TRIC CIRCULATION OPTIONS

1 Introduction

To complement the recommendations from Phase 1, Phase 2 of the Inter-County and Regional Transit Plan began with the identification of a set of mobility options. These mobility options are intended to provide circulation within TRIC, and to connect with regional transit solutions that will ultimately provide mobility between TRIC and the larger region.

After establishing a final set of five TRIC mobility options based on department and stakeholder feedback, a framework for evaluation was established to guide the department and stakeholder committee in its analysis. This framework was presented at the stakeholder meeting on November 20, 2019, and comments were incorporated. The three-tiered framework below lays out the Guiding Principles, Goals and Objectives, and Evaluation Criteria that was used to determine the strengths and weaknesses of each mobility option relative to the plan's objectives.

1.1 Guiding Principles

To ground the evaluation of the final mobility options, a set of Guiding Principles was established. These principles are the top tier of the anticipated evaluation and establish a set of expectations for the final solution. It is expected that any final mobility option will fulfill each of the following criteria:

- **Safety:** The final mobility solution will provide safe, secure, and reliable transportation.
- **Coordination:** The provided service will work in tandem with existing (or planned) transit operators to meet the region's goals.
- **Feasibility:** The proposed solution will be possible to implement within a reasonable budget and timeline.
- **Public-Private Partnership:** The ultimate mobility solution will be funded and operated through a cooperative agreement between local employers and the government.

All of the mobility options, as well as the Goals and Objectives defined in Phase 1, have been authored with these principles in mind, to ensure that every step of the process considers options that are known to be Safe, Coordinated, Feasible, and implemented through a Public-Private Partnership.

1.2 Goals and Objectives

In project Phase 1, the project team reviewed local planning documents to identify a set of goals and objectives. These four sets of goals and objectives complement, support, and are supported by existing transit-related policies and goals in the region. Following stakeholder input, these themes, goals, and objectives have been carried into Phase 2 to guide the identification of feasible options to improve mobility within TRIC. **Table 1.1** presents the goals and objectives developed by the project team as part of Phase 1 of the project.

Table 1.1 – Inter-County and Regional Transit Goals and Objectives

Goal 1 – Enhance regional access to activity centers	
Goal 1 Objectives	
A	Maximize transit access to housing, employment, and the number of potential transit passengers
B	Provide fast and reliable travel alternatives to delay caused by highway congestion
C	Align with and promote local and regional economic development
D	Increase the number of options for when and how to travel
Goal 2 – Contribute to a cost-effective and economically viable transit system	
Goal 2 Objectives	
A	Expand use of emerging technologies
B	Minimize public capital and operating costs
C	Maximize flexibility to efficiently adjust transit investment to accommodate changes in demand
Goal 3 – Effectively integrate into the existing and planned transportation system	
Goal 3 Objectives	
A	Leverage existing public transportation right-of-way and services
B	Expand accessible multimodal options for moving people
C	Improve connectivity between all modes of passenger transportation
Goal 4 – Support safe and healthy communities and sound environmental practices	
Goal 4 Objectives	
A	Avoid or minimize impacts on sensitive natural, historic, and cultural resources
B	Avoid or minimize short- and long-term impacts on property, property access, and on-street parking
C	Maximize pedestrian and bicycle connections to transit
D	Avoid or minimize disproportionately high and adverse impacts on minority and/or low-income communities
E	Minimize traffic impacts

1.3 Evaluation Criteria

As stated, the evaluation criteria were established to respond to the stated Goals and Objectives identified in **Table 1.1**. **Table 1.2** shows the relationship between the evaluation metrics and the Goals and Objectives.

Table 1.2 – Relationship of Evaluation Metrics to Goals and Objectives

	Goal 1 Enhance regional access to activity centers	Goal 2 Contribute to a cost-effective and economically viable transit system	Goal 3 Effectively integrate into the existing and planned transportation system	Goal 4 Support safe and healthy communities and sound environmental practices
Reliable	■		■	
Environmentally Sustainable				■
Cost-Effective	■	■		
Connected	■		■	
Flexible		■		
Convenient		■		

The evaluation criteria develop the goals and objectives into a set of evaluation metrics. These metrics represent quantitative and qualitative ways to analyze the mobility options to evaluate their adherence to the principles, goals and objectives. The criteria are a reflection of what was heard from stakeholders, interviews with employers, and the online survey completed combined with typical evaluation metrics to transit studies. The proposed metrics are shown in **Table 1.3**.

Table 1.3 – Proposed Evaluation Metrics

Criteria	Description	Proposed Metric
Reliable	Provides consistent and trusted operation	Able to operate in all weather conditions
		Able to bypass traffic incidents and roadway closures
		Provides on-time service more than 90% of the time
Innovative	Operates in a way that produces low emissions	Encourages ride-sharing
		Operates via electric or hybrid vehicles
Cost-Effective	Financially sustainable to operate	User: Single ride cost no more than the cost of driving
		TMA/Operator: Minimizes up-front capital investment
		TMA/Operator: Minimizes operating costs through reliance on emerging technologies
Connected	Works in tandem with regional transportation system and services	Effectively bridges the gap between existing public and private transportation services
		*Note: all services were assumed to connect with any existing or future services, as part of the Guiding Principles.
Flexible	Supports individual schedules and the ability to go anywhere within the service area	User: Provides options for off-peak travel (such as guaranteed ride home)
		User: Provides options for non-fixed route travel
		TMA/Operator: Easily adaptable to serve changing transit demand
Convenient	Does not require high levels of advance planning or routine changes	Does not add more than 20% to worker's commute time
		Minimizes transfers and stops
		Provides service through any applicable security points to final destination

1.4 Evaluation Methodology

The evaluation process is a qualitative process, with mobility options receiving a score in each category, along with a short description of its performance against the evaluation criteria in total. For each mobility option, a brief scorecard has been assembled, broken down by the six evaluation criteria. Each criterion has been given a rating of "good," "fair" or "poor" based on the professional judgement of the project team of how well the option performs against that criteria. Generally, scores are defined as:

- Good: This mobility option typically meets or exceeds expectations in this category, as shown in other applications.
- Fair: This mobility option sometimes meets this criterion, or performance heavily depends on other factors.
- Poor: This mobility option typically does not meet expectations in this category, as shown in other applications.

Following the scorecard, the ratings for each mobility option are summarized with a brief description that identifies the main strengths and weaknesses.

At the end of the document, a summary table provides for easy comparison across all categories and mobility options.

2   Vehicle Share Network

Vehicle share networks provide individual vehicles (such as traditional passenger cars or electric vehicles) for short-term, short-distance use by those who are members of the service. Generally, designated parking spaces are provided at various locations throughout the service area to allow users to easily check vehicles in or out. If vehicles are restricted to travel within a designated service area, such as within TRIC, electric vehicles may provide cost savings and environmental efficiency when parking spots are paired with charging stations. The service may be operated in a number of ways, such as requiring users to reserve and pay for a vehicle on a per-hour basis, requiring a monthly subscription fee that allows access to the vehicles, or it may be sponsored by the employer as an employee benefit.

Table 2.1 – Vehicle Share Network Evaluation

Criteria	Proposed Metric	Score
Reliable	Able to operate in all weather conditions	Good
	Able to bypass traffic incidents and roadway closures	Poor
	Provides on-time service more than 90% of the time	Fair
Innovative	Encourages ride-sharing	Fair
	Operates via electric or hybrid vehicles	Good
Cost-Effective	User: Single ride cost no more than the cost of driving	Fair
	TMA/Operator: Minimizes up-front capital investment	Fair
	TMA/Operator: Minimizes operating costs through reliance on emerging technologies	Good
Connected	Effectively bridges the gap between existing public and private transportation services *All services were assumed to connect with any existing or future services, as part of the Guiding Principles. The rating reflects the anticipated quality of the connection.*	Good
Flexible	User: Provides options for off-peak travel (such as guaranteed ride home) *Guaranteed Ride Home services are assumed to be provided separately. Option was evaluated based on its ability to provide off-peak travel within TRIC.*	Good
	User: Provides options for non-fixed route travel	Good
	TMA/Operator: Easily adaptable to serve changing transit demand	Good
Convenient	Does not add more than 20% to worker's commute time	Good
	Minimizes transfers and stops	Good
	Provides service through any applicable security points to final destination	Good

2.1   Summary

Vehicle share networks perform highest on the Flexible and Convenient portion of the evaluation, as they provide an individual form of travel that is not subject to fixed routes, schedules, or transfer points. This option does not provide more travel reliability than traditional cars, as they are subject to the same congestion and traffic incidents as all other traffic. Some pricing schemes may encourage ridesharing or reduce the cost to the user. In addition, providing an electric fleet

reduces operating costs, but does require additional up-front investment. Factors that must be determined include whether vehicles will be allowed to travel outside TRIC (for instance as an emergency ride home option) and whether TMA stakeholders will engage in cost-sharing to reduce user cost.

3   Shuttle Services

Shuttle services provide local mobility within a designated service area, through transit vehicles that connect users between a central transit hub and work locations. Shuttle services generally operate under one or a combination of three basic operating structures: as a fixed-route circulator that serves many final destinations in a single route; as employer-sponsored shuttles that make trips between work locations and the central hub at designated times; or as an on-demand service.

Table 3.1 – Shuttle Services Evaluation

Criteria	Proposed Metric	Fixed-Route Circulator	Employer Shuttles	On-Demand
Reliable	Able to operate in all weather conditions	Good	Good	Good
	Able to bypass traffic incidents and roadway closures	Poor	Poor	Poor
	Provides on-time service more than 90% of the time	Fair	Fair	Fair
Innovative	Encourages ride-sharing	Good	Good	Fair
	Operates via electric or hybrid vehicles	Good	Good	Good
Cost-Effective	User: Single ride cost no more than the cost of driving	Good	Good	Fair
	TMA/Operator: Minimizes up-front capital investment	Good	Good	Good
	TMA/Operator: Minimizes operating costs through reliance on emerging technologies	Poor	Good	Good
Connected	Effectively bridges the gap between existing public and private transportation services *All services were assumed to connect with any existing or future services, as part of the Guiding Principles. The rating reflects the anticipated quality of the connection.*	Fair	Good	Good
Flexible	User: Provides options for off-peak travel (such as guaranteed ride home) *Guaranteed Ride Home services are assumed to be provided separately. Option was evaluated based on its ability to provide off-peak travel within TRIC.*	Fair	Fair	Good
	User: Provides options for non-fixed route travel	Poor	Fair	Good
	TMA/Operator: Easily adaptable to serve changing transit demand	Poor	Good	Good
Convenient	Does not add more than 20% to worker's commute time	Fair	Good	Good
	Minimizes transfers and stops	Poor	Good	Good
	Provides service through any applicable security points to final destination	Poor	Good	Good

3.1   Summary

Shuttle system performance greatly depends on the system's operating structure. All shuttle services may struggle to perform on Reliability, because they are subject to roadway traffic

conditions. Shuttle systems are excellent candidates for electric or hybrid vehicles due to their limited operating areas, lowering operating costs. They all also limit the amount of up-front capital investment needed. Fixed-route circulators perform the worst on Flexibility and Convenience, as they are likely to have multiple transfers or stops and are less likely to be able to provide service through security checkpoints. Employer sponsored shuttles or on-demand shuttles are more likely to provide direct service that limits the amount of time spent traveling.

4   Emerging Technology Solution

Self-driving shuttles are smaller than traditional cars, operate at low speeds, and may operate on private roads within the confines of a development or on public roadways. NDOT is currently exploring the idea of an autonomous-vehicle only roadway to parallel I-80. Autonomous shuttles have been successfully used on corporate campuses to ferry workers from remote parking lots or between buildings. The technology is steadily advancing, and potential partnerships with on-site technology companies makes this an exciting opportunity to explore.

Table 4.1 – Emerging Technology Solution Evaluation

Criteria	Proposed Metric	Score
Reliable	Able to operate in all weather conditions	Poor
	Able to bypass traffic incidents and roadway closures	Poor
	Provides on-time service more than 90% of the time	Fair
Innovative	Encourages ride-sharing	Fair
	Operates via electric or hybrid vehicles	Good
Cost-Effective	User: Single ride cost no more than the cost of driving	Good
	TMA/Operator: Minimizes up-front capital investment	Poor
	TMA/Operator: Minimizes operating costs through reliance on emerging technologies	Good
Connected	Effectively bridges the gap between existing public and private transportation services *All services were assumed to connect with any existing or future services, as part of the Guiding Principles. The rating reflects the anticipated quality of the connection.*	Good
Flexible	User: Provides options for off-peak travel (such as guaranteed ride home) *Guaranteed Ride Home services are assumed to be provided separately. Option was evaluated based on its ability to provide off-peak travel within TRIC.*	Good
	User: Provides options for non-fixed route travel	Good
	TMA/Operator: Easily adaptable to serve changing transit demand	Good
Convenient	Does not add more than 20% to worker's commute time	Good
	Minimizes transfers and stops	Good
	Provides service through any applicable security points to final destination	Good

4.1   Summary

Generally, an emerging technology solution (such as self-driving shuttles) perform well against the evaluation metrics. They provide flexible, convenient transportation options that allow for off-peak and non-fixed route travel and connect users directly to their destinations. Some hazardous weather conditions may prove problematic. While autonomous vehicles operate on public

roadways in Nevada and are therefore subject to general traffic conditions (basis for "poor" rating), they may be able to automatically re-route or change their schedule to avoid traffic incidents. In some major campus settings, separate road networks have been constructed to remove these vehicles from normal traffic conditions entirely, however for the purposes of this analysis it was assumed that vehicles would be operated in existing traffic flow.

Cost to users would need to be established for the specific situation and based on a number of financial and policy considerations, including capital cost; this can range from no cost (e.g., the Las Vegas shuttle, "Hop On," is free to users) to rates seen on taxi/Uber/Lyft, all of which are lower than an individual's cost to own and operate a personal vehicle. Ongoing operating costs are likely to be minimal due to the prevalence of electric or hybrid vehicles in this sector, and the driverless technology.

5   Fixed Guideway Transit

A fixed guideway transit system within the TRIC area would be similar to the Personal Rapid Transit system found at West Virginia University, light rail systems found all over the country, airport people movers, or fixed-guideway bus transit. This option would require extensive up-front capital costs but might realize lower costs over the long-term.

Table 5.1 – Fixed Guideway Transit Evaluation

Criteria	Proposed Metric	Score
Reliable	Able to operate in all weather conditions	Good
	Able to bypass traffic incidents and roadway closures	Good
	Provides on-time service more than 90% of the time	Good
Innovative	Encourages ride-sharing	Good
	Operates via electric or hybrid vehicles	Good
Cost-Effective	User: Single ride cost no more than the cost of driving	Good
	TMA/Operator: Minimizes up-front capital investment	Poor
	TMA/Operator: Minimizes operating costs through reliance on emerging technologies	Poor
Connected	Effectively bridges the gap between existing public and private transportation services *All services were assumed to connect with any existing or future services, as part of the Guiding Principles. The rating reflects the anticipated quality of the connection.*	Poor
Flexible	User: Provides options for off-peak travel (such as guaranteed ride home) *Guaranteed Ride Home services are assumed to be provided separately. Option was evaluated based on its ability to provide off-peak travel within TRIC.*	Good
	User: Provides options for non-fixed route travel	Poor
	TMA/Operator: Easily adaptable to serve changing transit demand	Poor
Convenient	Does not add more than 20% to worker's commute time	Good
	Minimizes transfers and stops	Poor
	Provides service through any applicable security points to final destination	Poor

5.1 Summary

Fixed guideway transit provides excellent quality of service in terms of travel time and reliability. However, it requires significant up-front capital investment (regardless of the transit mode) and significant operating and maintenance costs. By nature, fixed guideway transit must service designated stops, which limits the ability to provide flexible options or to adapt service in the future as demand changes. Many decision points will affect the outcome of the evaluation, including whether service is provided through any applicable security points, and how frequently the service runs.

6 App-based Rideshare Service

App-based rideshare services allow users to request rides on-demand and provide flexibility and familiarity. While Uber and Lyft are the most well-known services, others such as Rubyride provide alternate service models that excel within defined service areas and frequently partner with employers or municipalities to subsidize service. Rubyride hires drivers for defined shifts, ensuring that drivers are always available. Another service provider is ZIPZONE (Via). They partner with the Trinity Metro ZIPZONE app, allowing riders to hail a shuttle directly from their smartphone. Via's advanced algorithms enables multiple riders to seamlessly share the vehicle. The powerful technology directs passengers to a nearby virtual bus stop within a short walking distance for pick up and drop off, allowing for quick and efficient shared trips, without lengthy detours or inconvenient fixed routes and schedules.

Table 6.1 – App-based Rideshare Service Evaluation

Criteria	Proposed Metric	Score
Reliable	Able to operate in all weather conditions	Good
	Able to bypass traffic incidents and roadway closures	Poor
	Provides on-time service more than 90% of the time	Fair
Innovative	Encourages ride-sharing	Good
	Operates via electric or hybrid vehicles	Fair
Cost-Effective	User: Single ride cost no more than the cost of driving	Fair
	TMA/Operator: Minimizes up-front capital investment	Good
	TMA/Operator: Minimizes operating costs through reliance on emerging technologies	Good
Connected	Effectively bridges the gap between existing public and private transportation services *All services were assumed to connect with any existing or future services, as part of the Guiding Principles. The rating reflects the anticipated quality of the connection.*	Good
Flexible	User: Provides options for off-peak travel (such as guaranteed ride home) *Guaranteed Ride Home services are assumed to be provided separately. Option was evaluated based on its ability to provide off-peak travel within TRIC.*	Good
	User: Provides options for non-fixed route travel	Good
	TMA/Operator: Easily adaptable to serve changing transit demand	Good
Convenient	Does not add more than 20% to worker's commute time	Good
	Minimizes transfers and stops	Good
	Provides service through any applicable security points to final destination	Good

6.1   Summary

App-based rideshare services provide flexible, convenient, and low-cost service options for both users and operators. These services rely on vehicles and the public road network, meaning the service is subject to congestion and traffic incidents. However, utilizing a rideshare service minimizes capital investment and operating cost, and contracting through a dedicated third-party service such as Rubyride or ZIPZONE ensures that drivers will be available when and where they are needed. Some services encourage ridesharing, while preserving flexibility, and may be utilized to provide guaranteed-ride-home options in conjunction with other modes.

7   Summary

The table below shows the relative performance of each mobility option against all evaluation metrics. Only the On-Demand Shuttles option is shown for shuttle service, due to space constraints, and because it performed the best of the three operational choices. All five options were evaluated based on their reliability, innovation, cost-effectiveness to both users and operators, connectedness, flexibility, and convenience.

Overall, an app-based rideshare service and some form of shuttle service options are tied for the best performance, with the most metrics designated as having potential for "Good" performance. Each are cost-effective for both users and operators and allow for flexible and convenient travel, as well as provide the flexibility to adjust service in the future. The shuttle and app-based rideshare services also provide intuitive options to integrate emerging technology, such as electric and automated vehicles, providing an intuitive solution that makes use of multiple mobility options. Each service also encourages ride-sharing, promoting sustainability and the reduction of vehicle miles traveled.

The drawbacks of each are similar: Shuttles and app-based systems are reliant on public roadways, and thus are subject to prevailing traffic conditions. A more intensive capital investment would include the funding of a separate roadway system for automated shuttles, allowing for free-flow at all times.

There is no single "right" answer for the TRIC area, but the goal would be to use a combination of these mobility options to deliver the most user friendly and overall cost-effective service possible. Employers who offer shuttle service may also choose to contract with rideshare services to offer guaranteed rides home, as the app-based service is able to be more flexible than a traditional shuttle service.

Table 7.1 – Comparison of Mobility Options Evaluation

Criteria	Proposed Metric	Mobility Option				
		Vehicle Share Network	Employer Shuttle Services	Emerging Technology Solution	Fixed Guideway Transit	App-based Rideshare Service
Reliable	Able to operate in all weather conditions	Good	Good	Poor	Good	Good
	Able to bypass traffic incidents and roadway closures	Poor	Poor	Poor	Good	Poor
	Provides on-time service more than 90% of the time	Fair	Fair	Fair	Good	Fair
Innovative	Encourages ride-sharing	Fair	Fair to Good	Fair	Good	Good
	Operates via electric or hybrid vehicles	Good	Good	Good	Good	Fair
Cost-Effective	User: Single ride cost no more than the cost of driving	Fair	Fair to Good	Good	Good	Fair
	TMA/Operator: Minimizes up-front capital investment	Fair	Good	Poor	Poor	Good
	TMA/Operator: Minimizes operating costs through reliance on emerging technologies	Good	Poor to Good	Good	Poor	Good
Connected	Effectively bridges the gap between existing public and private transportation services*	Good	Fair to Good	Good	Poor	Good
Flexible	User: Provides options for off-peak travel (such as guaranteed ride home) **	Good	Fair to Good	Good	Good	Good
	User: Provides options for non-fixed route travel	Good	Fair	Good	Poor	Good
	TMA/Operator: Easily adaptable to serve changing transit demand	Good	Poor to Good	Good	Poor	Good
Convenient	Does not add more than 20% to worker's commute time	Good	Fair to Good	Good	Good	Good
	Minimizes transfers and stops	Good	Poor to Good	Good	Poor	Good
	Provides service through any applicable security points to final destination	Good	Poor to Good	Good	Poor	Good

* All services were assumed to connect with any existing or future services, as part of the Guiding Principles. The rating reflects the anticipated quality of the connection.

** Guaranteed Ride Home services are assumed to be provided separately. Option was evaluated based on its ability to provide off-peak travel within TRIC.