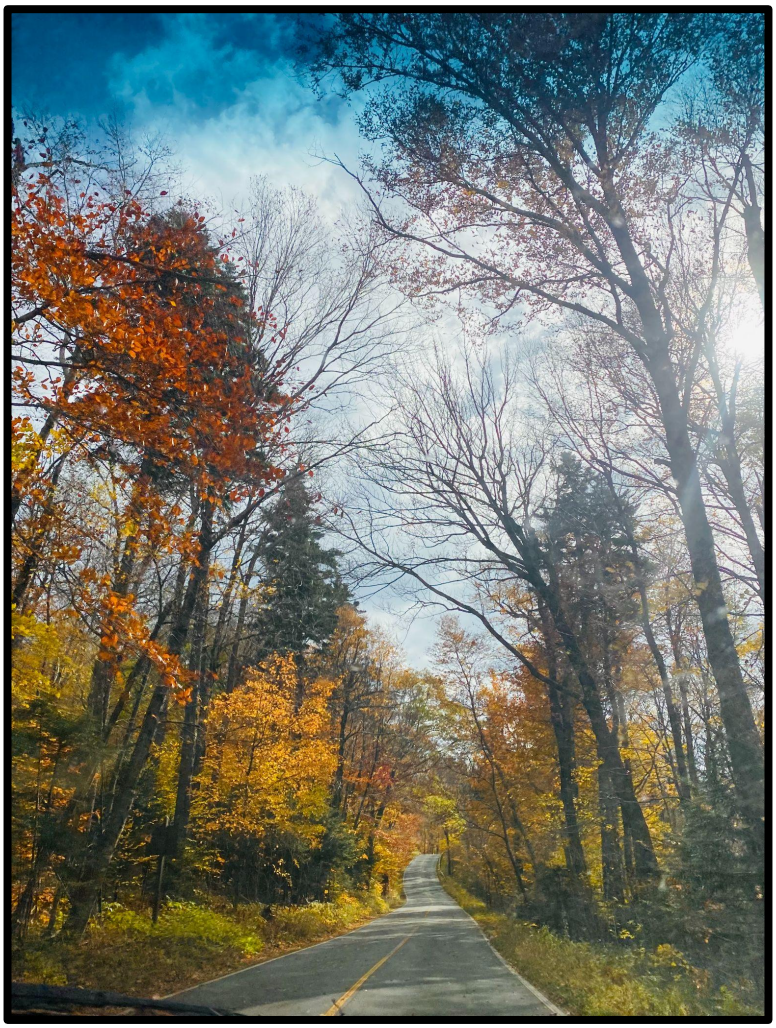


THE MOUNT GREYLOCK RESERVATION TRANSIT FEASIBILITY STUDY

Alex Park & Claudia Iannelli, Williams College

Environmental Planning Workshop (ENVI 302)
Professor: Sarah Gardner, Williams College
Client: Cosmo Catalano, Mt. Greylock Advisory Council

Contents

Land Acknowledgement

It is with gratitude and humility that we acknowledge that we are working and gathering on the ancestral homelands of the Mohican people, who are the indigenous peoples of this land.

Despite tremendous hardship in being forced from here, today their community resides in Wisconsin, and is known as the Stockbridge-Munsee Community.

We pay honor and respect to their ancestors past and present as we commit to building a more inclusive and equitable space for all.

Foreword

This feasibility study was undertaken during the fall semester of the 2021 academic year by Claudia Iannelli and Alex Park for the Mount Greylock Advisory Council, which advises the Mount Greylock State Reservation (henceforth referred to as the "Reservation" or "Mount Greylock"). The goal of this study was to determine the most efficient and effective solution to the severe traffic, illegal parking, and congestion issues experienced by the Reservation during peak season, which is defined as the weeks, and more specifically weekends in late September through the end of October. It must be noted that this study was conducted during a global pandemic, which resulted in several abnormalities, among which were difficulty in data collection and abnormal visitation patterns to the Reservation. Additionally, poor weather conditions during several key

weekends of peak season meant that visitation was low, so forming an adequate conception of what peak visitation looks like was challenging.

As a result, the study progressed with data collection over four separate site visits, input from stakeholders in the Reservation and local businesses, case studies of similar transit studies, and interviews with experts related to those case studies. Due to the nature of this study and its abbreviated timeline, the conclusions presented here will not only include recommendations for the implementation of novel systems of visitation organization, but also recommendations for the collection of new quantitative data and the conducting of a more extensive and in-depth study.

Executive Summary

The Mount Greylock Reservation Transit Feasibility Study is a preliminary study, conducted with the aim of producing a list of proposals to reduce traffic congestion at the mountain summit for the Mount Greylock Reservation. Due to the time constraints present in the study, the goal of this report is not to present a fully formed plan for the implementation of a shuttle bus system for the Reservation, but rather to produce both a series of possible short-term improvements to the Reservation, along with a framework which can be used in future studies. This framework and the proposals that comprise it can be used to both immediately improve traffic management and conditions on the Reservation, and to initiate a shuttle system which would hopefully mitigate long term traffic congestion. A shuttle system is recommended in this report, although it must be noted that a carrying capacity analysis of visitors to the park has not been done, so exact numbers and times of buses cannot be definitively stated.

Introduction

Environmental Planning Workshop: Community-Based Experience is an interdisciplinary, experiential workshop where the students in the course affect environmental change through hands-on community projects. These projects focus on the most pressing issues in the region and the planning field. At the beginning of the semester, the class was introduced to many clients and their projects. This project is concerned with The Mount Greylock State Reservation Project led by Appalachian Trail Conservancy Leader Cosmo Catalano and Forest & Park Superintendent Travis Clairmont. At 3,491 feet, Mount Greylock is the highest point in Massachusetts. From the summit on a clear day, you can see as far as 90 miles away, making it a popular tourist attraction and a prime reason to visit the rural town of Adams in Berkshire County.

A significant percentage of visitor use at the summit occurs during the aforementioned short time period in the late fall, at which point a problem of traffic control creates a burden on the park staff. A lack of parking spots at the summit leads to long lines of cars and visitors parking on the shoulder of the road illegally, despite signage telling them otherwise. Once one car parks on the side of the road, many more follow suit, causing more congestion on the roads and affecting the safe navigation of visitors on the road. Our clients are reluctant to enforce a policy of towing illegally parked cars because a tow truck cannot drive up and turn around down the narrow road. Our task was to research traffic congestion solutions and propose ways to implement solutions that are in the best interest of the Mount Greylock Reservation staff and its visitors. This project was assigned in early October, requiring immediate data gathering before the park closed for the year.

I) Research Approach Strategies & Results

1.1 Surveys

Strategy

Our first step was to research visitor use patterns to determine if, how, and when visitor use conditions (traffic congestion) negatively affect the visitor experience and natural resources on Mount Greylock. We conducted this study over the course of several site visits in the form of an in-person survey. With the help of several volunteers, the survey was conducted via question and answer after approaching visitors at random and asking them if they had time to answer a few questions. At the summit, each surveyor, with a clipboard and approximately 25-50 surveys, individually conducted as many surveys as possible. A loose introductory script and the survey questions are presented below:

"Hi, I am a student from Williams College working with the Mt. Greylock Reservation on an environmental planning project for Mount Greylock Reservation to improve traffic congestion issues during peak season. If you have a couple minutes, I would appreciate your input for our research and hear more about your visit today."

If the visitor said yes, then we would ask them the following 10 survey questions:

1. *Is today your first time visiting Mount Greylock?*
    a. *If not, how many times do you visit a year?*
2. *Why did you decide to visit today over other times?*
3. *How many people are traveling with you?*
4. *Where are you traveling from today? (zip code)*
5. *Do you know which road you took up the mountain?*
    a. *Rockwell (Route 7/Lanesborough)*
    b. *Notch (North Adams/Williamstown)*
6. *If you hiked, what trail did you come up?*
    a. *Are you planning to return on the same route?*
    b. *As a hiker, how has your experience been affected by all these cars?*
7. *How long was your drive up?*
8. *How long do you plan on staying?*
9. *We realize traffic is an issue during peak season. How has this affected your experience at all on a scale of 1-5? (1=not all, 5=will not drive up again this time of year)*
10. *Any suggestions on how we can improve traffic?*
    a. *Shuttle from bottom*

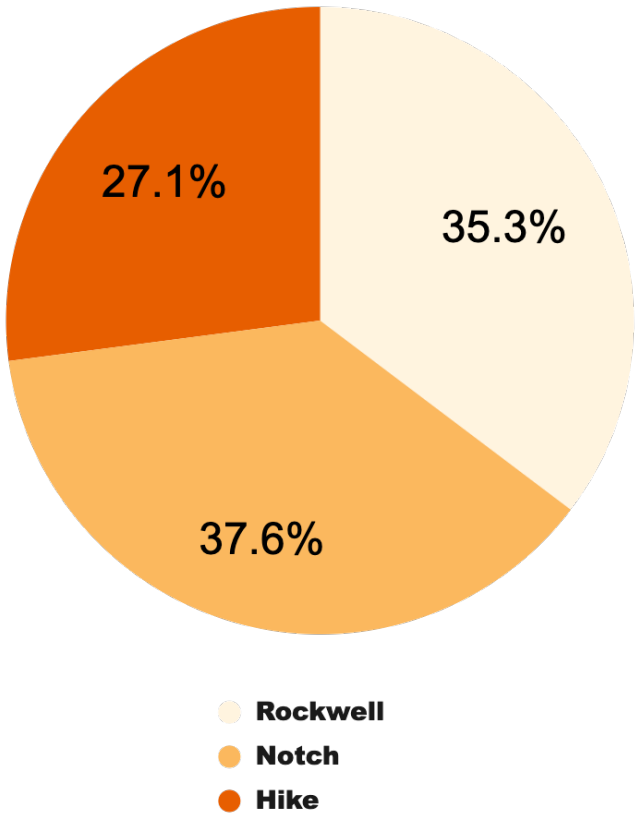
b. *More parking lots at summit or base*

c. *Appointment slots for visiting*

Results

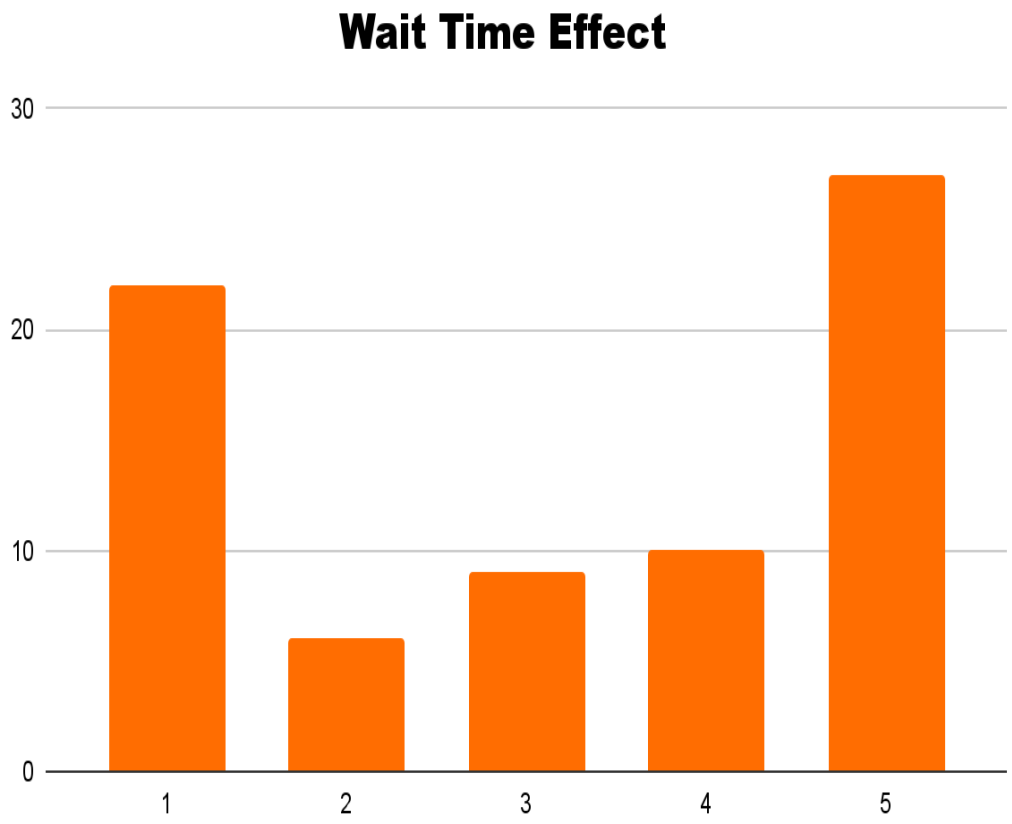
The Mount Greylock In-Person survey effort resulted in roughly 100 responses. While this may seem to be a low number and is certainly not adequate data to form any concrete recommendations on, the late timing of the commencement of this study, along with the information that our clients shared with us that this season was not as crowded due to the lack of good weather, indicated that this data would be used to initiate lines of inquiry, rather than quantitatively support solutions. Last year, during the more restrictive times of the pandemic, the Mount Greylock summit was more crowded because everyone wanted to go outside, and the weather happened to be good. Because we realize that weather and the limited amount of time we had impacted our results, we propose more time and investment into research gathering to provide a more accurate understanding of the visitor experience at Mount Greylock. Still, in this report, we work with what we gathered and made the best of the situation.

Road Usage



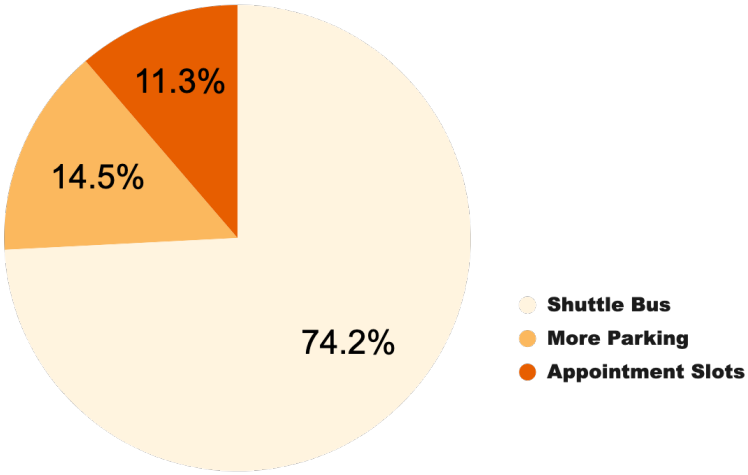
We found that 37.6% of respondents drove up Notch Road, 35.3% drove up Rockwell Road, and 27.1% hiked up one of several trails. These findings are helpful for determining traffic management in the future and determining a solution. However, in speaking with Travis Clairmont, who has far more experience with the Reservation, we determined that traditionally Rockwell Road experiences significantly more traffic than Notch Road (about 2/3rd of traffic drives on Rockwell), which indicated to us that our data collection sample size was too small to yield an accurate result for this metric. For instance, knowing the main roads people take up helps with the path of the shuttle, which was one proposed solution.

Wait Time



We found that a majority of people surveyed were either not affected by the wait time or were extremely affected by the wait time and would not drive up again. These responses depended on the day, as some of the days we visited Greylock were during the week with little or no traffic at the summit, and other weekends we visited were the busiest of the year. For instance, our first weekend we visited the “Greylock Ramble" on October 11, when up to 1,000 people hike to the summit via the Cheshire Harbor Trail. However, even on this busier day, some hikers remarked that seeing the car traffic made them feel good about themselves for hiking and not sitting on the line. It was mainly people who drove that were most affected by the traffic and did not want to endure it on their visit.

Initial Solution Proposals (Pre-Research)



Out of the 100 visitors we surveyed, 74.2% favored the idea of a shuttle, 14.5% favored appointment time slots for visits, and 11.3% favored more parking lots.

At the end of each survey, the interviewee was asked for feedback on what they thought might be the best ideas for solutions. They were prompted with three potential solutions, outlined in the survey above, and were asked their thoughts. The prompts were minimal, and the surveyors were looking for general responsiveness over specific input on any of the three proposals. For example, the question likely would have been phrased *"with regard to potential solutions, do you have any suggestions for how we might improve the visitor experience, possibly with a shuttle service, appointment slots, or more parking?"*

Shuttles

A shuttle service would take visitors from the parking lots at the base of the mountain to the summit, and then return them on a predetermined schedule.

Pros: There were a couple of reasons why people thought the shuttle was a great idea. Some said they liked it because they could enjoy the views more on the way up and not have to focus on navigating the windy, narrow road to the summit. Other visitors said that it would be great to help reduce carbon emissions and encourage "carpooling." Some even suggested that the shuttle should include trivia with a tour guide on the way up to make it more enjoyable. We feel that engaging the visitors on the way up is a great idea.

Cons: Some older visitors were hesitant to favor the shuttle due to uncertainty of the pandemic and not wanting to be in tight quarters with strangers when they were going to enjoy an outdoor activity. They would want everyone to be vaccinated as a requirement to board the shuttle. Another pushback had to do with bringing pets. Many visitors brought their pet dogs and were wondering if the shuttle would allow them to bring their dogs on board. They would rather drive up on their own if pets were not allowed. One last concern was if the shuttle would be for free or not. Currently, there is no longer a parking fee and visitors said if they had the option to drive up themselves and park for free or pay to take the shuttle, they would drive on their own.

Next Steps: After this feedback, we reached out to our clients to learn more about the feasibility of a shuttle service. They directed us towards some helpful transit feasibility case studies published on *ROSA P*, the National Transportation Library's *Repository and Open Science Access Portal*. Through these sources we were able to gain more background and resources on implementing a shuttle system to help us better determine what is most feasible for Mount Greylock. We discuss our case studies and subsequent interviews in further detail in the Research Strategy section called "Case Studies."

Appointment Time Slots

Appointment time slots could be reserved on the Mount Greylock mass.gov website before a trip to the mountain.

Pros: Visitors favored reserving parking spots in advance because they have seen it done successfully at larger parks such as Zion National Park and believe it could be done at Mount Greylock.

Cons: Many visitors did not favor the appointment slot times because they did not want to have to schedule their visit ahead of the time. When we asked the survey question, *Why did you decide to visit today over other times?* many said it was spur of the moment; they saw it was nice weather and wanted to make a day out of it and drive up to the summit. Some just like to drive up regularly for a picnic lunch or afternoon walk. It would be inconvenient if suddenly, they had to plan these outings in advance. Another drawback visitors saw with appointment time slots was making people aware that they were being put into place. They said we would have to get it out to visitors and make sure they were aware of the change.

Next Steps: After this feedback, we thought it would best to gradually implement appointment slots if Mount Greylock were to ever do them. That way, only a few spots would be reserved and overtime, people would see that appointment slots are happening, and more spots could be closed off for reservations only. Also, to inform visitors, we would need to update the Mount Greylock website, sharing a notice that appointment slots are being implemented. Furthermore, we could put up signs at the summit, in case regular visitors never checked the website. We also investigated more case studies featuring the implementation of appointment time slots that are further detailed in our Case Study section.

More Parking Lots at the Summit

Pros: A few visitors favored more parking lots because they thought it was an easy, no-brainer fix to the problem of not having enough spots. Other visitors said that if we had a shuttle, we would need more parking lots at the base of the mountain, and that would be the only reason for needing more lots.

Cons: Many visitors were against more parking because they thought it would just bring more visitors and make the traffic worse. Also, they were unsure where we would place the extra parking lots near the summit because there are not many feasible options. Furthermore, the construction and additional pavement surfacing would increase runoff and be an environmentally damaging solution.

Next Steps: Since it would not be an environmentally conscious decision, we do not propose more parking lots at the summit. We would only consider adding lots at the base of Mount Greylock for shuttle purposes.

1.2 Mount Greylock Council Board Meeting

Strategy

The Mount Greylock Council Board is an advisory board to the Department of Conservation and Recreation (DCR), which is a state agency of the Commonwealth of Massachusetts. The DCR is situated in the Executive Office of Energy and Environmental Affairs (EOEEA), which manages the operation of the Reservation. Membership is composed of representatives from each of the towns with land on the Reservation (Lanesborough, New Ashford, Williamstown, North Adams, Adams) as well as some at-large members and DCR staff. We introduced ourselves and explained our strategy for the project, and what had been accomplished thus far. We thought it would be helpful to gain productive feedback from the management staff and stakeholders with interests in the Reservation, which could then be implemented into our next steps.

Results

We presented our research and suggestions to the Mount Greylock Advisory Council Meeting on October 28, and received productive feedback. The Council was very enthusiastic about our involvement in this project and the potential for this project to begin to address issues of Reservation usage. They favored the idea of a shuttle and suggested that we investigate DCR Interpretive Services. The Park Interpreter's primary responsibility is to help visitors find meaning in the natural and cultural resources of DCR's facilities. They perform various interpretive, educational, and administrative tasks in the operation of visitor services and interpretation. The idea is that a Park Interpreter would ride on the shuttle and provide an interactive tour of Mount Greylock on the way up for visitors. This would be great to learn more about the history of Mount

Greylock and make the shuttle ride entertaining. We were also given more case studies by our clients that we had to start reading into.

Next Steps

Since the visitors and Council favored a shuttle, we researched its feasibility as a possible solution for traffic congestion. After reading through case studies, we decided to reach out to the study contributors to engage further with experts in the field who had a wealth of experience in implementing shuttle services.

1.3 Interviews

Strategy

We reached out to contributors of transit feasibility studies (enumerated in section 2 of this report) and park managers with the hope of connecting to either learn more about their studies, or take advantage of their expertise to help improve the scope and scale of our project.

Results

We were fortunate enough to be able to interview Travis Crayton, Scott Lian, Benjamin Rasmussen, and Heather Richardson. Travis Crayton was recommended by Kathryn Herndon-Powell, Regional Manager at the Central Virginia Appalachian Trail Conservancy, who we reached out to through the Triple Crown Park Reservation for the purpose of finding interviewees.

After our conversation with Travis, he directed us to Scott Lian, General Engineer at US Department of Transportation Volpe Center, and Scott put us into contact with his co-workers at Volpe, Benjamin Rasmussen, and Heather Richardson.

Travis Crayton

Background: Travis works at Research Triangle Park (RTP), the largest research park in the United States and a premier global innovation center. Its 7,000 acres house hundreds of companies, including science and technology firms, government agencies, academic institutions, startups, and nonprofits. Travis is RTP's Planner & Project Coordinator and is involved in many transportation projects. Before RTP, Travis earned his Master of City and Regional Planning, Master of Public Administration, and Bachelor of Arts degrees all from UNC-Chapel Hill. After graduating, he became a Transportation Planner at the U.S. Department of Transportation (DOT) Volpe Center for a variety of federal agencies. Thus, due his background and experience, we took his advice under serious consideration when figuring out next step plans for Mount Greylock.

Advice: After we provided more context on our project, Travis suggested that we focus on investment for data collection, such as counters for cars. That way, we could quantify the problem and see if a shuttle would even be cost-effective or worth it. Travis encouraged us to focus on the more inexpensive but very effective approaches to solving traffic congestion. Such suggestions included creating a new, informative website for Mount Greylock and including peak time data to discourage visitors from traveling during busiest hours. He also suggested more signage to prevent parking on trail shoulders and installing a wait-time sign at the bottom, which we have already proposed to our clients. He made several other short-term

recommendations, including trying to contact volunteer organizations and individual trail clubs that may be willing to help at the park when it gets exceptionally busy. He also drew our attention to the fact that park services are generally underfunded, and that a shuttle service would be costly, especially if the roads on Greylock necessitate a smaller (and therefore less cost effective) shuttle. Other suggestions he had or ideas that we were able to come up with based on our interview with him included looking into a reservation system, pricing (charging for a shuttle service/parking) only during peak times, an automated parking management system, and additional signage to provide more information to visitors.

Takeaways: Essentially, Travis' recommendations boiled down to a need for quantifying the problem that we were trying to solve. Knowing that the peak season is over, this quantification will need to wait for next year to gather accurate data, meaning that the scope of our project is changing slightly towards more of a grant proposal type of project, and some of our recommendations will reflect the need for additional data collection and likely funding. We will explore all the avenues that we have outlined above and pursue those which appear most promising to yield substantial results.

Scott Lian

Background: Scott works as General Engineer at the U.S. DOT Volpe National Transportation Systems Center, where he is an expert on alternative energy and fleet transportation. He is responsible for leading and participating on technical project-based teams that deal with multidisciplinary studies involving sustainable energy, emissions, advanced transportation fuels, fuel use reduction strategies, and the integration of autonomous, connected, and energy data rich environments to advance efficient transportation goals and related safety

and deployment issues. Before becoming General Engineer for Volpe, Scott worked as Volpe's Operations Research Analyst for almost 16 years. Within this role, he assisted and supported multiple national-level programs to develop and deploy advanced alternative fueled vehicles and related infrastructure with a focus on vehicle and overall system safety. Scott's foundation of engineering expertise stems from his Bachelor of Science in Mechanical Engineering/Mechanical Technology/Technician at Northeastern University. We were truly grateful to put into contact with a person of such background and expertise and received excellent advice and feedback from Scott.

Advice: One of the first things that Scott mentioned after we introduced our project and its goals was the two-tiered difficulty of implementing a shuttle service. Initially, he spoke about the challenges of starting a shuttle service in the near future, given the current labor shortage and high costs associated with acquiring the equipment for a shuttle. More importantly, however, he noted that while starting a service would be difficult, getting people to use the service would be even more challenging. Thus, if a shuttle service were to be implemented, there would need to be a large amount of effort expended on marketing it to the local community to ensure its success.

Scott, as an expert on alternative fuel sources, also gave us some advice on the electrification of a shuttle service in the future, were one to be implemented. He felt that due to the lack of electric and hybrid technology for vehicles, especially for larger trucks operating with heavy loads on mountain roads, we should not pursue non-fuel options at this point. The expense and inefficiency would negate any potentially beneficial emissions reductions that occurred. Additionally, he urged us to consider that combining the load of multiple vehicles into one, even if it was fuel-powered, would severely cut back on emissions resulting from Greylock traffic.

Takeaways: After our conversation, we decided implementing an electric bus would not be worth it and agreed with Scott that limiting cars on the road through a shuttle service would reduce emissions and thus would sufficiently reduce our impact on the environment to an acceptable level for the short term.

Benjamin Rasmussen

Background: Benjamin Rasmussen works as The Public Lands Team for Volpe, where he is the expert in shuttle service planning for public lands, non-motorized transportation planning and evaluation, regional and long-range transportation planning, and resiliency planning. In addition to managing the Volpe portfolios for the U.S. Fish and Wildlife Service and the National Park Service Midwest Region, Rasmussen leads and coordinates the work of Volpe's public lands team. He has also worked with the Federal Highway Administration, the Federal Transit Administration, and local, regional, and state transportation planning agencies. Before joining Volpe, Rasmussen worked as a senior program officer for an international environmental non-profit organization and as a transportation planner for a metropolitan planning organization. He is also a member of the Transportation Research Board's Metropolitan Policy, Planning, and Processes Committee, and the Special Task Force on Climate Change and Energy. His foundation of expertise stems from receiving a Master of City and Regional Planning at University of North Carolina at Chapel Hill and a Bachelor of Arts in International Relations/Political Science at Carleton College. It was great to hear Ben's perspective on our project, given all his experience.

Advice: Ben said his first step in tackling this project would be to figure out the best system for data collection and parking lot management. In terms of beginning data collection, he

said that his team usually drafts existing conditions reports based on whatever metrics the park location they are looking at has. Ben pointed out that typically, park staff share what they know from experience but that the knowledge isn't necessarily quantified. It is best to use their experience as a base, so if they know the parking lot gets busy during certain times, we can assess it statistically by checking video camera surveillance to count to spots that are open or utilizing a car counter. We had not considered a video camera as a strategy to count cars before. Ben shared two systems his team has worked with called, intuVision and LotSpot. intuVision Parking monitor has two options based on spot availability and entry/exit occupancy. These options can be used separately or together, depending on camera parking facility and the camera views.

Spot-by-Spot monitoring watches each parking spot individually and determines its status with highest accuracy in real time. For spot-based monitoring, cameras must be placed such that each parking spot is visible. For this option, each vehicle is tracked, reporting both total occupancy of the lot, as well as providing optional notifications when vehicles park in certain spots or remain parked longer than a specified duration. Entry/exit counting monitors the occupancy of a parking garage or lot, by counting vehicle entrances and exits. This solution requires cameras placed at entrances and exits and tracks the total number of vehicles in the garage or a particular floor, and outputs the calculated overall occupancy. Alarms can be sent when the area reaches a specified percentage of its capacity. Lot Spot basically serves the same purpose and uses smart cameras to collect visitor data *(unidentifiable)* by placing them in the entrances and exits of your lots.

For our shuttle proposal, Ben thought it would be a good idea to have a pre-recorded verbal guided tour that runs over the shuttle's speakers while you drive up to the summit. With a recording, the park does not have to worry about hiring someone to be a guide. Ben also said we

would need a market strategy for the shuttle service. He suggested we put out lots of advertisements and signage about the implementation of a shuttle service at the summit and on a website, so it reaches the public.

Takeaways: Ben reinforced our need for more data collection, and we believe that services like intuVision and LotSpot are feasible for Mount Greylock to implement. We also like the idea of a pre-recorded tour to play on the ride up, instead of having to find an on-site tour guide to ride up and down the shuttle.

Heather Richardson

Background: Heather Richardson works as Community Planner with respect to transportation and assists public land agencies in addressing issues of access and congestion using alternative transportation. She specifically focuses on public transit services connecting to and within public lands and how technology can improve such services. Her experience working at public land units in several regions enables her to share the lessons learned between them and facilitate growth in understanding. Richardson also has local transportation planning experience from the New York City Department of Transportation, where she worked in planning and operations for seven years. At the Volpe Center, she primarily supports work for the National Park Service regional offices and the Federal Transit Administration. Her expertise stems from her Master of Urban and Regional Planning at the Massachusetts Institute of Technology and her

Bachelor of Science in Environmental Policy and Management at the SUNY College of Environmental Science and Forestry. Given that Heather has worked with parks to develop transportation feasibility studies, her input was incredibly helpful for our project.

Advice: Heather provided a lot of great advice for our shuttle proposal. Her rule of thumb for us was to find the biggest vehicles possible for the job, because drivers are so expensive. She also said we would have to make sure the shuttle bus is wheelchair accessible. Depending on the size of the vehicle we provide, the driver may need a Commercial Driver's License. However, this is only the case if we rent out our own buses without a driver. She informed us that the government leases buses for $600/month and 55 cents/mile. If we were to find a service Mount Greylock could partner with that has a driver already, Heather predicts the cost would be much more feasible. It would be ideal for this service partner not to operate on the weekends because that is when we are thinking of having our shuttles. Heather also pointed out that we must remember that we are in a pandemic, and it might be difficult to get people in vehicles with a bunch of other people that they do not know. Of course, we cannot predict future pandemic conditions, but it might be a good idea to have some form of masking and vaccination requirements.

Heather agrees that we need more data collection and advised that the Metropolitan Planning Council (MPC) may be able to rent us out a car counter. She also shared that MPC may also be able to rent us highway signs to put on the main roads to show the wait time. A company called TRAFx also sells car counters for about $2,500. We told Heather that this is an environmental planning course and she said if money was not a barrier, her long-term environmentally sustainable idea for Greylock would be to reconstruct the road with a conduit surface underneath, creating a permeable surface and electric infrastructure. That way, the roads could support an electrified fleet of shuttles.

Takeaways: Heather's insight on shuttle planning and keeping in mind accessibility and

pandemic conditions was incredibly helpful. Also, it was great that she pointed us towards some great resources like MPC and TRAFx, which would be useful for Mount Greylock.

II) Case Studies

Source: The Franconia Notch State Park, franconianotch.org

The Franconia Notch State Park Transit Report studied the potential of a shared mobility service to improve access to trails and amenities throughout Franconia Notch State Park in Grafton County, New Hampshire. The project had three main goals to ensure and promote safety, equity, and efficiency. These goals align closely with what the project goals of the Mount Greylock Reservation Traffic Study. As far as safety, the study is aimed at addressing illegal, or at least unsanctioned, parking along the sides of roads. This is one of the main issues facing the Mount Greylock Reservation, as parking on the sides of roads presents a multitude of logistical issues as the roads are particularly narrow and difficult to navigate under normal circumstances. In terms of

meeting equity goals, we would like to maximize amenity access, and enhance visitor experience, as Franconia Notch State Park did. To address efficiency, Franconia Notch State Park wanted to preserve access to revenue generators, design a cost-effective service, and have two transit service alternatives. For Mount Greylock, we would like to do the same but a smaller, shorter-term scale.

Methodology

Web-Based Survey

As a beginning of their methodology, the Franconia Notch study disseminated a web-based survey to assess visitor interest in a shuttle service. This gave us a boost in confidence as we began our project research in the same way (with an in-person survey, but the same general idea). Their survey targeted both park users and people who might not currently have plans to visit the park, but still fit the profile of park users. This allowed Franconia Notch State Park to implement a service that reflected the mobility needs and preferences of both past and potential park visitors. The project team developed a survey analysis spreadsheet, so that the survey could be rapidly deployed when visitation levels began to rise and/or it became a more appropriate time to survey people about recreational travel. We discussed recommending this style of survey be implemented at the Mount Greylock Reservation in the future and believe that if the need for additional surveys arises in the future, this would be an adequate augmentation to a "boots-on-the-ground" approach with physical, in-person surveys.

Car and Hiker Counter Data

Data from trail and vehicle counters were used to determine general levels of demand for park amenities over time and throughout different seasons. The following graph in Figure 1 shows

vehicles required to transport the number of hikers counted by trail counters (scaled by average vehicle occupancy as reported in the hiker survey), plotted against the number of vehicles counted alongside I-93. From the graph, we see that the non-holiday weekdays rarely create sufficient demand to induce roadside parking (and correspondingly, do not require shuttle service); on the other hand, nearly every weekend and holiday generates enough demand to induce such behavior.

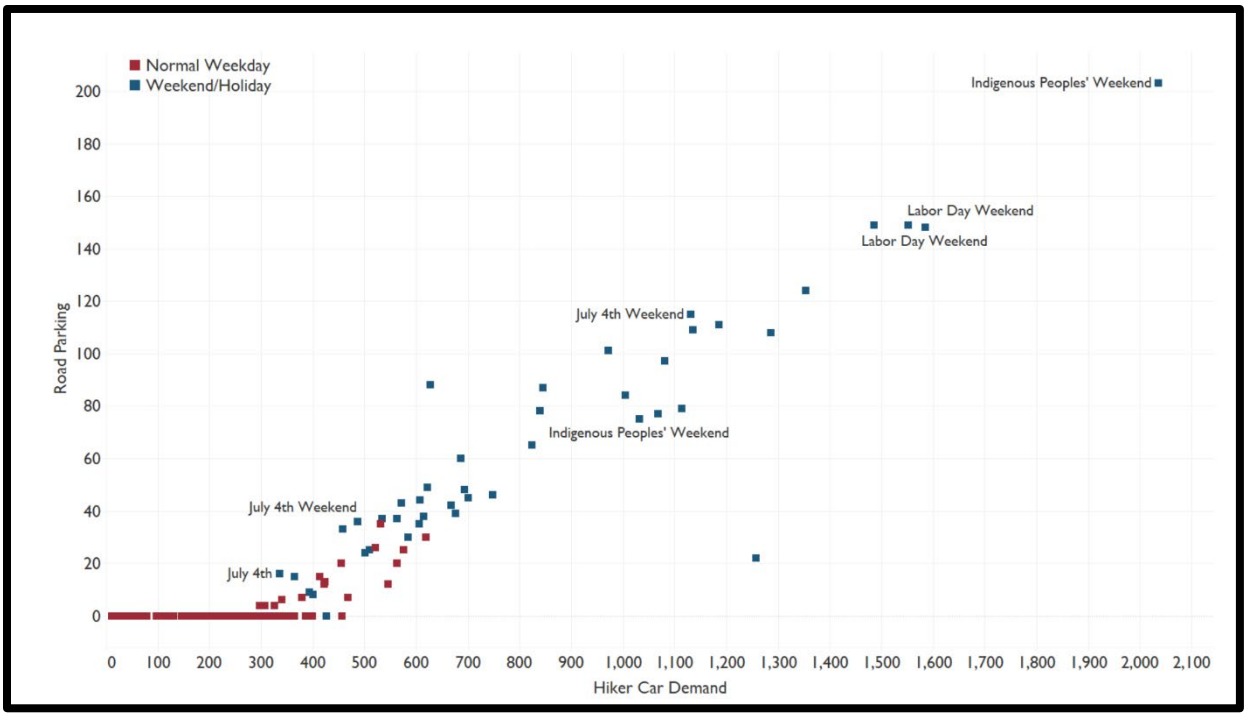


Figure 1: Roadside Parking Incidence vs Estimated Vehicle Volume

Location-Based Service Data

Location-based services data use anonymized cell phone geo-location data to measure visitor activity. Through an agreement with New Hampshire Department of Transportation, these data were used to assess general travel patterns within Franconia Notch State Park, as well as seasonal visitation and visitation by origin which is shown in Figure 2. The LBS data reveal that more than 75% of summer and fall visitors (June through October) came from out of state,

primarily from Massachusetts, Maine, and Vermont. This has implications for the promotion, operation, and pricing of a shuttle service.

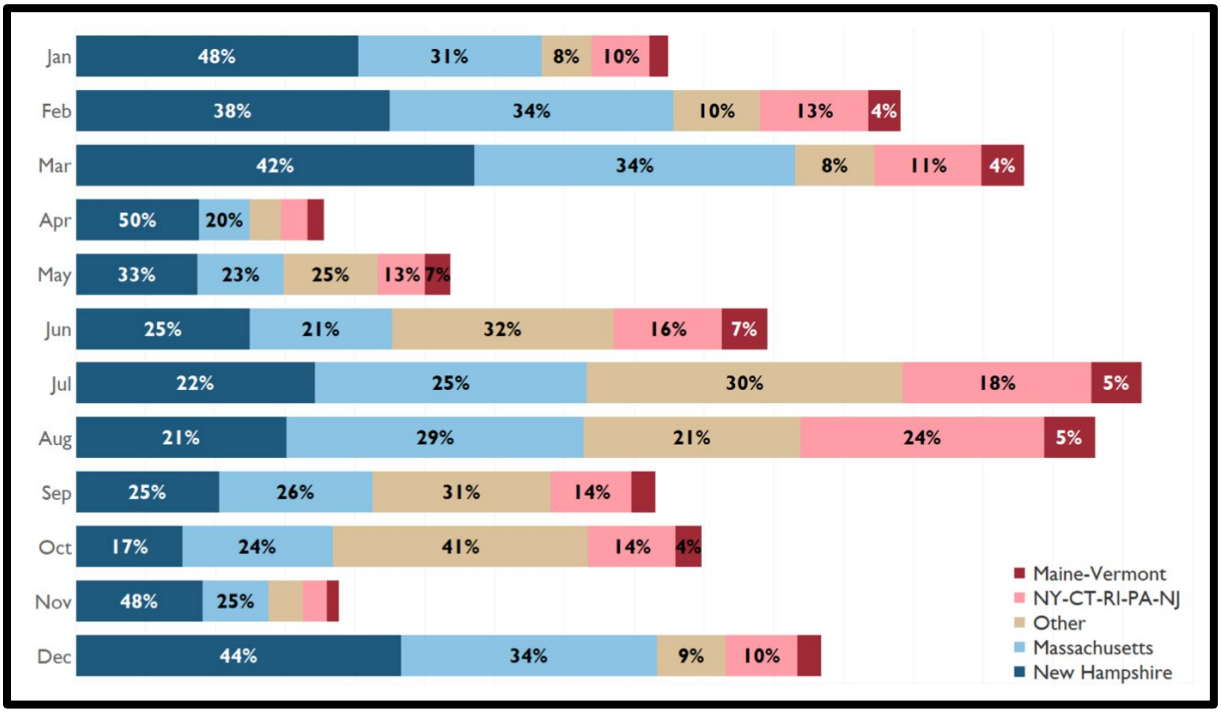


Figure 2: Relative Demand by Month and Origin

Exploring Pros and Cons of Service Options

The project team explored various transit and shared mobility options appropriate for use in FNSP, including different service models, bicycle and scooter share, connected and autonomous vehicles, subsidized ride-hailing use, and parking management approaches. Case studies were selected from state and national parks, as well as private businesses such as sports arenas and theme parks around the country, to identify the benefits and drawbacks of each shared mobility option in addressing the Franconia Notch State Park's mobility challenges. Table 1 illustrates their findings.

Service	Pro (+)	Con (-)
Shuttle Bus	Largest capacity Predictable/scheduled Most efficient when near capacity	Largest infrastructure requirements Possible wasted capacity / trips Inflexible operations
Parking Management	Revenue opportunity Electronic communication maximizes capacity	Large land requirements Pricing limits access Management requires staffing
On-Demand Taxi	"Right-sized" Flexible operations (late night)	Increases VMT/trips No economies of scale Limited availability (TNCs) Limited capacity & accessibility
Shared Bicycle / Scooter	Carbon neutral Smallest spatial requirements	Smallest capacity Weather-dependent Not accessible or universal Specialized vehicle maintenance

Service	Pro (+)	Con (-)
Shuttle Bus	Largest capacity Predictable/scheduled Most efficient when near capacity	Largest infrastructure requirements Possible wasted capacity / trips Inflexible operations
Parking Management	Revenue opportunity Electronic communication maximizes capacity	Large land requirements Pricing limits access Management requires staffing
On-Demand Taxi	"Right-sized" Flexible operations (late night)	Increases VMT/trips No economies of scale Limited availability (TNCs) Limited capacity & accessibility
Shared Bicycle / Scooter	Carbon neutral Smallest spatial requirements	Smallest capacity Weather-dependent Not accessible or universal Specialized vehicle maintenance

Table 1: Service Options

Service Proposals

Based on the findings from the existing conditions assessment and the exploration of service options, the project team developed two transit service alternatives. The base case ("Pilot") alternative reflects the 2019 shuttle program that provided service between two major tourist attractions at the park. The alternative ("Pilot Plus") extends the base case service to even more attractions and a longer ride. Using a cost estimation tool considering labor, capital, and fuel

expenses, they found the cost differential to be about $35,000 between the Pilot and the Pilot Plus, so they favored the Pilot program because it was much cheaper. The seasonal "break-even" ridership, at a fare of $5.00 per rider, is about 28,000. Though the shuttle program does have a theoretical capacity sufficient to carry this many riders (actual capacity depends on the time-of-day distribution of ridership), this would represent a substantial increase in visitors to the park's trails, which themselves experience degradation in user experience with high visitor volumes.

Rider Card Survey

After they implemented their shuttle, Franconia Notch State Park thought a useful tool could be a rider survey card. A short (1⁄2 page) feedback card could be designed to be distributed to shuttle riders at the end of the trip. The rider survey can ask where riders are visiting from, what attractions they visited, and their experience using the shuttle service. It can also be used to keep people engaged in future services and activities offered at the park.

Results

While the anticipated shuttle service has not materialized, the motivating issues remain. The park has continued to be overused in the summer, and the risk of pedestrians and parking along I-93 needs to be addressed.

Takeaways

In reviewing this report, we gained several interesting insights as to how we could improve our own project, and/or make recommendations for future projects and research that the Reservation staff could approve and conduct. These included but were not limited to a rider survey

card for a pilot shuttle bus service, vehicle and trail hiker counting to assess the number of visitors and to determine visitation trends throughout the year, and collecting data from cell phone tracking to determine what proportion of out-of-state visitors the park receives so we know where to market services and potential changes.

2.2 Triple Crown Area Transit Feasibility Study:

Source: SC Shank Art Collections, fineartamerica.com

The Triple Crown Area Transit Feasibility Study considers the feasibility of operating a shuttle service to one or more of the trailheads of the Triple Crown located in the Roanoke Valley of the Blue Ridge Mountains in Virginia. The trailheads of Triple Crown are only accessible by car and thus during peak season and time, there is heavy traffic congestion.

Methodology

Due to their multiple trail heads, Triple Crown study conducted a five-scenario analysis. To develop the shuttle service scenarios, the project team interviewed project stakeholders and engaged the National Park Service and project partners to develop a list of goals for a potential shuttle service to achieve. Based on these interviews and discussions, the following goals were identified. The goals are not listed in any particular order and are intended to be used as an analytical tool to assess potential shuttle service scenarios:

- **Goal 1:** Address acute parking demand and congestion challenges at McAfee Knob
- **Goal 2:** Disperse use across trailheads to improve visitor experience, visitor safety, and resource conditions along the Triple Crown trail segments
- **Goal 3:** Connect to other destinations in the region to provide easily accessible service to a greater number of people
- **Goal 4:** Provide a simple, easy-to-understand, and consistent service design for the public

This process involved an online workshop with project partners, at which consensus was achieved on the range of route options and specific stops to prioritize in shuttle service scenarios. The project team calculated route times and developed preliminary service schedules using several agreed-upon assumptions established through discussions with NPS and project partners. Both 20-

minute and 30-minute service headways are evaluated for all shuttle service scenarios analyzed in this report. NPS and project partners consistently identified a preference for 20-minute headways to meet visitor expectations. A 30-minute headway is included in analysis for cost comparison purposes. A two-minute dwell time is assumed for each stop location.

With more data collection, they created five scenarios based on the following criteria: timing of shuttle headways, duration of shuttle operation, capacity of shuttle bus, rate of turnover, and cost estimation. They created a table for each of their five shuttle scenarios like Table 2. For their analysis, the ridership projection and number of shuttles required was based on the total person capacity of the vehicle, or the number of seats on the vehicle, as it would not be safe to have standing passengers on mountainous highway routes. One-way vs roundtrip costs and rides were based on if there was a high rate of passenger turnover (i.e., passengers only go one stop and get off). This means the bus can carry more passengers over the course of the route. The team assumed that bus trips will not have high rates of turnover in the peak direction of travel. Then, they would see if the scenario was feasible and aligned with their four goals. This scenario provides service to two trailhead parking lots, serves three stops, and has a roundtrip total time of 40 minutes. Based on these service characteristics, this scenario achieves goals one and four, somewhat achieves goal two, and does not achieve goal three. They did this for the other four scenarios to make their conclusions about the feasibility of a shuttle. The assessment is shown in Figure 3.

SCENARIO #1		
Headway	20 minutes	30 minutes
No. of Shuttle Vehicles Required	2 vehicles	2 vehicles
Total Cost	$161,280–$201,600	$161,280–$201,600
Low-Ridership Projection		
One-way Cost Per Rider	$7.41–$9.27	$10.97–$13.71
Roundtrip Cost Per Rider	$14.83–$18.53	$21.94–$27.43
Total Rides Per Day	260	176
Riders Per Day	130	88
Annual Ridership	10,920	7,392
High-Ridership Projection		
One-way Cost Per Rider	$4.32–$5.41	$6.40–$8.00
Roundtrip Cost Per Rider	$8.65–$10.81	$12.80–$16.00
Total Rides	440	300
Riders Per Day	220	150
Annual Ridership	18,650	12,600

Table 2: Ridership and Cost Estimates

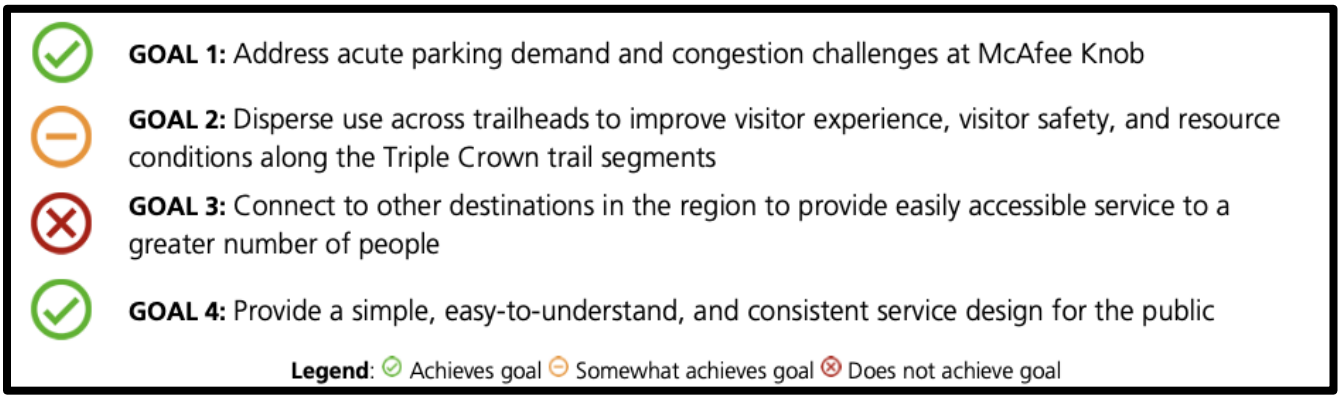


Figure 3: Assessment of Goal Alignment for Scenario #1

Results

The study concluded that the geometry and layout of the park is not conducive to a cost-efficient shuttle service, although a shuttle service would be effective at both addressing parking demand and congestion, and providing a simple and easy to understand service design for the public. They are still researching ways to incorporate a cost-effective shuttle at only three locations

in the future but in the meantime, they are moving forward with finding alternative strategies that are cheaper but will still improve traffic congestion.

Takeaways

While our project would only be looking at one shuttle service scenario because Greylock's main point of attraction is at the summit, it was helpful to see the report's five scenario analysis and see how to assess the ridership for Mount Greylock as a part of our proposal of gathering more data. We would also like to make sure our shuttle meets our goals that should be created after more data is collected.

2.3 Adirondacks High Peaks Region Shuttle Feasibility Study: The Adirondack Regions, New York

Source: The Adirondack Almanack, adirondackalmanack.com

Summary

This feasibility study was conducted by the US Department of Transportation during the COVID-19 global pandemic and aimed to assess the feasibility of implementing a shuttle service in the Adirondack High Peaks region, with the idea that such a system would support the intent of the New York State Action Plan for Climate Change. The report focuses on Route 73, which was identified as “the most problematic corridor for parking and congestion” by the New York State Department of Environmental Conservation. The report utilized the feedback of local stakeholders to present a potential route for the shuttle service, as well as possible financial resources for the

project. However, this study does not include a carrying capacity analysis (the fluctuating number of people the park sees over a period of time, related to how many people the park can feasibly service), because data collection and the feasibility study were conducted during the COVID-19 pandemic. The pandemic placed restrictions on the possible data gathering techniques that the research team assigned to the shuttle study was able to employ.

Key Findings

The analysis of the region under examination revealed that hikers made up a majority of the visitors to the region (85%), which is dissimilar to the current Mount Greylock situation. The peak season was determined to be between June and October, with a peak in August. While the peak visitation season for the Reservation is in October as opposed to August, the pattern of visitation following weather trends is reflected in both cases. The Adirondack High Peaks region, like the Mount Greylock Reservation, has small and insufficient parking options for peak visitation times. Dissimilar to the Mount Greylock Reservation, there are approximately 54 annual crashes on Route 73, the studied route of the Adirondack High Peaks study. According to the park staff, Mount Greylock has very few incidents of vehicular accident annually. This may in part be due to the lower traffic volume at the Reservation, but quantitative analysis supported by collected data over a significant time span would be needed to corroborate this supposition.

Proposed Shuttle Service Scenarios

Scenario 1

A feasible pilot shuttle service operating primarily along Route 73, with several stops connecting parking lots to trailheads. This scenario attempts to make use of existing traffic control

infrastructure, such as parking lots, in order to minimize costs and allow for decreased traffic congestion along Route 73. Additionally, it proposes a system of shuttles operating along a single route (with one breakoff spur), for efficiency's sake. The buses will begin at opposite terminuses, allowing for the optimized wait times for each location. There will also be two sets of shuttles, meaning that there will only be a 30-minute wait time at each stop. While the total round trip distance of approximately 70km or 120 minutes makes this necessary, the overlapping sets of shuttles will not be necessary for the Mount Greylock Reservation. However, multiple shuttles will still be required to enable a constant flow of passengers to the summit.

Pilot Service Route	Time (minutes)	Distance (in miles)
Keene/MF	0:17	11.6
Saint Huberts	0:07	5.3
Chapel Pond/Giant Mtn.	0:02	1.3
Frontier Town	0:20	17
Total Dwell Time (1-way)	0:08	n/a
One-way with dwell	0:58	35.2
Round trip	1:56	70.4

Scenario 3

The second scenario is presented as less realistic, as it would be far more expensive, requiring large infrastructural implementations such as bathrooms, water fountains, weather shelters, and on-call staff. The scenario is called the “Hub and Spoke” solution, and describes a centralized

transportation hub, serving primarily recreational visitors. This solution also allows for more access to the surrounding areas via the shuttle service. The central hub method of construction would also allow for more active administrative control of visitation and would act as a mechanism to interact with visitors between when they arrive and when they reach their ultimate destination. The moment a visitor arrives is the best time to provide information that may influence their experience in the area, whether it be educational or logistical in nature.

Scenario 3

The third proposed scenario focuses on the economic growth potential of connecting the region to the highway to Lake Placid as a mechanism for drawing more through traffic, thereby encouraging higher rates of visitation. The connection to Lake Placid would allow visitors to park in the High Peak region and access the Lake Placid amenities like restaurants and shopping facilities without having to re-park their car, since they would simply take the shuttle service.

Appendix E

Appendix E outlines the optimized method for the electrification of the shuttle service in the Adirondack High Peaks. The most critical element named was the creation and maintenance of a reliable and sustainable service. The current plan to use existing, previously purchased diesel powered buses for the pilot service is designed to mitigate any adverse reaction the public may have to additional expenditure on electric buses and infrastructure. Allowing the pilot shuttle service to operate and work out any kinks in the system would make the transition to electric buses in the future much smoother, as unforeseen obstacles would likely have been addressed.

Results

The report concluded that given the high and increasing rates of area usage, the pilot shuttle service proposed in Scenario 1 would be feasible. The uncertainties that must still be addressed to ensure the success of the shuttle service include creating a reliable pool of shuttle drivers, enacting an effective marketing and outreach strategy that would promote the new service, consistent enforcement of parking regulations designed to encourage use of the shuttle service, and permanent infrastructure to support the shuttle service. After the report's publication, three major next steps are to source the actual shuttles, finalize details such as a bus route and schedule, and collaborate with local stakeholders and official agencies.

Takeaways

One issue that this study tackles effectively is the potential future implementation of low-emissions or zero-emissions options to replace the presumed to-be-existing shuttle fleet once the service is up and running. In Appendix E, some of the key elements for electrification planning that must be considered were establishing and maintaining a reliable shuttle service, learning how to best refine operations, and creating and sustaining relationships with local electrical companies. Understanding the need for establishing a pilot service before the implementation of an all-electric fleet of expensive new shuttle buses will allow us to better assess the needs and conditions of the Mount Greylock Reservation.

III) Follow-Up Meetings with Clients

We always like to check-in with our clients and make sure we keep them informed on our progress and address any questions we may have or that they may have for us. We met with Cosmo and Travis separately to hear their individual thoughts and feedback on our project.

3.1 Cosmo Catalano

We spoke with Cosmo mainly about budgets, reservation time slots, and shuttle parking. Since our clients do not have a specific budget right now, Cosmo informed us that they can fill out a form and submit a proposal and hear back a couple of years later or attend the budget state hearing in the spring. Due to those limitations, came up with a range of proposals with cost analyses to give our clients a variety of solutions. If we were to recommend implementing a reservation system, Cosmo suggested we reach out to the Bascom Lodge on the summit to see if they have a parking policy in place for their guests and any spots that they reserve.

Next Steps: After our conversation with Cosmo, we reached out to Bascom Lodge to assess the best location for shuttle parking.

3.2 Travis Clairmont

After updating Travis on our findings, he provided us with some helpful feedback. Regarding the shuttle, he suggested reaching out to local bus companies nearby for price estimates. Furthermore, he thought we could close off the roads for the shuttle only at a certain time, for instance, only allowing cars before 9 a.m. This would allow for a transition period for cars to clear

off the road before beginning the bus service at 9:30 a.m. In this way we could cut down on shuttle operation time and associated expenses without sacrificing traffic congestion, because, as our preliminary research indicated, the majority of visitors do not begin arriving until after 9 a.m. in the morning. As far as shuttle pricing, Travis suggested we reach out to Dufour Tours, a transportation company that rents buses out of Hinsdale, Massachusetts. Travis believes a weekend shuttle will be feasible.

If Mount Greylock reinstates paying for parking passes at the summit, then it would make most sense to have a shuttle fee too. To encourage people to pay, Travis suggested we could offer membership passes for locals and frequent visitors that would make it cheaper in the long run for them to visit if they come often. Another idea we came up with was free senior or veteran passes.

We also came across another supporting point for investment in data collection, as Travis told us from experience that Rockwell Road is the busier road for travel, whereas in our data surveys we found that Notch Road was busier. To correct this data error, Mount Greylock could buy a car counter to lay in the parking lot that is priced around $2,500, or they could rent one from the state or Massachusetts Highway Department.

As far as updating the website, Travis saw it as a pressing issue. Currently, the Mount Greylock website is on mass.gov, the official website of the Commonwealth of Massachusetts. Travis shared that the Commonwealth only has one person who can access and post on this website. Thus, it is impossible to get an emergency bulletin out on Mount Greylock staff's behalf without trying to track down this one website operator. Travis does not foresee the mass.gov website system changing and believes it would be beneficial for Mount Greylock to have their own website separate from mass.gov so that he and other Mount Greylock staff can access it and add updates as needed.

When we asked more about signage and tickets, we discovered that the ticketing writing system on Mount Greylock for illegally parked cars also needs to be fixed. Currently, there are only two possible ticket writers for all of Mount Greylock Reservation. It is legislated that park supervisors and rangers should be able to write tickets but for reasons unknown, Travis is not permitted to write tickets even though he is a park supervisor.

In terms of signage, Travis suggested we reach out to the Massachusetts State Highway System to see if they could rent digital signs to us to place on Route 2 and Route 7 displaying the wait time for traveling up the mountain to discourage more cars from coming if traffic is high. Travis shared that the State Agency does not provide these digital signs.

Next Steps: After our conversation with Travis, we reached out to Dufour Tours and the Massachusetts State Highway System, and focused on developing a new website strategy for the Reservation.

IV) Exploration of Shuttle Service Feasibility

4.1 Dufour Tours

One of the first things to consider in implementing a shuttle service is a supply of shuttles. With the knowledge that purchasing shuttles for the Reservation would require a large upfront capital investment for an untested system, it was determined that creating a partnership with a local shuttle service would be both more feasible and less expensive. A local Lanesborough based shuttle service, Dufour Tours, was receptive to our proposition, and agreed to give us a quote on the potential cost of such a service. They informed us that a one-ton shuttle bus, seating 16 individual passengers, would cost $75/hour. The one-ton shuttle would comfortably fit on the particularly narrow and winding Mount Greylock roads. The fare encompassed a certified driver, insurance, and fuel.

Source: www.dufourtours.com

4.2 Shuttle Operation & Parking

Massachusetts Museum of Contemporary Art

There is a large parking lot at the **Massachusetts Museum of Contemporary Art (Mass MoCa)**, located in North Adams. This would be a great first stop for the shuttle because it brings business into the town, and then to the Reservation. The only limitation is that the shuttle ride from Mass MoCA to the shuttle is 35 minutes without traffic, which might be an inconvenience and added driving for visitors not from North Adams direction to get to. However, we still feel it is a feasible idea and think that one shuttle could operate out of Mass MoCA, with the other operating from the base of the mountain.

Base: Notch & Rockwell

Our other option for shuttle parking are the Notch and Rockwell lots at the mountain's base. Rockwell's current parking is the Visitor Center's lot, which could be expanded if necessary. Notch is bordered more by residential areas, so lot expansion would be limited. Still, after more thorough data collection on road usage, we may even consider just having one shuttle lot if we find one of the two roads to be much more popular and congested.

V) Cost-Benefit Analysis Table:

Scored 0-3: 0 (Worst) – 3 (Best), where 21 is the maximum total

Potential Recommendations	Envi: Energy	Envi: Land Use	Social / Equity	Cost	Public Opinion	Safety	Feasibility	Total
Shuttle Bus From Base (On each Road)	**2**	**3**	**2.5**	**1.5**	**2.5**	**2.5**	**2.5**	**16.5**
Website Updates	3	3	2.5	3	3	3	3	20.5
Vehicle Video Surveillance	2.5	3	n/a	3	3	3	3	20.5
Wait Time Sign	2.5	3	3	3	3	3	3	20.5
Car Counter	3	3	n/a	2	3	3	3	20
Reservation Slots	3	3	1.5	3	1	3	1.5	16
EV Bus from Base (2)	2	3	2	1	2.5	2.5	1	14
Mass MoCA	0	3	3	1	2	2	2	13
Repaved Conduit for EV	3	2	2	0	3	3	0	13
Gondola	3	1.5	2	0	3	3	0	12.5
Tram	3	0.5	2	0	3	3	0	11.5
Extra Parking (at summit)	1	1	2	0.5	2	2	1	6.5

Once research was completed and interviews had been conducted, an exhaustive list of potential recommendations was compiled. In compiling this list, no regard was given to expense or feasibility. Every real-world potential solution to the traffic congestion problem that had thus

far been encountered was also listed. Once our list was assembled, we created categories for evaluating the cost and feasibility of each potential solution, and scored them on a 0 to 3 scale, with 0 being the lowest rating and 3 being the highest. We then used the rankings to inform our recommendations, focusing on the top five options. Because it was the initial aim of the study, we also included the shuttle bus system despite it not being in the highest-ranking category.

Potential Recommendations	**Envi: Energy**	**Envi: Land Use**	**Social / Equity**	**Cost**	**Public Opinion**	**Safety**	**Feasibility**
Shuttle Bus From Base (On each Road)	**Not EV, gas fueled** **Carpooling**	**No construction necessary**	**Fee accessible** **Need car/transportation to get to base**	**Not terribly expensive to implement** **Park no longer free**	**Very much in favor in our surveys** **Concerns about Covid-19**	**Covid-19 concerns due to enclosed indoor space** **Tight, narrow roads**	**Local shuttle buses were onboard** **Prices are reasonable and competitive**
Website Updates	Using existing platform	No additional land use	Everyone with internet access	Minimal cost	All interviewees approved	Emergency bulletins - increased safety	Simple fix, more access
Vehicle Video Surveillance	Runs on electricity	Takes up no additional space	N/A	Relatively inexpensive	In favor of data collection	Monitor lot Improve traffic conditions	Simple implementation
Wait Time Sign	Requires electricity	Minimal footprint	N/A	Relatively inexpensive	Good feedback from survey and interviews	Would decrease traffic congestion	Simple implementation
Car Counter	Runs on a battery	Takes up no additional space	N/A	Relatively inexpensive	In favor of data collection	Results will improve traffic conditions	Simple implementation

Reservation Slots	Operated out of existing website	No land use	Advance planning Internet access	N/A	Value “spur of moment” appeal of reservation	Decrease congestion	Low feasibility due to lack of public support
EV Bus from Base (2)	EV but uphill requires lots of energy	Takes up no additional space	Higher fee b/c EV	High operational costs and implement of charging infrastructure	Very much in favor in our surveys Concerns about Covid-19	Covid-19 concerns due to enclosed indoor space Tight, narrow roads	Not very feasible b/c lacking infrastructure and cost will not be worth it None- EV shuttle would be more environmentally friendly
Mass MoCA	Additional travel needed to Mass MoCA and to Mount Greylock	Takes up not additional space, use MoCa lots	Supports town businesses and walkable for locals	More expensive than base shuttle b/c more miles of travel	In favor but worry about having it solely out out of MoCA if people are not traveling that way	Covid-19 concerns due to enclosed indoor space On real words with traffic Tight, narrow roads up Mount Greylock	Local shuttle buses were supportive Prices are reasonable and competitive Have to get approval from MoCA
Repaved Conduit for EV	Creates very sustainable electric corridor	Would require large construction project	High cost results in high fare	Very expensive to redo roads	“Cool” factor More sustainable	Would benefit shuttle service, decreasing congestion	High cost makes highly unlikely
Gondola	Low energy usage Electric	Would require construction in forest	High cost resulting in fare	Very high initial construction cost	“Cool” factor Tourism	Historically very safe	Cost makes highly unlikely

Tram	Electric	Clear cut trees to make way for infrastructure	Fee for tram	Very high initial construction cost	"Cool" factor Tourism	Historically very safe	Cost makes highly unlikely
Extra Parking (at summit)	Would encourage more private car travel	Destruction/ land clearing of summit forest	Would encourage private car travel	High construction costs Difficult construction logistics	Most people don't want less space at the summit for observation	Would encourage more private car use and more congestion	Cost and public opinion make this solution not feasible

VI) Proposals

The primary proposals will speak to potential solutions which may begin to help in mitigating the issues caused by the limited parking and road access, but which were not strictly a part of the scope of the shuttle feasibility study which was initially undertaken. These proposals would be more cheaply and expeditiously implemented into the Reservation and create a more visible impact sooner than a shuttle system would.

The secondary recommendation of this study is broken into two parts. This is because the timeframe of this project encompassed roughly two months, which is sufficient to adequately research and begin to formulate strategies and lines of inquiry, but not enough time to conduct the kind of data collection and analysis that would be required for an authoritative statement as to the best potential solution. Therefore, while the goal of this study is to present a feasible solution to the traffic congestion problem encountered at the Mount Greylock Reservation during peak season, the second part of the primary recommendation will be for additional data collection.

6.1 Primary Proposals

Our primary proposals are proposals that are far more easily, cheaply, and quickly implemented than a shuttle bus system would be but would still help to reduce the overall traffic issues that the Reservation experiences. While these solutions may not be as flashy as a shuttle system, or act as a silver bullet to the traffic congestion issue, their implementation will still greatly impact the issues that the Reservation is facing.

Signage

In speaking with Travis and several of our interviewees, we recommend placing electronic signage at the base of the Reservation, near the entrances of Notch Rd. and Rockwell Rd., accessed from Route 2 and Route 7, that indicate the estimated wait time at the summit parking lot. This would likely deter many visitors from driving to the top since they know that they might have to sit in their cars for 20 to 30 minutes, or even upwards of an hour, once they arrived. This would reduce congestion. Signs would need to be purchased by the Reservation, as both we and the park staff have been unable to source them from state agencies.

Website

The domain name www.mountgreylock.com is available to purchase the rights to for roughly $3,000, and www.mountgreylockreservation.com is available to lease for $4.99 per year (and $18.99 in years after that). While the Reservation already has a webpage on the www.mass.gov site, it can only be changed by one person who has control over all state park websites. As a result, turnaround time is slow and emergency bulletins cannot be effectively posted for the public. A proposed solution would be the creation of another domain, such as those

suggested above. Another, more realistic solution would be the addition of another website administrator, which would allow for more up to date information to be posted more regularly.

Reservation Slots

A system of reservation slots would allow for effective time management and traffic control over the Reservation, effectively eliminating the need for other solutions. However, one of the described benefits of Mount Greylock is not needing to make a reservation to travel to the summit. A majority of the site visitors that we interviewed, most of whom happened to be locals, said that their trip was spur of the moment and had not been planned in advance. Knowing this, a reservation system would likely be unpopular, at least among locals. It could still be useful during peak season but would also probably be unnecessary at other points during the year.

Ticketing

The last primary proposal that we have is to increase the ticketing ability of the Mount Greylock staff. Currently, there are only two staff members who are allowed to write tickets for cars that are parked illegally - the two park rangers. Legally, the park supervisor should also be allowed to write tickets, and it would be very beneficial to legislate for others to be able to write tickets as well. If there were more ticket writers, ticketing illegally parked cars would be more feasible, and the Reservation would be able to put up signs stating that certain areas were illegal to park in - and then they would be able to enforce those signs.

6.2 Secondary Proposals

Our secondary proposal is broken into 2 parts, an implementation portion, and a further data collections initiatives portion. The implementation section deals with potential considerations of instituting a shuttle service on the Mount Greylock Reservation. The second section talks about what data still needs to be collected before a shuttle service can be confidently recommended.

Part A

The first part of the secondary proposal is concerned with the implementation of a shuttle service on Mount Greylock. The first metric to take into consideration would be the timing and days of operation of the shuttle service. While there is not enough data collected to make a definitive assertion, we are certain that the shuttle service would not be required full-time. Rather, it is safe to assume that proposed shuttle service should operate only on the weekends during peak season – all weekends in October, and possibly the last weekend in September depending on weather and foliage conditions. Additionally, the shuttle should operate between 9:00 a.m. and 3 p.m., which would allow for time before and after for private cars to use the Reservation but would still capture the busiest time of day to minimize congestion.

The nature of the Reservation would require shuttles on each of the two roads leading to the summit parking lot. Cars would be required to park at the base of the mountain, and passengers would ride the shuttle to the summit. The shuttle would have only a single stop - the summit - and then would return to the base of the mountain. Because all parking would need to be located at the base of the mountain, an expansion to both parking lots would be necessary. Additional data is needed here to indicate by how much the parking lots would need to be enlarged. Since these extra spaces would only be used during times of high visitation and near capacity operation during good weather, the additional spaces could be made of semi-permeable surface, such as gravel.

The third metric of shuttle implementation is cost. Knowing the hourly rate of the Dufour shuttle service, and the ideal hours (based on current data and estimations) of 6 hours per day for each weekend in October, we can assert that one shuttle bus would cost $900 per weekend. If one shuttle bus operated on each road, a cost of $1,800 would be incurred. Two shuttles on each road (4 total) would result in a cost of $3,600 for each weekend. This is highly competitive pricing, making there is a low barrier to entry, unlike if the Reservation were to invest in purchasing a shuttle of its own, which would incur additional costs of insurance, labor, and fuel. Several case studies have shown that implementing parking and bus fares would help offset the costs of the shuttle service and is something that would not be unusual for the Mount Greylock Reservation, as in years past parking at the summit was not free (the past two years have been different due to the extenuating circumstances of COVID-19).

Part B

The second part of our secondary proposal grapples with the fact that we were unable to collect sufficient data in the allotted time frame of this study. In order to confidently implement a shuttle service, there is a need for quantitative analysis of visitor patterns and timing. There are several metrics which would be useful, as explained below.

The first two points of data to collect would be peak visitation season and visitor flow. Peak visitation is critical to understanding when the shuttle service needs to be implemented, and when it is not needed. Visitor flow addresses how many visitors are cycling through the park throughout the day during peak season. Both data points together will tell us when and how many buses are needed to service all visitors to the park. Fortunately, each of these data points can be tracked relatively easily, via the use of a car counter. Using our surveys to determine a rough

estimate of average number of people per car (3), a car counter would allow for an easy calculation of number of people per hour entering the Reservation, which would indicate how many buses would be needed and when.

In addition to tracking visitors to determine optimal bus timing and quantity, an expansion of the parking lots is necessary to accommodate the increasing number of people. Car counters would easily collect data to help determine by how much to increase the size of parking lots. Additionally, the LotSpot software, referred to us by Ben Rassmusen, tracks usage of parking lots to calculate the optimal set up of spaces for the most efficient use. This may not be necessary but would likely make the user experience of Mount Greylock more enjoyable.

6.3 Optimal Sustainable Solutions

Considering that this project is for an Environmental Planning course, we thought it would be both relevant and thought-provoking to propose the most sustainable solution if there were no barriers to receiving necessary funding. We looked at the feasibility of long-term emission-free solutions, including a gondola to the top of the summit, an electric tram, and an electrified fleet of shuttles. While there would be increased greenhouse gas release during their construction, in the

long run, these solutions are more environmentally friendly than the current situation of idling cars in traffic. It is also worth noting that a gondola and tram system would require cutting down trees to make way for their path up the summit. The gondola would eventually reach a height that would glide over the trees and require significantly less deforestation than a tram system, which would have to clear a strip of trees all the way up to the summit. When trees are cut down, much of that sequestered carbon is released into the atmosphere again as carbon dioxide (CO2). Much of the wildlife on the Reservation rely on trees as their homes, and they would lose that and possibly be disrupted during construction.

An electrified shuttle fleet would require reconstructing the road with a conduit surface underneath, creating a permeable surface to support electric infrastructure. Currently, without the reconstruction of the road, shuttles operating with heavy loads on mountain roads would have to recharge as soon as they get up to the top of the mountain and carry the deadweight of a large dead battery. The expense and inefficiency would negate any potentially beneficial emissions reductions that could occur. With the new road, the shuttle could easily make it to the top. However, the construction of tearing up a road is not great for the environment either, as far as releasing emissions and laying more cement. Still, with this solution, no trees would be cut down.

As far as the costs for these solutions, they are incredibly expensive and unfeasible now, with predicted prices in the 100 million range for gondola and tramway systems.

6.4 Next Steps, Shuttle Service

After our final presentation, and gathering all possible feedback from the stakeholders, we outline the potential next steps that the Reservation might take going forward. We believe that applying at least some of the solutions from the list of primary proposals in section 6.1 will

alleviate some of the pressure of the traffic congestion on the Reservation. The combination of different solutions, however, will be overall the most beneficial method of correcting the issue at hand. With that in mind, a combination was proposed by DCR Trail Coordinator Becky Barnes, which must be included in a separate section from the other proposals, as it is likely the most imminently feasible shuttle system proposal. This proposal would see the combination of a reservation system and a shuttle system, meaning that during periods of high visitor flow, visitors to the Reservation would either need to make a reservation with the park before entering the park in a private car, or visitors would be required to take the shuttle bus to the summit of the park.

This combined solution would address several issues, both foreseen and unforeseen, that a simple, shuttle-only system would not. The first issue is the desire of park patrons to not use a communal shuttle service. Whether they are planning out a trip from far away days in advance or are locals who have taken notice of marketing efforts by the park to advertise the new reservation/shuttle service system, making a reservation would allow these patrons to utilize their private cars, and not have to worry about the shuttle service.

The second foreseen issue that a reservation slot system in combination with a shuttle system would address is the situation of those visitors to the park who wish to drive part of the way up, park in one of the smaller lots, and then use the hiking trails. Since it is logically more likely that a hike would be planned in advance (simply due to a need for coordinating with the weather), reservation slots would be beneficial to hikers and allow them the access they desire to the full amenities of the park.

It is also worth noting that, because patrons of the Reservation are still allowed to use their private cars to access the summit, fewer shuttles, shuttles with a lower capacity, or both, would be needed, lowering expenses, and making the Reservation more financially accessible.

VII) Conclusion

Going forward, the Reservation and its partners would likely benefit from examining and discussing the possible implementation of the numerous Primary Proposals as well as Secondary Proposals A&B to mitigate long term traffic congestion. Due to the nature of this study, and its abbreviated timeline, we place great emphasis on the importance of data collection and an ongoing analysis process that will hopefully point towards additional recommendations that went unobserved in the development of our proposals. It was a great experience to work alongside Cosmo and Travis and we hope that they consider our recommendations and are successful in implementing solution(s) to improve the conditions on Mount Greylock.

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