shuttle Runs for MERA Scenario 2

Departure (Staging)	Arrival (Summit)	Arrival (Staging)	Vehicle #
10:00 AM	10:54 AM	11:48 AM	1
10:15 AM	11:09 AM	12:03 PM	2
10:30 AM	11:24 AM	12:18 PM	3
10:45 AM	11:39 AM	12:33 PM	4
11:00 AM	11:54 AM	12:48 PM	5
11:15 AM	12:09 PM	1:03 PM	6
11:30 AM	12:24 PM	1:18 PM	7
11:45 AM	12:39 PM	1:33 PM	8
12:00 PM	12:54 PM	1:48 PM	1
12:12 PM	1:06 PM	2:00 PM	2
12:24 PM	1:18 PM	2:12 PM	3
12:36 PM	1:30 PM	2:24 PM	4
12:48 PM	1:42 PM	2:36 PM	5
1:00 PM	1:54 PM	2:48 PM	6
1:12 PM	2:06 PM	3:00 PM	7
1:24 PM	2:18 PM	3:12 PM	8
1:36 PM	2:30 PM	3:24 PM	9
1:48 PM	2:42 PM	3:36 PM	10
2:00 PM	2:54 PM	3:48 PM	1
2:12 PM	3:06 PM	4:00 PM	2
2:24 PM	3:18 PM	4:12 PM	3
2:36 PM	3:30 PM	4:24 PM	4
2:48 PM	3:42 PM	4:36 PM	5
3:00 PM	3:54 PM	4:48 PM	6
3:12 PM	4:06 PM	5:00 PM	7
3:24 PM	4:18 PM	5:12 PM	8
3:36 PM	4:30 PM	5:24 PM	9

study team estimates that a slightly shorter headway seems appropriate in the recreation context (CUTR study available at http://www.nctr.usf.edu/pdf/77720.pdf)

Departure (Staging)	Arrival (Summit)	Arrival (Staging)	Vehicle #
3:48 PM	4:42 PM	5:36 PM	10
4:00 PM	4:54 PM	5:48 PM	1
4:15 PM	5:09 PM	6:03 PM	2
4:30 PM	5:24 PM	6:18 PM	3
4:45 PM	5:39 PM	6:33 PM	4
5:00 PM	5:54 PM	6:48 PM	5
5:15 PM	6:09 PM	7:03 PM	6
5:30 PM	6:24 PM	7:18 PM	7
5:45 PM	6:39 PM	7:33 PM	8
6:00 PM	6:54 PM	7:48 PM	9

Bolded runs would not pick up visitors at the Courtesy Station such that the last "new" transit visitors arrive via the 4:15 PM shuttle.

Vehicle Selection

MERA is limited to 30 foot vehicles, and ridership demand estimates show that demand for the shuttle would fluctuate between 34 and 135 passengers per hour, with an average hourly demand of 92 passengers per hour). With a high hourly demand, a 28 passenger vehicle is the most appropriate in Scenario 2. The hourly demand necessitates at least 15 minute headways, with 12 minute headways (5 trips per hour) between 12 p.m. and 4 p.m. Twenty-eight passenger vehicles are the largest capacity vehicles that can safely operate with the 30-foot length limit on Mount Evans Highway.

Most 28-passenger vehicles on GSA AutoChoice exceed 30 feet in length. One potential option (used for cost estimate purposes) is the light-duty StarTrans Senator HD (2014) (see Figure 4**Error! Reference source not found.**). The StarTrans Senator HD base model can be modified with options to improve performance on steep grade roadways. With these options and a wheelchair lift, the vehicle will cost approximately $100,000, with a total vehicle cost of $1,000,000 for ten vehicles.

Staging

The project team considered several options for staging transit near the Courtesy Station. Staging would need to accommodate at least 120 vehicles, which translates to 36,000 square feet for parking or approximately 0.75 acres. This represents a significant challenge and potential impact to this transit scenario.

Two options for staging for Scenario 2 are the development of a property adjacent to Echo Lake Lodge and Campground or the use of the old Echo Lake Ski Area (5.5 miles east of the lodge on CO 103. The project team has not spoken with the owners of these properties about the feasibility, costs, or constraints involved in using these as transit staging areas 35 days per year.

Operations and Maintenance Assumptions

The operations and maintenance assumptions for this scenario are the same as MERA Scenario 1.

Cost Estimates

The cost estimates for MERA Scenario 2 are a combination of the following costs:

1. Transit-supportive infrastructure costs
2. Vehicle purchase or lease
3. Start-up costs

4. Operation costs (annual)
5. Maintenance costs (annual)

The transit-supportive infrastructure includes bus shelters at the Courtesy Station (2), Summit Lake (1) and the Mount Evans Summit (2). No shelter is included at Mount Goliath because there is already a Nature Center. Additionally, benches are needed at each stop. The total cost for shelters and benches is $161,000.[50] Other general start-up costs include marketing, installation, initial promotion, staff training, etc. These costs are anticipated to be $20,000 in Year 1.

Table 56 and Table 57 show the combined cost estimate for a vehicle purchase option. This assumes that USFS or another party purchases ten 28-passenger shuttles. These can be shared with other sites or used off-site during the remainder of the year when not in use at MERA. These tables also calculate an annual maintenance cost, which assume a three percent increase per year to account for inflation and fluctuation in driver, maintenance, and fuel costs.

Table 56: Capital Cost for Vehicle Purchase in MERA Scenario 2

Vehicle	Quantity	Cost per Unit	Total
28-passenger shuttle	10	$100,000	$1,000,000

Table 57: Total and Per-Passenger Costs with Vehicle Purchase in MERA Scenario 2

Costs	Total	Per Passenger
Annual O&M Costs (Season 1)	$133,205	$6.89
Year One Capital Costs	$1,181,000	$61.13
Costs Per Season (2-12, cumulative)	$1,757,244	$7.58
Total	$3,238,654	$13.82

USFS may also elect to lease vehicles, which may be an attractive option to test the viability of transit service with less up-front capital investment. GSA AutoChoice presents pricing options for 16-25 passenger vehicles. GSA offers a short-term lease in which the federal agency pays a monthly lease fee to use the vehicles for a few months at a time.[51] GSA short-term lease rates for vehicles of this size are $4,357 per month, with an estimate cost per season of $13,071. Because lease rates include maintenance costs but not fuel or driver costs, the annual operations and maintenance cost is calculated separately. These costs include fuel and drivers only, at a cost of $99,361 per year. Table 58 shows the total costs and per passenger costs with a lease option.

[50] Bench and bus shelter costs: http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=2

[51] GSA also has leasing options that commit the leaser to a 7 year or 100,000 mile lease, which would be less attractive to the USFS if they were testing transit on a pilot basis. If USFS pursues transit, they are encouraged to work with their regional GSA office for more detailed pricing options. Rates vary by region, but they are unlikely to *exceed* the rates presented here. Short-term lease rates include mileage and preventative maintenance.

Table 58: Total and Per-Passenger Costs with Vehicle Lease in MERA Scenario 2

25-passenger vehicles	Quantity	Cost per Month	Cost per Season	Total Capital[52]	Capital Per Passenger	Total O&M (Fuel & Driver)	Total Per Passenger
One Season	10	$4,357	$13,071	$130,710	$6.77	$99,361	$11.91

The total cost per passenger is similar between the purchase and lease options, with the lease being slightly less expensive. In both cases, capital costs account for approximately half of the total cost.

Relative to MERA Scenario 1, there is a larger number of passengers using this transit service (552 passengers represents 20% of the approximately 2,700 visitors on a 90th percentile day). Also, Scenario 2 has a shorter total length of the service in terms of miles and minutes, which results in a cost per passenger that is much lower than Scenario 1 in both the purchase- and lease-scenarios. A cost of $11 to $14 per passenger may significantly reduce demand, and the USFS should consider options to subsidize this cost. Capital investment from the USFS (or another funding source) for vehicles and infrastructure could also help reduce the cost-per-passenger.

[52] Cost estimates should also include $181,000 for bus shelters, benches, and start-up costs for year one. These are calculated separately. However, if they were included in the least costs and aggregated over twelve years, the capital per passenger cost would be $7.54 in year one and the total per passenger cost would be $12.68.

Synthesis

The project team determined that the most cost-effective, defined as cost per rider, and likely transit scenarios are BLRA Scenario 4, GP Scenario 3, and MERA Scenario 2. Though GP Scenario 3 is more expensive than GP Scenario 2, GP Scenario 3 is more likely since it would help alleviate crowding on Mt. Bierstadt, the trail, and in the wilderness area. While MERA Scenario 2 is slightly more expensive than MERA Scenario 1, MERA Scenario 2 would serve more passengers. This scenario is likely if the road degrades to a point where it would be closed to private vehicles due to safety concerns. Table 59 summarizes the operations and costs of the ARNF's most feasible scenarios in each of the three sites.

Table 59: Operations and Costs Summary of Feasible Scenarios

	BLRA Scenario 4	GP Scenario 3	MERA Scenario 2
Travel Time (Roundtrip)	20 minutes	66 minutes	108 minutes
Distance (Roundtrip)	4.4 miles	22 miles	30 miles
Hours of Operation	7am to 6pm	6 a.m. to 5 p.m.	10am to 8pm
Frequency of Service	20 minutes	15-30 minutes	12-15 minutes
Vehicles Required	1	5	10
Passengers/Day	195	400 (weekends), 200 (weekdays)	552
Cost to Own/Year	$25,981	$234,271	$269,888
Cost to Own/Year/Rider	$3.81	$8.37	$13.82
Cost to Lease/Year	$26,967	$181,790	$112,432
Cost to Lease/Year/Rider	$3.95	$6.49	$11.91-$12.68

If the Forest would like to pursue any or all of these transit scenarios, the next steps include getting line officer and Forest leadership team support, identifying partners and funding sources (such as the Federal Lands Access Program), estimating the cost and capacities of necessary staging areas, implementing accompanying transportation components (such as permit systems, etc.), and putting agreements into place.