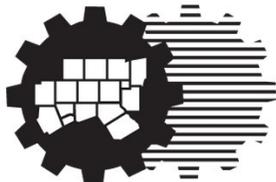


Last Mile Transit Connections Concept Study

**A Regional Exploratory Analysis of People Movers
and Other Local-Scale Transit Options**

DRAFT



**North Central Texas
Council of Governments**

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Introduction

People movers are a novel form of transportation that has recently attracted attention from local governments in the North Central Texas Council of Governments (NCTCOG) Metropolitan Planning Area, resulting in a number of proposals for new people mover systems in the region. Stakeholders have requested that the agency study the local feasibility of people movers and other local-scale transit options.

While a number of slightly varying definitions exist, for the purposes of this investigation, people movers are a form of small-scale fixed-guideway transportation that can serve as a circulator in a geographically small area, often connecting to larger-scale regional transit. After its conception in the late 1960s,¹ people mover technology enjoyed a period of intense interest but poor planning in many early systems led people movers to become somewhat emblematic of government waste and overspending.² However, when properly planned and implemented, these systems have the potential to reduce local traffic in their service area, provide opportunities for transit-oriented development, and expand the reach of existing regional transit service. Certain systems can also be used to move freight.

The purposes of this report are to introduce people mover technology and applications, examine people mover systems currently operating both domestically and internationally, assess the feasibility of this technology in the region, and identify locations where people movers might be feasible but have not been proposed. Comprehensively examining the whole region in this way will maintain equity and find implementation opportunities. The criteria and analysis process used in this analysis are designed to identify locations that may currently support people movers but could be applied to proposed development.

Available Technology

People mover systems can take a number of different forms depending on the system's context, needs, and scale. It should be noted that the technologies used by these systems are often similar to those used by light rail transit, which makes the demarcation between the two modes indistinct.

People mover systems are usually proprietary and often custom made for an application; therefore, vehicles and parts are rarely interchangeable among systems. Most vendors offer design-build or design-build-operate contracts to facilitate construction and operation of their proprietary technology.^{3,4,5}

Most systems use vehicle-mounted electric motors for propulsion, typically collecting either AC or DC electrical current from a third rail or other power distribution system built into the guideway. Propulsion is achieved either through conventional motors applying torque to the vehicle's wheels or linear induction motors (essentially an electric motor where the rotor is the vehicle and the stator is the track).⁶ Vehicles can also be driven by a moving cable pulled by a stationary motor. Many systems are fully automated but can also be controlled by drivers.

¹ http://libraryarchives.metro.net/DPGTL/publications/1968_tomorrows_transportation_new_systems_for_the_urban_future.pdf

² <http://www.citylab.com/commute/2011/12/whatever-happened-people-mover/672/>

³ <http://www.bombardier.com/en/transportation/products-services/rail-vehicles/automated-people-movers.html>

⁴ http://www.mhi-global.com/products/category/automated_people_mover.html

⁵ <http://www.dcc.at/>

⁶ http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_037.pdf

Vehicles typically ride on steel wheels similar to those found on rail vehicles, or on rubber tires similar to those used on road vehicles. Rubber tires involve more vehicle maintenance but can make for smoother rides and simpler guideways. In circumstances where the guideway's visual impact is an issue, monorail configurations are possible, but vehicles and switches are typically more complicated in these systems.

People mover systems are almost always completely grade separated, typically achieving this separation through long viaducts over obstructions or completely elevated guideway systems. Below grade and underground configurations are possible but tend to be more expensive to construct than other options.

Guideways can be configured and routed in multiple ways. Low-volume systems with only a small number of stations may be best served by a single guideway upon which a single vehicle/consist travels back and forth, particularly if the route is relatively linear. Systems with slightly higher ridership or headway expectations may be better served by adding a full or partial parallel guideway upon which another vehicle/consist can run, typically alternating between end stations with the first vehicle/consist.

Looped systems may be more practical in areas where higher ridership is anticipated or stations are not linearly distributed. A looped system also has the benefit of being able to run more than one vehicle/consist on a single guideway at the same time. Loops can incorporate single- or double-tracked spurs to outlying stations. However, a significant drawback of a single-looped system is that vehicles can only move in one direction, which means riders wishing to alight at the station previous to the one they boarded have to travel nearly the entire system to arrive at their destination, significantly adding to travel times. This is solved by adding a parallel guideway upon which a different set of vehicles can travel in the opposite direction.



Figure 1: Dallas/Fort Worth International Airport's Skylink people mover system uses rubber-tired vehicles traveling on a double-tracked elevated guideway to connect the airport's passenger terminals.⁷

⁷ Presented at NCTCOG's June 27, 2014 Regional People Mover Forum.

Locations Typically Implemented

People mover systems are typically costly compared to other forms of fixed-guideway transit, and are therefore best suited to areas where a large number of people need to circulate within a relatively small area. Systems rarely contain more than a few miles of guideway.

A vast majority of modern systems appear to be installed in airports, and most research on the topic reflects this trend.⁸ Airports are seen as ideal locations for these systems because of the need to transport large numbers of people quickly between relatively close destinations (airport passenger terminals and other facilities), often across restricted areas such as tarmacs and airfields. While widespread, such systems are not within the core scope of this study.

However, the same principles driving adoption of airport systems can apply to urban systems. Where a large number of people need to circulate within a relatively small area, adoption of these systems may be warranted. Such situations could include:

- Hospital districts/campuses where a large number of patients, medical professionals, and visitors need to circulate between multiple closely-spaced buildings.
- Entertainment districts where a large number of visitors circulate between relatively closely-spaced entertainment destinations.
- Downtowns, particularly in areas where a system could easily connect to other forms of transit and serve areas with a large number of residents and non-office commercial activity.
- Locations where a large attraction (stadium, airport, etc.) is not directly served by a nearby regional transit route; a two-station linear route connecting transit to the attraction could reduce travel times to/from the attraction and increase ridership on the connecting transit line.
- Other areas where a mix of uses exists in a small area and large volumes of people circulate between them.

People mover systems generally do not function well in areas lacking a mix of uses or a demonstrably large internal circulation. This includes homogenous office parks and office-dominated downtowns, unless the project is part of a centralized parking scheme or connected to regional transit.

This analysis will focus primarily on systems that provide circulation within urban areas, with a secondary focus on connections to transit. Future iterations of this study may broaden the scope to include freight and special activity centers.

Systems Operating in the Region

Two people mover systems currently operate in NCTCOG's Metropolitan Planning Area. Understanding how these systems were implemented and currently operate is therefore a useful component of a regional people mover feasibility study.

Las Colinas Area Personal Transit⁹

The Las Colinas Area Personal Transit (APT) System serves as a circulator in the Las Colinas Urban Center in Irving. The full build-out of three inner loops and one outer/express loop was conceived as a core component of this master planned development. Originally opened in 1989 with a 1.5-mile first phase

⁸ http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_037.pdf

⁹ <http://www.dcurd.org/apt-system/>

funded by a public-private partnership, the system has seen low ridership and periods of service suspension due to the failure of projected office development to materialize in the area's volatile real estate market. The fact that land uses in the area have been (until quite recently) relatively homogenous may also have contributed to lower ridership.

However, with the extension of Dallas Area Rapid Transit's (DART) Orange Line through Las Colinas in 2012, the Las Colinas APT now has a direct connection to broader regional transit, a key component that has led to success in other people mover systems. Hours of operation have been expanded to accommodate commuters transferring from DART, and ridership ballooned from roughly 500 passengers per week before the Orange Line opened to roughly 3,000 passengers per week in 2014. Nearby multifamily residential development (which may in part be fueled by the Orange Line) may also be driving some of this increased ridership. This growth has motivated expansion plans, including infill stations, double tracking the single-tracked portion of the route, and extending the system south to a future transit station and north to serve projected new development. Given the recent increase in ridership and proposed development in the area, these proposed expansions may be warranted.



Figure 2: The Las Colinas APT people mover connects the Las Colinas Urban Center in Irving to regional transit.¹⁰

The current fare-free system is operated and maintained by the Dallas County Utility and Reclamation District (DCURD), a tax-funded authority that maintains infrastructure in Las Colinas. The manually-driven cars are dispatched on demand to serve riders at four stations, one of which is directly connected to DART's Las Colinas Urban Center Station. The guideway is currently composed of three spokes which were originally intended to be part of two of the system's three planned inner loops. Over these guideways, DCURD operates two lines that share the longer spoke and split at the system's central junction. The DART connection is at the end of one of the shorter spokes, which means that the single station on the other short spoke is not directly connected to DART. DCURD plans to double track the single-tracked portions of the guideway and add another route, which would alleviate this problem.

The Las Colinas APT was built as part of a speculative development that has not yet achieved full build out. This investigation is not identifying greenfield locations to develop people mover systems as was done in Las Colinas; rather, it seeks to identify locations that have the land uses and density that would currently support people mover systems. However, DCURD's experience with this system may still provide useful information about what would make an urban people mover system work in the region. Perhaps

¹⁰ Presented at NCTCOG's June 27, 2014 Regional People Mover Forum.

the most notable lesson is that this system saw a significant boost in ridership after it was connected to DART's Orange Line. This provides local confirmation of what has been seen in other systems: that a connection to some kind of existing transit is often key to successful implementation of people movers.

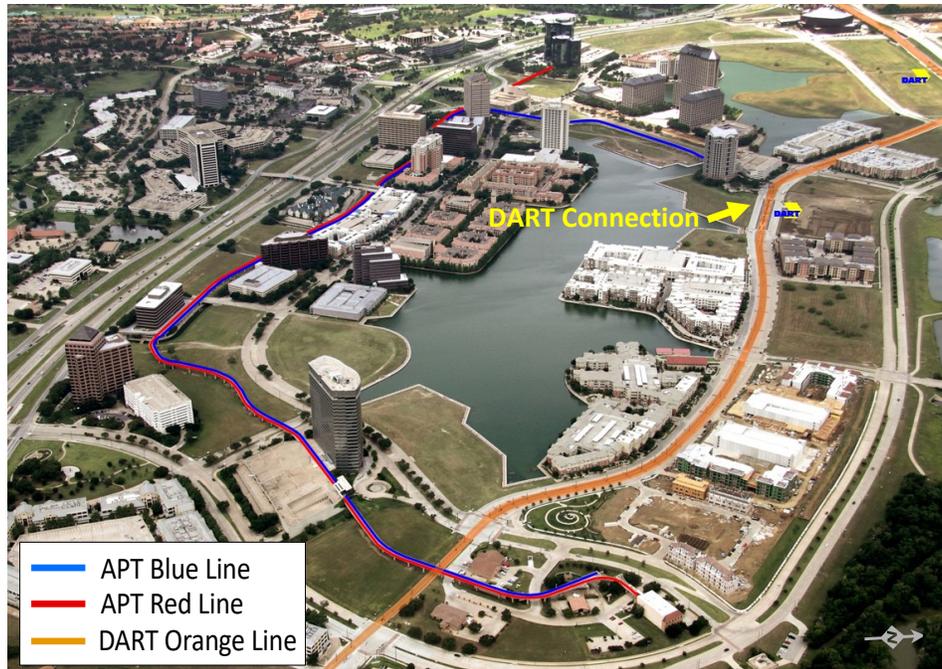


Figure 3: Current Las Colinas APT system.¹¹ The red and blue lines in this oblique aerial represent the current system. Note the presence of DART's Orange Line and its connection to the people mover system in the upper right quadrant.

Dallas/Fort Worth International Airport SkyLink

Dallas/Fort Worth International Airport's Skylink is an airside¹² people mover that shuttles passengers between the airport's five terminal buildings. Opened in 2005 to replace an older system, the 4.8-mile Skylink system has a maximum round trip travel time of 20 minutes, which is essential for quickly transporting passengers to connecting flights. Since Skylink remains on the secure side of the airport, it does not directly connect to parking, car rental facilities, transit, or other forms of ground transportation. However, it remains successful due to concentrated large numbers of passengers that need to move between distant terminals while remaining on the airside of security checkpoints.

¹¹ Presented at NCTCOG's June 27, 2014 Regional People Mover Forum.

¹² Refers to those areas of an airport that are on the ground but inside the secured portion of the terminal. "Landside" is used to refer to those areas outside of security.

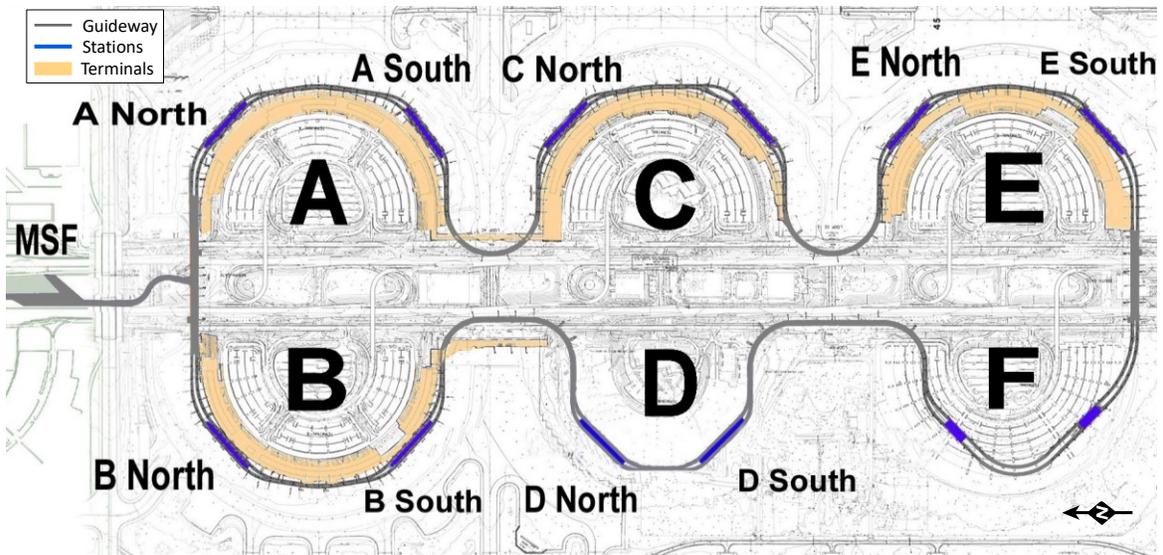


Figure 4: Current Dallas-Fort Worth Skylink system.¹³ Note the double-tracked looped route with an additional bulge built to accommodate a future Terminal F.

Operated as a fare-free service by the airport, Skylink uses fully automated rubber-tired vehicles. The system operates on two-minute headways, which necessitates a fleet of 64 vehicles. The guideway is an elongated double-tracked loop; a unidirectional single loop would provide unsuitably long travel times to those wishing to alight at the station previous to the one at which they boarded.

Airport people mover systems, particularly those serving the secure side of airport terminals, are beyond the scope of this analysis. These systems have much tighter security and see radically different ridership patterns than would be expected on an urban system. However, since airport systems comprise a majority of recent installations of people movers, they still have a role to play by informing discussions about available technologies.

Airtrans Adaptable People Mover (Closed)

Airtrans Adaptable People Mover (APM) was Dallas/Fort Worth (D/FW) International Airport's original people mover system, which operated from shortly after the airport's opening in 1973 until it was replaced by Skylink in 2005. Airtrans was a relatively slow, unidirectional system with stations on the outside of the secure areas of the airport terminals which made transfers between terminals inconvenient. Despite these drawbacks, Airtrans is still worth mentioning as a good example of the early application of a number of technologies commonly associated with people movers, particularly those related to automation.

Systems Proposed in the Region

Recent interest in people mover systems has resulted in a number of new proposals for systems in NCTCOG's Metropolitan Planning Area. In June 2014, NCTCOG held a People Mover Regional Forum in which stakeholders presented information regarding their proposed systems. Proposals discussed included:

¹³ Presented at NCTCOG's June 27, 2014 Regional People Mover Forum.

- Dallas Love Field
- Dallas Midtown
- Dallas Southwestern Medical District
- Arlington Entertainment District
- Arlington General Motors Facility (freight)
- Irving Freeport

Additionally, discussions have since begun regarding a potential people mover system at the Naval Air Station Fort Worth Joint Reserve Base. Some of these proposals have laid out preliminary routes while others are currently more conceptual.

Arlington Entertainment District (D/FW International Airport to University of Texas at Arlington)

This system is proposed to connect D/FW International Airport, Fort Worth’s Centreport district (including the Centreport Trinity Railway Express Station), a potential high-speed rail station along IH 30, Arlington’s entertainment district (including Six Flags, AT&T Stadium, and Globe Life Park), downtown Arlington, and the University of Texas at Arlington campus. The system would provide connections to multiple forms of fixed-rail transit and very roughly duplicate the service currently offered by the Metro Arlington Xpress commuter bus.

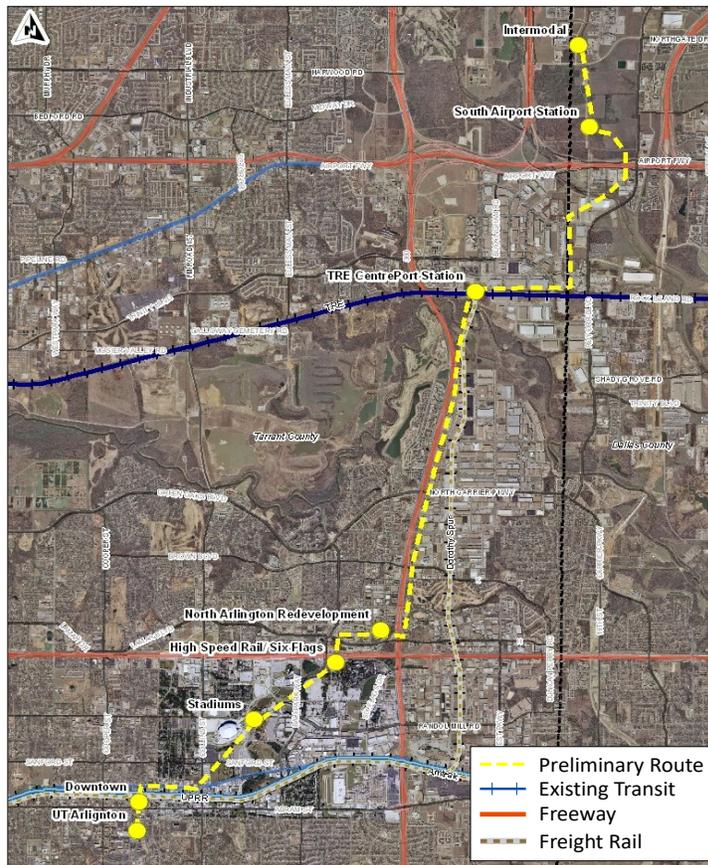


Figure 5: Conceptual routing for Arlington’s proposed system.¹⁴ The system proposes to connect the University of Texas at Arlington, downtown Arlington, the entertainment district, and redevelopment areas with D/FW International Airport and multiple forms of transit.

¹⁴ Presented at NCTCOG’s June 27, 2014 Regional People Mover Forum.

Arlington General Motors Facility

This freight mover system is proposed to connect the General Motors Arlington assembly plant to the nearby Union Pacific railyard where vehicles assembled at the plant are shipped, which includes crossing SH 360. Currently, vehicles assembled at the plant are moved to the railyard on trucks using SH 360's frontage roads and Abram Street, which has led to congestion and safety concerns. A freight mover system connecting these two sites would increase the plant's efficiency and have a positive impact on the transportation system in the area despite the fact that it would not move passengers.

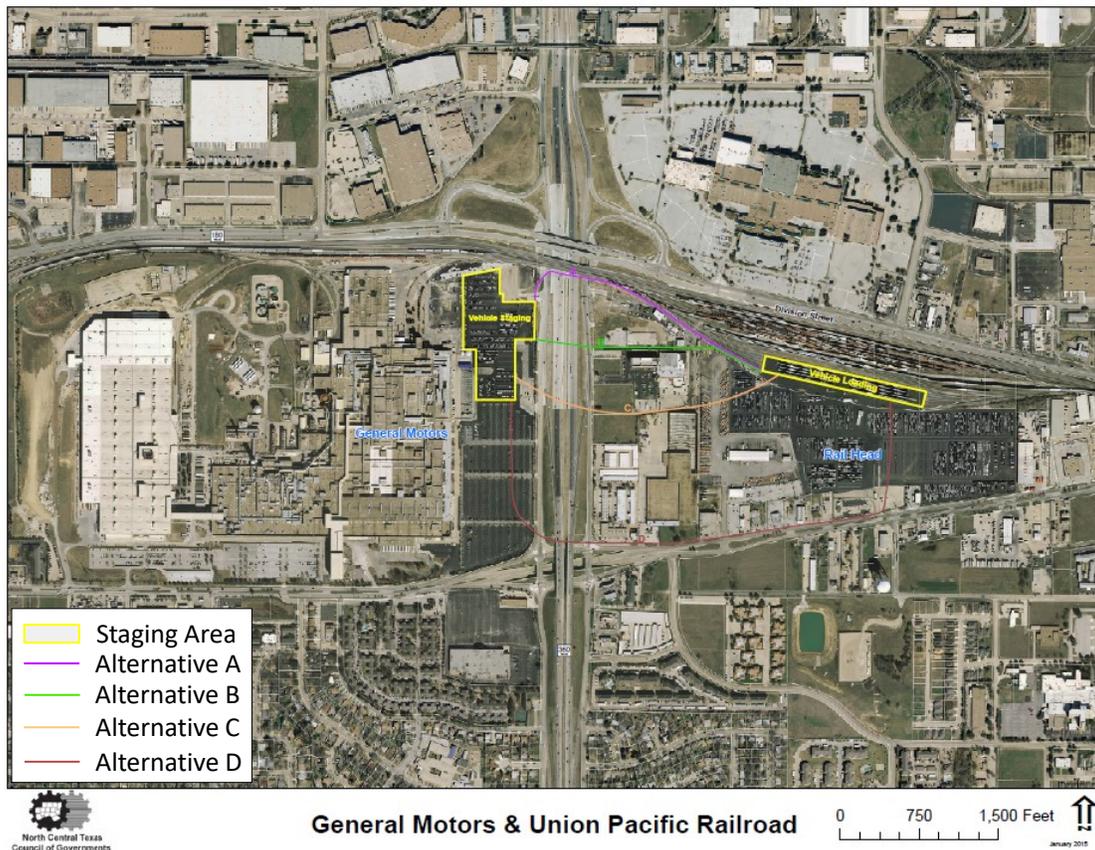


Figure 6: Potential routes for a freight mover system at General Motors Arlington.¹⁵

Dallas Love Field

This proposed system is an example of a people mover that would connect an important regional destination to a nearby transit line. DART's Green Line and Orange Line run adjacent to the airport property but do not directly serve the terminal. The currently proposed system is actually the second to be proposed for this area; the first would have directly connected the terminal to the Burbank Station. While this is a relatively short distance, it would have required a tunnel under one of the airport's main runways, which was determined to be prohibitively expensive. The second and current proposal is a two-mile elevated system that would connect the terminal to the Inwood/Love Field Station, potentially serving a rental car facility along the way. This would duplicate the service currently offered by DART's

¹⁵ Presented at NCTCOG's June 27, 2014 Regional People Mover Forum.

Love Link 524 bus route. This system is relatively close to the proposed system in the Southwestern Medical District, so possibilities for integration of these systems exist.



Figure 7: Proposed People Mover System at Dallas Love Field.¹⁶ The proposed line (shown here in yellow) connects the airport terminal to a rental car facility and DART's Inwood/Love Field Station.

Dallas Midtown

Dallas's Midtown Redevelopment Plan proposes to redevelop the area immediately north of the LBJ Freeway (IH 635) between the Dallas North Tollway and Preston Road. This area includes the Dallas Galleria and Valley View Mall, the latter of which is struggling and is seen by its owners as ripe for redevelopment. Both people movers and rubber-tired trolleys have been proposed as circulators within the redeveloped district. Longer-distance people movers have also been preliminarily proposed to connect the district to DART's Red Line four miles to the east and/or the future Cotton Belt Line roughly two miles to the north.

¹⁶ Presented at NCTCOG's June 27, 2014 Regional People Mover Forum.

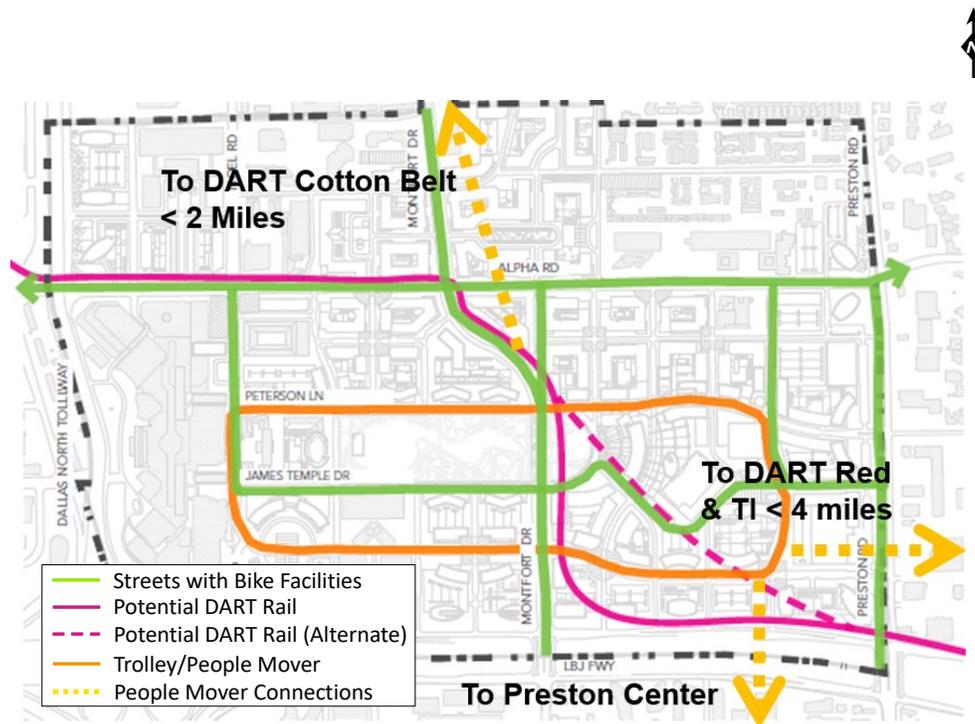


Figure 8: Proposed people mover connections in Dallas Midtown.¹⁷ A local circulator (either an on-street shuttle or grade-separated people mover) is shown in orange with potential longer-distance people mover connections in yellow.

Dallas Southwestern Medical District

Dallas’s Southwestern Medical District contains Dallas County’s Parkland Hospital, the Children’s Medical Center Dallas, and the University of Texas Southwestern Medical Center. The University of Texas Southwestern maintains a number of distinct campuses in the district, including its North Campus, South Campus, University Hospital, and William P. Clements Jr. University Hospital, among others. This expansive district is bisected by Harry Hines Boulevard. Shuttles circulate patients, staff, and visitors around the district, some of which run on elevated guideways. The district is looking to expand the current shuttle bus guideway system to provide more effective circulation. These are being designed for rubber-tired busses with the option to upgrade to a fixed-guideway system at a later time. This system is relatively close to the proposed system serving Love Field, so the possibility exists for integration if compatible technologies are chosen.

¹⁷ Presented at NCTCOG’s June 27, 2014 Regional People Mover Forum.

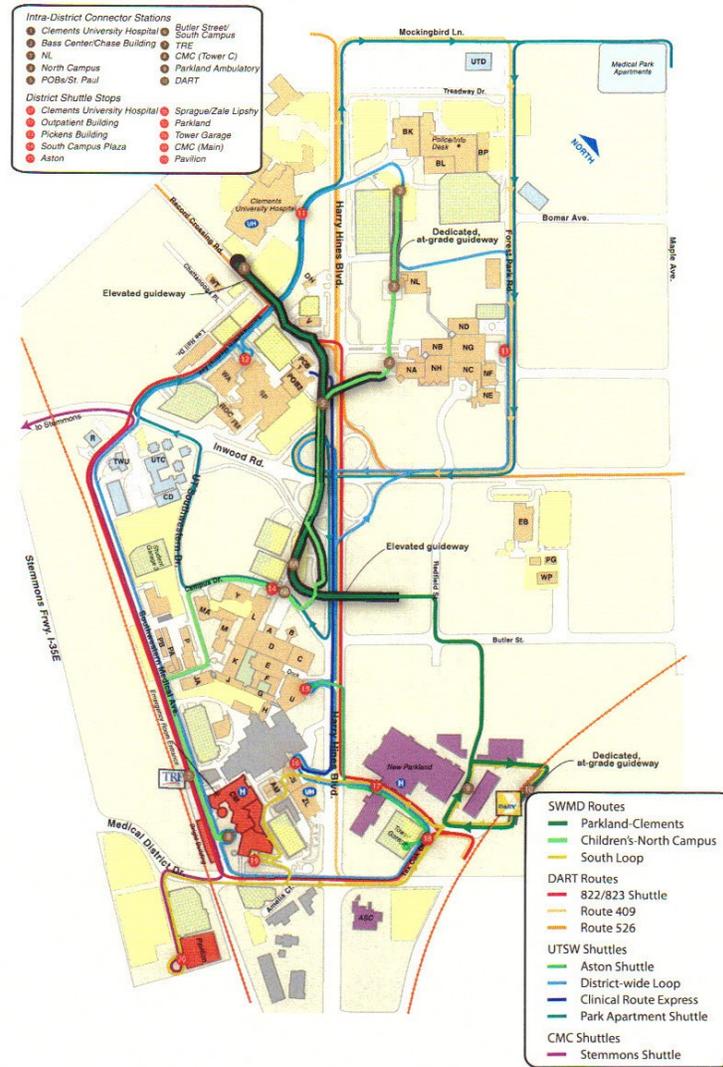


Figure 9: Proposed Shuttle Bus Network in the Southwestern Medical District.¹⁸ Note the expanded elevated guideway (bold lines)

Irving Freeport

This system is proposed to serve passengers and freight in Irving’s Freeport area, an industrial and office district located immediately north of Dallas/Fort Worth International Airport between Carpenter Freeway (SH 114) and LBJ Freeway (IH 635). The system is preliminarily routed as a loop with a short spur that would connect the system to a future station on DART’s Orange Line. Since this area has limited residential development, the system might function similarly to the nearby Las Colinas APT, where a large proportion of riders are area employees that commute on the DART light rail system.

¹⁸ Presented at NCTCOG’s June 27, 2014 Regional People Mover Forum.

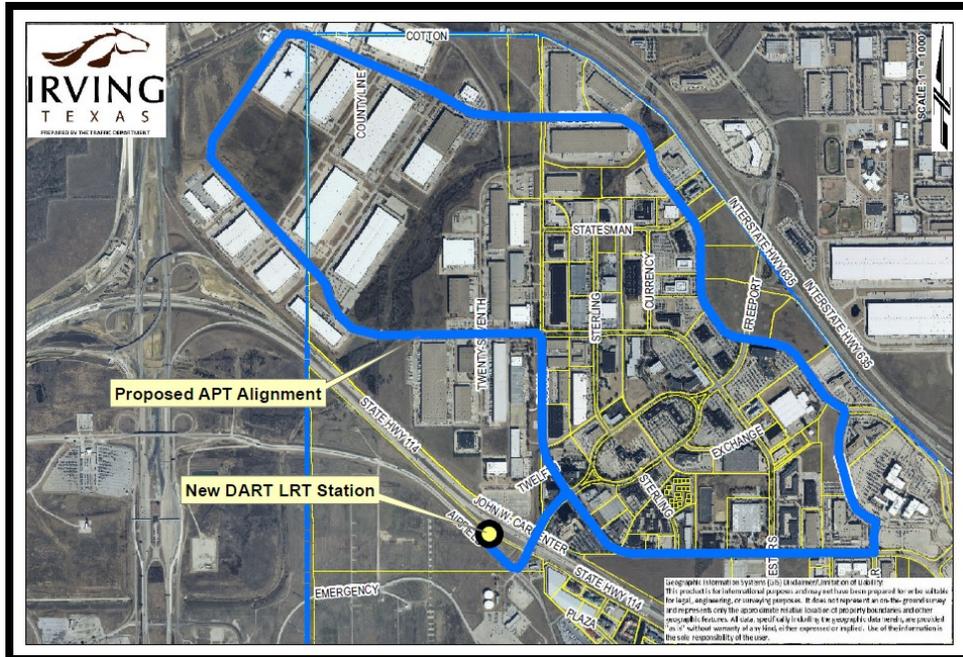


Figure 10: Proposed people mover at Irving Freeport.¹⁹ Shown here in blue, this potential system would connect an office and industrial area to DART's Orange Line.

Naval Air Station Fort Worth Joint Reserve Base

Another preliminary proposal has been considered for a system at Naval Air Station Fort Worth Joint Reserve Base. This would provide circulation at the base with a connection to the nearby Lockheed Martin Aeronautics headquarters.

Systems Operating in Other North American Cities

Since only one urban people mover system is currently operating in the region, this analysis looks to examples of these systems in other cities to understand potential successes and failures. Fourteen of these systems are currently operating in North America, not including those completely contained within theme parks or on the secure side of air terminals. This includes those where automated people mover technology is being used on some or all lines in larger regional transit networks. Of these 14, 4 were selected for further analysis based on their similarities to proposed systems or because of their notable successes: the Indiana University Health People Mover in Indianapolis, Indiana; the Jacksonville Skyway in Jacksonville, Florida; the Metromover in Miami, Florida; and the SkyTrain in Vancouver, British Columbia.

¹⁹ Presented at NCTCOG's June 27, 2014 Regional People Mover Forum.

System	Metro	Context	Year Operation Began	Length (miles)	Number of Stations	Q1 2015 Weekday Ridership
Indiana University Health People Mover	Indianapolis, IN	Hospital	2003	1.4	3	
Jacksonville Skyway	Jacksonville, FL	Downtown	1989	2.5	8	4,500
Metromover	Miami, FL	Downtown	1986	4.4	21	33,700
SkyTrain	Vancouver, BC	Citywide	1985	42.7	47	363,800

Table 1: North American Case Study Systems

Indiana University Health People Mover^{20,21}

Since 1997, the Methodist Hospital of Indianapolis, Indiana University Hospital, and the Riley Hospital for Children have been jointly operated as a single hospital system. This consolidated operation means that doctors, medical students, patients, and visitors regularly need to move between the three non-contiguous hospital campuses. This is an ideal application for people mover technology since large numbers of people need to circulate within and between these small areas. This modified monorail system consists of a single double-tracked line that runs through the campuses and above city streets between them, at one point dipping down to ground level to cross under a freeway. It has no direct connections to other forms of fixed-guideway transit but remains successful because of the need for local circulation.

The Indiana University Health People Mover is a privately-owned system operating in a public right-of-way; at the time of its construction, this was unprecedented in the United States.²² To make this possible, the Indianapolis City-County Council had to pass special legislation and enter into a franchise agreement with the hospital system. All funding for the people mover came from a \$40,000,000 private investment by the hospital system, which included costs for community improvements and station enhancements.²³ No taxpayer funding was used.



Figure 11: Indiana University Health People Mover vehicle in operation on its elevated guideway.²⁴

²⁰ This system was formerly known as the Clarian Health People Mover.

²¹ <http://iuhealth.org/university/for-patients/places-to-stay-and-transportation/>

²² http://www.indympo.org/SiteCollectionDocuments/www.indympo.org/PDF/tempo_se_10_02.pdf

²³ <http://www.schwagerdavis.com/pdf/clarian.pdf>

²⁴ <https://www.flickr.com/photos/littlesister/470590098>

This system is included because it is directly analogous to the proposed system at Dallas' Southwestern Medical District. They are likely to utilize different technology and funding mechanisms but would operate in similar environments.

Jacksonville Skyway²⁵

The Jacksonville Skyway in Jacksonville, Florida was one of the three systems ultimately constructed under the Urban Mass Transit Administration²⁶ Downtown People Mover Program which solicited and funded proposals for people mover systems in the downtown areas of cities.²⁷ First opened in 1989, this system has seen a number of upgrades and expansions and currently serves the central business district, a convention center, a college campus, and Jacksonville's main bus terminal. It has no direct connection to fixed-guideway transit. Operated by the Jacksonville Transportation Authority (JTA), this completely elevated monorail system consists of three linear spurs that operate as two lines; one of the spurs is shared by both of the lines. Individually, the spurs consist of two linear (non-looped) parallel guideways.

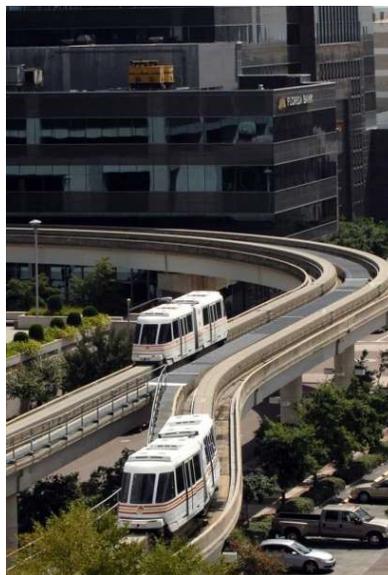


Figure 12: Two Jacksonville Skyway trainsets in operation.²⁸

A majority of the Skyway's \$183 million construction cost (1989 dollars) was covered by funding from the Downtown People Mover Program.²⁹ For most of its operational history, JTA has partially funded the system's operation by charging a passenger fare; however, the system is currently fare free³⁰. In September 2015, JTA announced it is reviewing the future of the Skyway, which needs \$64 million in improvements, including vehicle replacement and expansion. The JTA board will decide by January 2016 whether they will overhaul the system, incrementally upgrade, or terminate service.³¹ This review is in

²⁵ <http://www.jtafla.com/schedules/skyway/>

²⁶ The Urban Mass Transit Administration has since been renamed the Federal Transit Administration.

²⁷ <http://www.metrojacksonville.com/article/2014-oct-the-skyway-express-should-we-keep-or-get-rid-of-it>

²⁸ <http://jacksonville.com/news/metro/2013-09-09/story/jta-continues-quest-build-new-skyway-station-despite-missing-out-10#>

²⁹ <http://jacksonville.com/news/metro/2010-09-05/story/after-20-years-jacksonville-skyway-remains-punchline>

³⁰ <https://faculty.washington.edu/jbs/itrans/jack.htm>

³¹ <http://www.bizjournals.com/jacksonville/print-edition/2015/09/18/what-comes-next-for-the-skyway.html>

part due to lower than expected ridership, which has given the system a negative reputation.³² This lower ridership may be in part due to poor land-use planning, overbuilt parking in the system's service area, and the lack of a direct connection to regional transit. Lessons learned by JTA in operating this system could be applied to proposed systems in the area that serve a dense area but are not able to connect to other fixed-guideway transit.

Metromover³³

Another of the people mover systems funded by the Downtown People Mover Program, Miami's Metromover system serves as a downtown last-mile circulator for Miami's Metrorail heavy rail rapid transit system. Metromover sees much higher ridership than the system in Jacksonville, which may be due to a combination of factors, including the system's larger extent and Miami's larger population. Another key factor is its connection to regional fixed-guideway transit. First opened for operation in 1986, Metromover uses rubber-tired vehicles on a double-tracked elevated guideway to circulate passengers on two loops and two spurs in Miami's central business district and surrounding neighborhoods.



Figure 13: Miami Metromover vehicle in operation.³⁴

Metromover costs \$22.5 million per year to operate.³⁵ The system is primarily funded through county subsidies of the fare, local gas tax,³⁶ and matching federal funds. As of this writing, the transit service is free for all riders; however, prior to the 2002 approval of a half-penny transit tax³⁷ to provide a dedicated funding source to Metromover and other transportation projects,³⁸ the fare was 25 cents. Reasons for lifting the fare included a desire to boost ridership and a realization that the cost of collecting the fare nearly exceeded the funding it raised.

³² <http://jacksonville.com/news/metro/2010-09-05/story/after-20-years-jacksonville-skyway-remains-punchline>

³³ <http://www.miamidade.gov/transit/metromover.asp>

³⁴ <http://www.miamidade.gov/transit/metromover.asp>

³⁵ <http://www.bizjournals.com/jacksonville/news/2015/09/21/how-the-skyways-counterpart-is-a-big-success-in-a.html>

³⁶ <http://www.miamitodaynews.com/2015/02/25/metromover-fare-right-track-let-voters-engineer/>

³⁷ <http://www.miamitodaynews.com/2014/03/19/transit-tax-path-still-debated/>

³⁸ <http://www.miamidade.gov/citt/history.asp>

SkyTrain³⁹

Vancouver's SkyTrain system straddles the often blurry line between people mover systems and light rail transit. While it serves a large area and has station spacing typically associated with light rail, it also has the automated vehicles, completely grade-separated guideway, and frequent headways (2 to 7 minutes at peak times) typically associated with people mover systems. Operated by TransLink (Vancouver's transportation authority⁴⁰), the system's fully-automated vehicles run on rails and are driven by a combination of linear induction and traditional electric motors. Originally opened in 1985 with a starter system, it has since been expanded to include three lines and 42.7 miles of double-tracked guideway. A fourth line is under construction and projected to open in 2016. It has by far the highest ridership of any of the systems studied. This is likely due to the system's much larger size, but ridership may also be influenced by more transit-conducive land-use patterns in Vancouver. While this system is too large to be considered a traditional people mover system, its success shows the extensibility of people mover technology. It is included in this analysis to provide context for longer people mover proposals in the region connecting more distant destinations such as the proposed system linking Arlington to D/FW International Airport.



Figure 14: Vancouver SkyTrain trainset awaiting passengers in a station.⁴¹

As Vancouver's SkyTrain is operated by TransLink, it is funded by many of the same revenue sources as TransLink itself, including passenger fares, property taxes, fuel taxes, parking taxes, a power levy, bridge tolls, a vehicle levy, and the Area Benefitting Tax.⁴² Capital costs for building the area's transit systems are typically shared with the federal government and local sources. TransLink operates its services through concessions with a number of operating companies including, but not limited to, British Columbia Transit Company Ltd. which maintains the SkyTrain and commuter rail lines.

³⁹ <http://www.TransLink.ca/en/Fares-and-Passes/Single-Fares.aspx>

⁴⁰ <http://www.TransLink.ca/en/About-Us.aspx>

⁴¹ <http://www.vancitybuzz.com/2012/09/vancouver-transit-fines-fare-evaders/>

⁴² <http://buzzer.TransLink.ca/2013/03/TransLink-101-where-does-TransLink-get-its-funding-and-how-do-we-spend-it/>

Systems Operating Outside North America

Small-scale people movers are used worldwide, often with technology and applications similar to domestic systems. Transit funding and policy varies dramatically between countries but examining the nonfinancial aspects of a curated subset of these people mover systems is still useful. Many large-scale regional transit systems operating internationally share technologies with people movers, but since this analysis is intended to focus on local circulators, these are largely beyond the scope of this discussion.

Dortmund, Germany's H-Bahn ferries passengers to disconnected sections of a college campus and links to regional transit.⁴³ The system consists of 1.9 miles of elevated monorail guideway from which automated vehicles are suspended. Headways vary from 40 to 100 seconds and the system is estimated to carry over 5,000 passengers per day. Suspension railways like this tend to be more complex and expensive than other people mover technologies but they can be ideal for tourist-oriented systems since guideways are less obtrusive and the vehicles can provide unimpeded views of the terrain over which they are passing.

Cabletren Bolivariano is a cable-pulled people mover system in Caracas, Venezuela.⁴⁴ Its 1.3-mile double-tracked elevated guideway connects five stations in an urban area. The use of cables pulled by stationary motors in this system allows for simpler, cheaper vehicles and a lighter guideway. Despite having remote traction power, the system is able to achieve 4.5-minute headways and speeds as high as 29 mph.

Birmingham International Airport AirRail Link is another modern cable-pulled people mover in Birmingham, United Kingdom.⁴⁵ Using the same technology as Cabletren Bolivariano, the system connects the airport terminal to a regional rail station with a 0.4-mile double-tracked guideway. The current system replaced an older and more complex magnetic levitation people mover; reusing the old guideway structure greatly cut down on costs.

Charles de Gaulle Véhicule Automatique Léger (CDGVAL) is another landside airport system that connects Paris' Charles de Gaulle Airport to regional and long-distance transit.⁴⁶ The automated 2.2-mile linear system achieves 4-minute headways and has a maximum possible trip time of 8 minutes using its fleet of rubber-tired vehicles.

The Zhujiang New Town Automated People Mover System in Guangzhou, China is a fully underground people mover system that is tightly integrated with Guangzhou's subway system.⁴⁷ The automated rubber-tired vehicles provide local circulation to nine stations along a 2.4-mile linear route, which enhances regional transit's connectivity to a central business district.

Internationally, people movers are still seen as an effective solution to small-scale local transportation; four of the five systems introduced here began operations after 2000. As with domestic people movers, a large proportion of modern systems appear to be installed in or near airports but urban circulator systems still have a presence. This suggests that urban circulator systems may be a valid solution locally in areas

⁴³ <http://www.h-bahn.info/en/index.php>

⁴⁴ <http://www.dcc.at/references/cabletren-bolivariano-caracas/>

⁴⁵ <http://www.dcc.at/references/air-rail-link-birmingham-uk/>

⁴⁶ <http://www.businesswire.com/news/home/20070403005639/en/CDGVAL-Aeroports-De-Paris-Inaugurates-Automated-People-Mover>

⁴⁷ <http://www.railwaygazette.com/news/single-view/view/guangzhou-apm-enters-service.html>

with similar land use, demographics, and transportation policy, though differences in funding and the transportation planning process in other countries would make for an unwieldy direct quantitative comparison. Limiting direct comparison to systems operating in North America avoids these difficulties and makes for a stronger analysis process.

Land-Use Patterns in North American Systems

Connecting land uses is the fundamental purpose of transportation systems, so understanding land use is key to understanding how a transportation system will perform. People mover systems, like most other forms of fixed-route mass transit, perform best when the land use around stations is highly walkable and dense with employment, housing, and activities (origins and destinations). This reduces the need for transfers between transportation modes and tends to result in higher ridership.

To evaluate the land-use densities most appropriate for people movers, this study analyzed both residential and employment density surrounding the four North American case study systems using ArcGIS. These are not the only land-use factors that influence transit ridership but population and employment densities are uniform measures with wide and consistent coverage from reputable data sources. Data for population came from the US 2010 Decennial Census⁴⁸ and the Canadian 2011 Census.⁴⁹ Data for employment came from the US Census Bureau's 2013 Longitudinal Employer Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) dataset.⁵⁰ This dataset includes a breakdown of jobs by the 20 North American Industry Classification System (NAICS) sectors, which can be used as a proxy to indicate specific types of land use (e.g. professional office jobs are more likely located in multistory office buildings). An equivalent Canadian data source for employment was not found.

Since a half mile is the generally accepted effective walkshed for transit stations, the total population and employment within one-half mile of each station on each system was calculated. Densities (per square mile) were calculated from these sums, and the final values used in later analysis represent the average densities of all studied stations.

In addition to the GIS analysis, literature written about the systems was consulted to understand any policy or development characteristics that may be influencing ridership. In Miami and Vancouver, the presence of local government land-use policies to increase density and focus public development funding on stations improved the performance of the systems.^{51,52} A lack of coordinated policy in the case of Jacksonville most likely contributed to its lower ridership. This is consistent with the larger body of literature on land use and transportation.

In the case of Indianapolis, the system was a product of one private enterprise.⁵³ Here, public policy was not a factor as an overwhelming majority of adjacent land uses were controlled by a single entity. This indicates that people mover technology may be a sound investment for areas with unified ownership of an area too large to be comfortably walked.

⁴⁸ <http://www.census.gov/2010census/>

⁴⁹ <http://www12.statcan.gc.ca/census-recensement/index-eng.cfm>

⁵⁰ <http://lehd.ces.census.gov/data/>

⁵¹ http://web1.ctaa.org/webmodules/webarticles/articlefiles/Miami_Metrorail_Metromover.pdf

⁵² <http://www.gammathetaupsilon.org/the-geographical-bulletin/2010s/volume51-1/article3.pdf>

⁵³ <http://www.schwagerdavis.com/pdf/clarian.pdf>

The results of this land-use analysis indicate that population density within a half mile of people mover stations should be above approximately 8,200 persons per square mile, and employment density should be above approximately 32,900 jobs per square mile. Employment around people movers systems should tend to specialize in education; healthcare; public administration; professional, scientific, and technical services; and finance and insurance.⁵⁴ Additionally, local governments should enact and enforce policies to support dense development or the area around stations should be under consolidated ownership.⁵⁵

Quantitative Identification of Potential Sites

Analyzing the entire region for characteristics conducive to people mover systems is needed to identify locations that might currently support systems but haven't yet been identified. When combined with existing proposals, this should provide a guide for urban people mover investments in the region going forward.

The fundamental assumption underlying this process is that the four North American case study systems could be, on average, considered successful. A further assumption is that the land-use characteristics around these systems can be used to forecast the success of systems in the Dallas-Fort Worth area. As identified in the land-use study, four core land-use characteristics appear to be important to success in these systems: population density, employment density, the right mix of employment (typically professional), and the presence of conducive land-use policy and/or uniform institutional control of land. As land-use policy is predominately made at the municipal level, there is significant variation in how it is made and applied in the region which makes its inclusion in a regional analysis impractical. However, uniform institutional control of land can be inferred by the presence of large contiguous parcels of institutional land use in NCTCOG's land-use dataset. The absence of specifically prohibitive land uses is added in as well to restrict the resulting output. Additionally, airport terminals with more than 10 million passenger enplanements per year (D/FW International Airport and Dallas Love Field) are given a point to help reflect the reality that large passenger airports are conducive to people mover systems despite the fact that these are largely beyond the scope of this analysis. These six characteristics were used to develop a scoring matrix to spatially evaluate the region on a six-point scale.

Table 2 presents each metric and the values that are required to achieve the minimum and maximum subscores for the metric. For each metric, values equal to or below the minimum cutoff value are assigned a subscore of 0. Values above or equal to the maximum cutoff value are assigned a full subscore of 1 (or 0.25, in the case of the employment mix metrics). For all metrics except airport enplanements, values in between the minimum and maximum are assigned a subscore using a linear sliding scale. This is reversed for the prohibitive land-uses metric, since less prohibitive land use is a positive characteristic.

⁵⁴ These correspond to North American Industrial Classification System (NAICS) Sectors 61, 62, 92, 54, and 52, respectively.

⁵⁵ http://www.starconference.org.uk/star/2008/Kristin_Olson.pdf

Metric	Source	Year	Initial Geography	Units	Minimum Subscore			Maximum Subscore			
					Value	Source	Subscore	Value	Source	Subscore	
Population Density	NCTCOG forecast	2014	Traffic Survey Zone	Persons per square mile	709.4	MPA Mean	0	8,151	Mean from Analyzed Systems	1	
Employment Density	NCTCOG forecast	2014	Traffic Survey Zone	Jobs per square mile	446.1	MPA Mean	0	32,944	Mean from Analyzed Systems	1	
Employment Mix	Percentage of Workforce in NAICS Sector 52	LODES	2013	Block Groups	Percentage of LODES total	1.965%	MPA Mean	0	6%	Mean from Analyzed Systems	0.25
	Percentage of Workforce in NAICS Sector 54	LODES	2013	Block Groups	Percentage of LODES total	4.075%	MPA Mean	0	8%	Mean from Analyzed Systems	0.25
	Percentage of Workforce in NAICS Sector 61	LODES	2013	Block Groups	Percentage of LODES total	7.357%	MPA Mean	0	27%	Mean from Analyzed Systems	0.25
	Percentage of Workforce in NAICS Sector 62	LODES	2013	Block Groups	Percentage of LODES total	6.689%	MPA Mean	0	21%	Mean from Analyzed Systems	0.25
	Percentage of Workforce in NAICS Sector 92	LODES	2013	Block Groups	Percentage of LODES total	1.957%	MPA Mean	0	16%	Mean from Analyzed Systems	0.25
Presence of Conducive Land Uses	NCTCOG Land Use	2010	Land use polygons	Percentage of land area	2.455%	MPA Mean	0	10.79%	MPA Mean + 2σ	1	
Absence of Prohibitive Land Uses	NCTCOG Land Use	2010	Land use polygons	Percentage of land area	53.77%	MPA Mean + 2σ	0	13.73%	MPA Mean	1	
Airport Passenger Enplanements	Airport Reports	2015	Terminal Polygons	Annual Enplanements	N/A	N/A	N/A	10 mill.	Analyst Decision	1	
Total Score										6	

Table 2: Scoring Metrics

In all cases, the lower of the two cutoff values is the mean value for that metric in the region. In the population density, employment density, and employment mix metrics, the high cutoff value is derived from average of values found in the other North American systems. In the land-use metrics, the high cutoff value is the mean value plus two standard deviations. In simpler terms, an area must exceed the average value found in the land-use case study (or the local average plus two standard deviations) to achieve full points for a metric, but partial points are still awarded if an area exceeds the region’s local average for that metric.

The sum of the employment mix subscores is not allowed to rise above 1 despite the fact that it can sum to 1.25, which is intended to give an advantage in scoring to areas that may not specialize in all of the analyzed sectors. This also means that all six metrics are given equal weight, and the maximum possible score is 6/.

Conducive land uses include 'Institutional/Semi-Public', 'Education', and 'Mixed Use', but only where they are not assigned 'Primary Education', 'Private Education', or 'Secondary Education' development points. This is meant to capture large institutions like college campuses and hospitals where trip patterns and uniform institutional control of land have been keys to success in other systems. In NCTCOG’s land-use dataset, public schools are classified in the same way, so the development points are needed to eliminate them where possible.

Prohibitive land uses include 'Cemeteries', 'Landfill', 'Mobile Home', 'Parks/Recreation', 'Single Family', 'Small Water Bodies', 'Water', 'Farmland', 'Flood Control', 'Improved Acreage', 'Ranch Land', 'Residential Acreage', 'Timberland', and 'Vacant' uses. These land uses were identified as not being supportive of people mover systems. Single-family residential is considered prohibitive due to redevelopment concerns and relatively low population densities. Vacant and agricultural lands are considered prohibitive due to their lack of current development; this is not meant to imply that these areas will never develop or ever be able to support people mover systems. Classifying undeveloped land uses as currently prohibitive puts this metric in line with the near-present target of the rest of the metrics in this analysis.

As noted in Table 2, internally developed data sources were used for this analysis where possible. This includes NCTCOG's 2014 demographic forecasts for population and employment densities and 2010 land-use dataset⁵⁶ for conducive and prohibitive land uses. As with the land-use analysis, employment mix data comes from the Census Bureau's LEHD LODES dataset.

The spatial analysis was conducted using ESRI ArcGIS Desktop 10.2, making use of its Model Builder functionality to construct an analysis process that:

- Splits the region into a 0.875-mile analysis grid. 0.875-mile squares have approximately the same area as a circle created by the half-mile radius commonly associated with transit station walking distance but process much more quickly than overlapping circles.
- Proportionally splits the input geographies into the analysis grid. This includes traffic survey zones for population and employment density, census blocks groups for LODES employment mix data, and land-use polygons for conducive and prohibitive land uses. Where one of these geographies straddled the boundary of analysis squares, the relevant attributes were split between analysis squares based on the land area falling into each square.
- Summarizes the input data for each analysis square and calculates scores.
- Collects the scores and generates a smooth surface for mapping and further analysis.

Figure 15 shows the mapped output of this scoring process. Darker colors indicate higher scores. Qualitative examination of the regional distribution of scores determined that 2.0 would be the bare minimum score needed to warrant further examination so those areas scoring below 2.0 are not mapped.

Of these areas, only those that covered over 0.5 square miles were selected to move forward. These areas are shown in Figure 16 with symbol sizes corresponding to their relative area and score. Many of the smaller, borderline areas depicted in Figure 15 were returned by the analysis simply because a large amount of employment is located next to an area of unrelated institutional land use. While these areas may meet some of the base criteria, the fact that these land uses likely do not interact heavily means that a people mover system may not be warranted at these locations.

⁵⁶ <http://rdc.nctcog.org/FAQ.aspx>

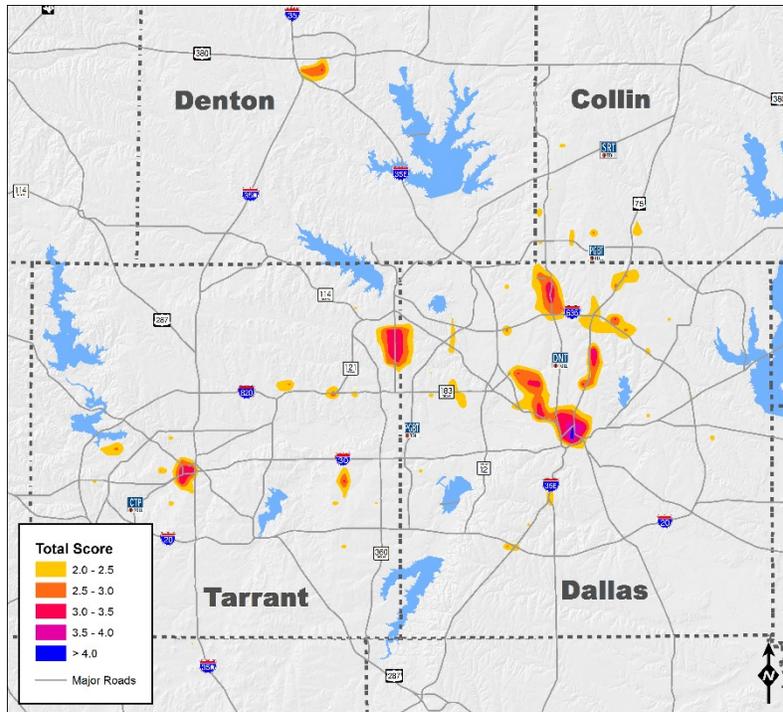


Figure 15: Regional GIS analysis output.

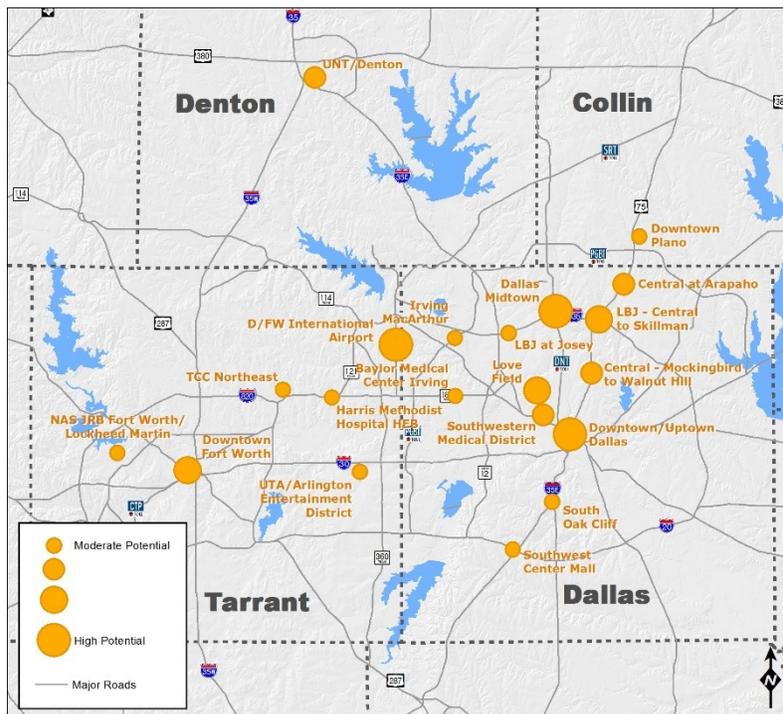


Figure 16: Candidate areas selected from GIS analysis output.

The analysis returned several, but not all, of the systems that have been previously proposed, including the systems in the Dallas Midtown area, Naval Air Station Fort Worth Joint Reserve Base, and the

Southwestern Medical District. This suggests that these areas may, in fact, be able to support the people mover systems suggested in their proposals. Note that the Dallas Midtown area was returned by the analysis in its current state without the redevelopment suggested in the proposal for this system.

For the proposed system connecting Arlington to D/FW International Airport, only the area around the University of Texas at Arlington campus and downtown Arlington was returned. Despite this, connecting this area of relatively dense commercial, office, and institutional development to D/FW International Airport and regional transit while also serving regional activity centers not captured by this analysis (AT&T Stadium, Globe Life Park, and Six Flags Over Texas) may still be a practical use of longer-distance people mover technology.

System/Area Name	Contexts	Transit Authority Area	Potential Transit Connection	Previously Proposed	Operational	Conceptual Routing	Score in GIS Analysis
Arlington (Airport-Entertainment District-University of Texas at Arlington)	Entertainment District, College Campus, Central Business District, Airport (landside)	FWTA (partial)	X	X		X	3.202
Central Expressway-Mockingbird to Walnut Hill	Office, Residential, College Campus	DART	X				3.957
Central Expressway at Arapaho	Office	DART	X				2.727
Central Plano	Office, Residential	DART	X				2.413
Downtown/Uptown Dallas	Central Business District, Residential, Mixed Use, Medical	DART	X				4.319
Fort Worth Central Business District	Central Business District, Entertainment District, College Campus	FWTA	X				3.582
Harris Methodist Hospital Hurst-Eules-Bedford	Medical District	None					2.971
Irving MacArthur	Office	DART	X				2.201
LBJ Freeway-Central Expressway to Skillman	Office, Residential	DART	X				3.185
Dallas Midtown	Retail, Residential	DART	X	X		X	3.360
Naval Air Station Fort Worth Joint Reserve Base	Military, Industrial	FWTA		X			2.688
Southwestern Medical District	Medical District	DART	X	X		X	3.431
University of North Texas Campus/Denton Central Business District	College Campus, Central Business District	DCTA	X				3.075
South Oak Cliff	Office, Retail, Residential	DART	X				2.321
Southwest Center Mall	Commercial, Residential	DART					2.637
Tarrant County College Northeast	College Campus, Retail, Residential	None					2.644
Baylor Medical Center Irving	Medical District	DART	X				2.392
LBJ at Josey	Office, Retail, Residential	DART	X				2.808

Table 3: Areas Returned By GIS Analysis

FWTA – Fort Worth Transportation Authority

DART – Dallas Area Rapid Transit

DCTA – Denton County Transportation Authority

The analysis also returned several areas that are not the target of any known people mover proposals:

- **Central Expressway, Mockingbird to Walnut Hill:** This area is a dense corridor of office and residential development along Central Expressway south of IH 635, including the Southern Methodist University campus. This corridor is already well served by DART's light rail transit but extending its last-mile reach with people movers in this corridor may be useful, particularly to those areas located across the freeway from the transit line.
- **Central Expressway near Arapaho:** This area further north along Central Expressway in Richardson has dense office and commercial development with a few residential units. This area is also on DART's light rail transit, and extending the existing transit's reach with a people mover system may be appropriate here as well.
- **Central Plano:** This somewhat smaller area includes downtown Plano and another potential connection to DART's light rail.
- **Downtown/Uptown Dallas:** At 4.319, downtown Dallas received the highest score in the region. This area is already well served by multiple forms of transit. Local circulation and last-mile connections could both be accomplished in this area with people mover technology, but careful planning would be needed to avoid duplication of proposed extensions to DART light rail, the Dallas Streetcar, and the McKinney Avenue Trolley.
- **Downtown Fort Worth:** A system here could potentially link the central business district, Intermodal Transportation Center, Stockyards District, Museum/West 7th District, Texas Christian University, multiple hospitals, and residential districts in between.
- **Harris Methodist Hospital Hurst-Euless-Bedford:**⁵⁷ The high score at this location is driven primarily by institutional land use and high single-site employment. The hospital is currently mostly contained within one building, but if the hospital builds additional buildings nearby (particularly on the opposite side of Airport Freeway), analysis suggests that a system similar to the system in Indianapolis may be appropriate at this facility.
- **Irving MacArthur:** A mostly commercial and office area near Las Colinas with a potential connection to DART light rail, this is another example of an area that may be served well by a last-mile circulator system. While this area was returned by the analysis, the areas surrounding the nearby operational system at Las Colinas and the proposed system at Freeport were not returned by the analysis.
- **LBJ Freeway, Central Expressway to Skillman:** This area is a large employment center that includes the Texas Instruments headquarters⁵⁸ and Medical City Dallas Hospital.⁵⁹ DART's light rail transit passes near both but does not directly connect to either, so a people mover system in this area could serve as a transit connection for one or both. Texas Instruments has a satellite campus on Forest Lane that is separated from the main campus by IH 635, so a people mover system could also circulate people and/or goods within and between these two campuses while connecting to the LBJ/Central DART Station between them.
- **University of North Texas Campus/Denton Central Business District:** The University of North Texas in Denton is the region's largest degree-granting institution by enrollment, and the analysis indicates that the university could support a campus people mover system. This system could circulate students, faculty, and visitors around the campus and possibly connect to downtown Denton and the nearby northern terminus of Denton County Transportation Authority's A-train commuter rail service.
- **South Oak Cliff:** This area near the IH 35E/US 67 interchange contains a relatively dense cluster of retail, office, and multifamily residential development that may benefit from local circulation. DART's Red and Blue lines are both close enough that a transit connection may also be feasible.

⁵⁷ <https://www.texashealth.org/heb/Pages/default.aspx>

⁵⁸ <http://www.ti.com/>

⁵⁹ <http://medicalcityhospital.com/>

- **Southwest Center Mall:** This area is primarily retail and multifamily residential but could still benefit from local circulation provided by a people mover system, particularly if a system were to connect opposite sides of IH 20 and US 67. A people mover system could also be a component of redevelopment of/around Southwest Center Mall.
- **Tarrant County College Northeast:** Currently a relatively small community college campus, Tarrant County College Northeast could benefit from a people mover system if it expands, particularly if expansion crosses major thoroughfares in the area. North Richland Hill's town center development is also nearby.
- **Baylor Medical Center Irving:** Much like with Harris Methodist Hospital Hurst-Euless-Bedford, this hospital campus may benefit from a people mover system if it expands to the north of Airport Freeway.
- **LBJ Freeway at Josey:** This relatively dense cluster of retail, office, and residential development near the IH 35E and IH 635 interchange could benefit from local circulation. Extending a hypothetical system here to DART's Green Line at the Royal Lane or Farmers Branch Stations could provide longer distance connections.

Since the analysis is a broad, regional examination of people mover viability, these potential systems are preliminary suggestions. For any of these systems to be seriously considered, more detailed planning and stakeholder involvement will need to occur.

Figure 17 depicts the systems returned by the analysis in combination with other existing and proposed systems in the region.

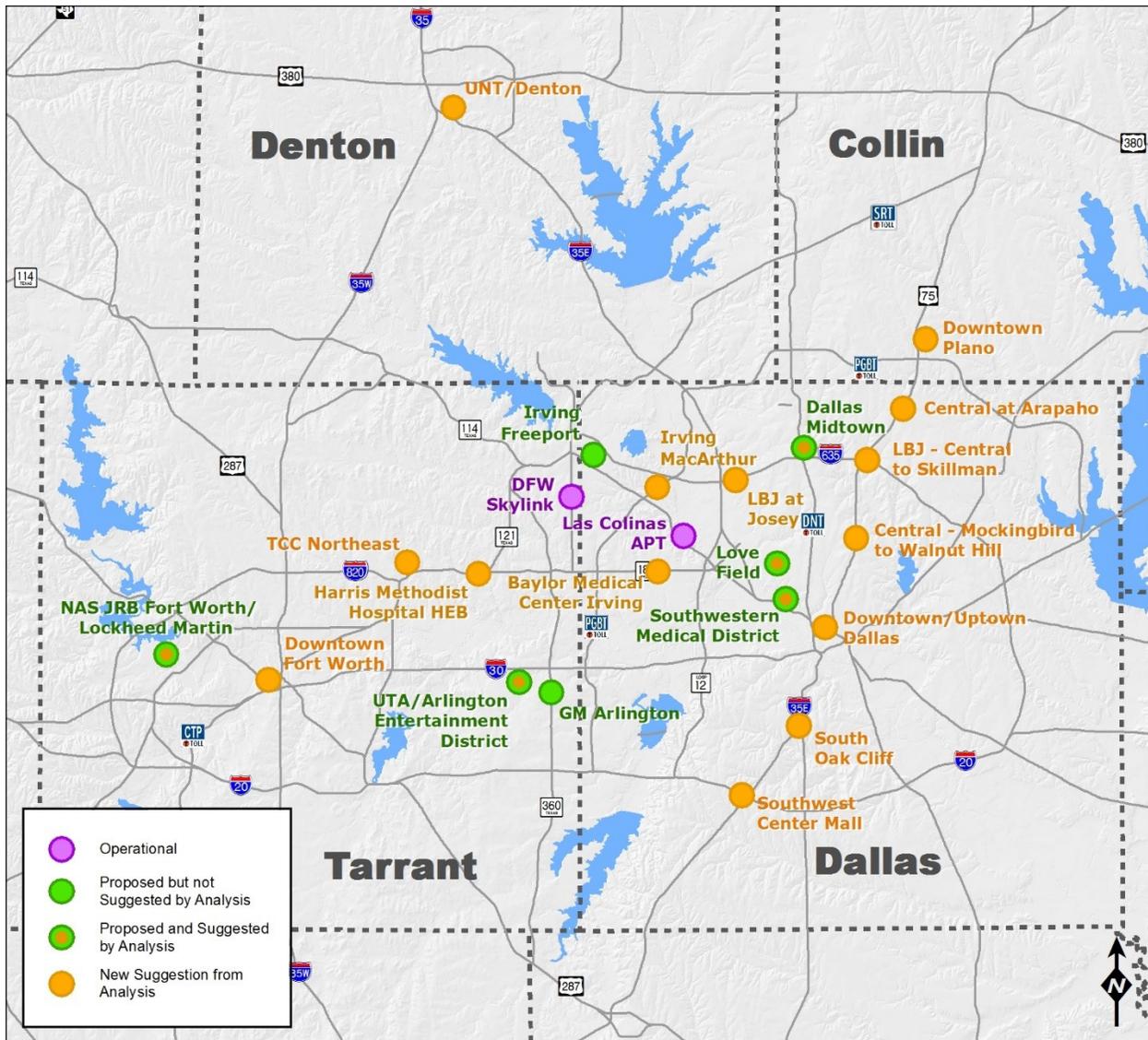


Figure 17: Candidate areas, proposed systems, and operational systems.

A number of proposed systems were not returned by the analysis. The analysis was designed primarily to capture areas where the urban fabric (population, employment, land use) is thick enough to support local circulator systems. This does not indicate that other systems are not feasible under special circumstances; rather, these systems simply do not meet the criteria for urban people mover systems as defined in this iteration of analysis. Further improvements to this analysis process in subsequent iterations could include components designed to capture activity centers/special generators and freight movement which might result in additional systems being identified as viable.

Ridership Estimation

Predicting ridership on any transit system is an involved process requiring detailed knowledge of the demographics, land use, special generators, and existing transit in the area around the proposed system. Additionally, the system's routing, stations, speed, headways, operating hours, fares, and other

characteristics must be considered. The systems previously proposed or identified by this analysis have not outlined specific operating characteristics, so the results of any ridership forecast can only be interpreted as order of magnitude estimates.

For simplicity, this ridership estimation is based on the areas returned by the GIS analysis, which includes most, but not all, of the systems proposed at the 2014 regional forum. For these areas, year 2040 trip productions and attractions from the trip generation stage of the regional travel demand model were summed together, including an intrazonal trip factor. Multiplying this sum by the one percent of trips assumed to take place on transit yields a rough estimate of trips that could be expected to use a people mover system on an average weekday. In testing, this methodology yielded an estimate similar to the known ridership on the Las Colinas APT.

Proposed People Mover System	< 1,000	1,000 - 3,000	3,000 - 6,000	> 10,000
Naval Air Station Fort Worth Joint Reserve Base	X			
LBJ at Josey	X			
Southwest Center Mall	X			
South Oak Cliff	X			
Central Plano		X		
Tarrant County College Northeast		X		
Baylor Medical Center Irving		X		
Harris Methodist Hospital Hurst-Euless-Bedford		X		
University of Texas at Arlington Campus/ Downtown Arlington			X	
University of North Texas Campus/Denton Central Business District			X	
Central Expressway at Arapaho			X	
Irving MacArthur			X	
Central Expressway - Mockingbird to Walnut Hill				X
Southwestern Medical District				X
LBJ Freeway - Central Expressway to Skillman				X
Downtown Fort Worth				X
Dallas Midtown				X
Downtown/Uptown Dallas				X

Table 4: Year 2040 Estimated Weekday People Mover Ridership

Many of the proposed systems with higher ridership estimates are already well served by existing transit, but the fact that there are many origins and destinations in these areas means that local circulation may still enhance mobility. Systems with lower ridership estimates may be better served by smaller or phased systems that connect directly to specific attractions.

Local Funding Options

Stakeholders planning for people mover systems in the region can consider many of the same capital and operations funding sources used in the four North American case study systems. This includes fares, local sales taxes (provided room exists under the 8.25 percent cap), property taxes (including tax increment financing), and private funding. Additionally, all three case study systems that were built with public funds

made use of federal funding. While people mover specific funding through the Downtown People Mover Program no longer exists, federal funding opportunities are still available, primarily through competitive grants administered by the Federal Transit Administration. Capital costs may be eligible for funding under New Starts and Small Starts⁶⁰, both of which award grants for capital costs associated with new fixed-guideway systems, extensions, and bus corridor improvements. Application requirements for Small Starts are less stringent but funding requests are limited to \$75 million, and total project costs must not exceed \$250 million. Provided additional rounds of funding are made available, competitive TIGER Grants⁶¹ from the US Department of Transportation may also cover capital expenses.

Conclusion

The analysis presented in his report is intended to be preliminary; it is not binding and none of the discussed systems are officially endorsed or eliminated by this document. More detailed analysis is necessary to refine these results, and continued investigation may discover other areas worthy of consideration. This additional analysis could include: a freight movement component, identification of transit currently serving these areas to avoid duplication, future year demographic information, examination of environmental justice concerns, activity centers/special generators, a more quantitative approach to transit proximity, more detailed ridership estimates, and cost/benefit estimation.

Even in its preliminary state, this investigation finds that people mover systems may be an appropriate transportation option in the region. A number of systems have been previously proposed by stakeholders, and analysis indicates that many of these meet the density and land-use criteria that have made systems successful in other North American cities. Additionally, analysis indicates that several additional sites in the region meet these criteria and may be worthy of stakeholder consideration. Funding options for these systems are available and, if properly implemented, many could have considerable ridership and serve as an important piece of the region's transportation system.

⁶⁰ http://www.fta.dot.gov/documents/MAP-21_Fact_Sheet_-_Fixed_Guideway_Capital_Investment_Grants.pdf

⁶¹ <http://www.transportation.gov/tiger>