Oregon State University Cascades

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FROM: CASEY BERGH, PE - THE MOBILITY LAB AT OSU-CASCADES

SUBJECT: DRAFT 2019 MICRO-TRANSIT PILOT STUDY

The Mobility Lab at OSU-Cascades conducted a pilot study of on-demand, app-based micro-transit service in Bend, Oregon from July 1, 2019 through December 13, 2019. The study was conducted to test whether on-demand, app-based micro-transit is cost-effective and helpful in achieving goals for managing transportation demand.

The pilot study results warranted additional evaluation of the service through a demonstration period that was initiated Jan. 6 and will continue through March 31, 2020. This memorandum summarizes data collected through summer and fall 2019.

EXECUTIVE SUMMARY

The study area was selected because it includes an area of the city with limited access to public transit, and overlaps other existing routes to provide more direct connections between Oregon State University – Cascades (OSU-Cascades) and Central Oregon Community College (COCC). Fixed-route service previously offered in the area was discontinued July 1, 2018 due to low ridership. In addition to the two higher-education institutions, the area includes primarily low-density housing and employment uses.

The study evolved to include a second study scenario, testing demand for on-demand transit services in Bend's central core area (including Downtown, Box Factory, and The Old Mill District) in summer months when visitors to Bend contribute to congestion and parking demand. A fixed-route shuttle ran during the summer months in 2017 and 2018.

Data collected during the fall service period indicated strong demand and efficient service, which warranted extension of the study through a demonstration period in early 2020. Data from the summer service period indicated the service is right-sized for Bend, and identified opportunities to improve efficiency by attracting more riders. Continuation of on-demand services in summer 2020 is recommended to allow for additional advertisement of the new service in conjunction with additional education and outreach to residents and existing transit riders.

Key findings from the summer pilot period include:

- Micro-transit services offered convenience (on-demand, door-to-door) and earned exceptional customer ratings (averaged 4.97 of 5 stars).

- Services cost $20,000 less than total operational cost of past fixed route services while expanding service area beyond past service boundaries.
- 2,835 fewer rides were taken in summer 2019 compared to summer 2018. Reductions could be influenced by lack of rider awareness of new service model or educational barriers associated with technology use.
- An average of 66 rides were completed per day, resulting in average productivity of 3.4 rides per revenue hour. Productivity kept pace with similar services offered in other US cities (see Appendix A).
- Costs were $14.36 per ride, which is less than Bend Dial-A-Ride service, but more than fixed route service offered by CET in Bend.
- The service encouraged shared rides (average occupancy of two passengers per trip) and helped reduce congestion and parking demand in popular areas (1,300 passengers were dropped off downtown and 467 were dropped off in the Old Mill District over the eight-week period).
- Helped reduce consumption of fossil fuels and reduced Vehicle Miles Traveled (7,400 fewer miles were driven in 2019 compared to 2018[1]).
- One of three vehicles in circulation, provided by CET, was wheelchair accessible.

Key findings from the fall pilot period include:

- Ridership increased 128 percent or 2.3 times compared to the same time period in 2017 when fixed route services were last offered.
- An average of 99 rides were completed per day, resulting in average productivity of 4.6 rides per revenue hour and cost of $10.40 per ride.
- 58 percent of trips started or ended at a higher-education campus (38 percent at COCC and 20 percent at OSU-Cascades). Other top destinations included downtown and the Old Mill District.

Overall, more than 3,500 unique riders took over 10,000 rides from July 1 through December 13, 2019 with an average rating of 4.9 out of 5.

The study was conducted in collaboration with several local agencies and was made possible through funding from the City of Bend, Visit Bend, St. Charles Health System, the Bend Metropolitan Planning Organization (Bend MPO), and Cascades East Transit (CET).

INTRODUCTION

When OSU-Cascades opened a 4-year university campus in 2016, CET was already offering fixed-route transit services. Routes connected OSU-Cascades to COCC, downtown, and Hawthorne Station. Route 12, which connected to COCC and the neighborhoods in between, had the lowest ridership of all fixed routes in CET's network and was discontinued in summer 2018.

The City of Bend, CET, and the Bend MPO are actively updating long-term plans for transportation and transit systems in Bend and Central Oregon. Transit plays an important role in these plans and has the long-term potential

[1] If the same number of rides had been taken in 2019 as were taken in 2018, the reduction would have been 3,000 miles.

to move people more efficiently than any other mode. However, with the exception of a few select cities, transit ridership is declining nationally. In Deschutes County, 0.4 percent of work-based commute trips were by bus from 2014 to 2018, representing a decline of 33 percent from the 2009 to 2013 time period. (1)

Fundamental changes in public transportation are inevitable in the next decade, as influenced by:

- Rapid development and adoption of new technology
    - Major automotive companies are shifting their focus from manufacturing to shared mobility services (e.g., ride share, bike share, car share)
    - Autonomous and connected vehicles are in service in select US cities (e.g., Phoenix, Las Vegas, etc.) and being tested in many others.
    - Communication technology advancements (e.g., high-speed internet, 4g/5g wireless networks, etc.) have influenced rates of telecommuting and e-commerce, and facilitates ride-hailing services and even fast-food delivery.
- Generational behavior change and shifting attitudes
    - A 2019 AAA Foundation survey found that less than half of teens in the Western US reported getting their license at or before age 18 and only 32.2% did so at or before age 16. (2)
    - People are sharing assets that would have otherwise been owned by one individual or household (e.g., scooters, bikes, cars)
- Alternatives to travel
    - Telecommuting or remote employment
    - Online shopping or e-commerce (and associated delivery)
    - Online socializing
- Increasing number of on-demand flexible-route options
    - Technology is enabling new services to compete with public transit
    - New services can complement public transit by providing a trip to/from transit (i.e., first-mile, last-mile)
    - Fewer riders “need” to take public transit or higher occupancy modes if they can afford another shared service that is more convenient.

This on-demand transit pilot study will be conducted at a time when several factors could influence Bend’s transportation system:

- Central Oregon has been among the fastest growing regions anywhere in the U.S., growing by approximately 6,000 residents per year.
- Oregon HB 2017 increased transit funding, which will allow for new transit service to be provided to the city and region. Cascades East Transit will be expanding existing services and increasing frequency of the most popular routes.
- The City of Bend’s draft transportation plan identifies an increase in transit trips as one measure to alleviate need for future road widening. A significant shift in travel behavior is required over the plan horizon, putting pressure on transit providers to attract many new riders.
- CET is updating their regional transit master plan, which will include an evaluation of the hub-and-spoke model.

National experts on shared mobility at the Transportation Sustainability Research Center at University of California – Berkeley provide the following advice for adapting to the dynamics of a changing industry today and in the future (3):

> Looking to the future, technology will be both a key enabler and a "multi-modal multiplier" for public transit operators. Technology can dramatically multiply the effectiveness of public transportation, allowing existing services to become automated and to right-size transit vehicles based on demand and predictive analytics…
>
> By leveraging best practices and technology from the private sector, public transit has the opportunity to present itself as a competitive alternative to private vehicle ownership today and private automated vehicle ownership tomorrow. By using technology to employ flexible route services and on-demand or dispatch operations, public transit has the opportunity to increase market share and reduce inefficiencies…In the future, public transit must reinvent itself as a convenient, customer-focused, on-demand alternative to private vehicle use. "Innovative transit" strategies need to become an integral part of urban planning, public policy, and ultimately a public transit renaissance.

The Mobility Lab is helping Central Oregon learn how new transportation technologies can provide more convenient, cost-effective and sustainable ways to travel. We are educating the community, informing policy, and testing transportation technologies to encourage implementation of those that can reduce congestion and improve livability in Bend.

The Mobility Lab is a collaborative effort led by OSU-Cascades, with support from the City of Bend, the Bend Metropolitan Planning Organization, Visit Bend, Bend 2030, Central Oregon Intergovernmental Council, and St. Charles Health System.

PROJECT SCOPE

Through a partnership-driven approach, OSU-Cascades, its funding partners, and Downtowner, LLC (an on-demand transit company) worked together to develop, deploy, and analyze on-demand transit in Bend.

Downtowner provided an on-demand, app-driven transit service to the public. Door-to-door rides were offered at no cost to the rider. The service operated with three vans, including one wheelchair-accessible van. Rides were requested by riders on demand via a mobile app and via a call-in number for passengers without access to a smartphone.

The pilot program tested two scenarios that varied in service hours, service areas, and dates of service, as summarized in Table 1.

Table 1. Service Details by Season

	Summer Service	**Fall Service**
Dates	7/1/19 through 9/22/19	9/23/19 through 12/13/19
Hours of Service	Noon to 8 p.m.	7 a.m. to 6 p.m.
Weekdays	Yes	Yes
Weekends	Yes	No

SUMMER SERVICE

During the summer months of 2019, on-demand transit services targeted the most popular and congested areas of Bend (including Downtown Bend, the Old Mill District, and along the Galveston Avenue corridor). A fixed-route service was operated by Cascades East Transit in the summer months of 2017 and 2018. Funding partners were seeking options to increase ridership and appeal to a broader segment of Bend residents and visitors.

Figure 1 illustrates the summer service area. Technology enabled a service area expansion within weeks of initial service launch, based on available capacity and rider requests. The northern service boundary was extended from Galveston Avenue to Portland Avenue and the southern boundary was extended from Columbia Street to Reed Market Road.

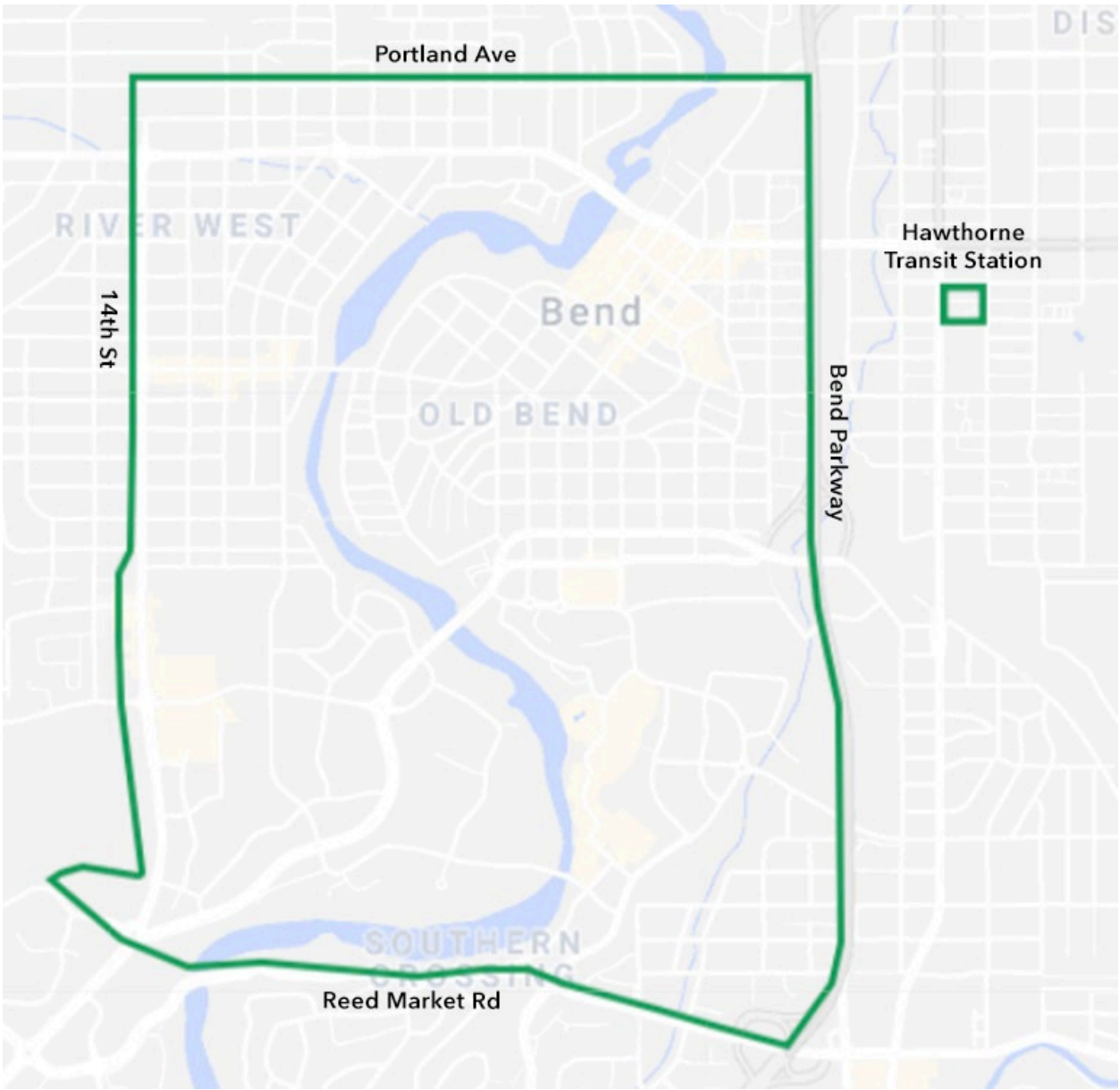

Figure 1. Summer Service Area Map

FALL SERVICE

When classes resumed at OSU-Cascades and COCC in September 2019, the service area expanded west of 14th Street/Century Drive to Mount Washington Drive, as shown in Figure 2. This expansion was planned prior to service launch, in conjunction with reduction of service to Hawthorne Station, downtown, and the area in an around the Old Mill District. However, based on observed demand during the summer months, the fall service area retained destinations downtown and in and around the Old Mill District. The fall service area included two higher-education institutions (OSU-Cascades and Central Oregon Community College), single-family residential properties, industrial and office parks, and a master-planned community (Northwest Crossing) with mixed-use office and commercial properties.

Prior to July 2018, Cascades East Transit offered fixed-route service within the western area of the fall service area. That service was discontinued due to lack of ridership.

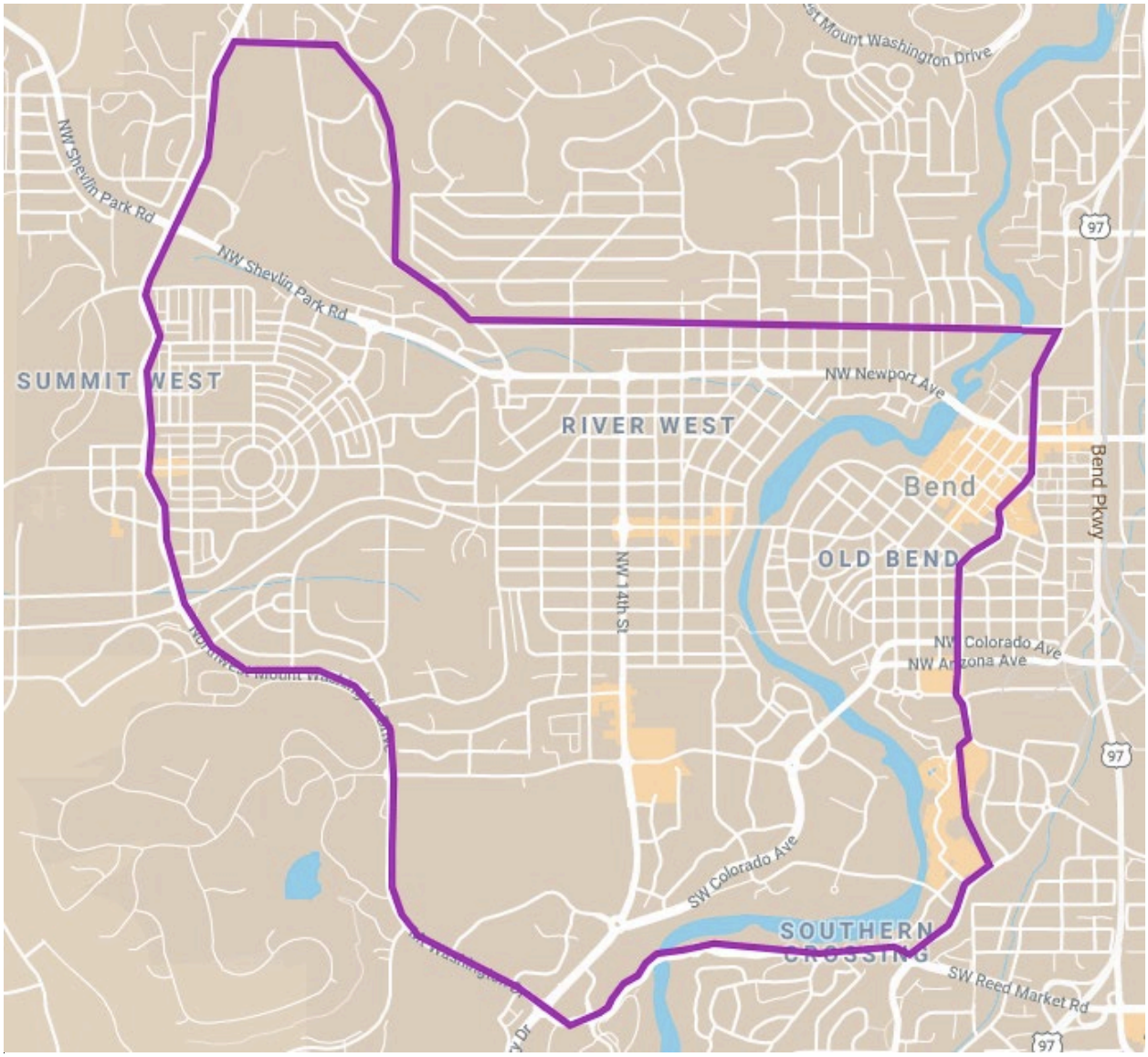

Figure 2. Fall Service Area Map

STUDY PURPOSE

The Mobility Lab at OSU-Cascades launched this pilot study to inform future transit and transportation plans by observing how residents and visitors respond to a new transit service. Nationally, micro-transit projects are being conducted in Los Angeles, Seattle, and various cities in California, but none reflected the demographics and density of the Bend community.

As Bend grows in population, there is great value in understanding if this type of service can help move people efficiently and effectively.

The service filled a void in Bend's transit network created when Cascades East Transit's Route 12 was discontinued on July 1, 2018 and provides a direct benefit to many transit-dependent individuals reliant on public transit to access higher education.

The study has informed the CET 2040 Transit Master Plan update, the City of Bend Transportation System Plan, and the Bend MPO Metropolitan Transportation Plan update.

PERFORMANCE REVIEW

Throughout the duration of the service, Downtowner collected data from every trip requested and completed. Data was generated by vehicles with GPS devices and by user inputs within the mobile app and phone reservation system. Additional feedback was generated by user surveys distributed within the app.

Trip Origin and Destination

Trip origin and destination data was collected for every trip reservation. Figure 3 illustrates the relative frequency of trips ending at various locations throughout the service area for the month of November 2019. The height of the bars represent relative frequency of trips ending, and the colors also represent frequency of trips ending from lowest frequency (green) to highest frequency (dark red).

Figure 3. Graphical Representation of Trip Origin and Destination Pairs in November 2019

Maps showing frequent pick-up and drop-off locations were provided by the operator of the service (Downtowner) and are included in Appendix B.

Tables 2 and 3 summarize the number of passengers picked up (origin) and dropped off (destination) at the most popular locations during the summer and fall months, respectively.

Two weeks of service, from September 5 through September 23, 2019, are not included in the tables because the service area and hours were transitioning after Labor Day until classes started at OSU-Cascades and COCC.

Table 2. Summer Passenger Frequency by Origin and Destination - July 1 to Sept. 4, 2019

Location	Passengers Picked Up	Passengers Dropped Off	Total Passengers
Downtown	1,313	1,337	2,650
Old Mill District	401	467	868
OSU-Cascades	277	279	556
Box Factory	166	159	325
Galveston Ave	64	126	322
Crux Fermentation Project	98	199	297
Hawthorne Station	127	158	285
Bend Brewing Co.	56	99	155

Table 3. Fall Passenger Frequency by Origin and Destination - Sept. 23 to Dec. 13, 2019

Location	Passengers Picked Up	Passengers Dropped Off	Total Passengers
COCC	1,227	1,136	2,363
Downtown	699	890	1,589
OSU-Cascades	725	544	1,269
Old Mill District	341	623	964
14th St./ Simpson Ave. Area	477	464	941
Mt. Washington/ NW Crossing Dr. Area	203	241	444

As shown in Tables 2 and 3, downtown was a popular destination during both summer and fall seasons. Summer destinations tended to reflect popular areas for shopping and dining. The most popular fall destinations included the higher education institutions, downtown, the Old Mill District, and mixed-use developments.

Evaluation

A performance evaluation plan was prepared in July 2019 with input from the City of Bend, the Bend MPO, and Cascades East Transit. The plan includes performance metrics to evaluate how well the service operated, and performance targets that make comparison to past fixed route services. No single metric is intended to indicate success or failure of the service, but rather provide a holistic view of the service to inform future plans.

Table 4 summarizes performance metrics evaluated in summer and fall months, based on data provided by Downtowner. Table 5 summarizes performance targets for the on-demand service, established to quantify performance compared to past services.

Table 4. On-Demand Transit Performance Evaluation

Goal	Hypothesis	Summer Performance (July 1 to Sept. 4, 2019)	Fall Performance (Sept. 23 to Dec. 13, 2019)
1. Increase ridership	This new service provides a convenient travel option	• 2,349 app accounts created • 4,249 total rides • 71% of riders had not ridden a CET bus	• 1,206 app accounts created • 5,660 total rides
2. Improve cost-efficiency of public transit service	Cost per on-demand ride is lower than past fixed-route services offered to the same population and service area	• 2,178 total trips completed • 2.0 persons per on-demand trip • $49 per revenue hour • **$14.40 per ride**	• 4,402 total trips completed • 1.29 persons per on-demand trip • $47.50 per revenue hour • **$10.40 per ride**
3. Manage vehicle-miles traveled by single-occupancy vehicles (SOV)	Availability of the service decreases SOV miles traveled	• 3,181 miles driven in service • 5,910 SOV miles equivalent* • **2,729 SOV miles reduced**	• 9,110 miles driven in service • 11,156 SOV miles equivalent* • **2,046 SOV miles reduced**
4. Preserve or enhance the environment	The availability of the service will decrease fuel consumption and GHG emissions	• 17 mpg (avg. of three vehicles) • 31 passenger-miles per gallon (PMPG) • **130 gallons fuel saved vs. SOV equivalent**	• 15 mpg (avg. of two vehicles) • 19 passenger-miles per gallon (PMPG) • **30 gallons fuel saved vs. SOV equivalent**
5. Mobility for persons with disabilities	Mobility for persons with disabilities will be improved	• 3 trips completed by persons with disabilities	• 0 trips completed by persons with disabilities
6. Provide a first-mile/ last-mile solution	Improve access to Hawthorne Station	• 351 passengers started or ended trips at Hawthorne Station	• No service connection to Hawthorne Station
7. Manage parking demand	Ridesharing reduces parking demand at key destinations	• 2,288 trips ending at key destinations (Downtown, Old Mill District, Box Factory, Galveston Avenue)	• 3,193 trips ending at key destinations (COCC, OSU-Cascades, Downtown, Old Mill)

*Average of 1.05 persons per automobile trip in Bend (3)

Table 5. On-Demand Performance Targets vs. Past Fixed Route Services

Performance Measure	Performance Target	Baseline: Fixed-route Service in Summer 2018	Met Target in Summer 2019?	Baseline: Fixed-route Service in Fall 2017	Met Target in Fall 2019?
Ridership	Average number of trips per week increases by 50%	104 rides/day	No, decreased by 27% (76 rides/day)	43 rides/day	Yes, increased by 128% (99 rides/day)
Occupancy (passengers per trip)	Increase by 30% in summer and 15% in fall	2.6 passengers/trip	No, decreased by 25% (2.0 passengers/trip)	0.8 passengers/trip	Yes, increased by 62% (1.3 passengers/trip)
Operational cost per trip	Reduce costs per passenger to $18 or less in fall	N/A	N/A	$26/ride	Yes, decreased by 61% ($10.40/ride)

As summarized in Table 4, more than 3,500 unique riders downloaded the Ride Bend app during the summer and fall study periods. The summer period includes 8 weeks of data and the fall period includes 12 weeks of data. Comparing the two seasons, notable observations include:

- Only two vehicles were in operation in fall compared to three vehicles in operation during summer. However, almost three times as many miles were driven in fall than summer. The higher mileage in fall reflects the larger service area, and indicates the two vehicles were much more utilized in fall than the three vehicles operating in the summer.
- More trips were taken per week in fall than summer, with fewer riders per trip. During summer months many large groups traveled together while visiting Bend.
- The service encouraged shared rides, exceeding the average occupancy per vehicle in Bend of 1.05, and helped reduce congestion and parking demand in popular areas (1,337 trips ended downtown in summer and 1,136 trips ended downtown in fall) (3).
- Vehicle occupancy (number of people per trip) heavily influenced reduction in fuel consumption and associated GHG emissions. In summer, the use of fuel-efficient vans combined with occupancy of 2 persons per trip to generate fuel savings of 130 gallons compared to 38-passenger buses. A combination of reduced occupancy and a change in the vehicle fleet to heavier vans, eliminated fuel savings.
- Persons with disabilities had access to Ride Bend, but only a few accessible rides were requested in summer and no rides were requested in fall. Ride Bend was promoted by Cascades East Transit to riders of public transit and information was shared with Central Oregon Coalition on Access. However, additional advertisement through the City's accessibility manager and local organizations could help increase awareness of the service.
- As a first-mile/last-mile service, Ride Bend was not well utilized. CET conducted outreach and posted information at Hawthorne Station throughout the summer service period. If service to Hawthorne Station resumes, additional in-person education could help remove barriers to use.

Evaluation of the on-demand performance compared to past fixed route services, as summarized in Table 3, indicate there are benefits and challenges associated with on-demand services. Some of the challenges may be related to introducing a new service model that requires some education of riders.

The following observations were generated through conversations with drivers, passengers, data provided in Tables 4 and 5, and additional data provided by Downtowner (see Appendix B):

- Summer
    - 2,835 fewer rides were taken in summer 2019 compared to summer 2018. Reductions could be influenced by lack of rider awareness of new service model or educational barriers associated with technology use.
    - Occupancy of past fixed-route services exceeded that of 2019 on-demand services. Until a critical mass of riders are using on-demand services, efficiencies are not realized.
    - On-demand services cost $20,000 less than total operational cost of past fixed route services while expanding service area.
    - An average of 66 rides were completed per day, resulting in average productivity of 3.4 rides per revenue hour.
    - Costs per ride were $14.36 per ride, which is less than Bend Dial-A-Ride service, but more than fixed route service offered by CET in Bend.

  - Reduced consumption of fossil fuels and reduced Vehicle Miles Traveled (VMT). Compared to two 38-passenger buses running continuously, the on-demand service only traveled when a ride was requested. If the same number of rides would have been taken in 2019 as were made in 2018, on-demand service would have reduced the distance traveled by over 3,000 miles[2].
- Fall
  - Ridership increased 128% or 2.3 times compared to the same time period in 2017 when fixed route services were last offered.
  - An average of 99 rides were made per day, resulting in average productivity of 4.6 passengers per revenue hour and cost of $10.40 per ride.
  - 58 percent of trips started or ended at a higher education campus (38 percent at COCC and 20 percent at OSU-Cascades)
  - While occupancy did not meet targets, it exceeds the average occupancy in Bend by 52%.
  - As demand for the service increased over time, wait times for riders increased. Wait times varied by hour of day and correlated with hours of highest demand.

FINDINGS AND RECOMMENDATIONS

Various measures of success can be used to evaluate micro transit services in different communities. Measures are often prioritized based on input from the community and elected officials. While various measures were evaluated in this study, the service is recommended to be continued based on its ability to generate shared trips between popular destinations. Encouraging shared rides (effectively reducing VMT and parking demand) will be necessary to avoid the need to widen key corridors to four lanes in the future. It could also serve as a tool to build ridership to levels that support fixed route services (potentially greater efficiencies).

Overall, the summer service offered a convenient and attractive transit option at a lower total operational cost than fixed route services. Fewer passengers rode in the summer than past years, but with continuous and aggressive advertising in the future, this service could be more cost-effective and help the City of Bend achieve greater reductions in parking demand and congestion in key areas of the City.

During the fall pilot period, ridership increased over past fixed route ridership, warranting continued testing through a demonstration period in 2020. Continued evaluation will occur from January 6 through March 31, 2020. Prior to the end of the demonstration period, Cascades East Transit will determine whether to continue Ride Bend through 2020 as a part of their services.

Based on lessons learned in Bend, the following service parameters are recommended for future services:

- Continuous and aggressive advertisement of services prior to and throughout the service period to build awareness and educate the public on how to use technology-based services.
- Establish an acceptable range of wait times (e.g., 10-15 mins) and pre-determine strategies to reduce the wait times if the maximum limit is consistently exceeded.

[2]Accounts for the reduction in trips taken in 2019 compared to 2018; 3,181 miles were driven in 2019 compared to 10,608 in 2018.

- Size the service vehicles to accommodate average occupancy and occasional large groups, while minimizing fuel consumption and emissions.
- Obtain rider demographic information to help researchers understand which populations are not utilizing the services and provide targeted outreach and education to those groups.

Additional data and observations will be documented in an update to this report after the demonstration period ends on March 31, 2020.

REFERENCES

(1) US Census Data summarized by Best Workplaces for Commuters, accessed 1/21/20: https://www.bestworkplaces.org/resource-center/mode-split-by-msa-5-year
(2) Tefft, B. C. & Foss, R. D. (2019). Prevalence and Timing of Driver Licensing Among Young Adults, United States, 2019. (Research Brief.) Washington, D.C.: AAA Foundation for Traffic Safety
(3) Shaheen, S., A. Cowen. Is It Time for a Public Transit Renaissance? Journal of Public Transportation, Vol. 21, No. 1, 2018.
(4) U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates, Commuting Characteristics by Sex, Accessed 1/15/2020.

APPENDIX A – PRODUCTIVITY REFERENCES FOR ON-DEMAND/FLEXIBLE TRANSIT SERVICES

Service Area	Agency	Productivity	Data Source
Southeast Corridor Circulator	Regional Transportation District	3.1	1
Link On-Demand	Regional Transportation District	3.4-3.8	1
University of Denver Chariot	Regional Transportation District	3.7	1
Los Angeles County	Los Angeles County Metropolitan Transportation Authority	2.7	2
Southeast Seattle and Tukwila	King County Metro	>5	2
Citrus Heights Franklin-South Sacramento Rancho Cordova	Sacramento Regional Transit	3.24	3

1) Becker, Jeff. *Microtransit: Pilot to Program.* Presented at Shared Use Mobility Summit, Chicago, IL. March 6, 2019.
2) Schmitt, A. (2018, July 3). *The Most Successful "Micro Transit" Pilots Are Performing Like Decent Dial-a-Ride Services*. Retrieved from https://usa.streetsblog.org/2018/07/03/the-most-successful-micro-transit-pilots-are-performing-like-decent-dial-a-ride-services/
3) Sullivan, M. (2019, December 4). *Mobility on Demand hits 45,000 rides; will comply with new California law*. Retrieved from https://thesource.metro.net/2019/12/04/mobility-on-demand-hits-45000-rides-will-comply-with-new-california-law/

APPENDIX B - PERFORMANCE DATA PROVIDED BY DOWNTOWNER