APPENDIX D (NEW): INNOVATION IN TRANSPORTATION

Study Purpose and Need

Shared mobility and emerging technologies are changing perceptions of transportation, spawning new business models, and influencing individual transportation choices and behavior. These changes offer the potential to increase safety, multimodal connectivity and use of shared travel modes, while decreasing mobile source emissions and roadway congestion. Technology has been a key enabler of these innovations.

The Lake Tahoe Region's renowned natural beauty and wealth of seasonal recreation options drive both its economy and travel patterns. While recreational visitors arriving by car from surrounding metros like the San Francisco Bay Area and nearby Reno stimulate Tahoe's tourism-based economy, the demand these travelers place on local and regional roadway networks far outstrips supply. As surrounding regions continue to grow, travel times from Tahoe to the San Francisco Bay Area during periods of peak demand may take as long as 12 hours. However, because the Tahoe Region is committed to minimizing its impact on the natural environment and its overall environmental footprint, expanding highway capacity to accommodate this additional demand is not feasible. Likewise, fiscal and geographic constraints in the Tahoe Region along with limited ability to influence mode choice for trips originating in surrounding metros diminishes the ability of transit to alleviate seasonally peaked congestion within the Tahoe area.

As the Metropolitan Planning Organization (MPO) for the Lake Tahoe Region, Tahoe Regional Planning Agency (TRPA) recognizes a need to promote multimodal travel options and explore next generation mobility options to help alleviate the Region's key mobility challenges while protecting Tahoe's natural environment. TRPA's commitment to transit, trails, technology, and community centered solutions is documented in this and previous Regional Transportation Plans (RTPs). Yet, the dynamic nature and rapidly changing pace of next generation mobility technologies demands special consideration, especially given Tahoe's unique geography.

Key Mobility Challenges in the Tahoe Region

- Severe congestion-related delays during peak seasonal and weekly travel demand periods
- Regional geography impedes connectivity
- Limited transit service
- Fixed road capacity
- Limited ability to influence mode choice for trips originating in nearby metros
- Telecommunications network gaps

With these considerations in mind, TRPA commissioned a study in the spring of 2019 to explore the ability of emerging transportation technologies to address longstanding mobility challenges in the region. Further, the study sought to identify innovative approaches being used by peer regions to manage travel demand and encourage sustainable travel choices. This document synthesizes findings from this study by topic area, including:

- A brief explanation of the emerging technology or innovation including potential benefits and drawbacks as well as uses of the strategy in other resort and mountain towns
- Past applications of the strategy at Tahoe (as applicable) and potential opportunities
- Policy recommendations for the Tahoe Region based on the above considerations

Finally, this report provides suggestions to improve readiness to implement emerging and innovative transportation solutions at Tahoe from a planning perspective.

Study Approach

The project consisted of a stepwise approach where the consultant team: 1) determined

research topics with promising applications at Tahoe in consultation with TRPA staff; 2) presented findings on those topics to TRPA staff in a series of knowledge transfer webinars; 3) presented key findings from this research to the Tahoe business community and other stakeholders at an interactive workshop; and 4) synthesized findings from steps 1 - 3 and provided recommendations in this report. Each step is explained in greater detail below.

Emerging transportation modes and innovative approaches for study were selected in close consultation with TRPA staff based on past the agency's experience with similar initiatives and perceived potential to address the region's goals. The research sought to identify how peer agencies in rural or mountain resort towns have approached similar transportation challenges with these emerging and innovative transportation solutions, and included the following topics:

- Micromobility
- Microtransit
- Shuttles
- Automated Shuttles
- Incentives and Marketing
- Transportation Management Associations

Additionally, research was conducted on cross-cutting topics, including: 1) emerging approaches to mobility integration that seek to seamlessly match supply and demand across different modes and steps in a trip chain; and 2) analyzing infrastructure impacts and needs related to emerging technologies such as connected and automated vehicles. Research findings on these topics were presented to TRPA in a series of three webinars held in fall 2019.

On December 4, 2019, the consultant team presented key findings from this research at a workshop hosted at Lake Tahoe Community College[7]. The workshop was cosponsored by the Truckee North Tahoe Transportation Management Association (TNT/TMA) and the South Shore Transportation Management Association (SS/TMA) and focused on planned work to relieve traffic congestion, innovative and emerging transportation solutions for Tahoe, and the future of travel options at Lake Tahoe. Invitees to the workshop included a cross section of planning and business community stakeholders from around the Lake Tahoe Region. The figures below document workshop attendees' workplace locations and their industry representation.

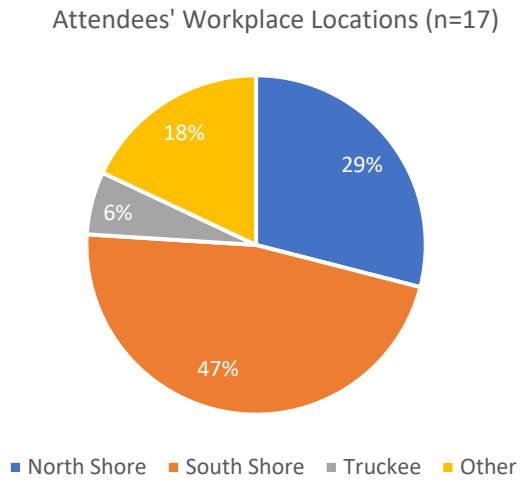

Figure 81: Attendee Workplace Breakdown

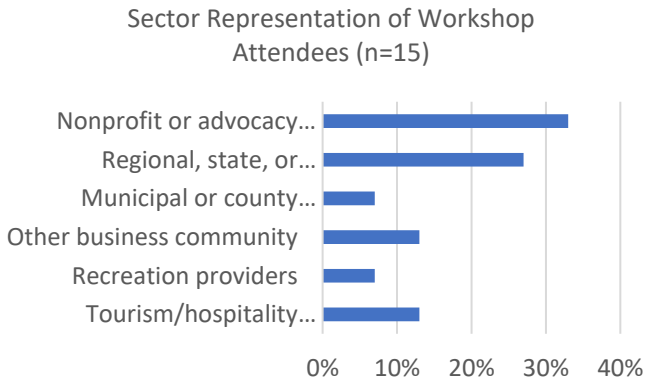

Figure 82: Attendee Sector Representation

[7] The workshop presentation slide deck is available at: https://www.trpa.org/wp-content/uploads/1.-Emerging-Mobility-Overview-ICF.pdf

Live polling software was used throughout the presentation of key research findings to determine attendees' support for implementing the solution under review. In the case of Micromobility, which has already been implemented at Tahoe, respondents were also asked to indicate how well they believed it was working at Tahoe.

Following the research takeaways presentation, attendees were asked to use the live polling software to tag locations on a map of Lake Tahoe that they believed represented the greatest areas of opportunity for applying the emerging and innovative transportation solutions presented in the preceding part of the workshop. Next, attendees were asked to divide into North Shore and South Shore groups based on their respective affiliations. Once separated into groups, respondents were asked to participate in a visioning exercise that included development of responses to the following questions: 1) What solutions would they apply to improve congestion and lack of transportation options in their assigned areas during peak seasonal travel time in a fiscally unconstrained scenario? 2) How would they market the options developed in Step 1 to travelers?

Figure 83: Workshop Attendees in Facilitation Activity

The information and opinions collected during the workshop were then used to further refine and inform the synthesis of study findings and recommendations presented in the following section of this document. These findings and recommendations are presented by topic area, including a topic overview, potential benefits, and drawbacks, and uses of the solution in planning contexts like Tahoe's. Each topic also includes considerations of suitability and opportunity for the Tahoe Region. Where applicable past, present, and planned future applications of the solution at Tahoe are also discussed.

TRPA Stakeholder Support

Existing Micromobility

- Working Well: 39%
- Neutral: 33%
- Not working well: 17%
- Unsure: 11%

New Micromobility Options

- Very supportive: 76%
- Somewhat supportive: 12%
- Neither supportive nor unsupportive: 12%

Findings and Recommendations

Micromobility: Lightweight low-speed vehicles that are often shared and electric.

Micromobility encompasses a variety of low-speed modes that typically serve one or two passengers and are booked and paid for through a mobile application. Dockless bikeshare and shared e-scooters are the two most common types of micromobility. The micromobility industry has grown rapidly since the arrival of dockless bicycles in the United States in 2017, with e-scooters since taking a dominant place in the industry with dockless bicycles largely retired. The exception to this trend has been pedal assist e-bikes, which have been successfully launched by private mobility service providers in several metropolitan areas. Rapid expansion of the Micromobility sector, fueled in part by huge influxes of investment capital and acquisitions from large transportation network companies like Uber and Lyft, have been followed by recent contractions in lower-density markets. However, the shared electric moped sector has recently expanded

its footprint while established modes like e-scooters have undergone recent vehicle form factor changes in certain markets (e.g., the addition of seats and larger wheels and tires).

Micromobility has been used to:

- Increased access to opportunities, goods, and services for short-distance trips
- Provide transit connections
- Provide active and non-polluting alternatives to short driving trips
- Provide recreational options for residents and visitors
- Encourage alternatives to driving alone and ride sourcing trips for residents and visitors

Potential benefits and uses of micromobility in resort and mountain towns are numerous. However, several concerns have been raised. With respect to sustainability, studies have determined that e-scooters may only provide a net sustainability benefit when most trips are shifted from cars. Questions have also been raised about whether the lifespan of the e-scooter vehicles are sufficiently long and whether current Micromobility business models adopted by private operators are financially sustainable.

Additional considerations include access for unbanked users and those without smartphones who cannot book or pay for trips via the private service providers' apps. Additionally, affordability and access to vehicles for low-income users and accessible design for persons with disability present further issues for consideration. Micromobility vehicle obstructions in public rights-of-way such as sidewalks may present further accessibility issues. Finally, e-scooter safety issues have been especially concerning with a number of jurisdictions restricting operating times or banning their operations outright in response to such concerns.

At present, lack of open data limits and proprietary business information make some of these issues opaque (e.g., average lifespan for e-scooters). However, private service providers are taking steps to address some of the issues addressed above through steps like providing more accessible and durable vehicles, designating parking areas that avoid sidewalk clutter and obstructions, and providing payment alternatives and discounted programs for unbanked and low-income customers. Jurisdictions can encourage these steps by aligning regional goals with requirements and incentives in their permitting processes and performance reviews of permitted vendors.

Micromobility at Tahoe

Tahoe was an early adopter of micromobility. The Micromobility company Lime debuted dockless bikeshare in South Lake Tahoe in 2017 and launched an e-scooter fleet in the same area the following year. Analysis conducted with data on Lime's Tahoe operations in summer 2018 found that trips peaked in July and August, on the weekends, and at midday. Origins and destinations of Lime trips were concentrated on the US50 corridor near the border with Stateline. However, the exact nature of these trips – e.g., commute, recreation, etc. – is unclear. Following industry trends, Lime has subsequently decommissioned its bikeshare fleet in Tahoe and focused on its e-scooter operations. Although e-scooters have been heavily utilized throughout South Lake Tahoe, laws allowing the devices vary between jurisdictions. The Pathway Partnership, a local partnership of government agencies, nonprofits, and advocacy representatives, is actively working on an education campaign to clarify the various laws.

Recommendations

- Continue increasing extent and connectivity of bicycle and pedestrian infrastructure.
- Continue evolving Complete Streets policies that support mode separation and high-quality active transportation infrastructure.
- Continue work through the Pathway Partnership to clarify e-mobility regulations.
- Consider implementation of "rolling lanes" that accommodate powered micromobility vehicles that operate at higher speeds than traditional active travel modes.
- Encourage the use of safety, accessibility, and equity considerations in micromobility vehicle permitting processes and vendor reporting requirements.
    - Monitor developments related to emerging standards, such as the Mobility Data Specification, that allow agencies to collect vehicle data in real-time; promote the adoption of standards in Tahoe's permitting process as these mature.
- Pursue public-private partnerships to increase shared micromobility options for visitors and commuters (e.g., e-bikes).
    - Ensure public-private agreements include data sharing requirements that support the region's ability to measure performance relative to goals.
- Monitor deployment of new micromobility options and consider potential of these options to serve travel needs in Tahoe.

Microtransit: On-demand, dynamically routed transit systems.

Microtransit uses technology to provide on-demand, dynamically routed trips to multiple passengers using mid-sized vehicles like passenger vans and minibuses. Microtransit services may provide door-to-door service for customers or require them to make their way to common pick-up and drop-off points. Trip booking is typically available through an app or in some cases may also be available by phone.

In resort and mountain towns, microtransit has been used to:

- Improve congestion and parking conditions in dense or popular areas such as retail and entertainment districts, resorts, and popular recreation destinations such as beaches.
- Provide transportation services to low-density areas.
- Provide alternative transportation options to ride sourcing trips (Uber and Lyft).
- Connect to, or replace, fixed-route transit.

The technology powering microtransit services can be outfitted for existing vehicle fleets, either privately or publicly owned. However, both options may represent a significant cost for agencies.

Microtransit at Tahoe

In 2018, South Lake Tahoe launched a microtransit pilot with the operator, Chariot. The pilot provided fixed-route service between South Lake Tahoe and Stateline that riders could book through a mobile application. The technology was capable of dynamic routing, but this feature was not used during the pilot period. The Chariot pilot provided important takeaways to inform future microtransit programs in South Lake Tahoe, such as:

TRPA Stakeholder Support

New Microtransit:

- Very supportive: 83%
- Somewhat supportive: 17%

- Partnerships between local business owners and decisionmakers were important for the implementation and support of the pilot.
- Interstate operation in California and Nevada was successful and established a precedent for handling multijurisdictional regulatory barriers.
- Chariot was able to successfully hire local drivers in a short time-period, which is often an obstacle for successful microtransit operations.
- The pilot provided valuable data regarding travel needs and behavior.
- Connectivity with existing fixed-route transit is most successful when these services have frequent headways.
- Public outreach may be needed to educate and inform the community regarding new transportation technologies and mobile applications.
- Telecommunication network improvements are needed to provide reliable service outside core areas.

A different service, Mountaineer, has operated a microtransit service in the Squaw Valley and Alpine Meadows resort areas in North Lake Tahoe since 2018. The service, funded by a one percent assessment of lift tickets, lodging, and vacation rentals at the two resorts. The service provides free rides to resort village residents, employees, and visitors seven days a week during the winter ski season. Mountaineer is the locally branded service, but is powered by technology from the company Downtowner, which operates microtransit shuttles in resort and mountain communities in Colorado. Mountaineer has expanded to operate other village shuttles in the area and will begin to operate the Olympic Village Inn shuttle in the 2019-2020 winter ski season. Further, Downtowner has plans to outfit the existing bus fleet with microtransit technology.

TRPA could encourage other resort shuttle services to adopt microtransit technologies such as those used by Mountaineer to provide a more cohesive transportation experience for their residents, employees, and visitors.

Tahoe Transportation District fleet vehicles could also provide additional microtransit service during off hours such as weekend evenings if they were outfitted with the appropriate technologies.

Recommendations

- Pursue on-demand, dynamically routed microtransit operations to provide curb-to-curb service to travelers.
  - Design contracts to allow operations to scale up or down in response to demand.
- Expand microtransit partnership regionally; pursue similar partnerships with other resorts and other hospitality providers to provide seamless experience for residents and visitors throughout the region.
- Consider possibilities to outfit existing midsized transit vehicles with microtransit technology (TransLoc, Etc.) to provide service during off hours in targeted areas, such as the US50 corridor on peak season weekend evenings.

Shuttles: Traditional, on-demand or fixed-route transit system.

Shuttles provide regular transportation service between two locations or within a specified service area. In practice, shuttles may provide on-demand service, such as a resort providing a shuttle to transport a guest to a destination of their request, or they may provide more traditional, fixed-route transit, such as a shuttle between a designated pickup spot to a popular hiking trail or beach, with minimal stops at other designated pickup spots en route. Traditional shuttle buses are typically used but larger vehicles such as off duty school or transit buses or contracted coach buses may also be used for routes with higher demand. Shuttle passengers may be able to book rides beforehand by speaking to front desk services at a resort or visitors center or by calling a phone number. Notably the technology that allows microtransit to provide dynamic routing is being adopted by some traditional shuttle operations, in which case riders can book a ride through a mobile application.

Shuttles have been used in resort and mountain towns to:

- Improve congestion and parking conditions in dense or popular areas by providing rides from resorts, central areas, and park and ride lots
- Provide transportation services to low-density areas or areas where transit does not operate (or operates during specific, restricted time frames)
- Provide alternative transportation options to ride sourcing trips (Uber and Lyft)
- Provide transportation to particular groups, such as resort guests, resort employees, visitors or locals traveling to or from the airport or major transportation hub

By providing a shared alternative, shuttles can help reduce parking demand and congestion. However, availability of these services may be limited to patrons or employees of the shuttle service sponsor. In cases such as these, marketing of alternative services such as bus routes, pooled ride sourcing trips, or other potential solutions discussed in this report may help alleviate the proprietary shuttle service challenges. Public-private partnerships could also be explored to broaden customer bases of these services to include the public.

TRPA Stakeholder Support

New shuttle(s):

- Very supportive: 94%
- Somewhat supportive: 6%

Shuttles at Tahoe

The Tahoe Region has benefited from a variety of shuttles that have been implemented by both public transportation agencies and private resorts, most of which are free to the rider. There are also private companies that provide shuttle services to riders for a fee. Many resorts on the North and South Shores have shuttles between the resorts, ski areas, and nearby towns, including stops at transit centers. North Tahoe operates the North Lake Tahoe Express between the Reno-Tahoe International Airport and North Tahoe/Truckee attractions and ski resorts. South Tahoe is served by the South Tahoe Airporter. The Tahoe Transportation District also operates seasonal shuttles to recreation destinations with limited parking, such as the East Shore Express to access Sand Harbor, which has seen dramatic increases in ridership over the past four years. However, financial constraints to local public transportation ended service between South Lake Tahoe and Emerald Bay, one of the most heavily visited spots at Tahoe.

The North Shore has experimented with allowing hard shoulder running for transit vehicles to avoid delays and congestion when regular traffic on the two-lane highways has fallen below a certain speed. Developing policies and regulations that allow shuttles to travel on the shoulders throughout the region when travel speeds fall below a certain threshold would further incentivize travelers to choose shuttles as a faster option to reach their destination and might encourage the

expansion of shuttle services to recreation destinations.

The Tahoe Region has many opportunities to expand partnerships with resorts to provide more shuttle services to residents and visitors, including on-demand shuttles equipped with technology for dynamic routing, like the Mountaineer service already in operation in North Tahoe. Additionally, service of existing airport shuttles could also be improved to encourage more ridership through improvements such as more frequent service. Such improvements should also be accompanied by marketing efforts to inform travelers of their options for travel to and from the Reno airport. Marketing improvements might lead to increased ridership and help offset additional service and marketing costs. The Tahoe Region might consider developing remote park and ride lots on busy roads into Tahoe to encourage drivers to avoid congestion by parking their vehicles at no cost and taking complimentary shuttles to their destinations in more congested town centers and resort areas.

Recommendations

- Expand seasonal shuttle operations to recreation destinations and equip shuttles to carry gear (e.g., mountain bikes, skis, and snowboards).
- Provide shuttle services from remote park and ride lots to resort and other hospitality providers at no cost to user.
- Encourage shuttle services to consider integrating on-demand, dynamic routing technology, such as that used by Mountaineer.
- Permit authorized shuttle services to run on hard shoulders during periods of congestion.
- Improve existing airport shuttle service between Reno-Tahoe International Airport and both North and South Shores with reduced headways and more service to resort and hospitality providers.
    - Begin conversations with South Lake Tahoe resorts and other hospitality providers about potential partnership to increase marketing of South Shore Airporter, possibly through South Shore TMA, like Truckee North Shore TMA shuttle marketing.

Automated Shuttles: Low-speed driverless vehicles operating on fixed or dynamic routes.

Automated shuttles are a rapidly developing technology. Current deployments operate at cruising speeds of 10 - 12 miles per hour and can typically carry 10-15 passengers, with seating for 4-8 riders. They can travel 30 - 60 miles or 5-10 hours on a single charge, but extreme weather conditions (both hot and cold) may reduce this range. Current deployments are fully automated, yet they are only able to operate in limited conditions and they will not operate unless all those conditions are met. Therefore, they typically operate in highly controlled environments such as campuses or business parks.

Automated shuttles have not yet been used in mountain and resort towns. However, there is research and development underway to advance automated shuttle technology for winter conditions to improve operations in snowy and icy conditions. Benefits of automated shuttles include potential efficiency improvements and high frequency service with lower operational costs than traditional alternatives. However, at present the vehicles are costly and requirements that mandate an on-board safety technician may offset these potential cost and efficiency gains.

TRPA Stakeholder Support

New automated shuttle(s):

- Very supportive: 42%
- Somewhat supportive: 32%
- Somewhat unsupportive: 16%
- Very unsupportive: 11%

Automated Shuttles at Tahoe

Automated shuttles could provide circulator-type service for short trips in areas of high demand. They can be equipped with technology to provide dynamic routing service once the technology advances to the point that the automated shuttles could operate in a wider array of environmental conditions. At this point, with the expense of implementing automated shuttles and the current state of technological maturity, they are not advisable for implementation in Tahoe. However, the region should continue to monitor deployments of automated shuttles in regions with similar planning contexts and consider potential opportunities as the technology matures and costs decrease.

Recommendations

- Monitor adoption of automated shuttles in resort and mountain towns and in areas with harsh winter weather conditions.
    - Consult with peer regions who have adopted automated shuttles regarding cost, procurement, planning, and operational considerations.
    - Consider sustainability of business and operational models when consulting with peer regions.
- Consider potential for efficiency gains alongside labor and workforce implications.
    - Requirement for vehicle attendant may negate efficiency gains when compared to shuttle/microtransit options that require a driver.
- Consider whether fixed or dynamic routing best serves travelers.
    - Dynamic routing requires an effective platform for trip planning and payment
    - Consider usability for unbanked travelers and those without smartphones.

Incentives and Marketing: Providing information to travelers about sustainable transportation options and encouraging travelers to choose more sustainable transportation modes.

Transportation demand management (TDM) programs focus on understanding how and why people make transportation decisions in order to help them use the infrastructure that is already in place for transit, ridesharing, walking, biking, and driving, rather than relying on new, often more expensive, infrastructure to solve congestion. Incentives and marketing are two common strategies of TDM programs, which are often managed by locally or regionally oriented public organizations to inform people about and encourage them to use all of their transportation options in order to optimize the entire transportation system for all users. Incentives might include free or discounted transit, employer or hospitality subsidies, reimbursements, pre-tax payroll reductions. These programs may also include disincentives such as parking management programs and congestion pricing. Marketing of commuter options and incentives may include print and digital media as well as programs aimed at specific stakeholder groups such as employers.

TDM incentives and marketing strategies have been used in resort and mountain towns to:

- Improve congestion and parking conditions in dense areas or during peak times
- Provide traveler information about existing, new, or altered transportation options
- Encourage travelers to choose sustainable transportation modes when possible
- Support local business through partnerships and rewards that drive business to local products and services

Marketing and incentives programs for resort and mountain towns must consider the targeted audience and whether certain programs aim to influence the behavior of commuters, visitors, or both. While marketing and incentives programs may offer benefits like those listed above, some strategies may be expensive to implement, while others may be unpopular if the benefits are not clear. To alleviate public discomfort with new programs, trial periods that demonstrate the effectiveness of proposed solutions can help allay some of these concerns.

TRPA Stakeholder Support

New marketing and incentives:

- Very supportive: 88%
- Somewhat supportive: 6%
- Neither supportive nor unsupportive: 6%

Incentives and Marketing at Tahoe Opportunities

TRPA's Linking Tahoe website is an important marketing tool for the Tahoe Region. The website is a one-stop-shop for travel options throughout the Lake Tahoe Basin, providing links to transportation services and ways to travel to and from the Tahoe Basin. The program is a strong start to increase public awareness of travel options for people to get to, from, and around the Tahoe Basin and encourage more people to walk, bike, use transit, take water shuttles, and choose off-peak times to drive to better manage congestion on the region's roads. Linking Tahoe's Commute Tahoe Program Guide identifies many strategies for employers to establish a commute program and encourage employee participation in sustainable transportation modes of travel.

TRPA should continue to develop Linking Tahoe materials and advertise the Linking Tahoe website and Commute Tahoe programs through hospitality providers and other employers, as well as through print and digital media targeting residents, employees, and guests. TRPA can develop a "toolbox" of marketing materials with sample social media and website text and images and update content on a regular basis or in the case of planned special events so that hospitality providers and other employers and other partner organizations throughout the region can support the goals of Linking Tahoe. The Tahoe Region could also consider developing a comprehensive parking management program for everyday parking, seasonal parking during peak periods, and parking for special events. The program might consider park and ride facilities, priced parking in residential parking, such as through a permitting process.

Transportation Management Associations (TMAs) are valuable partners when developing, marketing, and launching incentives and marketing strategies. TRPA should utilize the resources of the Truckee North Tahoe TMA and South Shore TMA to expand the reach and influence of Linking Tahoe materials.

Recommendations

- Continue to develop and update Linking Tahoe outreach materials to provide holistic travel resources for residents and visitors
    - Partnership with TMAs to disseminate Linking Tahoe materials to hospitality providers and other employers
    - Provide a "toolbox" of marketing materials for hospitality providers and other employers to present available travel options
- Develop partnerships with visitors' authorities at the local or state level to coordinate on marketing campaigns and to elevate Linking Tahoe resources
- Consider policies for hospitality providers and other employers to provide bus schedules and alternative transportation options and display Linking Tahoe materials on website and physical copies on location
- Consider providing information about Linking Tahoe and promoting benefits of shared and sustainable travel options on dynamic message signs during peak seasons and special events
- Promote the development of a parking management program
    - Include permanent or temporary park and ride lots for peak season travel and special events with supportive shuttle services
    - Develop parking management plans that include provisions for special events such as Fourth of July, New Year's Eve, or recurring events such as golf tournaments or winter sport competitions
    - Consider trial period for policies such as on-street parking price increases, residential parking permit programs, free off-street parking, and park and ride programs that can demonstrate the effectiveness of these solutions without requiring a permanent or lasting commitment

congested corridors, and policies to protect

Transportation Management Associations

Organizations that provide employers and travelers within a specific area with options and information that advocate for sustainable transportation decisions.

The structure of Transportation Management Associations (TMAs) is largely dependent on the context of the areas that these organizations serve and factors such as funding. TMAs are focused on a specific geographic area, which might be as small as a business park or as large a multi-county region. They are usually supported by local government and businesses. The work of TMAs varies widely, but TMAs in other resort and mountain towns have focused on the following:

- Advocating for transportation modes that reduce traffic, such as transit, carpool, bike, and walk options, such as incentive programs targeted at employers and commuters.
- Hosting and supporting community events that encourage sustainable transportation.
- Managing websites and mobile applications for trip planning and reward programs.

TMAs might support local or regional implementation of some of the pilot strategies discussed in this report, such as marketing campaigns and incentives programs, coordinating partnerships to expand or implement shared transportation options such as microtransit or shuttle services, or undertake education and advocacy campaigns to promote these options. While TMAs offer benefits such as those outlined above, they are often reliant on local funding resources, which can be significantly constrained in less populous regions.

TMAs at Tahoe

The Tahoe Region is home to two TMAs: Truckee-North Tahoe TMA (TNT/TMA) and South Shore TMA (SS/TMA). SS/TMA is currently undergoing a board restructuring process to better serve the South Shore. TNT/TMA promotes and advocates for innovative transportation solutions and is focused on fostering public-private partnerships and other resources to support these solutions. TNT/TMA organizes stakeholder meetings to convene public and private interests around transportation options, contracts the management of the North Lake Tahoe Express shuttle between the North Shore Resort Triangle area and the Reno-Tahoe International Airport, and coordinates shuttle/transportation marketing sponsorship opportunities.

A strong partnership between the North Shore and South Shore TMAs could develop greater regional cohesion around transportation options and marketing to visitors, residents, and employees. TNT/TMA has successfully leveraged community resources to support marketing of the North Lake Tahoe Express airport shuttle. Increased collaboration between the two TMAs could possibly help SS/TMA implement similar marketing initiatives with material support from South Shore resorts and other hospitality providers.

The focus and work of TMAs can be restricted due to funding constraints and the local transportation environment. Federal Congestion Mitigation and Air Quality (CMAQ) program funds that can be granted by TRPA to SS/TMA are limited. However, TRPA can support growth of TMAs by using their position as a convening body and encouraging the North and South Shore TMAs to advance their role as providers of transportation options to travelers at Lake Tahoe and partners with hospitality providers and other employers.

Recommendations

- Expand and build capacity in TMAs to develop public-private partnerships that support new transportation initiatives such as micromobility, microtransit, shuttles, and incentives/marketing
- Develop strong partnership between North Shore and South Shore TMAs through jointly coordinated, regular meetings of regional transportation stakeholders
- Manage partner list of transportation stakeholders including hospitality providers and other employers to designate marketing duties
    - Disseminate Linking Tahoe marketing "toolbox"
    - Disseminate information about special events regarding transportation services such as event or recreation-specific shuttles, microtransit, parking restrictions, park and ride services and complimentary shuttles
- Explore funding resources for TMAs (especially SS/TMA)
    - TRPA can consider providing a marketing budget to TMAs to further these organizations' marketing strategies

Planning Considerations

This section of the report examines cross-cutting considerations for emerging and innovative transportation in Tahoe from a planning and implementation perspective. In doing so, this section seeks to support a strategic approach to capital investments, funding, and partnership building as well as institutional preparedness to implement existing solutions and future ones.

Mobility Integration

Mobility integration is a rapidly emerging concept that seeks to match supply and demand for public and private transportation services in each environment to provide holistic end-to-end journeys on a single charge. Mobility integration is accomplished by stacking technologies such as journey planning, real-time information, and mobile ticketing with on-demand mobility options including those offered by public and private service providers.

In Europe, mobility integration is often referred to as Mobility as a Service (MaaS) and may include payment models that bundle services to offer consumers a range of alternative mobility options on a subscription basis. For example, consumers may be given unlimited access to transit, bike sharing, and pooled ridesharing trips for $500/month. However, some MaaS implementations have followed a "pay as you go" model that allow consumers to select and pay for the combination of modes in their journey as needed.

The term Mobility on Demand (MOD) is used by the US Department of Transportation (USDOT) to represent its vision for future mobility. MOD envisions fully accessible end-to-end journeys that improve mobility options for all travelers and seamless delivery of goods and services on demand. MOD leverages innovative technologies such as mobility integration technology stacks and facilitates public-private partnerships to achieve this vision. USDOT's MOD program has offered several funding opportunities to advance this vision including the Mobility on Demand Sandbox Program, which awarded $8 million in funding to 11 sites across the nation for eligible activities "[including] all activities leading to the demonstration of the innovative MOD and transit integration concept, such as planning and developing business models, obtaining equipment and service, acquiring/developing software and hardware interfaces to implement the project, and operating the demonstration[8]." In 2019, USDOT announced the availability of $15 million in Integrated Mobility Innovation (IMI) Program funds that sought to further advance MOD, transit automation, and mobility payment integration. USDOT's MOD program and related initiatives such as its Accessible Transportation Technology Research Initiative (ATTRI) and Strategic Transit Automation Research (STAR) programs represent important funding opportunities for regions such as Tahoe to further advance emerging concepts like mobility integration.

At present, mobility integration in the United States is limited to developing platforms like those offered by Transit App and proprietary journey planning and mobile ticketing platforms like those offered by Uber and Lyft that promote the companies' respective bundles of mobility services to users. As the technology stacks facilitating mobility integration mature and the benefits are embraced by greater numbers of consumers, Tahoe should begin to consider how it can align the benefits of this concept with the region's policy objectives. Important considerations include access to digital platforms for those without smartphones and payment issues for those who are unbanked. Additionally, special consideration should be given to making these platforms easy to use for Tahoe's visitors and integrating them with the region's overall TDM efforts. Further, gaps in Tahoe's telecommunications networks should be addressed to facilitate mobility

[8] https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program

integration and use of other app-based mobility services.

Infrastructure

Long-range planning for capital investments like highway and multimodal infrastructure often looks decades into the future. However, recent disruptions in the transportation sector have challenged assumptions about mode split and travel behavior underlying these activities. Accordingly, many states and regions have been challenged to understand future transportation networks needs in this climate of rapid change.

From an infrastructure planning and operations perspective, several key considerations have emerged. First, growth in e-commerce and ride sourcing trips have increased demand for curb space. Second, the introduction and rapid growth of e-scooters and other types of micromobility have introduced a new set of vulnerable road users to the nation's roadways. Finally, these new set of vulnerable road users and the emergence of automated and connected vehicles are resulting in new road user classes with unique needs. Planning for this diverse and rapidly shifting set of circumstances is challenging. However, by pursuing "no risk" strategies for infrastructure that will benefit all users regardless of the path and pace of change, agencies can help prepare for the future while supporting safe and efficient travel for today's road users.

Effective plans and strategies for managing curbside demand, including steps such as designating fixed or flexible loading and pick-up/drop-off zones, can help alleviate congestion and avoid fragmentation of bicycle and pedestrian networks. Curbside management resources are available from organizations like Institute of Transportation Engineers (ITE) and National Association of City Transportation Officials (NACTO) to help inform these approaches.

To support safe and efficient travel by active travel modes like Micromobility, Tahoe can continue to build on its trail network and provide high-quality, low-stress facilities that are protected and segregated by use. For example, new classes of high-speed micromobility vehicles may require dedicated lanes to avoid conflicts with human-powered active travel modes like traditional bicycles. Tahoe can also adopt policies such as Complete Streets and Vision Zero, which support safe, comfortable, and convenient travel for all users regardless of their mode. Some jurisdictions have leveraged such policies to mandate the construction of facilities that align with these principles when roads are improved.

Mode separation will also help advance operations of automated vehicles (AVs). Research has demonstrated that automated driving systems (ADS) are especially challenged by dynamic transportation environments that include vulnerable road users like pedestrians and bicyclists (the latter has proved to be especially challenging for these systems). By providing clearly demarcated and well-maintained facilities for active travel, Tahoe can support both current and future travel by vulnerable road users such as bicyclists and help to minimize ADS disengagements. In a similar vein, research has shown that AV operations are supported by a state of highway good repair that can help minimize damage to expensive sensor suites that constitute the ADS. Research has also shown that AV operations are improved with quality and consistency of traffic control devices such as signage and lane markings. The Federal Highway Administration (FHWA) and other research and advisory bodies such as the National Cooperative Highway Research Program (NCHRP) are working to provide guidance to infrastructure owner operators to support greater quality and consistency of roadway infrastructure as well as other infrastructure considerations for AV deployment. In the meantime, Tahoe can adopt "no risk" strategies like those that promote mode separation and state of good repair that will benefit all road users regardless of which path unfolds.

Partnerships

Public-private partnerships and interagency partnerships are crucial to advancing

emerging and innovative transportation in Tahoe. The role of Tahoe's TMAs in fostering partnerships with the private sector and the role of TRPA as a convening body to foster interagency partnerships were discussed earlier in this report. Some additional opportunities are discussed below.

To support Mountaineer microtransit operations at the North Shore, representatives from Squaw Valley and Alpine Meadows established a Tourism Business Improvement District (TBID) to manage the contract with Downtowner for the technology. If Tahoe seeks to expand a service like Mountaineer regionwide it may wish to consider steps to encourage established TBIDs to pursue similar projects or to facilitate the formation of new TBIDs where a need for these services exist, but a convening body is lacking. Alternately, the TMAs could assume responsibility for a regionwide role in contracting for these services.

A strong partnership with Tahoe Transportation District (TTD) and Truckee Area Regional Transit (TART) will be important for the success of any new transportation options because fixed-route transit remains the most successful and efficient way for agencies to provide transportation services. Many of the strategies outlined in this document highlight fixed-route transit options and the ability for Micromobility, microtransit, and shuttles to connect to transit strengthens the entire transportation system.

Stakeholders in Tahoe demonstrated strong support for additional micromobility options at the December 4th, 2019 workshop. However, because the Tahoe Region's population is small, travel demand is seasonal in nature, and connectivity is impeded by the area's geography, there may be a limited business case for deployment of additional options. Public-private partnerships such as the one that brought Pace bikeshare to the North Shore may be a feasible option to provide modes like shared pedal assist e-bikes to Tahoe, which may be better suited to the topography and climate of Tahoe than traditional bikes and e-scooters. Partnerships with resorts and other hospitality providers who may benefit from increasing commute options for employers and visitors are one potential avenue for exploration.

Planning for Innovation

Innovation comes with inherent cost and risk. Accordingly, public agencies that wish to reap the benefits of emerging and innovative transportation solutions must be willing to use pilots, demonstrations, and trial periods to test these new approaches with the understanding that some may fail or require further refinement and iteration. Including dedicated funds for pilots and demonstrations in TRPA's long-range plans and programs can help support this approach. Similarly, trial periods can demonstrate potential value of innovations with minimal risk.

Next Steps

The findings and recommendations in this document are presented for the region's consideration as it begins to develop the 2020 RTP. However, the financial and operational feasibility of each recommendation merits further study and consideration by local stakeholders. TRPA can build on the visioning exercise conducted at the December 4th, 2019 workshop by conducting a multi-day charrette including a representative group of regional stakeholders and subject matter experts. The figure below, which represents areas in the Tahoe Region that workshop participants believed to be most promising for emerging and innovative transportation solutions, as well as other feedback gathered from that workshop can provide jumping off points for that exercise. Additionally, TRPA may wish to conduct visitor surveys to better understand this group's willingness to use and pay for proposed solutions. New platforms like those offered by the mobile survey company MFour allow survey administrators to set geofences around select areas and to push mobile surveys to users who enter those geofenced areas. These platforms may be a good supplement or alternative to traditional mail or intercept surveys and provide valuable

insights about which strategies may produce the greatest return on investment for TRPA, its partners, and the region.