



NPS Emerging Mobility: Summary Evaluation of Low-Speed Automated Shuttle Pilots at NPS Sites



June 2022



CONTEXT

Through its [Emerging Mobility Program](#), the NPS uses pilots as opportunities to test technologies and evaluate operations, infrastructure requirements, costs, and benefits, including visitor satisfaction, increased access, and reducing environmental impact. The NPS implemented electric automated shuttle pilots at [Yellowstone National Park](#) and [Wright Brothers National Memorial](#) in 2021. These were the first-ever such pilots at a recreational public lands site in the country and allowed the NPS to test the suitability of emerging automated vehicle technologies in public lands. The NPS is evaluating both pilots to assess how the automated technologies performed in park settings and to identify potential future use cases for emerging technologies across the National Park System.

AUTOMATED SHUTTLES

In early 2020, the NPS applied for and received a grant of \$600,000 from the U.S. Department of Transportation (DOT) Technology and Innovation Deployment Program to support two automated shuttle pilots, in coordination with the Office of Federal Lands Highway within DOT.

“The Electric Driverless Demonstration in Yellowstone” (TEDDY) pilot took place at the Canyon Village area of Yellowstone National Park, and the “Connected Autonomous Shuttle Supporting Innovation” (CASSI) pilot took place at Wright Brothers National Memorial.

Figure 1: Shuttle Pilots at Yellowstone National Park (left) and Wright Brothers National Memorial (right)



Source: U.S. DOT Volpe Center and NPS

The following table contains detailed information on the two pilots.

Table 1: Details of the Two 2021 NPS Automated Shuttle Pilots

Category	Yellowstone (TEDDY)	Wright Brothers (CASSI)
Operator	Beep	EasyMile/Transdev
Vehicle	Local Motors Olli	EasyMile EZ10
Number of Shuttles	Two	One
Operating Days of Week	Seven days, Monday–Sunday	Five days, Monday–Friday
Service Day	7:00 am – 9:00 pm (with two breaks)	10:00 am – 4:30 pm (with one break)
Planned Hours per Day	9 hours	5.5 hours
Number of Unique Routes	Two Routes	One Route
Route Miles	1.5 miles / 1.6 miles	1.5 miles
Number of Stops	Three / Four	Two

Source: NPS and U.S. DOT Volpe Center

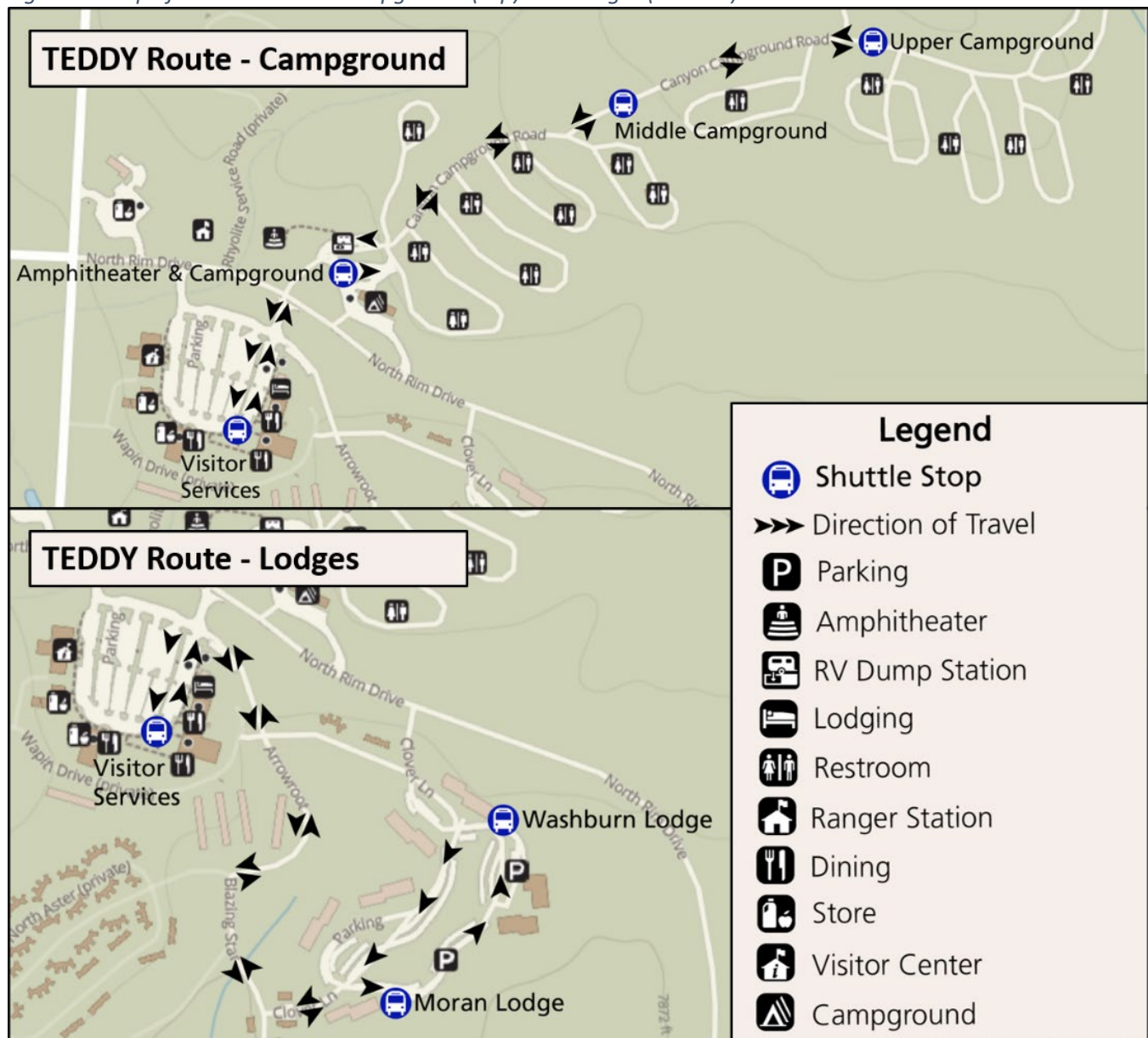


YELLOWSTONE NATIONAL PARK

In January 2020, the NPS issued a Sources Sought (similar to a request for information, or RFI) targeted to industry to collect information to inform a possible NPS automated shuttle pilot. Informed by promising responses to the Sources Sought, the NPS issued a request for quotes (RFQ) in June 2020 to select a vendor for the summer 2021 TEDDY pilot at Yellowstone National Park. Beep, Inc., was selected in September 2020 as the vendor for the TEDDY pilot.

The TEDDY pilot ran from June to August 2021 with two electric automated shuttles, bringing visitors to and from the lodges and campground in Yellowstone’s Canyon Village along two routes.

Figure 2: Map of TEDDY Route – Campground (top) and Lodges (bottom)



Source: NPS and U.S. DOT Volpe Center

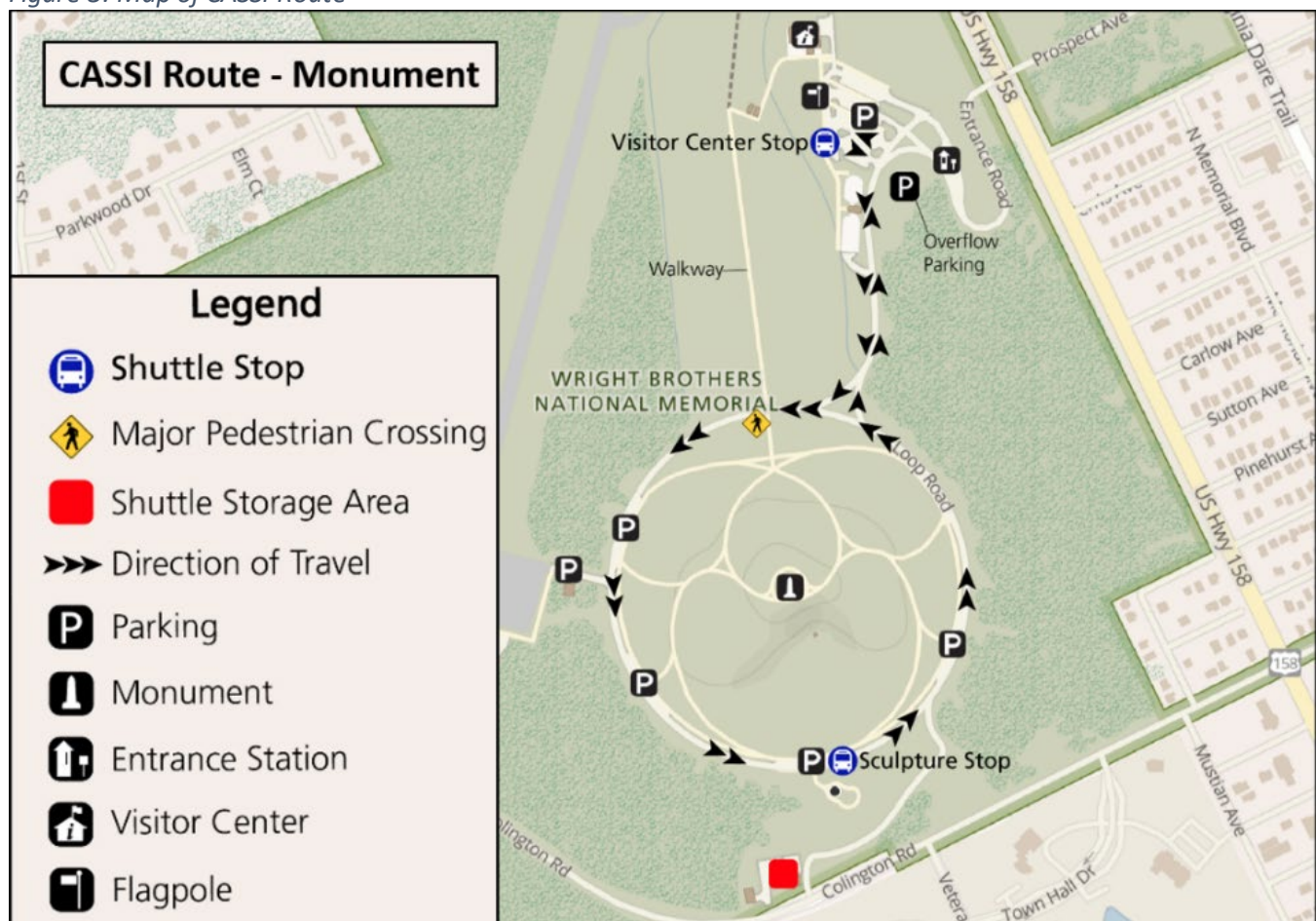


WRIGHT BROTHERS NATIONAL MEMORIAL

In March 2020, the North Carolina Department of Transportation (NCDOT) announced it was accepting applications from North Carolina communities for deployment proposals for CASSI, its electric automated shuttle project. In coordination with Park, Regional, and WASO staff, the NPS submitted an application to NCDOT for a potential CASSI demonstration at Wright Brothers National Memorial in May 2020. Due to the COVID-19 public health emergency, discussions about a possible CASSI demonstration were delayed; however, in October 2020, the NPS and NCDOT resumed discussions about a deployment for spring 2021. Partners included the NPS, NCDOT, EasyMile (shuttle provider), and Transdev (operator).

The CASSI pilot ran from April to July 2021 with a single automated shuttle, bringing visitors from the main parking lot near the Visitor Center onto Wright Brothers Memorial Loop, and to the Wright Brothers Monument.

Figure 3: Map of CASSI Route



Source: NPS and U.S. DOT Volpe Center



RESULTS

The TEDDY shuttles at Yellowstone National Park had more than 2,500 trips and 10,000 riders. The CASSI shuttle at Wright Brothers National Memorial had more than 800 trips and 3,300 riders.

Over 90% of survey respondents for both pilots somewhat or strongly agreed with the statement: "I had a good experience using the shuttle."

Table 2: Comparison of TEDDY and CASSI Automated Shuttle Pilot Operations

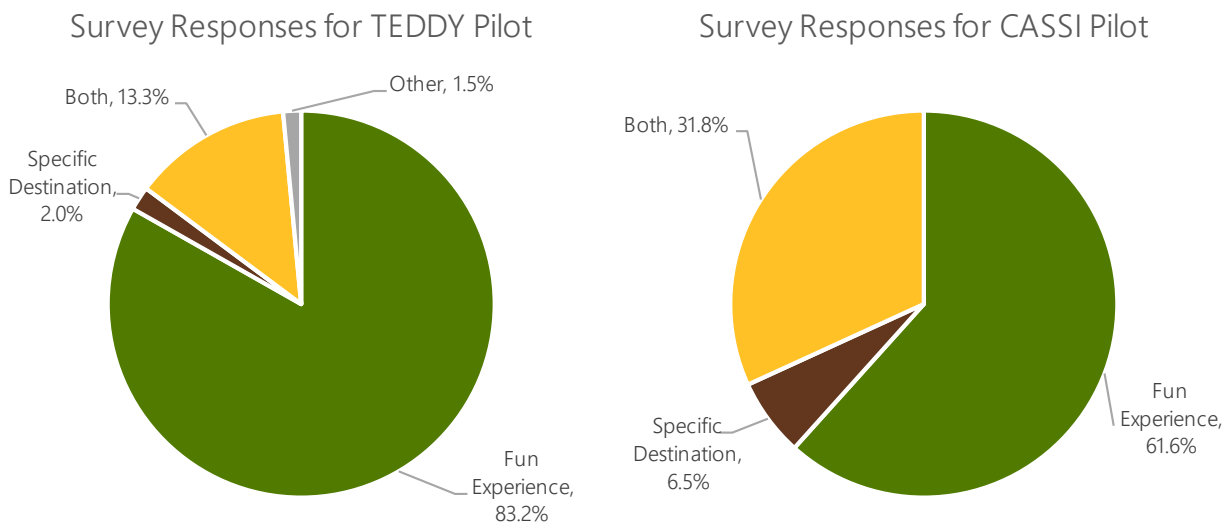
Category	Yellowstone (TEDDY)	Wright Brothers (CASSI)
Number of Days in Operation	74	54
Number of Trips	2,544	809
Number of Passengers	10,057	3,380
Average Passengers per Trip	4.0	4.2
Average Passengers per Vehicle per Operating Day	68.0	62.6
Average Trips per Vehicle per Operating Day	17.2	15.0

Source: Transdev, Beep, and U.S. DOT Volpe Center

Automated shuttle technologies are still in an early stage of development and are not ready to provide useful public transportation service in complex environments. Despite the fact that the routes chosen for these initial pilots were relatively short and simple compared to the range of possible routes that might be desirable in a National Park setting, TEDDY and CASSI both faced many operational challenges. For instance, the shuttles had many disengagements and service suspensions stemming from relatively common weather events (e.g., rain), vegetation growth near routes, encounters with normal vehicle and pedestrian traffic, software updates, and other causes.

Given the early stage of technology development, most visitors who sought to ride the shuttles did so in order to experience the technology rather than for the transportation service. The majority of survey respondents in both pilots noted that they took shuttle rides primarily for a fun experience rather than to get to a specific destination. The graphs below show the breakdown of results for the two pilots.

Figure 4: Comparison of Survey Responses on the Purpose of Rides



Source: NCDOT, Montana State University, and U.S. DOT Volpe Center



The above results are part of an evaluation effort conducted by the U.S. DOT Volpe Center. In addition to analyzing the vehicle data and survey results, the evaluation report also documents lessons learned related to infrastructure requirements, contracting, communications, planning, visitor experience and management, technology, evaluation and surveys, and accessibility in order to inform any future automated vehicle or other emerging mobility pilots. The NPS published the full evaluation report of both pilots in June 2022.

POTENTIAL FUTURE DIRECTIONS

Results of the automated shuttle demonstrations will be used to inform future NPS work and to provide additional use cases for the automated shuttle industry. The TEDDY and CASSI pilots were useful in understanding how currently available automated shuttle technologies (i.e., low-speed automated shuttles that can carry six to eight passengers along a fixed route) operate in a National Park setting. While some aspects worked well, there were also many challenges to operating service.

To further advance knowledge and understanding of automated vehicles capabilities in National Parks, any future automated vehicle testing will not seek to replicate the TEDDY and CASSI pilots, but instead consider distinctly different use cases, vehicle formats, or technologies. For instance, beyond the fixed route service with novel-design low-speed automated shuttles already tested, many companies are developing on-demand, point-to-point services, which may provide useful test cases for NPS sites. Similarly, companies have developed automated driving systems for light-duty passenger vehicles, cutaway buses, and full-size transit buses, which could potentially be tested at NPS sites in the next two to five years. Similarly, outside of transit-related service, there may be opportunities to test automated vehicles for other applications, such as personal individual transportation, ridehailing service, interpretive services, or goods delivery. Automated vehicle pilot tests will remain useful to the NPS to determine applicability of various vehicle technologies in a park setting, and the NPS may consider more permanent installations in the future when technology requirements, needs, and park suitability align.

The NPS is also exploring other types of emerging mobility pilot projects with dozens of parks across the country. These future pilots may involve:

- Using technology to display real-time parking or transit information in parks, online, or through mobile apps.
- Implementing electric vehicle charging stations in partnership with gateway communities.
- Partnering with gateway communities and transportation providers to establish bike share or scooter share opportunities.
- Establishing designated pick-up/drop-off zones for ridehailing.

Learn more about the NPS Emerging Mobility program by visiting the [webpage](#).