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Rationale for Funding a Feasibility Study for an Automated Rapid Transit Application in the Twin Cities

Ferrol O. Robinson, Principal Investigator
Humphrey School of Public Affairs
University of Minnesota

September 2011

Research Project
Final Report 2011-17

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Technical Report Documentation Page

1. Report No.	2.	3. Recipients Accession No.	
MN/RC 2011-17			
4. Title and Subtitle Rationale for Funding a Feasibility Study for an Automated Rapid Transit Application in the Twin Cities		5. Report Date September 2011 6.	
7. Author(s) Ferrol O. Robinson		8. Performing Organization Report No.	
9. Performing Organization Name and Address Humphrey School of Public Affairs University of Minnesota 301 19th Avenue S. Minneapolis, MN 55455		10. Project/Task/Work Unit No. CTS Project #2010095 11. Contract (C) or Grant (G) No. (c) 89261 (wo) 215	
12. Sponsoring Organization Name and Address Minnesota Department of Transportation Research Services Section 395 John Ireland Boulevard, MS 330 St. Paul, MN 55155		13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code	
15. Supplementary Notes http://www.lrrb.org/pdf/201117.pdf			

16. Abstract (Limit: 250 words)

This report discusses the potential benefits and perceived impediments to implementing an automated rapid transit (ART) system in the Twin Cities and Minnesota. The report also briefly reviews the status of ART applications, also referred to as personal rapid transit (PRT), in the United States and abroad. Finally, the report evaluates the potential ability of ART to promote the policy goal of creating efficient development, livable communities, and work opportunities through a variety of relevant strategies.

The report concludes that an ART feasibility study is needed to provide more definitive answers to issues and questions raised about ART, and it provides the rationale for funding such a study, as well as an outline of the elements of the feasibility analysis.

17. Document Analysis/Descriptors	18. Availability Statement		
Automated rapid transit, ART, Personal rapid transit, PRT, Traditional transit, Public transit, Livable communities, Transit oriented development, Feasibility analysis, Automated guideway transit, Communities	No restrictions. Document available from: National Technical Information Services, Alexandria, Virginia 22312		
19. Security Class (this report) Unclassified	20. Security Class (this page) Unclassified	21. No. of Pages 24	22. Price

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Prepared by:

Ferrol O. Robinson

Humphrey School of Public Affairs
University of Minnesota

September 2011

Published by:

Minnesota Department of Transportation
Research Services Section
395 John Ireland Boulevard, Mail Stop 330
St. Paul, Minnesota 55155

Acknowledgments

The author would like to thank the Minnesota Department of Transportation for funding this research.

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Executive Summary

Introduction and Background

This report provides background on automated rapid transit (ART) systems and the rationale for funding a feasibility study of an ART system for a Twin Cities application. It is crucial that a feasibility study be conducted to address the many questions and issues that have been raised concerning this transportation technology.

As a concept, ART has been around for several decades, but this past decade has seen a significant maturing and advancement in its concept of operation and its technological reliability. In its current form, ART is a new and innovative transit mode that promises to change how transit services are deployed. ART development and technological advances have progressed rapidly in the last decade. This is evidenced by the significant number of ART initiatives in the United States and internationally. These include initiatives in such diverse places as London, England; Amristar, India; San Jose, California; and the state of Minnesota.

Rationale for and Purpose of Funding an ART Feasibility Study

If feasibility is demonstrated, ART has the potential for helping to achieve the goal of encouraging efficient development and creating livable communities and work opportunities. An ART system could aid in encouraging public transit and other transportation systems; encouraging regional growth management that minimizes sprawl, while maximizing livability, opportunities, and choices for everyone; encouraging neighborhood improvement to promote neighborhoods as places where people, businesses, and communities thrive; and protecting and restoring an expanding open space network of natural areas and urban green spaces.

The feasibility study is intended as a first step in evaluating the viability of implementing ART in the Twin Cities, possibly in a city that has expressed interest in an ART system. The analysis would include alignment and right-of-way requirements, technology assessment, reliability and readiness, and construction and operating costs. The feasibility study should contain a significant outreach and education element aimed at understanding what people (stakeholders and customers) want of their transportation system, how ART may fit in that picture, and what is the view of policymakers and legislators.

The dual role of ART technology in terms of its ability to fill the “first-mile/last-mile” gaps of traditional transit services, as well as its potential for replacing many auto trips, makes ART a desirable solution to a variety of urban transportation problems. An ART feasibility study for a Twin Cities application is needed to provide more definitive answers to many of the issues and questions raised about ART by supporters and opponents alike.

1 Introduction

It is becoming increasingly clear that, if the concept of an automated rapid transit (ART) system is to be implemented in Minnesota, a feasibility study must be conducted to address the many questions and issues that have been raised concerning this transportation technology. For an analysis of potential benefits and impediments of ART, refer to the companion report, Personal Rapid Transit Workshop (2010). This document provides the background and rationale for funding a feasibility study for an ART system for a Twin Cities application. In addition, this document outlines the main elements of the ART feasibility study. In this report, ART designation is used in lieu of personal rapid transit (PRT) because, in its current conception, the system may not be necessarily “personal”, but it retains its automation, speed advantage, and intrinsic transit service quality.

2 Background

As a concept, ART has been around for several decades, but this past decade has seen a significant maturing and advancement in its concept of operation and its technological reliability. In its current form, ART is a new and innovative transit mode that promises to change how transit services are deployed.

2.1 Concept of Operation

An important insight is that ART can overcome many of the shortcomings that characterize traditional transit systems. And it does this, not by competing with other transit services, but by complementing them, whether light rail transit (LRT), bus rapid transit (BRT), commuter rail, or regular and express bus services. A shortcoming, and one of the main reasons why traditional transit modes are not able to capture as much modal share as they are capable, is that most potential riders, unless they can walk conveniently to stations, do not have adequate access to transit. Feeder buses most often are unable to provide frequent, convenient and or fast access to stations. Park-and-ride facilities still rely on auto access, use up valuable open space, and are often not welcome in neighborhoods where they are to be located. At the transit trip destination, many activity center jobs, shopping and personal business opportunities are unreachable by walking from transit stations. ART goes a long way toward solving these so-called last-mile/first-mile service gaps by offering transit riders the means to more conveniently access stations and stops at the beginning of the trip (collection/feeder function), and the means to get from transit stations to the destination end of their trip (distribution function).

A second insight is that ART can serve activity centers that are usually not well served, if served at all, by traditional transit. ART can provide circulation service within downtowns, shopping centers, university campuses, hospital campuses, etc., as well as shuttle services between these activity centers.

In the above applications, whether used as a collection/feeder, distribution, circulation or shuttle service, ART can enhance the effectiveness of the current investment in transit by providing the means to increase access and ridership, and thus mode share and cost-effectiveness (see figure 1 below).

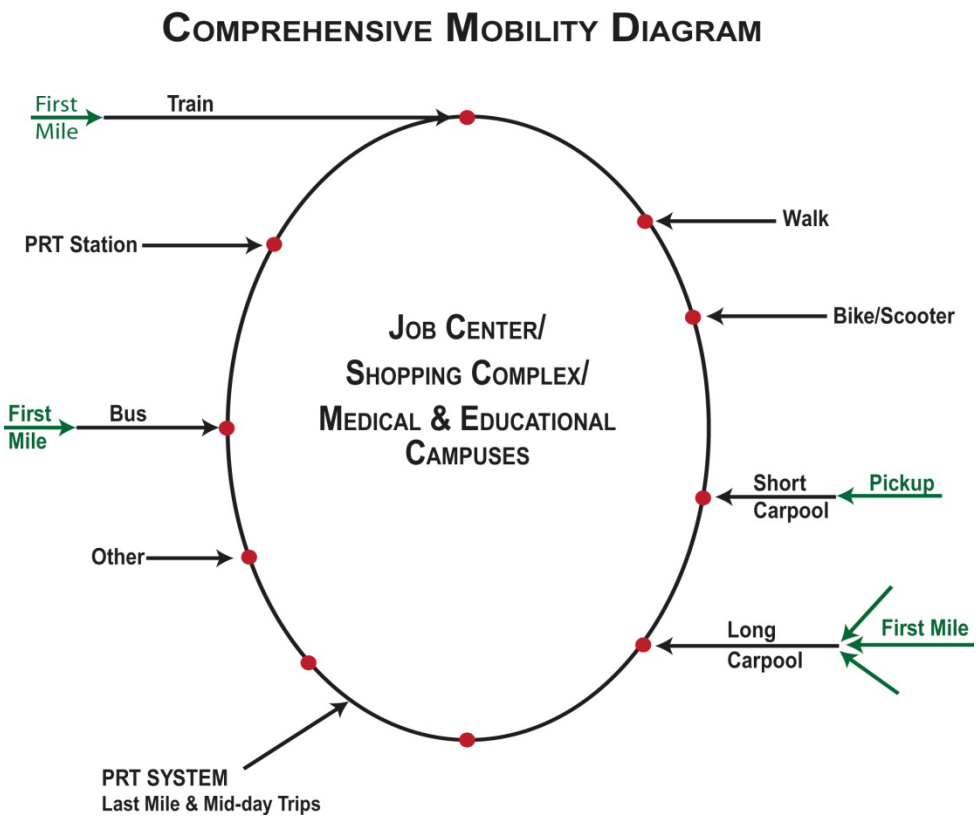

Figure 1: Comprehensive Mobility Diagram (Source: ULTra PRT Consulting Inc.)

2.2 ART Technology

ART development and technological advances have progressed rapidly in the last decade. This is evidenced by the significant number of ART initiatives in the United States and internationally. The following partial list illustrates current ART (or PRT) initiatives. It is important to note the variety of applications as well as how many are being considered for environmental and quality-of-life reasons.

- **Heathrow Airport, London:** The ULTra PRT system is completing testing at Heathrow Airport. In March 2010 a demand of almost 600 passengers per hour was successfully tested, and in October 2010 a live trial started carrying airport employees 12 hours per day, seven days a week. Seventy percent of passengers will not have to wait for a vehicle: the vehicle is waiting for them. It is anticipated that service will open to general passengers in 2011. The Independent Safety Verification Team has approved ULTra Heathrow for operation.
- **Masdar City, Abu Dhabi:** The Dutch PRT system **2getthere** has completed testing using seven passenger vehicles and three freight vehicles and is now open to the general public. The first phase of the system links The Masdar Institute of Science and Technology via 1.2 km (0.7 mi) and five stations—three for passengers and two for freight. PRT is an important element for providing eco-friendly transportation for the City of Masdar.
- **Suncheon City, South Korea:** A private-sector company, POSCO, has signed a Memorandum of Understanding with the government of Suncheon City to build and operate a PRT system inside the city's Coastal Wetlands Park. The system will connect the park with

parking lots located outside the park. No cars will be allowed inside, thus eliminating all modes of pollution and noise. After an evaluation of all transportation options, VECTUS of Sweden was selected as the system provider. The initial 5 mi (8 km) PRT will later be expanded to connect with the newly built Central Train Station and the city's downtown.

- **Sweden: PRT** feasibility studies have been completed for 20 cities in Sweden in order to select a city in which to implement the first subsidized PRT system in that country. The finalist cities are Stockholm, Uppsala and Sodertalje. Selection of the final site will be made by the Swedish Transport Administration. The Swedish company VECTUS has been conducting PRT testing at its facility in Uppsala. This system has been safety-certified to a minimum headway of 3 seconds at a speed of 28 miles per hour (45 km per hour).
- **Amristar, India:** After evaluating three cities (Agra, Amristar and Gurgaon), Amristar has been selected for implementation of a PRT system. A 7 km (4 mi) ULTra PRT system is expected to begin operations in a few years.
- **Mineta Airport, San Jose, CA:** San Jose is in Phase II of its evaluation of the feasibility of PRT at the Mineta Airport. PRT is intended to connect the airport terminal with nearby LRT and CalTrain stations, parking facilities and hotels and, eventually, to a Bay Area Rapid Transit (BART) station. If feasible, PRT is expected to be built by 2015. PRT is a key transit element of the City of San Jose's Innovative Sustainable Communities initiative.
- **Ithaca, NY:** In September 2010, a study of the Feasibility of PRT in Ithaca, New York, was prepared for The New York State Energy Research and Development Authority and The New York State Department of Transportation. The study concluded "that a PRT system can be accommodated within the existing built environment of a mature city like Ithaca, and that a PRT system in conjunction with transit-oriented development would provide substantial environmental, quality of life and economic benefit to the region. However, the study has also identified several areas that will require additional research before the city and the region can make a decision to pursue the implementation of a PRT system in Ithaca."
- **State of Minnesota:** MnDOT, with assistance from the University of Minnesota's Humphrey School of Public Affairs and the Center for Transportation Studies, issued a Request for Information (RFI) to assess the level of interest and applicability of ART in Minnesota. MnDOT received 21 responses, including four cities and public entities, 11 ART developers and vendors, and five consulting firms. In August 2010, MnDOT held a workshop, attended by more than 80 public- and private-sector representatives, to disseminate the responses to the RFI, and to seek input from the audience regarding impediments to ART implementation, potential benefits, and principles to guide ART implementation.

3 Perceived Impediments and Expected Benefits of ART Implementation

The following section is adopted from this paper's companion report, Personal Rapid Transit Workshop, jointly prepared by the Center for Transportation Studies and the Humphrey School of Public Affairs University of Minnesota, for the Minnesota Department of Transportation (MnDOT) (2010).

3.1 Perceived Impediments to ART Implementation

1. Public and Policymakers' Perception of ART

- Absence of ART-related public education and outreach results in a lack of familiarity on the part of the public and policymakers.
- Perception of ART as too futuristic leads to concerns about technology, safety, and viability.
- There are concerns that ART will intrude on the built and natural environment and create a visual impact.
- Perception about "having to ride" with strangers.
- Perception that the small-vehicle capacity (four to six passengers) is not suitable to satisfy peak passenger demands.
- Lack of independent analysis and evaluation creates doubts on claims about benefits.

2. Institutional Issues and Barriers

- ART has not been part of the political and public process.
- Current institutional infrastructure does not allow for consideration of ART (for example, Comprehensive Plans don't include ART as a transportation option).
- An ART community impact analysis (CIA) is needed to dispel ART-related concerns.
- Public and policymakers are tied to mass transit and have low expectations for it.
- Policymakers are risk-averse: more inclined to continue to do what is "known and proven."
- An assessment of ART benefits versus risks has not been conducted.
- ART requires dedicated right of way, which is often owned by public entities.
- False starts and missteps have created uncertainties.
- Uncertainties have resulted in decision-makers not ranking ART high enough to get funding.
- Lack of public and/or private funding has precluded building an ART demonstration project.

3. Lack of Clarity in Explaining ART Applications

- Lack of uniform definition of ART (often confused with group rapid transit, for example).
- In the past, ART was often presented as being in direct competition with buses and LRT. This led to unproductive clashes with traditional transit interests and may have contributed to slowing ART progress.
- ART is now seen as a niche application in locations not well served by traditional transit, and as a complement to traditional transit systems to make them more productive and successful.

- Central planning for transportation tends to ignore niche applications.
- Confusion about applicability of ART has led to premature proposals for large network applications, absent an ART demonstration project.
- Many benefits invoked by ART proponents (e.g., substantially replacing autos and substantially reducing our dependence on petroleum-based fuels) are, at best, long term.

4. Cost and Financing Issues

- Need to differentiate ART operating costs, which are likely not to require public subsidy, from capital costs for an ART demonstration project, which may need public-private funding.
- Need to improve the accuracy of estimates of capital and operating costs: the wide range of estimates (from RFI responses) creates credibility problems.
- Whenever cost estimates are presented, assumptions associated with these estimates need to be clearly stated.
- Past ART proposals have lacked a credible business plan, which may have made it difficult to secure the necessary funding.

3.2 Anticipated Benefits of ART

1. Environmental Sustainability

- ART requires a small footprint: amount of land needed is small, typically located in or above existing road rights of way or other built space.
- Is energy efficient: powered by electricity—on-demand service, does not circulate empty; reduces over-reliance on scarce petroleum-based fuels.
- Produces minimal local emissions; is considered a green technology.
- Minimal noise: quiet and efficient.
- Exclusive, separated guideway operation offers a congestion-free trip.
- Multi-level stations allow for ART station-oriented development.
- By making it easier to use traditional transit, may increase transit ridership and reduce number of car trips.
- By providing greater access to peripheral parking facilities, could reduce parking requirements in the core and result in more efficient land use.

2. Improvement in Levels of Service

- Exclusive guideway operation and off-line stations allow for efficient service and high service speeds.
- Since vehicles wait for passengers at off-line stations, wait time is minimized.
- Accessibility is improved by adding stations where demand requires it, without reducing system speeds.
- Ability to add interconnected guideway “loops” provides greater service coverage flexibility, while maintaining non-stop service and speeds.
- Service connection to bus, LRT, and commuter rail stations expands the service coverage of these modes and addresses their first-mile/last-mile service gaps.
- Can operate over interconnected loops as well as along short-haul routes.

3. Financial Sustainability

- ART is characterized by low operating costs: no drivers required and vehicles do not operate when empty.
- Analyses indicate that ART will recover operating costs from fares, parking revenue-sharing and advertising revenues; operating subsidies are not expected to be needed.
- Reducing or eliminating public operating subsidies will lead to more sustainable funding.
- If system is built in Minnesota, would result in ongoing, green technology job creation and enable the state to export this technology to other states and other countries.
- Could increase shared parking use and parking efficiency by improving access to parking facilities, which could be a source of parking revenues.
- Could possibly reduce car-ownership expenses as well as the need for a second car.
- Could be used to distribute small cargo and packages at night, which could secure additional revenues.

4. Livability

- Democratization of mobility: no age or other impediments to use; Americans with Disabilities Act
- (ADA) accessible.
- Promotes and facilitates transit use and transfers from autos.
- Reduces reliance on autos for short- to medium-length trips.
- Uses existing right of way: does not cut through communities.
- Exclusive guideway operation improves safety by reducing conflicts with cars, bicycles,
- and pedestrians

4 Rationale for Funding an ART Feasibility Study

If feasibility is demonstrated, ART has the potential for helping to achieve the goal of encouraging efficient development and creating livable communities and work opportunities. ART is particularly relevant to strategies aimed at achieving this goal, as described below. (The McKnight Foundation Region and Community Program goal and strategies have been adapted for evaluating ART in this document. It is anticipated that similar goals and strategies are likely to be used by a variety of funding organizations.)

Strategy: Encourage public transit and other transportation systems that lessen dependence on cars and reduce negative impacts on air, water, and land.

ART encourages public transit use by complementing, not competing with, traditional transit modes, thus increasing their effectiveness. Just as important, ART can lessen dependence on cars because of its high level of service and competitiveness, and can compete with shuttle bus service in many applications. Additionally, ART requires a small footprint and can often fit within existing public rights of way, thus minimizing the use of space and land. Finally, ART's ability to provide connections to remote parking means that, in the short term, current spaces can be used more effectively and, in the mid to long term, parking space requirements can be reduced. The outcome from these positive attributes is that ART can reduce the negative impacts on air (greenhouse gases), water (run-offs) and land (right-of-way (ROW) and parking needs). It should be noted that in many cities where ART is being considered for implementation, the driving force relate to environmental and ecological concerns, as described in the background section).

ART is an innovative approach to promote multimodal transportation options and increase accessibility and choices that include transit, walking and bicycling. At the same time, this transportation innovation has the potential for drawing positive attention to road and street design standards as well as parking regulations, given its long-term potential for reducing the space needed for transportation.

Strategy: Encourage regional growth management that minimizes sprawl, while maximizing livability, opportunities, and choices for everyone.

The research into the feasibility of ART can encourage regional growth management and reduce sprawl by making urban activity centers such as downtowns and university campuses more accessible and convenient places to live and work. As noted previously, by complementing traditional transit services and reducing reliance on autos, ART promotes multimodal transportation options and increased accessibility and choices, which represent quality-of-life aspects that lead to increased livability.

Strategy: Encourage neighborhood improvement to promote neighborhoods as places where people, businesses, and communities thrive.

ART has the mid- to long-term potential to help achieve this strategy. ART could become an important tool to support comprehensive commercial revitalization along urban transportation corridors and their surrounding neighborhoods. Application corridors could include Lake Street

in Minneapolis and Payne-Arcade Avenues in Saint Paul. And, in terms of serving neighborhoods and complementing LRT services, Hiawatha LRT in Minneapolis, and the future Central Corridor LRT on University Avenue in Saint Paul would be good applications.

Strategy: Protect and restore an expanding open space network of natural areas and urban green spaces to accommodate a balanced regional growth.

This strategy can be achieved to the extent that ART transportation is able to take advantage of its reduced footprint and space requirement, and reduced parking requirement. In the long term, these advantages could help protect and restore the open space network and urban green spaces.

5 Purpose of Feasibility Study

The feasibility study is intended as a first step in evaluating the viability of implementing ART in the Twin Cities, possibly in a city that has expressed interest in an ART system. The feasibility study would address issues regarding ART benefits such as reduced air, noise and space impacts, and increased access and choices. It would also analyze the integration of ART with transit, walking, bicycling and parking; it would address impediments to ART implementation such as impacts on the built environment, including visual impacts, and funding and financing issues. The analysis would include alignment and ROW requirements, technology assessment, reliability and readiness, and construction and operating costs.

Very important, the feasibility study should contain a significant outreach and education element aimed at understanding what people (stakeholders and customers) want of their transportation system, how ART may fit in that picture, and what is the view of policymakers and legislators.

Key elements that must be considered in a feasibility analysis of ART are outlined in the attachment to this paper.

6 Estimated Budget and Schedule

The budget to complete a feasibility study and related outreach and education efforts is estimated at $1.4 million, and the anticipated study duration is two years.

7 Conclusion

The potential benefits and perceived impediments to implement an ART system in Minnesota have been documented in this report. In addition, the potential ability of an ART system to help achieve the regional goal of encouraging “efficient development and creating livable communities and work opportunities” though a variety of strategies has been addressed. Finally, the dual role of ART technology in terms of its ability to fill the “first-mile/last-mile” gaps of traditional transit services, as well as its potential for replacing many auto trips, make ART a desirable solution to a variety of urban transportation problems.

Notwithstanding the potential ART benefits and advantages described above, it is concluded that an ART feasibility study is needed to provide more definitive answers to many of the issues and question raised about ART by supporters and opponents alike. We hope that this effort has provided the rationale for funding such a feasibility analysis.

References

Personal Rapid Transit Workshop 2010, Center for Transportation Studies and the Humphrey School of Public Affairs, University of Minnesota, for the Minnesota Department of Transportation (MnDOT).

Appendix A: Automated Rapid Transit Feasibility Study Outline

Automated Rapid Transit Feasibility Study Outline

Given the continued interest in pursuing ART, a feasibility study will be needed to assess potential benefits and costs, to identify impediments and how to overcome them, and to determine whether ART is the preferred solution, and how it could move forward to implementation. The following or similar elements should be included in the feasibility analysis:

1. Define study purpose and need
   a. Provide more transportation choices?
   b. Complement current transit services?
   c. Serve an area, market segment or trips not currently well served?
   d. Reduce auto traffic in the service area?
   e. Reduce energy use and emissions?

2. Conduct alternatives analyses to select a preferred site and mode
   a. Alternative sites to be evaluated
   b. Alternative modes to be evaluated
   c. System design and connections
      - Connectivity to trip generators
      - Access to employment
      - Connectivity to transit services
      - Connectivity to parking facilities
      - Connectivity to remote special generators
      - Service characteristics (frequency, wait time, dwell time, operating speeds, etc.)
      - Fare structure and transfer arrangement
      - System design characteristics (alignment/route layout, number of stations and locations, system length, one-way/two-way operations, at-grade, below or elevated system, etc.)
   d. Passenger demand and socioeconomic profile
   e. Americans with Disabilities Act (ADA) compliance (station access, vehicle access and accommodation, etc.)

3. Impacts: positive and adverse
   a. Conflicts with pedestrians and traffic
   b. Travel time reliability
   c. Passenger and public safety
   d. Change in mode share
   e. Reduction in vehicle-miles of travel
   f. Air quality and greenhouse gas emissions
   g. Energy consumption
   h. Visual intrusion/aesthetics
   i. Noise
   j. Right-of-way (ROW) needs and property impacts
   k. System footprint and use of land
   l. Land use and transit-oriented development
   m. Disruption to transportation and land uses during construction

n. Utility relocation

4. Technology
   a. System and component reliability
   b. Passenger safety
   c. System security
   d. Emergency evacuation systems
   e. Operations under adverse weather conditions (e.g., snow/ice removal)
   f. System expandability
   g. Compatibility with legacy systems

5. Business plan
   a. Civil capital costs (tunnels, elevated structures, etc.)
   b. ROW costs
   c. Total system capital cost
   d. Annual operation and maintenance costs
   e. Revenue-generation options and total revenue
   f. Operating subsidies
   g. Economic development and job creation potential
   h. Funding options, including public and private sources
   i. Analysis of procurement options
   j. Risk assessment

6. Outreach and education
   a. Stakeholder identification and engagement
   b. Identification of policy and political champions
   c. Outreach and education plan

7. Permits and approvals
   a. Safety (fire, emergency evacuation, etc.)
   b. Environmental clearance (National Environmental Policy Act (NEPA))
   c. ROW use regulations (Federal Highway Administration (FHWA), Minnesota Department of Transportation (MnDOT))
   d. Utility relocation