DMC TRANSPORTATION & INFRASTRUCTURE PROGRAM

INTEGRATED TRANSIT STUDIES



Transit Circulator Study Report

Prepared for:

Destination Medical Center Corporation

City of Rochester, Minnesota

DMC Transportation & Infrastructure Program

DMC
A Global Destination for Health & Healing

CITY OF ROCHESTER MINNESOTA

DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

Prepared by:

HDR

June 20, 2018

City Project No. J8621

This report is one of five Integrated Transit Studies (ITS) Reports and an Executive Summary that were prepared for the Destination Medical Center Corporation (DMCC) and the City of Rochester, Minnesota. The ITS reports were accepted by the DMCC on June 28, 2018 (Resolution No. 69-2018) and by the City of Rochester on July 2, 2018 (Resolution 237-18).

The Integrated Transit Studies are comprised of the following reports:

- Executive Summary
- Transit Circulator Study Report
- Parking & Transportation Management Authority (TMA) Study Report
- City Loop Study Report
- Street Use & Complete Streets Study Report
- Street Operations Study Report

Table of Contents

Background 1

DMC Transit Travel Markets 3

Transit Planning Process 5

Development of Tier 1 Circulator Alternatives 7

Modal Options 7

Preliminary Screening of Modes 10

Profile Options 11

Application of Modes to Routes and Profiles 11

Tier 1 Alternatives Description 13

Surface Options 13

DMC Modified Tram 13

Scenario A (BRT, Tram) 13

Subterranean Options 17

Scenario B (Autonomous Vehicle and BRT) 17

Elevated Options 17

Scenario C (Autonomous Vehicle, AGT) 17

Scenario D (Autonomous Vehicle, AGT) 17

Evaluation of Tier 1 Alternatives 21

Tier 1 Evaluation Criteria 21

Tier 1 Evaluation Results 22

DMC Modified Scenario (Tram) 22

Scenario B (BRT) 22

Scenario D (Autonomous Vehicle) 22

Development of Tier 2 Alternatives 25

Alternative Characteristics 25

Transit Alternative Phase I (TAP 1) 25

DMC Modified Tram Alternative 27

Scenario A BRT 31

Scenario D Autonomous Vehicle 35
Performance of Alternatives 38

Development of Hybrid Alternative 41

Circulator Implementation Activities 45

Coordination with Rochester Public Transit 45
Identification of a Funding Plan 45
Capital Funding Programs 46
Operating Funds 48
Circulator Phasing Strategy 49
Benchmarking 49
Next Steps 51

Figures

Figure 1. DMC Master Plan 4
Figure 2. Transit Circulator Study Process 5
Figure 3. Peripheral and Remote Commuter Parking Locations 14
Figure 4. DMC Modified Tram 15
Figure 5. Scenario A (BRT and Tram) 16
Figure 6. Scenario B (Subterranean) 18
Figure 7. Scenario C Elevated 19
Figure 8. Scenario D Elevated 20
Figure 9. Transit Alternative Phase 1 (TAP 1) 26
Figure 10. Tier 2 DMC Modified Tram Route 28
Figure 11. DMC Modified Tram Typical Section in Median 29
Figure 12. DMC Modified Tram Typical Section in Curb Lane 30
Figure 13. Scenario A BRT Route 32
Figure 14. Scenario A (BRT) Typical Section In 2nd Street SW Median 33
Figure 15. Scenario A (BRT) Typical Section in 11th Avenue Median 34
Figure 16. Scenario D (Autonomous Vehicle) Route 36
Figure 17. Scenario D Elevated Autonomous Vehicle Typical Section 37
Figure 18. BRT Hybrid 42
Figure 19. FTA Small Starts Process 46

Tables

Table 1. Tier 1 Evaluation Criteria 21
Table 2. Evaluation Summary for Tier 1 Alternatives 23
Table 3. Performance Comparison of Tier 2 Circulator Options 38
Table 4. Cost Comparison of Tier 2 Alternative Systems ($2017) 38
Table 5. Comparison of Scenario A BRT and Hybrid BRT Circulator Performance 43

Appendices

Appendix A. Existing and Future Conditions

Appendix B. Statement of Purpose and Need

Appendix C. Transit Operations Plans

Appendix D. Alternatives Development

Appendix E. Federal and State Environmental Review Process Class of Action Recommendation Technical Memorandum

List of Acronyms

AGT	Automated Guideway Transit
AV	Autonomous Vehicle
BAT	Business Access and Transit
BRT	Bus Rapid Transit
CMAQ	Congestion Mitigation and Air Quality
DMC	Destination Medical Center
DMCC	Destination Medical Center Corporation
EDA	Economic Development Agency
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
ITS	Integrated Transit Study
LOS	Level of Service
MSP	Minneapolis-St. Paul
O&M	Operating and maintenance
PRT	Personal Rapid Transit
PTN	Primary Transit Network
RCL	Rochester City Lines
RPT	Rochester Public Transit
STP	Surface Transportation Program
TAP	Transportation Alternatives Program
TAP 1	Transit Alternative Phase 1
TDM	Travel Demand Management
TDP	Transit Development Plan
TIGER	Transportation Investment Generating Economic Recovery
UMR	University of Minnesota Rochester
USDOT	U.S. Department of Transportation

Background

The purpose of the Rochester Transit Circulation Study is to define a high quality downtown public transportation service for residents, commuters, businesses, patients, students, and visitors. The study will support the City of Rochester and Destination Medical Center (DMC) district transportation, economic development, and livability goals and will substantially increase public transportation use to and within downtown.

The need for this transportation investment is driven by dramatic growth anticipated in downtown Rochester. The *Destination Medical Center Development Plan* land use vision anticipates a 65 percent increase in downtown transportation and a 30 percent increase in population. Both the City of Rochester *Downtown Master Plan* and the *DMC Development Plan* identified the need for an aggressive increase in transit mode share, capturing 23 to 30 percent of all downtown commuters on transit.

The following five factors contribute to the need for the Downtown Rochester Transit Circulation Project:

1. Implementation of the DMC Development Plan will significantly increase travel to downtown.
2. The existing transportation network cannot fully accommodate DMC Plan development if current travel behavior with a high percentage of single occupant vehicle travel continues.
3. Existing parking programs and policies will support the continued use of private automobiles.
4. Existing transit services cannot effectively capture a large portion of the increased travel demand to downtown.
5. Implementation of the DMC Development Plan without strategic transportation investment will result in severe congestion at downtown entry points and along some primary streets.

These factors necessitate implementation of the high quality, high capacity transit service that can attract downtown commuters from their cars, and reduce demand on the local street network. This investment will facilitate successful implementation of the DMC Development Plan by maintaining downtown access, ensuring mobility within downtown, and increasing land availability for office and commercial development.

This report describes the development and evaluation of transit options that will be implemented with other transportation improvements to address the travel needs outlined above and support the implementation of the DMC Plan. The information is presented in the following sections:

- DMC Transit Travel Markets
- Transit Planning Process
- Development of Tier 1 Transit Circulator Alternatives
- Evaluation of Tier 1 Transit Circulator Alternatives
- Development of Tier 2 Transit Alternatives
- Development of Hybrid Alternative
- Circulator Implementation Plan

This report references the technical memorandums that support the technical analysis described in this document.

DMC Transit Travel Markets

The DMC Plan (**Figure 1**) focuses upon six unique subdistricts: Heart of the City, Discovery Square, Downtown Waterfront, Central Station, St. Marys Place, and University of Minnesota-Rochester (UMR)/Recreation. The Plan recommends linking individual elements using a tram which follows the dashed orange line that primarily runs east and west along 2nd Street SW and north and south along 1st and 3rd Avenues NW/SW. In addition to the tram, the Plan also includes an intermodal transit center at the north end, identified as Central Station. These transit elements described in the Plan provided the starting point for the development of the detailed transit options described in this report.

Implementation of the DMC Plan relies upon effective transit service for three primary travel markets:

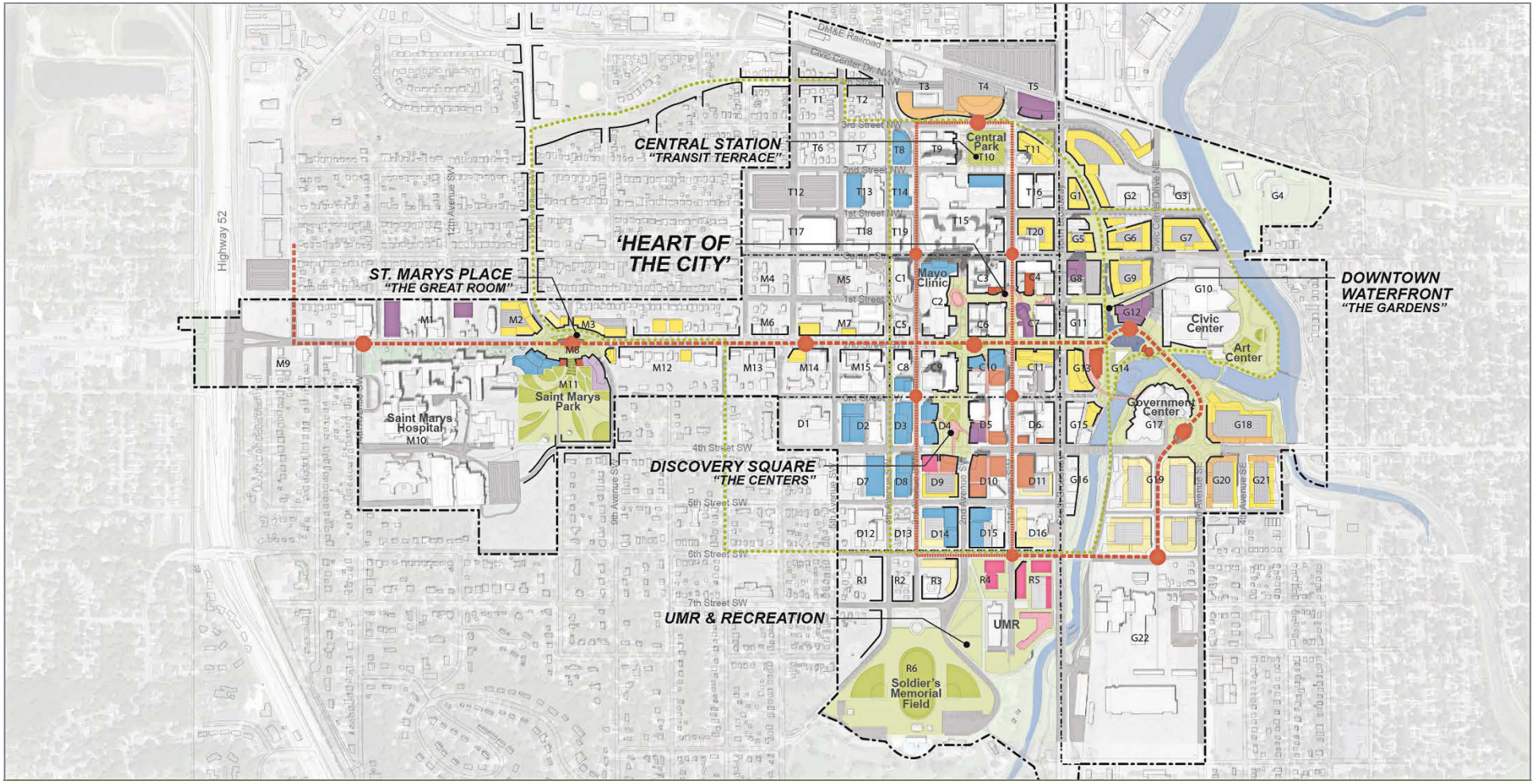
1. Mayo Clinic passenger and staff connection between the St. Marys Hospital campus and the downtown Mayo campus. The existing Mayo Clinic downtown shuttle service represents the largest existing transit travel market, primarily serving trips between St. Marys Hospital and the Gonda building.

2. Peripheral and remote parking connections to downtown. Several candidate locations for commuter parking have been identified in the Parking and Transportation Management Authority Study. The transit alternatives were developed assuming construction of those potential parking ramps.

3. General downtown circulation extending beyond the users served by the Mayo Clinic shuttle route, serving non-Mayo trips between the St. Marys area and downtown along the 2nd Street corridor area as well as anticipated growth north and south of the downtown core. This service will address the travel needs of downtown employees, residents, patients, visitors, and students.

These three distinct markets may be served individually by unique transportation options, or jointly by a single transportation service. Serving the markets individually provides the opportunity to tailor each service to meet the unique needs of each market. Serving the markets jointly with a single service may offer service advantages such as higher service frequency and a longer span of service than any of the markets may receive individually. A combined service may also support a "signature" project that can attract federal funding.

Figure 1. DMC Master Plan

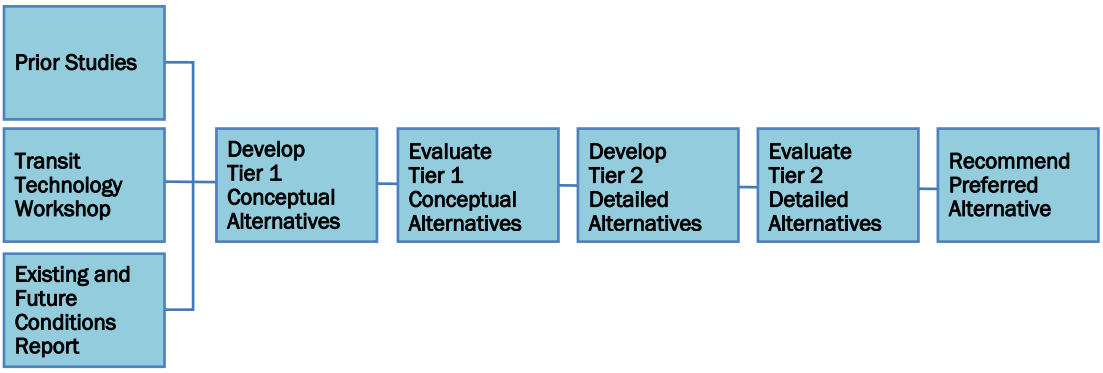


Source: DMC Development Plan

Transit Planning Process

The Rochester Integrated Transit Studies advance the public transportation element supporting implementation of the DMC Plan land use vision. The transit planning approach leading to a recommended transit circulator is shown below in **Figure 2**.

Figure 2. Transit Circulator Study Process



The planning process builds upon the DMC Development Plan and other prior studies. Much of the supporting information is referenced in *Transit Circulation Study Existing and Future Conditions*. The overall planning process is documented in detail in *Transit Circulation Study Alternatives Development*. These reports are included in the appendix, along with all other technical memorandum supporting the transit circulator analysis.

The planning process was supported by three public meetings and a technology workshop that was also open to the public. The initial public meeting focused upon the need for the transit investment, the overall study process, types of transit modes to be considered, and potential transit routes. The second public meeting provided technical analysis of the initial set of transit options for public input. Both meetings were well attended. In addition, the public participated in a technology workshop in which representatives from various vendors including Personal Rapid Transit (PRT) and monorail described the existing and potential applications of their technologies.

The transit technical analysis was conducted in two steps. In the Tier 1 analysis, a broad range of technology and route options were developed and evaluated at a qualitative level based on their ability to serve the three DMC travel markets. The technology analysis drew from traditional transit modes and evolving options discussed in a technology workshop. Three transit circulator options advanced for more detailed development.

Conceptual engineering was conducted for the three Tier 2 transit options. The engineering analysis identified the approximate centerline of the route in the right-of-way, right-of-way requirements, general roadway impacts, and capital costs. Operating plans were prepared identifying the frequency, span of service, and operating cost for the proposed circulator options, along with local and regional bus services that would form the broader transit network serving downtown. This information facilitated both a quantitative and qualitative analysis of the Tier 2 alternatives.

One Tier 2 alternative advanced based upon its ridership, costs, and service characteristics. Several "hybrid" versions of this option were developed to incorporate attractive service characteristics of other options. The development and evaluation of the circulator and transit system alternatives are outlined below.

Development of Tier 1 Circulator Alternatives

Throughout the planning process, the circulator alternatives were guided by the need to serve the three key travel markets: Mayo Clinic passenger connection between St. Marys and the Mayo/Gonda buildings, peripheral and remote commuter parking connection with St. Mary's and downtown, and circulation within downtown. In addressing those markets, the Tier 1 transit options were shaped to accomplish the following:

- Consider a variety of modal options
- Identify potential profile options (surface, subterranean, and elevated)
- Identify suitable technologies for profile and alignment options
- Develop general characteristics for evaluation

Modal Options

Transit mode refers to the type of technology used to transport passengers. These technologies vary substantially with respect to capacity, size, propulsion, capital costs, operating costs, and guideway requirements. The suitability of a mode depends largely upon ridership, physical and operational requirements of the travel markets, and the financial capacity of the implementing organization. The initial range of technologies are summarized below.

Moving Sidewalks are escalators that move horizontally but not vertically. They are widely used within airport terminals such as Minneapolis-St. Paul (MSP) to provide a continuous, although relatively slow, service for distances of less than one mile.



Frankfurt Airport Moving Sidewalk



Minneapolis Airport Moving Sidewalk

Bus Rapid Transit (BRT) is an enhanced bus service that typically includes distinctly branded buses and stations, level vehicle boarding at stations, real-time information, and traffic signal priority. The buses can be either standard length or articulated to carry additional passengers. BRT can operate in exclusive or shared travel lanes.



Cleveland Health Line BRT



Kansas City Max BRT

Tram is a technology that operates on tracks, generally along exclusive or shared traffic lanes, similar to BRT. Trams typically include the BRT characteristics identified above, such as traffic signal priority, level boarding, and wider spacing between stops than traditional bus service. The vehicles are longer than traditional buses, usually the length of an articulated bus or longer.



Kansas City Tram



Houston Tram

Personal Rapid Transit (PRT) technology is primarily a concept at this time, with limited actual application. A PRT system would use elevated guideways to provide non-stop service to a requested station. While there are several companies advancing the technology, there is no demonstrated track record of reliability, capital, or operating costs for an urban PRT passenger service. Two limited systems operate at Heathrow Airport and the University of West Virginia.



London Heathrow Airport PRT



University of West Virginia PRT

Automated Guideway Transit (AGT) applications are frequently found in large airports connecting different terminals, parking facilities, and car rental destinations. The vehicles travel rapidly between stops along an exclusive guideway that is either elevated or underground. Several vendors provide most of the AGT systems, which are proprietary in nature.



Indianapolis Monorail



Miami People Mover AGT

Magnetic Levitation propels inert vehicles using a magnetic field incorporated into an exclusive guideway. This technology can achieve extremely high speeds, making it particularly suitable for inter-city travel. This option must be grade-separated. The technology may be better suited for long trips such as travel between Minneapolis and Rochester, rather than within downtown Rochester.





Shanghai to Pudong Airport Magnetic Levitation

Autonomous Vehicle transit applications are currently limited; however, major corporations such as Google, Microsoft, and General Motors are rapidly advancing the technology as demonstrated by changes in the automotive industry. Autonomous vehicles can operate in shared or exclusive travel lanes on the surface, below, or above grade. Like PRT, direct station to station service would be a key advantage of this technology. Unlike PRT and AGT, a unique guideway is not required since the vehicles can operate on city streets. Therefore, there will be little risk of becoming limited to a specific vendor for the long term.



Easy Mile Autonomous Vehicle



Olli Autonomous Vehicle

Preliminary Screening of Modes

Several of the initial transit modes can be eliminated from further consideration based upon their technical maturity and operating requirements. PRT has no demonstrated service record beyond the limited application at the University of West Virginia. The proprietary nature of the technology is particularly unattractive for public use. Autonomous vehicle technology will offer the same operational capabilities promised by PRT, at a lower cost, with more flexibility, and no proprietary limitations. For these reasons, PRT was eliminated from further consideration in this analysis.

Magnetic levitation is a proven technology but with application generally limited to longer trips than will be applicable in downtown Rochester. The proprietary nature of the technology further reduces its attractiveness. For these reasons, magnetic levitation was eliminated from further consideration.

Profile Options

Profile refers to the grade at which a technology may operate. Options include surface (ground level), elevated, and subterranean (underground).

Surface operation is generally the easiest, least expensive option to implement because no tunneling or elevated structure is required, both of which can significantly increase costs.

Elevated operation can have higher travel speeds than surface since the exclusive guideway avoids traffic conflicts. An elevated structure is more expensive than surface construction, although in some instances, that may be partially offset by avoiding utility conflicts that can occur with surface construction.

Subterranean (tunnel) operation avoids street level congestion, offering similar travel speed advantages as elevated alternatives. Underground construction is the most expensive of the three options, which limits guideway length when capital budgets are constrained.

Application of Modes to Routes and Profiles

The characteristics of the individual transit modes determine their applicability to different operating conditions as outlined below.

- **Moving Sidewalks** are generally best suited for a weather-protected environment such as a tunnel. Its relatively slow operating speed also limits this mode's applicability for long distances.
- **BRT and Tram** can operate in exclusive or shared traffic lanes, making surface streets the most cost-effective location option for these modes. They can also operate in a tunnel or on an elevated guideway, but are usually used at the surface level to reduce cost and optimize access.
- **AGT** requires a unique guideway that must be grade-separated from other transportation modes. Most AGT operation is above or below grade.
- **Autonomous Vehicles** currently under development will be able to operate in almost any environment.

Mixing profiles (surface, elevated, and subterranean) in a system provides flexibility to operate several modes, but introduces transfers at different grades which is onerous to the passenger, reducing ridership potential.

This page is intentionally blank.

Tier 1 Alternatives Description

The Tier 1 route options were developed to address the three DMC travel markets. Each of the proposed Tier 1 alignments reach one or more of the peripheral and remote parking locations shown in **Figure 3**. The parking locations are designed and located to intercept auto commuters as they approach downtown. They may also serve as a mobility hub offering a high level of shelter and amenities to passengers transferring to other transit modes.

All of the Tier 1 routes provide the Mayo Clinic linkage between St. Mary's Hospital and the Mayo/Gonda buildings. Connections to other circulation destinations such as Discovery Square, UMR, and the Civic Center vary by transit alternative.

In addition to meeting the service needs of the three travel markets, the Tier 1 alternatives were structured to provide a variety of route, mode, and profile options for consideration in selecting three alternatives for detailed development. The alternatives are grouped based upon profile: surface (at-grade), subterranean (tunnel), or elevated.

Surface Options

The surface option modes include BRT and tram. Both of these modes can coexist safely and effectively with pedestrian, bicycle, and auto travel along local streets.

DMC Modified Tram

The DMC Modified Tram route has been modified from the *DMC Development Plan* to reach additional parking access for commuters, and facilitate development of 1st Avenue as a pedestrian corridor. This alternative is shown in **Figure 4**. The route begins at parking site 1, travels through downtown, connects with parking site 4, and continues back through downtown, ending at parking site 3. Service then returns in the opposite direction.

Scenario A (BRT, Tram)

This alternative, shown in **Figure 5**, also extends from parking site 1 through downtown to parking site 4. Instead of turning back towards downtown, this option continues south to parking site 5 where it reverses direction and returns to parking site 1. The dashed line shows a future extension from parking site 5 to site 6.

Figure 3. Peripheral and Remote Commuter Parking Locations

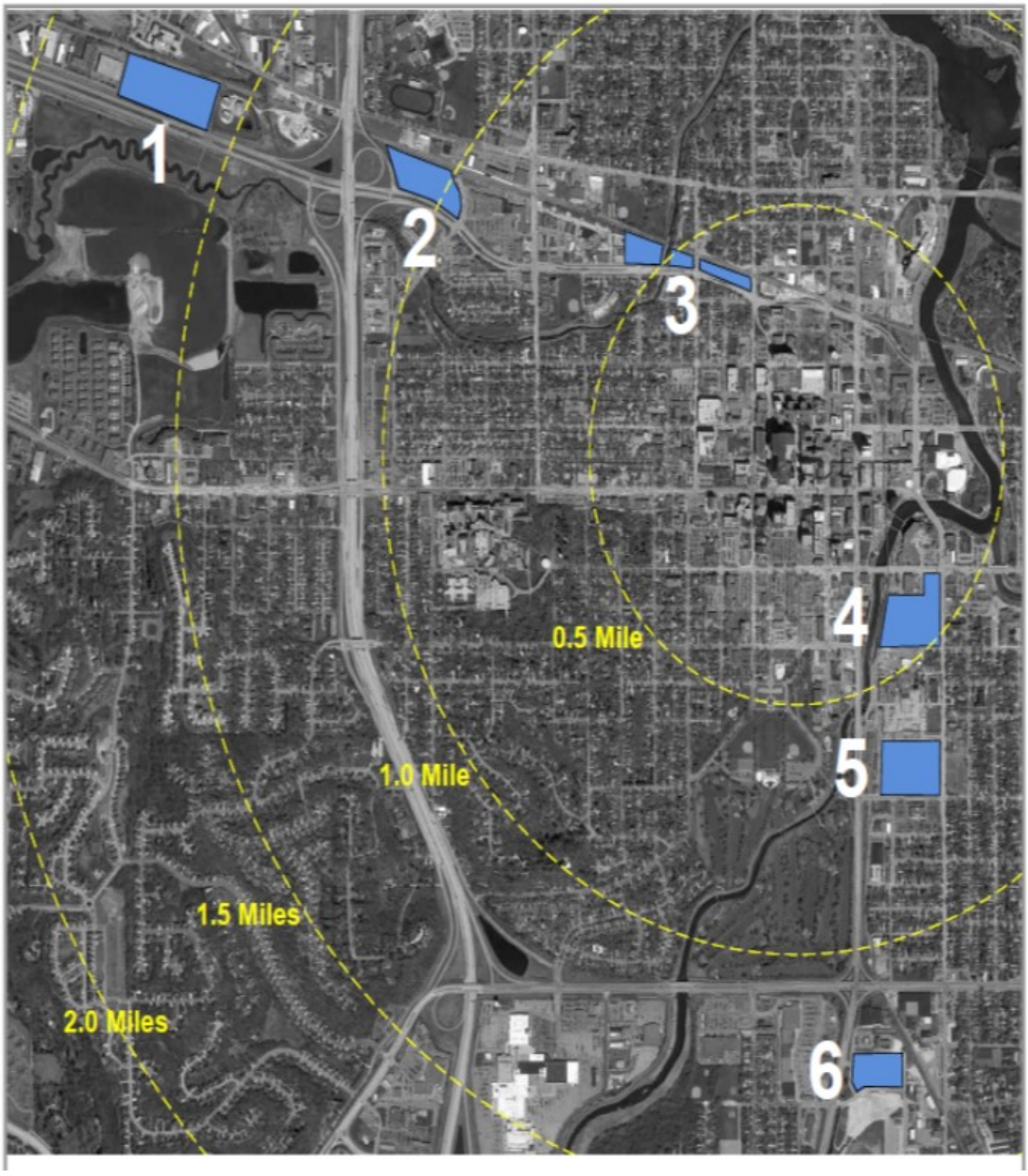


Figure 4. DMC Modified Tram

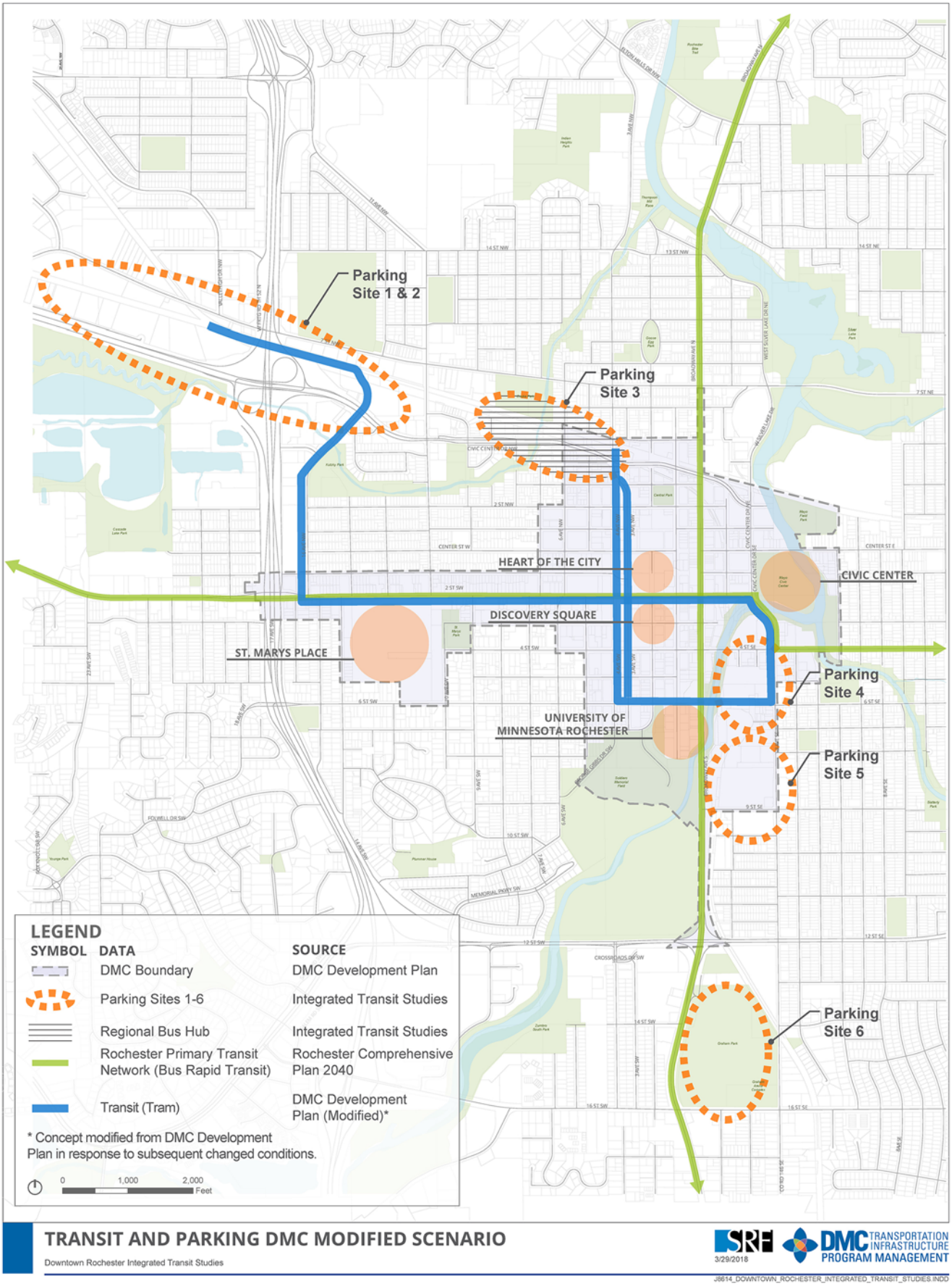
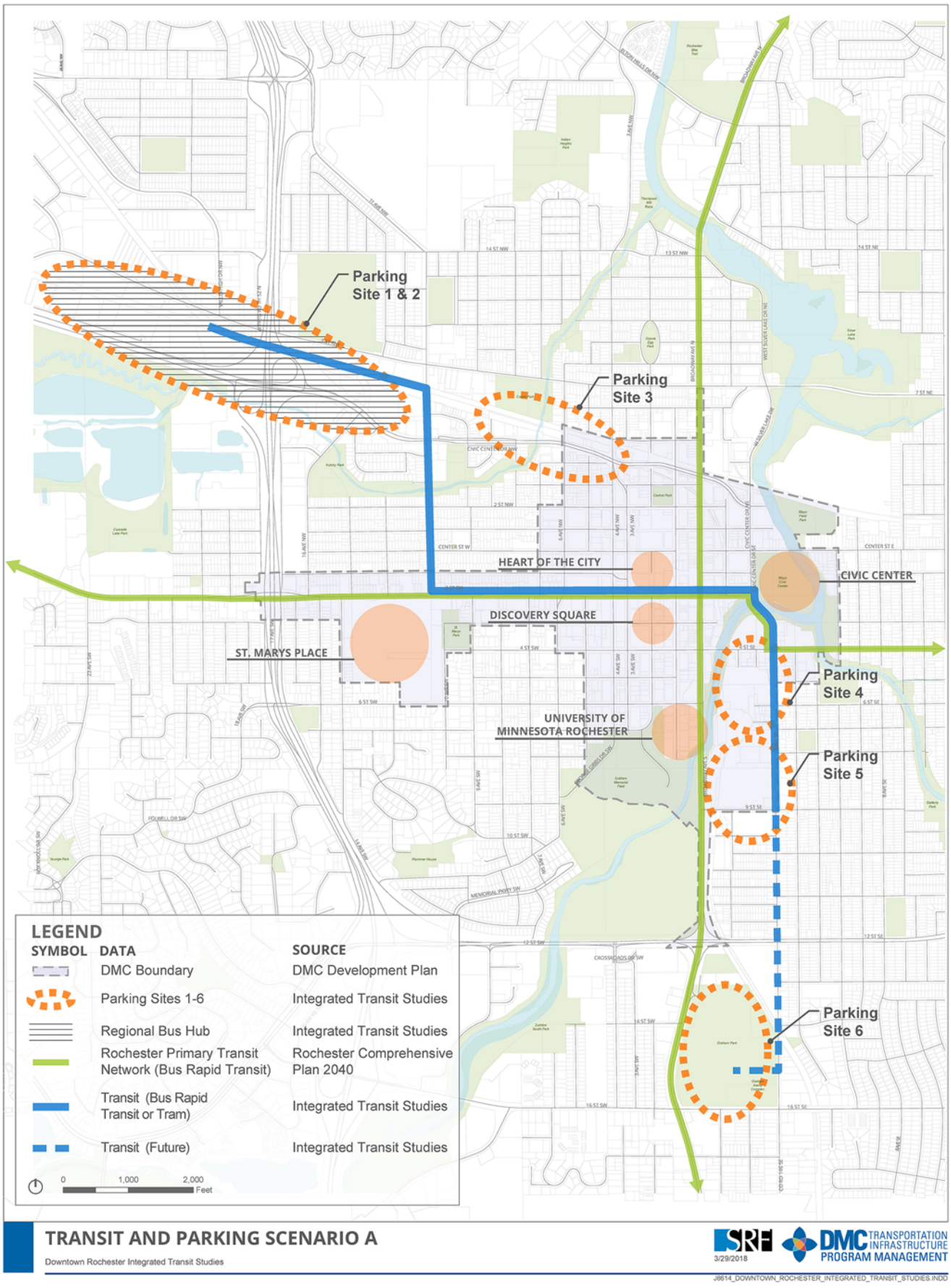


Figure 5. Scenario A (BRT and Tram)



Subterranean Options

Due to cost considerations, the tunnel was applied only to a portion of the East/West route which has an existing ridership base (Mayo Clinic Shuttle) and may support the increased construction cost. Moving sidewalks and autonomous vehicles were initially selected for the tunnel because of the reduced tunnel diameter for these modes. The moving sidewalk was dropped because of the need to carry non-ambulatory passengers between Mayo Clinic sites.

Scenario B (Autonomous Vehicle and BRT)

Although this alternative is classified as subterranean, it is a combination of both tunnel and surface elements. A surface BRT route connects the tunnel with several parking opportunities as shown in **Figure 6**.

Similar to the DMC Modified and Scenario A alternatives, the BRT portion of this option begins at parking site 1. The alignment extends east along the freight railroad right-of-way, but continues to 3rd Avenue NW before turning south. The route then extends to 6th Street SW, following 6th Street across the Zumbro River using a new transit bridge. The alignment turns south at 3rd Avenue SE, ending at parking site 5. Commuter parking is also available along this route at parking site 4. This option could be extended further south to parking site 6.

The subterranean portion of this alternative would connect St. Marys Place and the Gonda building using autonomous vehicles operating under the 2nd Street SW right-of-way. To reach other destinations, a transfer would be required between the surface BRT and the subterranean route from stations proximate to the Gonda building.

Elevated Options

All of the modes discussed in this report could operate on an elevated guideway; however, AGT and autonomous vehicles are best suited for this option.

Scenario C (Autonomous Vehicle, AGT)

Similar to Scenario B, this configuration consists of two elements: an east/west line extending from St. Marys to downtown, and a north/south route extending from parking site 3 past site 4 to the civic center (**Figure 7**). For this alternative, however, the modes and profiles are the same (elevated) for both options. A transfer would be required between the east/west and north/south routes for the AGT alternative, but not for tor the autonomous vehicles.

Scenario D (Autonomous Vehicle, AGT)

This scenario follows a combination of the routes reflected in the DMC Modified and Scenario C options. It provides direct parking access from sites 1 and 4 and eliminates the need for transfers for the AGT option since this option has a single route with no branches (**Figure 8**).

Figure 6. Scenario B (Subterranean)

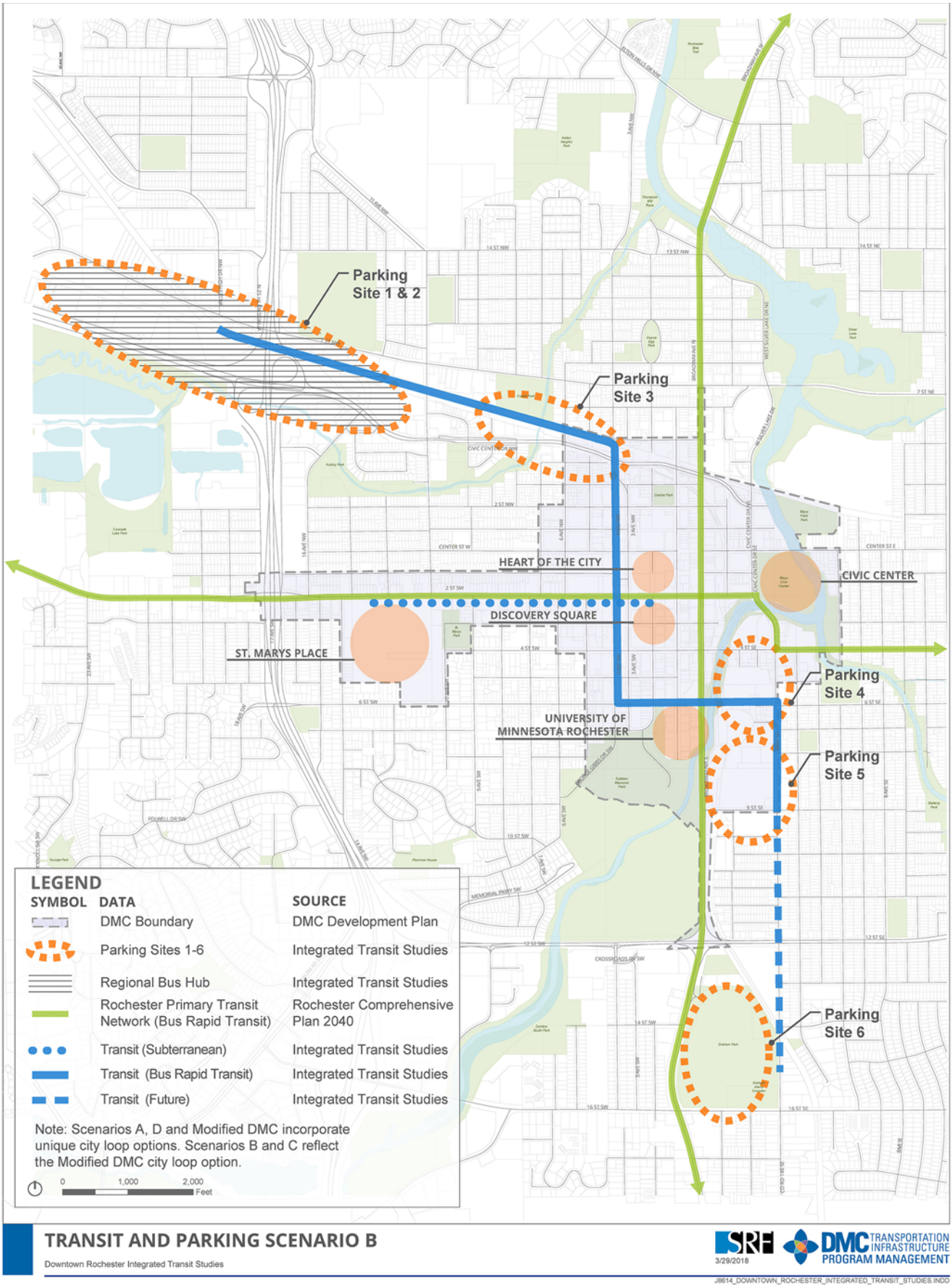


Figure 7. Scenario C Elevated

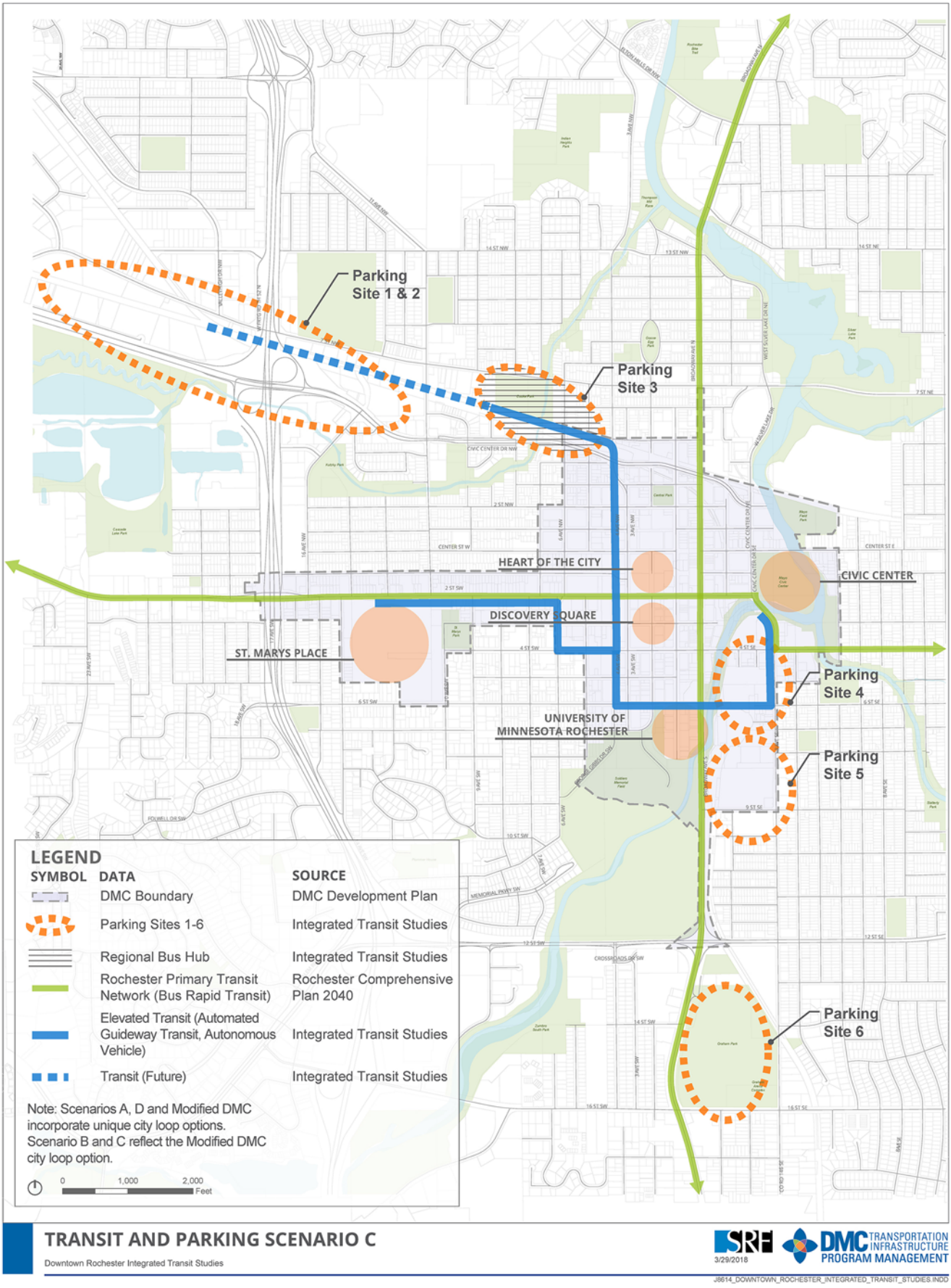
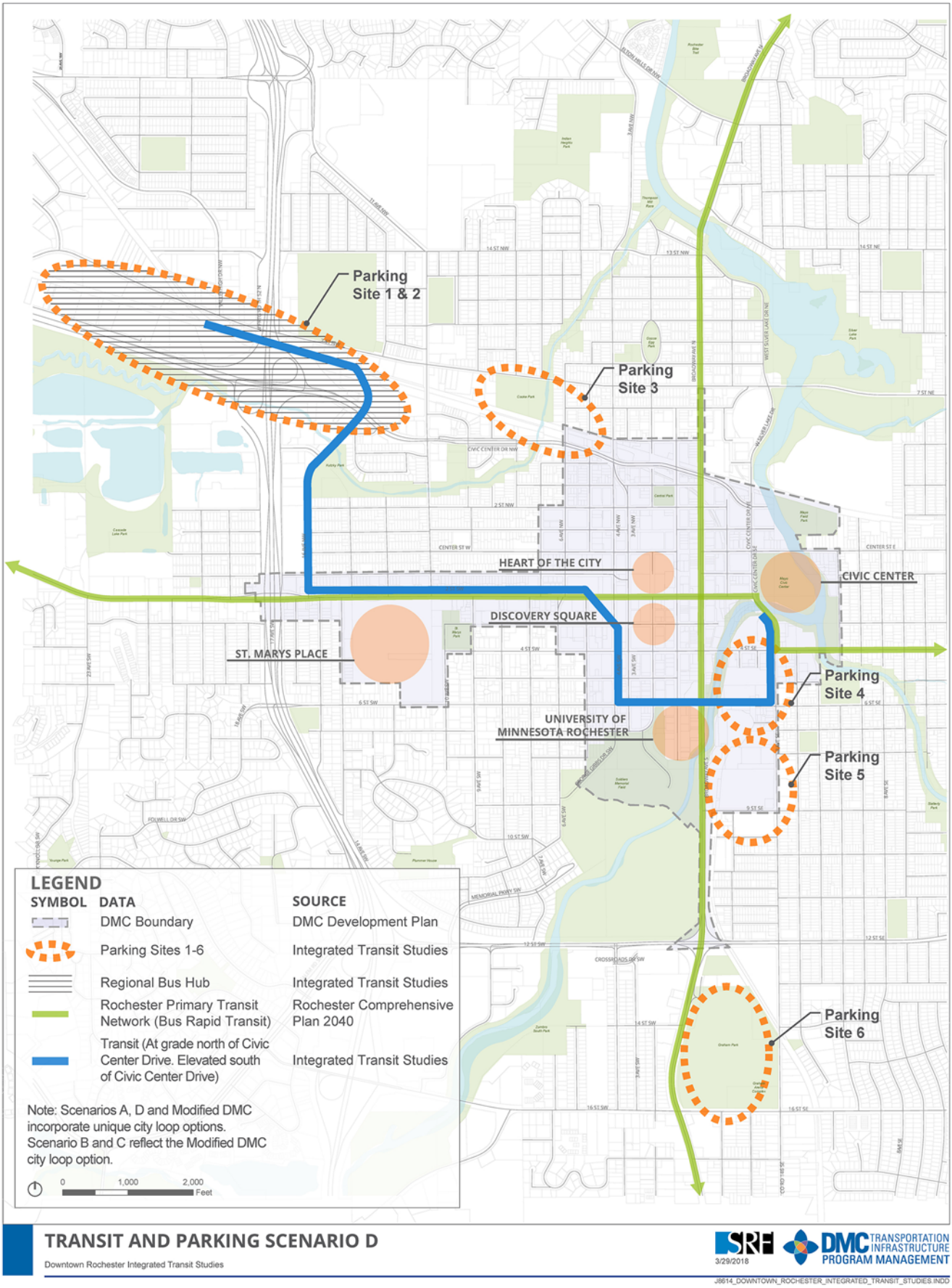


Figure 8. Scenario D Elevated



Evaluation of Tier 1 Alternatives

The Tier 1 alternatives provide a broad range of route, mode, and profile options for consideration in selecting three options for detailed development. The evaluation criteria applied to the Tier 1 alternatives are generally qualitative in nature. The Tier 2 evaluation includes additional quantitative criteria commensurate with their increased detail.

Tier 1 Evaluation Criteria

The Tier 1 evaluation criteria are described in **Table 1** below.

Table 1. Tier 1 Evaluation Criteria

Criteria	Description
1.Connectivity to Peripheral Parking	Number of commuter parking spaces within 5, 10, and 15 minutes travel time to St. Mary's, Heart of City, and Discovery Square
2. Service Quality: Mayo Clinic Connection	Circulator travel time from St. Mary's to Gonda Building, service frequency, reliability, and comfort
3. Service Quality: DMC Internal Circulation	Availability of shuttle in both east/west and north/south directions, number of employees proximate to circulator stations
4. Potential Visual, Noise, and Historic Building Impacts	Impacts of guideway, vehicles, and power supply on adjacent land uses
5. Ability to Attract DMC Development	Quality of service and level of investment
6. At-grade Right-of-way Requirement	Space required at street level for travel route
7. Ease of Access from Street Level	Grade changes needed to access the circulator stations from street level
8. Ease of Access from Subway and Skyway Levels	Grade changes needed to access the circulator stations from subway or skyway levels
9. Service Simplicity	Ability for new riders to understand the system with minimal or no guidance
10 Scalability	Ability to increase service frequency by time of day
11. Ability to Extend Service	Ability to increase length of system (cost and duration to complete)
12. Capital Cost	Order of magnitude cost for construction, vehicles, and maintenance facility based upon industry experience, on per mile basis
13. Operating and Maintenance Cost	General needs for operating and maintenance expenditures based upon nature of route and mode
14. Potential for Public Funding	Likelihood of alternative to attract federal funding, based upon past experience for similar projects

Tier 1 Evaluation Results

The evaluation criteria were applied to each of the Tier 1 alternatives. The evaluation results and recommendations are summarized in **Table 2**.

The Tier 1 evaluation results were used to narrow the range of alternatives from eight to three. Several route options were advanced and the number of modes was reduced from four to three with the elimination of AGT. The AGT option was significantly higher in cost and did not provide any significant advantage over autonomous vehicles in the elevated options. The subway was eliminated due to excessive cost. The rationale for selection of the three alternatives recommended for further analysis is summarized below.

DMC Modified Scenario (Tram)

- Connects three commuter parking locations with St. Mary's and downtown destinations
- Provides access to and between all key DMC destinations
- Rail investment is highly attractive to private development
- Surface street operation reinforces activity at street level

Scenario B (BRT)

- Introduces a lower-cost mode for comparison with tram
- Connects three commuter parking locations with St. Marys and downtown destinations; potential to extend to a fourth parking location
- Provides access to most key DMC destinations; opportunity to consider trade-offs
- BRT is moderately attractive to private investment
- Surface street operation reinforces activity at street level
- Provides greatest opportunity for phasing and extendibility

Scenario D (Autonomous Vehicle)

- Elevated option introduces higher speed and service reliability
- Connects two commuter parking locations with St. Mary's and downtown destinations
- Less impact on ground level right-of-way resources
- May be highly attractive to private development
- Ability to add at-grade service extension

Table 2. Evaluation Summary for Tier 1 Alternatives

		TRANSIT OPTIONS							
		ADVANCE FOR FURTHER STUDY	ADVANCE FOR FURTHER STUDY					ADVANCE FOR FURTHER STUDY	
		MODIFIED DMC STREETCAR DEDICATED LANES	SCENARIO A (AT-GRADE DEDICATED LANES)		SCENARIO B (SUBTERRANEAN AV / AT-GRADE BRT)	SCENARIO C (ELEVATED)		SCENARIO D (AT-GRADE/ELEVATED)	
	SCREENING CRITERIA		BRT	TRAM		AV	AGT	AV	AGT
1	Market 1: Connectivity to Peripheral Parking	HIGH PARKING ACCESS	HIGH PARKING ACCESS	HIGH PARKING ACCESS	GOOD PARKING ACCESS	OK PARKING ACCESS	OK PARKING ACCESS	GOOD PARKING ACCESS	GOOD PARKING ACCESS
2	Market 2: Mayo Connection	MEDIUM FREQUENCY	HIGH FREQUENCY	MEDIUM FREQUENCY	HIGH FREQUENCY	HIGH FREQUENCY, GRADE SEPARATION	LOW FREQUENCY, GRADE SEPARATION	HIGH FREQUENCY, GRADE SEPARATION	HIGH FREQUENCY, GRADE SEPARATION
3	Market 3: DMC Internal Circulation	N/S AND E/W CIRCULATION, HIGH EMPLOYMENT SERVED	E/W CIRCULATION ONLY, HIGH EMPLOYMENT SERVED	E/W CIRCULATION ONLY, HIGH EMPLOYMENT SERVED	N/S AND E/W CIRCULATION AT DIFF GRADES, HIGH EMP	N/S AND E/W CIRCULATION, ELEVATED, HIGH EMP	N/S AND E/W CIRCULATION, ELEVATED, HIGH EMP	E/W ONLY CIRCULATION, ELEVATED	E/W ONLY CIRCULATION, ELEVATED
4	Potential Visual, Noise, Historic Building Impacts	POSSIBLE OVERHEAD WIRES ON 2 MAIN STREETS	LIMITED IMPACTS	POSSIBLE OVERHEAD WIRES ON 1 MAIN STREET	LIMITED IMPACTS	ELEVATED GUIDEWAY	ELEVATED GUIDEWAY	ELEVATED GUIDEWAY	ELEVATED GUIDEWAY
5	Ability to Attract DMC Development	HIGH QUALITY VERY HIGH INVESTMENT MODE BIAS HIGH	HIGH QUALITY MODERATE INVESTMENT MODE BIAS MEDIUM	HIGH QUALITY HIGH INVESTMENT MODE BIAS HIGH	HIGH QUALITY HIGH INVESTMENT (AV) MODE BIAS MEDIUM	HIGH QUALITY HIGH INVESTMENT MODE BIAS UNTESTED	MODERATE QUALITY HIGH INVESTMENT MODE BIAS HIGH	HIGH QUALITY HIGH INVESTMENT MODE BIAS UNTESTED	HIGH QUALITY VERY HIGH INVESTMENT MODE BIAS HIGH
6	At-grade Right-of-Way Requirement	ROW ON 2 MAIN STREETS	ROW ON 1 MAIN STREET	ROW ON 1 MAIN STREET	ROW ON 1 MAIN STREET	ONLY PIERS	ONLY PIERS	ONLY PIERS	ONLY PIERS
7	Ease of Access from Street Level	ON STREET	ON STREET	ON STREET	N/S ON STREET	ALL ELEVATED	ALL ELEVATED	ALL ELEVATED	ALL ELEVATED
8	Ease of Access from Skyway/ Subway Levels	ON STREET	ON STREET	ON STREET	PART SUBTERRANEAN	ALL ELEVATED	ALL ELEVATED	ALL ELEVATED	ALL ELEVATED
9	Service Simplicity	EASY TO FIND, USE	EASY TO FIND, USE	EASY TO FIND, USE	SURFACE EASY, SUBWAY MORE DIFFICULT TO FIND	EASY TO FIND INITIALLY COMPLEX TO USE	EASY TO FIND INITIALLY COMPLEX TO USE	EAST TO FIND INITIALLY COMPLEX TO USE	EASY TO FIND, USE
10	Scalability (ability to vary capacity/frequency by time of day)	LESS CAPACITY FLEXIBILITY THAN BRT	HIGH FLEXIBILITY	LESS CAPACITY FLEXIBILITY THAN BRT	HIGH FLEXIBILITY	HIGH FLEXIBILITY	LIMITED ABILITY TO ALTER CAPACITY	HIGH FLEXIBILITY	LESS CAPACITY FLEXIBILITY THAN BRT
11	Ability to Extend Service	EXPENSIVE TO EXTEND	INEXPENSIVE TO EXTEND	EXPENSIVE TO EXTEND	BRT INEXPENSIVE AV EXPENSIVE TO EXTEND	INEXPENSIVE TO EXTEND	VERY EXPENSIVE TO EXTEND	INEXPENSIVE TO EXTEND	VERY EXPENSIVE TO EXTEND
12	Order of Magnitude Capital Cost (Millions $2016)	$240-380	$35-110	$215-290	$100-180	$140-230	$175-345	$160-260	$225-450
13	Operating & Maintenance Cost	COMPLEX SYSTEM SUBSTANTIAL STAFFING	MODERATE TECHNOLOGY MODERATE STAFFING	COMPLEX SYSTEM SUBSTANTIAL STAFFING	MODERATE TECHNOLOGY MODERATE STAFFING	MODERATE TECHNOLOGY LIMITED STAFFING	COMPLEX SYSTEM SUBSTANTIAL STAFFING	MODERATE TECHNOLOGY LIMITED STAFFING	COMPLEX SYSTEM SUBSTANTIAL STAFFING
14	Potential for Public Funding	HIGH FUNDING NEEDS NUMEROUS PROJECTS FUNDED	MODERATE FUNDING NEEDS NUMEROUS PROJECTS FUNDED	HIGH FUNDING NEEDS NUMEROUS PROJECTS FUNDED	MIX OF MODERATE AND HIGH NEEDS FUNDING MIXED	MODERATE/HIGH FUNDING NEEDS LIMITED FUNDING RECORD	VERY HIGH FUNDING NEEDS NO RECENT FUNDING	MODERATE/HIGH FUNDING NEEDS LIMITED FUNDING RECORD	VERY HIGH FUNDING NEEDS NO RECENT FUNDING

This page is intentionally blank.

Development of Tier 2 Alternatives

The Tier 2 analysis advanced the three recommended Tier 1 alternatives through conceptual design in coordination with the Street Use, Parking and Travel Demand Management, and City Loop Studies. Conceptual engineering was conducted for the three alternatives to more fully develop their service and cost characteristics and to identify likely implementation impacts.

The Tier 2 alternatives were expanded beyond the circulator component to create transit system options incorporating Rochester Public Transit (RPT) direct (express) services, private regional express services, and elements of the RPT Transit Development Plan 2017-2021. The characteristics of these supporting transit services vary by alternative, and are described in detail in the *Transit Circulation Study: Transit Operations Plans*.

Alternative Characteristics

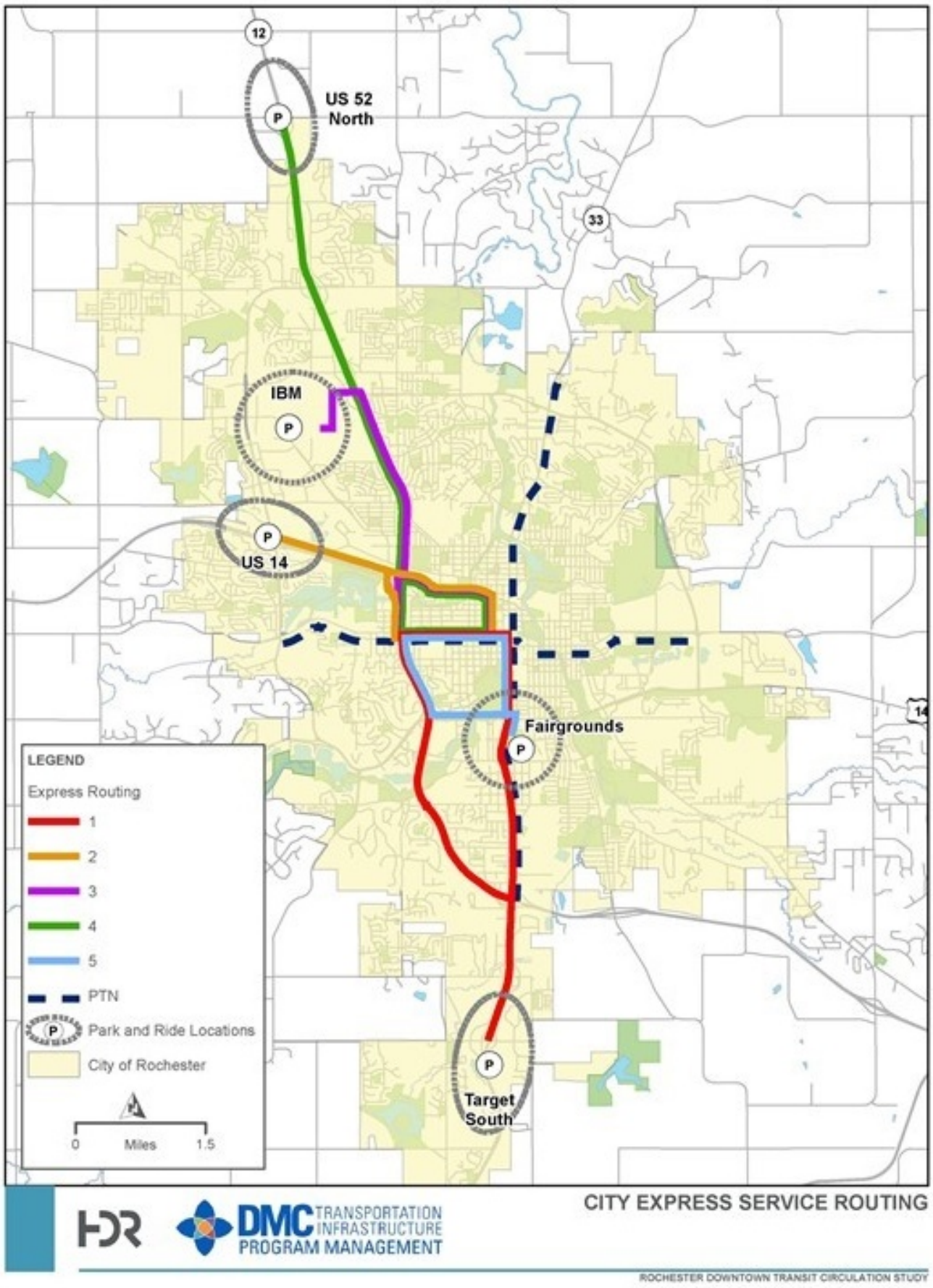
Physical and operational characteristics are summarized below for the following alternatives:

- Transit Alternative Phase 1 (TAP 1)
- DMC Modified Tram Alternative
- Scenario A BRT
- Scenario D Elevated Autonomous Vehicle

Transit Alternative Phase I (TAP 1)

This alternative represents the background bus service expansion that is planned to meet the growing transit needs of the community, independent of the transit circulator options described in this report. This is supplemented by additional express bus service required to accommodate future DMC commuter demand that exceeds the capacity of the other transit services. It also includes two BRT routes that are in the planned Primary Transit Network (PTN). This alternative establishes a low-capital transit alternative to provide a base for comparison with the proposed circulator systems. The major components of the TAP 1 alternative are shown in **Figure 9**.

Figure 9. Transit Alternative Phase 1 (TAP 1)



DMC Modified Tram Alternative

Physical Characteristics

Mode: Tram. A single steel wheel on steel rail vehicle similar to the modern streetcar and light rail.

Route: The DMC Modified alternative follows the route shown in **Figure 10**. The route is generally consistent with the Tier 1 alternative, except between parking site 1 and 16th Avenue NW where it shifts from railroad right-of-way to Civic Center Drive. It provides service between St. Marys and downtown, and extends to parking sites 1, 3, and 4. It also provides both east/west and north/south circulation within the downtown area.

Location within the Street: Generally double track in dedicated lanes located in the center of the street with areas of mixed traffic along 3rd/4th Avenue SW.

Cross Section – The typical section for the DMC Modified option in the median of 2nd Street is shown in **Figure 11**. This alternative also operates in curb lanes with service split between 3rd and 4th Avenues as reflected in **Figure 12**.

Operational Characteristics

Span of Service

Weekday: 5:00 a.m.-11:00 p.m.

Weekend: 6:00 a.m.-11:00 p.m.

Frequency of Service

Peak Period: 6 minutes

Off Peak: 12 minutes

Evening: 24 minutes

Weekend: 12 minutes

Figure 10. Tier 2 DMC Modified Tram Route

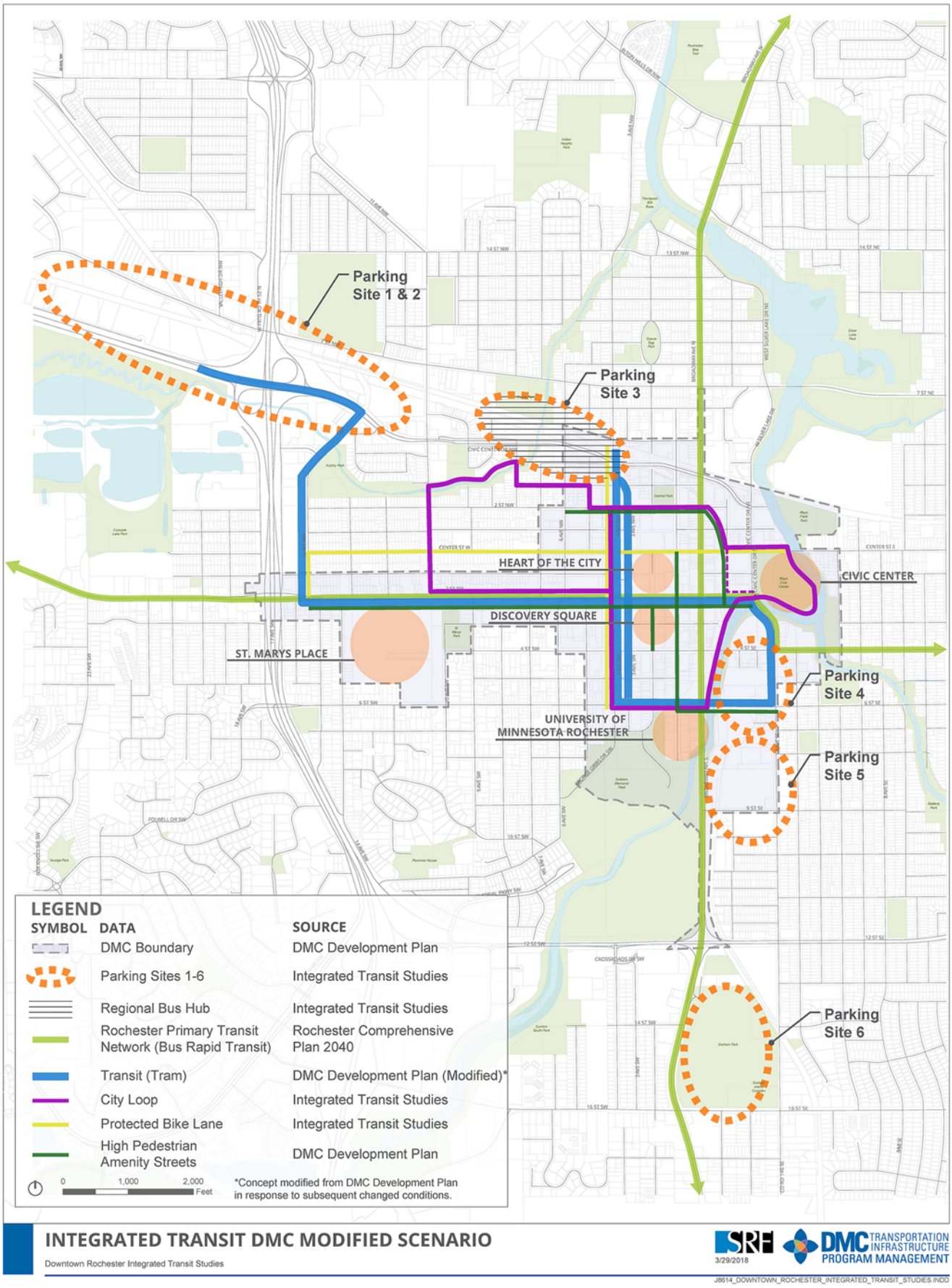
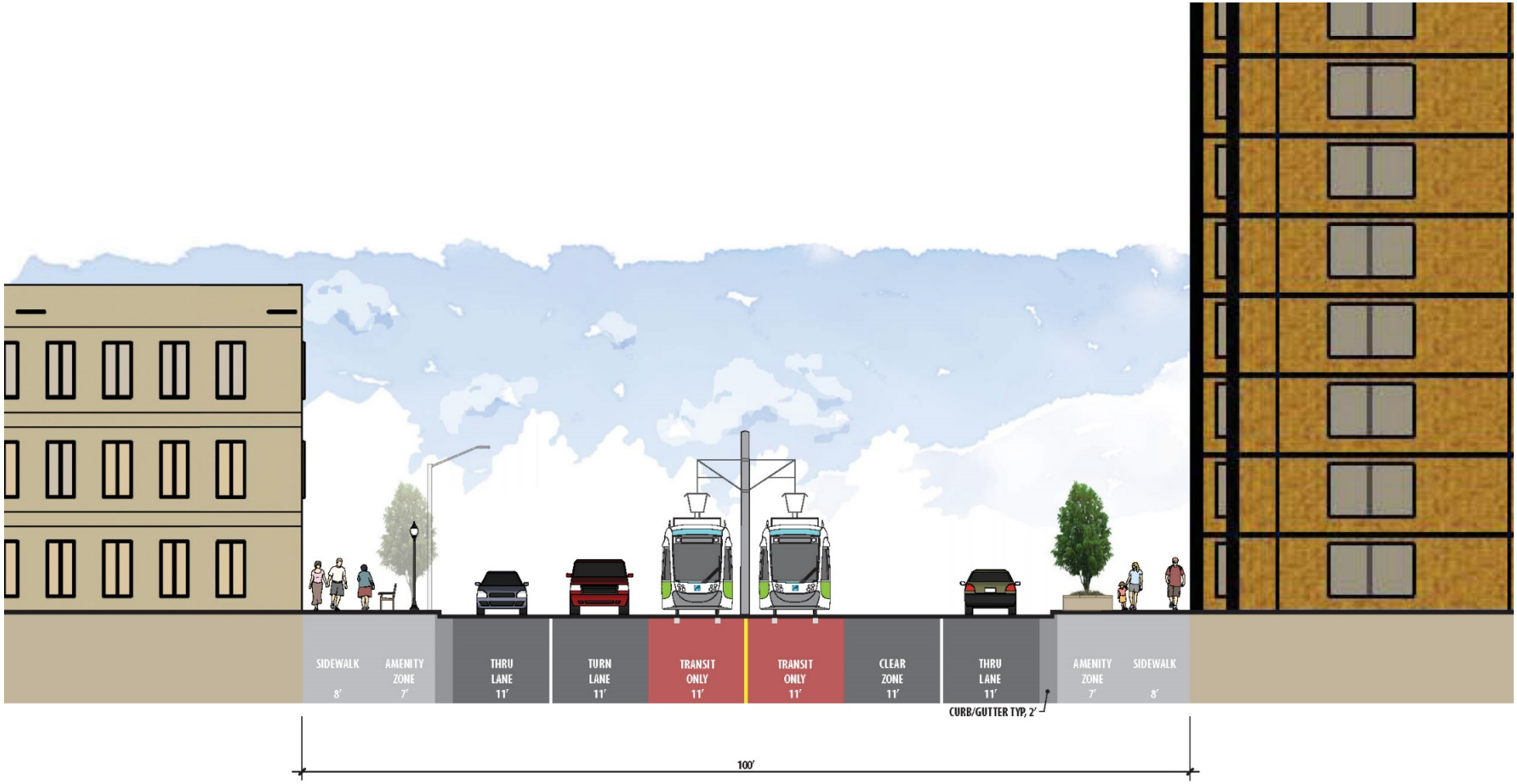


Figure 11. DMC Modified Tram Typical Section in Median

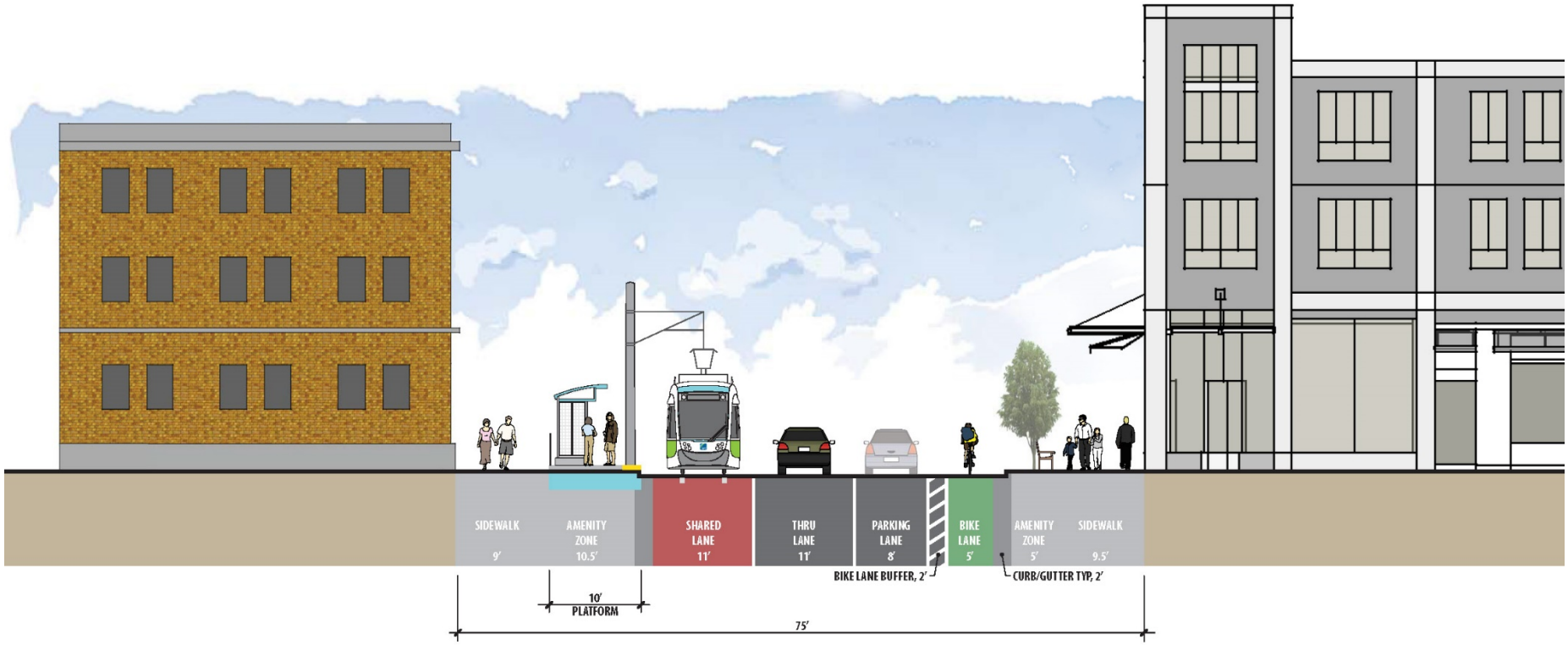


Tram | 2nd Street SW, just west of 1st Avenue SW

facing west

March 14, 2018

Figure 12. DMC Modified Tram Typical Section in Curb Lane



Tram | 3rd Avenue NW, north of W Center Street

facing north

March 14, 2018

Scenario A BRT

Physical Characteristics

Mode: Bus Rapid Transit. A 40 or 60 foot bus with premium amenities and a dedicated guideway.

Route: The Scenario A BRT alternative follows the route shown in **Figure 13**. The route is unchanged from Tier 1, except for following Civic Center Drive from site 1 parking to 11th Avenue NW rather than using the railroad right-of-way to the north. It provides service between the eastern edge of the St. Marys Hospital Campus and downtown, and connects to commuter parking sites 1, 4, and 5. It also provides east/west circulation within the downtown area.

Location within the Street: Generally two lane exclusive guideway located in the center of the street. Curb operation may also be considered.

Cross Section: The typical section for Scenario A (BRT) in the median of 2nd Street SW is shown in **Figure 14**. Center running in the median of 11th Avenue is shown in **Figure 15**.

Operational Characteristics

Span of Service

Weekday: 5:00 a.m.-11:00 p.m.

Weekend: 6:00 a.m.-11:00 p.m.

Frequency of Service

Peak Period: 2.5 minutes

Off Peak: 10 minutes

Evening: 20 minutes

Weekend: 10 minutes

Figure 13. Scenario A BRT Route

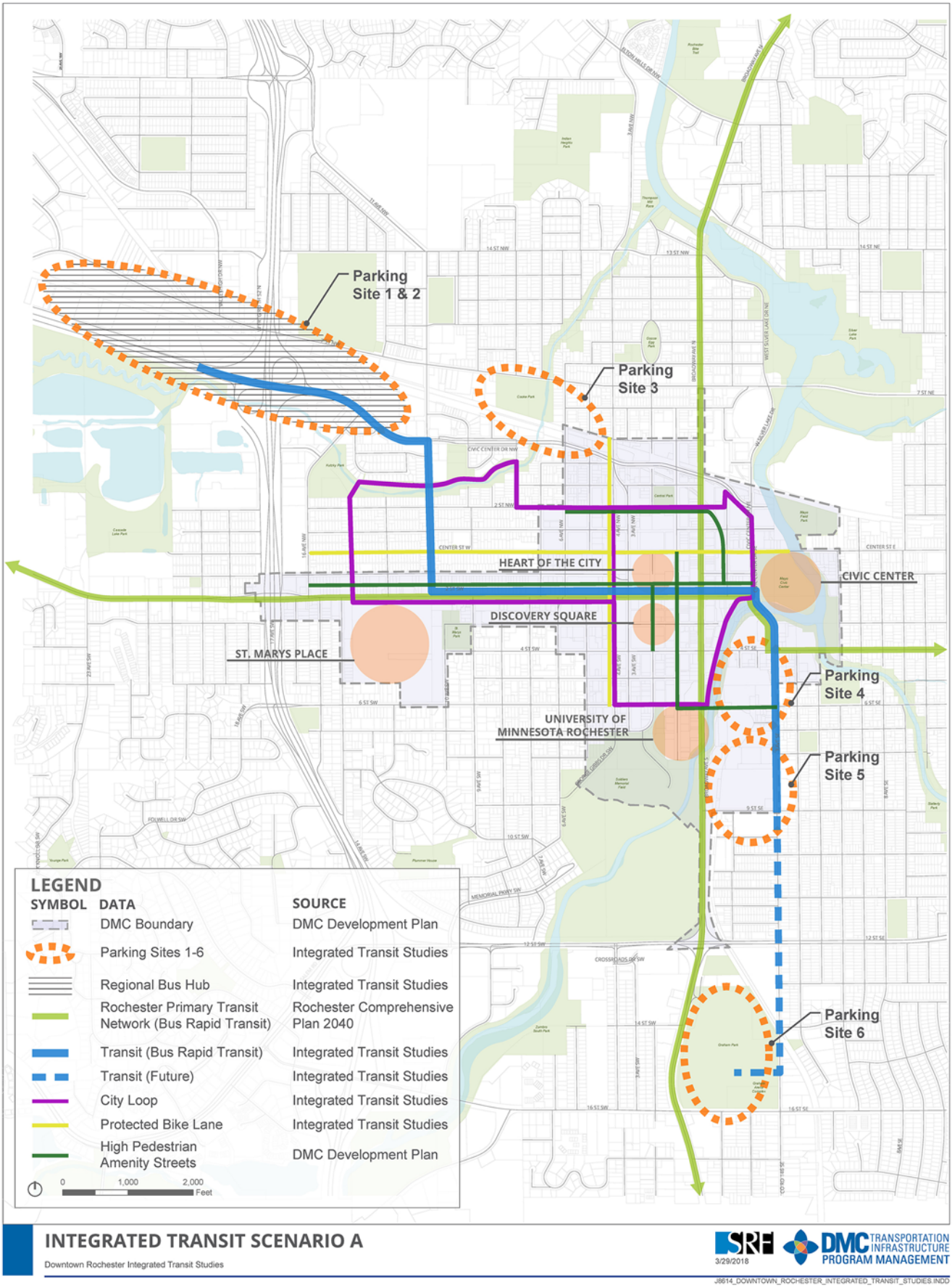
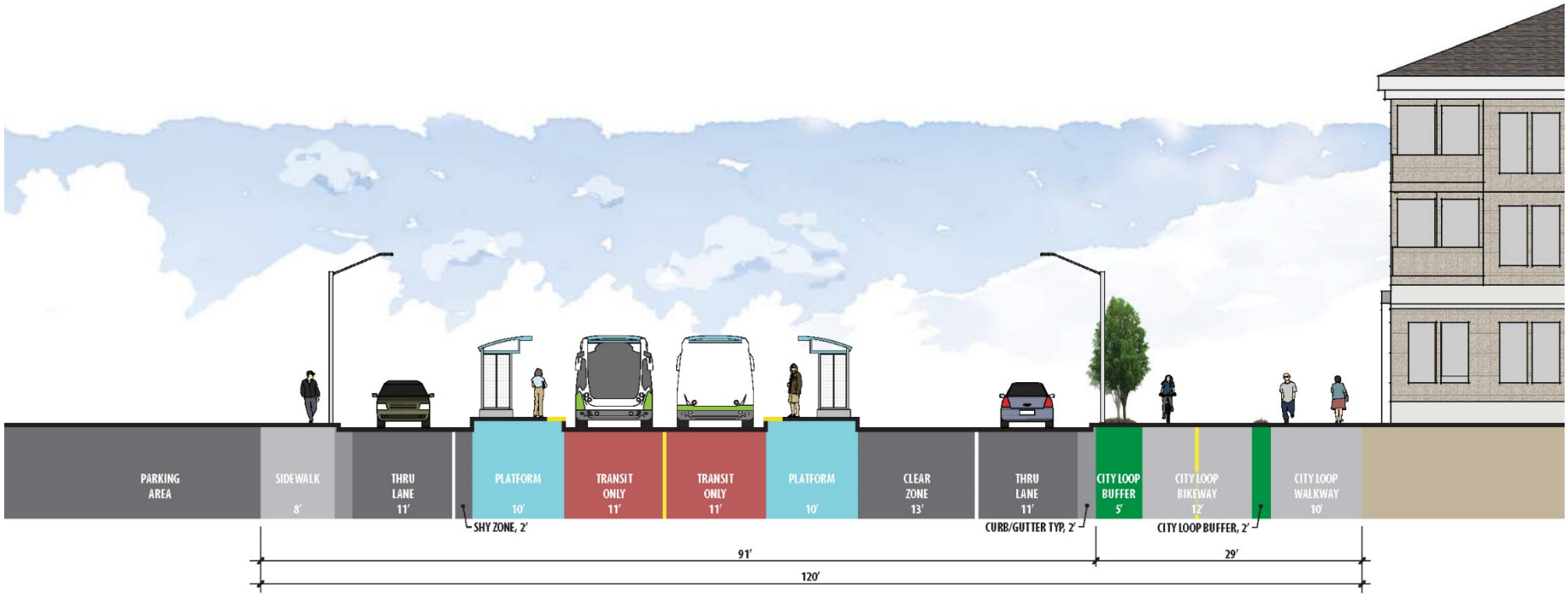


Figure 14. Scenario A (BRT) Typical Section In 2nd Street SW Median

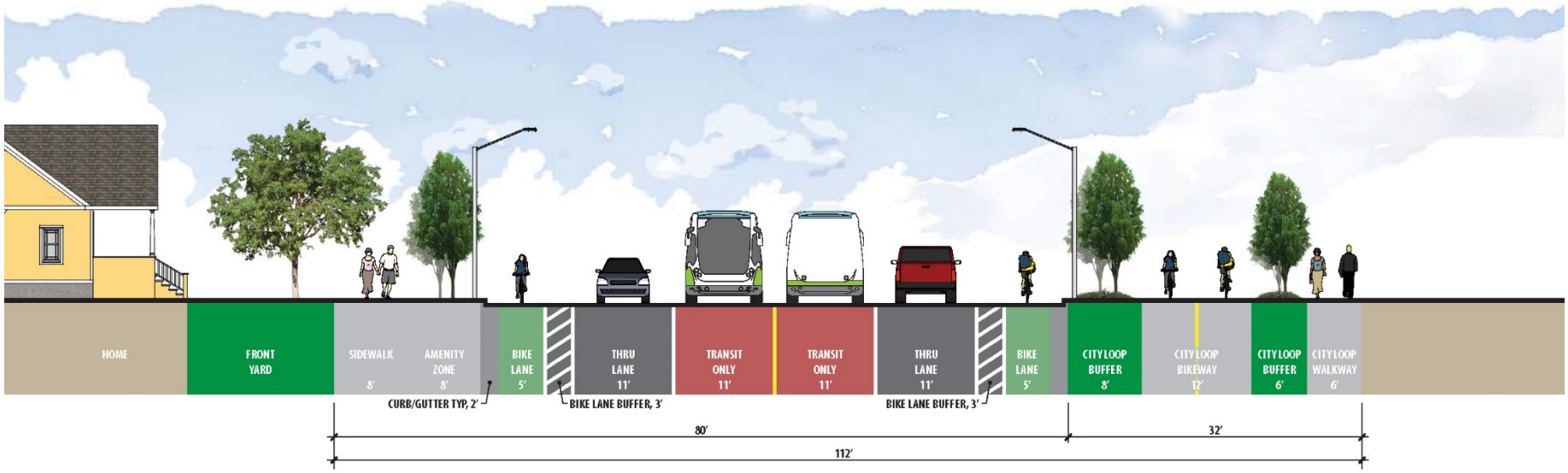


Bus Rapid Transit | 2nd Street SW, St Marys Station

fading west

March 14, 2018

Figure 15. Scenario A (BRT) Typical Section in 11th Avenue Median



Bus Rapid Transit | 11th Avenue NW, between 1st and 2nd Streets NW

facing north

March 14, 2018

Scenario D Autonomous Vehicle

Physical Characteristics

Mode: The autonomous vehicle is a rubber tired shuttle that is approximately 30 feet long. The guideway was generally designed to allow flexibility in vehicle selection; however, to provide for compatibility, it is recommended that the vehicle procurement criteria be established prior to designing the structure.

Route: The Scenario D Autonomous Vehicle alternative follows the route shown in **Figure 16**. Like the Tier 2 BRT, the Tier 2 Autonomous Vehicle follows the same path as the Tier 1, with the exception of shifting to the Civic Center right-of-way from parking site 1 to 16th Avenue NW. The route provides service between the north side of the St. Marys campus and downtown, and extends to parking sites 1 and 4. It also provides limited east/west circulation within the downtown area.

Location within the Street: Generally is a 26 foot elevated guideway offset to the right-of-way line. The northern section along Civic Center Drive operates above the median with the exception of the small segment under US 52.

Cross Section: **Figure 17** shows the typical section for Scenario D (Autonomous Vehicle).

Operational Characteristics

Span of Service

Weekday: 5:00 a.m.-11:00 p.m.

Weekend: 6:00 a.m.-11:00 p.m.

Frequency of Service Autonomous Vehicle service is demand-responsive. Vehicles will generally be available at each station, or arrive within 1 minute or less of a service request.

Figure 16. Scenario D (Autonomous Vehicle) Route

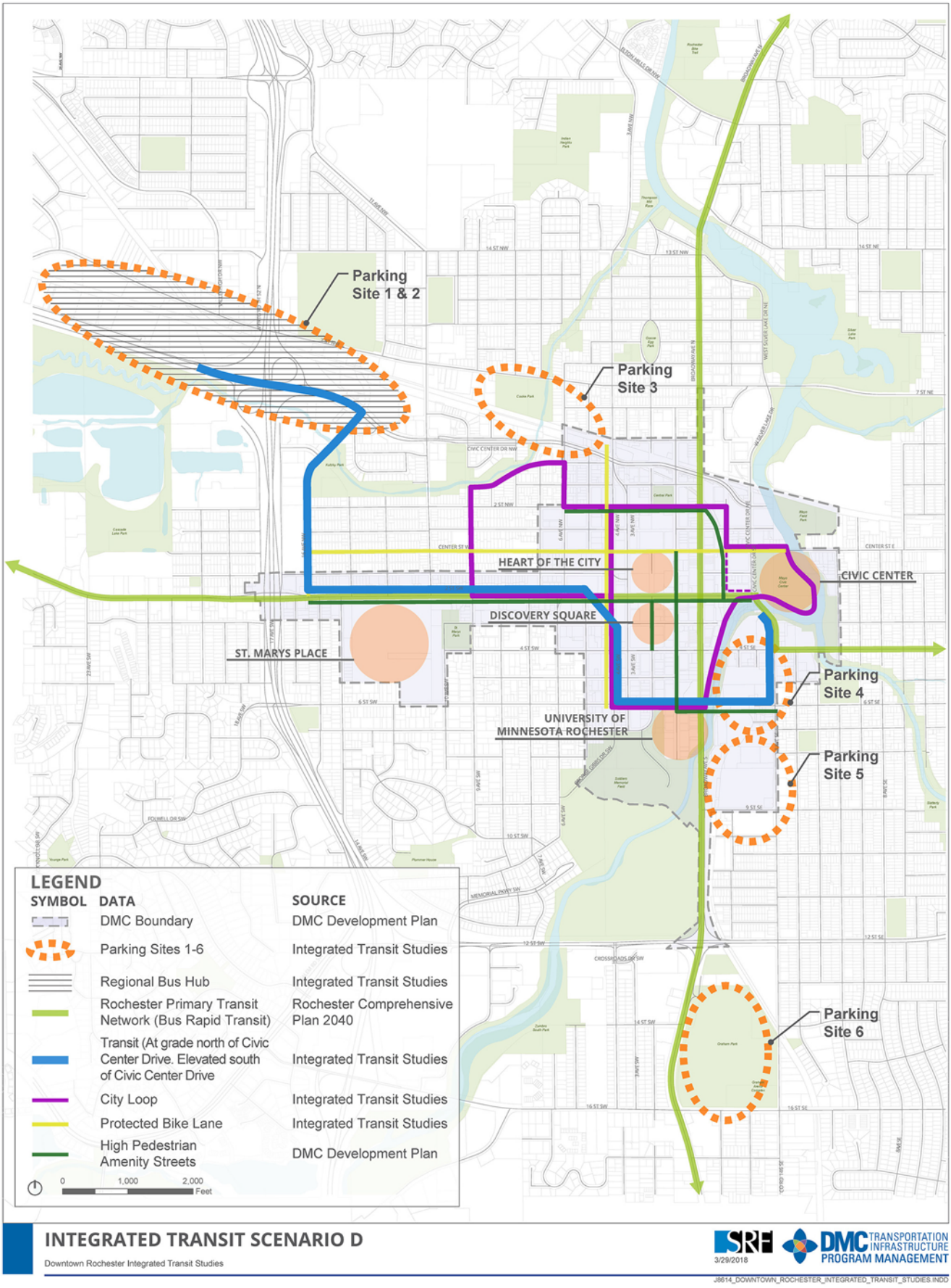
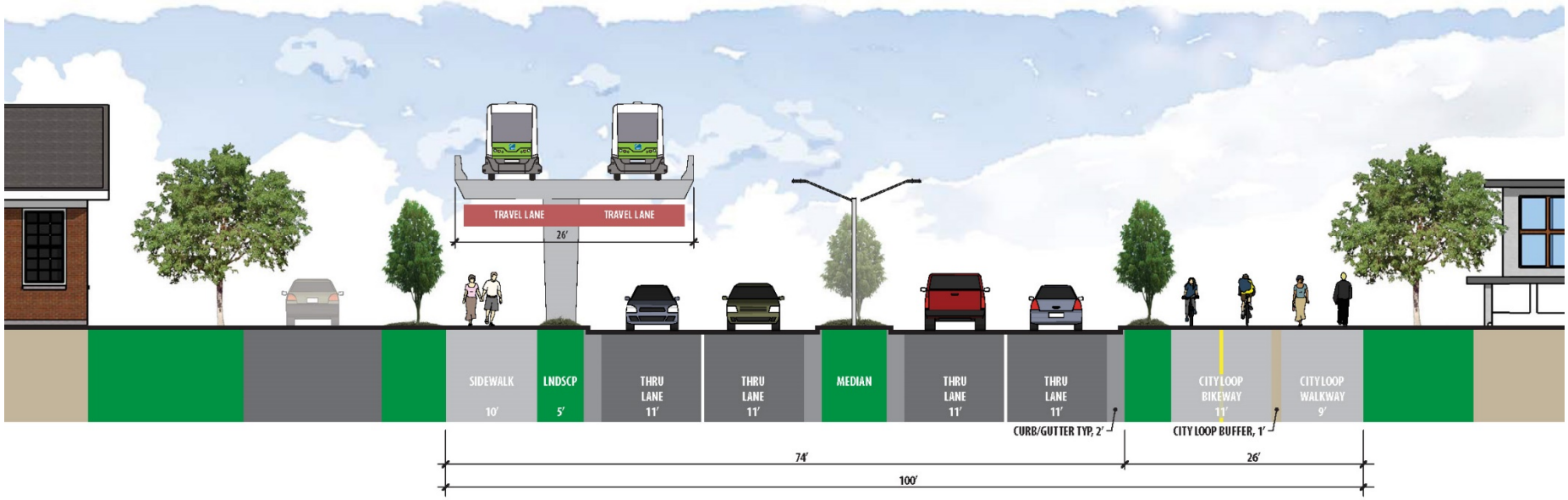


Figure 17. Scenario D Elevated Autonomous Vehicle Typical Section



Elevated Autonomous | 2nd Street SW, just west of 7th Avenue SW

facing west

March 14, 2018

Performance of Alternatives

The capital and operating costs and ridership forecasts are summarized in **Table 3** for the Tier 2 circulator options. TAP 1 does not have a dedicated circulator. **Table 4** identifies the total capital and operating costs for each of the Tier 2 alternatives, including the supporting bus transit components needed to serve downtown commuter market parking outside of the DMC District. The detailed capital cost estimates for the circulators are included in *Transit Circulation Study Alternatives Development.* Operating costs are described in detail in *the Transit Circulation Study Transit Operations Plans* for the transit system options.

Table 3. Performance Comparison of Tier 2 Circulator Options

Alternative	DMC Modified	Scenario A BRT	Scenario D Autonomous Vehicle
Circulator Capital Cost ($2017)	$262.7M	$101.1M	$486.4M
Circulator Operating Cost ($2017)	$3.4M	$3.7M	$3.5M
Daily Circulator Ridership	27,750	21,750	26,170

Table 4. Cost Comparison of Tier 2 Alternative Systems ($2017)

	TAP 1	DMC Modified Tram	Scenario A (BRT)	Scenario D (Elevated Autonomous Vehicle)
Component				
Capital Costs				
Circulator	NA	$262,700,000	$101.100,000	$486,400,000
PTN BRT	$73,600,000	$67,000,000	$67,000,000	$67,000,000
Express Bus	$28,000,000	$6,000,000	$5,500,000	$11,000,000
Total Capital Cost	$101,600,000	$335,700,000	$173.600,000	$564,400,000
Operating Costs (Annual)				
Circulator	NA	$3,400,000	$3,700,000	$3,500,000
PTN BRT	$9,400,000	$7,000,000	$7,000,000	$7,000,000
Express Bus	$6,000,000	$1,400,000	$1,300,000	$2,700,000
Total Operating Cost	$15,400,000	$11,800,000	$12,000,000	$13,200,000

Several characteristics stand out with respect to both the circulator and system alternatives. Both the DMC Modified Tram and the Scenario D Autonomous Vehicle have high circulator ridership, however, both also require a substantial capital investment. The Scenario A BRT circulator provides an attractive balance of high ridership and moderate capital cost.

Looking at the overall systems, the Scenario A BRT maintains its capital cost advantage over the other options which have circulators. In addition, this alternative has a low operating cost. The capital cost advantage of the TAP 1 system over Scenario A BRT would be offset by its higher operating cost within the first decade of operation. The Scenario A BRT performs better than the other options with respect to both the circulators themselves and the overall transit systems. The BRT mode also offers some flexibility over the Tram option in that it can more readily incorporate autonomous vehicle technology as it is developed for transit applications.

This page is intentionally blank.

Development of Hybrid Alternative

Based upon the Tier 2 performance characteristics, the Scenario A BRT circulator was selected to advance for further development. Several "hybrid" options were developed from the Scenario A base, incorporating the increased coverage of the DMC Modified Tram route. The north/south Tram alignment along 3rd and 4th Avenues was incorporated into the Scenario BRT option, with an extension from 4th Avenue to Parking Area A. This effectively created a single loop operation connecting the remote and peripheral parking northwest and southeast of downtown.

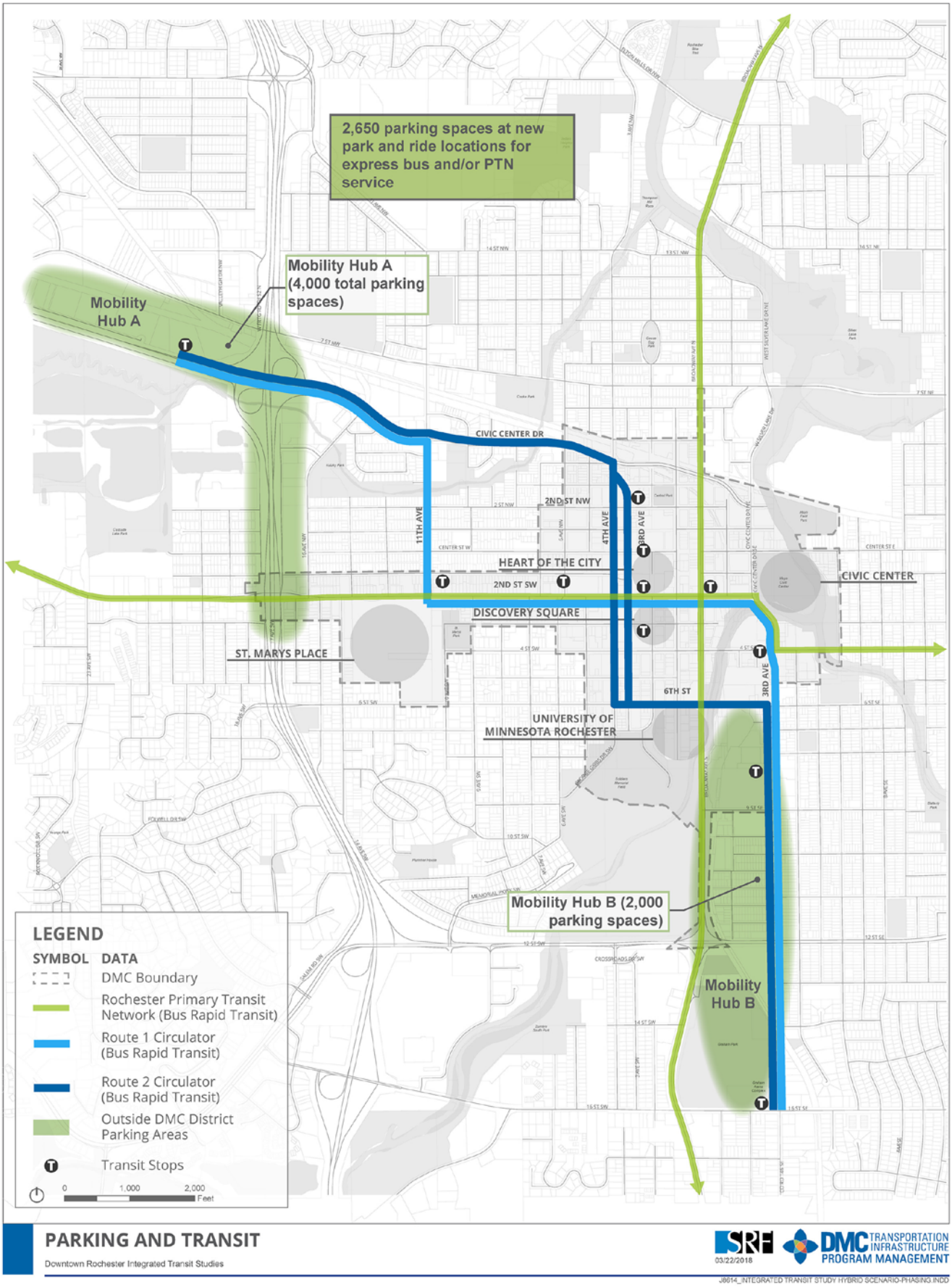
Because a loop operation would require a consistent headway along its entire length, the loop was split into two routes as shown in **Figure 18**. This allows the service frequency on each of the two routes to be adjusted individually based upon ridership in each service area.

In **Figure 18**, the commuter parking sites are now referred to as Mobility Hubs. As the circulator alternatives evolved, so did the service concepts for the parking locations. In addition to offering parking, the site concepts were expanded to include waiting facilities for transfers to and between cars, circulator buses, express buses, and regional buses. With the increased activity level, these hubs may also support some commuter-oriented retail activity.

Route 1 starts at Mobility Hub A and follows the same path as the Tier 2 Scenario A BRT circulator. Route 2 also begins at Mobility Hub A, and continues east along Civic Center Drive. Instead of turning south at 11th Avenue, however, Route 2 extends further along Civic Center to 4th Avenue NW. Route 2 then turns on 3rd and 4th Avenues to connect to 6th Street SW. The BRT travels north on 3rd Avenue and south on 4th Avenue, similar to the DMC Modified Tram. Route 2 continues along 6th Street to 3rd Avenue SE where it rejoins Route 1 and ends at Mobility Hub B. Mobility Hub B is located at Graham Park, significantly increasing the reach and length of the Hybrid circulator compared to Scenario A.

The addition of the second route to the original Scenario A BRT offers several service advantages. Downtown commuters have direct circulator access from Mobility Hub A, using Route 2, rather than stopping first at St. Mary's on Route 1. Route 2 also provides closer circulator service from both Mobility Hub A and B parking to work destinations north and south of 2nd Street. This results in a shorter walk from the circulator to the workplace. The north/south orientation of Route 2 also offers more circulator coverage beyond 2nd Street for non-commuter trips within downtown. Finally, this route connects the University of Minnesota Rochester campus with the downtown area.

Figure 18. BRT Hybrid



Splitting the Scenario A BRT service between two routes will reduce the frequency of service, although a high level of service will still be available on both routes. Route 1 would operate every 7.5 minutes in the peak (increased from 2.5 minutes in Scenario A), while Route 2 operates at 5 minute intervals in the peak. Off peak, evening and weekend service would be the same on both routes as for Scenario A, although each of these service frequencies could be adjusted. The Hybrid results in a significant decrease in peak hour bus volume on 2nd Street, creating additional transit capacity along that route for future growth.

As in Scenario A BRT, Route 1 operates in exclusive lanes. Route 2 also operates in exclusive lanes for a significant portion of the trip, but runs in shared Business Access and Transit (BAT) lanes along 3rd and 4th Avenues. These curb lanes only allow transit vehicles and cars accessing businesses and parking adjacent to the lane.

The characteristics of the Hybrid BRT circulator are compared with the Scenario A BRT in **Table 5** below.

Table 5. Comparison of Scenario A BRT and Hybrid BRT Circulator Performance

	Scenario A BRT	Hybrid BRT
Capital Cost ($2017)	$101.1M	$142.0M
Operating Cost ($2017)	$3.7M	$7.1M
Daily Ridership	21,750	22,600

The Hybrid BRT ridership increases slightly from the Scenario A BRT. Both the capital and operating cost increase significantly compared to Scenario A due to the second route and extension to Graham Park. Hybrid BRT service advantages not included in this table are described above.

This page is intentionally blank.

Circulator Implementation Activities

Advancing the transit service improvements outlined in this report will require several types of activities listed below.

- Coordination with Rochester Public Transit
- Identification of a funding plan
- Development of a phasing strategy for the circulator capital investment
- Initiation of a benchmarking process

The transit circulator implementation process will involve numerous steps over a 20-year period, including a series of incremental transit improvements. The initial transit improvements impacting downtown will occur as the RPT implements the 2017-2021 Transit Development Plan (TDP). These improvements will significantly enhance the quantity and quality of transit service to and within downtown. Subsequent expansion of local transit service will depend primarily on the rate of employment growth in downtown and funding availability.

Coordination with Rochester Public Transit

Rochester Public Transit is implementing an aggressive five-year plan that will increase revenue hours of service by 83 percent and expand the peak hour fleet by 89 percent. The plan includes an expansion of park-n-ride service and implementation of the 2 PTN BRT projects referenced earlier in this report.

Introduction of a downtown circulator must be accomplished in the context of the overall transit system. The circulator operating plan and local and express bus services will need to be integrated to optimize the effectiveness of both services. In addition, all bus operations on 2nd Street may travel along the Hybrid BRT route, requiring coordination of services.

Identification of a Funding Plan

Implementation and operation of a circulator will require both construction funding at the beginning of the project, and operation funding for its duration. This section outlines the funding sources available for circulator projects. These funding sources are described in greater detail in *Integrated Transit Studies: Transit Circulator Implementation Plan.*

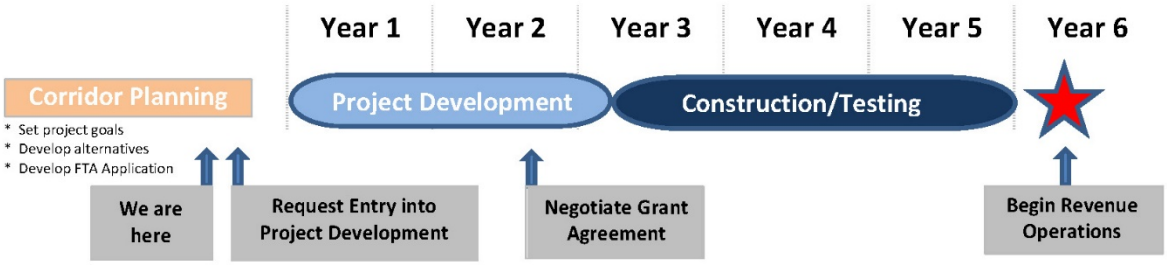
Capital Funding Programs

Capital cost elements include design; guideway and station design and construction; utility relocation; vehicles; and right-of-way. Candidate approaches to fund the capital costs are summarized below.

Federal Transit Administration (FTA) Small Starts Program

The FTA Capital Investment Grant Small Starts program is the primary funding source for BRT projects. Capital projects with a total capital cost under $300 million, and federal funding request under $100 million are eligible for this program. Projects with a higher total cost or federal funding request fall in the FTA New Starts program, which has more rigorous requirements and requires a longer schedule. Based upon the characteristics of the DMC circulator, Rochester should shape an initial project that is eligible for Small Starts. The Small Starts schedule is summarized in **Figure 19**.

Figure 19. FTA Small Starts Process



Rochester is currently approaching the end of the Corridor Planning phase, leading to an application to enter Project Development if FTA funding will be pursued. A BRT project can advance through the process in about six years, assuming that the project satisfies FTA project evaluation criteria.

The Small Starts program includes a streamlined option that would enhance the competitiveness of the circulator for FTA funds if an initial project is proposed that is less than $100 million in capital cost, and it can be demonstrated that there are currently at least 6,000 transit riders in the study corridor. The ridership minimum could be met if Mayo shuttle passengers are included.

The Small Starts program is discussed further in Integrated Transit Studies: Transit Circulator Implementation Plan, which also includes a summary of funding approaches for 12 recent BRT projects. The program is described in detail in Reporting Instructions for the Section 5309 Capital Investment Grants Program: Small Starts, June 2017 and Final Interim Policy Guidance Federal Transit Administration Capital Investment Grant Program, June 2016.

The remaining funding options are identified below. They are less complex and offer lower funding levels than Small Starts. More information on each is included in *Integrated Transit Studies: Transit Circulator Implementation Plan.*

Other Federal Programs

FTA Formula Funds: RPT receives annual formula funds through the FTA Section 5307 Urbanized Area Formula Program and Section 5339 Bus and Bus Facilities Formula Grants. Since the RPT five-year TDP reflects an aggressive expansion program, any formula funds are likely to go into that expansion in the short term.

Federal Highway Administration (FHWA) Funds: This includes FHWA funding sources that are eligible to be "flexed" (transferred) to the FTA to support implementation of transit projects. These sources include: Congestion Mitigation and Air Quality (CMAQ) Improvement Program, Surface Transportation Program (STP), and Transportation Alternatives Program (TAP).

U.S. Department of Transportation (USDOT) TIGER Grants: The Transportation Investment Generating Economic Recovery (TIGER) program provides competitive grants for transportation projects that contribute to the long-term economic competitiveness of the nation; improve the condition of existing transportation facilities and systems; increase energy efficiency and reduce greenhouse gas emissions; improve the safety of U.S. transportation facilities; and/or enhance the quality of living and working environments of communities through increased transportation choices and connections. Continuation of the grant program is under review by the new administration.

State Transit Funding

The State of Minnesota provides capital assistance to transit agencies for a variety of uses. The RPT 2017-2022 TDP identifies state funding for approximately 42 percent of its capital budget, including bus purchases, a transit center, and expansion of the Public Works Transit Operations Center. While State transit grants could be a funding source for the circulator, other Rochester transit needs would also need to be considered.

Other State Funding

The State of Minnesota currently provides DMC funding based directly on new development within the DMC boundaries. The City of Rochester, in cooperation with the Economic Development Agency (EDA) of the Destination Medical Center Corporation (DMCC),

determines how the funding will be spent. As development continues, transit would be a logical recipient of a portion of the funds to mitigate congestion related to that development and foster continued growth.

Private Participation

Several streetcar projects have been supported by assessment districts, however, there are no examples of BRT capital support using assessment fees.

Operating Funds

Long-term funding for operating and maintenance (O&M) may reflect a combination of multiple sources. At this early stage of project planning, operating funding sources are typically less defined compared to capital revenue sources. However, it is critical to initiate discussions among the public and private partners that would benefit from the proposed service to identify which potential sources have the most political support to carry forward for further evaluation. The following provides a list of potential operating funding sources which can be narrowed down as the circulator moves through the project implementation process.

Fare Revenue: Passenger fares will potentially be a key sources of operating revenue for the circulator. Setting a fare structure will require a balance between revenue generation, cost recovery, simplicity, and ease of use.

Other Operating Revenues: Rochester may consider taking advantage of the positive image created by a high capacity project to encourage sale of static and electronic advertising on stations, vehicle exteriors, vehicle interiors, website, and promotional materials.

Reallocation of Existing Fixed Route Bus Service Costs within the Corridor: Integration of the circulator into the RPT system may replace some existing service, and facilitate more efficient travel for the remaining routes. Any cost savings associated with these impacts can help to offset the circulator operating and maintenance costs.

State Operating Funds: Minnesota funds transit operations through a formula grant program (Section 5311). RPT currently relies heavily upon state operating funds, which comprise 68 percent of the 2017 operating budget. In the final year of the 2017-2021 TDP, operating funds from the state are assumed to increase by over 45 percent.

Contributions from Private Partners: For major employers and/or other activity centers served directly by the circulator, a revenue structure could be established where the employer/activity center purchases a set number of tickets per year or pays an agreed upon share of operating costs relative to the benefits the transit service provides. The Mayo Clinic currently provides and/or subsidizes a variety of transit services which

could potentially be shifted towards transit operations if the Mayo services can be discontinued.

Assessment Districts/Tax Increment Financing Districts: In addition to providing a source of revenue for capital costs, these Districts could also provide assistance in paying for a share of on-going maintenances costs.

Parking Fees: A parking fee is a tax or surcharge levied on paid parking. The fee could be applied within one or more of the corridors throughout downtown. This would be a component of the overall Integrated Transit Studies implementation strategy, extending beyond the circulator.

Circulator Phasing Strategy

Projects of this scale are typically implemented in phases. The construction schedule is generally determined by funding and development activities along the route. The diverse nature of the various projects included in the overall DMC plan will require a detailed, yet flexible phasing strategy to coordinate inter-dependent projects, optimize construction efficiencies and minimize construction impacts.

Benchmarking

The ITS investments are designed to address future travel needs associated with DMC growth. The implementation plan can be based upon an assumed employment growth rate, or implementation activities can be triggered based upon specific benchmarks. Three potential benchmarks are outlined below.

- Downtown employment growth: This measure is a general indicator reflecting an increase in travel. The information could be estimated relatively easily. It is a general measure, however, and does not identify specific types of transportation needs by mode of travel.
- Downtown parking occupancy: This measure focuses specifically upon availability of parking for downtown commuters. Its accuracy would rely upon monitoring both the private and public parking supply, and distinguishing between short-term and long-term parking.
- Peak hour Level of Service (LOS) at key portal locations: This benchmark measures the ease of access to and from the downtown area during peak commuter periods.

To be effective, the benchmarks must be applied and monitored regularly. In addition, the threshold values for action must be set allowing adequate time for implementation of transportation policies and/or projects. Each type of transportation action will require a different lead time for implementation. These actions could include, but are not limited to:

- Travel Demand Management (TDM). These activities may be implemented relatively quickly, but can require significant stakeholder approval.
- Increasing portal capacity. The lead time may be moderate, depending upon right-of-way availability.
- Providing remote/peripheral parking. Lead time may be moderate for surface parking, depending upon right-of-way availability. Structured parking may require longer lead time due to funding and environmental considerations.
- Implementing fixed guideway transit service. Most of these transit projects are funded through a federal process that takes 7-10 years on average.

It is important to note that responses to any system of benchmarks must recognize relationships between the various ITS projects and advance an overall program, rather than individual, competing projects.

Next Steps

The circulator includes a two-route BRT as the preferred solution for transit. The circulator plan identifies the placement of the routes in the streets, station locations, and operating plans. Each would be developed in greater detail as the project advances.

The next step to advance the project is to adopt a locally preferred alternative. If some type of federal funding is to be pursued, this would include adding the project to the regional transportation plan.

Development of an initial funding plan will establish the direction for the project. The use of the most common funding source, FTA Small Starts, would require a project approach that satisfies FTA requirements. Development of the funding plan would also provide a forum for local decision makers to assess their level of commitment to advance the project based upon the long-term funding needs. This funding discussion tends to involve the broad range of stakeholders that will eventually need to support project implementation.

Assuming the use of FTA Small Starts funding, the City would need to apply to the FTA for approval to enter the Small Starts Program. The ITS study results provide most of the information necessary for the application. The most significant requirement to enter the Small Starts Program is the local commitment of funds to perform the design and environmental documentation. The application would include an overall schedule and approach to advance the project.

If the funding plan does not include federal participation, the Small Starts process still provides a general template from which Rochester can structure its own project development approach. The lack of federal review would shorten the schedule for completion and reduce project capital cost.

Appendix A. Existing and Future Conditions

This page is intentionally blank.

Transit Circulation Study: Existing and Future Conditions

DMC Transportation & Infrastructure Program

City of Rochester, MN

Prepared for:

DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

Prepared by:

SRF Consulting Group, Inc. HDR

Date: May 2018

J8621- Downtown Rochester Transit Circulation Study

This page is intentionally blank.

Table of Contents

Summary **1**

Introduction **3**

Background Documents Review **6**

2nd Street Corridor Framework Study (2009) 6

Downtown Rochester Master Plan (2010) 7

University of Minnesota Rochester (UMR) Campus Master Plan "Envision UMR" (2014) 8

Destination Medical Center (DMC) Development Plan (2015) 8

Ten Key Transportation Principles 11

DMC Transit Investment Strategy 12

Mayo Clinic 5-Year Master Plan Updated (2016) 14

City of Rochester Comprehensive Plan 2040 (Draft 2017) 14

Draft Transit System and Market Analysis 15

Draft Travel Patterns and Link Analysis 15

Primary Transit Network (PTN) Framework 15

RPT Transit Development Plan 2017-2021 18

Transit Demand Assessment **18**

Transit Supportive Land use 21

Major Study Area Destinations 23

Population and Employment Densities 24

Transit Need 27

Travel Demand 29

Existing Transit Services **30**

Rochester Public Transit (RPT) 30

RPT Rolling Stock and Facilities 31

RPT Rolling Stock and Facilities 34

RPT Park-and-Ride Program 34

Existing and Projected RPT Ridership 36

City of Rochester Paratransit Service (ZIPS) 38
Regional Services 38
Existing and Projected Regional Ridership 41
Mayo Clinic Shuttle Service 41
Existing and Projected Traffic and Parking Conditions 44
Existing and Projected Traffic Conditions 44
Parking Conditions 48
Existing Pedestrian Subway and Skyway Network 49
Conclusion: Transit Needs Identification and Analysis 49

Tables

Table 1. Land Use Allocation Summary 23
Table 2. Summary of Transit Dependent Characteristics 27
Table 3. RPT Service Summary 31
Table 4. Existing RPT Park-and-Ride Summary 35
Table 5. Aggregated Route-Level Weekday Ridership by Study Area Corridor 38
Table 6. Mayo Clinic Shuttles Service Summary 42
Table 7. Mayo Shuttle Ridership Summary 42

Figures

Figure 1. Study Area Location 4
Figure 2. DMC Master Plan 10
Figure 3. *DMC Development Plan* Transit Investment Strategy 13
Figure 4. Draft Primary Transit Network 17
Figure 5. Proposed Weekday Daytime Network 19
Figure 6. Proposed High Frequency Network 20
Figure 7. Study Area Existing Land Use and Major Destinations 22
Figure 8. Study Area Existing Population Density 25
Figure 9. Study Area Existing Employment Density 26
Figure 10. Study Area Existing Transit Need 28
Figure 11. ROCOG Model Vehicle Trip Generation 29

Figure 12. Existing RPT Service 32
Figure 13. Existing Study Area Rochester Public Transit Routing and Stop Locations 33
Figure 14. Existing Study Area RPT Stop-Level Ridership Activity 37
Figure 15. Rochester City Lines Existing Regional Network 39
Figure 16. Rochester City Lines Routing and Vehicle Staging Areas within Study Area 40
Figure 17. Existing Mayo Shuttle Routing in Study Area....43
Figure 18. Study Area Existing Average Daily Traffic....45
Figure 19. Existing Portal Capacity: PM Peak Period Analysis....46
Figure 20. 2040 No Build Portal Capacity: PM Peak Period Analysis....47
Figure 21. Existing Study Area Pedestrian Skyway and Subway Network 50
Figure 22. Existing Combined Transit Routing in the Study Area 52

Appendix

Appendix A. DMC Integrated Studies Baseline Assumptions (ROCOG, 2016)

List of Acronyms

ACS	American Community Survey
ADA	Americans with Disabilities Act
CBD	Central Business District
DMC	Destination Medical Center
HBW	Home-based work
PTN	Primary Transit Network
RCL	Rochester City Lines
ROCOG	Rochester-Olmsted Council of Governments
RPT	Rochester Public Transit
TDM	Travel Demand Management
TDP	Transit Development Plan
UMR	University of Minnesota Rochester
ZIPS	Zumbro Independent Passenger Service

Transit Existing and Future Conditions

Summary

This memo examines existing and future transit conditions in Rochester, Minnesota, and provides a base from which to identify the need for future transit investment in the downtown area. This memo generally aligns with the transit vision developed in the *2015 Destination Medical Center (DMC) Development Plan*. The *DMC Development Plan* identified several key investment transit strategies needed to accommodate the future growth and substantial increase in commuter travel demand expected in downtown Rochester over the next 20 years. The *DMC Development Plan* assumes 65 percent growth in total employment, a 30 percent increase in population, and a substantial increase in Mayo Medical Center patients and their travel companions. Over the next 20 years, this growth will create congestion affecting street operations throughout both the DMC District and at the Downtown Transit Center. If the associated growth in commuter travel demand follows current trends (approximately 70 percent of commuters drive alone), area roadways will be severely congested, and 180 additional acres of surface parking (equivalent to eight city blocks of six-story parking structures) will be required, as documented in the *DMC Development Plan*.

The assessment of existing and future transit markets and service in the study area defines the level of transit investment needed to accommodate the expected growth in downtown Rochester. If the transportation network is to continue functioning adequately in the future, the share of transit trips relative to total trips will need to nearly triple over the next 20 years. The following summary identifies the transit findings and needs in the study area:

- Land use is anticipated to intensify in the study area based on *DMC Development Plan* assumptions. Multi-family residential units are expected to increase by 168 percent; medical space is expected to increase by 66 percent; and the planned University of Minnesota Rochester (UMR) campus will drastically increase educational uses. Major mixed-use corridors include 2nd Street SW, 3rd Avenue SE, Center Street, Broadway, and 4th Street SW/SE.
- Population and employment growth is expected to lead to a substantial increase in travel demand, which will outpace existing transportation capacity if travel behavior continues as it does today, with 70 percent of all trips taken by single occupancy vehicles.
- Transit dependent populations in the study area are proportionately higher than those within the entire City of Rochester, suggesting the

importance of improved local circulation with transit investments within the study area.

- If the *DMC Development Plan* is realized, trips to the DMC district are expected to grow by nearly 64 percent, a growth of nearly 104,000 total trips per day. The increased intensity of development and trip generation would increase traffic well above the current roadway network capacity, creating severely congested conditions.
- Three types of transit service currently operate in downtown Rochester, including Rochester Public Transit (RPT), regional service provided by Rochester City Lines (RCL) and LeRoy City Lines, and Mayo Shuttles. While each service accommodates unique transit markets, many of the routes overlap similar corridors (e.g., 2nd Street SW) and provide access to similar downtown destinations. In some cases, the existing transit service within the study area is not well integrated, limiting the effectiveness of service options within the area.
- Projected transit ridership for both local and regional trips will need to increase between 154 and 285 percent in order to achieve the commuter transit mode share goal of a 23 to 30 percent. This growth in transit use will require substantial increases in service and vehicles, which will require facility expansions and improvements to provide more capacity, ensure effective operations, and provide improved amenities for passenger.
- Increased travel forecasted in the *DMC Development Plan* will overwhelm roadway capacity and breakdown the roadway network operations without significant changes in travel behavior. High-quality, frequent transit service will be essential to reduce auto dependency and avoid overcapacity conditions.
- Parking supply will need to be managed to shift travel demand to transit. Park-and-ride lots outside the downtown core will play an important role in effectively providing access to downtown through direct connections to high-quality transit. The current overcapacity RPT park-and-ride conditions will present a major constraint if future transit demand is expected to rely on a seamless connection between park-and-ride locations and transit service destined to the study area. Peripheral lots surrounding downtown will also become important to convert auto trips to transit outside of downtown.
- The existing pedestrian skyway and subway network serves an important purpose by providing safe and climate-controlled access to downtown buildings. While this existing network can expand the reach of downtown circulator options, some changes in the capacity, access, and extent of the system should be considered in the development of downtown circulator options.

Introduction

This memo examines existing and future transit conditions in Rochester, Minnesota, and provides a base from which to identify the need for future transit investment in the downtown area. The City of Rochester is the largest community in Olmsted County in southwest Minnesota, with a population of over 112,000 people.[1] The city is comprised largely of low density urban development patterns but is built upon a strong downtown core, where many of the regional employers are located, particularly numerous Mayo Clinic facilities and other regional and local health care facilities.

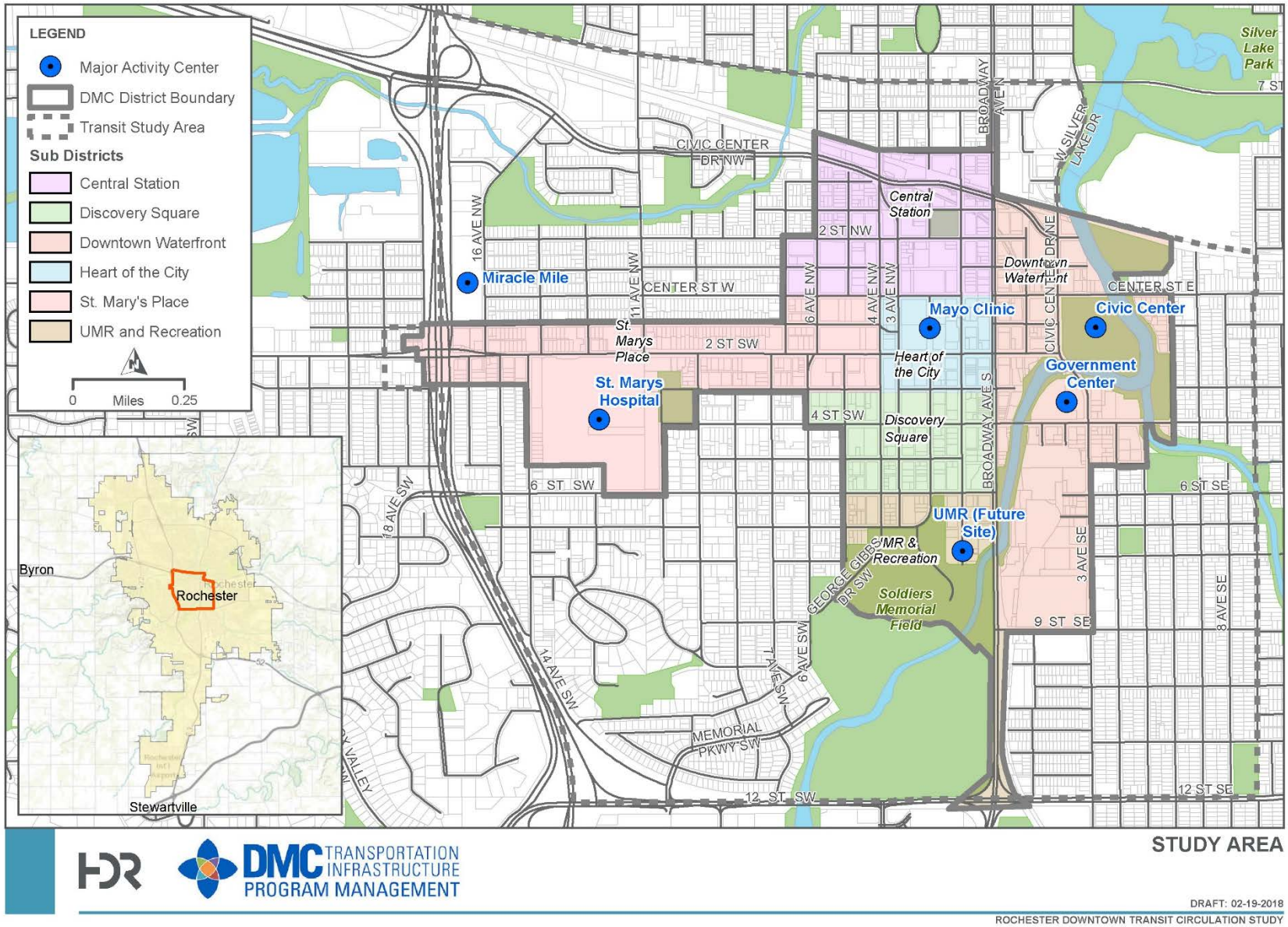
This memo considers the findings identified in the *DMC Development Plan* and assumes a study area similar to the DMC district. The study area (shown in **Figure 1**) includes the DMC district and adjacent neighborhoods, which is generally delineated with the following boundaries:

- Civic Center Drive NW to the north
- 12th Street SW/SE to the south
- 3rd Avenue SE to the east
- U.S. 52 to the west

This memo explores the transit market demand that exists and is projected within the study area. Transit market demand is a key component of identifying unmet transit needs and opportunities for transit investment. A variety of higher density land uses and major activity centers typically serving transit-dependent populations are common market attributes for successful transit service investment. The *DMC Development Plan* also anticipates several distinct transit sub-markets that warrant high-quality transit investment, including Mayo Clinic patients, visitors, and staff making short trips between health care facilities; commuters making longer trips to and from downtown; and residents and visitors traveling to different destinations within the study area.

[1] U.S. Census Bureau, 2015 American Community Survey 1-Year Estimate.

Figure 1. Study Area Location



This memo also reviews the levels of transit service currently operating within the study area. RPT is the primary local transit service provider within the City of Rochester and is managed by the city's Public Works Department. RPT provides traditional all-day bus service, direct park-and-ride based bus service, and evening bus service throughout the city limits on weekdays and Saturdays. The Zumbro Independent Passenger Service (ZIPS) Americans with Disabilities Act (ADA) paratransit service is also offered within the City of Rochester service area for individuals with mobility challenges and is managed by the city's Public Works Department. Longer distance, regional commute transit service is offered by RCL and LeRoy City Lines, privately operated service providers connecting towns outside of the City of Rochester directly to downtown Rochester destinations. In addition, the Mayo Clinic operates visitor, employee, and patient shuttles between campuses and local park-and-ride lots within the city and downtown area.

The focus of this memo is to evaluate the following five key components necessary to identify opportunities and constraints for future transit investment consideration within the study area, including:

- A brief review of regional and local plans and policies relevant to future transit investment in downtown Rochester, including the *DMC Development Plan*, the adopted Rochester Downtown Master Plan, the adopted *Transit Development Plan (TDP) 2017-2021*, and the *Rochester Comprehensive Plan 2040*, currently under development.
- Review of current and projected transit market demand, including land use, population and employment, transit dependent demographics, travel demand, and DMC-specific transit sub-markets.
- Review of existing transit services and facilities, specifically those owned and operated by RPT, RCL, ZIPS Paratransit, and Mayo Clinic Shuttles, but also facilities that promote safe and convenient access to transit.
- Review of current and projected traffic and parking conditions within the study area that may impact transit operations, help determine future transit facility locations, and provide opportunities to support the success of future transit investment.
- Review of the existing pedestrian skyway and subway network that connects many buildings in the downtown core, which may present opportunities for future transit investment integration.

This memo includes the following sections:

- Background Documents Review
- Transit Demand Assessment
- Existing Transit Services

- Existing and Projected Traffic and Parking Conditions
- Existing Pedestrian Subway and Skyway Network
- Conclusion: Transit Needs Identification and Analysis

Background Documents Review

A number of different plans and policies have been developed or are under development that support the need for future transit services. Each plan identifies objectives and recommendations to support the anticipated growth expected within downtown Rochester. The documents will assist in identifying potential transit improvements and help to reduce the range of options considered within the study area. The following plans and policies have been reviewed and are summarized below:

- 2nd Street SW Corridor Framework Study (2009)
- Downtown Rochester Master Plan (2010)
- University of Minnesota – Rochester Campus Master Plan (2014)
- DMC Development Plan (2015)
- Mayo Master Plan Update (2016)
- Rochester Comprehensive Plan 2040 (Draft 2017)
- Rochester Transit Development Plan 2017-2021

2nd Street Corridor Framework Study (2009)

With nearly 40 percent of all jobs in Rochester being proximate to the 2nd Street corridor, the *2nd Street Corridor Framework Study* evolved from a partnership between private, non-profit, and public entities to create a plan that would develop 2nd Street SW between Highway 52 and 6th Avenue SW (west of the Central Business District [CBD] and Mayo Downtown Campus) as an attractive destination for business, residents, and visitors. This key study includes a framework to achieve a vision, which includes fostering mid-rise development along the corridor; growing medical, lodging, residential, and commercial activities; considering how transit service could be improved for those living, working and traveling to or through the corridor; and how to safely manage movement of people and goods within the corridor.

The long-term transportation strategy creates a multi-modal corridor serving the 2nd Street "Urban Village" and downtown with improved transit, bike, and pedestrian facilities, all with the intent of giving people attractive transportation choices beyond the single occupant vehicle.

Downtown Rochester Master Plan (2010)

The *Downtown Rochester Master Plan* outlines feasible strategies to take advantage of new investment and economic activity near downtown (such as the Mayo Clinic, IBM, and UMR to promote and grow downtown Rochester over the next 20 years. Implementation of the plan will reinforce the City of Rochester's widely-recognized position as one of the best places to live in the United States.

Transportation is a key plan component to meet the needs of Mayo patients, staff, and allied health staff, which is a dynamic situation necessitating constant balancing and adjustment. Resolving connectivity issues throughout downtown, including the integration of skyway and sidewalk systems, improving pedestrian safety, and reducing the appearance of roadways as barriers, are key mobility objectives within downtown. Investments in a higher capacity transit network, ranging from bus priority to fixed rail, as well as appropriate land use, ensures continued mobility for all users.

Identifying land for development opportunity though various public and private partnerships will reinforce new commercial, housing, open space, and civic amenities that can facilitate the mixed-use development patterns that decrease reliance upon personal automobiles.

The *Downtown Rochester Master Plan* establishes a vision for the future of downtown Rochester. The plan provides direction and guidance for leaders, stakeholders, and individuals involved in decision-making in downtown Rochester. The master plan includes a mobility element that:

- Targets a 50 percent commuter trip mode share using alternatives to single occupancy vehicles by 2030, including a 23 percent downtown transit mode share.
- Identifies a 30 percent non-commuter mode share goal for alternative modes by 2030.
- Develops the concept for transit priority streets in downtown Rochester, which was subsequently included in the *DMC Development Plan*, the *Rochester Comprehensive Plan 2040*, and the *Transit Development Plan 2017-2021*.
- Mitigates the potential economic development and livability impact from expansive growth in off-street parking demand that would occur in downtown Rochester if current mode share distribution remained unchanged.
- Creates a transit framework that will double transit trips by 2030, removing short and inefficient auto trips from downtown streets. The framework identifies specific transit recommendations, including:

- Conducting a comprehensive operations analysis to improve efficiency of operations.
- Developing 2nd Street and Broadway Avenue as Primary Transit Corridors.
- Improving transit service comprehension.
- Expanding remote parking and connecting with high-frequency transit by expanding on the success of the existing park-and-ride and remote parking program.
- Enhancing mobility options that create a pedestrian-oriented environment, which better balances mobility options and reduces dependency on private vehicular travel.

University of Minnesota Rochester (UMR) Campus Master Plan "Envision UMR" (2014)

The *UMR Campus Master Plan* defines a conceptual physical framework to implement a new downtown urban campus in Rochester over time that could support a student population of 1,400 within the next ten years. Campus connectivity is one of the three key master plan themes.

It is the intent of UMR to encourage walking, cycling, transit use, and other alternative modes of transportation as a means to access the future campus located on the south end of downtown Rochester. UMR expects to minimize its footprint of campus parking, with the university currently leasing only one space for every eight students and one space for every 1.5 staff associated with their current location. A sizeable portion of the student population (17 percent) identified transit as their first or second most preferred means of getting around.

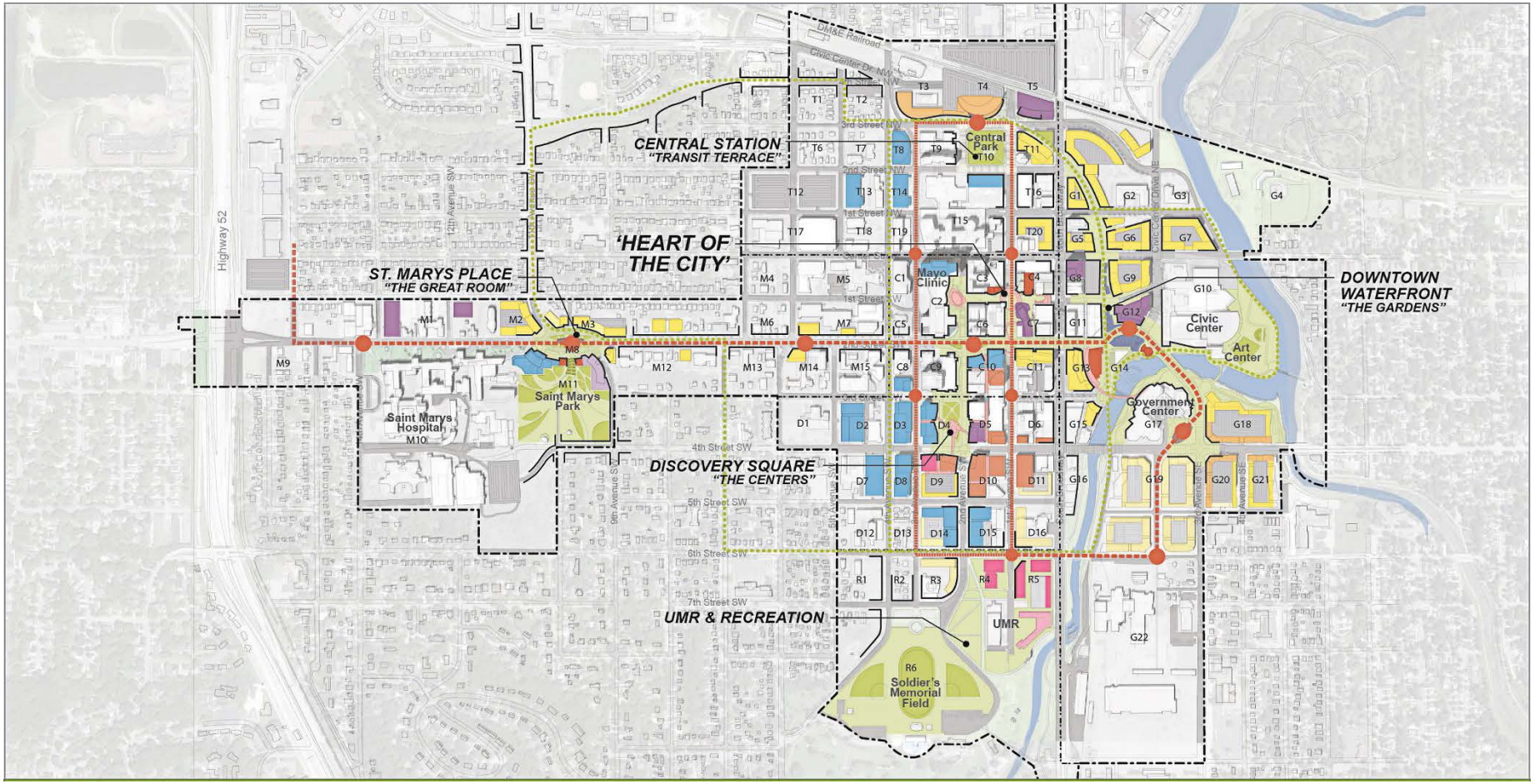
Destination Medical Center (DMC) Development Plan (2015)

The *DMC Development Plan* provides a vision for a series of distinct districts in downtown Rochester centered on the Heart of the City District encompassing the Mayo Medical Center, with particular focus on creating a nexus of community investment, health care, health research, and bioscience advancement. This plan utilizes public investment to advance the City of Rochester as a global medical destination, as well as a regional destination for those in Minnesota and surrounding states. The *DMC Development Plan* outlines the long-term vision and planning framework needed to secure downtown Rochester as a global medical destination. The plan was developed in partnership among the Mayo Clinic, the City of Rochester, Olmsted County, and other key stakeholders.

Creating six unique sub-districts emphasizes urban development to refocus commercial, recreational, and residential activities back into downtown. This follows decades where the predominant pattern of growth in the city has followed a pattern of low density dispersion along major arterial street corridors emanating from downtown. Through four phases of investment, each sub-district would have a targeted emphasis to catalyze development attracting a variety of tenants and activities. The six sub-districts, each leading to different land use and development patterns, are listed below and identified in **Figure 2**.

- **The Heart of the City:** The heart of downtown Rochester, which includes the Mayo Clinic and other future commercial, hospitality, retail, and residential uses.
- **Discovery Square:** The center for future bio-medical, research, and technology innovation facilities.
- **Downtown Waterfront:** A destination for residents and visitors adjacent to the Heart of the City, which includes the convention center, civic center, and other recreational activities.
- **Central Station:** The location of the future regional transit hub north of the Heart of the City, which will be positioned to support a future high-speed rail connection and the pathway to future growth.
- **St. Marys Place**: A monumental gateway that will act as one of the primary entry points into downtown Rochester, which includes St. Marys Hospital.
- **UMR/Recreational Area**: The future site of the UMR, which includes an urban college campus and many recreational activities for students, residents, and visitors.

Figure 2. DMC Master Plan



Source: DMC Development Plan

The anticipated future growth will result in a significant increase in travel demand within the study area, and therefore will require significant investment in the existing transportation network. The DMC transportation framework and its associated investments reflect major changes transpiring in the City of Rochester over the next 20 years. These changes include:

- Intense land use development in the downtown area
- Concentrated employment growth, particularly in districts with major Mayo Clinic influence
- Rise of downtown as a residential neighborhood
- Increased demand for downtown access
- Placemaking: connecting new and existing activity centers
- Rapidly changing travel behavior, consumption preferences, and essential living infrastructure

The 2015 *DMC Development Plan* identifies five overall goals to guide transportation and infrastructure planning and development:

- Create a comprehensive strategic plan with a compelling vision that harnesses the energy and creativity of the entire community
- Leverage the public investment to attract more than $5 billion in private investment to Rochester and the SE Minnesota region
- Contribute to the creation of approximately 35,000 - 45,000 new jobs in Minnesota, with workforce development strategies that support growth
- Generate approximately $7.5 - $8.9 billion in new tax revenue over 35 years
- Achieve the highest quality patient, companion, visitor, employee, and resident experience, now and in the future

Ten Key Transportation Principles

Aligning with the broader *DMC Development Plan* goals, the plan establishes 10 transportation investment principles for the next 20 years needed to achieve the vision laid out in the plan.

1. Make it easy, affordable, and convenient for people from Southeast Minnesota and around the world to get to downtown Rochester.
2. Bring 30 percent of the workforce to downtown Rochester on transit by 2035.

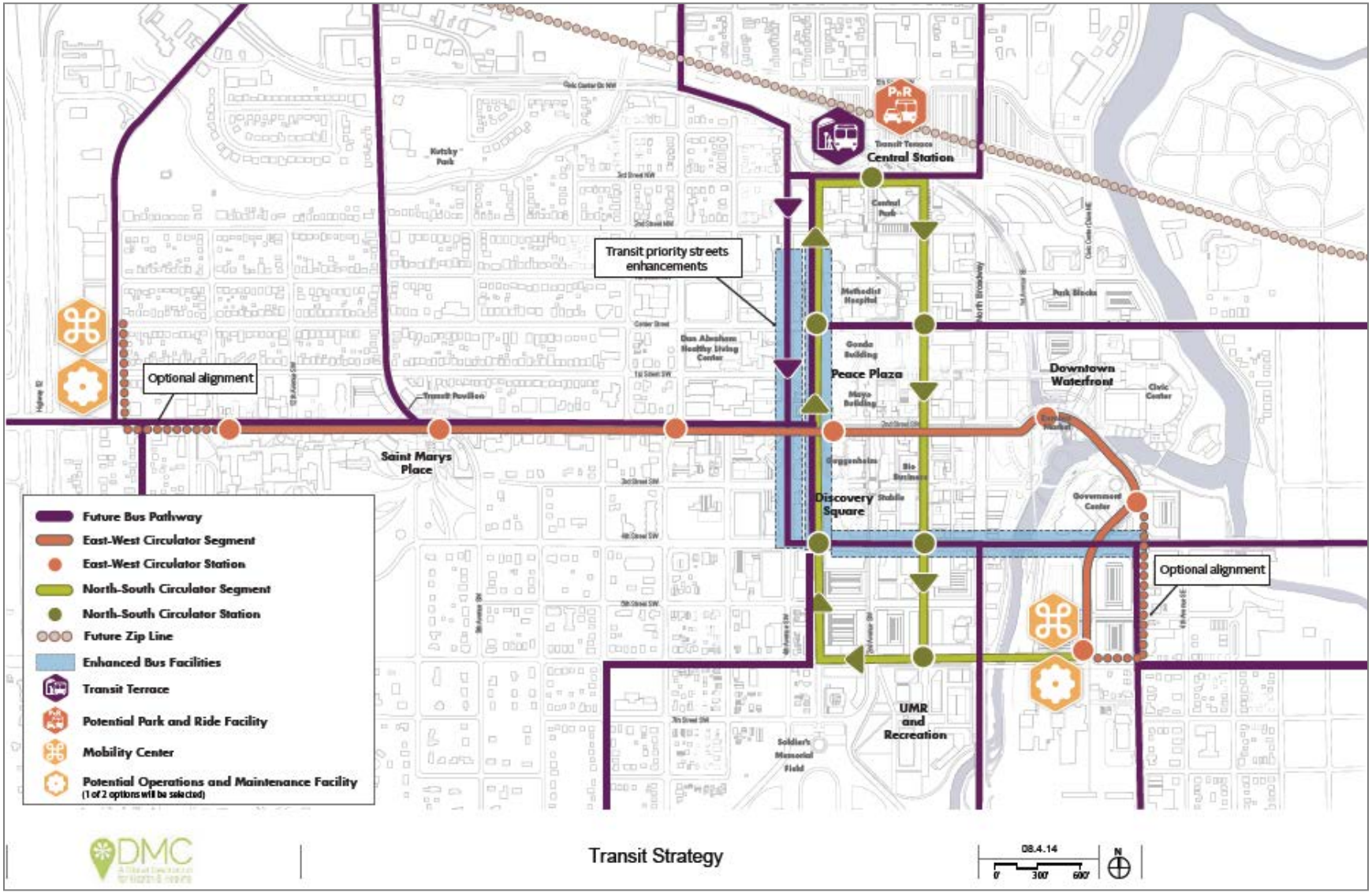
3. Create a park-once downtown environment connected by a frequent downtown circulator.
4. Build shared parking prioritized for economic development.
5. Create world-class streets, designed for people.
6. Create an exceptional place for healthy, human-powered transportation.
7. Form a downtown Rochester access authority.
8. Invest in a sustainable transportation infrastructure and programs that reduce the ecological footprint of the City.
9. Use DMC funding to leverage public and private transportation infrastructure funding.
10. Establish and maintain a transportation network that is accessible and inclusive to people of all ages, abilities, and states of wellness.

DMC Transit Investment Strategy

The *DMC Development Plan* identifies an investment strategy focused on capital improvements within the DMC development district to accommodate the anticipated growth in transit demand to, from, and within the downtown core. The investment strategy includes four capital investment components, which are described below and are visually represented in **Figure 3**:

- Optimize local and regional transit service downtown by rerouting transit service and improving the operating environment along the 3rd and 4th Avenue couplet to create additional capacity for long-term service growth.
- Invest in transit priority streets within downtown, including design treatments and enhanced passenger amenities to make transit faster, more reliable, more legible, more comfortable, and more easily accessible.
- Develop the Transit Terrace, a world-class multimodal transit center at the proposed Central Station District to connect future regional high-speed rail, the downtown circulator, regional and local bus service, and active transportation modes.
- Construct and operate a high-quality and frequent downtown streetcar line providing east-west circulation along 2nd Street SW and north-south circulation along 1st and 3rd Avenues. This includes a new operations and maintenance facility to accommodate streetcar vehicles and maintain service facilities. It will also be anchored by several "mobility centers" to provide access to multimodal connections.

Figure 3. *DMC Development Plan* Transit Investment Strategy



Mayo Clinic 5-Year Master Plan Updated (2016)

The *Mayo Clinic 5-Year Master Plan* provides guidance for future growth of the Mayo Clinic facilities and establish coordination with other planning efforts that may influence its future. The plan allows Mayo to be engaged in planning efforts related to land use, livability, economic development, higher education, and historic preservation.

The Mayo Medical Center employs approximately 30,475 individuals in downtown Rochester distributed between the St. Marys Hospital campus and the downtown medical center campus. Mayo provides a comprehensive transportation program to meet the needs of its patients, staff, and allied health staff, which is a dynamic situation necessitating constant balancing and adjustment.

Historically, Mayo has worked to manage its evolving transportation and parking needs, seeking to maintain employee parking at a level of one space for every two employees through a significant transportation management program including a bus pass program; cooperation with the City of Rochester on a network of park-and-ride lots; and encouragement of carpooling, cycling, and walking as a means of travel to work.

As a means to further community goals of minimizing downtown traffic congestion and pollution, assist in energy conservation, and minimize the need for investment of land and money in parking resources, the continued expansion of viable transit service throughout the City of Rochester with designated park-and-rides will be needed as Mayo embarks on its next phase of growth, expected to involve a substantial increase in employees over the next 20 years. The Plan identified 2nd Street SW and Broadway Avenue as two transit corridors within the context of the urban green space plans.

City of Rochester Comprehensive Plan 2040 (Draft 2017)

The *City of Rochester Comprehensive Plan 2040* is currently being updated to identify long-term strategies and policies to guide future development of land in the city. The comprehensive plan process includes analysis that evaluates the existing levels of transit service currently operating within the city and assesses current and future transit markets that can support future transit investment. The following *Comprehensive Plan 2040* components have been reviewed for this analysis:

- Draft Transit System and Market Analysis
- Draft Transit Patterns and Link Analysis
- Draft Primary Transit Network (PTN) Framework

Draft Transit System and Market Analysis

The transit component of the *City of Rochester Comprehensive Plan 2040* outlines the opportunities and constraints associated with accommodating future growth in travel demand with various forms of transit service. The Transit System and Market Analysis provides a city- and region-wide analysis of Rochester's existing fixed bused transit network, which is laid out as a radial pulse network focusing on a singular downtown transfer point at 2nd Street SW transit center. Included is a route-by-route breakdown of ridership, subsidy, routing, and trip generators on each, as well as studying transit dependency. This analysis notes successful transit networks must include service on a street grid with a variety of density or areas with transit-orientated development, a sense of safety for all users, serving major origins/destinations, and generally complementing both existing and proposed land use patterns. Additionally, this analysis gives a system-wide look at existing stop conditions and modest proposals to improve several stops throughout the City of Rochester. Privately operated service is included, because it provides significant commuter-only service between regional cities and downtown.

Draft Travel Patterns and Link Analysis

This memo provides a city- and region-wide analysis of home-based work (commute) and non-work trips relating to all modes of transportation. This memo describes the fundamental building blocks to develop non-single-occupancy-vehicle based transportation networks by studying the travel demand patterns throughout various areas of Rochester. These areas include downtown, suburbs, shopping centers (Walmart, Target, Apache Mall, etc.), major employers (IBM, Mayo, etc.), and other trip generators. Key findings include that 40 percent of trips are destined for downtown; non-work trips are typically short distances; congestion is limited to specific chokepoints and not currently a critical issue; freight movement is focused on highways while deliveries utilize a variety of local roads; and all-mode collisions increase with land use intensity. This memo acknowledges plans for the Rochester International Airport expansion, including the primary goals of strengthening downtown to airport travel service, pursuing additional regional hub airline service, and increasing flight frequencies to the Minneapolis-St Paul International Airport.

Primary Transit Network (PTN) Framework

Advancing and serving transit-orientated development throughout Rochester while maintaining robust service to existing markets is a critical component of the PTN strategy. The PTN offers a policy and analytical framework for the development of transit to ensure reliable, frequent, and comprehensive

service is delivered to those who choose transit and businesses seeking improved transit access. Determining these needs will further enable the creation of a logical transit network serving Rochester and fostering denser development around key transit hubs.

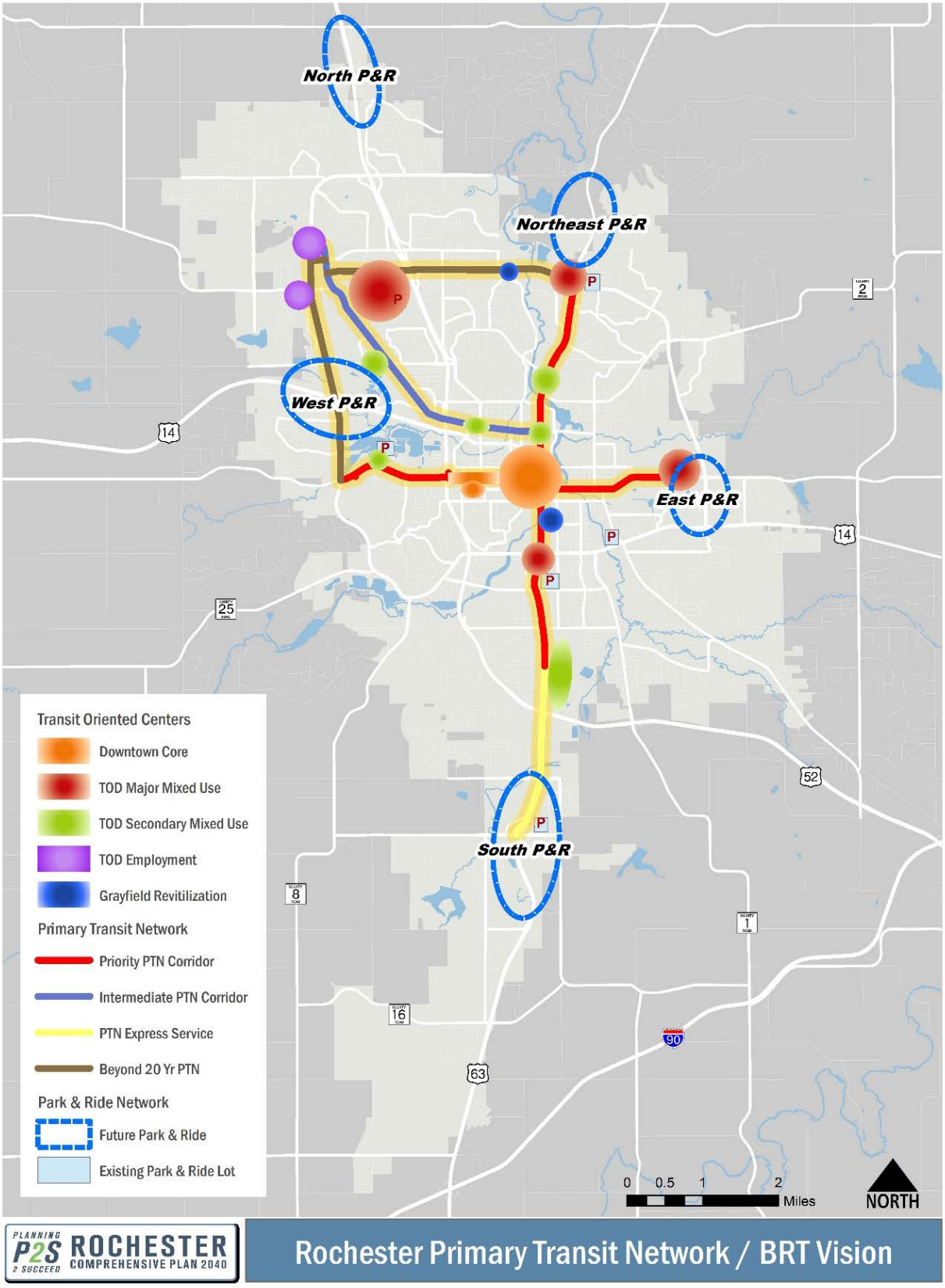
The PTN establishes a foundation for key transit features including ridership and productivity potential, with an emphasis on providing 15-minute or less headways; determining impacts of small changes and how that could positively impact the overall network; the creation of visibly permanent infrastructure signaling a commitment of investment to the community through good design and amenities; and combining transit access with beneficial land use changes to promote healthy development and give people a choice in how they travel in Rochester.

Implementation of the full PTN is dependent upon identifying additional operating and capital resources and developing more detailed plans. Today, the PTN framework is intended to provide a high-level view of what may be required from state, local, and private stakeholders tomorrow. This includes, but is not limited to, funding, capital improvements, fleet acquisition, zoning changes, private stakeholder involvement, community involvement, and the implementation of complementing strategies (e.g., biking and walking).

The *City of Rochester Comprehensive Plan 2040* identifies a PTN that assists in guiding intensification of new and re-developed land use mixes along the network at transit-supportive densities as a means to grow transit trip generation to levels sufficient to support higher frequency transit service and enable persons to consider transit as a primary travel option. **Figure 4** illustrates the Draft PTN strategy.

The Priority PTN corridors will offer enhanced bus service that will improve circulation within the DMC. Bus frequency will increase throughout the day along 2nd Street and Broadway Avenue, and schedule reliability will benefit from the implementation of roadway treatments such as transit signal priority. In addition, the PTN will implement a broad range of passenger amenities such as real-time bus arrival information and enhanced shelters. These PTN bus investments will facilitate access to and movement within the DMC.

Figure 4. Draft Primary Transit Network



RPT Transit Development Plan 2017-2021

RPT recently developed a TDP to guide the city's transit system for the next five years. The TDP includes planning for operations, capital facilities, finances, marketing, management, and implementation. The plan reviews existing route-level service, ridership, and performance for each RPT line to identify opportunities and constraints necessary to make network improvements. The plan also includes a summary of public outreach, an assessment of existing and future community characteristics to inform the need for increases in service, and service guidelines as a framework for short-term bus service planning in the City of Rochester.

Figure 5 illustrates the proposed Weekday Daytime Network and **Figure 6** illustrates the proposed High Frequency Network. The plan identifies an 82 percent increase in revenue hours between 2016 and 2021 to accommodate the anticipated growth in transit demand within the City of Rochester.

Transit Demand Assessment

The future need for transit service is largely based on the existing and projected travel demand generated by a variety of different users more likely to use transit. Understanding key transit markets provides valuable insight on the success of transit investments. Travel demand, transit supportive land use, population and employment densities, transit-dependent demographics, ridership generators, and DMC-specific transit sub-markets were reviewed as elements contributing to the need for and success of transit in downtown Rochester.

Commuter travel demand associated with the anticipated employment growth in the study area would result in severe roadway congestion and the need for a large increase in parking supply if demand is not shifted to transit. The Rochester Downtown Master Plan and the *DMC Development Plan* identified transit mode share goals of 23 and 30 percent, respectively, for commuter travel into downtown. This nearly triples the existing transit mode share for commuters. To achieve this mode share goal, a series of strategies were identified in the *DMC Development Plan* to manage single occupancy vehicle use. These strategies include transit investments and improvements, parking supply limitations, travel demand management (TDM) programs, and other improvement strategies.

Figure 5. Proposed Weekday Daytime Network

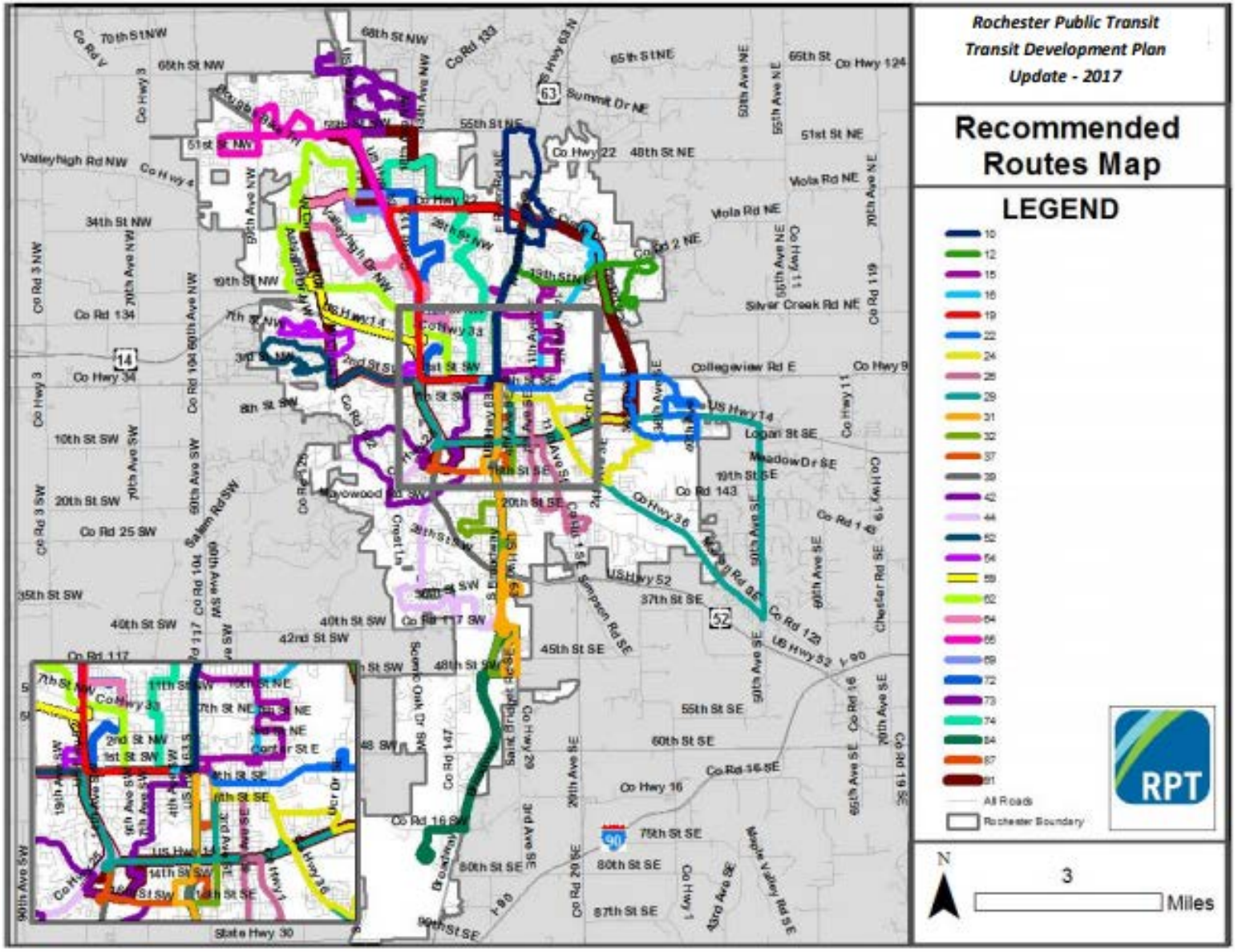
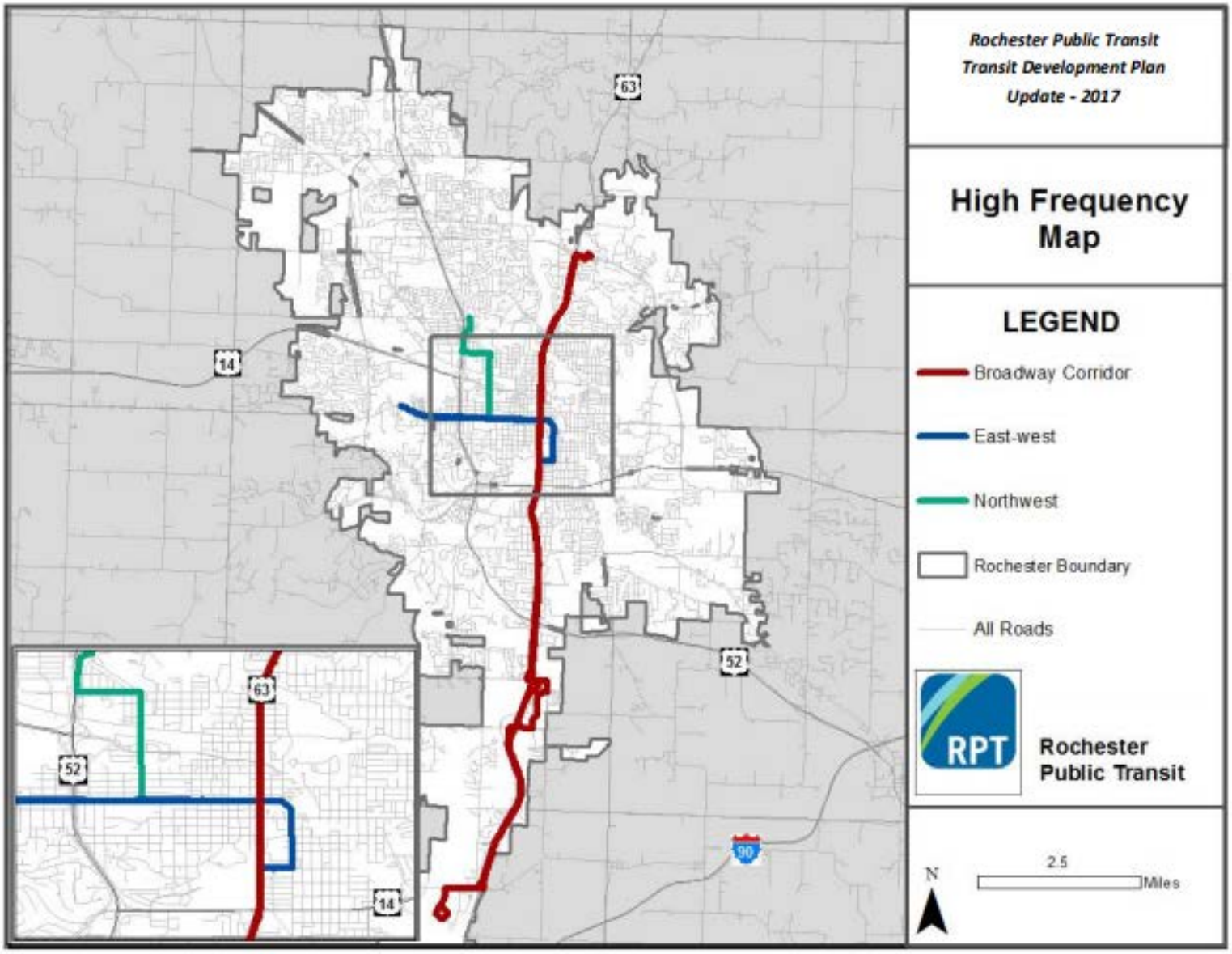


Figure 6. Proposed High Frequency Network



The concentrated growth associated with the *DMC Development Plan* will increase the demand for short trips, particularly for patients, visitors, shopping, recreation, and commute trips. The *DMC Development Plan* identified three key travel markets that will increase the demand for transit within downtown Rochester, including:

- Patients, staff, and visitors traveling between the downtown Mayo Clinic and St. Marys campuses.
- Short trips between downtown destinations and major trip generators, including health care facilities, government institutions, visitor centers, and retail/recreational locations.
- Park-once and ride markets, which allow commuters and visitors to travel from outside the study area, park on the periphery of downtown, and connect to high-quality transit options to reach downtown destinations.

Services designed to address each of these markets will consider the travel needs of all transit passengers, including those with mobility challenges.

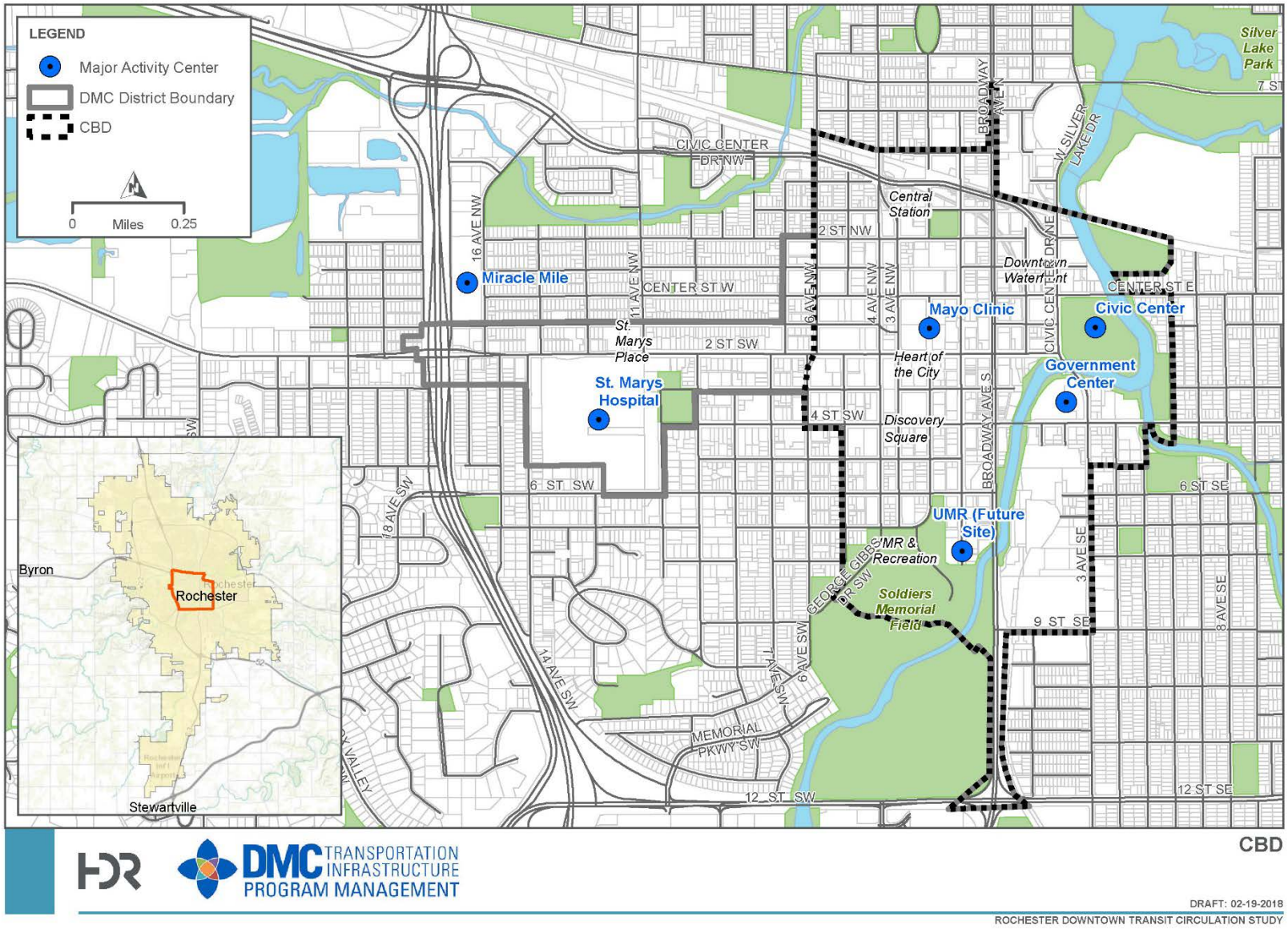
Transit Supportive Land use

Transit investments in the downtown area will be most effective when providing access to a variety of land use types (retail, employment, residential, mixed-used, etc.) and multiple trip generators throughout the day. The Rochester-Olmsted Council of Governments (ROCOG) assumes approximately 26,000 new jobs in the DMC district over the next 25 years, which equates to about 1,050 new jobs per year, or 55 percent of the total new jobs expected in the City of Rochester by 2040.[2] With the increase in visitors (assumed to generate nearly 6-7 million annual trips), residents, and UMR students, the demand and need for improved transit options becomes crucial.

Figure 7 illustrates the existing land use within the study area. A mix of uses with high concentrations of employment is present throughout much of the downtown core, particularly surrounding the Mayo Clinic facilities. Single and multi-family residential uses are more common throughout neighborhoods surrounding the downtown employment area, which is currently devoted primarily to institutional, civic, and medical uses. Notable mixed-use corridors in the study area include 2nd Street SW, 3rd Avenue SE, 4th Street South, Broadway, and Center Street.

[2] Source: DMC Integrated Studies Baseline Assumptions Memo (ROCOG), 2016.

Figure 7. Study Area Existing Land Use and Major Destinations



Source: City of Rochester

Land use in the study area is expected to intensify if the projected growth is realized. **Table 1** details the projected land use projections for the CBD, the 2nd Street SW corridor, and the DMC Development District. As shown, multi-family, educational, and medical uses will all substantially increase by 2040 in downtown Rochester. These future uses in downtown will be the foundation of economic development in the study area by creating tax-producing land use opportunities for the City and business owners.

Table 1. Land Use Allocation Summary

Land Use	Base Land Use (2010)			Projected Land Use (2040)		
	Central Business District (CBD)	2nd Street SW	DMC District	CBD	2nd Street SW	DMC District
Single Family (units)	63	498	561	79	498	577
Multi-family (units) [1]	962	1,241	2,203	3,430	2,488	5,918
Commercial/ Retail (1,000 sq. ft.)	689.9	1,001.3	1,691.0	1,333.9	1,034.3	2,368.0
Industrial (1,000 sq. ft.)	497.0	--	497.0	476.0	40.0	516.0
Office (1,000 sq. ft.)	1,486.9	112.5	1,599.0	1,669.0	368.9	2,038.0
Education [2] (students)	866	--	866	4,856	--	4,856
Hotels (rooms)	2,438	1,110	3,548	3,724	1,110	4,834
Hospital [3] (1,000 sq. ft.)	7,061.8	6,477.5	13,539.0	12,118.0	10,385.0	22,503.0
Bio Tech (1,000 sq. ft.)	--	--	--	1,020.0	--	1,020.0

Source: DMC Integrated Studies Baseline Assumptions Memo (Rochester-Olmsted Council of Governments [ROCOG])

[1] Includes senior housing residents

[2] Includes the future UMR expansion

[3] Includes all Mayo Facilities

Major Study Area Destinations

Major destinations are typical transit generators, given their likelihood to generate significant travel demand, both during commute and non-commute times. Many major destinations within the study area have influenced the development of other uses within proximity (e.g., hotels and retail within proximity of Mayo Clinic facilities to serve visitors and patients). The parking supply for some of the major destinations within the study area is expected to be limited based on the *DMC Development Plan* assumptions, resulting in a high likelihood of continued transit trip generation. Existing and future major trip generators within the study area, listed below and identified in

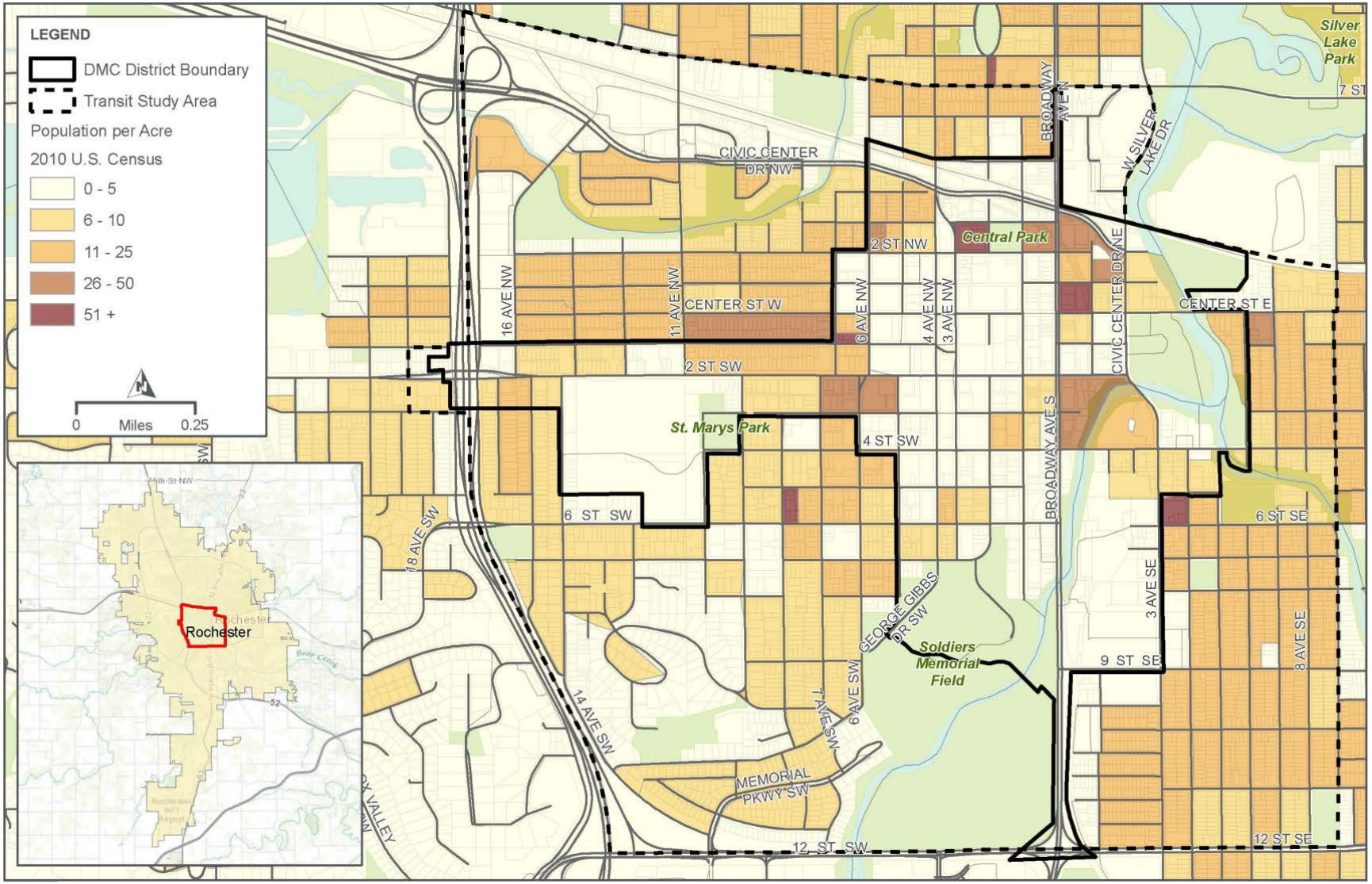
Figure 7, can generate various types of travel demand, given the user groups traveling to these locations.

- **Mayo Clinic Facilities:** A series of health care-oriented facilities and hospitals (including the Mayo Building and the Gonda Building, which are the hub of Mayo's clinical services activity) in the center of the study area, generating commuter, patient, visitor, student, and shopping trips.
- **St. Marys Hospital:** A major hospital located along 2nd Street SW in the western part of the study area, generating commuter, patient, visitor, and shopping trips.
- **Rochester Methodist Hospital:** A hospital located in the north-central portion of the study area, generating commuter, patient, and visitor trips.
- **UMR:** A higher education institution, currently located in the central study area with expansion planned for the southern study area, generating commuter, student, and visitor trips.
- **Rochester Government Center:** The center for local and regional government located at the intersection of 4th St SE and 3rd Avenue SE on the eastern edge of the study area, generating commuter and visitor trips.
- **Mayo Civic Center:** A multi-purpose center for conventions, arts, and other events, generating a variety of visitor and commuter trips.
- **Miracle Mile:** A major retail destination located just outside the periphery of the district along 16th Avenue NW, generating commuter and shopping trips.
- ***DMC Development Plan* Sub-districts:** Including the Heart of the City, Discovery Square, Downtown Waterfront, Central Station, St. Marys Place, and UMR/Recreational Area.

Population and Employment Densities

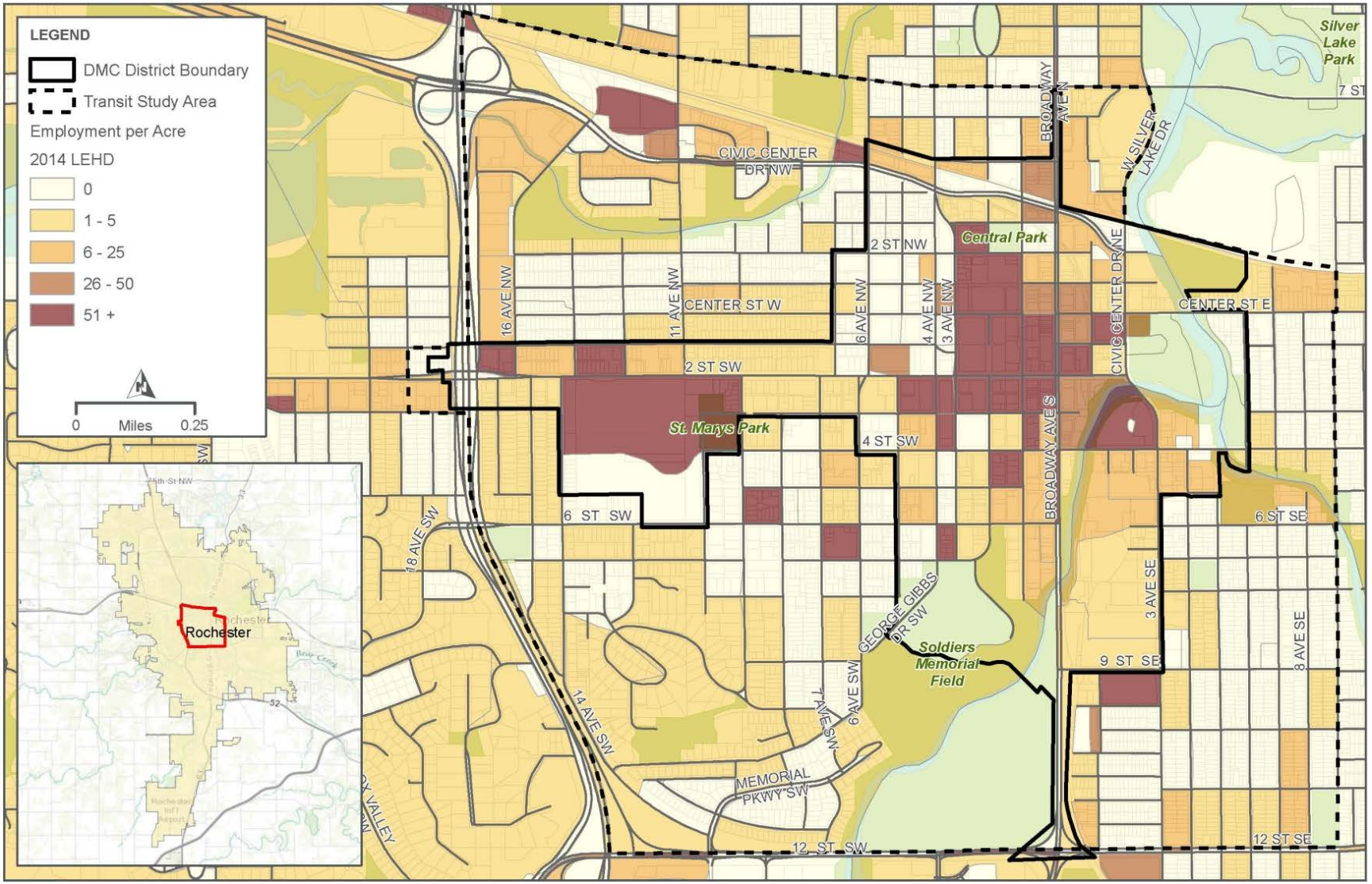
Uses with a higher density population and employment density levels are primary contributors in generating transit ridership needed to warrant transit investment, given the concentration of individuals likely to utilize transit for mobility needs. **Figure 8** and **Figure 9** illustrate the existing population and employment densities within the study area. Higher population and employment densities are generally located along similar corridors identified as mixed-use corridor above, including 2nd Street SW, 3rd Avenue SE, 4th Street SE, Broadway, and Center Street.

Figure 8. Study Area Existing Population Density



Source: 2010 U.S. Census

Figure 9. Study Area Existing Employment Density



Source: 2014 U.S. Census American Communities Survey

It is important to note that high population densities alone are not always an indicator of a competitive transit environment. Densities of all levels organized around a grid street design with limited barriers, maximum connectivity, and ample pedestrian/bike facilities all promote fast, convenient, and safe access to transit. The street connectivity and block length directly influence the pedestrian ease and directness to reach a transit stop, as well as the efficiency and effectiveness of transit routing. The study area is largely grid-like with ample sidewalks and safe crossings for pedestrians and cyclists to access transit. The results from the on-board survey conducted for the *RPT Transit Development Plan 2017-2021* identified the majority of riders walk to get to and from their bus stop, suggesting the importance of sufficient pedestrian conditions to access transit stops.[3]

Transit Need

Reviewing U.S. Census population demographic characteristics helps to identify market segments more oriented toward transit use. These segments include senior citizens, youth, mobility challenged, financially disadvantaged, and zero-vehicle households. **Table 2** compares the typical transit dependent populations between the study area and the City of Rochester. As shown, all but one of the typical transit dependent demographic categories in the study area exceeds those in the City of Rochester. **Figure 10** illustrates the block level transit need index for the study area using the 2014 U.S. Census American Community Survey (ACS) results. The transit need index is developed by rating each category individually on a scale of 1 to 5 based on natural breaks in the category values. The individual scores are subsequently combined for each Census block to develop the need index. Transit dependency need is fairly moderate within the study area, although relatively more noticeable along 2nd Street SW.

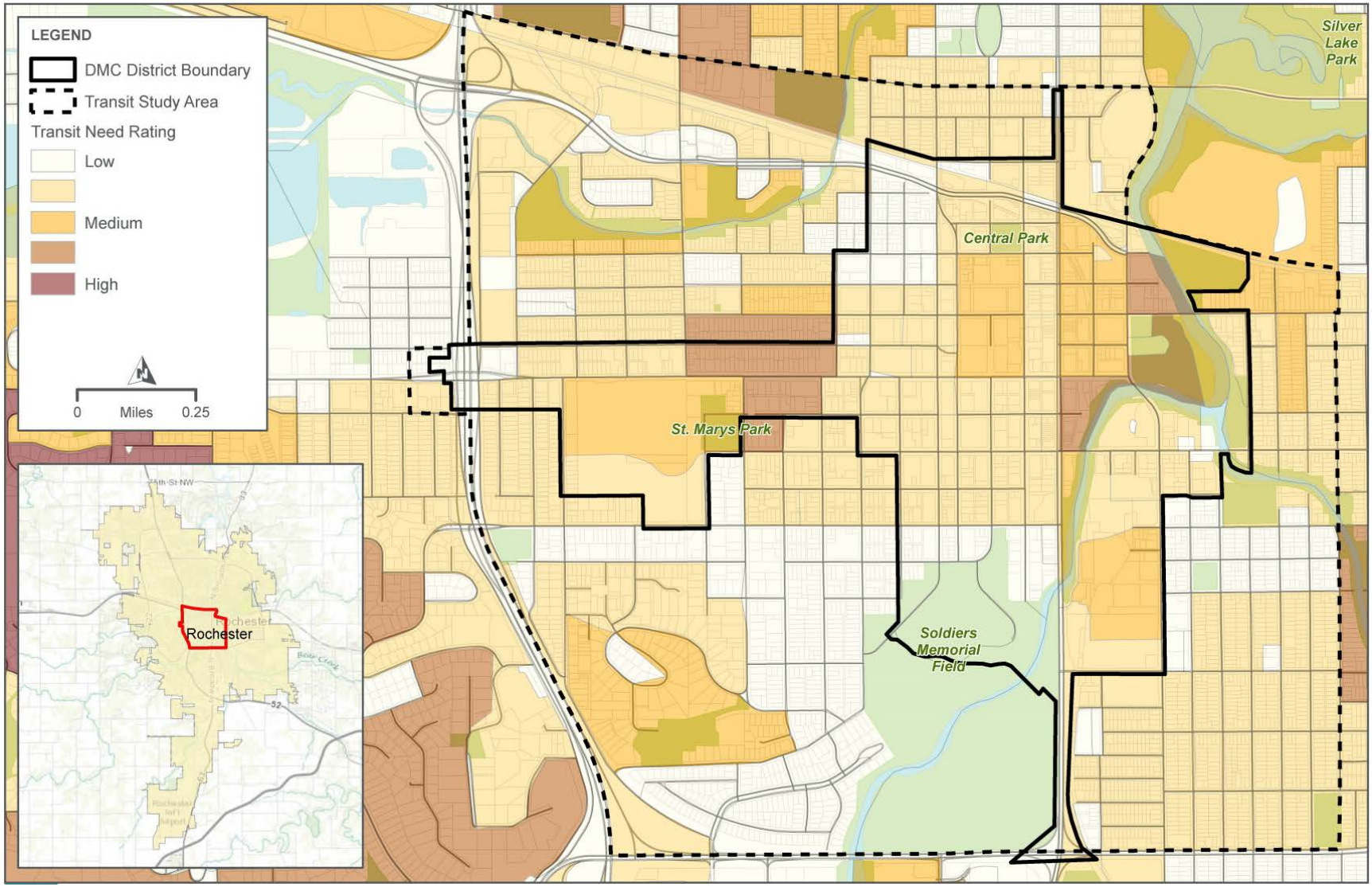
Table 2. Summary of Transit Dependent Characteristics

Demographic Category	Study Area		City of Rochester	
	Number	Percentage (%)	Number [1]	Percentage (%)
Total Population	10,081	100	112,000	100
Senior (65+)	1,976	20	13,236	14
Youth (10-17)	1,885	19	22,334	24
Mobility Challenged	1,399	14	7,996	9
Below Poverty	1,796	18	9,772	11
Zero-Vehicle Households	1,130	11	3,095	3

[1] Total population is based on 2015 ACS, but all demographic groups is based on a percentage from the 2014 ACS.

[3] The survey reported that more than 70 percent of all respondents walk to get to and from their bus stop

Figure 10. Study Area Existing Transit Need



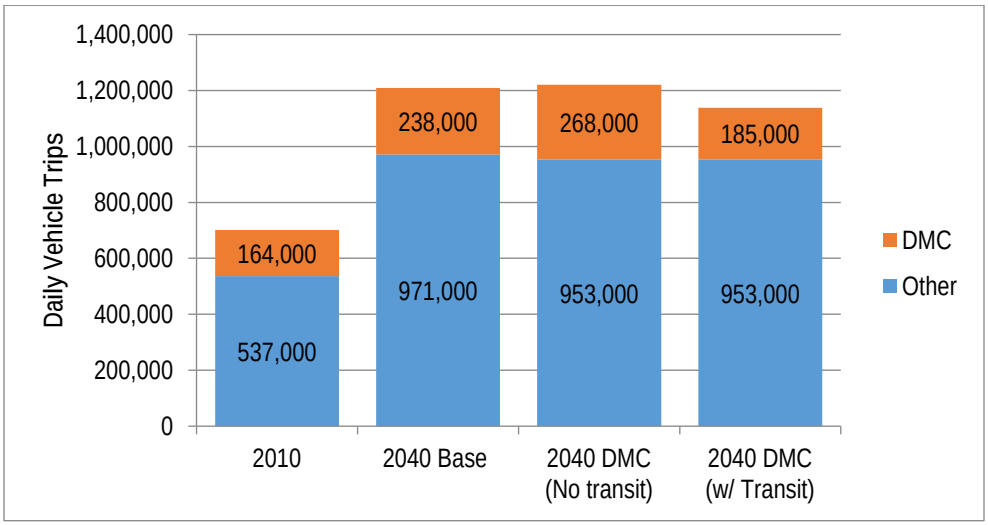
Source: 2014 U.S. Census American Communities Survey

Travel Demand

Evaluating demand for both commuter and non-commuter travel can assist in identifying high concentrations of trip pairs that are likely to be more competitive for transit use. These existing travel trends are important in the context of the amount and length of trips downtown Rochester currently generates.

Figure 11 shows the results of the city-wide Comprehensive Plan's base 2040 ROCOG model results for various scenarios. Assuming the *DMC Development Plan* is realized, trips to the DMC district are expected to grow by nearly 64 percent without transit investment, a growth of nearly 104,000 total trips per day. The increased intensity of development and trip generation would increase traffic well above the amount the current roadway network is able to accommodate, creating severely congested conditions.

Figure 11. ROCOG Model Vehicle Trip Generation



Source: ROCOG Travel Demand Model

Using the ROCOG travel demand model, the following origin-destination trip pairs are used to evaluate major travel demand movements in the study area:

- **Home-based work (HBW) trips**: Person vehicle trips taken to commute from home to employment locations.
- **Non-work trips**: All other person vehicle trips taken for non-work purposes, such as shopping, medical, recreational, and other personal trips.

Approximately 40 percent of home-based work trips are destined to downtown, creating heavy radial flow to the downtown core. The two largest destinations in the study area are the Mayo Clinic Facilities and St. Marys Hospital. The results from the on-board survey conducted for the *RPT Transit Development Plan 2017-2021* indicated approximately 68 percent of respondents take the existing RPT bus service to and from work, and 50 percent of these riders have access to another mode in the absence of bus service.

Existing Transit Services

Existing transit service within the study area includes a mix of service types catering to several different user groups. In some cases, the different services are not well integrated since many overlap along similar corridors, operate with similar schedules, serve similar markets, and may compete for ridership. RPT operates local bus service for both peak-period commuters and all-day riders within the City of Rochester. Regional express commuters are served by RCL and LeRoy City Lines, privately operated services providing longer distance trips to downtown Rochester during peak periods. The Mayo Clinic operates a series of shuttles that connect various campuses to destinations, including a set of remote commuter parking lots outside of the DMC district. Private shuttles also operate throughout the downtown area serving hotels, hospitals, and visitor destinations. The City of Rochester has sustained a 10 percent transit mode share for commute trips destined to downtown, which is relatively high compared to other cities of its size. This above average transit mode share is the result of the city and the Mayo Clinic maintaining effective programs and policies that reduce auto dependency, including parking demand management (and lack of supply) and subsidized transit passes. The following summaries each of the different transit service providers currently in operation in the City of Rochester.

Rochester Public Transit (RPT)

RPT provides local bus transit service within the City of Rochester. Owned and operated by the City of Rochester, the service offers riders all-day, peak only, and limited night service on weekday and Saturdays only. RPT offers a series of direct connections to park-and-ride lots throughout the city. **Table 3** summarizes the existing RPT service. **Figure 12** illustrates the existing RPT transit service and existing park-and-ride locations in the City of Rochester.

Table 3. RPT Service Summary

Service Area	Weekday Routes Served [1]	Service Span	Saturday Routes Served	Service Span
Northwest	1D, 1N, 8, 9, **10**, 11, 12, 12M, 12N, **18**, **18D**, 19	5:30 AM – 10:30 PM	25, 26	8:00 AM – 6:00 PM
Northeast	1, 1D, 1N, 2,16	6:00 AM – 10:00 PM	21	8:00 AM – 6:30 PM
Southwest	6A, 6B, 6M, 7, 7A, 7N, 8, 14	5:30 AM – 10:30 PM	23, 24	8:30 AM – 7:00 PM
Southeast	3, 3N, 4A, 4B, 4D, 4M, 5, 6A, 6B, **6D**, 6M, 7N, **15D**, 17	5:30 AM – 11:00 PM	22, 23, 24	8:30 AM – 7:00 PM

[1] D = Direct routes (typically connecting to park-and-rides); M = Mid-day routes; N = Night routes; A/B = Route operates different patterns; **BOLD** = Frequent route (operating with headways every 20 minutes or better)

RPT service is designed with a "radial" network, where routes traveling throughout the city are anchored to the 2nd Street SW transit center located in the core of downtown. This network is well-designed to serve the commute market traveling to and from downtown Rochester destinations.[4] Much of the RPT service operating through downtown Rochester "pulses" with similar timing intervals as other routes to align with commuter works shifts, which creates a high concentration of bus vehicles in downtown at certain locations. **Figure 13** illustrates the RPT network for all service operating through the study area. As shown, existing RPT service is highly concentrated along 2nd Street SW, as all routes serve the downtown transit center.

RPT Rolling Stock and Facilities

RPT operates its service with a fleet of 49 fixed-route buses, 41 of which are 40 feet long with a 38-person seated capacity, and the remaining 8 are 35 feet in length. The current level of fixed-route service requires 37 peak weekday vehicles and 5 Saturday vehicles. All vehicles are low-floor, kneeling vehicles to provide sufficient wheelchair access and are equipped with a bike rack that can carry up to two bikes. The RPT *Transit Development Plan 2017-2021* identified the need to operate 15 additional vehicles over the next five years to accommodate projected growth in ridership demand.

RPT serves a total of 566 active bus stops throughout the city. Many of the stops within the study area include sufficient pedestrian access, although several are not always near marked pedestrian crosswalks. A small amount of these stops within the study area are equipped with shelters, while many would require upgrades in passenger amenities as growth in transit demand is realized.

[4] The survey results from the *RPT Transit Development Plan 2017-2021* indicate that more than 80 percent of respondents do not transfer to a second bus to reach their destination.

Figure 12. Existing RPT Service

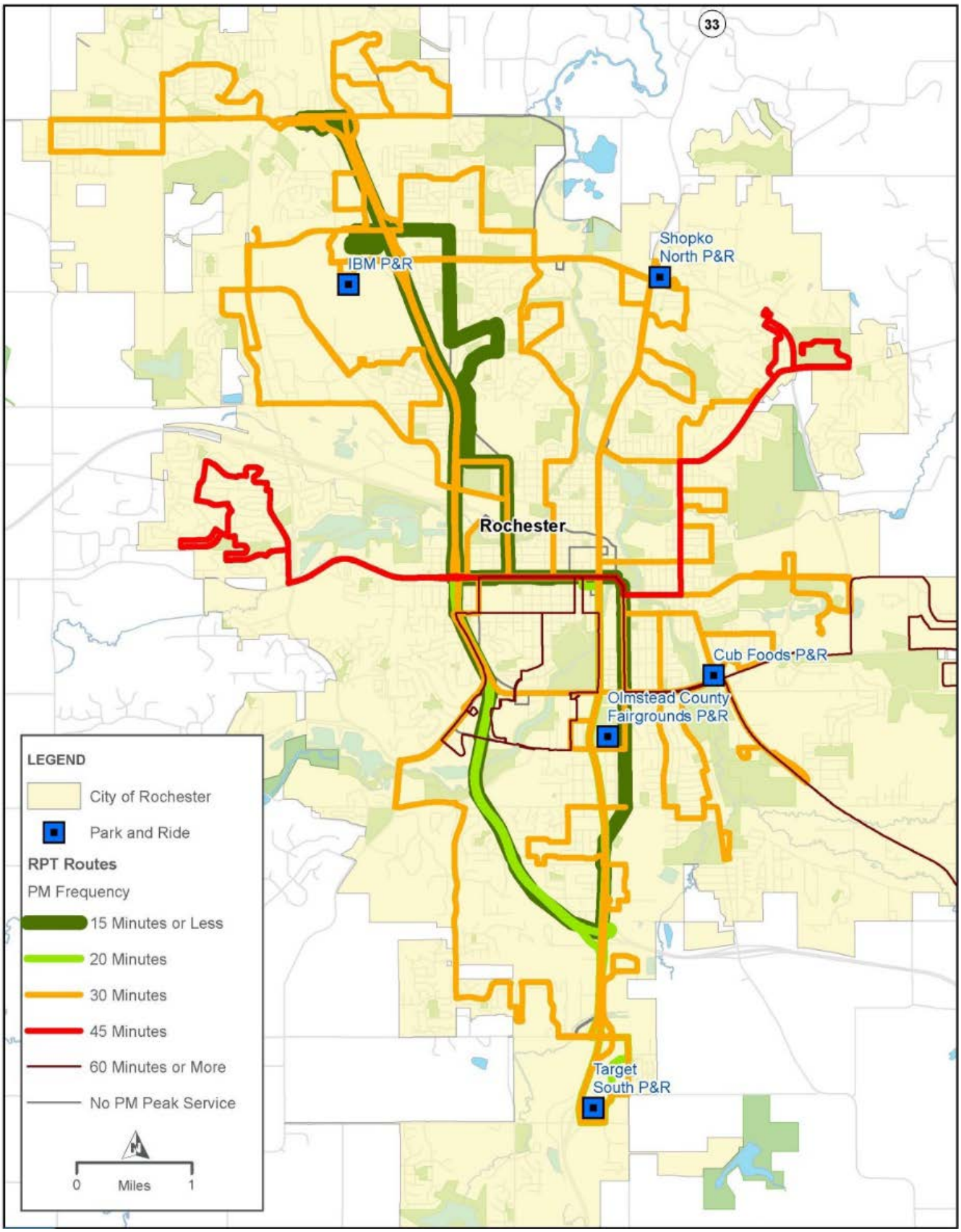
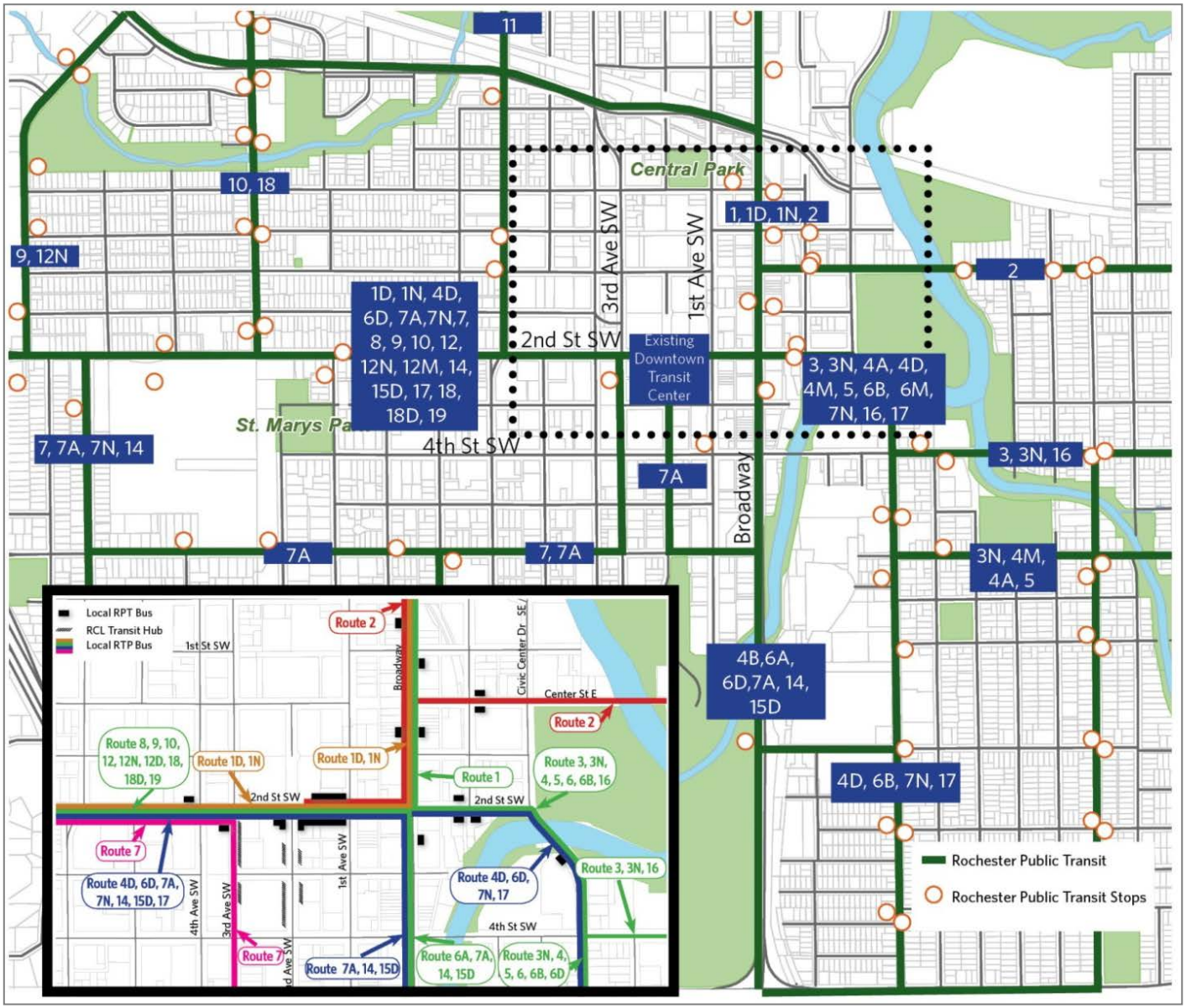


Figure 13. Existing Study Area Rochester Public Transit Routing and Stop Locations



The 2nd Street SW transit center serves as the main hub for all local RPT service, providing a single point for passenger boarding and alighting and transfer activity. The transit center is made up of eight individual stops, five of which are equipped with large, climate-controlled shelters and real-time arrival displays. The transit center occupies curb space equivalent to about three city blocks on both sides of 2nd Street SW and partially on 2nd Avenue SW. **Figure 13** illustrates the RPT transit routing, RPT transit center, and other bus stop locations within the vicinity of the RPT transit center.

RPT Rolling Stock and Facilities

RPT operates its service with a fleet of 49 fixed-route buses, 41 of which are 40 feet long with a 38-person seated capacity, and the remaining 8 are 35 feet in length. The current level of fixed-route service requires 37 peak weekday vehicles and 5 Saturday vehicles. All vehicles are low-floor, kneeling vehicles to provide sufficient wheelchair access and are equipped with a bike rack that can carry up to two bikes. The *RPT Transit Development Plan 2017-2021* identified the need to operate 15 additional vehicles over the next five years to accommodate projected growth in ridership demand.

RPT serves a total of 566 active bus stops throughout the city. Many of the stops within the study area include sufficient pedestrian access, although several are not always near marked pedestrian crosswalks. A small amount of these stops within the study area are equipped with shelters, while many would require upgrades in passenger amenities as growth in transit demand is realized.

The 2nd Street SW transit center serves as the main hub for all local RPT service, providing a single point for passenger boarding and alighting and transfer activity. The transit center is made up of eight individual stops, five of which are equipped with large, climate-controlled shelters and real-time arrival displays. The transit center occupies curb space equivalent to about three city blocks on both sides of 2nd Street SW and partially on 2nd Avenue SW. **Figure 13** illustrates the RPT transit routing, RPT transit center, and other bus stop locations within the vicinity of the RPT transit center.

RPT Park-and-Ride Program

Several RPT routes connect to six existing park-and-ride lots located throughout the city. The lots are typically comprised of designated spots within an existing parking lot used for a separate commercial purpose (e.g., Target). The existing RPT park-and-ride summary is detailed in **Table 4**. Total parking capacity at the park-and-ride locations amounts to 2,184 parking stalls designated for RPT riders. On average, approximately 75 percent of the total park-and-ride capacity is used among the six lots, with

two lots showing over capacity conditions and the remaining lots nearing total capacity conditions. This high utilization is largely attributable to the cost of parking in downtown Rochester, the relative shortage of parking, and the connections to frequent, direct transit service to the downtown transit center.

Table 4. Existing RPT Park-and-Ride Summary

Park-and-Ride Lot	Parking Capacity	Parking Stalls Occupied	Utilization (%)	RPT Route Served
NE – Hwy 63 N at Shopko N	160	296	147	1, 1D, 1N
S – Hwy 63 S at Target S	190	265	139	6M, 7N, 15D
SE – Hwy 14 E at Cub Foods	50	50	100	3N, 4D, 17
NW – Hwy 52 N at IBM	667	653	98	12M, 12N, 18D
S – Broadway Ave S at the Olmsted Co Fairgrounds	371	258	70	6D, 6M, 7N
RCTC	746	117	16	3, 3D, 3N
Total	2184	1639	75	

Source: Rochester Public Transit Survey, February 2018

RPT has established effective working relationships with a number of major retailers to designate parking for RPT customers. However, the lot designations are not guaranteed long-term, and the RPT has expressed interest in identifying more permanent facilities for its riders. The results from the system-wide on-board survey conducted for the *RPT Transit Development Plan 2017-2021* identified a lack of downtown parking and parking pricing is the main incentive for riders to use the bus.[5] In addition, the RPT survey revealed that more than 70 percent of all respondents were either satisfied or more than satisfied with the current park-and-ride program, suggesting the continued importance of a well-established and reliable park-and-ride city program.

With the exception of the new RCTC lot, the RPT Park-and-Ride facilities are all near or over capacity. Diversion of future DMC commuters to Park-and-Ride service will require significant expansion of Park-and-Ride capacity. The increase in demand for park-and-ride spaces will be substantial, but will depend upon the total parking supply provided for downtown commuters.

[5] The survey results revealed that nearly 35 percent of all respondents take the bus because parking is unavailable or too expensive.

Existing and Projected RPT Ridership

RPT carried approximately 1.71 million passengers in 2014[6] and averaged over 6,700 passengers on a typical weekday in 2016.[7] The weekday ridership is largely concentrated during typical AM and PM peak times, aligning with the level of service offered during the peak periods. Ridership during the AM and PM peak times accounts for approximately 73 percent of total weekday ridership.[8] The high peak ridership is largely attributed to the high proportion of existing transit riders who utilize RPT services to get to and from work.[9] Nine RPT routes (Routes 18D, 11, 9, 10, 1D, 15D, 1, 6D, and 5) carry approximately 60 percent of the total weekday ridership, while the top five ridership routes (18D, 11, 9, 10, 1D) all connect the northwest area of the City of Rochester to the downtown transit center. The combined weekday ridership of all routes serving existing RPT park-and-ride lots accounts for more than 45 percent of the total weekday ridership, suggesting the importance of additional direct and frequent service connecting to park-and-ride lots for downtown employees.

Existing stop-level ridership in the study area is shown in **Figure 14**.[10] The highest passenger activity locations are located along the corridors that service the most RPT trips and those routes with the highest ridership, including 2nd Avenue SW/SE, Broadway N/S, and 3rd Avenue SE. Average route-level weekday ridership for each route that travels along major transit corridors within the study area has been aggregated and summarized in **Table 5**.

[6] Source: National Transit Database
[7] Source: Rochester Public Transit
[8] AM Peak: Trips starting between 6 and 9 AM; PM Peak: Trips starting between 3 and 6 PM.
[9] The results from the on-board survey conducted for the *RPT Transit Development Plan 2017-2021* indicated approximately 68 percent of respondents take the existing RPT bus service to and from work.
[10] Source: RPT Transit Development Plan 2017-2021

Figure 14. Existing Study Area RPT Stop-Level Ridership Activity

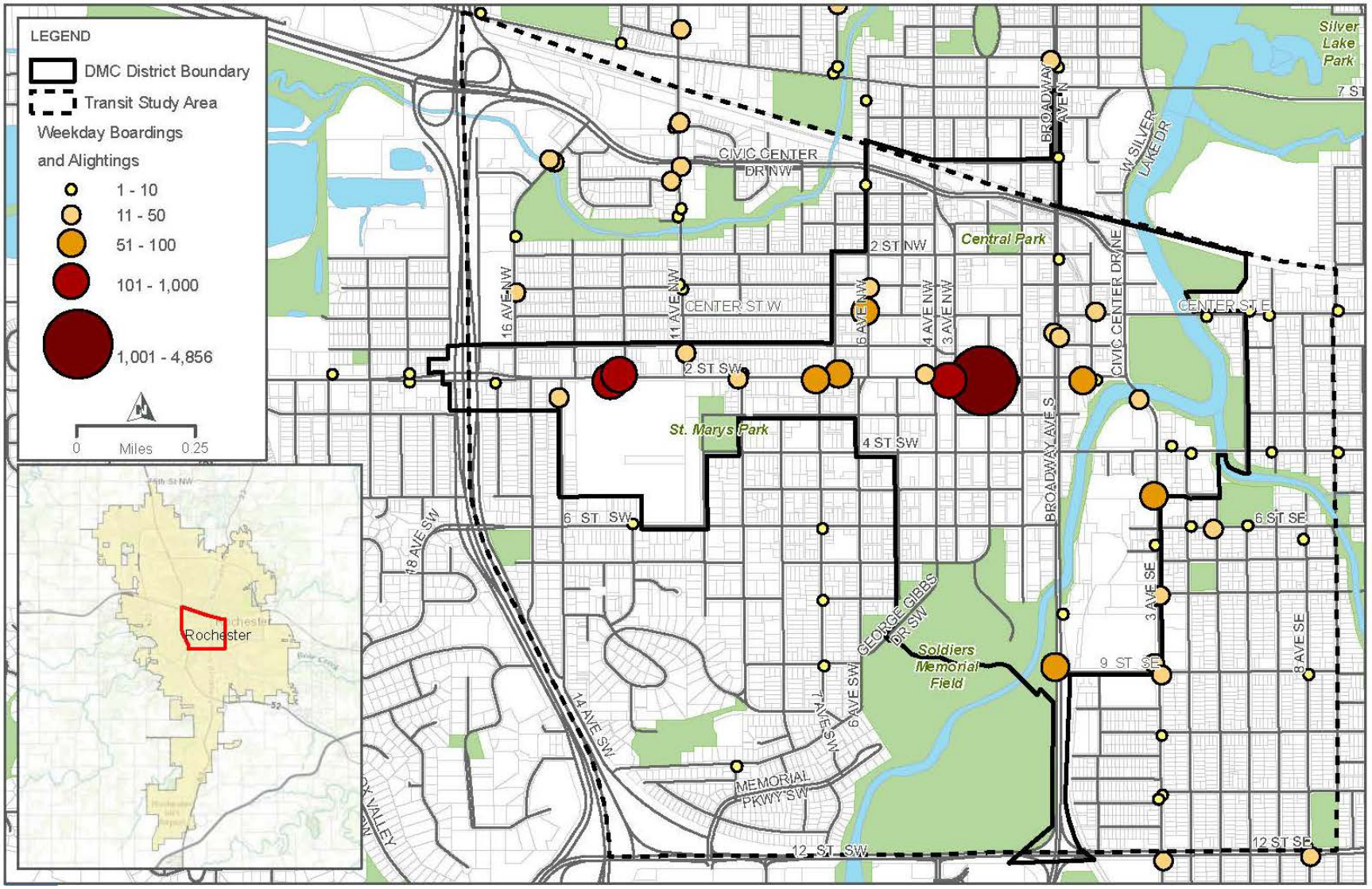


Table 5. Aggregated Route-Level Weekday Ridership by Study Area Corridor

Corridor	Average Weekday Ridership
2nd St. SW/SE	3,958
3rd Ave. SE	1,780
Broadway N/S	1,593
16 Ave. NW	591
11th Ave. SW	536
6th Ave. NW	483
4th St. SE	440
14th Ave. SW	359
Center St. E	260
3rd Ave. SW	117

Source: Rochester Public Transit, 2012

Based on the transit mode share goal of 23 to 30 percent of all trips commuting to downtown, local transit ridership is expected to increase between 194 and 285 percent, depending on the service corridors defined in the *DMC Development Plan*. This equates to between approximately 12,900 and 18,800 net new RPT local transit trips in Rochester. This future transit ridership is expected to overwhelm the existing service capacity, park-and-ride lot capacity, and many of the existing transit facilities' capacity in the study area. The amount of transit-designated curb space and passenger waiting area to accommodate the growth in service needed to carry these projected trips would require significant expansion.

City of Rochester Paratransit Service (ZIPS)

ZIPS is the local ADA complimentary paratransit service for the Rochester area. It provides an alternative mobility option for those unable to use the fixed-route RPT bus system. Eligibility to use ZIPS is determined by federal ADA guidelines. The operation is contracted by the City through First Transit, who subcontracts with R&S Transport, who provides drivers, vehicle maintenance and storage, dispatch, and customer service. ZIPS carried approximately 40,000 passengers in 2013.

Regional Services

RCL is a privately owned and operated regional commuter express service that connects outlying areas outside the City of Rochester to downtown Rochester. The service connects 40 different regional communities to downtown Rochester. The service operates between one and four round trips per route at typical peak commute times on weekdays only, for a total of

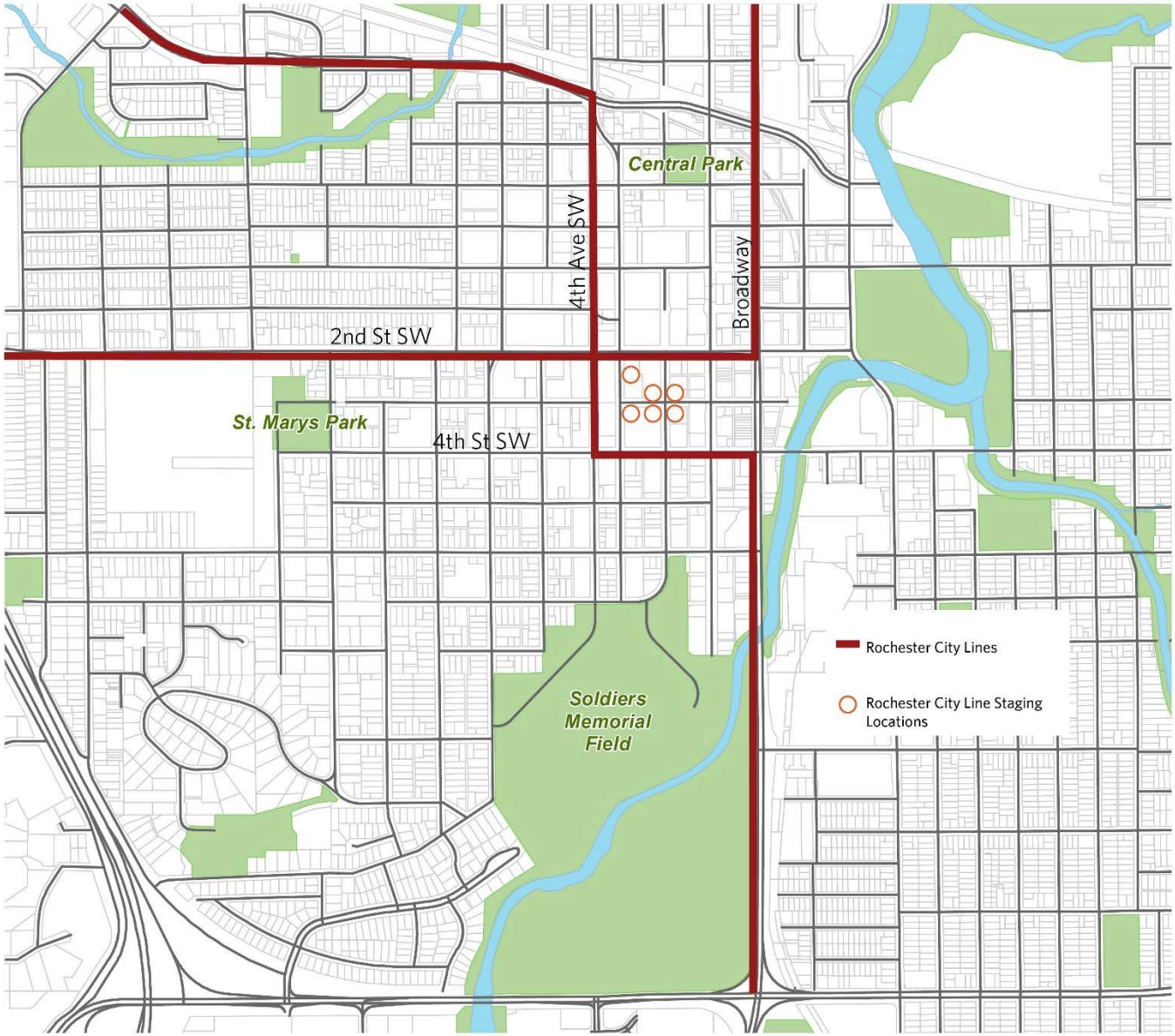
102 trips per day. **Figure 15** illustrates the RCL routing network and communities served by the commuter service. LeRoy City Lines provide a single route to Rochester with 4 daily trips.

Figure 15. Rochester City Lines Existing Regional Network



Nearly all the routes make two stops in downtown Rochester: one at St. Marys Hospital on 2nd Street SW and one in downtown, at a staging area along 2nd and 3rd Avenues SW, near the existing RPT transit center on 2nd Street SW. The RCL buses dwell in the staging area during the day, and board passengers at this location as the initial stop in the afternoon outbound trip. The stating area is conveniently located to access all major destinations in downtown Rochester. RCL vehicles circulate through downtown using several different travel paths to access the existing transit hub. **Figure 16** details the location of the RCL transit hub and the RCL routing within the study area.

Figure 16. Rochester City Lines Routing and Vehicle Staging Areas within Study Area



RCL service operations is unusual in that some vehicles are driven by licensed operators who also work at various locations in downtown Rochester, which minimizes the operating costs for deadhead and additional travel time typical in most express transit operations. RCL vehicle staging in downtown requires the use of downtown curb space equivalent to approximately four city blocks, presenting a constraint if service is expected to grow to accommodate future commute travel growth destined for downtown Rochester.

RCL and LeRoy City Lines are for-profit business and do not receive public subsidy for operations or facility improvements. Service is funded exclusively through passenger fares,[11] therefore, trips may be introduced or eliminated at any time. RCL requires a 35 passenger subscription minimum for each trip, making the service highly productive.[12]

Existing and Projected Regional Ridership

Regional service carried approximately 4,200 passengers per average weekday in 2013-14.[13] Most RCL riders are employees of the Mayo Clinic, each of whom receive a monthly transit commute subsidy that covers a portion of their monthly transit fare. Transfer activity between RCL and RPT service are rare since the RCL transit hub is close to many employment destinations, including all Mayo Clinic buildings.

Based on the regional population projections and anticipated transit mode, future ridership is expected to increase. Similar to RPT ridership projections, this future regional ridership is expected to overwhelm the existing service capacity and many of the existing transit facilities' capacity in the study area. The amount of transit-designated curb space and passenger waiting area to accommodate the growth in service needed to carry these projected regional and local trips would require significant expansion.

Mayo Clinic Shuttle Service

The Mayo Clinic provides employees, patients, and visitors exclusive shuttle service between all Mayo facilities in the City of Rochester and connections to off-site park-and-ride locations. A total of five Mayo shuttles operate on weekdays only and are free to for all Mayo patients, visitors, and employees. **Table 6** summaries the various Mayo shuttle characteristics.

[11] Mayo Clinic subsidizes a portion of Mayo employee passenger fares.
[12] RCL operated with an average 72 percent seated capacity of all trips in 2013-14 using a fleet of 57-seat over-the-road coaches standard among all trips in service.
[13] Source: City of Rochester Comprehensive Plan 2040

Table 6. Mayo Clinic Shuttles Service Summary

Shuttle Name	Stop Locations	Service Hours	Peak Frequency [1]	Service Availability
Intercampus (2nd Ave SW)	Mayo Clinic, St. Marys, West Lot	4:30 AM – 12:50 AM	5 mins	Visitor, Patients, & Staff
East Lot	East Lot, Mayo Clinic, St. Marys	5:30 AM – 8:18 PM	7.5 mins	Staff
West Lot	West Lot, St. Marys, Mayo Clinic	4:30 AM – 12:50 AM	5 mins	Staff
Northeast	Northeast Clinic, Assisi Heights, Mayo Clinic	6:00 AM – 5:45 PM	30 mins	Staff
Northwest	Mayo Clinic, Technology Drive Center, Superior Drive Support Center, Valley High Business Center, Mayo Support Center, Northwest Clinic	6:05 AM – 6:47 PM	40 mins	Staff

[1] The frequency shown is in operation during typical commute times. The shuttles operate variable headways throughout the day and may reduce in frequency during off-peak times.

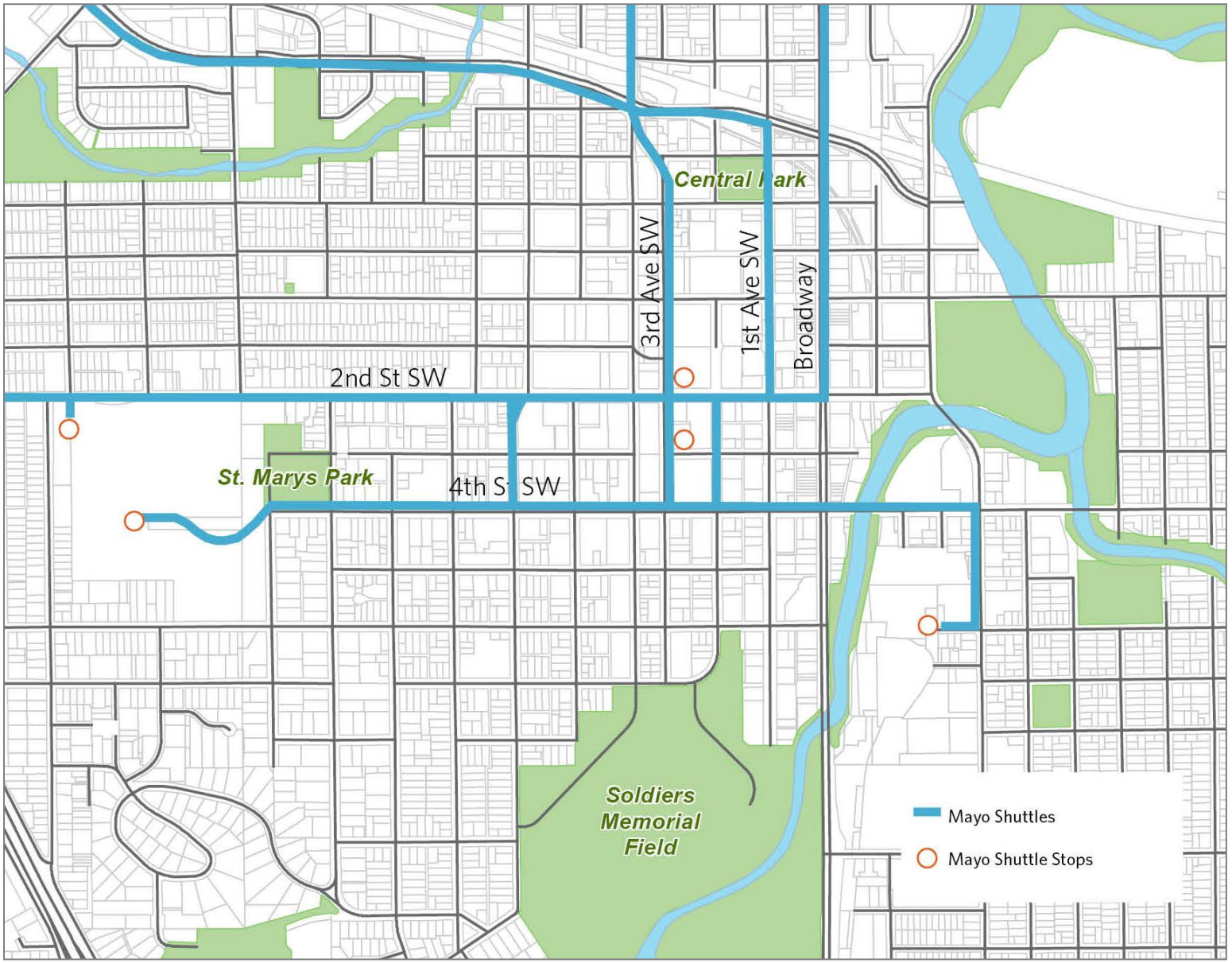
Figure 17 illustrates the routing of all Mayo shuttles operating in the study area. Most of the shuttles use 2nd Street SW to connect to Mayo Clinic buildings and St. Marys Hospital, which overlap with many RPT services along the corridor. As shown in **Table 7**, the shuttles carry nearly 7,000 daily passengers, with more than half traveling on the intercampus shuttle along 2nd Street SW which serves visitors, patients, and staff. Average weekday boardings at locations within the study area (e.g., Guggenheim, Gonda, St. Marys) account for nearly 75 percent of all Mayo shuttle weekday boardings.

Table 7. Mayo Shuttle Ridership Summary

Shuttle	Average Weekday Ridership
Intercampus (2nd Avenue SW)	3,538
East Lot	940
West Lot	1,837
Northeast	98
Northwest	387
Total	6,801

Source: Mayo Clinic, 2013

Figure 17. Existing Mayo Shuttle Routing in Study Area



Existing and Projected Traffic and Parking Conditions

Reviewing existing and projected traffic conditions in the study area would assist in identifying corridors and roadway segments that are currently congested or may become congested in the future. The anticipated growth in the study area is expected to overload existing roadway conditions, limiting the ability to move people effectively into and through downtown. The current supply of parking will not be sufficient to accommodate future increases in commuter demand if travel habits remain as they do today, with nearly 70 percent of commuters driving alone. Congested roadway and portal conditions may create constraining conditions to provide efficient and effective operations of future transit investments, particularly those operating at street grade and mixed with general purposed traffic.

Existing and Projected Traffic Conditions

The existing roadways in the study area provide vital access to a variety of destinations and are key contributors to the economic success of Rochester. Implementation of the *DMC Development Plan* will significantly increase demand on local streets. The Plan forecasts that available peak hour street capacity will decrease from about 72 percent to 10 percent in the next 20 years unless there is a significant decrease in the share of commuting trips made by automobile.

Existing traffic volumes are shown in **Figure 18**. Primary traffic streets that carry the greatest daily traffic are listed below:

- 2nd Street SW
- Broadway Avenue
- 3rd and 4th Avenue SW/NW
- 3rd Avenue SE and 4th Street SE
- Civic Center Drive

The ability of vehicles to enter the downtown will also be impacted by the traffic induced by new development. **Figure 19** depicts the current availability of street capacity at the key downtown portals. Entry points from US 52 are approaching capacity today. **Figure 20** reflects the impact of DMC development in the future peak period with the current auto mode share. Based upon traffic analysis conducted during the Integrated Transit Studies, all of the US 52 entry points except the US 14 interchange will be over capacity. Several of the portals east of Broadway Avenue will also be approaching capacity. This constricted downtown access will reduce the attractiveness of downtown development sites.

Figure 18. Study Area Existing Average Daily Traffic

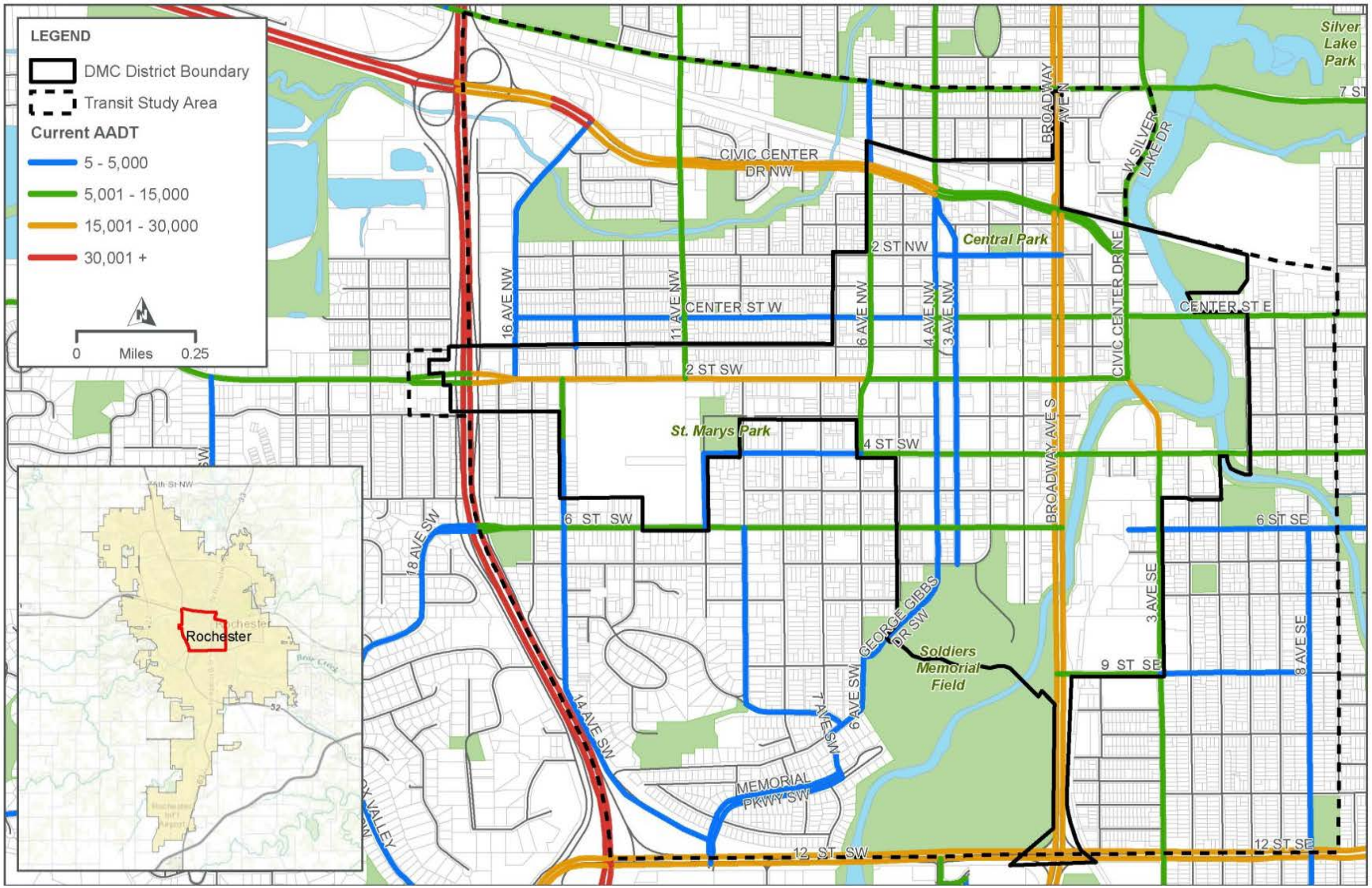


Figure 19. Existing Portal Capacity: PM Peak Period Analysis

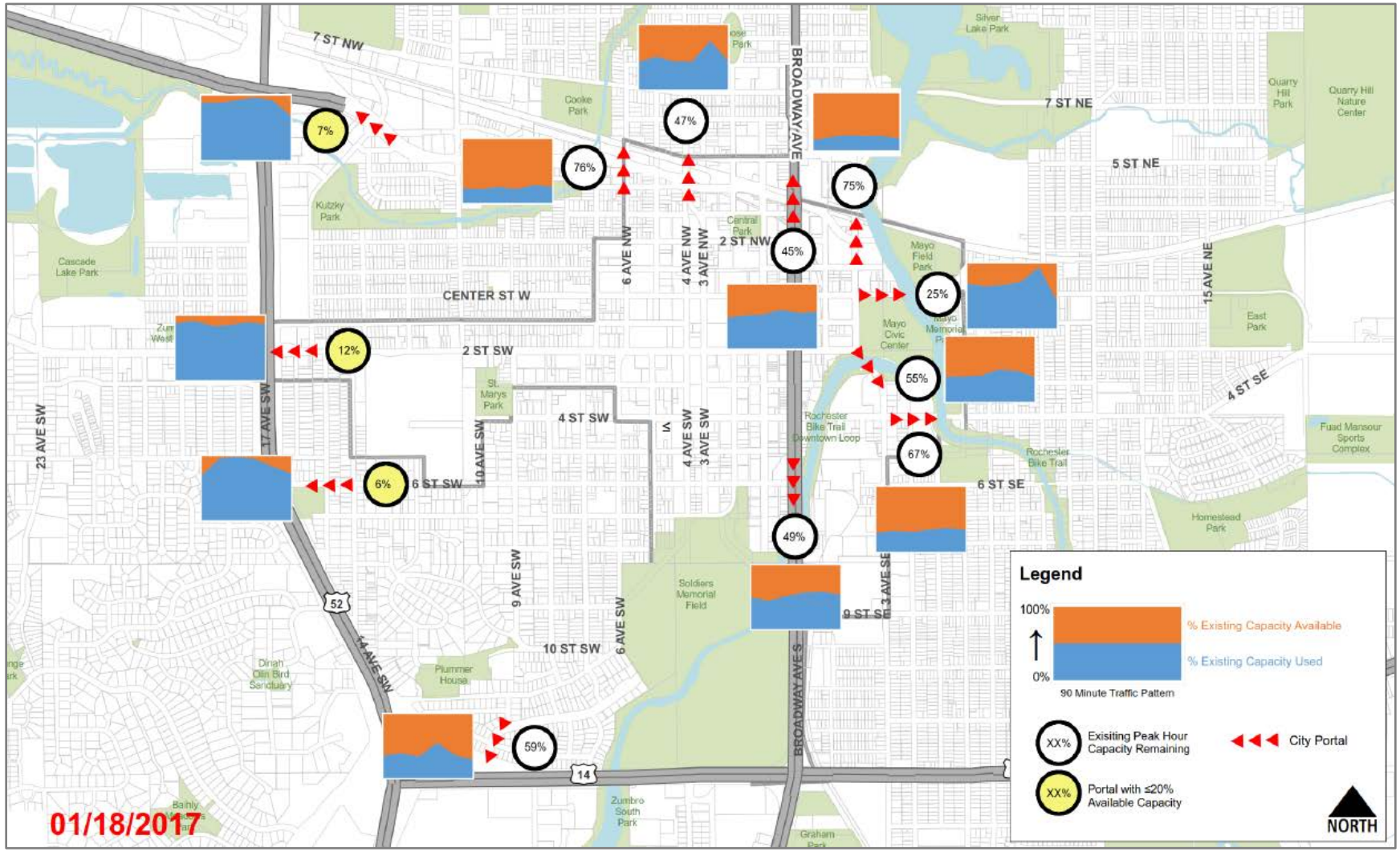
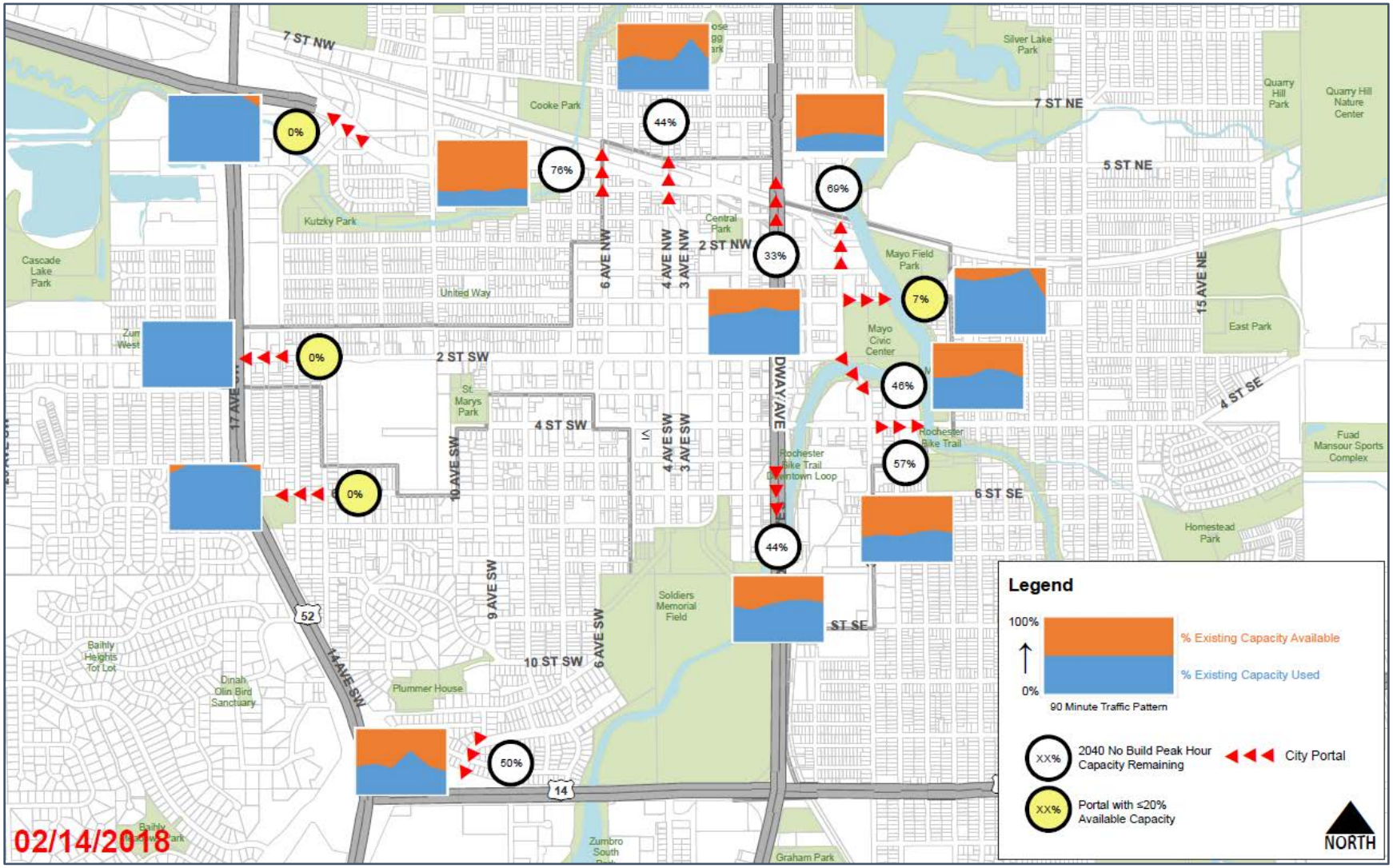


Figure 20. 2040 No Build Portal Capacity: PM Peak Period Analysis



Parking Conditions

The *DMC Development Plan* projected travel demand growth will require a substantial increase in parking supply if current commuter travel habits continue as they are today with 70 percent of commuters driving alone. To meet the anticipated increase in employment given current travel behavior, additional parking supply needs were estimated to require 180 acres of surface parking (equivalent to eight city blocks of six-story parking structures).

Most of the existing parking in downtown Rochester is provided to meet peak demand for a single use (e.g., employees). While much of the downtown parking becomes available for all uses after 5 PM, most is limited to commuter use during the work day. The *DMC Development Plan*, however, assumes a shared parking approach, which allows different uses in the same area with different peak parking needs to utilize the same parking supply. This approach is expected to reduce DMC district parking demand by 33 percent.

Parking located on the periphery of downtown is expected to play a significant role in providing effective mobility options to downtown destinations. The park-once strategy will accommodate parking demand on the periphery of downtown, and require a high-quality transit option to facilitate travel to destinations in downtown Rochester. The *DMC Development Plan* aims to limit parking supply in the downtown core by leveraging the existing park-and-ride program success, which creates several key benefits by:

- Limiting traffic congestion in downtown, improving safety for pedestrians and cyclists in downtown.
- Reducing parking demand in the downtown core for commuters, freeing up parking for visitors, patients, tourists, and shoppers.
- Reducing the need for additional parking supply at downtown locations, freeing those sites for future tax-producing uses.

Existing Pedestrian Subway and Skyway Network

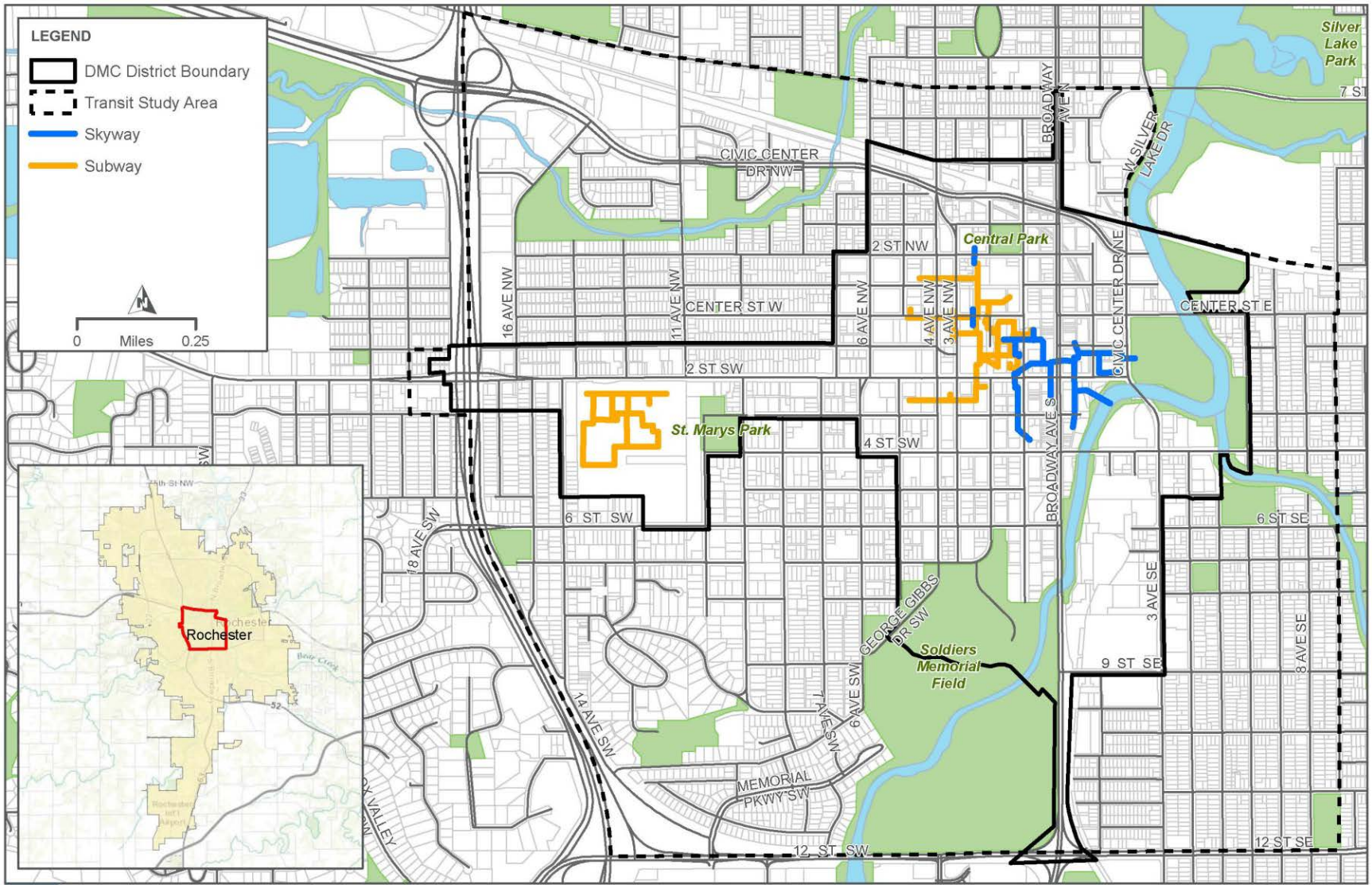
Within the downtown Rochester area there are currently areas served by skyway and subway pedestrian networks. Both provide safe and climate-controlled access to multiple destinations. **Figure 21** illustrates the skyway and subway networks in the study area, as presented in the *Mayo Clinic 5-Year Master Plan (Updated 2016)*. The existing skyway network is concentrated on connecting destinations in the eastern study area, while the subway network is more concentrated on connecting employment locations in the downtown core and St. Mary's Hospital. The network is fairly limited but may provide an opportunity to integrate into future transit investment in the study area.

Conclusion: Transit Needs Identification and Analysis

The assessment of existing and future transit markets and service in the study area defines the level of transit investment needed to accommodate the expected growth in downtown Rochester. The share of transit trips relative to total trips will need to nearly triple over the next 20 years to maintain acceptable levels of street traffic and not require significant growth in off-street parking, which will necessitate transit improvements and investments. The following summary identifies the transit findings and needs in the study area:

- Land use is anticipated to intensify in the study area based on *DMC Development Plan* assumptions. Multi-family residential units are expected to increase by 168 percent; medical space is expected to increase by 66 percent; and the planned UMR campus will drastically increase educational uses. Major mixed-use corridors include 2nd Street SW, 3rd Avenue SE, Center Street, Broadway, and 4th Street SE. This population and employment growth is expected to lead to a substantial increase in travel demand that will require improved transit options.
- The increase in travel will congest the local street system, impacting both auto and transit movement within the DMC area. Increased transit ridership will also exceed the capacity of the local and regional transit network.
- The City of Rochester has sustained a 10 percent transit mode share for commute trips destined to downtown, which is relatively high compared to other cities of its size. This above-average transit mode share is the result of the city and the Mayo Clinic maintaining effective programs and policies that reduce auto dependency, including parking demand management (and lack of supply) and subsidized transit passes. These activities must continue to help offset the increase in travel.
- Transit dependent populations in the study area are higher than those within the City of Rochester, suggesting the importance of improved local circulation with transit investments.

Figure 21. Existing Study Area Pedestrian Skyway and Subway Network



- If the *DMC Development Plan* is realized, trips to the DMC district are expected to grow by nearly 64 percent, a growth of nearly 104,000 total trips per day. The increased intensity of development and trip generation would increase traffic well above the current roadway network capacity, creating severely congested conditions.

- Three types of transit service currently operate in downtown Rochester, including RPT, regional service, and Mayo Shuttles. While each service accommodates unique transit markets, many of the routes overlap similar corridors (e.g., 2nd Street SW) and provide access to similar downtown destinations. **Figure 22** illustrates the combined routing for all three transit providers in the study area. In some cases, the existing transit service within the study area is not well integrated, limiting the effectiveness of service options within the area.

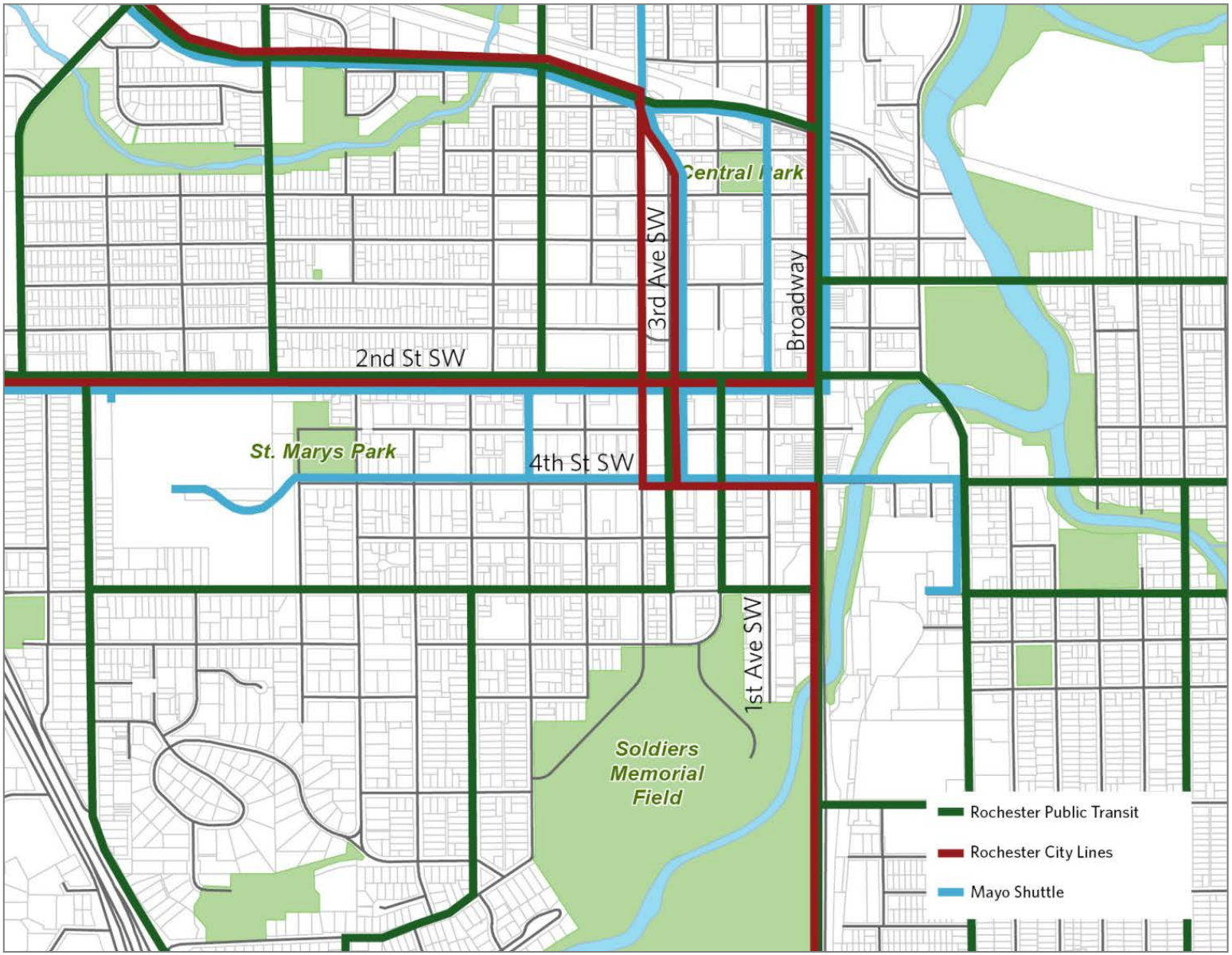
- Projected transit ridership for both local and regional trips will need to increase between 154 and 285 percent in order to achieve the commuter transit mode share goal of 23 to 30 percent. This growth in transit use will require substantial increases in service and vehicles, which will require facility expansions and improvements to provide more capacity, ensure effective operations, and provide improved amenities for the passenger.

- Increased travel forecasted in the *DMC Development Plan* will overwhelm roadway capacity and breakdown the roadway network operations without significant changes in travel behavior. High-quality, frequent transit service will be essential to reduce auto dependency and avoid overcapacity conditions.

- Parking supply will need to be managed to shift travel demand to transit. Park-and-ride lots outside the downtown core will play an important role in effectively providing access to downtown through direct connections to high-quality transit. The current overcapacity RPT park-and-ride conditions will present a major constraint if future transit demand is expected to rely on a seamless connection between park-and-ride locations and transit service destined to the study area. Peripheral lots surrounding downtown will also become important to convert auto trips to transit outside of downtown.

- The existing pedestrian skyway and subway network serves an important purpose by providing safe and climate-controlled access to downtown buildings. While this existing network can expand the reach of downtown circulator options, some changes in the capacity, access, and extent of the system should be considered in the development of downtown circulator options.

Figure 22. Existing Combined Transit Routing in the Study Area



Appendix A

DMC Integrated Studies Baseline Assumptions (ROCOG, 2016)

This page is intentionally blank.

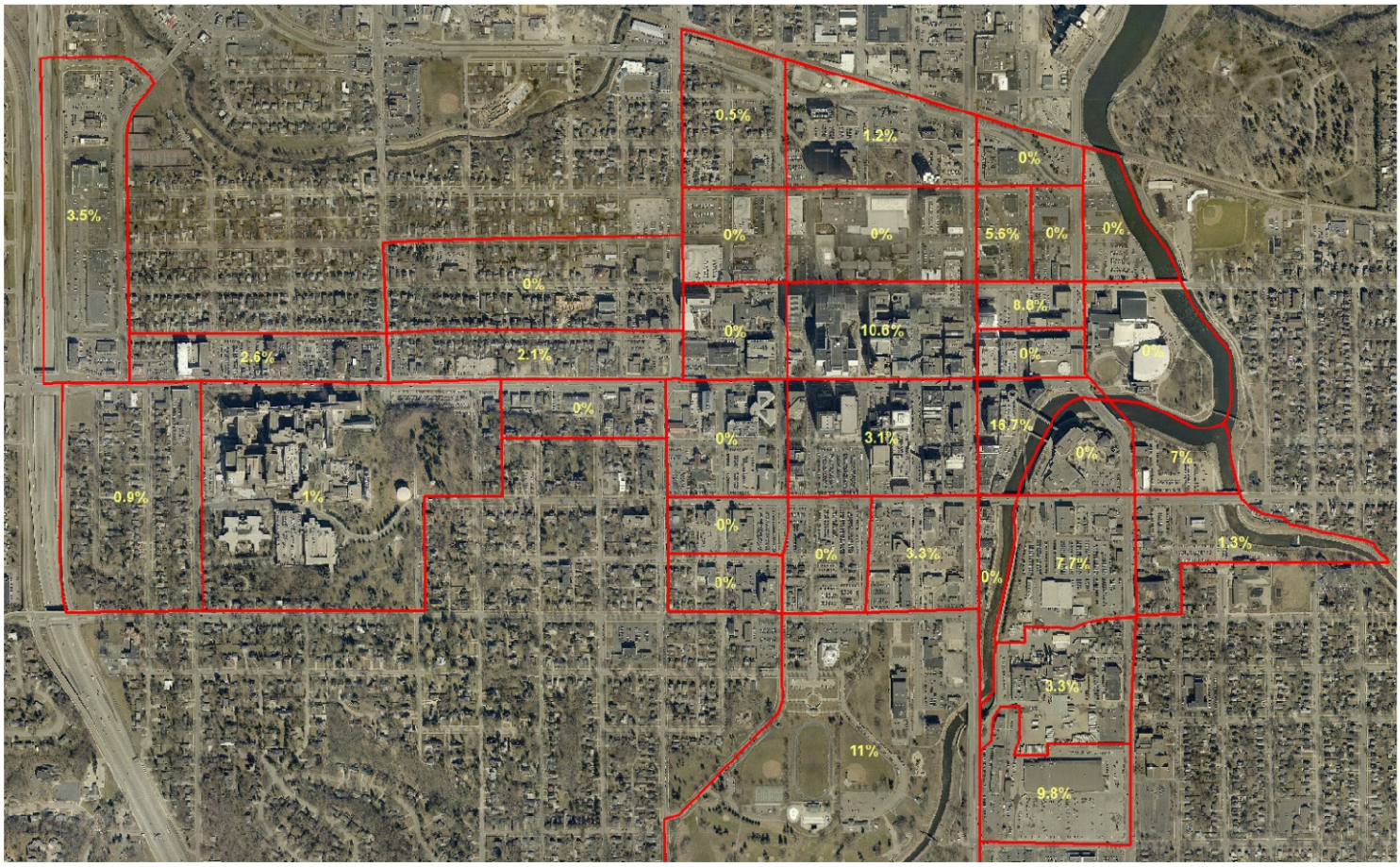
EMPLOYMENT Assumption for DMC District

1) The baseline assumption for DMC Employment Growth is for an annual average of approximately 1,050 jobs per year to be added in the DMC Development District through 2040.

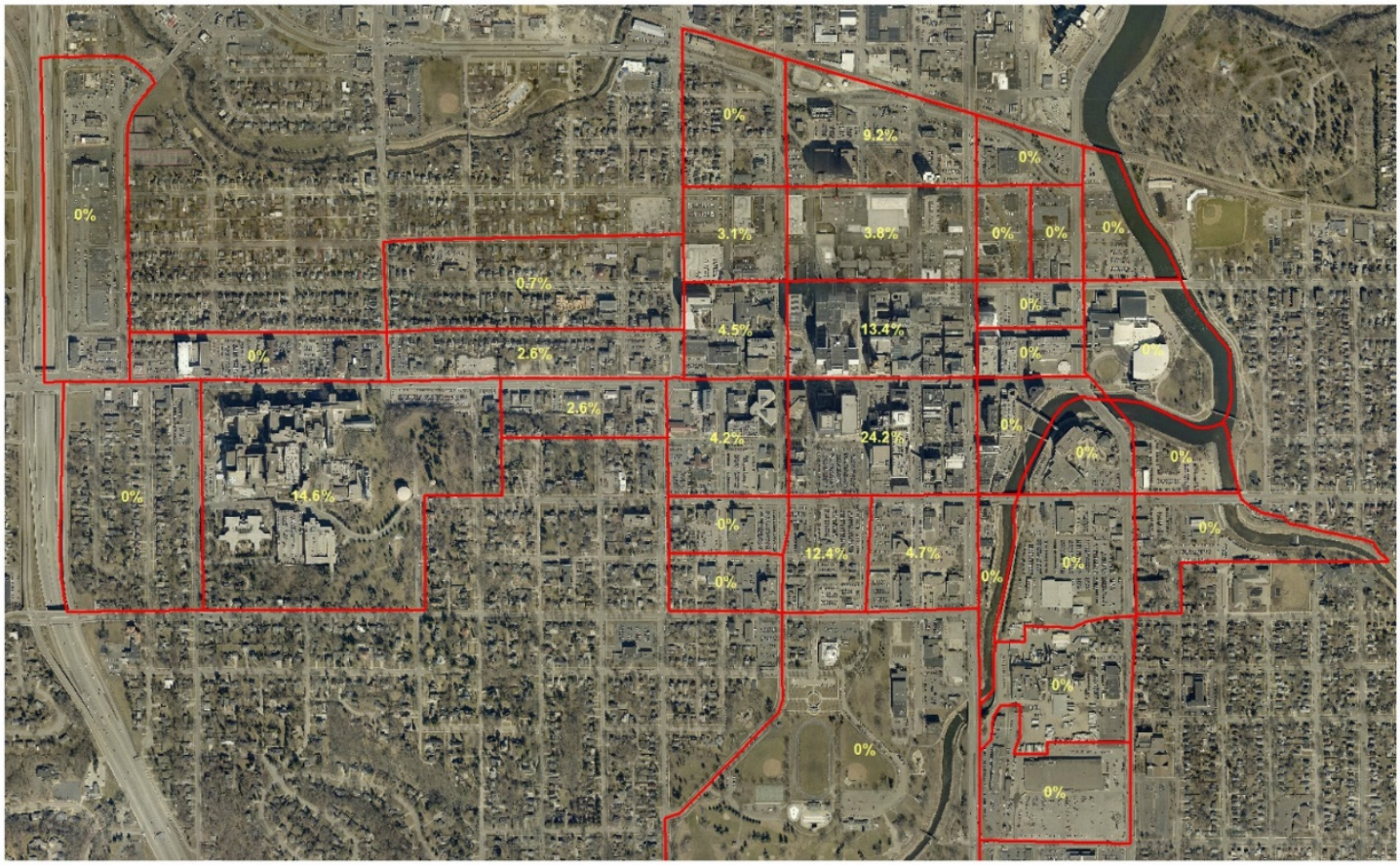
   This is arrived at by

   a. Taking the ROCOG 2040 Employment Projection for 2040 of 165,900 jobs in Olmsted County
   b. Subtracting the estimated number of jobs in Olmsted County as of 2015 of approximately 115,000 = 50,900 new jobs over 25 years
   c. Applying the Rochester share of countywide job base = 93% x 50,900 = 47,300 jobs will be in Rochester
   d. The current level of the Rochester job base located in the DMC District is 45% and has been steady at that level for a period of years; however, we assume the DMC initiative will draw a higher percentage of new job growth into the district, assumed to be 55%; 55% x 47,300 = 26,000
   e. Over the 25 year period of 2015 to 2040, this averages (rounded) to 1050 per year

2) The distribution of job growth in non-medical retail/office/service within the DMC District as reflected in the ROCOG Traffic Model utilized for the City Comprehensive Plan Update shows the following in terms of % growth distribution by Traffic Analysis Zone. Note that this distribution includes proposed University of Minnesota – Rochester campus in south area of downtown (11% factor):



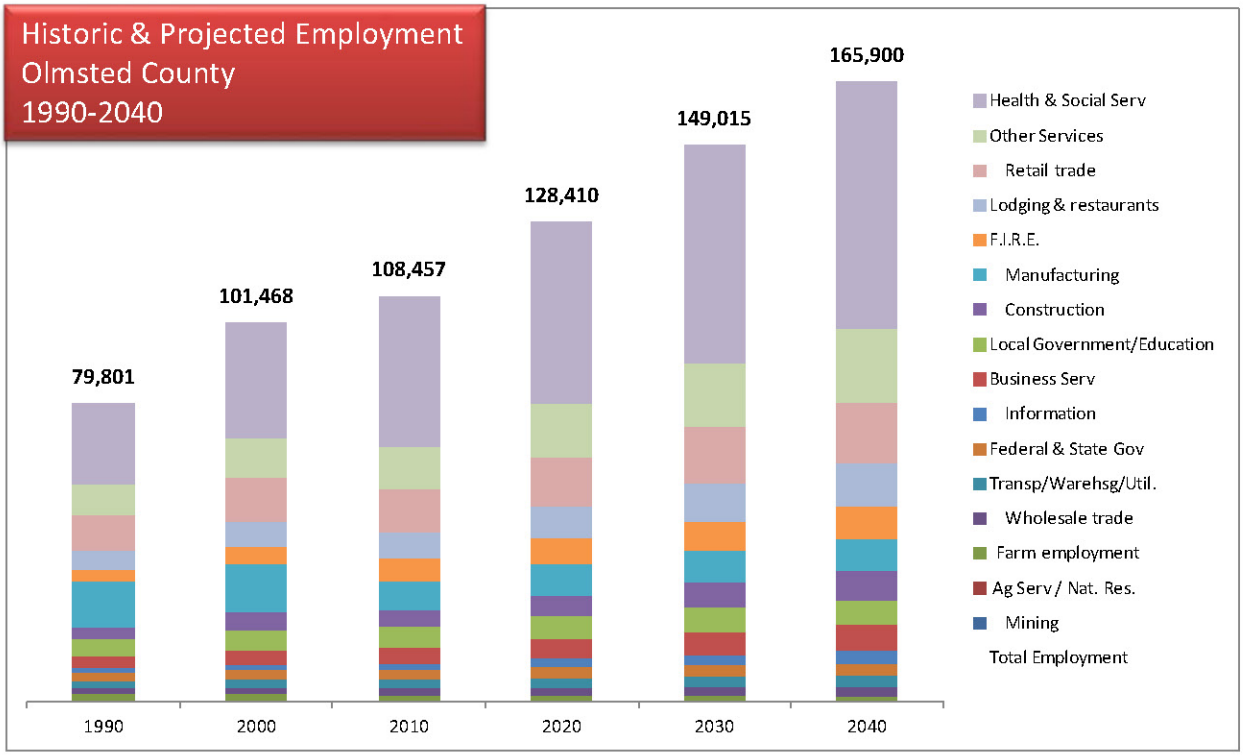
3) The distribution of job growth in medical service / medical science within the DMC District as reflected in the ROCOG Traffic Model utilized for the City Comprehensive Plan Update shows the following in terms of % growth distribution by Traffic Analysis Zone



4) Background Information used to assist in developing these assumptions is included on the following pages

Background Information informing the Employment Assumption

Total Employment Numbers / Olmsted County: Rochester-Olmsted Council of Governments future employment projections (2013)



City Employment Share

Source: On the Map / US Census Bureau

	OLMSTED	ROCHESTER		Rochester
Total All Jobs				**% Share**
	2011	**2011**		
Total All Jobs	96,273	89,755		93.2%
Jobs by NAICS Industry Sector				
	2011	**2011**		
Agriculture, Forestry, Fishing and Hunting	246	26		10.6%
Mining, Quarrying, and Oil and Gas Extraction	8	3		37.5%
Utilities	147	143		97.3%
Construction	2,794	1,900		68.0%
Manufacturing	8,763	7,701		87.9%
Wholesale Trade	1,737	1,353		77.9%
Retail Trade	8,879	8,216		92.5%
Transportation and Warehousing	1,562	1,219		78.0%
Information	1,800	1,771		98.4%
Finance and Insurance	10,661	10,591		99.3%
Real Estate and Rental and Leasing	687	630		91.7%
Professional, Scientific, and Technical Services	1,703	1,571		92.2%
Management of Companies and Enterprises	383	383		100.0%
Administration & Support, Waste Management and Remediation	2,567	2,208		86.0%
Educational Services	4,816	3,883		80.6%
Health Care and Social Assistance	36,506	35,912		98.4%
Arts, Entertainment, and Recreation	788	719		91.2%
Accommodation and Food Services	7,120	6,800		95.5%
Other Services (excluding Public Administration)	2,063	1,864		90.4%
Public Administration	3,043	2,862		94.1%

DMC Area Employment Share and Sector Distribution / Existing

Source: On the Map / U.S. Census Bureau

NOTES:

- 2nd and 4th column indicate share of citywide sector employment in DMC District in 2014 and 2010;
- 5th and 6th columns indicate breakdown of jobs just in DMC District by whether they are in CBD (area east of 6th Ave west) or West 2nd St corridor (area west of 6th Ave West).
- Right column indicates distribution of jobs within the DMC District by sector, for example, 79.7% of all DMC District jobs are in health care and social assistance sector.

Work Area Profile Report **% of Citywide Jobs by Sector in DMC Area**	**2014**	2014 Number of DMC- Area Jobs	**2010**	2014 % DMC Jobs in CBD Area	2014 % DMC Jobs in West 2nd St Area	Sector Share of DMC Area Jobs
Total All Jobs	45.3%	37,839	45.3%	76.3%	23.7%	
Jobs by NAICS Industry Sector						
Agriculture, Forestry, Fishing and Hunting	33.3%	9	26.1%			0.02%
Mining, Quarrying, and Oil and Gas Extraction	0.0%	0	0.0%			0.00%
Utilities	67.8%	99	59.9%	100.0%	0.0%	0.26%
Construction	10.2%	214	7.6%	100.0%	0.0%	0.57%
Manufacturing	1.8%	136	2.2%	100.0%	0.0%	0.36%
Wholesale Trade	2.6%	26	1.6%	100.0%	0.0%	0.07%
Retail Trade	5.4%	462	5.5%	92.4%	7.6%	1.22%
Transportation and Warehousing	14.4%	178	11.4%	100.0%	0.0%	0.47%
Information	11.9%	234	15.5%	98.3%	1.7%	0.62%
Finance and Insurance	21.4%	245	19.8%	96.7%	3.3%	0.65%
Real Estate and Rental and Leasing	14.8%	107	12.4%	94.4%	5.6%	0.28%
Professional, Scientific, and Technical Services	28.7%	493	29.0%	92.1%	7.9%	1.30%
Management of Companies and Enterprises	22.1%	167	6.2%	98.2%	1.8%	0.44%
Administration & Support, Waste Management and Remediation	8.2%	196	9.8%	86.7%	13.3%	0.52%
Educational Services	0.9%	39	0.7%	89.7%	10.3%	0.10%
Health Care and Social Assistance	79.6%	30,157	80.1%	71.9%	28.1%	79.70%
Arts, Entertainment, and Recreation	8.1%	65	13.5%	95.4%	4.6%	0.17%
Accommodation and Food Services	38.3%	2,422	38.3%	86.4%	13.6%	6.40%
Other Services (excluding Public Administration)	19.6%	452	26.3%	96.5%	3.5%	1.19%
Public Administration	89.5%	2,138	73.1%	99.9%	0.1%	5.65%

RESIDENTIAL POPULATION ASSUMPTIONS FOR DMC DISTRICT

1) The baseline assumption for DMC Population Growth is for an annual average of approximately 1,050 jobs per year to be added in the DMC Development District through 2040.

   This is arrived at by

   a. The ROCOG 2040 projection for 2040 is for 215,200 residents in Olmsted County
   b. ROCOG projects the City of Rochester share of 2040 county population will be 164,600, approximately 76% of the county wide total. Subtracting the latest estimated population of Rochester (summer 2015) of 112,225 = 52,375 over 25 years, an average of 2100 persons per year
   c. Our estimates (2010) and projection (2040) of residents who live within the DMC District are reported in the following table

	In Single Family Housing	In Multi Family Housing	Assisted Senior Housing	Total
2010	646	3,021	1,113	4,781
2040	684	8,834	1,197	10,715
Change	38	5,813	84	5,934

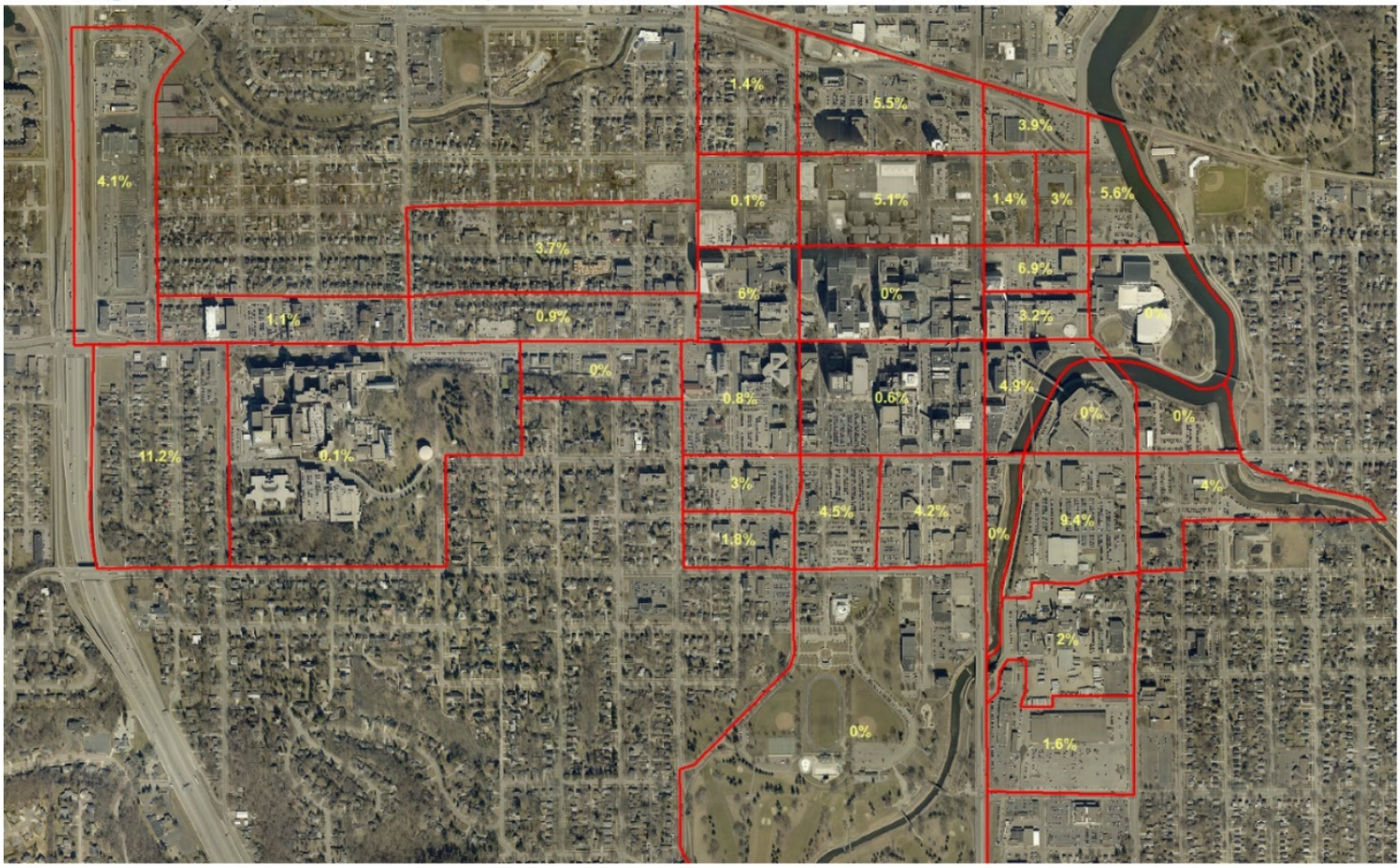
In addition to these numbers consideration needs to be given to the potential growth in students at the University of Minnesota-Rochester and how those numbers may change over time. Today there are approximately 450 students enrolled, with about 250 living in a "student housing" center constructed on 1st Ave SW, which would represent about 55% of enrollment. The student housing number should be considered above and beyond the population numbers reported in the table.

According to various master plan document and presentation materials related to the future UMR campus, the expectation is for the enrollment number to grow to potentially 1,500 in a decade, with a potential campus capacity at full development of approximately 4,500. Using the assumption that similar levels of students would reside in student housing as the campus grows, potential downtown population would need to potentially reflect an additional 2475 students by 2040 if full enrollment projections are achieved by UMR.

Downtown Population Distribution

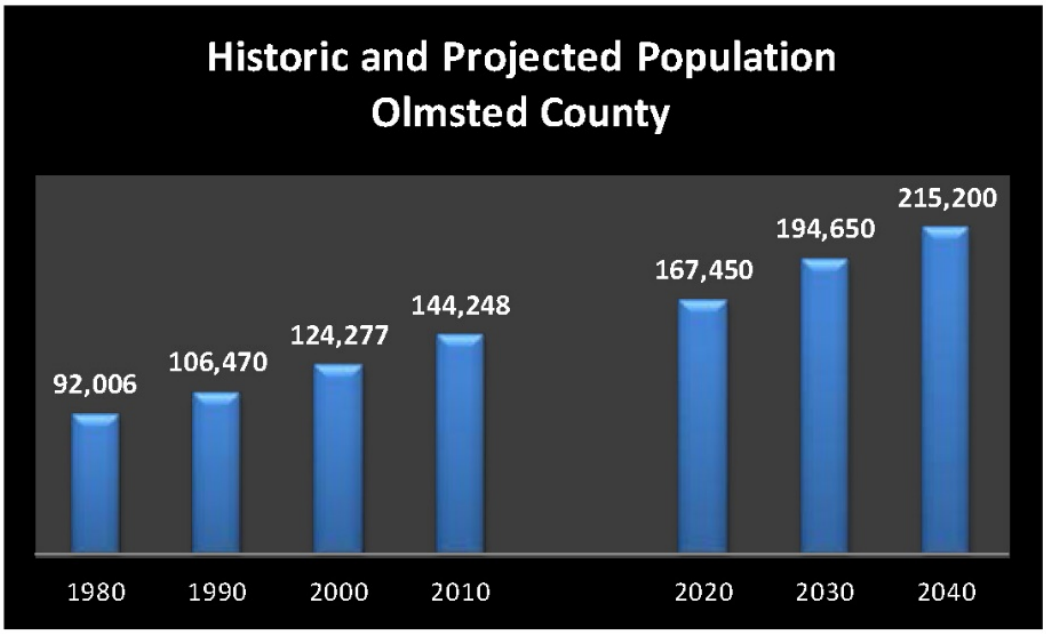
The figure on the following illustrates ROCOG's assumptions regarding the distribution of future population growth across the DMC District. While the DMC Plan anticipated a concentration of residential growth in the northeast Waterfront District, ROCOG assumes the residential growth will be more widely distributed, reflecting consideration of the DMC Plan but also the Downtown Master Plan, as well as the evidence from the recent development proposals which illustrate interest across the district in construction of mixed use residential development projects.

Figure : Projected Downtown Population Distribution



BACKGROUND DATA ON POPULATION GROWTH ASSUMPTIONS

1) Olmsted County historic and projected population – Esimated prepared by Rochester Olmsted Council of Governments (2013)



2) Population distribution within Olmsted County – Estimate prepared by Rochester-Olmsted Council of Governments (2013)

Historic / Projected Population

Olmsted County Jurisdictions | Historic / Census Count | ROCOG Projection | Change by Decade

Jurisdiction	1990	2000	2010	2020	2030	2040	2010-2020	2020-2030	2030-2040
Populalation / Townships	24,158	25,340	20,728	21,318	22,279	22,623	590	960	344
Population / Small Cities	10,722	13,131	16,751	20,400	24,573	28,614	3,649	4,173	4,041
Rochester Population	71,590	85,806	106,769	125,776	148,046	164,633	19,007	22,270	16,587
Total County Population	106,470	124,277	144,248	167,494	194,898	215,870	23,246	27,404	20,972
Township %	23%	20%	14%	13%	11%	10%			
Small City %	10%	11%	12%	12%	13%	13%			
Rochester %	67%	69%	74%	75%	76%	76%			

DEVELOPMENT FOOTPRINT IN THE DMC DISTRICT /

PROJECTED GROWTH & TOTAL DEVELOPMENT

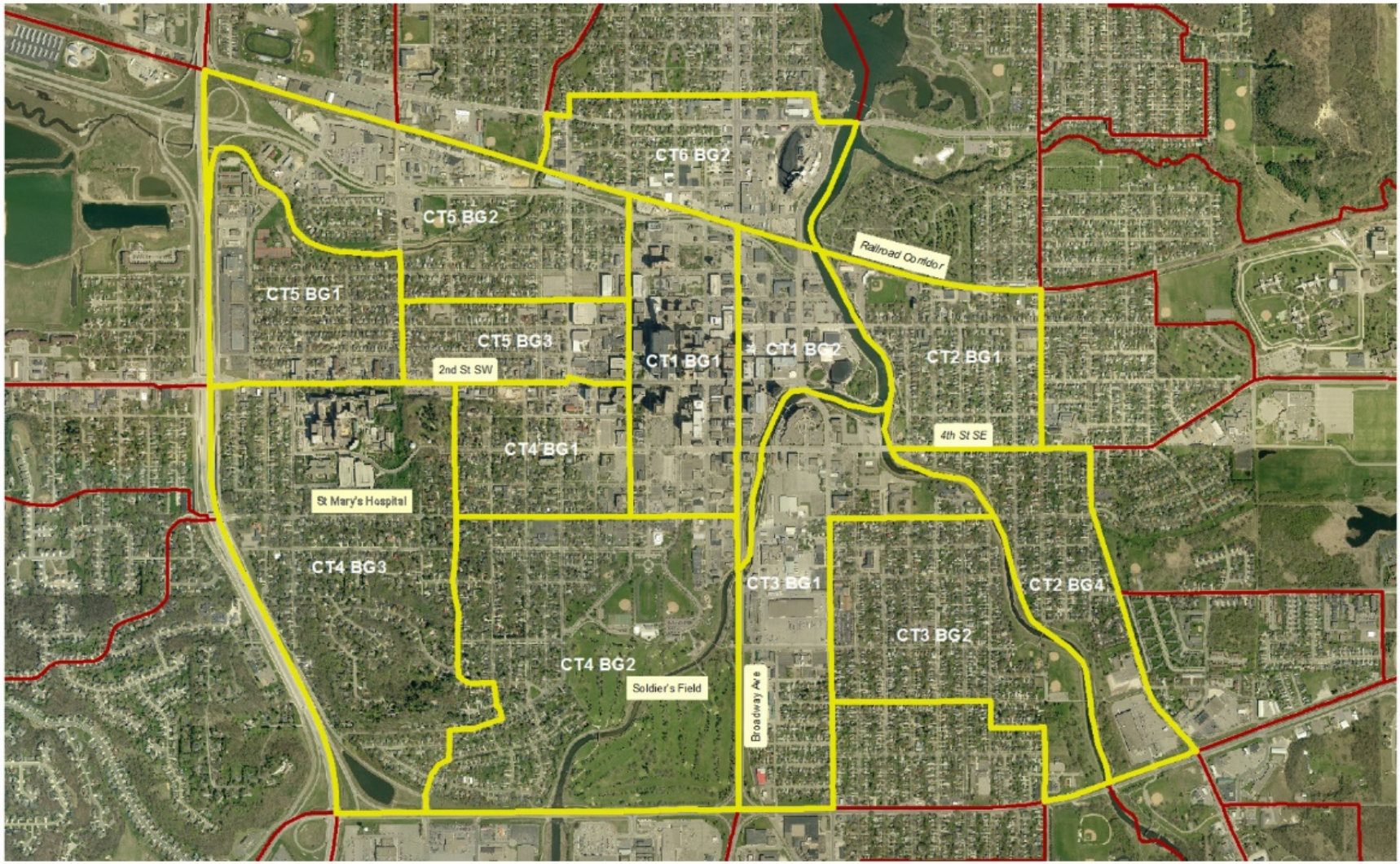
The following table reports on base year and projected development intensity by different classes of land use within the DMC District.

	Base		2040			District	Total
Land Use	CBD	2nd st	CBD	2nd St		2010	2040
Single Family *(units)*	63	498	79	498		561	577
Multi Family *(units)*	962	1,241	3,430	2,488		2,203	5,918
Commercial *(1000's sqft)*	317.4	178.0	602	178.0		495	780
Industrial *(1000's sqft)*	496.9	-	476	40.0		497	516
Office *(1000's sqft)*	1,486.9	112.5	1,669	368.9		1,599	2,038
Higher Education *(students)*	450		4,500			450	4,500
Elementary / Daycare *(stude*	416	-	356	-		416	356
Hotels *(rooms)*	2,438	1,110	3,724	1,110		3,548	4,834
Hi Intensity Retail *(1000's sqf*	57.6	89.5	128.9	89.5		147	218
Retail Center *(1000's sqft)*	314.9	733.8	592	733.8		1,049	1,326
Mayo *(1000's sqft)*	6,253.5	-	11,018	1,125.0		6,253	12,143
Hospital *(1000's sqft)*	808.3	6,477.5	1,100	9,260.0		7,286	10,360
BioTech *(1000's sqft)*	-	-	1,020	-		-	1,020
Future Commercial *(1000's sc*	-	-	11	33.3		-	44

MISCELLANEOUS POPULATION METRICS

Downtown Population Characteristics

The following information reports on characteristics of special interest for residents in the DMC District. This data is gathered from the 2009-2013 American Community Survey and is reported at the Block Group level. The following map of the downtown highlights the Census Tract (CT #) and Block Group number (BG) for each geographic, which corresponds in turn to the identifier in the 1st column of the table on page 11



Block Group	Persons	Total Low & Mod Income	% Low & Mod Income	Occupied Housing Units	Percent Owner Occupied	Percent Renter Occupied	Percent No Vehicle	Renter 15 to 34	Renter 35 to 64	Renter 65 & Over	Number Elderly Living alone	Total English as 2nd Language	Total Do Not Speak English	Disabled in Labor Force	Total Workers	Percent who use Transit for JTW	Percent Walk to Work	Percent Bike to Work	Estimate 2nd / 3rd Shift worker	Percent Workers 2nd/3rd Shift
CT1 BG1	543	149	27%	398	20%	80%	46%	14	67	85	162	19	4	91	137	17%	35%	0%	9	7%
CT1 BG2	679	347	51%	604	3%	97%	73%	71	160	188	257	70	16	102	236	4%	75%	0%	47	21%
CT2 BG1	903	369	41%	329	53%	47%	12%	0	41	0	36	0	0	14	429	3%	10%	6%	128	30%
CT2 BG4	846	59	7%	390	64%	36%	18%	53	16	0	50	12	0	54	423	4%	0%	0%	91	24%
CT3 BG1	660	137	21%	394	35%	65%	6%	23	0	0	17	0	0	92	437	5%	6%	0%	82	19%
CT3 BG2	1587	502	32%	643	67%	33%	6%	22	7	0	23	27	36	122	867	9%	5%	0%	219	26%
CT4 BG1	993	310	31%	544	35%	65%	18%	42	29	0	61	35	0	54	456	0%	50%	0%	81	18%
CT4 BG2	896	63	7%	432	75%	25%	3%	0	0	0	33	9	0	45	551	7%	15%	0%	64	12%
CT4 BG3	1133	95	8%	468	70%	30%	5%	0	14	0	33	0	0	66	551	2%	16%	1%	87	18%
CT5 BG1	678	127	19%	386	45%	55%	13%	11	32	0	16	0	0	58	501	2%	23%	3%	65	13%
CT5 BG2	1290	466	36%	584	46%	54%	10%	30	21	0	40	37	0	50	698	6%	42%	1%	212	30%
CT5 BG3	836	376	45%	369	8%	92%	16%	13	37	0	17	9	0	108	486	0%	35%	2%	172	35%
CT6 BG2	422	108	26%	272	34%	66%	37%	24	51	16	64	110	0	26	219	3%	8%	0%	104	47%

Key to columns

- Yellow: number of low and moderate income households residing in the DMC District and % of total households
- Lilac: Owner and Renter occupancy and number of households without a vehicle
- Blue: age distribution of renters
- Peach: number of elderly (65 and up) living alone
- Green: Number of persons for whom English is 2nd language or who reported not speaking English
- Gray: number of disable in working age (16-64) population
- Salmon: Distribution by non-SOV modes for Journey to Work
- Pink: number of workers and % of all workers this represents who are estimated to work 2nd or 3rd shift based on work start time reported as part of Census JTW data

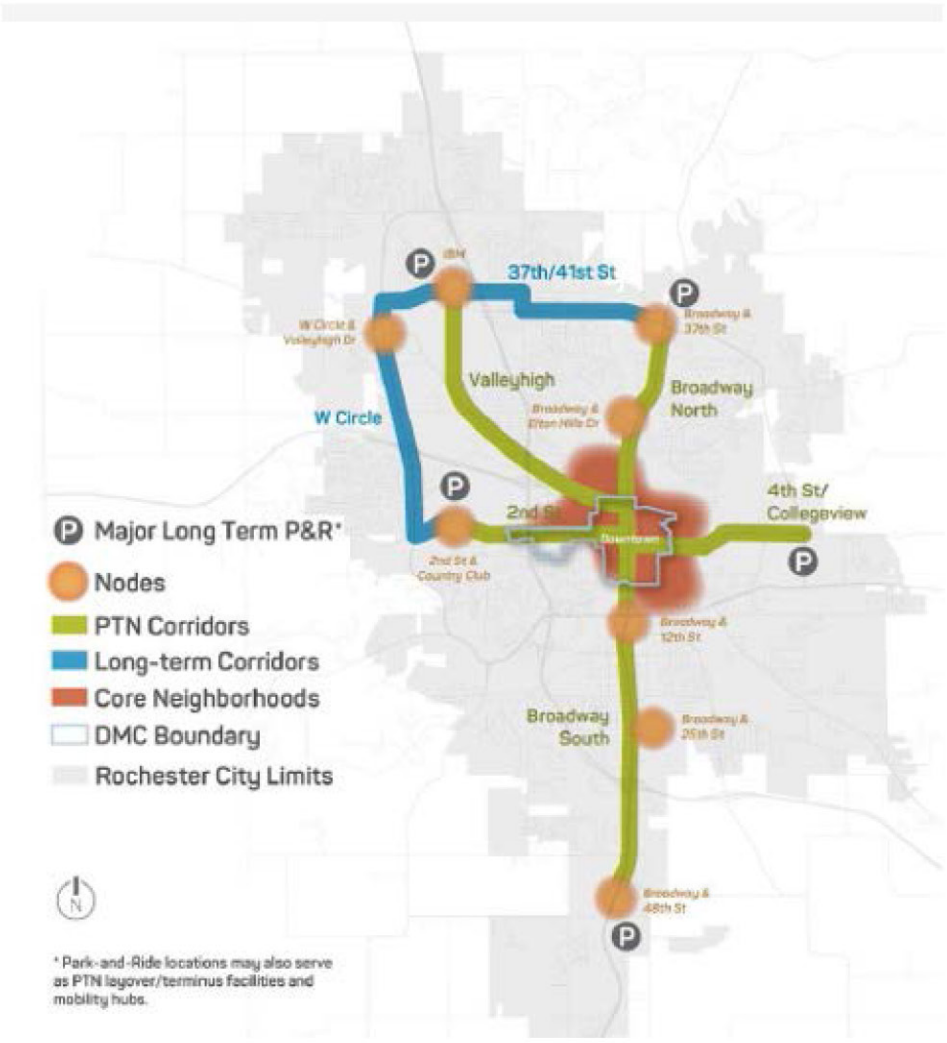
INFRASTRUCTURE ASSUMPTIONS

This information was covered at the September 20-21st, 2016 Workshop and is included herein to provide a complete package of materials

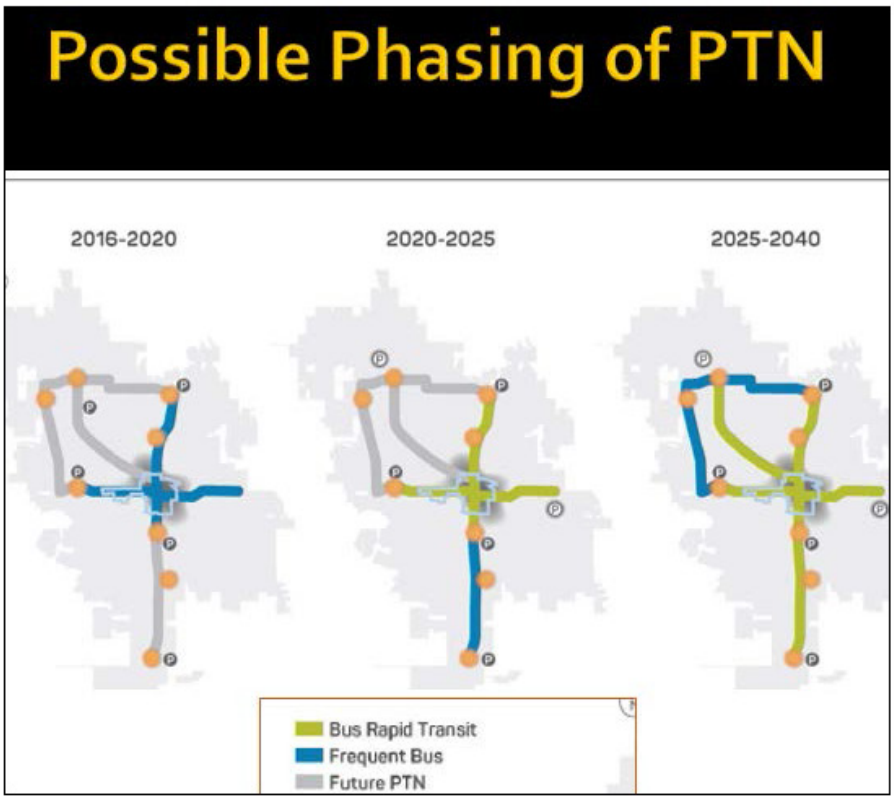
PRIMARY TRANSIT NETWORK

The Rochester Comprehensive Plan is anticipated for release in November 2016 and will include a recommended Primary Transit Network, which is envisioned as a set of corridors in which high frequency, high quality transit service would be provided. The ultimate vision is for some level of Bus Rapid Transit to be provided, which in conjunction with other services (regular route bus, express bus) is envisioned to provide ~ 15 minute service eventually in these corridors.

Concept of a Primary Transit Network (PTN) aligned with TOD Nodes & Corridors



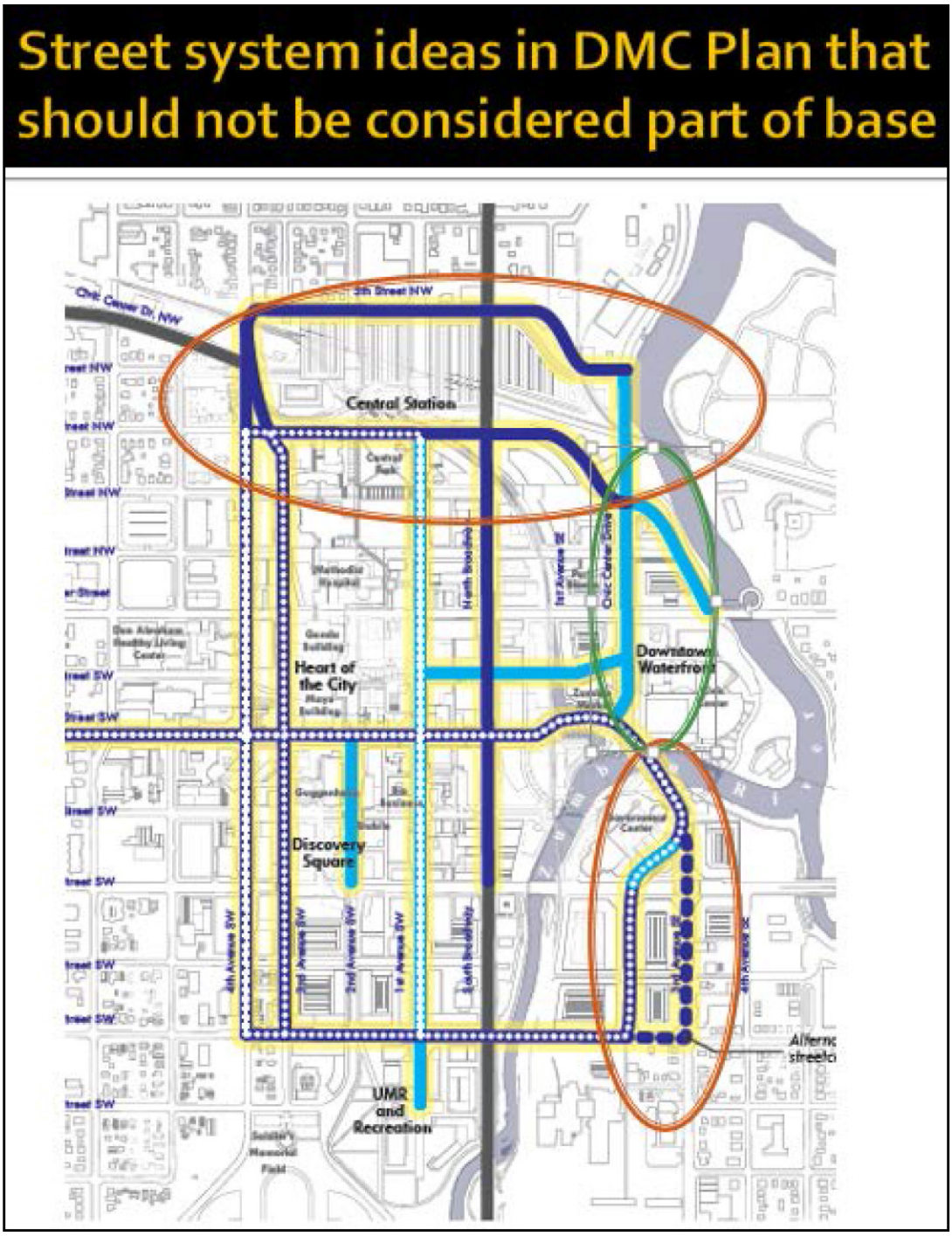
The potential phasing of different levels of enhanced service in the PTN corridors are represented in this graphic



The Transit Action Plan from the 2011 Downtown Master Plan illustrates how the PTN corridors could interface with a downtown circulator system on 2nd St SW in terms of route alignments



STREET NETWORK

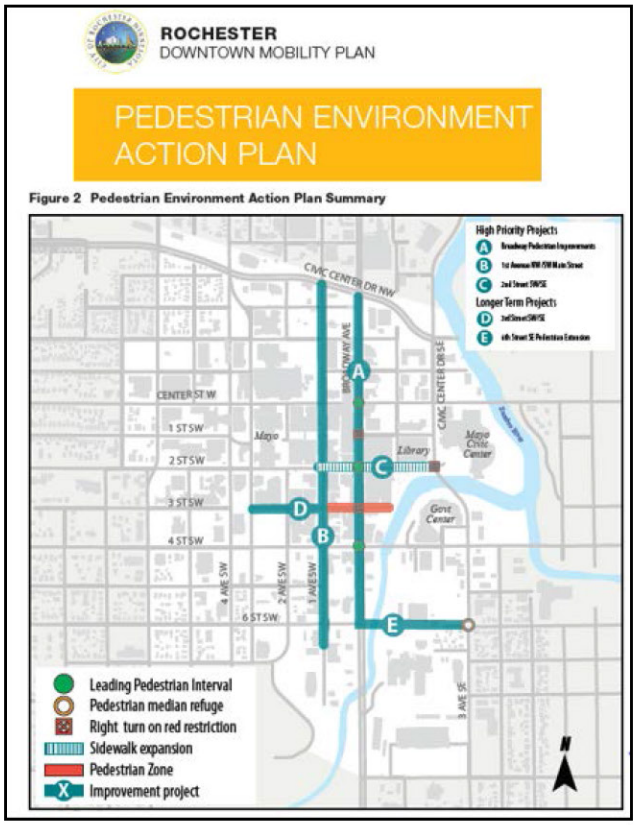


This illustration highlights two street system alignment concepts highlighted in RED ovals (a northside street couplet around a potential multi-modal transit terrace along Civic Center Dr and a circulator routing impacting the Government Center Parking Lot and Mayo Fullerton Lot in the southeast quadrant of the District) should not be considered part of any base existing or committed network. In addition, the alignment of a new street in the northeast quadrant along the riverfront should not be considered part of the base or committed network, but could be tested as an alternative. In addition, Civic Center Drive in front of the Mayo Civic Center (within the green oval) was proposed to be narrowed to a two or three lane facility in the DMC Plan. This should be evaluated as an alternative, not assumed as part of the base network.

NON MOTORIZED IMPROVEMENTS

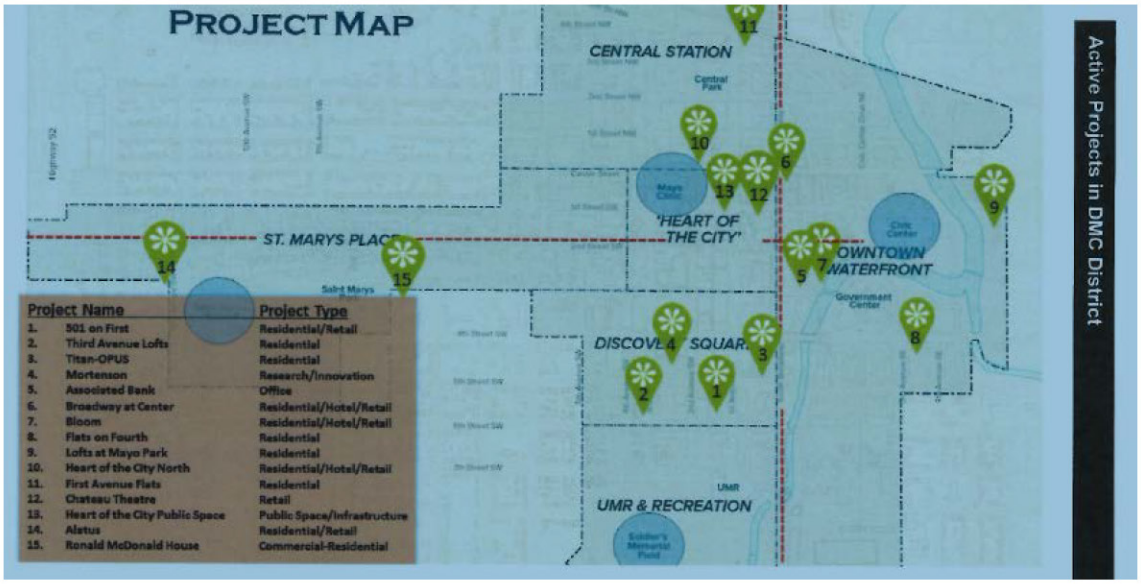
As a reminder of information presented in the September 20/21st workshop, the Pedestrian and Bicycle Action Plans from the Downtown Master Plan should be reviewed to inform Street Typology, Transit Alignments and City Loop interface during the course of the studies. The two graphics included here highlight the corridors, with copies of the Action Plans available on the E-Builder project site.





DEVELOPMENT PROSPECTS (AS OF 11/1/16)

Consultants are also advised to keep track of development proposals that are coming forward. THE DMC/EDA staff provide updates in DMCC Board packets. ROCOG staff can provide additional preliminary information about development intensity for most of these projects.



Appendix B. Statement of Purpose and Need

This page is intentionally blank.

Transit Circulation Study: Statement of Purpose and Need

DMC Transportation & Infrastructure Program

City of Rochester, MN

Prepared for:

DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

Prepared by:

SRF Consulting Group, Inc. HDR

Date: April 2018

J8621- Downtown Rochester Transit Circulation Study

This page is intentionally blank.

Table of Contents

Statement of Purpose and Need.....1

Introduction.....1

Study Area.....1

Planning Context.....3

Project Purpose and Need.....5

Project Purpose.....5

Project Need.....5

Tables

Table 1. Plans Impacting Rochester Transit Service.....3
Table 2. Land Use Allocation Summary.....7
Table 3. Existing RPT Park-and-Ride Summary.....18
Table 4. Mayo Shuttle Service Summary.....22

Figures

Figure 1. Study Area Location.....2
Figure 2. ROCOG Model Vehicle Trip Generation.....8
Figure 3. Projected Net New Local Transit Ridership.....10
Figure 4. Projected Net New Regional Transit Ridership.....11
Figure 5. Existing Volume/Capacity Along Study Area Roadways.....14
Figure 6. Existing Portal Capacity: PM Peak Period Analysis.....15
Figure 7. 2040 No Build Portal Capacity: PM Peak Period Analysis.....16
Figure 8. Existing Combined Transit Routing in the Study Area.....20

Appendices

Appendix A. Background Documents Review 23

Introduction.....23

2nd Street Corridor Framework Study (2009).....23

Downtown Rochester Master Plan (2010).....24

University of Minnesota Rochester (UMR) Campus Master Plan "Envision UMR" (2014).....25

Destination Medical Center (DMC) Development Plan (2015).....25

TEN key transportation principles.....28

DMC Transit Investment Strategy.....29

Mayo Clinic 5-Year Master Plan Updated (2016).....31

City of Rochester Comprehensive Plan 2040 (Draft 2017).....31

Draft Transit System and Market Analysis.....32

Draft Travel Patterns and Link Analysis.....32

Primary Transit Network (PTN) Framework.....32

RPT Transit Development Plan 2017-2021 (2017).....35

Appendix A Figures

Figure A-1. DMC Master Plan.....27

Figure A-2. *DMC Development Plan* Transit Investment Strategy.....30

Figure A-3. Draft Primary Transit Network.....34

Figure A-4. Proposed Weekday Daytime Network.....36

Figure A-5. Proposed High Frequency Network.....37

List of Acronyms

AGT	Automated Guideway Transit
AV	Autonomous Vehicle
BRT	Bus Rapid Transit
CBD	Central Business District
DMC	Destination Medical Center
HBW	Home-based work
Mayo	Mayo Medical Center
MSP	Minneapolis-St. Paul International Airport
PTN	Primary Transit Network
RCL	Rochester City Lines
ROCOG	Rochester-Olmsted Council of Governments
RPT	Rochester Public Transit
TDM	Travel Demand Management
TDP	Transit Development Plan
UMR	University of Minnesota Rochester

This page is intentionally blank.

Statement of Purpose and Need

Introduction

A Statement of Purpose and Need defines *the fundamental reasons why a project is needed and proposed*. It is a foundational element in a transportation alternatives study that provides the framework against which potential solutions (alternatives) can be considered and assessed.

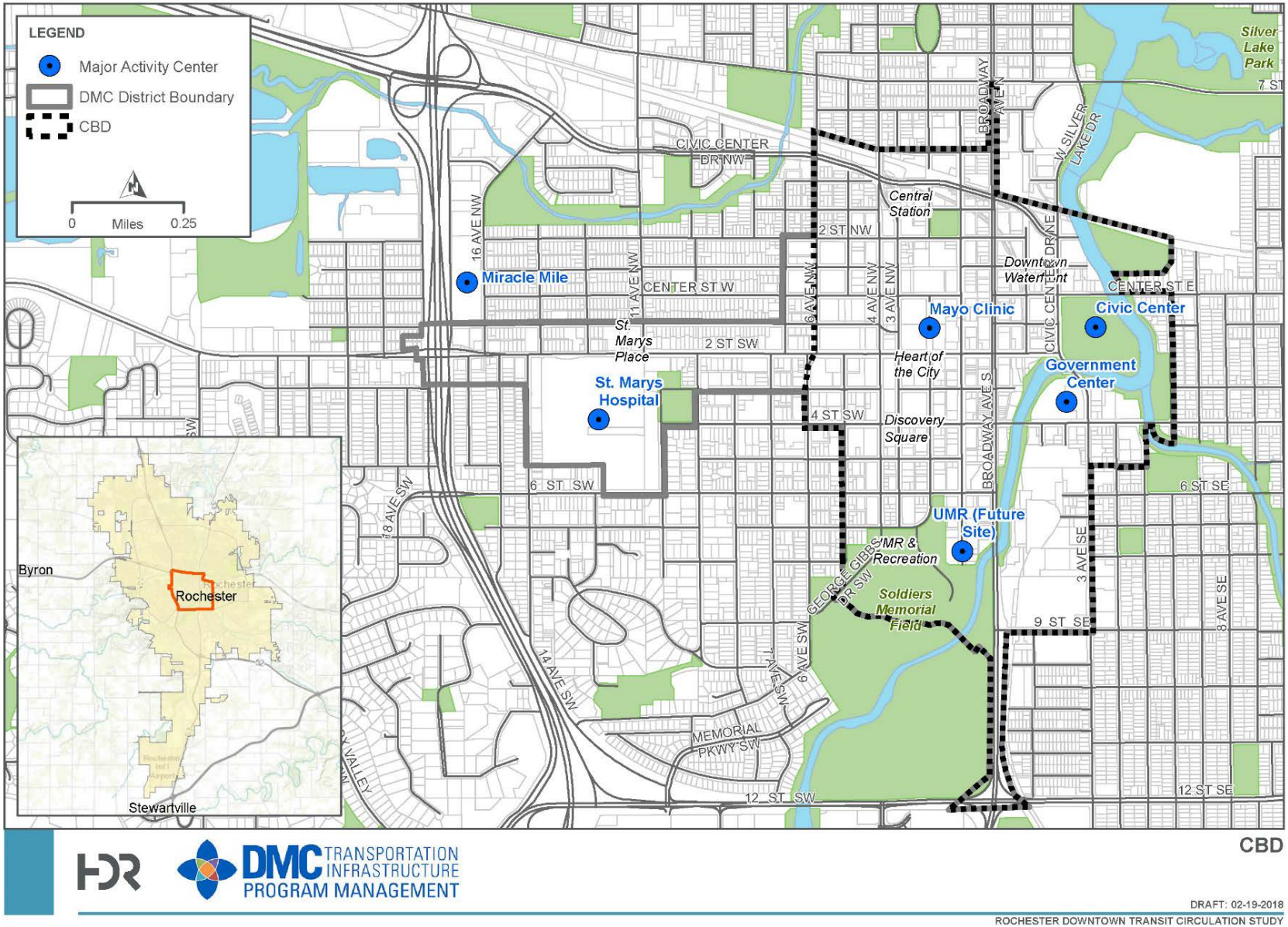
The Statement of Purpose and Need has six components:

- **Study area**: Identify the location in which the problem and potential solutions occur
- **Planning context**: Review of previous plans and polices that developed the foundation for why the project is needed and proposed
- **Purpose**: The fundamental reason(s) why the project is proposed
- **Needs**: Documentation of the transportation problems the project is intended to address.
- **Goals and objectives**: Desired outcomes of the project, and the framework to identify and evaluate potential solutions
- **Evaluation criteria**: Used to measure and assess the performance of potential solutions against the goals and objectives

Study Area

The study area for the Downtown Rochester Transit Circulation Study Project is shown in **Figure 1**. The Statement of Purpose and Need is intended to identify and document the transportation problems to be addressed within this study area and is not intended to identify specific solutions. While several transit capital improvements have been discussed for downtown Rochester - including a downtown transit circulator and a downtown transit center - this document sets aside those potential solutions to first examine the underlying issues (needs) to be addressed. In this way, this Statement of Purpose and Need is intended to help develop a shared understanding and agreement regarding needs so the most appropriate solutions can be advanced.

Figure 1. Study Area Location



Planning Context

A number of different plans and policies have been developed or are currently under development that support the need for improved transit service in the study area (**Table 1**). Each plan identifies objectives and recommendations to support the anticipated growth expected within downtown Rochester. The documents will assist in identifying potential transit improvements and help reduce the range of options being considering within the study area. The documents below are reviewed and summarized in **Appendix A**.

Table 1. Plans Impacting Rochester Transit Service

Document	Document Purpose	Relevance to Purpose & Need
2nd Sreett SW Corridor Framework Study (2009)	• Provides the framework to develop 2nd Street SW as an attractive destination for business, residents, and visitors • Develops a long-term transportation strategy to create a multi-modal corridor serving the 2nd Street "Urban Village"	• Presents the need for improved transit, bike, and pedestrian facilities along 2nd Street SW to give people attractive transportation options beyond personal automobiles
Downtown Rochester Master Plan (2010)	• Provides vision for the future of downtown Rochester • Established an Economic Development vision which the DMC Development Plan expanded upon • Targets a 50 percent commuter trip mode share using alternative modes by within 20 years, including 23 percent by transit • Develops a multi-modal transportation strategy to support growth in downtown • Creates a transit framework to limit reliance on automobile trips within downtown	• Identifies the need for more transit investment to accommodate future growth in travel demand and support the transit mode share goal • Supports the need to improve transit operations and legibility in downtown • Identifies 2nd Street SW and Broadway Avenue as corridors in need of transit priority investment • Focuses on expanding the park-and-ride program to connect with frequent transit serving the downtown area
University of Minnesota – Rochester Campus Master Plan (2014)	• Develops a framework to implement a new downtown urban campus within Rochester to support a student population of about 1,400 within the next 10 years	• Identifies the need for future transit to encourage future student population to use alternative transportation modes to access the future campus • Supports the need to limit parking supply for students and staff

Document	Document Purpose	Relevance to Purpose & Need
Destination Medical Center (DMC) *Development Plan* (2015)	• Creates a vision for a series of six sub-districts within downtown Rochester to support the planned growth of an integrated Health Service, Medical Science and Bio-Tech cluster anchored by the Mayo Medical Center. • Examines the projected intensification of downtown land use, which is expected to result in a significant increase in travel demand • Develops goals and principles to guide transportation and infrastructure planning in the DMC district • Targets a 30 percent commuter transit mode share by 2035 • Identifies four key transit investment strategies to support the transit mode share goal	• Identifies the need for substantial increases in transit capacity to accommodate projected transit ridership into, out of, and within downtown • Relies on the need for transit investment to limit vehicles in downtown and the associated parking supply • Supports the need to optimize transit operations and provide additional transit facilities in the DMC district • Identifies the need for a downtown transit circulator that can capture various transit markets, including connections to peripheral park-and-ride lots
Mayo 5-Year Master Plan Update (2016)	• Provides guidance of future growth for all Mayo Clinic facilities, including those located within downtown • Establishes a 5-year planning coordination tool to assist in the development of Mayo Clinic expansion	• Supports the need for increased transit investment necessary to accommodate future expansion of Mayo Clinic facilities • Strives to maintain a parking ratio of 1 space for every two employees, which requires a robust Travel Demand Management (TDM) program to provide employees with quality travel choices • Identifies the need for a park-and-ride program to limit the number of personal vehicles needing direct on-site access to Mayo Facilities
Rochester Comprehensive Plan 2040 (Draft 2017)	• Identifies long-term strategies and policies to guide future development of land in the City of Rochester. • Reviews the various transit services currently operating within the City of Rochester • Assesses existing and projected demand for transit using a series of demographic, land use, and travel demand information • Develops a Primary Transit Network (PTN) framework to guide the development of future land use oriented around transit streets	• Supports the need to invest in transit in downtown to accommodate future intensification of land use and associated travel demand increases • Identifies specific primary transit corridors that are more suitable for transit priority treatments, including: o 2nd Street SW o N/S Broadway Avenue o 4th Street SE/Collegeview Road SE o Valleyhigh Drive NW • Identifies specific transit trip generators and transit-oriented demand locations that will increase success of future transit investment
Rochester Transit Development Plan 2017-2021 (2017)	• Reviews existing operations, capital facilities, finances, marketing, management, and implementation of existing and future Rochester Public Transit (RPT) services • Includes a City-wide community assessment, service guidelines, and public outreach results as a framework for short-term service planning • Identifies needed improvements within a 5-year timeframe	• Supports the need for transit investment in the downtown area due to high levels of stop-level ridership • Identifies needed transit capacity increases within the study area • Presents a financial plan to support the suggested increases in local bus service over the next five years to accommodate growth in transit demand within Rochester

Project Purpose and Need

Project Purpose

The following statement describes the fundamental purpose of the Rochester Downtown Transit Circulation Project:[1]

The purpose of the Rochester Downtown Transit Circulation Project is to provide high quality downtown public transportation[2] service for residents, commuters, businesses, patients, students, and visitors that will support the City of Rochester and DMC district transportation, economic development, and livability goals and substantially increase public transportation use downtown.

Anatomy of the Purpose Statement:

- What: Provide high quality downtown transit service
- For whom: Residents, commuters, businesses, patients, students, and visitors
- Why (intended outcome): a) To support the City of Rochester and DMC district transportation, economic development, and livability goals and b) To substantially increase transit use downtown

Project Need

This section provides the background for the statement of project purpose. It identifies the problems or needs the Downtown Rochester Transit Circulation Project is intended to address and the underlying causes of those needs.

The downtown area of the City of Rochester is expected to grow dramatically, with approximately 65 percent more jobs and 30 percent more people in the next 20 years. Both the City of Rochester *Downtown Master Plan* and the *DMC Development Plan* identified an aggressive transit mode share increase to accommodate this growth, a goal to carry between 23 and 30 percent of all commuters on transit. As a result, transit ridership on both the local and regional transit systems is expected to nearly double, requiring more transit capacity.

---

[1] Because the Statement of Purpose and Need is written to describe an action (project), the purpose statement refers to the Rochester Downtown Transit Circulation *Project* rather than *study*.

[2] For the purpose of this document, "public transportation" is defined to include one or more of a wide range of transportation solutions other than private vehicles that could address the identified needs. Examples of potential solutions include bus, bus rapid transit, tram, automated guideway transit (AGT), personal rapid transit, moving sidewalks, and a range of autonomous (self-driving) vehicles (AV).

The need to serve a greater share of travel with transit is driven by existing constraints posed by the lack of available right of way for street expansion which, without a shift in travel demand growth to more efficient modes, would result in study area roadways that will be severely congested and the need for approximately eight additional city blocks of six-story parking structures will be required if travel behavior follows current trends. Transit investment will be needed to accommodate the growth in trip making associated with this projected growth, facilitate the opportunity to reach these transit mode share goals, and support the vision of making downtown Rochester into a world-class destination for residents, commuters, businesses, patients, students, and visitors.

The following five factors contribute to the need for the Downtown Rochester Transit Circulation Project:

1. Growth in local and regional travel associated with the implementation of the DMC Development Plan
2. Limited ability of the existing transportation network to support local and regional economic development priorities
3. Congested downtown entry points and primary streets resulting from continued reliance on personal automobiles
4. Parking program and policies that encourage the use of private automobiles
5. Constrained transit system capacity and need to optimize/coordinate multiple existing services (Rochester Public Transit, Rochester City Lines [RCL], LeRoy City Lines, Mayo and private shuttles)

The needs statements below are based on current understanding and available information. The needs statements and documentation can be revisited and updated as the project continues.

1. Growth in Local and Regional Travel Associated with the Implementation of the DMC Development Plan.

The *DMC Development Plan* included an aggressive land use plan to intensify a variety of uses within the study area. **Table 2** details the existing and projected land use figures within the Central Business District and DMC District **(Figure 1**). As shown, multi-family, educational, and medical uses will substantially increase by 2040 in downtown Rochester.

Table 2. Land Use Allocation Summary

Land Use	Base Land Use (2010)			Projected Land Use (2040)		
	Central Business District (CBD)	2nd Street SW	DMC District	CBD	2nd Street SW	DMC District
Single Family (units)	63	498	561	79	498	577
Multi-family (units)	962	1,241	2,203	3,430	2,488	5,918
Commercial/ Retail (1,000 sq. ft.)	689.9	1,001.3	1,691.0	1,333.9	1,034.3	2,368.0
Industrial (1,000 sq. ft.)	497.0	--	497.0	476.0	40.0	516.0
Office (1,000 sq. ft.)	1,486.9	112.5	1,599.0	1,669.0	368.9	2,038.0
Education [1] (students)	866	--	866	4,856	--	4,856
Hotels (rooms)	2,438	1,110	3,548	3,724	1,110	4,834
Hospital [2] (1,000 sq. ft.)	7,061.8	6,477.5	13,539.0	12,118.0	10,385.0	22,503.0
Bio Tech (1,000 sq. ft.)	--	--	--	1,020.0	--	1,020.0

Source: DMC Integrated Studies Baseline Assumptions Memo (ROCOG)

[1] Includes the future UMR expansion

[2] Includes all Mayo Facilities

This anticipated intensification of downtown land use is expected to lead to substantial increases in employment and population.

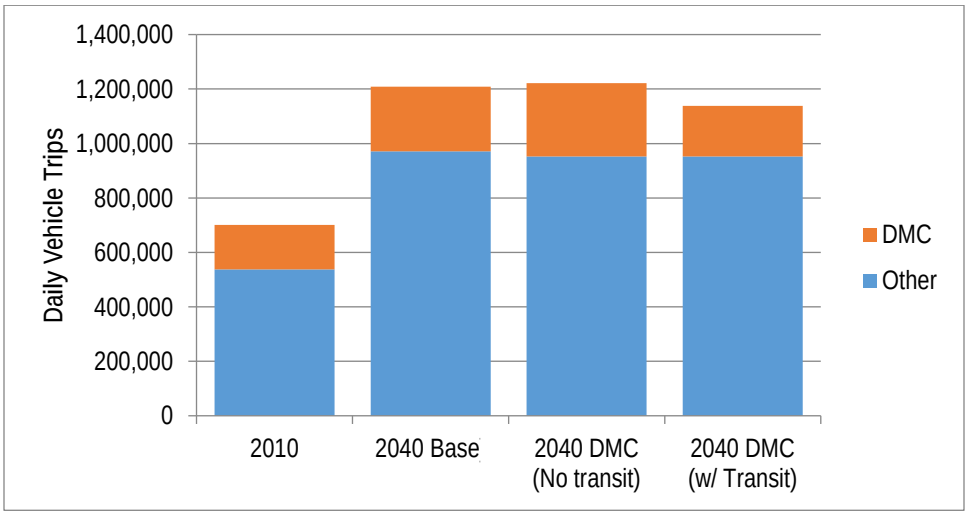
Employment levels within the study area are projected to grow significantly by 2040. The region anticipates an increase of approximately 51,000 new jobs over the next 25 years within Olmstead County, 51 percent of which are expected to be created within the DMC development district.[3] This equates to approximately 26,000 new jobs or 1,050 jobs per year within the DMC district. The growth in jobs will lead to a significant increase in travel demand and will overload the existing transportation network if existing travel patterns remain. Nearly 70 percent of all commuter trips are personal vehicles trips, so the growth in travel demand will result in severely congested roadways and require nearly 40 city blocks of surface parking. Population is

[3] Source: Rochester-Olmstead Council of Governments (ROCOG)

also expected to increase by nearly 30 percent within the DMC district, largely as a result of *DMC Development Plan* land use plan.

Figure 2 shows the results of the city-wide Comprehensive Plan's base 2040 ROCOG traffic model results for various scenarios. As the *DMC Development Plan* is realized, vehicle trips to the DMC district are expected to grow by nearly 64 percent without transit investment, a growth of nearly 104,000 total trips per day. The increased intensity of development and trip generation will increase peak period traffic well above the amount the current roadway network is able to accommodate, creating severely congested conditions.

Figure 2. ROCOG Model Vehicle Trip Generation

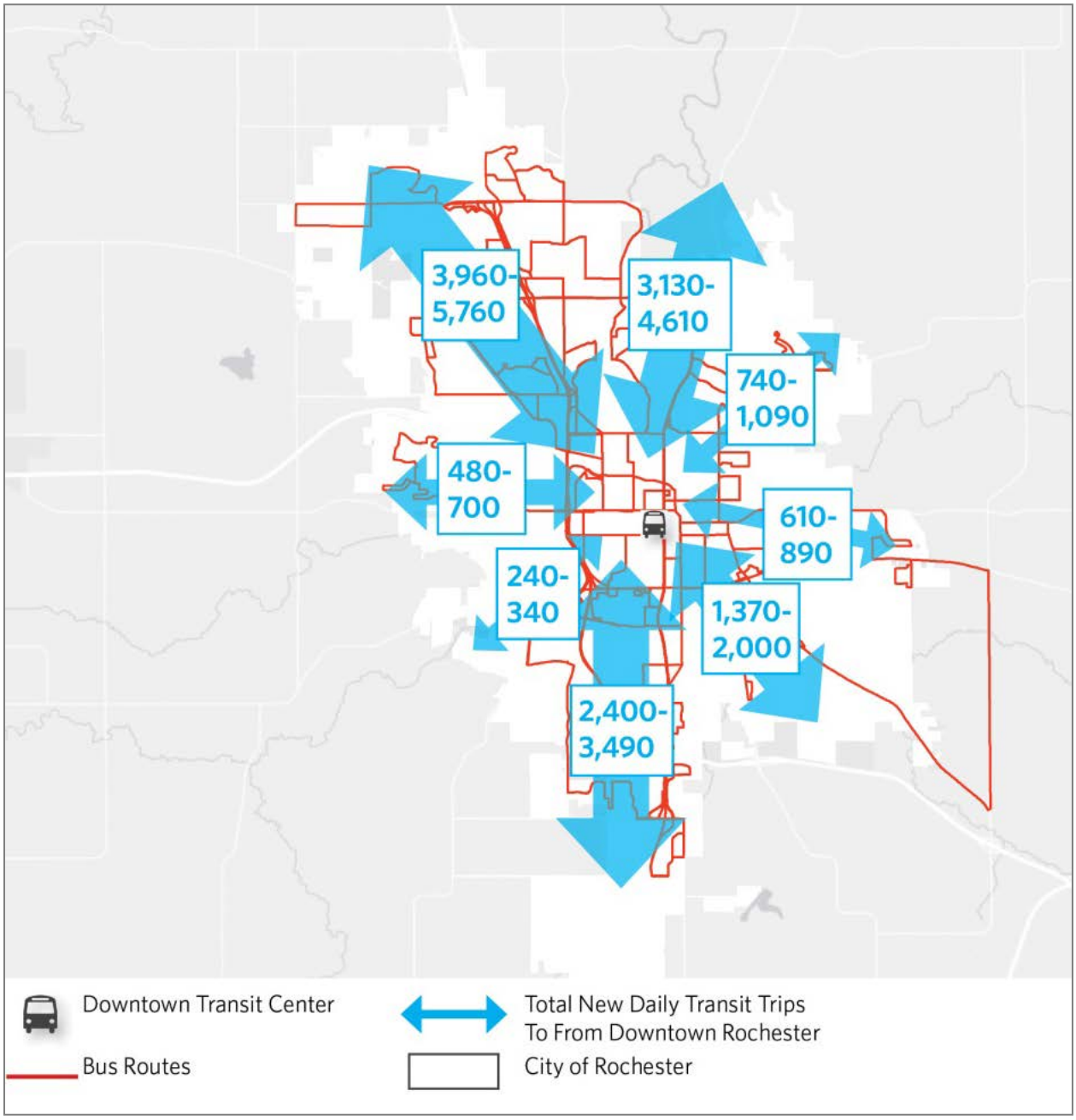


In addition to the projected increases in commuter trips, the concentrated growth associated with *DMC Development Plan* will increase the demand for short trips, particularly for patients, visitors, shopping, recreation, and commute trips. The *DMC Development Plan* identified four key markets that will increase the demand for transit within downtown Rochester, including:

- Patients, staff, and visitors traveling between the Mayo Clinic downtown and St. Mary's Hospital campuses
- People with mobility challenges that will benefit from improved transit options and enhanced access to transit
- Short-trips between downtown destinations and major trip generators, including health-care facilities, government institutions, visitor centers, and retail/leisure/recreational locations
- Park-once and ride markets, which allow commuters and visitors to travel from outside the study area, park on the periphery of downtown, and connect to high-quality transit options to reach downtown destinations

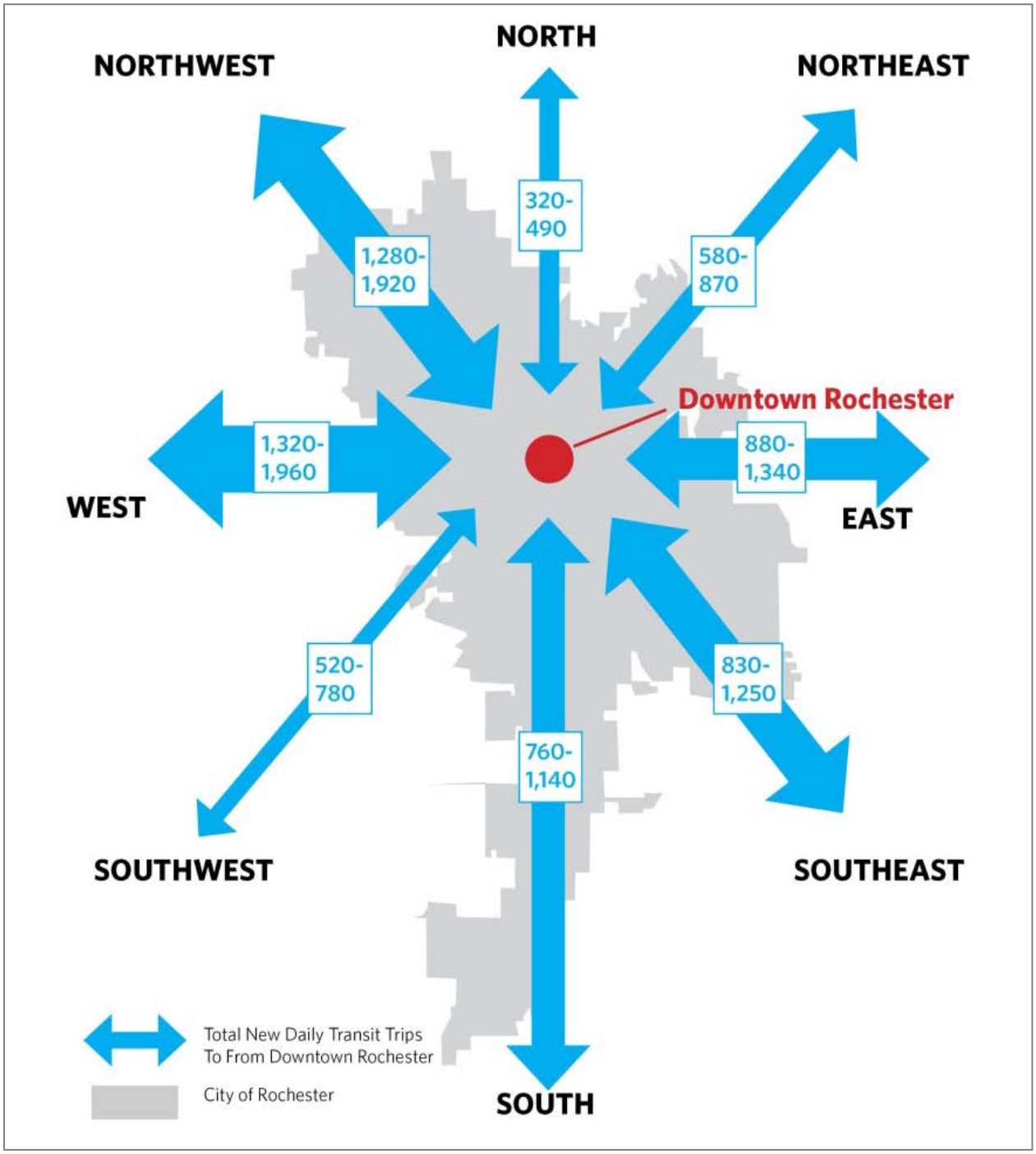
Based on the City of Rochester population projections and anticipated transit mode share of 23 to 30 percent of all trips commuting to downtown, future local transit ridership within the City of Rochester is expected to increase between 194 percent and 285 percent depending on the service corridors defined in the *DMC Development Plan*. This equates to approximately 12,900 to 18,800 net new RPT local transit trips in the City of Rochester daily, depending upon the actual transit mode share. Similarly, if the transit mode share goals are realized, future regional commute transit ridership is expected to increase between 154 percent and 231 percent depending on the service corridors defined in the *DMC Development Plan*. This equates to approximately 10,710 to 13,970 net new regional transit trips in Rochester and the surrounding communities. **Figures 3 and 4** illustrate the projected range of net new local RPT transit trips within the City of Rochester and net new regional transit trips within the region. This future transit ridership is expected to overwhelm the existing service capacity, park-and-ride lot capacity, and capacity at many of the existing transit facilities in the study area.

Figure 3. Projected Net New Local Transit Ridership



Source: DMC Development Plan, 2015.

Figure 4. Projected Net New Regional Transit Ridership



Source: DMC Development Plan, 2015

2. Limited Ability of the Existing Transportation Network to Support Local and Regional Economic Development Priorities.

The City of Rochester, Olmsted County, DMC, and other local agencies and organizations have prepared the numerous plans discussed in this document. Together, these documents describe a range of goals and policies related directly or indirectly to economic development. As discussed elsewhere in this document, congestion on the transportation network will limit the achievement of these goals and policies, since it will create a mobility and access barrier within the study area.

Specifically, the significant increase in projected growth and travel demand is expected to congest study area roadways and limit efficient mobility for all users. This limits the opportunity to support economic development objectives within the study area, as one of the key goals of the *DMC Development Plan* is to generate between $7.5 and $8 billion in new tax revenue over the next 35 years. Congested roadways as a result of unchanged current travel behavior will restrict efficient movement of goods and people and discourage visitors and shoppers from supporting businesses within downtown Rochester.

To facilitate the projected land use intensification and future transit-oriented development goals identified in the *Draft City of Rochester Comprehensive Plan 2040*, transit investment will become a vital component to link and support mixed-use development within downtown Rochester. Access to jobs, residences, recreation, health services, and retail will all require improved transit investment and optimized transit operations.

While basic transit service (bus) provided at the right level can potentially address mobility issues and support economic development goals at a basic level, high-quality fixed-route transit improvements, such as tram or high-quality Bus Rapid Transit (BRT), can also catalyze and accelerate economic development by attracting developers who see the permanent nature of the investment as a long-term commitment.

3. Congested Downtown Entry Points and Primary Streets Resulting from continued reliance on personal automobiles.

The existing roadways in the study area provide vital access to a variety of destinations and are key contributors to the economic success of Rochester. Implementation of the *DMC Development Plan* will significantly increase demand on local streets. The Plan forecasts that available peak hour street capacity will decrease from about 72 percent to 10 percent in the next 20 years unless there is a significant decrease in the share of commuting trips made by automobile.

Existing traffic volumes are shown in **Figure 5**. Primary traffic streets that carry the greatest daily traffic are listed below:

- 2nd Street SW
- Broadway Avenue North and South
- 3rd and 4th Avenue SW/NW
- 6th Street SW
- Civic Center Drive
- 4th Street SE / 3rd Avenue SE

In addition to increasing congestion on local streets, the traffic generated by the *DMC Development Plan* will also impact traffic flow at the major entry portals into downtown. **Figure 6** depicts the current availability of street capacity at these portal locations. Downtown entry points from US 52 are already approaching capacity today. **Figure 7** reflects the impact of DMC development in the future peak period with the current auto mode share. Based upon traffic analysis conducted during the Integrated Transit Studies, all of the US 52 entry points except the US 14 interchange will be over capacity. Several of the portals east of Broadway Avenue will also be approaching capacity.

Constrained access into and out of downtown will significantly limit mobility for residents, visitors, commuters, and all other future users of the transportation network. Congested roadways will increase safety risk for pedestrians and cyclists and will likely result in more crashes within downtown. The increase in vehicular traffic will also restrict the opportunity to enhance the livability of the community since attractive transportation options will not be available for the emerging workforce and future residents.

Figure 5. Existing Daily Traffic Volume Along Study Area Roadways

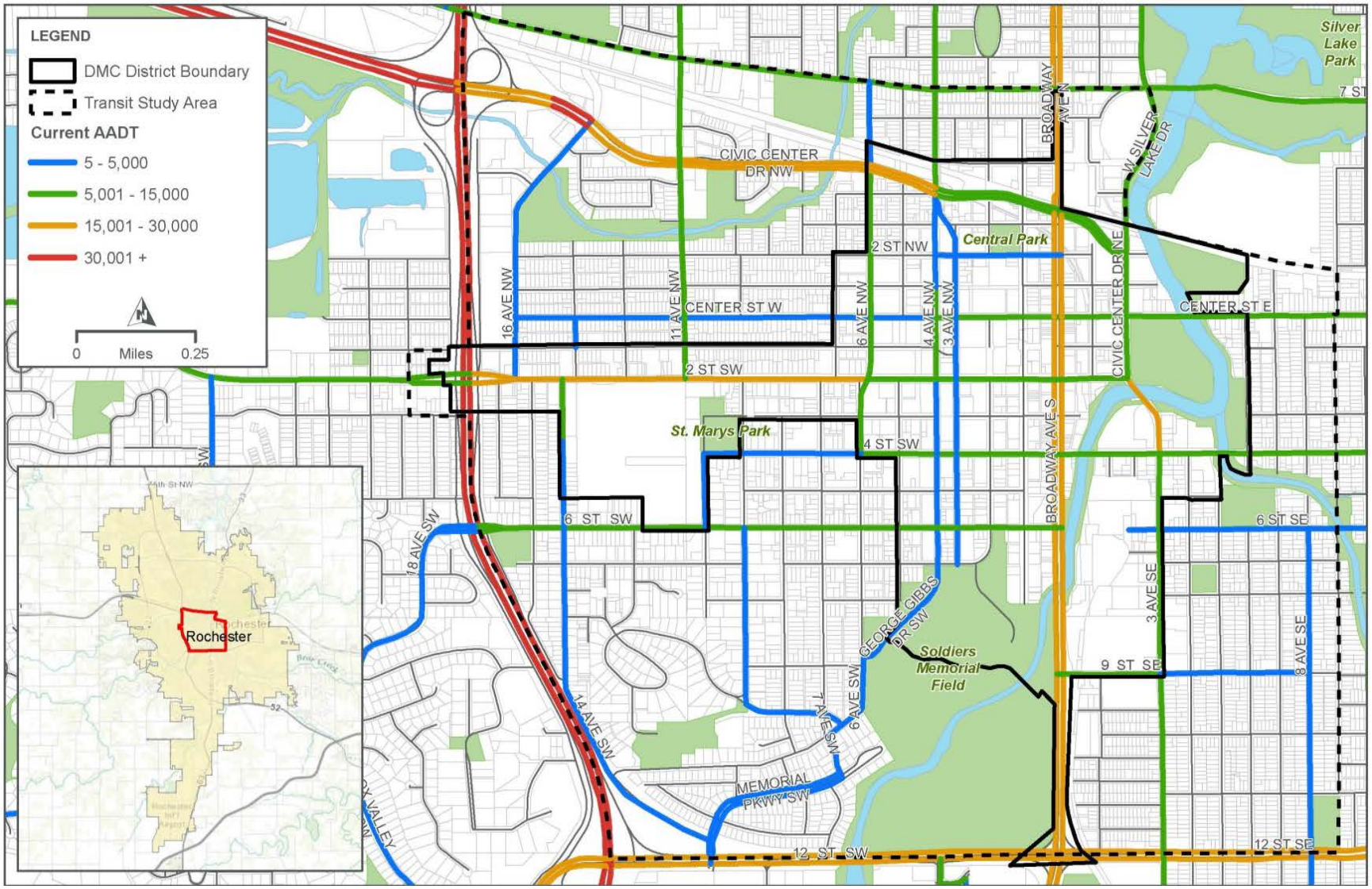


Figure 6. Existing Portal Capacity: PM Peak Period Analysis

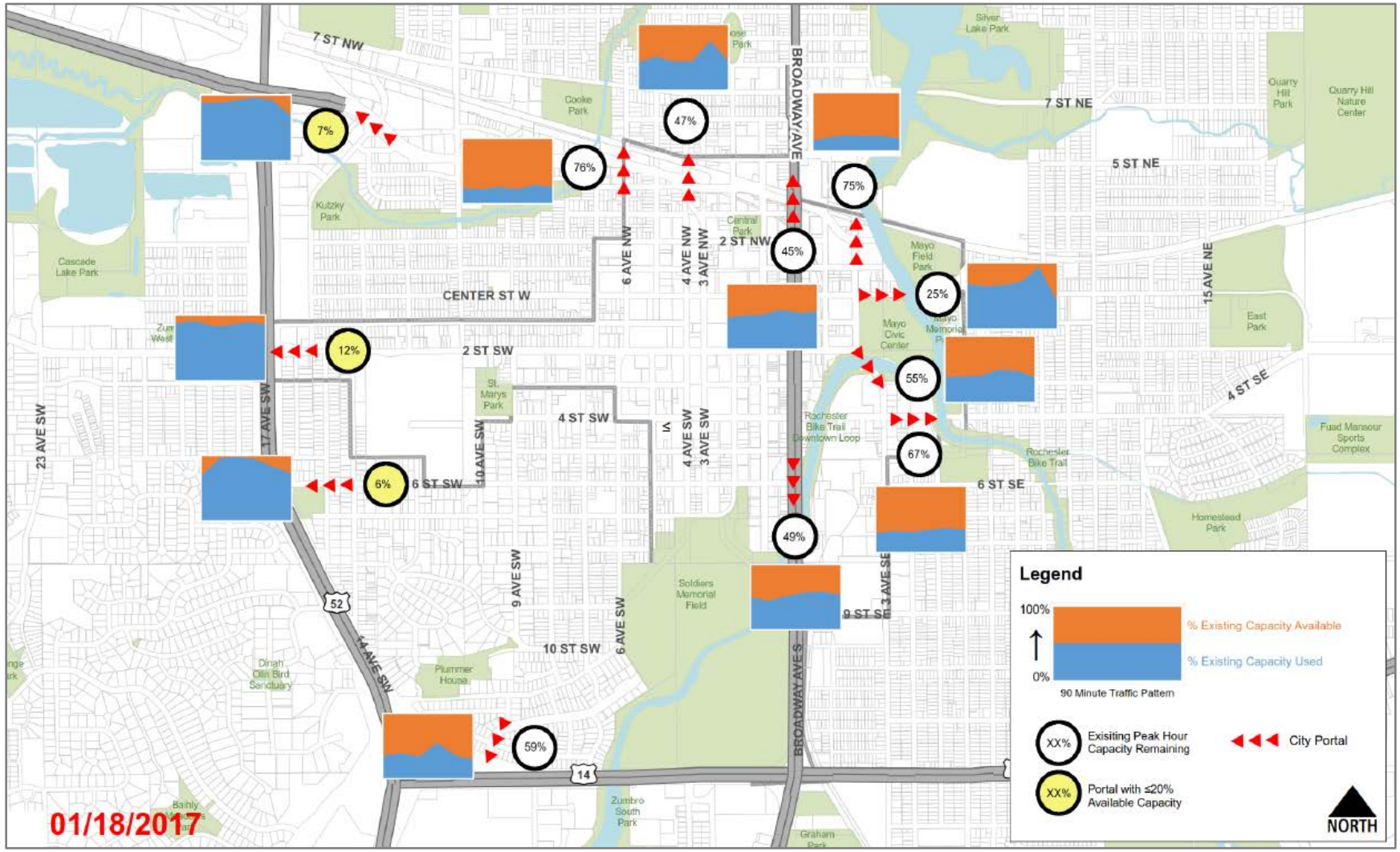
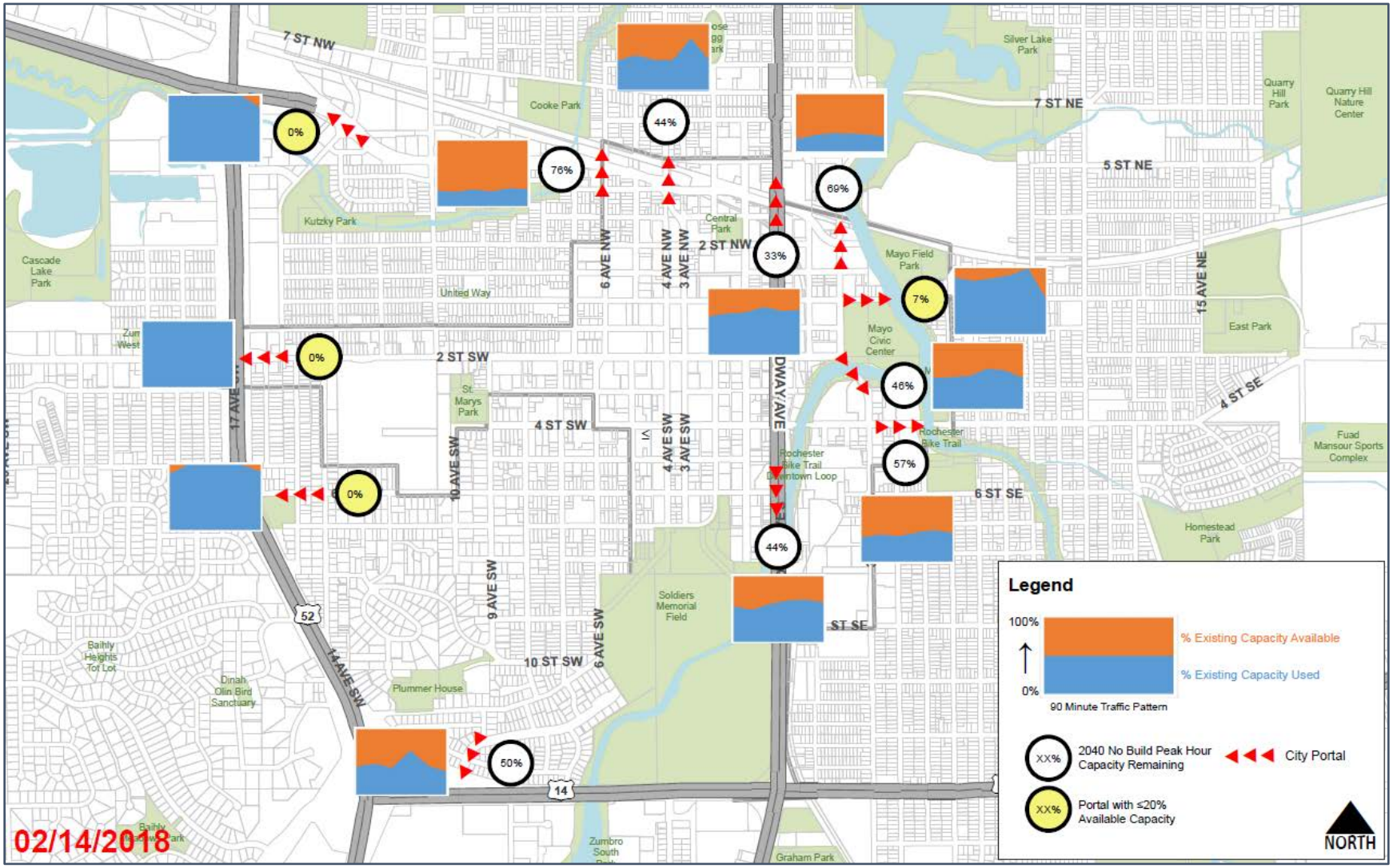


Figure 7. 2040 No Build Portal Capacity: PM Peak Period Analysis



4. Parking Program and Policies that Encourage the Use of Private Automobiles.

The *DMC Development Plan* travel demand growth will require a substantial increase in parking supply if current commuter travel habits continue as they are today. Meeting this increased commuter parking demand would reinforce existing travel habits, bringing more cars into downtown and requiring conversion of additional downtown land to parking use.

Parking supply to meet the anticipated increase in employment is estimated in the *DMC Development Plan* to require 180 acres of surface parking (equivalent to 40 city blocks of surface parking or eight city blocks of six-story parking structures). Most of the existing parking in downtown Rochester is provided to meet peak demand for a single use (e.g., employees). Shared parking is limited during weekday work hours, which reduces flexibility in daytime parking use. If this single use parking approach is continued, the amount of parking in downtown will need to be increased substantially to accommodate the projected intensification of study area land use.

Managing the parking supply in downtown Rochester is highly dependent on increases in transit investment and optimization within the study area. Without proper management of the parking supply in downtown, several key disadvantages will emerge that go against the vision of the *DMC Development Plan*, including:

- Traffic congestion will increase in downtown because vehicles will be driving to access future parking, which may also adversely affect safety for pedestrians and cyclists downtown. Traffic congestion will also limit efficient movement of goods and people, both which may have negative impacts on a thriving local and regional economy.
- Parking supply designated for visitors, patients, tourists, and shoppers will be limited because much of the parking will be used by commuters. This will greatly limit access to future downtown uses for multiple user groups.
- Projected supply of parking will use valuable land in the study area that could potentially be used for other purposes consistent with planning documents that will have higher tax revenue potential.
- The cost to construct, operate, and maintain parking (which is estimated to be between $30,000 and $60,000 per stall) will take away funding that can be better used for other uses.

Several RPT routes connect to six existing park-and-ride lot lots located throughout the City of Rochester. The lots are typically made up of

designated spots within an existing parking lot used for a separate commercial purpose (e.g., Target). The existing RPT park-and-ride summary is detailed in **Table 3**. Total parking capacity at the park-and-ride locations amounts to 1,297 total parking stalls designated for RPT riders. On average, approximately 113 percent of the total park-and-ride capacity is used among the five lots, with two lots showing over capacity conditions. This high utilization is largely attributable to the cost of parking in downtown Rochester, the relative shortage of parking, and the connections to frequent, direct transit service to the downtown transit center.

Table 3. Existing RPT Park-and-Ride Summary

Park-and-Ride Lot	Parking Capacity	Parking Stalls Occupied	Utilization (%)	RPT Route Served
NE – Hwy 63 N at Shopko N	160	296	147	1, 1D, 1N
S – Hwy 63 S at Target S	190	265	139	6M, 7N, 15D
SE – Hwy 14 E at Cub Foods	50	50	100	3N, 4D, 17
NW – Hwy 52 N at IBM	667	653	98	12M, 12N, 18D
S – Broadway Ave S at the Olmstead Co Fairgrounds	371	258	70	6D, 6M, 7N
RCTC	746	117	16	3, 3D, 3N
Total	2184	1639	75	

Source: Rochester Public Transit Survey, February 2018

RPT has established effective working relationships with a number of major retailers in designating parking for RPT customers. However, the park-and-ride lot designations are not guaranteed over the long-term, and the City of Rochester has expressed interest in identifying more permanent facilities for its riders. The results from the system-wide on-board survey conducted for the *RPT Transit Development Plan* 2017-2021 identified lack of parking and parking pricing are the main incentives for riders to use the bus.[4] In addition, the RPT survey showed that more than 70 percent of all respondents were either satisfied or more than satisfied with the current park-and-ride program, suggesting the continued importance of a well-established and reliable park-and-ride program. The current overcapacity park-and-ride conditions will present a major constraint if future transit demand is expected to rely on a seamless connection between park-and-ride locations and transit service destined to the study area.

[4] The survey results revealed that nearly 35 percent of all respondents take the bus because parking is unavailable or too expensive.

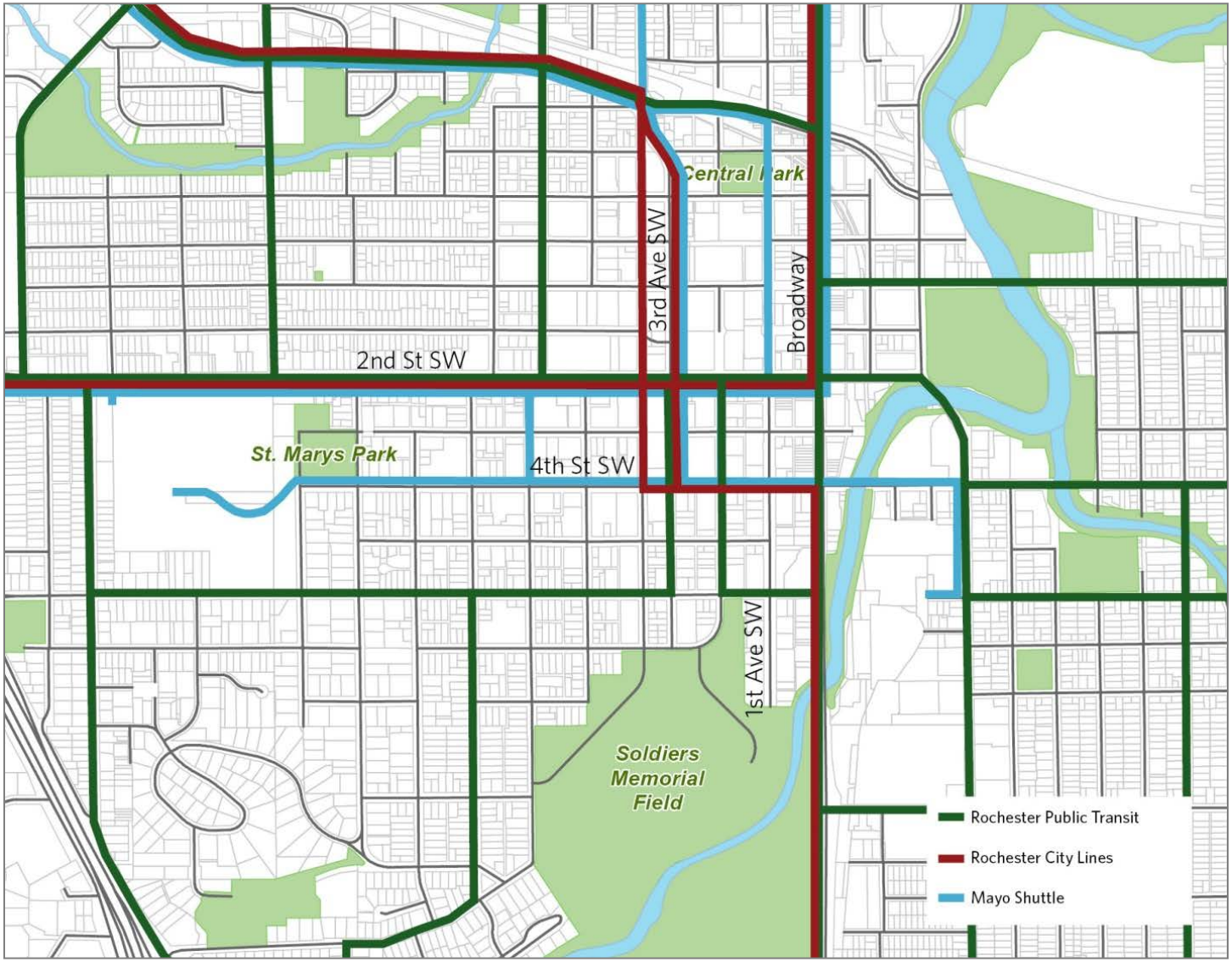
5. Constrained Transit System Capacity and Need to Optimize/Coordinate Multiple Existing Service (Rochester Public Transit, Rochester City Lines, Mayo and Private Shuttles).

Existing transit service within the study area includes a mix of service types catering to several different user groups. In some cases, the different services are not well integrated, limiting the effectiveness of service options within the area. RPT operates local bus service for both peak-period commuters and all-day riders within the City of Rochester. Regional express commuters are served by RCL and LeRoy City Lines, privately-operated services providing longer distance trips to downtown Rochester during peak periods. The Mayo Clinic also operates a series of shuttles that connect various campuses to destinations included a set of parking ramps outside of the DMC district. **Figure 8** illustrates the transit pathways of the three different operators providing service in the study area. Private shuttles also operate throughout the downtown area serving hotels, hospitals, and visitor destinations.

RPT service is designed as a "radial" network, with most routes intersecting at the primary transfer area at 2nd Street SW and 2nd Avenue SW in the core of downtown. This network is well-designed to serve the commute market traveling to and from downtown Rochester destinations.[5] Much of the RPT service operating through downtown Rochester "pulses" with similar timing intervals as other routes to align with commuter works shifts, which creates a high concentration of bus vehicles in downtown at certain locations and certain times of the day. The 2nd Street SW transit center acts as the main hub for all local RPT service, providing a single point for passenger boarding and alighting and transfer activity. The transit center is made up of eight individual stops, five of which are equipped with large, climate controlled shelters and real-time arrival displays. The transit center occupies curb space equivalent to about three city blocks on both sides of 2nd Street SW and partially on 2nd Avenue SW.

[5] The survey results from the *RPT Transit Development Plan 2017-21* indicate that more than 80 percent of respondents do not transfer to a second bus to reach their destination.

Figure 8. Existing Combined Transit Routing in the Study Area



Source: Rochester Public Transit, Rochester City Lines, Mayo Clinic, 2016.

Regional service carries longer-distance commuters primarily during similar peak times. Nearly all of the routes make two stops in downtown Rochester: one at St. Marys Hospital on 2nd Street SW and one at the RCL transit hub in downtown, along 2nd and 3rd Avenues SW proximate to the existing RPT transfer area at 2nd Street SW and 2nd Avenue SW. In 2013-2014, regional routes carried approximately 4,200 passengers on an average weekday. Most of the passengers are Mayo Clinic employees.

The RCL transit hub is used for both passenger loading and vehicle staging, and is conveniently located to access all major destinations in downtown Rochester. RCL vehicles circulate through downtown using several different travel paths to access the existing transit hub. RCL vehicle staging in downtown requires the use of downtown curb space equivalent to approximately four city blocks, presenting a constraint if service is expected to grow to accommodate future commute travel growth destined for downtown Rochester.

The Mayo Clinic provides employees, patients, and visitors exclusive shuttle service between all Mayo facilities in the City of Rochester and connections to off-site park-and-ride locations. A total of five individual Mayo shuttles operate on weekdays only and are free to all Mayo patients, visitors, and employees. Most of the shuttles use 2nd Street SW to connect to Mayo Clinic buildings and St. Marys Hospital, which overlap with many RPT services along the corridor. As shown in **Table 4**, the existing Mayo Shuttles carry nearly 7,000 passengers per average weekday, more than half of which travel between downtown Mayo Facilities and St. Mary's Hospital along 2nd Street SW on the intercampus shuttle which serves visitors, patients and staff.[6] The remaining riders on the other Mayo shuttles are all Clinic employees.

[6] Source: Mayo Clinic, 2017.

Table 4. Mayo Shuttle Service Summary

Shuttle Name	Stop Locations	Service Hours	Peak Frequency [1]	Service Availability	Average Weekday Ridership
Intercampus (2nd Ave SW)	Mayo Clinic, St. Mary's, West Lot	4:30 AM – 12:50 AM	5 minutes	Visitor, Patients, & Staff	3,538
East Lot	East Lot, Mayo Clinic, St. Mary's	5:30 AM – 8:18 PM	7.5 minutes	Staff	940
West Lot	West Lot, St. Mary's, Mayo Clinic	4:30 AM – 12:50 AM	5 minutes	Staff	1,837
Northeast	Northeast Clinic, Assisi Heights, Mayo Clinic	6:00 AM – 5:45 PM	30 minutes	Staff	98
Northwest	Mayo Clinic, Technology Drive Center, Superior Drive Support Center, Valley High Business Center, Mayo Support Center, Northwest Clinic	6:05 AM – 6:47 PM	40 minutes	Staff	387

[1] The frequency shown is in operation during typical commute times. The shuttles operate variable headways throughout the day and may reduce in frequency during off-peak times.

The City of Rochester has been able to sustain a 10 percent transit mode share for commute trips destined to downtown, which is relatively high compared to other cities of its size. This above average transit mode share is the result of the city and the Mayo Clinic maintaining effective programs and policies that limit auto dependency, including parking demand management and subsidized transit passes. However, given the anticipated goal to carry between 23 and 30 percent of all downtown commuters on transit, ridership on both the local and regional transit systems is expected to nearly double. This will result in overcrowding conditions, slower and less efficient service, and decreased passenger comfort. The existing passenger amenities and waiting areas will not be able to accommodate future transit demand in downtown Rochester.

The existing transit system does not have the capacity to serve anticipated ridership growth and does not have the functionality to serve the wide range of user groups (transit markets) that need to be served to achieve transit mode split goals. The transit markets include commuters, visitors, patients, residents, students, people with mobility challenges, short trips within downtown, and park-and-ride connections. If transit is expected to play an important role in providing mobility for future growth, the existing transit service will need to be successfully integrated to meet passenger demand and provide sufficient facilities for transit operations (including improved bus parking, passenger information, and transfer facilities).

Appendix A. Background Documents Review

Introduction

A number of different plans and policies have been developed or are under development that supports the need for future transit services. Each plan identifies objectives and recommendations to support the anticipated growth expected within downtown Rochester. The documents will assist in identifying potential transit improvements and help to reduce the range of options considered within the study area. The following plans and policies have been reviewed and are summarized below:

- *2nd St SW Corridor Framework Study* (2009)
- *Downtown Rochester Master Plan* (2010)
- *University of Minnesota – Rochester Campus Master Plan* (2014)
- *DMC Development Plan* (2015)
- *Mayo Master Plan Update* (2016)
- *Rochester Comprehensive Plan 2040* (Draft 2017)
- *Rochester Transit Development Plan* 2017-2021 (2017)

2nd Street Corridor Framework Study (2009)

With nearly 40 percent of all jobs in Rochester being proximate to the 2nd Street corridor, the *2nd Street Corridor Framework Study* evolved from a partnership between private, non-profit and public entities to create a plan that would develop 2nd Street SW between Highway 52 and 6th Ave SW (west of the CBD and Mayo Downtown Campus) as an attractive destination for business, residents, and visitors. This key study includes a framework to achieve a vision, which includes fostering mid-rise development along the corridor, growing medical, lodging, residential, and commercial activities, considering how transit service could be improved for those living, working and traveling to or through the corridor; and how to safely manage movement of people and goods within the corridor.

The long-term transportation strategy creates a multi-modal corridor serving the 2nd Street "Urban Village" and downtown with improved transit, bike, and pedestrian facilities, all with the intent of giving people attractive transportation choices beyond the single occupant vehicle.

Downtown Rochester Master Plan (2010)

The *Downtown Rochester Master Plan* outlines feasible strategies to take advantage of new investment and economic activity near downtown (such as Mayo Clinic, IBM, and University of Minnesota Rochester (UMR)) to promote and grow downtown Rochester over the next 20 years. Implementation of the plan will reinforce the City of Rochester's widely-recognized position as one of the best places to live in the United States.

Transportation is a key plan component to meet the needs of Mayo patients, staff, and allied health staff, which is a dynamic situation necessitating constant balancing and adjustment. Resolving connectivity issues throughout downtown, including the integration of skyway and sidewalk systems, improving pedestrian safety, and reducing the appearance of roadways as barriers, are key mobility objectives within downtown. Investments in a higher capacity transit network, ranging from bus priority to fixed rail, as well as appropriate land use, ensures continued mobility for all users.

Identifying land for development opportunity though various public and private partnerships will reinforce new commercial, housing, open space, and civic amenities that can facilitate the mixed-use development patterns that decrease reliance upon personal automobiles.

The *Downtown Rochester Master Plan* establishes a vision for the future of downtown Rochester. The plan provides direction and guidance for leaders, stakeholders, and individuals involved in decision-making in downtown Rochester. The master plan includes a mobility element that:

- Targets a 50 percent commuter trip mode share using alternatives to single occupancy vehicles by 2030, including a 23 percent downtown transit mode share.
- Identifies a 30 percent non-commuter mode share goal for alternative modes by 2030.
- Develops the concept for transit priority streets in downtown Rochester, which was subsequently included in the *DMC Development Plan*, the *Comprehensive Plan 2040*, and the *Transit Development Plan 2017-2021*.
- Mitigate the potential economic development and livability impact from expansive growth in off-street parking demand that would occur in downtown Rochester if current mode share distribution remained unchanged.

- Creates a transit framework that will double transit trips by 2030, removing short and inefficient auto trips from downtown streets. The framework identifies specific transit recommendations, including:
    - Conducting a comprehensive operations analysis to improve efficiency of operations.
    - Develop 2nd Street and Broadway Avenue as Primary Transit Corridors.
    - Improve transit service comprehension.
    - Expand remote parking and connect with high-frequency transit by expanding on the success of existing park-and-ride and remote parking program.
    - Enhances mobility options that create pedestrian-oriented environment, which better balances mobility options and reduces dependency on private vehicular travel.

University of Minnesota Rochester (UMR) Campus Master Plan "Envision UMR" (2014)

The *UMR Campus Master Plan* defines a conceptual physical framework to implement a new downtown urban campus in Rochester over time that could support a student population of 1,400 within the next ten years. Campus connectivity is one of the three key master plan themes.

It is the intent of UMR to encourage walking, cycling, transit use, and other alternative modes as a means to access the future campus located on the south end of downtown Rochester. UMR expects to minimize its footprint of campus parking, with the university currently leasing only one space for every eight students and one space for every 1.5 staff associated with their current location. A sizeable portion of the student population (17 percent) identified transit as their first or second most preferred means of getting around.

Destination Medical Center (DMC) Development Plan (2015)

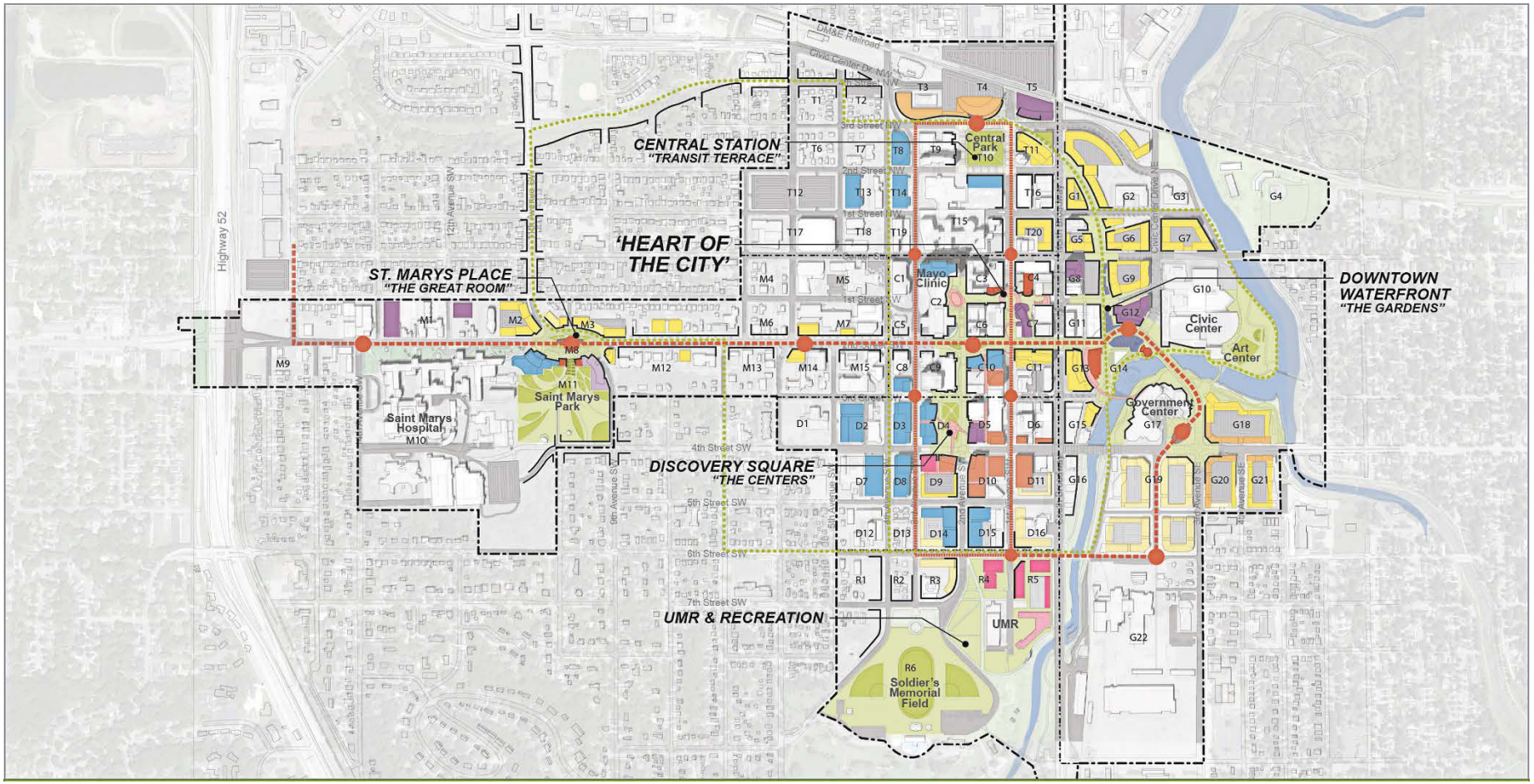
The *DMC Development Plan* provides a vision for a series of distinct districts in downtown Rochester centered on the Heart of the City District encompassing the Mayo Medical Center, with particular focus on creating a nexus of community investment, health care, health research, and bioscience advancement. This plan utilizes public investment to advance the City of Rochester as a global medical destination, as well as a regional destination for those in Minnesota and surrounding states. The *DMC Development Plan*

outlines the long term vision and planning framework needed to secure downtown Rochester as a global medical destination. The plan was developed in partnership amongst the Mayo Clinic, the City of Rochester, Olmstead County, and other key stakeholders.

Creating six unique sub-districts emphasizes urban development to refocus commercial, recreational, and residential activities back into downtown, following decades where the predominant pattern of growth in the city has followed a pattern of low density dispersion along major arterial street corridors emanating from downtown. Through four phases of investment, each sub-district would have a targeted emphasis to catalyze development attracting a variety of tenants and activities. The six sub-districts, each leading to different land use and development patterns, are listed below and identified **Figure A-1**.

- **The Heart of the City:** The heart of downtown Rochester, which includes the Mayo Clinic and other future commercial, hospitality, retail and residential uses.
- **Discovery Square:** The center for future bio-medical, research, and technology innovation facilities.
- **Downtown Waterfront:** A destination for residents and visitors adjacent to the Heart of the City, which includes the convention center, civic center, and other recreational activities.
- **Central Station:** The location of the future regional transit hub north of the Heart of the City, which will be positioned to support a future high-speed rail connection and the pathway to future growth.
- **St. Mary's Place**: A monumental gateway that will act as one of the primary entry points into downtown Rochester, which includes St. Mary's Hospital.
- **UMR/Recreational Area**: The future site of the UMR, which includes an urban college campus and many recreational activities for students, residents, and visitors.

Figure A-1. DMC Master Plan



The anticipated future growth will result in a significant increase in travel demand within the study area, and therefore will require significant investment in the existing transportation network. The DMC transportation framework and its associated investments reflect major changes transpiring in the City of Rochester over the next 20 years. These changes include:

- Intense land use development in the downtown area
- Concentrated employment growth, particularly in districts with major Mayo Clinic influence
- Rise of downtown as a residential neighborhood
- Increased demand for downtown access
- Placemaking connecting new and existing activity centers
- Rapidly changing travel behavior, consumption preferences, and essential living infrastructure

The 2015 *DMC Development Plan* identifies five overall goals to guide transportation and infrastructure planning and development:

- Create a comprehensive strategic plan with a compelling vision that harnesses the energy and creativity of the entire community
- Leverage the public investment to attract more than $5 billion in private investment to Rochester and the SE Minnesota region
- Contribute to the creation of approximately 35,000 – 45,000 new jobs in Minnesota, with workforce development strategies that support growth
- Generate approximately $7.5 - $8.9 billion in new tax revenue over 35 years
- Achieve the highest quality patient, companion, visitor, employee, and resident experience, now and in the future

TEN key transportation principles

Aligning with the broader *DMC Development Plan* goals, the plan establishes 10 transportation investment principles for the next 20 years needed to achieve the vision laid out in the plan.

1. Make it easy, affordable and convenient for people from Southeast Minnesota and around the world to get to downtown Rochester.
2. Bring 30 percent of the workforce to downtown Rochester on transit by 2035.

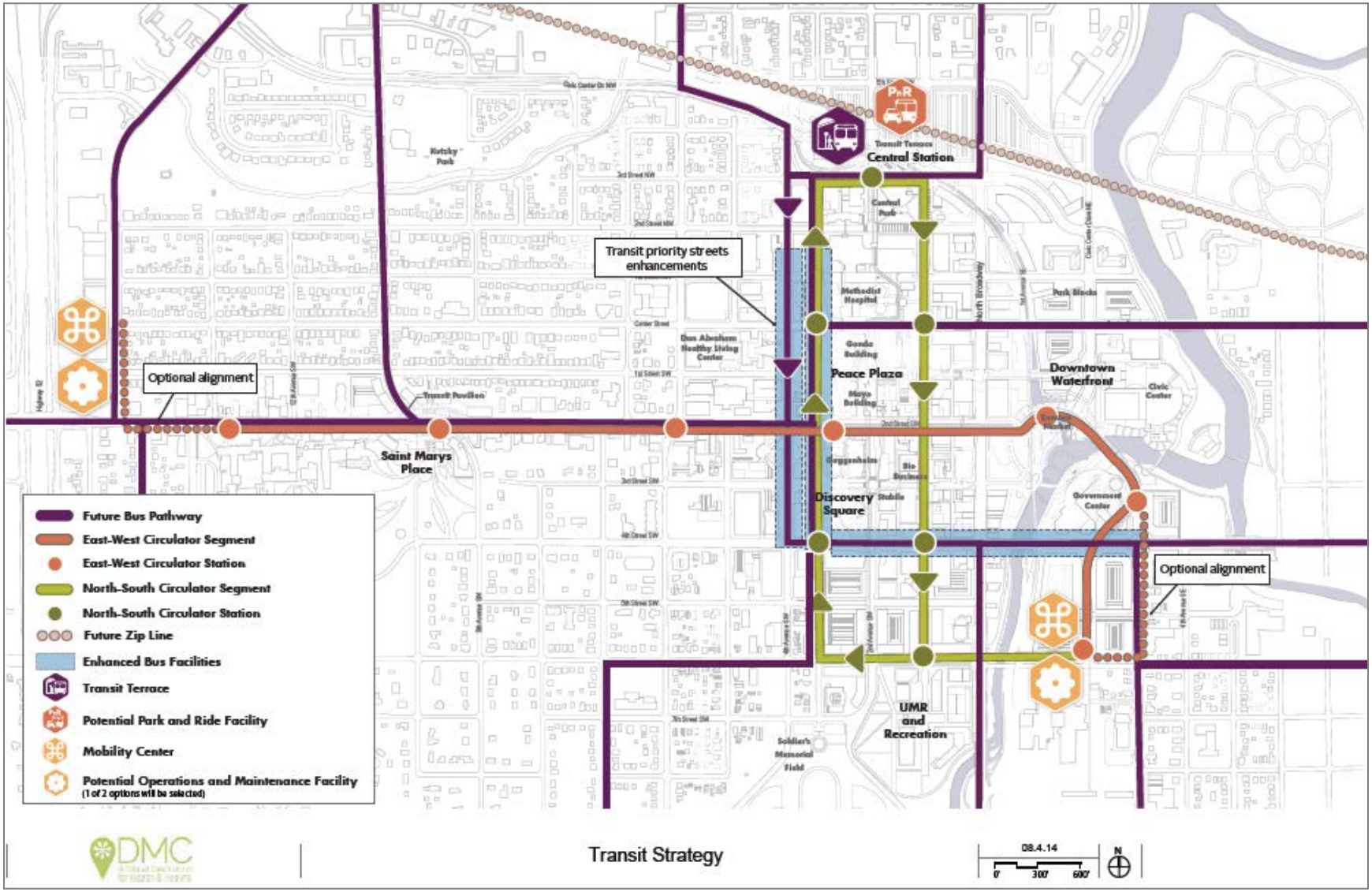
3. Create a park-once downtown environment connected by a frequent downtown circulator.
4. Build shared parking prioritized for economic development.
5. Create world-class streets, designed for people.
6. Create an exceptional place for healthy, human-powered transportation.
7. Form a downtown Rochester access authority.
8. Invest in sustainable transportation infrastructure and programs that reduce the ecological foot print of the City.
9. Use DMC funding to leverage public and private transportation infrastructure funding.
10. Establish and maintain a transportation network that is accessible and inclusive to people of all ages, abilities and states of wellness.

DMC Transit Investment Strategy

The *DMC Development Plan* identifies an investment strategy focused on capital improvements within the DMC development district to accommodate the anticipated growth in transit demand to, from, and within the downtown core. The investment strategy includes four capital investment components, which are described below and are visually represented in **Figure A-2**:

- Optimize local and regional transit service downtown by rerouting transit service and improving the operating environment along the 3rd and 4th Avenue couplet to create additional capacity for long-term service growth.
- Invest in transit priority streets within downtown, including design treatments and enhanced passenger amenities to make transit faster, more reliable, more legible, more comfortable, and more easily accessible.
- Develop the Transit Terrace, a world-class multimodal transit center at the proposed Central Station District to connect future regional high-speed rail, the downtown circulator, regional and local bus service, and active transportation modes.
- Construct and operate a high-quality and frequent downtown streetcar line providing east-west circulation along 2nd Street SW and north-south circulation along 1st and 3rd Avenues. This includes a new operations and maintenance facility to accommodate streetcar vehicles and maintain service facilities. It will also be anchored by several "mobility centers" to provide access to multimodal connections.

Figure A-2. *DMC Development Plan* Transit Investment Strategy



Mayo Clinic 5-Year Master Plan Updated (2016)

The *Mayo Clinic 5-Year Master Plan* provides guidance for future growth of the Mayo Clinic facilities and establish coordination with other planning efforts that may influence its future. The plan allows Mayo to be engaged in planning efforts related to land use, livability, economic development, higher education, and historic preservation.

The Mayo Medical Center employs approximately 30,475 individuals in downtown Rochester distributed between the St. Mary's Hospital campus and the downtown medical center campus. Mayo provides a comprehensive transportation program to meet the needs of its patients, staff, and allied health staff, which is a dynamic situation necessitating constant balancing and adjustment.

Historically, Mayo has worked to manage its evolving transportation and parking needs, seeking to maintain employee parking at a level of one space for every two employees through a significant transportation management program including a bus pass program, cooperation with the City of Rochester on a network of park-and-ride lots, and encouragement of carpooling, cycling and walking as a means of travel to work.

As a means to further community goals of minimizing downtown traffic congestion and pollution, assist in energy conservation, and minimize the need for investment of land and money in parking resources, the continued expansion of viable transit service throughout the City of Rochester with designated park-and-rides will be needed as Mayo embarks on its next phase of growth, expected to involve a substantial increase in employees over the next 20 years. The Plan identified 2nd Street SW and Broadway Avenue as two transit corridors within the context of the urban green space plans.

City of Rochester Comprehensive Plan 2040 (Draft 2017)

The *City of Rochester Comprehensive Plan 2040* is currently being updated to identify long-term strategies and policies to guide future development of land in the city. The comprehensive plan process includes analysis that evaluates the existing levels of transit service currently operating within the city and assesses current and future transit markets that can support future transit investment. The following *Draft City of Rochester Comprehensive Plan 2040* components have been reviewed for this analysis:

- Draft Transit System and Market Analysis
- Draft Transit Patterns and Link Analysis
- Draft Primary Transit Network (PTN) Framework

Draft Transit System and Market Analysis

The transit component of the *City of Rochester Comprehensive Plan 2040* outlines the opportunities and constraints associated with accommodating future growth in travel demand with various forms of transit service. The Transit System and Market Analysis provides a city- and region-wide analysis of Rochester's existing fixed bused transit network, which is laid out as a radial pulse network focusing on a singular downtown transfer point at 2nd Street SW transit center. Included is a route-by-route breakdown of ridership, subsidy, routing, and trip generators on each, as well as studying transit dependency. This analysis notes successful transit networks must include service on a street grid with a variety of density or areas with transit-orientated development, a sense of safety for all users, serving major origins/destinations, and generally complementing both existing and proposed land use patterns. Additionally, this analysis gives a system-wide look at existing stop conditions and modest proposals to improve several stops throughout the City of Rochester. Privately operated RCL is included, as it provides significant commuter-only service between regional cities and downtown.

Draft Travel Patterns and Link Analysis

This memo provides a city- and region-wide analysis of home-based work (commute) and non-work trips relating to all modes of transportation. This memo describes the fundamental building blocks to develop non-single-occupancy-vehicle based transportation networks by studying the travel demand patterns throughout various areas of Rochester, including downtown, suburbs, shopping centers (Walmart, Target, Apache Mall, etc.), major employers (IBM, Mayo, etc.), and other trip generators. Key findings include that 40 percent of trips are destined for downtown, non-work trips are typically short distances, congestion is limited to specific chokepoints and not currently a critical issue, freight movement is focused on highways while deliveries utilize a variety of local roads, and all-mode collisions increase with land use intensity. This memo acknowledges plan for Rochester International Airport expansion, including primary goals of strengthening downtown to airport travel service, pursuing additional regional hub airline service, and increasing flight frequencies to the Minneapolis-St Paul International Airport.

Primary Transit Network (PTN) Framework

Advancing and serving transit-orientated development throughout Rochester while maintaining robust service to existing markets is a critical component in the development of a PTN strategy. The PTN offers a policy and analytical framework for development of transit to ensure reliable, frequent, and comprehensive service is delivered to those who choose transit and businesses seeking improved service while identifying transit capital and fleet

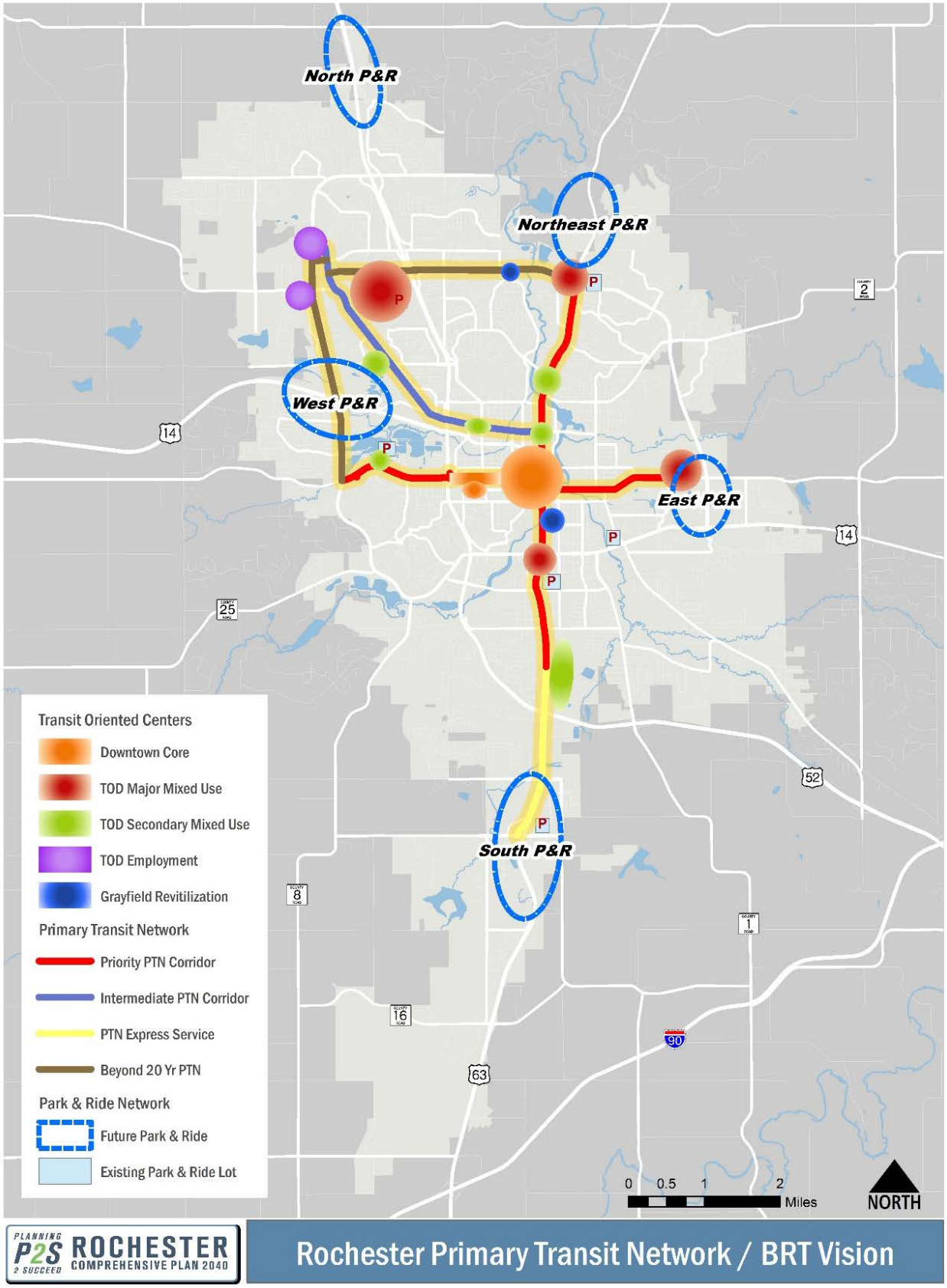
needs. Determining these needs will further enable creation of a logical transit network serving Rochester and fostering denser development around key transit hubs.

The PTN establishes a foundation for key transit features including ridership and productivity potential, with an emphasis on providing 15-minute or less headways; determining impacts of small changes and how that could positively impact the overall network; creation of visibly permanent infrastructure signaling a commitment of investment to the community through good design and amenities; and combining transit access with beneficial land use changes to promote healthy development and give people a choice in how they travel in Rochester.

Implementation of the full PTN is dependent upon identifying additional operating and capital resources and developing more detailed plans. Today, the PTN framework is intended to provide a high-level view of what may be required from state, local, and private stakeholders tomorrow. This includes, but is not limited to, funding, capital improvements, fleet acquisition, zoning changes, private stakeholder involvement, community involvement, and implementation of complementing strategies (e.g., biking and walking).

The *City of Rochester Comprehensive Plan 2040* identifies a PTN that assists in guiding intensification of new and re-developed land use mixes along the network at transit-supportive densities as a means to grow transit trip generation to levels sufficient to support higher frequency transit service and enable persons to consider transit as a primary travel option. **Figure A-3** illustrates the Draft PTN strategy. The PTN component of the comprehensive plan has identified Broadway Avenue, 2nd Street SW, and 4th Street SE as possible priority PTN corridors, based on a combination of current transit ridership, existing transit market generators, and current and future land use densities.

Figure A-3. Draft Primary Transit Network



RPT Transit Development Plan 2017-2021 (2017)

RPT recently developed a *Transit Development Plan* (TDP) to guide the city's transit system for the next 5 years. The TDP includes planning for operations, capital facilities, finances, marketing, management, and implementation. The plan reviews existing route-level service, ridership, and performance for each RPT line necessary to identify opportunities and constraints necessary to make network improvements. The plan also included a summary of public outreach, assessment of existing and future community characteristics to inform the need for increases in service, and service guidelines as a framework for short-term bus service planning in the City of Rochester.

Figure A-4 illustrates the proposed Weekday Daytime Network and **Figure A-5** illustrates the proposed High Frequency Network. The plan identifies an 82 percent increase in revenue hours between 2017 and 2021 to accommodate the anticipated growth in transit demand within the City of Rochester during the 5-year period.

Figure A-4. Proposed Weekday Daytime Network

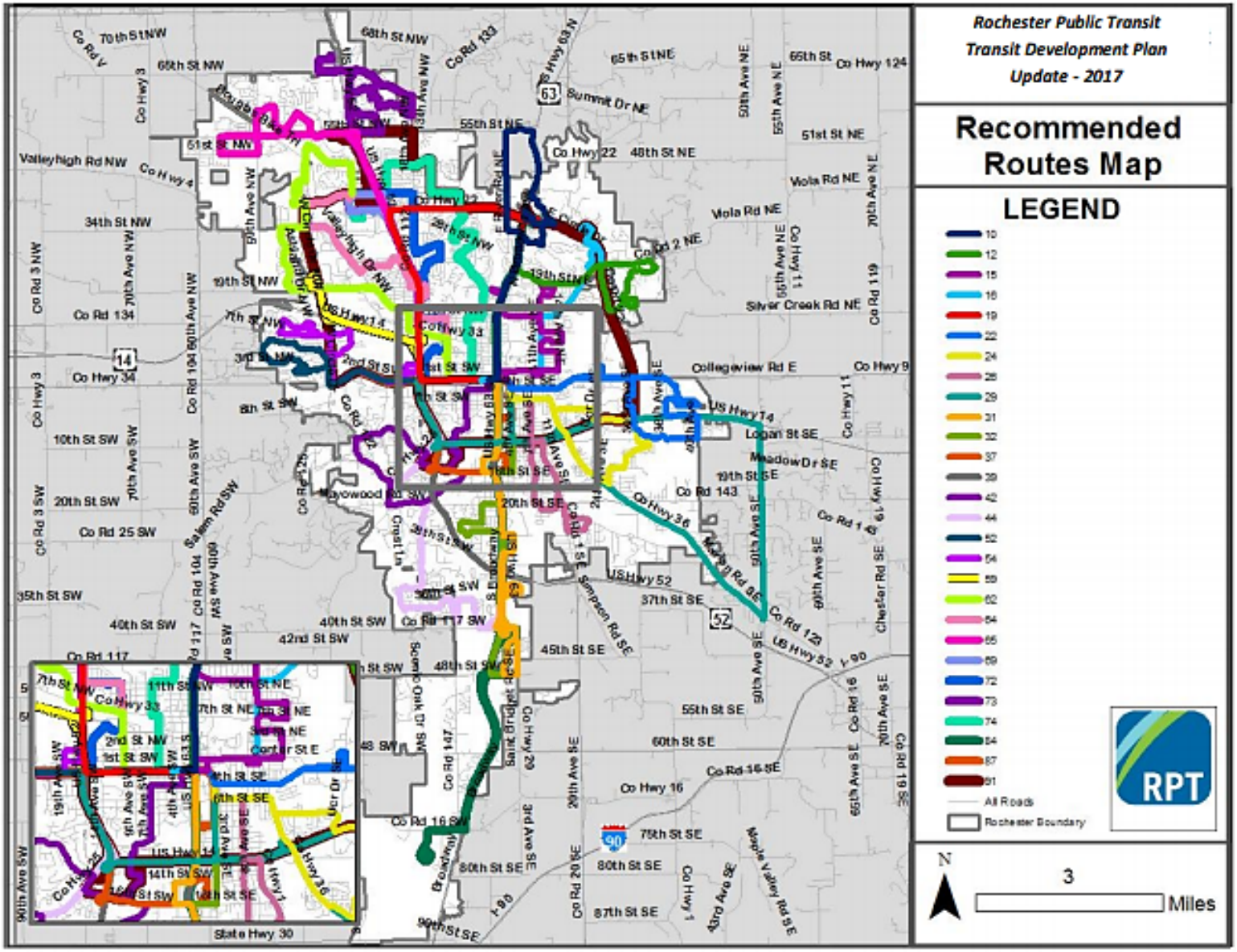
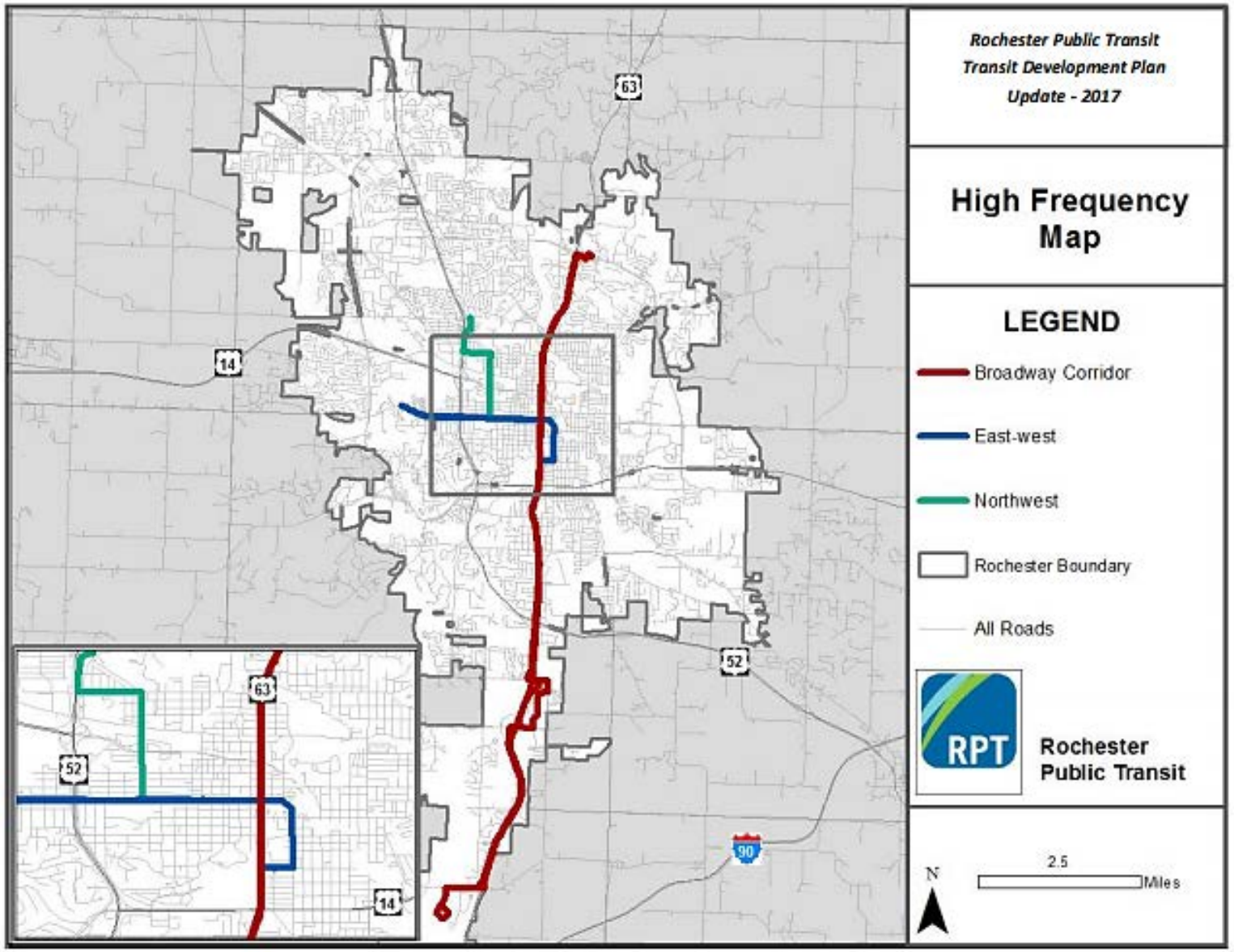


Figure A-5. Proposed High Frequency Network



Appendix C. Transit Operations Plans

This page is intentionally blank.

Transit Circulation Study: Transit Operations Plans

DMC Transportation & Infrastructure Program

City of Rochester, MN



Prepared by:





Date: May 2018

DMC Project No. J8621 Rochester Transit Circulation Study

This page is intentionally blank.

Table of Contents

Transit Operations Plans 1

Introduction 1

Existing Transit Services 1

Description of Alternatives 2

Transit Alternative Phase 1 (TAP 1) 2

Destination Medical Center (DMC) Modified Tram 4

Scenario A Bus Rapid Transit (BRT) 4

Scenario D Elevated Autonomous Vehicles (AV) 7

Hybrid BRT 7

Operating Assumptions 10

Circulator 10

PTN BRT 14

Express Bus Assumptions 16

Regional Commuter Services (RCS) Assumptions 20

Rochester Public Transit (RPT) Assumptions 22

2nd Street Transit Lane Needs Assessment 23

Summary of Operating Costs and Fleet Requirements by Alternative 24

Figures

Figure 1. Transit Alternative Phase 1 (TAP 1) 3
Figure 2. DMC Modified Tram 5
Figure 3. Scenario A (BRT) 6
Figure 4. Scenario D (Elevated AV) 8
Figure 5. Hybrid BRT 9
Figure 6. Express Service Routing 18

Tables

Table 1. Transit Service Components of Alternatives....10
Table 2. Circulator Ridership by Alternative....11
Table 3. Circulator Service Assumptions by Alternative....12
Table 4. Circulator Service Assumptions by Alternative....13
Table 5. PTN BRT Service Assumptions....15
Table 6. PTN BRT Cost Assumptions....16
Table 7. Peak-Hour Express Bus Ridership....17
Table 8. Express Service Assumptions....19
Table 9. Express Service Costs and Fleet Requirements....20
Table 10. Assumed Adjustments to RCS Services by Alternative....21
Table 11. Adjustments to RPT Services by Alternative....22
Table 12. Downtown 2nd Street Peak Hour (AM) Vehicles Between Broadway Avenue and Third Avenue....23
Table 13. Operating Cost and Fleet Requirement Summary....25

List of Acronyms

AV	Autonomous Vehicle
BAT	Business Access and Transit
BRT	Bus Rapid Transit
DMC	Destination Medical Center
EB	Eastbound
PTN	Primary Transit Network
RCL	Rochester City Lines
RCS	Regional Commuter Services
RPT	Rochester Public Transit
TAP 1	Transit Alternative Phase 1
TDP	Transit Development Plan

Transit Operations Plans

Introduction

This report describes the operating characteristics of the transit options developed for the Transit Circulation Study. Each alternative represents a transit system that includes: downtown circulator service, regional express bus service, Rochester express service, and local bus service. This report summarizes the operating characteristics of each system component, identifying routes, modes (type of vehicle), service frequencies, and operating costs. The report provides this information in the following sections:

- Existing Transit Services: Summary of current transit operations serving downtown Rochester.
- Description of Alternatives: General summary of routes and modes.
- Operating Assumptions: Frequency of service, vehicle hours of service, number of vehicles required, peak hour vehicles, and operating cost by service type.
- Operating Costs and Fleet Requirements: Annual operating and maintenance costs including labor, fuel, and parts summarized by transit alternative.

The report also examines the potential need for dedicated transit lanes on 2nd Street to accommodate the transit vehicle volumes associated with the transit options.

Existing Transit Services

The circulator will be integrated with the existing transit service. These services are described in detail in the *Transit Circulation Study: Existing and Future Conditions* report. Service parameters for each component of the transit system would be modified with implementation of the circulator service described in this report. The existing services are summarized below.

- **Rochester Public Transit (RPT)**: RPT provides local bus transit service within the City of Rochester. Several types of routes are offered, including: all day, peak only, and night and weekend service. RPT provides direct (express) connections to six park-and-ride lots throughout the city.
- **Private Regional Commuter Services (RCS):** Two companies currently provide private regional commuter service that connects

outlying areas outside the City of Rochester to downtown Rochester. Rochester City Lines (RCL) provides most of this service, along with Leroy City Lines. The service operates from approximately 40 different regional communities, connecting commuters from park-and-ride locations to downtown Rochester during peak weekday commute times.

- **Mayo Clinic Shuttles**: The Mayo Clinic provides employees, patients, and visitors exclusive shuttle service between all Mayo facilities in the City of Rochester and connections to off-site park-and-ride locations. Five Mayo shuttles operate on weekdays only and are free for all Mayo patients, visitors, and employees.

Description of Alternatives

Five alternatives were developed for downtown Rochester:

1. Transit Alternative Phase 1 (TAP 1)
2. Destination Medical Center (DMC) Modified Tram
3. Scenario A Bus Rapid Transit (BRT)
4. Scenario D Elevated Autonomous Vehicle (AV)
5. Hybrid BRT

The routes and modes are summarized for each option below. The operating plans and costs for the four options are summarized in the subsequent sections. The development of these options is described in greater detail in *Transit Circulation Study: Alternatives Development*.

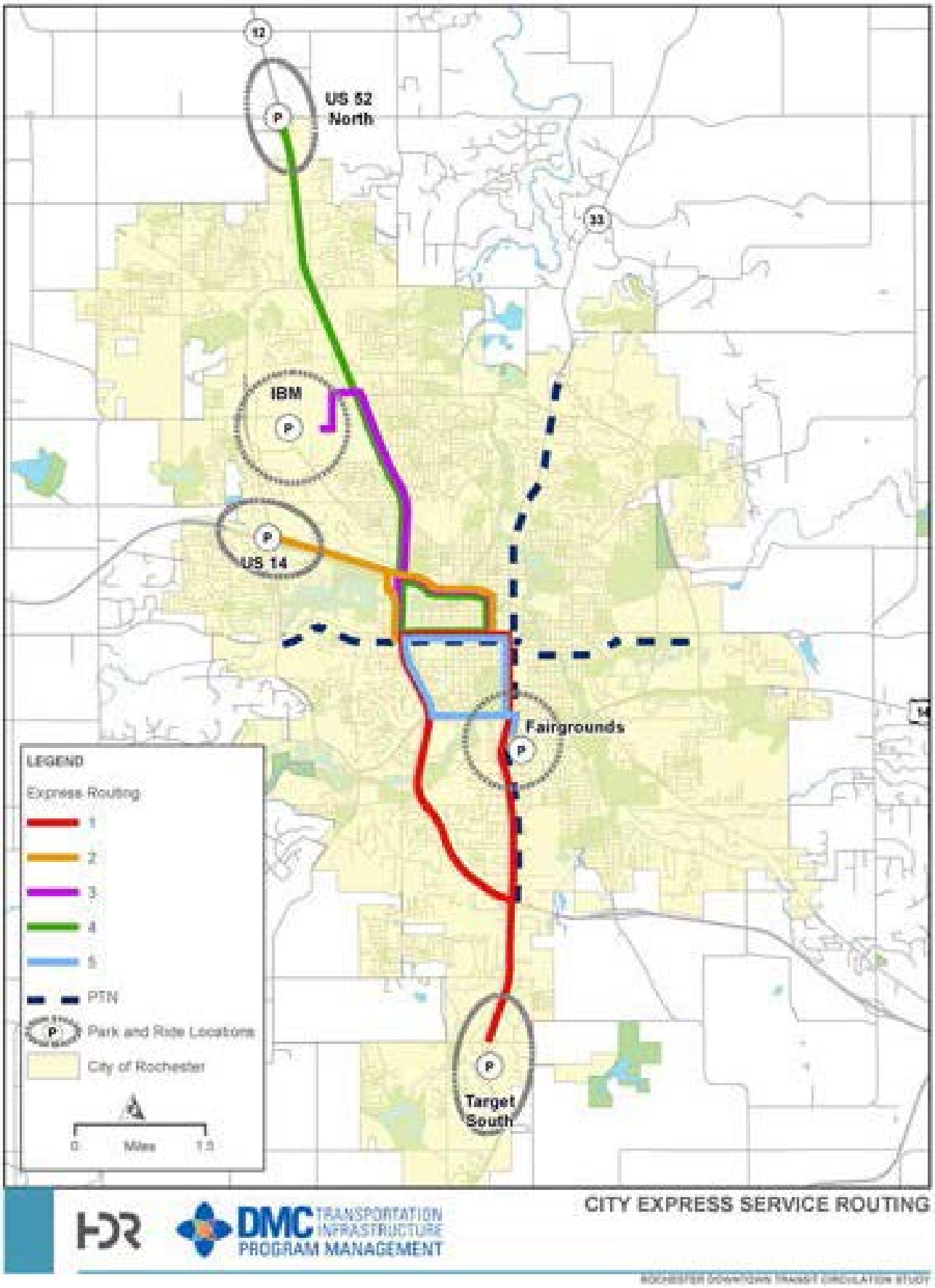
Transit Alternative Phase 1 (TAP 1)

The Transit Alternative Phase 1 (TAP 1) represents a bus-focused option primarily using conventional buses on local roadways. This option draws from recommendations in the *Rochester Transit Development Plan (TDP) 2017-2021* and the *Rochester Comprehensive Plan 2040 Primary Transit Network Framework*. The TDP includes a significant increase in local bus service, increasing service frequency and span of service.

Key elements of this alternative also include five express bus routes and two BRT routes, shown in **Figure 1**. Each of the express routes begins at a new or expanded park-and-ride facility.

These east-west and north-south BRT routes are key elements of the 2040 primary transit network (PTN) and are labeled as PTN in the **Figure 1** legend. In the remainder of this report, these routes are identified as PTN BRT to distinguish them from the BRT circulator in Scenario A and the Hybrid BRT.

Figure 1. Transit Alternative Phase 1 (TAP 1)



The PTN BRT service includes bus stop consolidation to increase travel speeds, enhanced amenities at stations, transit signal priority, enhanced fare collection, and real-time passenger information. Some of these features may be added incrementally over time.

The frequency of service on these routes is reduced in the other options described below, which provide additional travel options that reduce demand on the PTN BRT and remote park-and-ride facilities.

Destination Medical Center (DMC) Modified Tram

The *Destination Medical Center Development Plan* recommended a tram as the primary component of a transit system moving passengers within downtown and providing connections to other local and regional transit services. The routing of the initial plan was modified in this analysis to reflect land use changes and parking opportunities that have evolved since completion of that Plan.

The resulting DMC Modified Tram circulator is shown in **Figure 2**. The tram operates in exclusive lanes, providing internal circulation and connecting to parking sites 1, 3 and 4 that intercept auto drivers prior to their entry into downtown.

The TAP 1 express service and PTN BRT described above is carried over in this option. The frequency of the express bus service is decreased, however, since some commuters would shift from express bus to parking sites 1, 3 and 4. This allows a reduction in the express bus service level.

Scenario A Bus Rapid Transit (BRT)

Scenario A BRT (**Figure 3**) uses enhanced bus service that includes: dedicated lanes, transit signal priority, enhanced stations, real-time information, enhanced fare collection and special branding of vehicles and stations. Like the tram, the BRT option provides downtown circulation. It connects to parking at sites 1, 4 and 5.

The parking supply for this alternative is comparable to the DMC Modified Tram option, resulting in a similar diversion of commuters from the express bus as that realized by the tram. Although the PTN BRT is a component of this option, its frequency is reduced due to the overlap with the BRT circulator.

Figure 2. DMC Modified Tram

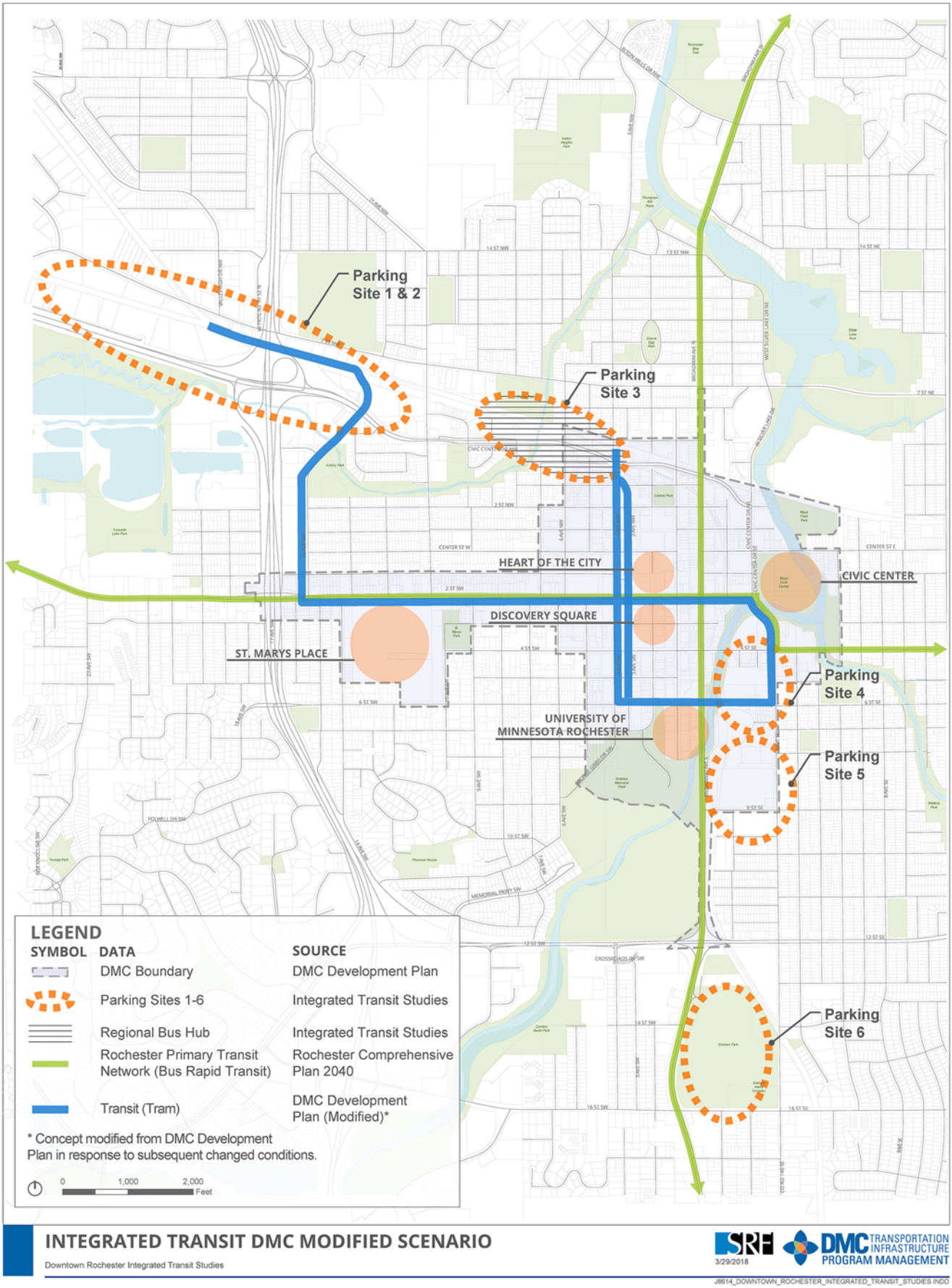
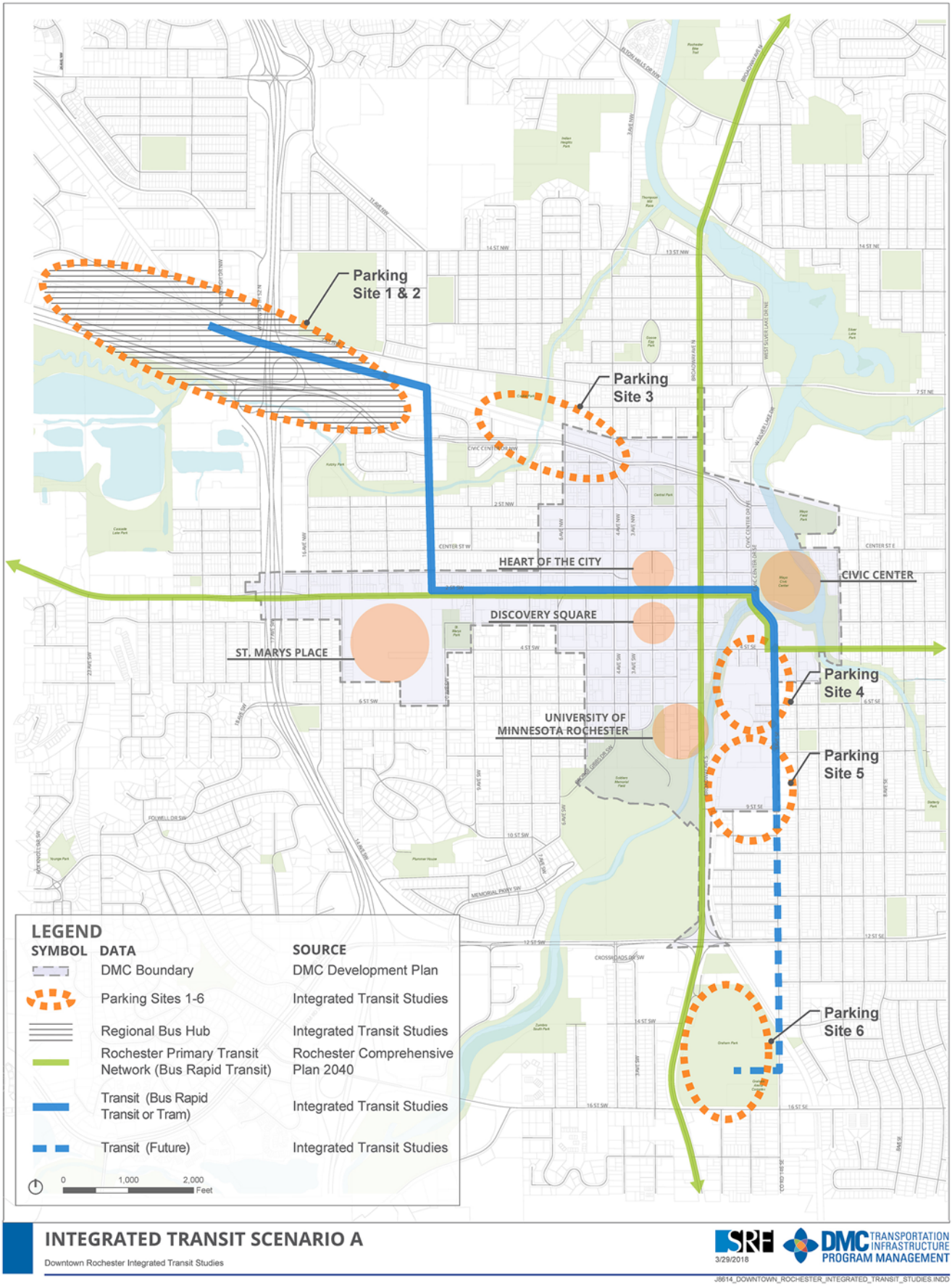


Figure 3. Scenario A (BRT)



Scenario D Elevated Autonomous Vehicles (AV)

Scenario D AV (**Figure 4**) represents a change in the technology, route, and guideway compared to the other options. The autonomous vehicle is an evolving, driverless technology. It can operate directly between a trip origin and destination, avoiding the delay associated with intermediate stops. Like the other circulator options, it runs in an exclusive lane. However, this alternative uses an exclusive, elevated guideway rather than running at street level. It experiences no traffic or signal delay as it connects downtown destinations and provides access to parking sites 1 and 4. These vehicles will not operate on a specified schedule, but will respond to passenger requests. During peak periods, vehicles will focus upon major trip locations such as the parking sites. They will carry full passenger loads directly between these hubs and key stations such as St. Marys and downtown.

The circulator parking supply in this alternative is somewhat less than in the other transit options, but the remote park-and-ride capacity is significantly higher. Therefore, the express bus service is higher than in the DMC Modified Tram and Scenario A BRT options. The express bus service is lower than TAP 1, however.

Hybrid BRT

The Hybrid BRT includes two separate routes, both connecting the with circulator parking at each end as shown in Figure 5. As the circulator alternatives evolved, so did the service concepts for the parking locations. In addition to offering parking, the site concepts were expanded to include waiting facilities for transfers to and between cars, circulator buses, express buses, and regional buses. With the increased activity level, these hubs may also support some commuter-oriented retail activity. With this additional activity, the Hybrid parking locations were re-named Mobility Hub A and B as shown in the figure.

Hybrid Route 1 follows the same path as the Scenario A BRT. Route 2 uses a path similar to the north/south element of the DMC Modified Tram, extending the reach of the BRT system and providing options for commuters using the Mobility Hub parking..

The non-circulator elements of the Hybrid reflect characteristics of both the DMC Modified Tram and Scenario A BRT. The express bus service level is the same as in the DMC Modified Tram. RCS service is the same as Scenario A BRT. The PTN BRT is consistent for each of these options, reduced in frequency from TAP 1.

Figure 4. Scenario D (Elevated AV)

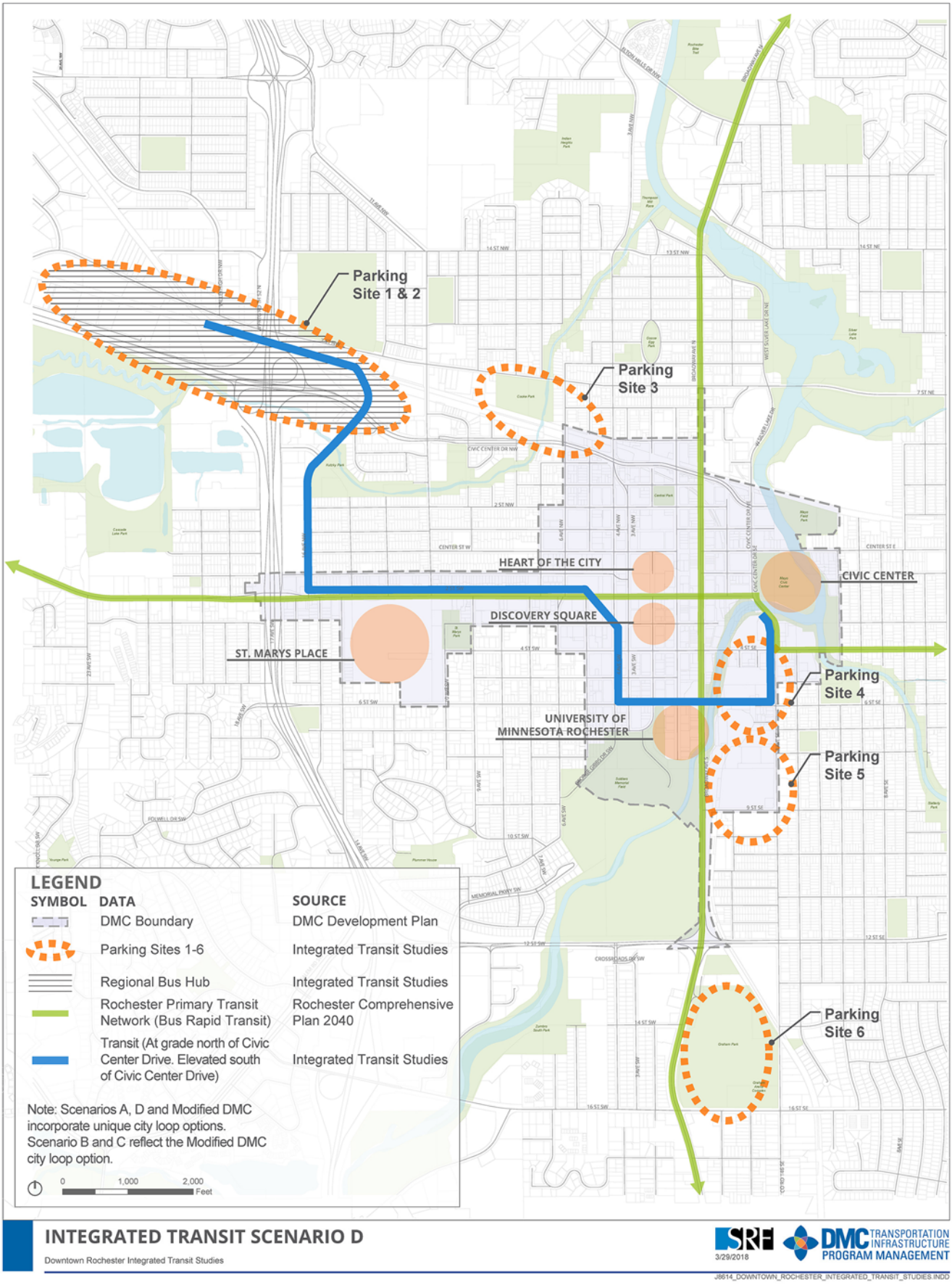
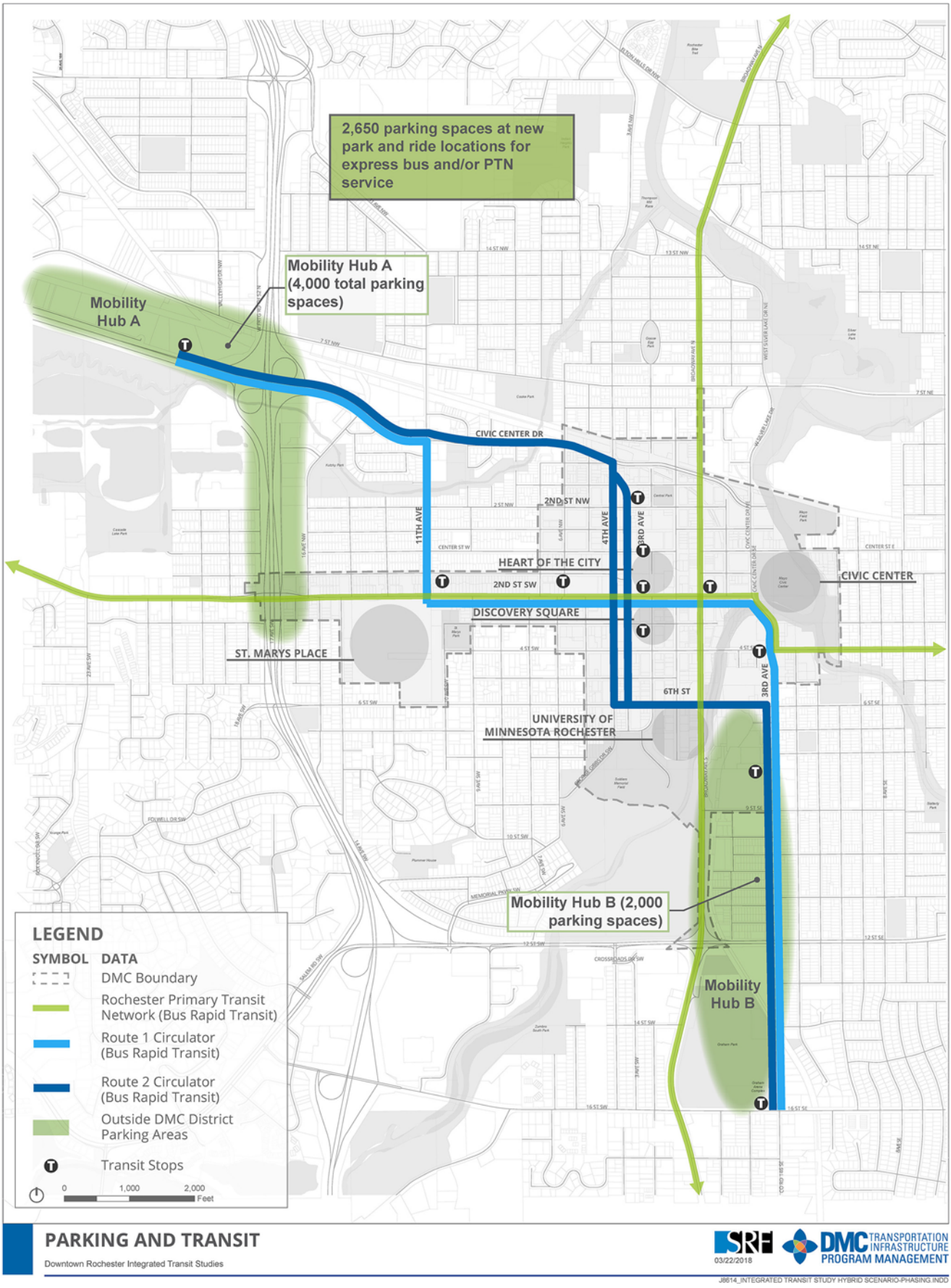


Figure 5. Hybrid BRT



Operating Assumptions

Each of the five transit options includes the various types of service identified in **Table 1**. TAP 1 represents the low capital investment option and is the only alternative that does not include a new circulator service.

Table 1. Transit Service Components of Alternatives

Alternatives	Transit Services				
	New Circulator Service	PTN BRT	RPT Local	RPT Express	RCS
TAP 1		X	X	X	X
DMC Modified Tram	X	X	X	X	X
Scenario A (BRT)	X	X	X	X	X
Scenario D (Elevated AV)	X	X	X	X	X
Hybrid BRT	X	X	X	X	X

This section is organized to show the differences in each type of service by alternative.

Circulator

Ridership is the primary determinant of the peak hour service level provided by each of the circulator options. The service frequency must be adequate to provide sufficient capacity to accommodate all the travelers. That capacity requirement is determined by the maximum passenger volume along the route. **Table 2** below shows the daily, peak period, and peak hour maximum ridership levels that were used to determine the service frequency for the circulator in each alternative. The ridership forecasts are documented in *Street Use Travel Demand, Traffic and Transit Forecasts Technical Memorandum*.

As shown in **Table 2,** the maximum ridership level is generated at a Mobility Hub in 4 of the 7 locations. The ridership forecast varies primarily because the parking supply assumptions change between alternatives.

The TAP 1 alternative does not have a dedicated circulator, however, the PTN BRT overlaps with much of the circulator service area and is used to represent the circulator for this option. It includes an east-west route that operates along 2nd Street in downtown and a north-south route that follows Broadway Avenue. The PTN BRT offers a similar service without the availability of the dedicated lane available to the circulator options.

Table 2. Circulator Ridership by Alternative

Alternative		Daily Ridership Demand	Max Peak Period Ridership	Max Ridership Location	Max Peak Hour Ridership Demand
TAP 1	North South PTN Line	N/A	N/A	Terminal Park-and-ride	270[1]
	East West PTN Line	N/A	N/A	Terminal Park-and-ride	270[1]
DMC Modified Tram		27,750	4,000	Mobility Hub A	1,600
Scenario A (BRT)		21,750	5,400	Mobility Hub B	2,160
Scenario D (Elevated AV)		26,230	4,000	Mobility Hub A	1,600
Hybrid BRT	Route 1	10,650	N/A	St Marys Place	632
	Route 2	11,935	N/A	Mobility Hub A	945

1. PTN ridership demand assumes that half of the vehicle capacity will be used at the Park-and-Ride, and the remainder along the rest of the route.

Table 3 identifies the service assumptions used along with the ridership forecast to develop an operating plan for each of the transit alternatives. The following parameters are included:

- Round Trip Distance: The total distance traveled by the transit vehicle to travel from one end of the route to the other and back again.
- Average Speed: Average speed the transit vehicle travels, taking into account stops, signals, turns, etc.
- Frequency: Number of minutes between vehicle arrivals at stop. May vary by time of day or day of the week.
- Round Trip Running Time: Total time required to complete the round-trip distance.
- Cycle Time: Running time plus layover at end of route. Layover provides driver an opportunity for a break, and "catch up" if the vehicle is behind schedule.
- Trips Per Hour: number of vehicles passing stop in an hour (60 minutes/frequency).
- Vehicle Capacity: Passenger capacity of the transit vehicle.

- Peak Hour Capacity: The number of total passengers that can be transported during the peak hour (number of peak hour vehicles times vehicle capacity). The assumed capacity does not represent the maximum capability of the vehicles. During extreme peaking, circulator vehicles could accommodate up to 33 percent more passengers for the relatively short trips made in dedicated lanes. This would result in an increase in the number of standees.

The circulator services are assumed to operate from 5 AM to 11 PM on weekdays, and 6 AM to 11 PM on weekends for all alternatives.

Table 3. Circulator Service Assumptions by Alternative

Alternative		Round Trip Distance (miles)	Average Speed (mph)	Round Trip Running Time (minutes)	Frequency	Assumed Cycle Time	Trips Per Hour	Vehicle Capacity	Peak Hour Capacity
TAP 1	North South PTN Line	11.86	10	71.2	Weekday: 10 minutes peak/ 15 minutes off-peak Weekend: 15 minutes all day	90 minutes peak/off-peak	Peak: 6 Off-Peak: 4	90	540
	East West PTN Line	8.73	10	52.4	Weekday: 10 minutes peak/ 15 minutes off-peak Weekend: 15 minutes all day	70 minutes peak 75 minutes off-peak	Peak: 6 Off-Peak: 4	90	540
DMC Modified (Tram)		7.97	10 shared lane/18 exclusive lane	30.5	Weekday: 6 minutes peak/ 12 minutes off-peak Weekend: 12 minutes all day	36 minutes peak/off-peak	Peak: 10 Off-Peak: 5	160	1,600
Scenario A (BRT)		6.10	18 exclusive lane	20.3	Weekday: 2.5 minutes peak/ 10 minutes off- peak Weekend: 10 minutes all day	27 minutes peak 30 minutes off-peak	Peak: 24 Off-Peak: 6	90	2,160
Scenario D (Elevated AV)		NA	25	NA	Weekday: 1 minute peak/1 minute off-peak Weekend: 1 minute all day	NA	95	30[1]	2,850
Hybrid BRT	Route 1	5.80	18 exclusive lane, 10 shared lane	21.2	Weekday: 7.5 minutes peak/ 10 minutes off- peak Weekend: 15 minutes all day	30 minutes peak/off-peak	Peak: 8 Off-Peak: 6	90	720
	Route 2	6.06	18 exclusive lane, 10 mixed, 14, BAT[2]	24.8	Weekday: 5 minutes peak/ 10 minutes off-peak Weekend: 10 minutes all day	30 minutes peak/ off-peak	Peak: 12 Off-Peak: 6	90	1080

1. While current autonomous shuttles typically accommodate 10-12 passengers, larger vehicles (30 or more passengers) are in development. One vendor currently has 24 passenger vehicles in service

2. Business Access and Transit (BAT) lanes are curb lanes reserved for auto and truck access to adjacent property, and transit usage.

The autonomous vehicle option does not represent a fixed-schedule service as in the other alternatives. While it operates along a specific path, the vehicles are demand responsive, traveling directly between origin and destination stations, bypassing intermediate locations. During peak periods, the vehicles will carry full loads directly connecting major origins and destinations. In the off peak, they will function like driverless taxi cabs, carrying small passenger loads upon request.

For this analysis, all the autonomous vehicles were assumed to operate in a "worst case" scenario, traveling the complete length of the elevated guideway for each trip. Within this constraint, the autonomous vehicle option can provide a minimum of a vehicle every 40 seconds at any point along the route, which will satisfy the maximum forecasted ridership demand during peak periods.

Table 4 shows the cost assumptions and fleet requirements for each alternative. The following parameters are used to develop the operating cost:

- Annual Revenue Hours: Number of hours per year the transit vehicle is traveling and available to transport passengers.
- 2017 RPT Bus Cost per Hour: Average cost per revenue hour to operate existing Rochester Public Transit buses.
- Cost per Hour Premium: Incorporates hourly cost ratio of standard bus to BRT and tram in other transit systems operating both modes.
- Annual Operating Cost: Product of the annual revenue hours and the cost per hour with appropriate premium.
- Peak Vehicle Requirements: Number of vehicles required to serve the anticipated demand, plus 20 percent spare vehicles to maintain service while buses are out for maintenance.

Table 4. Circulator Service Assumptions by Alternative

Alternative NS=North/South EW = East/West Alternative		Annual Revenue Hours	2017 RPT Bus Cost per Hour	Cost per Hour Premium[1]	2017 Cost per Hour	Annual Operating Cost	Peak Vehicle Requirements[2]
TAP 1	NS PTN BRT Line	45,552	$98.94	15%	$113.78	$5,200,000	11
	EW PTN BRT Line	37,180	$98.94	15%	$113.78	$4,200,000	9
DMC Modified (Tram)		25,116	$98.94	35%	$133.56	$3,400,000	8
Scenario A (BRT)		32,916	$98.94	15%	$113.78	$3,700,000	14
Scenario D (Elevated AV)		NA	NA	NA	NA	$3,500,000	32

Alternative NS=North/South EW = East/West Alternative		Annual Revenue Hours	2017 RPT Bus Cost per Hour	Cost per Hour Premium[1]	2017 Cost per Hour	Annual Operating Cost	Peak Vehicle Requirements[2]
Hybrid BRT	Route 1	28,806	$98.94	15%	$113.78	$3,300,000	6
	Route 2	33,488	$98.94	15%	$113.78	$3,800,000	10

1. Premium is based on peer review agencies that operate BRT and tram systems, in addition to bus systems, in 2014. Premium rate is the increase between the bus system and the BRT/tram line cost.
2. Includes a 20 percent spare ratio

The autonomous vehicle operating costs are based upon the number of vehicles rather than the number of vehicle hours. Currently, autonomous vehicles are leased from a vendor for a flat rate that includes operating cost. This results in a relatively high operating cost for systems like Rochester with a high peak fleet requirement. The operating cost in **Table 4** reflects this cost model. This cost model may change as more transit agencies use autonomous vehicle services and the operating costs are based upon service hours used rather than fleet size.

PTN BRT

PTN BRT service levels vary slightly among the five alternatives. The PTN BRT provides the only circulator service in the TAP 1 Alternative. This service continues to operate with the circulator options, however, the frequency is reduced because of the overlap in service with the circulators.

Table 5 details the PTN BRT network service levels for the five alternatives. The values shown for TAP 1 match those shown in the circulator section above.

Table 6 details the cost assumptions and fleet requirements for the PTN for each alternative. The PTN service levels and costs are constant for the Modified DMC (Tram), Scenario A (BRT), Scenario D (Elevated AV) and Hybrid circulator options.

Table 5. PTN BRT Service Assumptions

Alternative NS=North/South EW= East/West		Round Trip Distance (miles)	Average Speed (mph)	Round Trip Running Time (minutes)	Frequency	Assumed Cycle Time	Trips Per Hour	Vehicle Capacity	Peak Hour Capacity
TAP 1	NS PTN BRT Line	11.86	10	71.2	Weekday: 10 minutes peak/ 15 minutes off- peak Weekend: 15 minutes all day	90 minutes peak/off- peak	Peak: 6 Off-Peak: 4	90	540
	EW PTN BRT Line	8.73	10	52.4	Weekday: 10 minutes peak/ 15 minutes off- peak Weekend: 15 minutes all day	70 minutes peak 75 minutes off-peak	Peak: 6 Off-Peak: 4	90	540
DMC Modified (Tram)	NS PTN BRT Line	11.86	10	71.2	Weekday: 15 minutes peak/off-peak Weekend: 15 minutes all day	90 minutes peak/off- peak	Peak: 4 Off-Peak: 4	90	360
	EW PTN BRT Line	8.73	10	52.4	Weekday: 15 minutes peak/off-peakWeekend: 15 minutes all day	75 minutes peak/off- peak	Peak: 4 Off-Peak: 4	90	360
Scenario A (BRT)	NS PTN BRT Line	11.86	10	71.2	Weekday: 15 minutes peak/off-peak Weekend: 15 minutes all day	90 minutes peak/off- peak	Peak: 4 Off-Peak: 4	90	360
	EW PTN BRT Line	8.73	10	52.4	Weekday: 15 minutes peak/off-peakWeekend: 15 minutes all day	75 minutes peak/off- peak	Peak: 4 Off-Peak: 4	90	360
Scenario D (Elevated AV)	NS PTN BRT Line	11.86	10	71.2	Weekday: 15 minutes peak/off-peak Weekend: 15 minutes all day	90 minutes peak/off- peak	Peak: 4 Off-Peak: 4	90	360
	EW PTN BRT Line	8.73	10	52.4	Weekday: 15 minutes peak/off-peakWeekend: 15 minutes all day	75 minutes peak/off- peak	Peak: 4 Off-Peak: 4	90	360
Hybrid BRT	NS PTN BRT Line	11.86	10	71.2	Weekday: 15 minutes peak/off-peak Weekend: 15 minutes all day	90 minutes peak/off- peak	Peak: 4 Off-Peak: 4	90	360
	EW PTN BRT Line	8.73	10	52.4	Weekday: 15 minutes peak/off-peakWeekend: 15 minutes all day	75 minutes peak/off- peak	Peak: 4 Off-Peak: 4	90	360

Table 6. PTN BRT Cost Assumptions

Alternative		Annual Revenue Hours	2017 RPT Bus Cost per Hour	Assumed Cost per Hour Premium[1]	2017 Cost per Hour	Annual Operating Cost	Peak Fleet Requirements[2]
TAP 1	North South PTN BRT Line	45,552	$98.94	15%	$113.78	$5,200,000	11
	East West PTN BRT Line	37,180		15%	$113.78	$4,200,000	9
	Total	82,732		15%	$113.78	$9,400,000	20
DMC Modified Tram	North South PTN BRT Line	33,696	$98.94	15%	$113.78	$3,800,000	8
	East West PTN BRT Line	28,080		15%	$113.78	$3,200,000	6
	Total	61,776		15%	$113.78	$7,000,000	14
Scenario A (BRT)	North South PTN BRT Line	33,696	$98.94	15%	$113.78	$3,800,000	8
	East West PTN BRT Line	28,080		15%	$113.78	$3,200,000	6
	Total	61,776		15%	$113.78	$7,000,000	14
Scenario D (Elevated AV)	North South PTN BRT Line	33,696	$98.94	15%	$113.78	$3,800,000	8
	East West PTN BRT Line	28,080		15%	$113.78	$3,200,000	6
	Total	61,776		15%	$113.78	$7,000,000	14
Hybrid BRT	North South PTN BRT Line	33,696	$98.94	15%	$113.78	$3,800,000	8
	East West PTN BRT Line	28,080		15%	$113.78	$3,200,000	6
	Total	61,776		15%	$113.78	$7,000,000	14

RPT = Rochester Public Transit

1. Premium is based on peer review agencies that operate BRT and streetcar systems, in addition to bus systems, in 2014. Premium rate is the increase between the bus system and the BRT/streetcar line cost.
2. Includes a 20 percent spare ratio.

Express Bus Assumptions

A new set of express buses is assumed to accommodate additional transit demand from park-and-ride locations throughout the City of Rochester. The new services are expected to connect the following park-and-ride lots to downtown Rochester:

- US 14 location near the US 14/W Circle Drive interchange
- IBM location near the US 52/37th Street NW interchange
- US 52 North location near the US 52/75th Street NW interchange
- Olmsted County Fairgrounds near the S Broadway Avenue/16th Street SW intersection

- Target South location near the US 63/48th Street SE interchange

Routing for the express service connecting the park-and-ride locations with downtown is shown in **Figure 6**. Projected one-way peak hour ridership demand for each of the five park-and-ride locations is detailed in **Table 7**. The peak hour ridership is estimated at 20 percent of the total daily ridership. The fairgrounds parking lot locations are assumed to supplement the demand handled by the north/south PTN BRT line terminating at the Shopko South parking lot. Therefore, the fairgrounds express ridership assumes that half the capacity of the PTN BRT will be filled at the park-and-ride. Express Service will carry the remaining park-and-ride passengers not using the PTN BRT. The service characteristics of the various express services is summarized by alternative in **Table 8**. The service levels are the same for the Scenario A and Hybrid BRT options.

Table 7. Peak-Hour Express Bus Ridership

Park-and-Ride Location	TAP 1	DMC Modified Tram	Scenario A BRT	Scenario D Elevated AV	Hybrid BRT
US 14	1,508	356	316	634	356
IBM	420	99	88	176	99
US 52 North	1,259	296	264	528	296
Olmsted County Fairground	550	N/A	N/A	166	N/A
Target South	145	35	30	61	35

N/A = Not Applicable

Figure 6. Express Service Routing

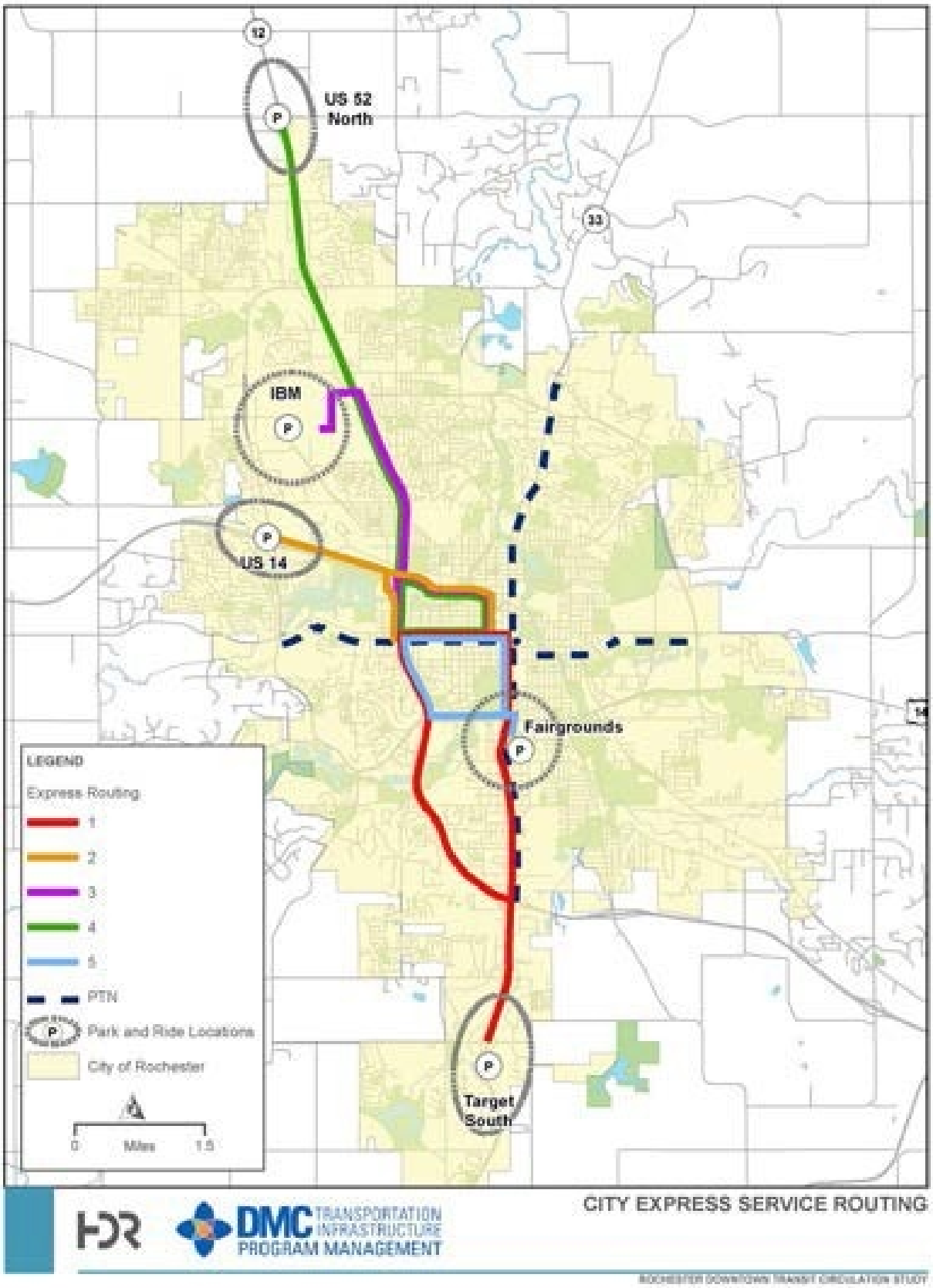


Table 8. Express Service Assumptions

Park-and-Ride Location	TAP 1			DMC Modified Tram			Scenario A (BRT)			Scenario D (Elevated AV)			Hybrid BRT		
	Service Levels	Hourly Capacity	Annual Revenue Hours	Service Levels	Hourly Capacity	Annual Revenue Hours	Service Levels	Hourly Capacity	Annual Revenue Hours	Service Levels	Hourly Capacity	Annual Revenue Hours	Service Levels	Hourly Capacity	Annual Revenue Hours
US 14	2 minutes headway (6 hours)	1500 (30 trips per hour)	18,720	8 minutes headway (6 hours)	375 (7.5 trips per hour)	4,680	10 minutes headway (6 hours)	300 (6 trips per hour)	4,680	5 minutes headway (6 hours)	600 (12 trips per hour)	7,800	8 minutes headway (6 hours)	375 (7.5 trips per hour)	4,680
IBM	7.5 minutes headway (6 hours)	400 (8 trips per hour)	7,800	30 minutes headway (6 hours)	100 (2 trips per hour)	3,120	35 minutes headway (6 hours)	100 (2 trips per hour)	1,560	15 minutes headway (6 hours)	200 (4 trips per hour)	4,680	30 minutes headway (6 hours)	100 (2 trips per hour)	3,120
US 52 North	2.5 minutes headway (6 hours)	1,200 (24 trips per hour)	23,400	10 minutes headway (6 hours)	300 (4 trips per hour)	6,240	12 minutes headway (6 hours)	250 (5 trips per hour)	6,240	6 minutes headway (6 hours)	500 (10 trips per hour)	10,920	10 minutes headway (6 hours)	300 (4 trips per hour)	6,240
Olmsted County Fairground	5 minutes headway (6 hours)	600 (12 trips per hour)	7,800	N/A, demand does not warrant service. PTN BRT will accommodate			N/A, demand does not warrant service			20 minutes headway (6 hours)	150 (3 trips per hour)	150	N/A, demand does not warrant service. PTN BRT will accommodate		
Target South	20 minutes headway (6 hours)	150 (3 trips per hour)	3,120	40 minutes headway (2 hours)	75 (1.5 trips per hour)	520	40 minutes headway (2 hours)	75 (1.5 trips per hour)	520	40 minutes headway (2 hours)	75 (1.5 trips per hour)	520	40 minutes headway (2 hours)	75 (1.5 trips per hour)	520
Total			60,840			14,560			13,000			27,040			14,560

Table 9 details the cost assumptions and fleet requirements for the express service for each alternative.

Table 9. Express Service Costs and Fleet Requirements

Alternative	Annual Revenue Hours	2017 Estimated RPT Bus Cost per Hour	Annual Operating Cost	Peak Fleet Requirements[1]
TAP 1	*60,840*	*$98.94*	*$6,000.000*	*47*
DMC Modified Tram	*14,560*	*$98.94*	*$1,400,000*	*12*
Scenario A (BRT)	*13,000*	*$98.94*	*$1,300.000*	*11*
Scenario D (Elevated AV)	*27,040*	*$98.94*	*$2,700.000*	*22*
Hybrid BRT	*14,560*	*$98.94*	*$1,400,000*	*12*

RPT = Rochester Public Transit
1. Includes a 20 percent spare ratio.

Regional Commuter Services (RCS) Assumptions

The primary consideration of RCS service in this analysis is the impact on bus volumes on 2nd Street. This service is privately operated. The operating costs are not included in analysis. The peak hour RCS bus volume is forecast to be 33 buses an hour based upon the ridership forecast developed in this study. Based upon the current directional split 18 buses are eastbound (EB) and 15 buses are westbound (WB) on 2nd Street SW in the AM peak.

RCS routes currently operate from various areas outside the City of Rochester into downtown Rochester daily during AM and PM peak periods. RCS services currently stop at St. Marys Hospital and in the downtown core, primarily south of 2nd Street. This operation will continue under TAP 1, although buses will no longer be permitted to dwell on downtown streets in the midday. The downtown RCS operating plans for the other options vary as described in **Table 10**. No RCS buses will operate on 2nd Street SW between 3rd Avenue SW and Broadway in any of these options.

The St. Marys RCS stop is assumed to be moved off of 2nd Street SW, to be incorporated into the ground floor of a new parking ramp constructed over the existing surface lot immediately east of St. Marys. Several options exist for downtown RCS stops. As noted in **Table 10,** DMC RCS buses will make their downtown stop in a new transit center in the ground floor of a proposed Discovery Square ramp. An alternate RCS stop may also be

incorporated into a new parking facility in blocks 95 and 96, bounded by 1st and 2nd Streets NW and 5th and 7th Avenues NW. This location may be considered for all of the circulator options.

Table 10. Assumed Adjustments to RCS Services by Alternative

Alternative	Service Description	RCS Vehicle Storage in Mid-Day	RCS Peak Hour (AM) Bus Volumes on 2nd Street
TAP 1	Each line will continue to serve St. Marys Hospital and downtown. This analysis assumes RCS vehicles will travel along 2nd Street to reach both destinations, similar to existing conditions.	Projected demand will require additional vehicles. Vehicle staging will occur at the existing RCS facility on N Broadway Avenue and/or in other locations outside of downtown (e.g., spread between different Park-and-ride lots outside of downtown). Additional operator relief vehicles will be required for drivers to reach their final destinations after parking buses outside of downtown at various locations.	18 EB/15 WB
DMC Modified (Tram)	Each line will continue to serve St. Marys Hospital and a new potential station at Discovery Square ramp (assumed to be too small to stage vehicles). This analysis assumes RCS vehicles will not travel on 2nd Street between 3rd Avenue and Broadway.	Projected demand will require additional vehicles. Vehicle staging will occur at the existing RCS facility on N Broadway Avenue and/or in other locations outside of downtown (e.g., spread between different Park-and-ride lots outside of downtown or the Mobility Hubs). Additional operator relief vehicles may be required for drivers to reach their final destinations after parking buses outside of downtown at various locations.	West of 3rd Avenue: 18 EB/15 WB (AM) East of 3rd Avenue: None
Scenario A (BRT)	Each line will continue to serve both St. Marys Hospital and downtown. This analysis assumes RCS vehicles will not travel on 2nd Street between 3rd Avenue and Broadway.	Projected demand will require additional vehicles. Vehicle staging will occur at the existing RCS facility on N Broadway Avenue and/or in other locations outside of downtown (e.g., spread between different Park-and-ride lots outside of downtown or the Mobility Hubs). Additional operator relief vehicles may be required for drivers to reach their final destinations after parking buses outside of downtown at various locations.	West of 3rd Avenue: 18 EB/15 WB (AM) East of 3rd Avenue: None
Scenario D (Elevated AV)	Service will terminate at nearest Mobility Hub, connect with circulator. RCS buses will not enter downtown.	Projected demand will require additional vehicles serving downtown. Vehicle staging will occur at facilities owned by the private operator and/or at the Mobility Hubs. Additional operator relief vehicles may be required for drivers to reach final destination after parking buses, depending on where vehicles are staged during the day.	None
Hybrid BRT	Each line will continue to serve both St. Marys Hospital and downtown. This analysis assumes RCS vehicles will not travel on 2nd Street between 3rd Avenue and Broadway.	Projected demand will require additional vehicles. Vehicle staging will occur at the existing private operator facilities and/or in other locations outside of downtown (e.g., spread between different Park-and-ride lots outside of downtown or the Mobility Hubs). Additional operator relief vehicles may be required for drivers to reach their final destinations after parking buses outside of downtown at various locations.	West of 3rd Avenue: 18 EB/15 WB (AM) East of 3rd Avenue: None

Rochester Public Transit (RPT) Assumptions

The primary consideration of RPT local service in this analysis is the impact on bus volumes on 2nd Street. This service will be provided independently of the circulator and PTN BRT. The operating costs are not included in analysis.

The Rochester Transit Development Plan 2017-2021 recommends improvements that will increase peak hour bus frequency by 30 percent in 5 years. RPT staff then anticipates local peak hour service to increase by 2 buses per year on 2nd Street downtown over the following 10 years. This increases the total local bus service on 2nd Street to 75 buses per hour.

The existing directional balance of RPT buses on 2nd Street was examined in order to forecast the future directional split of the 75 buses. The resulting ratio was approximately 40 percent eastbound and 60 percent westbound. This equates to 30 buses eastbound and 45 westbound.

The RPT services are assumed to be adjusted for each alternative as shown in **Table11**.

Table 11. Adjustments to RPT Services by Alternative

Alternative	Adjustments to RPT Services		
	Stop Locations and Alignment	Vehicle Requirements	RPT Peak Hour (AM) Bus Volumes on 2nd Street
TAP 1	No change to alignments or stop locations. .	30% increase through TDP, 2 additional peak hour buses per year in following 10 years	30 EB/45 WB
DMC Modified Tram	DMC Development Plan recommended rerouting some local buses to 3rd/4th Avenues. This adjustment was beyond the scope of this study. It would result in lower bus volumes, however.	30% increase through TDP, 2 additional peak hour buses per year in following 10 years	30 EB/45 WB
Scenario A (BRT)	No change to alignments or stop locations	30% increase through TDP, 2 additional peak hour buses per year in following 10 years	30 EB/45 WB
Scenario D (Elevated AV)	No change to alignments or stop locations	30% increase through TDP, 2 additional peak hour buses per year in following 10 years	30 EB/45 WB
Hybrid BRT	No change to alignments or stop locations	30% increase through TDP, 2 additional peak hour buses per year in following 10 years	30 EB/45 WB

2nd Street Transit Lane Needs Assessment

Second Street will experience a significant increase in peak-hour transit volume in all of the transit alternatives. The anticipated volumes in the downtown core are shown in **Table 12** below. To attract commuters from autos to transit, it will be imperative to provide consistent, high-quality transit service to and from downtown destinations. This will be particularly important for the circulators connecting parking to downtown. Dedicated transit lanes can significantly enhance service reliability, and can improve travel speeds when combined with transit signal priority.

There is no specific warrant to determine the viability of a dedicated transit lane. Thirty buses per hour per direction is a general guideline for consideration of a dedicated lane, however, many other factors including other demands on the right-of-way must be considered. **Table 12** identifies the projected bus volumes on 2nd Street downtown for each of the alternatives. The bus volume drops considerably for the circulator options which assume a substantial transit shift from TAP 1 express buses to the parking facilities surrounding downtown. About 53-71 buses per hour will use 2nd Street downtown in each direction in the peak hour in the circulator alternatives. This volume significantly exceeds the minimum for consideration of a dedicated lane. The volume may be higher between downtown and St. Marys, depending upon routing of the RCS buses.

Table 12. Downtown 2nd Street Peak Hour (AM) Vehicles Between Broadway Avenue and Third Avenue

Service	Direction	TAP 1	DMC Modified	Scenario A (BRT)	Scenario D (Elevated AV)	Hybrid BRT
Local Bus	EB	30	30	30	30	30
	WB	45	45	45	45	45
Express Bus	EB	62	11	13	26	11
	WB	15	2	2	5	2
RCS[1]	EB	18	0	0	0	0
	WB	15	0	0	0	0
PTN	EB	6	4	4	4	4
	WB	6	4	4	4	4
Circulator	EB	NA	10	20	NA	8
	WB	NA	10	20	NA	8
Total	EB	116	55	67	60	53
	WB	81	61	71	54	59

1. RCS buses serving downtown use stops off 2nd Street

Although the RCS buses would operate in the dedicated lanes west of 3rd Avenue, they would not stop at the stations. These over-the-road coaches only have single doors and do not have level boarding, which would create a bottleneck at the stations due to slow boarding and alighting. The alternatives have been designed in a manner that accommodate RCS bus boarding and alighting off the dedicated 2nd Street lane.

The dedicated lanes could be in the center or curb lanes of the street. Each location has advantages and disadvantages. The location of the dedicated lanes would be determined during the next phase of project development.

Summary of Operating Costs and Fleet Requirements by Alternative

Table 13 details the estimated operating costs and fleet requirements for each alternative, based on the various assumptions described in this report.

Table 13. Operating Cost and Fleet Requirement Summary

	TAP 1	DMC Modified Tram	Scenario A (BRT)	Scenario D (Elevated AV)	Hybrid Route 1	Hybrid Route 2[1]
Operating Costs						
Annual Circulator Revenue Hours	NA	25,116	32,916	NA	28,808	33,488
Annual PTN/Express Revenue Hours	143,572	76,336	74,776	88,816	76,366	NA
2014 Rochester Public Transit (RPT) Bus Cost per Hour	$93.23	$93.23	$93.23	$93.23	$93.23	$93.23
2017 Estimated RPT Bus Cost Per Hour	$98.94	$98.94	$98.94	$98.94	$98.94	$98.94
Assumed Cost Premium for Enhanced Service	15%	35%	15%	NA	15%	15%
Circulator Cost Per Hour	NA	$133.56	$113.78	NA	$113.78	$113.78
PTN Cost Per Hour	$113.78	$113.78	$113.78	$113.78	$113.78	NA
Express Cost per Hour	$98.94	$98.94	$98.94	$98.94	$98.94	NA
Circulator Annual Operating Cost	NA	$3,400,000	$3,700,000	$3,500,000	$3,300,000	$3,800,000
PTN Cost	$9,4 00,000	$7,000,000	$7,000,000	$7,000,000	$7,000,000	NA
Express Cost	$6,000,000	$1,400,000	$1,300,000	$2,700,000	$1,400,000	NA
Total Cost[2]	$15,400,000	$11,800,000	$12,000,000	$13,200,000	$11,700,000	$3,800,000
Fleet Requirements						
Circulator Peak Fleet Required	NA	8	14	32	6	10
PTN Peak Fleet Required	20	14	14	14	14	NA
Express Peak Fleet Required	47	12	11	22	12	NA
Circulator Vehicle Passenger Capacity	NA	160	90	30	90	NA
PTN Vehicle Passenger Capacity	90	90	90	90	90	NA
Express Vehicle Passenger Capacity	50	50	50	50	50	NA

1. Non-circulator components are identified under Route 1. They are not repeated under Route 2.
2. Total operating cost for Hybrid is sum of Routes 1 and 2.

Appendix D. Alternatives Development

This page is intentionally blank.

Transit Circulation Study: Alternatives Development

DMC Transportation & Infrastructure Program

City of Rochester, MN

Prepared for:

DMC TRANSPORTATION INFRASTRUCTURE PROGRAM MANAGEMENT

Prepared by:

SRF Consulting Group, Inc.

HDR

Date: May 2018

DMC Project No. J8621 Transit Circulation Study

This page is intentionally blank.

Table of Contents

Background 1

Transit Planning Process 4

Development of Tier 1 Alternatives 6

Modal Options 6

Profile Options 11

Preliminary Screening of Modes 11

Application of Modes to Routes and Profiles 12

Tier 1 Alternatives Description 13

Surface Options 15

DMC Modified Tram 15

Scenario A (BRT, Tram) 17

Subterranean Options 17

Scenario B (Autonomous Vehicle and BRT) 17

Elevated Options 20

Scenario C (Autonomous Vehicle AGT) 20

Scenario D (Autonomous Vehicle, AGT) 22

Evaluation of Tier 1 Alternatives 24

Tier 1 Evaluation Criteria 24

Tier 1 Evaluation Results 25

DMC Modified Scenario (Tram) 25

Scenario B (BRT) 25

Scenario D (Autonomous Vehicle) 25

Development of Tier 2 Alternatives 29

Tier 2 Alternatives Conceptual Design Process 29

Study Integration 29

Guideway Design Process 29

Design Assumptions 30

Station Locations 32

Tier 2 Alternatives Operations Planning Process 32
Alternative Characteristics 32
Transit Alternative Phase I (TAP 1) 33
DMC Modified Tram Alternative 33
Scenario A BRT 40
Scenario D Autonomous Vehicle 46
Development of Hybrid Alternative 52

Figures

Figure 1. DMC Master Plan 2
Figure 2. Transit Circulator Study Process 4
Figure 3. Peripheral and Remote Commuter Parking Locations 14
Figure 4. DMC Modified Tram 16
Figure 5. Scenario A (BRT and Tram) 18
Figure 6. Scenario B (Subterranean) 19
Figure 7. Scenario C Elevated 21
Figure 8. Scenario D Elevated 23
Figure 9. Transit Alternative Phase 1 (TAP 1) 34
Figure 10. Tier 2 DMC Modified Tram Route 35
Figure 11. DMC Modified Tram Typical Section in Median 37
Figure 12. DMC Modified Tram Typical Section in Curb Lane 38
Figure 13. Scenario A BRT Route 42
Figure 14. Scenario A (BRT) Typical Section In 2nd Street SW Median 44
Figure 15. Scenario A (BRT) Typical Section in 11th Avenue Median 45
Figure 16. Scenario D (Autonomous Vehicle) Route 47
Figure 17. Scenario D Autonomous Vehicle Typical Section 49
Figure 18. BRT Hybrid 53

Tables

Table 1. Tier 1 Evaluation Criteria 24
Table 2. Evaluation Summary for Tier 1 Alternatives 27
Table 3. Preliminary Capital Cost Estimates for Circulators 39
Table 4. Performance Comparison of Tier 2 Circulator Options 51
Table 5. Comparison of Scenario A BRT and Hybrid BRT Circulator Performance 54

Appendix

Detailed Circulator Cost Estimates

List of Acronyms

AGT	Automated Guideway Transit
AV	Autonomous Vehicle
BAT	Business Access and Transit
BRT	Bus Rapid Transit
DMC	Destination Medical Center
MSP	Minneapolis-St. Paul
PRT	Personal Rapid Transit
PTN	Primary Transit Network
RCL	Rochester City Lines
RPT	Rochester Public Transit
SCC	Standard Cost Category
TAP 1	Transit Alternative Phase 1
TDP	Transit Development Plan
UMR	University of Minnesota Rochester
YoE	Year of Expenditure

J8621_RPT_Transit Circulator Study Report_FINAL

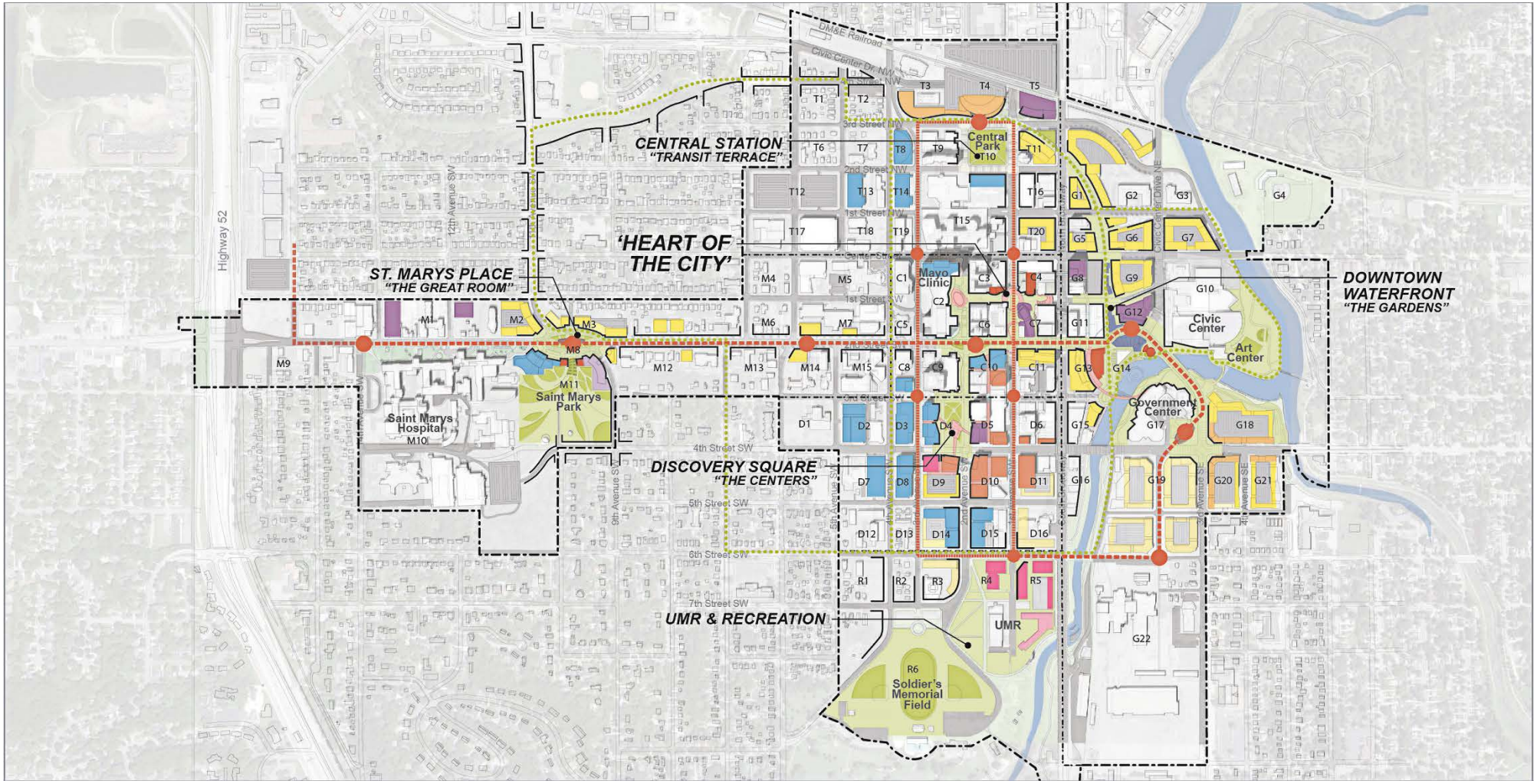
This page is intentionally blank.

Background

The Destination Medical Center (DMC) will use public investment in infrastructure and programs to encourage private development and economic activity in the City of Rochester and southeast Minnesota. Transportation is a major area of investment and early actions and investments will play a crucial role in ensuring development and economic growth is accommodated gracefully and with maximum economic return. The Transit Circulation Study identifies the transit component of the overall plan. The circulator was developed in coordination with the Street Use, Parking and Travel Demand Management, and City Loop Studies so that each of the elements are complimentary to each other and work together to achieve the development goals of the City and the *2015 DMC Master Plan* (**Figure 1**).

The *DMC Master Plan* focuses upon six unique subdistricts: Heart of the City, Discovery Square, Downtown Waterfront, Central Station, St. Marys Place, and University of Minnesota Rochester (UMR)/Recreation. The Plan links these individual elements using a tram which follows the dashed orange line that primarily runs east and west along 2nd Street SW and north and south along 1st and 3rd Avenues NW/SW. In addition to the tram, the Plan also includes an intermodal transit center at the north end, identified as Central Station. These transit elements described in the Plan provided the starting point for the development of the detailed transit options described in this report.

Figure 1. DMC Master Plan



This distribution of travel destinations in downtown Rochester creates three primary travel markets:

1. Mayo Clinic passenger connection between St. Marys and downtown. The existing Mayo downtown shuttle service represents the largest existing travel market, primarily serving trips between St. Marys Hospital and the Gonda building. Passengers using this service include Mayo employees and patients, along with their companions.

2. Peripheral and remote parking connection to downtown for employees working downtown. Several candidate locations for commuter parking have been identified in the Parking and Transportation Management Authority Study. The transit alternatives were developed assuming construction of those potential parking ramps.

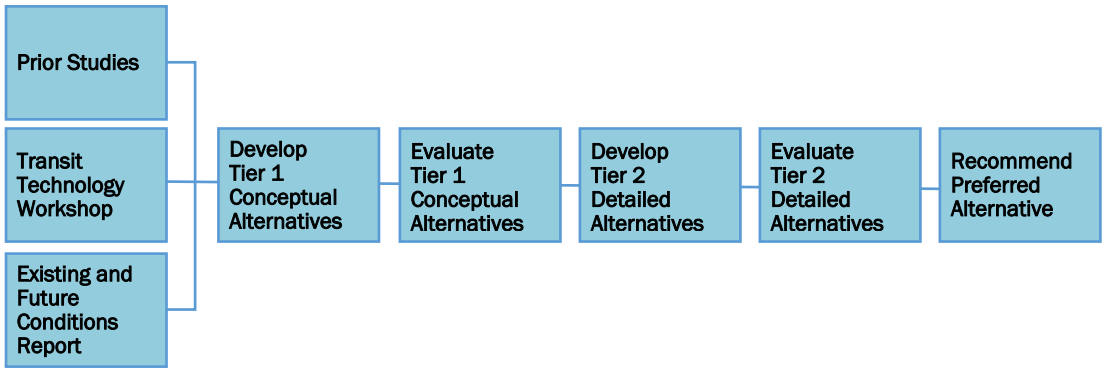
3. Downtown circulation extending beyond the Mayo Clinic shuttle route, serving anticipated growth north and south of the downtown core. This service will address the travel needs of downtown employees, residents, patients, visitors, and students.

These three distinct markets may be served individually by unique transportation options or jointly by a single transportation service. Serving the markets individually provides the opportunity to tailor each service to meet the unique needs of each market. Serving the markets jointly with a single service may offer service advantages such as higher service frequency and a longer span of service than any of the markets may receive individually. A combined service may also support a "signature" project that can attract federal funding.

Transit Planning Process

The *DMC Development Plan* identified an initial transportation plan to support implementation of the land use vision. The Rochester Integrated Transit Studies verify, validate, and further develop the *DMC Development Plan* vision and recommendations in greater detail. The Transit Circulation Study advances the public transportation element supporting the *DMC Development Plan*. The overall transit circulator planning process is shown below in **Figure 2**.

Figure 2. Transit Circulator Study Process



The planning process builds upon the *DMC Development Plan* and other prior studies. Much of the supporting information is provided in *Transit Circulation Study: Existing and Future Conditions*. The process used two levels of alternatives development. First, there was a general review and assessment of potential transit technologies and potential circulator routes that would serve the three travel markets. A broad range of technologies were presented in a technology workshop, which were analyzed with respect to their potential use in Rochester. Second, the resulting combinations of modes and routes were then evaluated in the Tier 1 analysis using primarily qualitative criteria, and three options were selected for more detailed development.

During the Tier 2 analysis, conceptual engineering was conducted for the three transit options. The engineering analysis identified the approximate centerline of the route in the right-of-way, right-of-way requirements, general roadway impacts, and capital costs. Operating plans were also prepared identifying the frequency, span of service, and operating cost for the proposed circulator options, along with the primary transit network (PTN) Bus Rapid Transit (BRT), express, and regional bus services providing access to downtown. This information facilitated both a quantitative and qualitative analysis of the Tier 2 alternatives.

Based upon the Tier 2 review, one alternative advanced based upon its ridership, costs, and service characteristics. Several "hybrid" versions of this option were developed to incorporate attractive service characteristics of one of the other options. The remainder of this tech memo describes the circulator planning process and results in detail.

Development of Tier 1 Alternatives

Throughout the planning process, the alternatives were guided by the need to serve the three key travel markets: Mayo Clinic passenger connection between St. Marys and Gonda building, peripheral and remote commuter parking connection with St. Marys and downtown, and circulation within downtown. In addressing those markets, the Tier 1 transit options were shaped to accomplish the following:

- Consider a variety of modal options
- Identify potential profile options (surface, subterranean, elevated)
- Identify suitable technologies for profile and alignment options
- Develop general characteristics for evaluation

Modal Options

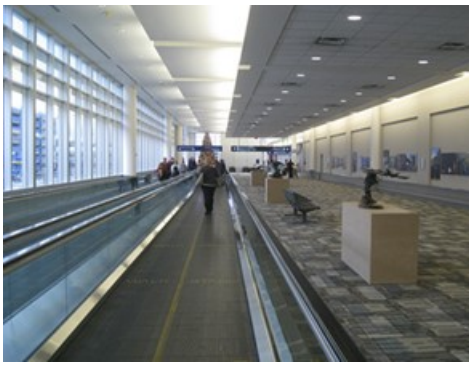
Transit mode refers to the type of technology used to transport passengers. These technologies vary substantially with respect to capacity, size, propulsion, capital costs, operating costs, and guideway requirements. The suitability of a mode depends largely upon ridership, physical and operational requirements of the travel markets, and the financial capacity of the implementing organization.

The Tier 1 analysis started with a broad array of transit modes, most of which were discussed in the Transit Technology Workshop identified earlier. Key characteristics of the initial transit modes considered are described below.

Moving Sidewalks are escalators that move horizontally but not vertically. They are widely used within airport terminals such as Minneapolis-St. Paul (MSP) to provide a continuous, although relatively slow service for distances of less than one mile.



Frankfurt Airport Moving Sidewalk



Minneapolis Airport Moving Sidewalk

Bus Rapid Transit (BRT) is an enhanced bus service that typically includes distinctly branded buses and stations, level vehicle boarding at stations, real-time information, and traffic signal priority. The buses can be either standard length or articulated to carry additional passengers.

BRT can operate in exclusive or shared travel lanes. The bus stops are generally spaced further apart than with typical bus routes to reduce dwell time and improve travel speeds. Most BRT systems connect downtowns with suburbs, although several have focused upon downtowns. Representative cities using BRT include Minneapolis, Phoenix, Eugene, Pittsburgh, Miami, Orlando, and Columbus. Orlando operates a BRT that operates solely within the downtown area.



Cleveland Health Line BRT



Kansas City Max BRT

Tram is a technology that operates on tracks, generally along exclusive or shared traffic lanes, similar to BRT. Trams typically include the BRT characteristics identified above, such as traffic signal priority, level boarding, and wider spacing between stops than traditional bus service. The vehicles are longer than traditional buses, usually the length of an articulated bus or longer. Like BRT, most of the North American trams connect downtown with suburbs; however, there are a large number that operate primarily in the downtown area. Example cities with downtown tram service include Kansas City, Little Rock, Portland, Cincinnati, Tacoma, and Tucson.



Kansas City Tram



Houston Tram

Personal Rapid Transit (PRT) technology is primarily a concept at this time, with limited actual application. The operating concept provides direct station-to-station travel that bypasses stops at intermediate locations. A full system would use elevated guideways to provide a network of service across a large geographic area. The vehicles do not require drivers, which potentially reduces operating costs. While there are several companies that are advancing the technology, there is no demonstrated track record of reliability, capital, or operating costs for an urban PRT passenger service.

The University of West Virginia has operated a limited PRT application connecting its dispersed campus facilities with downtown Morgantown for about 30 years. This system allows PRT passengers to bypass intermediate stations; however, the system does not offer the variety of destinations and multiple paths to reach them that take full advantage of the PRT operating concept. Heathrow Airport recently opened a smaller PRT that operates as a shuttle between an airport terminal and two parking ramps.



London Heathrow Airport PRT



University of West Virginia PRT

Automated Guideway Transit (AGT) applications are frequently found in large airports connecting different terminals, parking facilities, and car rental destinations. The vehicles travel rapidly between stops along an exclusive guideway that is either elevated or underground. Like PRT, the AGT vehicles do not require operators, potentially reducing operating costs. Monorail falls within this transit mode category.

Several vendors provide most of the AGT systems, which are proprietary in nature and are not interchangeable. This tends to limit the owner to that vendor for the long term, reducing competition and increasing system vulnerability to the longevity of the vendor. Downtown Miami, Detroit, and Jacksonville are the only cities operating AGT.



Indianapolis Monorail



Miami People Mover AGT

Magnetic Levitation propels inert vehicles using a magnetic field incorporated into an exclusive guideway. This technology can achieve extremely high speeds, making it particularly suitable for inter-city travel. The Shanghai example pictured below is relatively short at 18 miles. There are limited applications internationally, none of which are in the United States. This option must be grade-separated. The technology may be better suited for long trips such as travel between Minneapolis and Rochester, rather than within downtown Rochester.





Shanghai to Pudong Airport Magnetic Levitation

Autonomous Vehicle (AV) transit applications are currently limited; however, major corporations such as Google, Mercedes Benz, Microsoft, and General Motors are rapidly advancing the technology as demonstrated by changes in the automotive industry. Autonomous vehicles can operate in shared or exclusive travel lanes on the surface, below, or above grade. Like PRT, direct station to station service would be a key advantage of this technology. Unlike PRT and AGT, a unique guideway is not required since the vehicles can operate on city streets. Therefore, there will be little risk of becoming limited to a specific vendor for the long term. Several pilot projects are testing autonomous vehicle operation using small transit vehicles such as those shown below.



Easy Mile Autonomous Vehicle



Olli Autonomous Vehicle

Profile Options

Profile refers to the grade at which a technology may operate. Options include surface (ground level), elevated, and subterranean (underground).

Surface operation is generally the easiest, least expensive option to implement because no tunneling or elevated structure is required, both of which can significantly increase costs. It is generally the most accessible option because passengers can board at street level. Special design considerations may be necessary in downtown Rochester to mitigate noise and vibration proximate to medical buildings with sensitive medical equipment.

Elevated operation can have higher travel speeds than surface since the exclusive guideway avoids traffic conflicts. An elevated structure is more expensive than surface construction, although in some instances, that may be partially offset by avoiding utility conflicts that can occur with surface construction. Elevated routes are generally located in office, retail, or high-rise residential areas. Single family residential streets are generally unattractive as elevated guideway routes because the height and scale of the guideway conflicts with the character of the neighborhood. Visual impact may also be a consideration in other areas. Elevated options in downtown Rochester will need to go over or under any skyway pedestrian facilities. Like surface options, they may also require noise and vibration mitigation when close to sensitive medical equipment.

Subterranean (tunnel) operation avoids street level congestion, offering similar travel speed advantages as elevated alternatives. Underground construction is the most expensive of the three options, which limits guideway length when capital budgets are constrained. This may force use of less expensive surface construction elsewhere in the service area if broad geographic coverage is required. Lack of guideway visibility from the street can make this transit service less apparent to potential riders.

Preliminary Screening of Modes

Several of the initial transit modes can be eliminated from further consideration based upon their technical maturity and operating requirements. PRT has no demonstrated service record beyond the limited application at the University of West Virginia. The proprietary nature of the technology is particularly unattractive due to reliance upon a single vendor for expansion of the system or replacement of parts. Autonomous vehicle technology offers the prospect of the same operational capabilities promised by PRT, at a lower cost, with more flexibility, and no proprietary limitation.

For these reasons, PRT was eliminated from further consideration in this analysis.

Magnetic levitation is a proven technology but with application generally limited to longer trips than will be applicable in downtown Rochester. The proprietary nature of the technology further reduces its attractiveness for Rochester. For these reasons, magnetic levitation was eliminated from further consideration.

Application of Modes to Routes and Profiles

The characteristics of the individual transit modes determine their applicability to different operating conditions as outlined below.

- **Moving Sidewalks** are generally best suited for a weather-protected environment such as a tunnel. Any tunnel application will generally result in a relatively short facility due the high construction expense of the tunnel itself. Its relatively slow operating speed also limits this mode's applicability for long distances.
- **BRT and Tram** can operate in exclusive or shared traffic lanes, making surface streets the most cost-effective location option for these modes. They can also operate in a tunnel or on an elevated guideway, but are usually used at the surface level to reduce cost and optimize access.
- **AGT** requires a unique guideway that must be grade-separated from other transportation modes. Most AGT operation is above or below grade.
- **Autonomous Vehicles** currently under development will be able to operate in almost any environment. Physical or operational specifications such as axle width, vehicle height, and capacity may be identified for specific subterranean and elevated applications.

Mixing profiles (surface, elevated, subterranean) can provide the opportunity to operate several types of modes within a system, but introduces transfers at different grades which is onerous to the passenger, reducing ridership potential.

Tier 1 Alternatives Description

The transit alternative development process began with a review of the tram proposed in the *DMC Development Plan*. The tram concept was further defined and adjusted based upon changes that have occurred in downtown Rochester since completion of the *DMC Development Plan*. The revised DMC proposed circulator is referenced in this report as the DMC Modified Tram, reflecting modifications and expanding vehicle options. The subsequent transit alternatives developed in Tier 1 are original to this transit study, and are referred to as Scenarios A through D as described below.

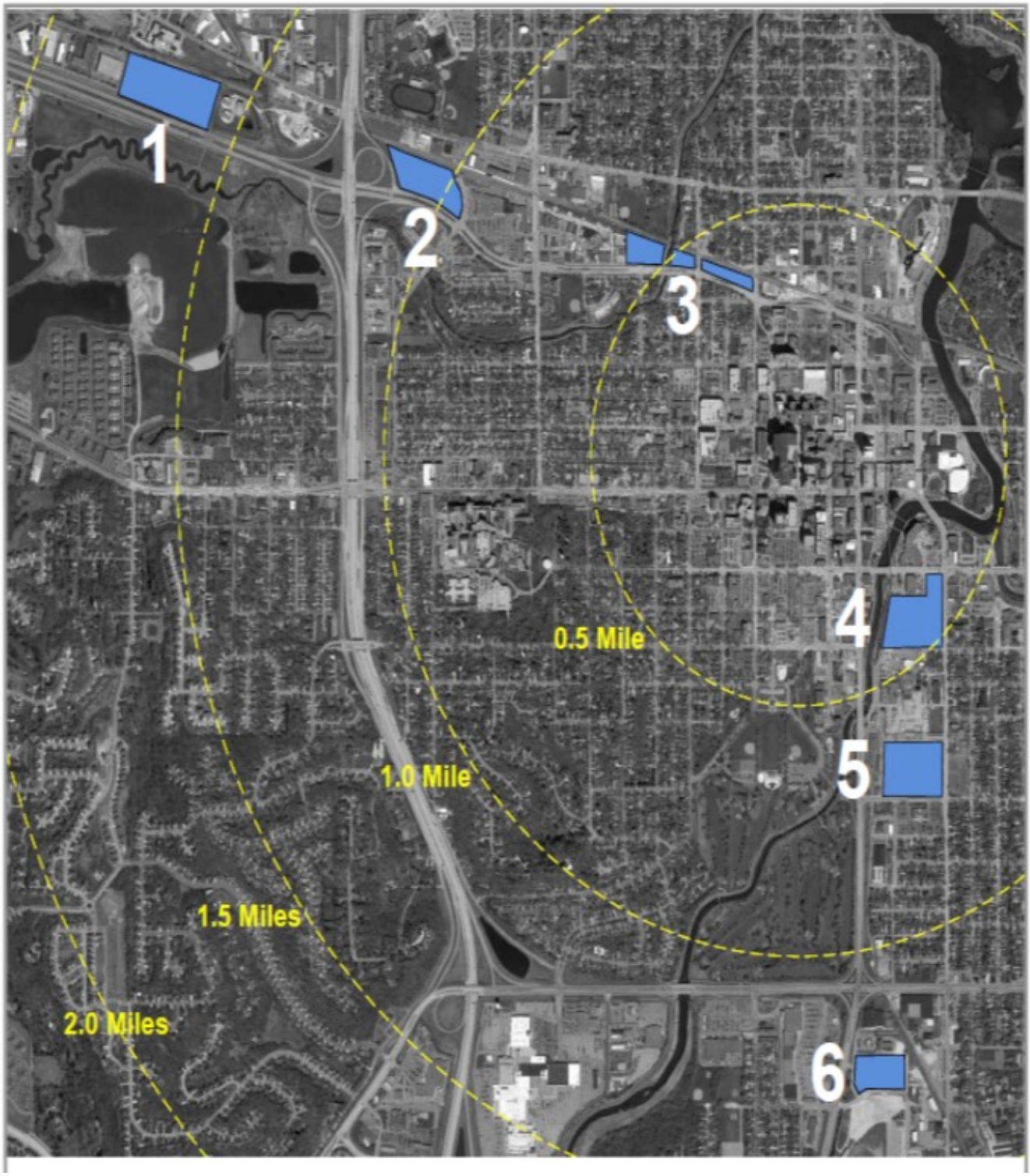
The Tier 1 route options connect the peripheral and remote parking locations and activity centers discussed earlier. Each of the proposed Tier 1 alignments reach one or more of the peripheral and remote parking locations. The parking locations are shown in **Figure 3.** In addition to storing commuter cars, these parking ramps may also serve as a mobility hub. The hub provides a high level of shelter and amenities to passengers transferring to and between circulator, PTN, express bus, and regional buses. The hub locations vary by alternative.

Each of the parking facilities in **Figure 3** is designed and located to intercept auto commuters as they approach downtown. Sites 1, 5, and 6 are considered "remote" since their distance from downtown is not conducive to walking. All parkers at these sites must rely on a transit shuttle to complete their trips. The remaining ramp locations are close enough for some ramp patrons to complete their trip by walking, depending on their destination. Others will use the transit shuttle. These parking locations are referred to as "peripheral."

All of the Tier 1 routes use the segment of 2nd Street SW between 11th Avenue SW and 4th Avenue SW, providing the Mayo Clinic linkage between St. Marys Hospital and the Gonda building. Connections to other circulation destinations such as Discovery Square, UMR, and the Civic Center vary by transit scenario.

In addition to meeting the service needs of the three travel markets, the Tier 1 alternatives were structured to provide a variety of route, mode, and profile options for consideration in selecting three alternatives for detailed development. Each of the route and profile options is paired with appropriate modes, as discussed below. The alternatives are grouped based upon profile: surface (at-grade), subterranean (tunnel), or elevated.

Figure 3. Peripheral and Remote Commuter Parking Locations



Surface Options

The street-level option modes include BRT and tram. Both of these modes can coexist safely and effectively with pedestrian, bicycle, and auto travel along local streets. In contrast, moving sidewalks and AGT are not practical surface applications within street right-of-way because of the need to isolate their guideways from other activity such as bikes and cars. Autonomous vehicles are not included in the surface option at this time but may be incorporated as the alternatives advance. Three surface options are described below, including a modified version of the proposed DMC streetcar.

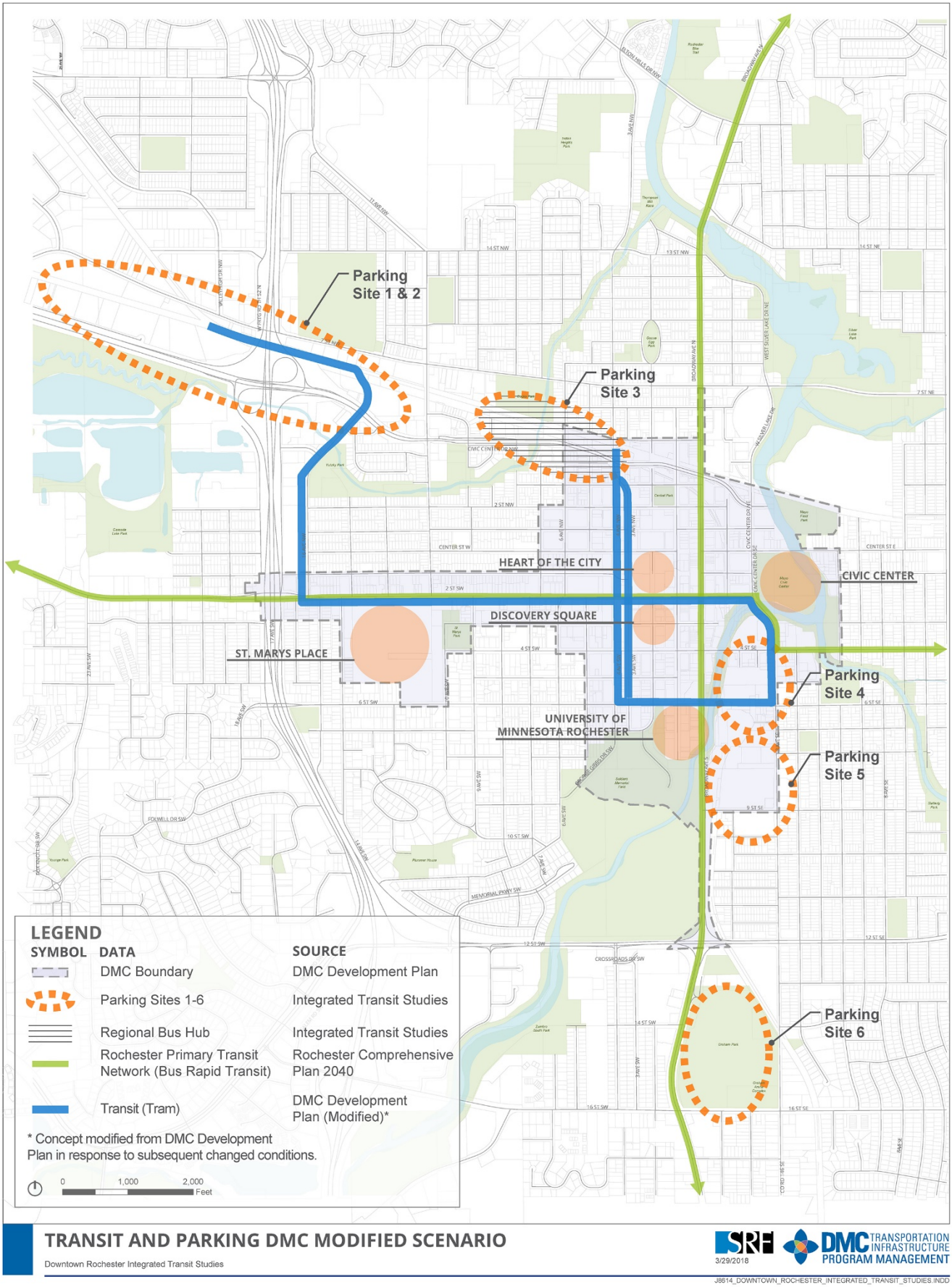
DMC Modified Tram

The DMC Modified Tram generally follows the same route as proposed in the *Master Plan*, with two exceptions:

- The northwest leg of the route was extended north along 16th Avenue NW to Civic Center Drive NW. The route follows the freight railroad right-of-way north of the Civic Center to reach parking site 1.
- The North/South Loop using 1st and 3rd Avenues NW/SW was modified due to plans to make 1st Avenue more pedestrian focused. Instead of running as a loop, the North/South element runs north on 3rd Avenue and returns south on 4th Avenue.

This alternative is shown in **Figure 4**. As indicated above, the route extends from parking site 1, following the freight rail right-of-way paralleling 7th Street NW. The route turns south across Civic Center Drive and travels down 16th Avenue NW to 2nd Street SW. The route continues east on 2nd past St. Marys through downtown and across the Zumbro River along 3rd Avenue SE. The alignment serves parking site 4, and crosses the river on a new transit bridge following 6th Street. The route then runs to 3rd Avenue SW, turning north to Civic Center Drive, reaching parking site 3, and then returning south again along 4th Avenue and retracing its path back to parking site 1. Each of the circulators reverse their routes, providing service in both directions.

Figure 4. DMC Modified Tram



Scenario A (BRT, Tram)

This alternative, shown in **Figure 5**, also begins at parking site 1. It follows the freight railroad right-of-way past 16th Avenue NW, turning south on 11th Avenue NW. The route then turns east on 2nd Street SW at St. Marys Place and continues east across the river to 3rd Avenue SW. This option then stays on the east side of the Zumbro River, reaching parking site 4 and continuing further south to parking site 5. Service then reverses direction along the same route. The dashed line on **Figure 5** shows how the route could be extended to reach parking site 6. This alignment alternative supports two different transit modes, BRT and tram.

Subterranean Options

As noted earlier, subterranean alignments are the most expensive to construct. Therefore, the tunnel was applied only to a portion of the East/West route, which has an existing ridership base (Mayo Clinic Shuttle) and may support the increased construction cost. To minimize the East/West tunnel size and cost, two modes were selected that have the smallest vehicle and guideway dimensions: moving sidewalks and autonomous vehicles. This reduces the size of the tunnel and its construction cost compared to the other modes, and may reduce costly utility conflicts. In addition, the moving sidewalk and autonomous vehicle modes do not require underground space for vehicle maintenance and storage, further reducing the need for underground construction.

Scenario B (Autonomous Vehicle and BRT)

Although this alternative is classified as subterranean, it is a combination of both tunnel and surface elements (**Figure 6**). Initially, both moving sidewalk and autonomous vehicles were considered for a tunnel link between St. Marys and the Gonda Building traveling under 2nd Street SW. The route meets with the surface element at its eastern end. The moving sidewalk was eliminated because of the potential need for non-ambulatory passengers between the Mayo facilities. The autonomous vehicle would provide the Mayo connection in this option.

Figure 5. Scenario A (BRT and Tram)

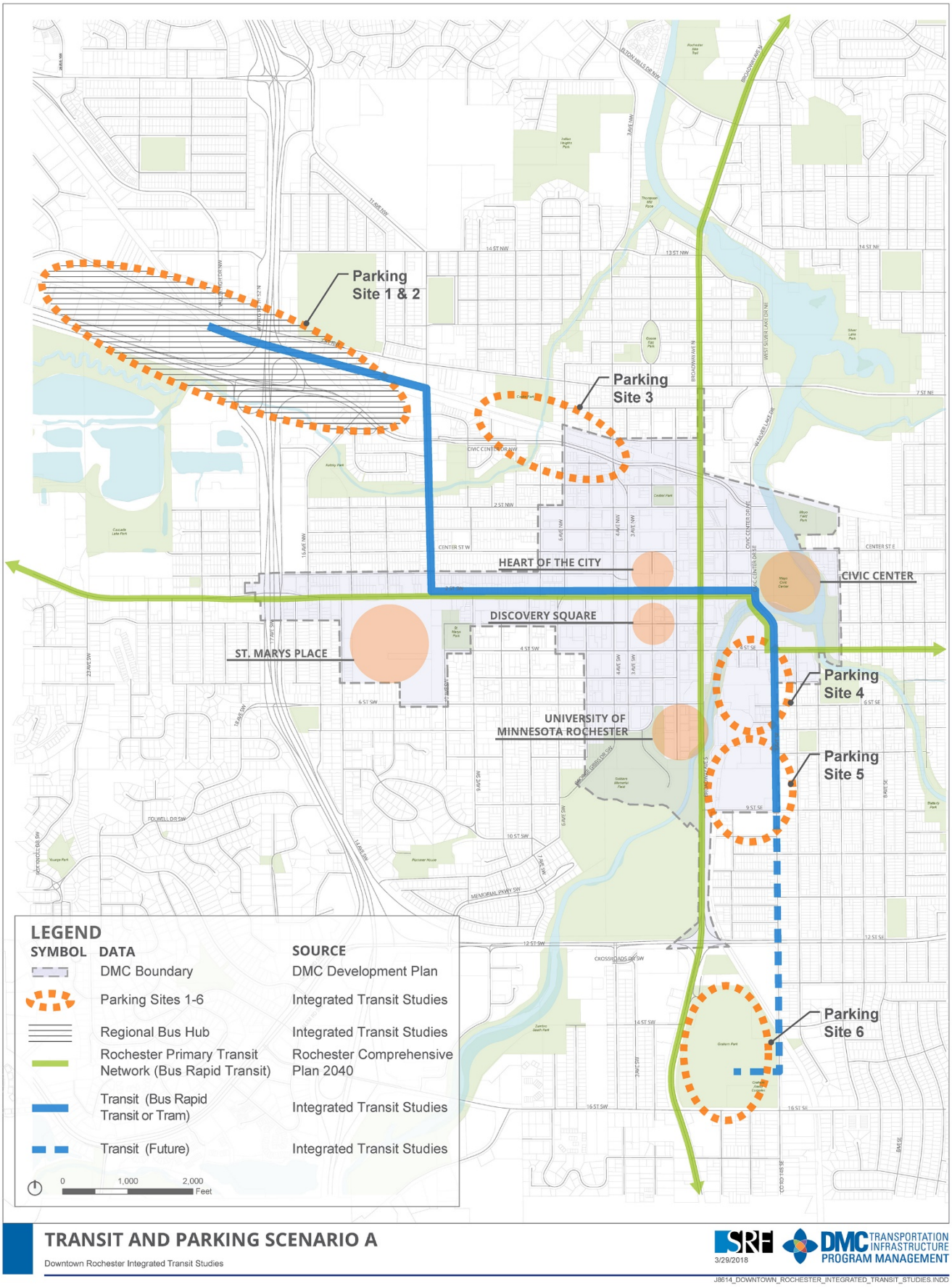
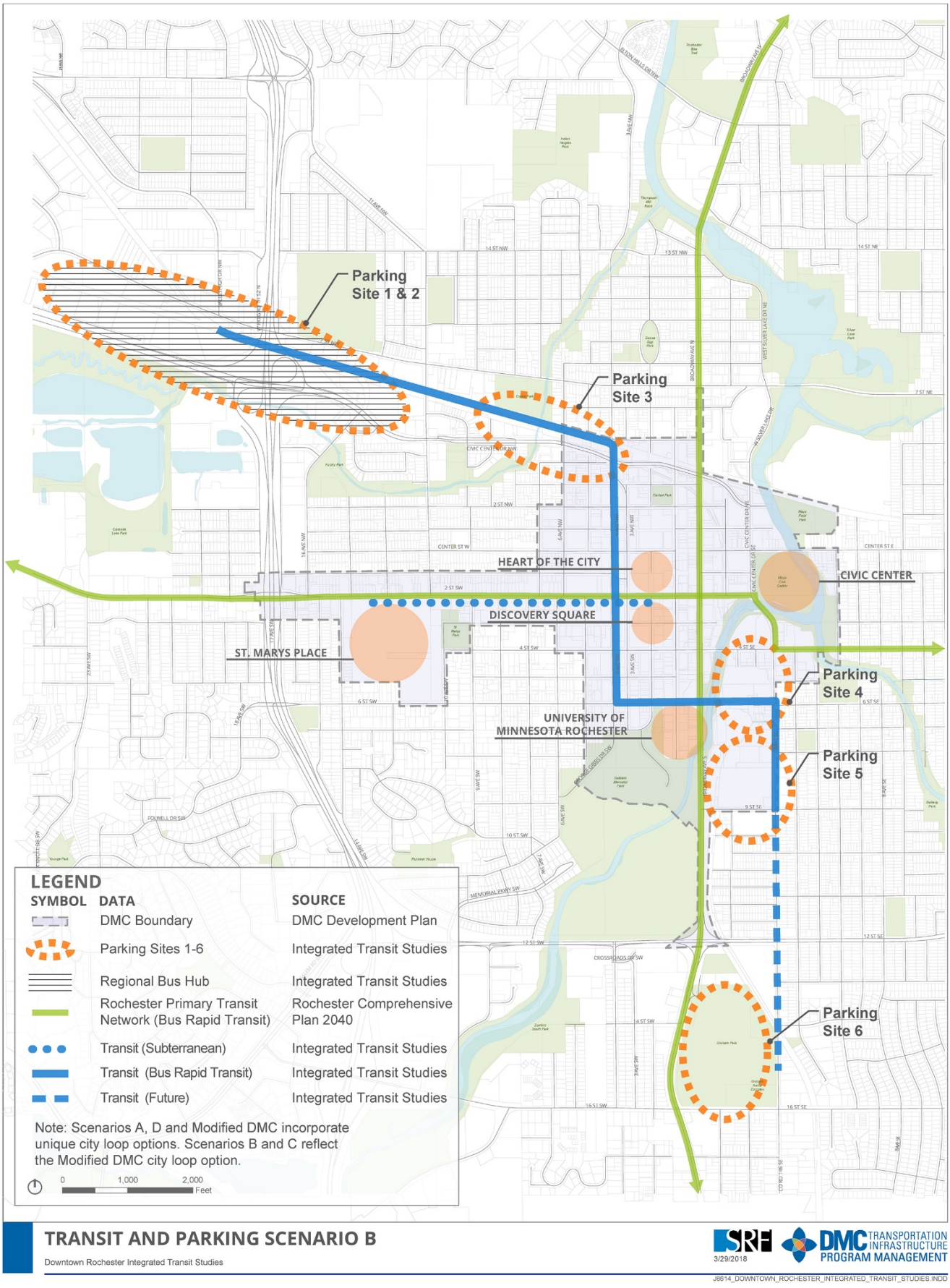


Figure 6. Scenario B (Subterranean)



Similar to the DMC Modified and Scenario A alternatives, the BRT portion of this option begins at parking site 1. The alignment extends east along the freight railroad right-of-way, but continues to 4th Avenue NW before turning south. The route then extends to 6th Street SW, following 6th Street across the Zumbro River using a new transit bridge. The alignment turns south at 3rd Avenue SE, ending at parking site 5. Additional parking is available at site 4. This option could be extended further south to parking site 6 to take advantage of the existing parking at that location, the fairgrounds. Service reverses at the end of the line and returns to parking site 1.

The surface portion of this route includes two modal options: BRT and tram. A transfer would occur between the surface and subterranean elements from stations proximate to the Gonda building.

Elevated Options

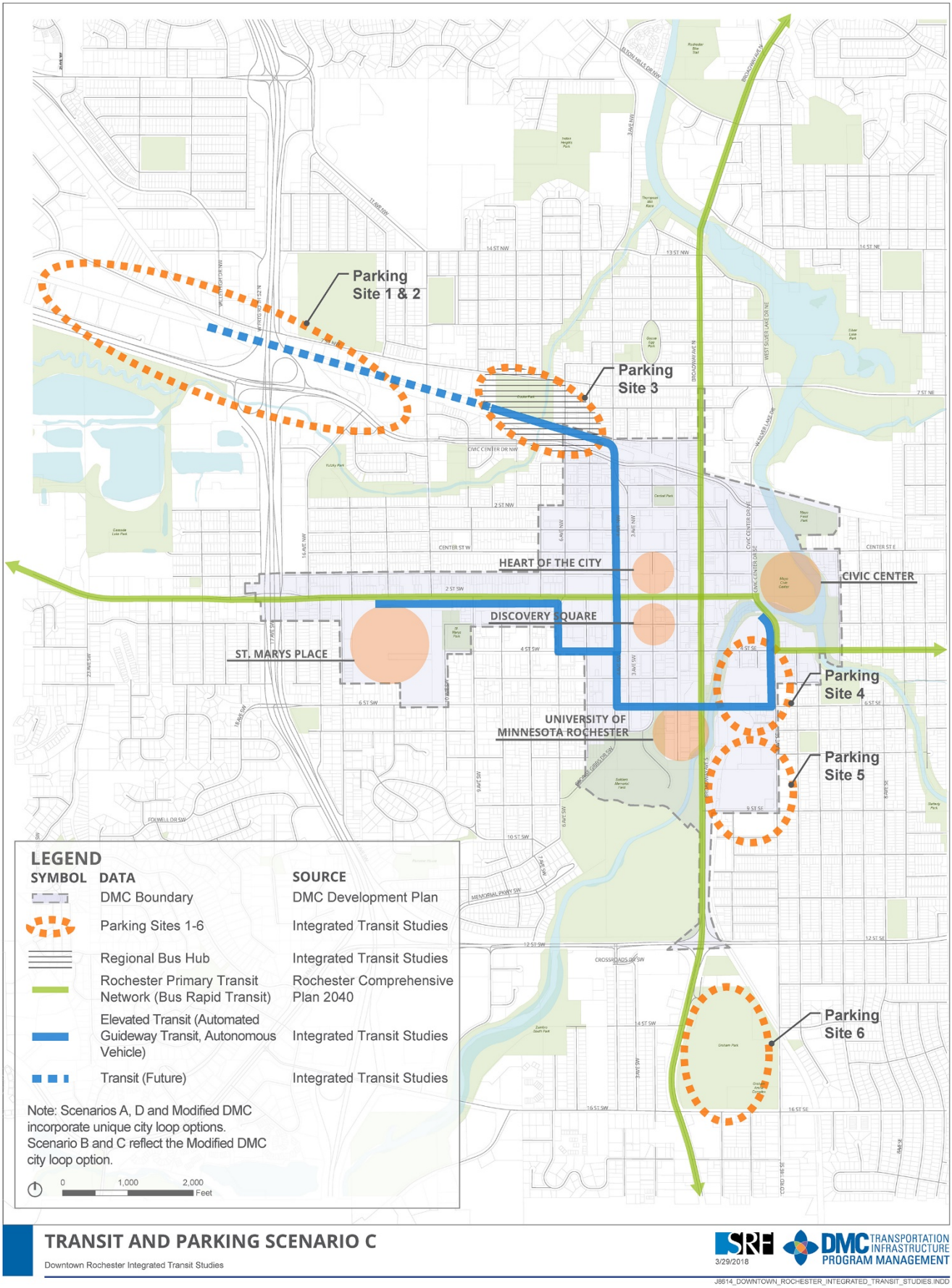
All of the modes discussed in this report could operate on an elevated guideway; however, the Tier 1 elevated alternatives include only AGT and autonomous vehicles. Elevated moving sidewalks were not considered due to the desire for weather protection. BRT and tram applications are generally elevated only in limited circumstances, for example, to avoid a freight railroad crossing or heavy auto traffic, and were not considered here.

Scenario C (AV, AGT)

Similar to Scenario B, this configuration consists of two elements: an east/west line extending from St. Marys to downtown, and a north/south route covering the remainder of the service area (**Figure 7**). For this alternative, however, the modes and profiles are the same for both options. A transfer would be needed between AGT routes, in order to avoid the major aerial structure that would be required to facilitate AGT turns between the segments. An autonomous vehicle interface allowing the turning movements would be substantially smaller but would still create a substantial visual impact over the street. The turning capability removes the need for transfers between AV vehicles, however.

The east/west route generally parallels 2nd Street from St. Marys Place, turning south at 6th Avenue SW and then east at 4th Street SW to a station serving Discovery Square and allowing AGT transfers to the north/south line. The elevated Discovery Square station will be larger than others to accommodate transfers. Shifting the east/west route from 2nd Street SW to 4th Street SW avoids the visual impact of this large station on 2nd Street.

Figure 7. Scenario C Elevated



The north/south element of Scenario C begins at parking site 3. This route could be extended west along Civic Center Drive to parking site 1 to provide additional commuter parking capacity at a later time.

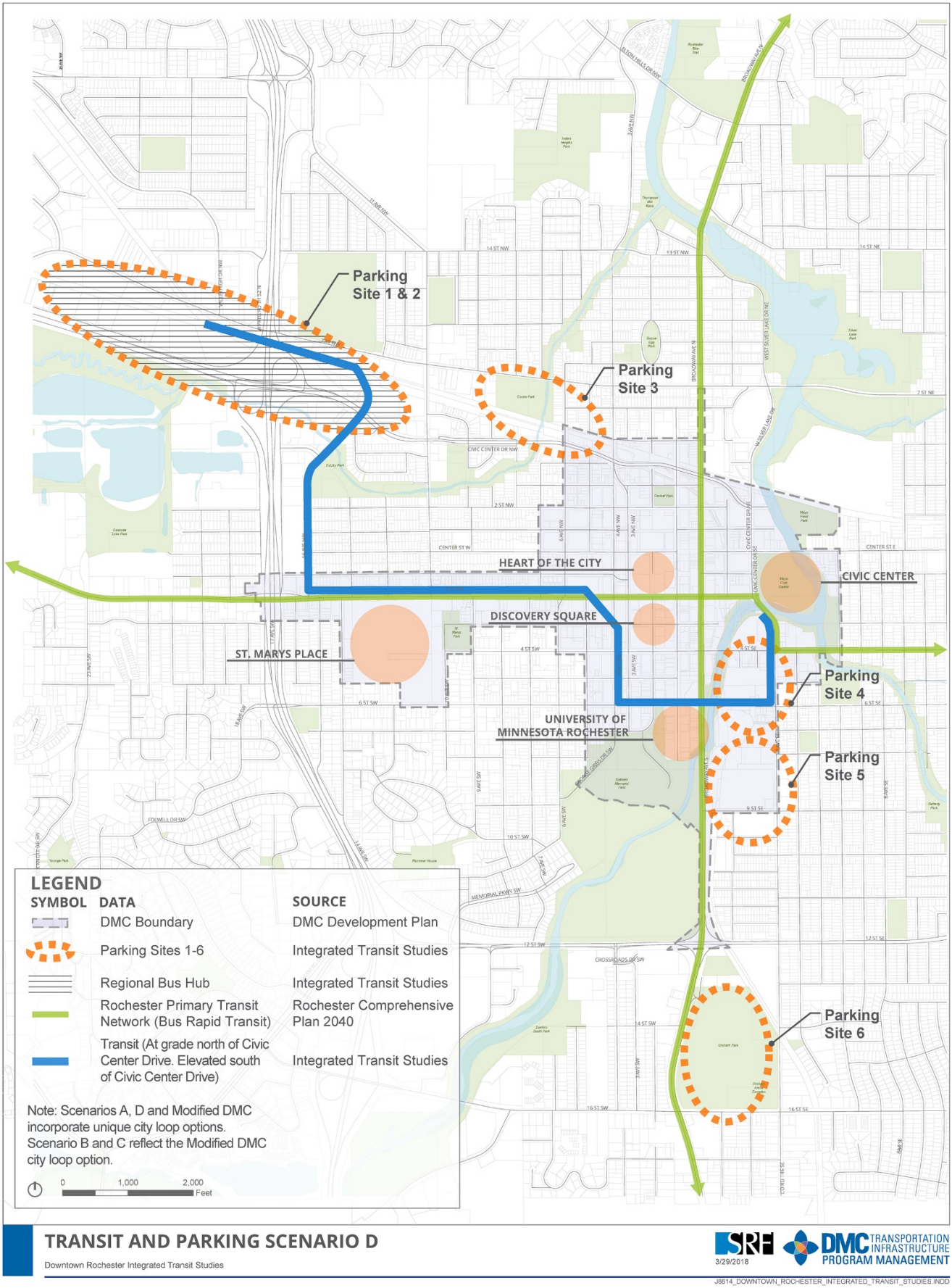
In its initial stage, the route continues south from site 3 along 4th Avenue to 6th Street SW and then goes east along 6th crossing over the Zumbro River on its own structure. The route turns north along 3rd Avenue SE, passing through parking site 4 and ending at the Government Center. Service reverses at the end of the line and returns to parking site 3. As noted earlier, this scenario includes both autonomous vehicle and AGT modal options.

Scenario D (Autonomous Vehicle, AGT)

This scenario follows a combination of the routes reflected in the DMC Modified and Scenario C options. The route starts at parking site 1 and follows the freight rail right-of way parallel to 7th Street NW, crossing over the railroad and Civic Center Drive at 16th Avenue NW. The route continues along 16th Avenue to 2nd Street SW (**Figure 8**). At 5th Avenue SW, the route crosses diagonally southeast through the block until reaching 4th Avenue SW. This alignment presumes that an elevated transit station would be incorporated into redeveloped property on that block.

After entering the 4th Avenue SW right-of-way, the route continues south to 6th Street SW, where it turns east and crosses over the Zumbro River on a new bridge. The route then turns north along 3rd Avenue SE, passing through parking site 4 and ending at a station adjacent to the Government Center. AGT service reverses at the end of the line and returns to parking site 1. Autonomous vehicles respond to specific trip requests and may or may not reverse direction depending upon the next trip request.

Figure 8. Scenario D Elevated



Evaluation of Tier 1 Alternatives

The Tier 1 alternatives provide a broad range of route, mode, and profile options for consideration in selecting three options for detailed development. The evaluation criteria applied to the Tier 1 alternatives are generally qualitative in nature. The Tier 2 evaluation includes additional quantitative criteria commensurate with their increased detail.

Tier 1 Evaluation Criteria

The Tier 1 evaluation criteria are described in **Table 1** below.

Table 1. Tier 1 Evaluation Criteria

Criteria	Description
Connectivity to circulator Parking	Number of circulator parking spaces within 5, 10, and 15 minutes travel time to St. Marys, Heart of City, and Discovery Square
Service Quality: Mayo Clinic Connection	Circulator travel time from St. Marys to Gonda Building, service frequency, reliability, and comfort
Service Quality: DMC Internal Circulation	Availability of shuttle in both east/west and north/south directions, number of employees proximate to circulator stations
Potential Visual, Noise, Historic Building Impacts	Impacts of guideway, vehicles, and power supply on adjacent land uses
Ability to Attract DMC Development	Quality of service and level of investment
At-grade Right-of-way Requirement	Space required at street level for travel route
Ease of Access from Street Level	Grade changes needed to access the circulator stations from street level
Ease of Access from Subway and Skyway Levels	Grade changes needed to access the circulator stations from subway or skyway levels
Service Simplicity	Ability for new riders to understand the system with minimal or no guidance
Scalability	Ability to increase service frequency by time of day
Ability to Extend Service	Ability to increase length of system (cost and duration to complete)
Capital Cost	Order of magnitude cost for construction, vehicles, and maintenance facility based upon industry experience, on per mile basis
Operating and Maintenance Cost	General needs for operating and maintenance expenditures based upon nature of route and mode
Potential for Public Funding	Likelihood of alternative to attract federal funding, based upon past experience for similar projects

Tier 1 Evaluation Results

The evaluation criteria were applied to each of the Tier 1 alternatives. The evaluation results and recommendations are summarized in **Table 2**.

The Tier 1 evaluation results were used to narrow the range of alternatives from eight to three. Several route options were advanced and the number of modes was reduced from five to three with the elimination of AGT and moving sidewalk. The AGT option was significantly higher in cost and did not provide any significant advantage over autonomous vehicles in the elevated options. The subway was eliminated due to excessive cost. The rationale for selection of the three alternatives recommended for further analysis is summarized below.

DMC Modified Scenario (Tram)

- Connects three commuter parking sites with St. Marys and downtown destinations
- Provides access to and between all key DMC destinations
- Rail investment is highly attractive to private development
- Surface street operation reinforces activity at street level
- Establishes a high investment option for comparison purposes

Scenario B (BRT)

- Introduces a lower-cost mode for comparison with tram
- Connects three commuter parking sites with St. Marys and downtown destinations; potential to extend to a fourth parking site
- Provides access to most key DMC destinations; opportunity to consider trade-offs
- BRT is moderately attractive to private investment
- Surface street operation reinforces activity at street level
- Provides greatest opportunity for phasing and extendibility

Scenario D (Autonomous Vehicle)

- Elevated option introduces higher speed and service reliability
- Connects two commuter parking sites with St. Marys and downtown destinations
- Less impact on ground level right-of-way resources
- May be highly attractive to private development
- Ability to add at-grade service extension

This page is intentionally blank.

Table 2. Evaluation Summary for Tier 1 Alternatives

TRANSIT OPTIONS

		ADVANCE FOR FURTHER STUDY	ADVANCE FOR FURTHER STUDY					ADVANCE FOR FURTHER STUDY	
		MODIFIED DMC STREETCAR DEDICATED LANES	SCENARIO A (AT-GRADE DEDICATED LANES)		SCENARIO B (SUBTERRANEAN AV / AT-GRADE BRT)	SCENARIO C (ELEVATED)		SCENARIO D (AT-GRADE/ELEVATED)	
	SCREENING CRITERIA		BRT	TRAM		AV	AGT	AV	AGT
1	Market 1: Connectivity to Peripheral Parking	HIGH PARKING ACCESS	HIGH PARKING ACCESS	HIGH PARKING ACCESS	GOOD PARKING ACCESS	OK PARKING ACCESS	OK PARKING ACCESS	GOOD PARKING ACCESS	GOOD PARKING ACCESS
2	Market 2: Mayo Connection	MEDIUM FREQUENCY	HIGH FREQUENCY	MEDIUM FREQUENCY	HIGH FREQUENCY	HIGH FREQUENCY, GRADE SEPARATION	LOW FREQUENCY, GRADE SEPARATION	HIGH FREQUENCY, GRADE SEPARATION	HIGH FREQUENCY, GRADE SEPARATION
3	Market 3: DMC Internal Circulation	N/S AND E/W CIRCULATION, HIGH EMPLOYMENT SERVED	E/W CIRCULATION ONLY, HIGH EMPLOYMENT SERVED	E/W CIRCULATION ONLY, HIGH EMPLOYMENT SERVED	N/S AND E/W CIRCULATION AT DIFF GRADES, HIGH EMP	N/S AND E/W CIRCULATION, ELEVATED, HIGH EMP	N/S AND E/W CIRCULATION, ELEVATED, HIGH EMP	E/W ONLY CIRCULATION, ELEVATED	E/W ONLY CIRCULATION, ELEVATED
4	Potential Visual, Noise, Historic Building Impacts	POSSIBLE OVERHEAD WIRES ON 2 MAIN STREETS	LIMITED IMPACTS	POSSIBLE OVERHEAD WIRES ON 1 MAIN STREET	LIMITED IMPACTS	ELEVATED GUIDEWAY	ELEVATED GUIDEWAY	ELEVATED GUIDEWAY	ELEVATED GUIDEWAY
5	Ability to Attract DMC Development	HIGH QUALITY VERY HIGH INVESTMENT MODE BIAS HIGH	HIGH QUALITY MODERATE INVESTMENT MODE BIAS MEDIUM	HIGH QUALITY HIGH INVESTMENT MODE BIAS HIGH	HIGH QUALITY HIGH INVESTMENT (AV) MODE BIAS MEDIUM	HIGH QUALITY HIGH INVESTMENT MODE BIAS UNTESTED	MODERATE QUALITY HIGH INVESTMENT MODE BIAS HIGH	HIGH QUALITY HIGH INVESTMENT MODE BIAS UNTESTED	HIGH QUALITY VERY HIGH INVESTMENT MODE BIAS HIGH
6	At-grade Right-of-Way Requirement	ROW ON 2 MAIN STREETS	ROW ON 1 MAIN STREET	ROW ON 1 MAIN STREET	ROW ON 1 MAIN STREET	ONLY PIERS	ONLY PIERS	ONLY PIERS	ONLY PIERS
7	Ease of Access from Street Level	ON STREET	ON STREET	ON STREET	N/S ON STREET	ALL ELEVATED	ALL ELEVATED	ALL ELEVATED	ALL ELEVATED
8	Ease of Access from Skyway/ Subway Levels	ON STREET	ON STREET	ON STREET	PART SUBTERRANEAN	ALL ELEVATED	ALL ELEVATED	ALL ELEVATED	ALL ELEVATED
9	Service Simplicity	EASY TO FIND, USE	EASY TO FIND, USE	EASY TO FIND, USE	SURFACE EASY, SUBWAY MORE DIFFICULT TO FIND	EASY TO FIND INITIALLY COMPLEX TO USE	EASY TO FIND INITIALLY COMPLEX TO USE	EAST TO FIND INITIALLY COMPLEX TO USE	EASY TO FIND, USE
10	Scalability (ability to vary capacity/frequency by time of day)	LESS CAPACITY FLEXIBILITY THAN BRT	HIGH FLEXIBILITY	LESS CAPACITY FLEXIBILITY THAN BRT	HIGH FLEXIBILITY	HIGH FLEXIBILITY	LIMITED ABILITY TO ALTER CAPACITY	HIGH FLEXIBILITY	LESS CAPACITY FLEXIBILITY THAN BRT
11	Ability to Extend Service	EXPENSIVE TO EXTEND	INEXPENSIVE TO EXTEND	EXPENSIVE TO EXTEND	BRT INEXPENSIVE AV EXPENSIVE TO EXTEND	INEXPENSIVE TO EXTEND	VERY EXPENSIVE TO EXTEND	INEXPENSIVE TO EXTEND	VERY EXPENSIVE TO EXTEND
12	Order of Magnitude Capital Cost (Millions $2016)	$240-380	$35-110	$215-290	$100-180	$140-230	$175-345	$160-260	$225-450
13	Operating & Maintenance Cost	COMPLEX SYSTEM SUBSTANTIAL STAFFING	MODERATE TECHNOLOGY MODERATE STAFFING	COMPLEX SYSTEM SUBSTANTIAL STAFFING	MODERATE TECHNOLOGY MODERATE STAFFING	MODERATE TECHNOLOGY LIMITED STAFFING	COMPLEX SYSTEM SUBSTANTIAL STAFFING	MODERATE TECHNOLOGY LIMITED STAFFING	COMPLEX SYSTEM SUBSTANTIAL STAFFING
14	Potential for Public Funding	HIGH FUNDING NEEDS NUMEROUS PROJECTS FUNDED	MODERATE FUNDING NEEDS NUMEROUS PROJECTS FUNDED	HIGH FUNDING NEEDS NUMEROUS PROJECTS FUNDED	MIX OF MODERATE AND HIGH NEEDS FUNDING MIXED	MODERATE/HIGH FUNDING NEEDS LIMITED FUNDING RECORD	VERY HIGH FUNDING NEEDS NO RECENT FUNDING	MODERATE/HIGH FUNDING NEEDS LIMITED FUNDING RECORD	VERY HIGH FUNDING NEEDS NO RECENT FUNDING

This page is intentionally blank.

Development of Tier 2 Alternatives

The Tier 2 analysis advanced the three recommended Tier 1 alternatives through conceptual design in coordination with the Street Use, Parking and Travel Demand Management, and City Loop Studies. Conceptual engineering was conducted for the three alternatives to more fully develop their service and cost characteristics and to identify likely implementation impacts.

Tier 2 Alternatives Conceptual Design Process

Study Integration

The first step of this process was to determine whether there were any changes necessary to what had been proposed during the earlier phases. The consultant team developed conceptual engineering drawings based on cross sections developed in Tier 1 and continued to refine these with comments from the project team as well as utilizing best practices developed within the *Rochester Destination Medical Center District Design Guidelines.*

The concept drawings were used by the project team to identify potential impacts and coordination points among the four studies and to prioritize elements and make decisions on route and street use. As the study continues into the selection process, portions of each study may be combined with others to create a hybrid option and ultimately guide a cost estimate for the project that is advanced towards implementation.

Guideway Design Process

The conceptual engineering for the recommended route provided a realistic assessment of the physical constraints and impacts associated with the recommended alternative. The design was conducted at a level to allow reasonable assessment of potential issues related to implementation.

During concept development, the initial step included development of an optimal cross section. This cross section was then applied to the route options with some modifications considering right-of-way availability and street use prioritization. Ultimately, each transit option was reviewed by the other study teams to provide a study-wide view of the concept.

Design Assumptions

The following design assumptions were made to create conceptual alignment drawings. During final design, these criteria will be further developed and modified in greater detail. Without survey and detailed engineering, the alignments should be treated as conceptual.

Bus Rapid Transit (BRT)

- Articulated bus approximately 60 feet in length
- 11 foot transit lanes inclusive of lane delineator
- Center running preferred for operational efficiency
- Prefer side platforms to allow flexibility to share stations with local buses
- 10 foot by 80 foot platforms (center platforms 12 foot by 80 foot)
- 2 foot shy zone between platform and general purpose lanes
- Transit signal priority
- Transit only phases required when bus turning movements conflict with general traffic
- Design speed to match roadway speed
- Northern terminus to have elevated station with circulation area for bus turnaround (site to be designed during future phase)
- Southern terminus to allow for buses to turn around on site (site to be designed during future phase)

Tram

- Rail vehicle ranging in length from 60-80 feet
- 11 foot transit lanes to allow guideway to share with buses
- Center running exclusive lane preferred
- Prefer side platforms to allow flexibility to share stations with local buses
- 10 by 80 foot side platforms (center platforms 12 by 80 foot)
- 2 foot shy zone between platform and general purpose lanes
- 66-foot minimum horizontal curve radius
- Vehicle to be selected during later phase (design guideway to accommodate a typical US single streetcar vehicle)
- Transit signal priority

- Transit only phases required when tram turning movements conflict with general traffic
- Design speed to match roadway speed but not to exceed 35 mph through signal-controlled intersections
- Northern terminus to have elevated station within the parking structure. Crossover at-grade to allow turnback operations (to be designed during future phase)
- Terminus in vicinity of Civic Center Drive NW/4th Avenue NW allows storage track for a single vehicle without impeding turnback operations (to be designed during future phase)
- Maintenance facility location (to be determined at a later phase)

Autonomous Vehicle (Elevated)

- Design vehicle is based upon an EZ10 Easy Mile, characteristics expanded to accommodate 30 passengers
- Elevated guideway
- Pier spacing approximately 90-100 feet
- Minimum vertical clearance from lowest point of structure to top of roadway: 16 foot 4 inches
- Pier size: 5 foot by 4 foot 6 inches
- Typical guideway width of 26 feet
    - 9 foot lanes
    - Minimum emergency access route width: 2 foot 6 inches
    - Barrier: 1 foot 6 inches
- Stations
    - Center platforms: 24 feet by 120 feet
    - 1 elevator
    - 1 staircase
    - 9 foot bypass lane
    - 9 foot boarding lane
    - Provide circulation to allow vehicles to reverse direction at each station
- Emergency access stairs to guideway (locations to be determined in future phase)

- Northern terminus to provide internal circulation for vehicles to layover and provides access to maintenance facility within garage

Station Locations

Conceptual engineering drawings show potential station locations for planning purposes only. These locations were used for the initial ridership forecasting and cost estimating. These initial locations were developed based upon the current and anticipated distribution of employment, location of key activity centers, and typical station spacing for a downtown transit operation. The locations are expected to evolve as the project advances, considering site specific characteristics such as right-of-way availability, utility locations, adjacent land uses, and potential joint development with public or private interests.

Tier 2 Alternatives Operations Planning Process

The operating plans for the Tier 2 alternatives considered the wide range of local transit elements that currently serve the transit market. This includes Rochester Public Transit (RPT) direct and express services, private regional express currently provided primarily by Rochester City Lines (RCL), the PTN BRT described below, and the proposed future circulator service. The service frequency for each service is based primarily upon the results from the ridership forecast documented in *Street Use Travel Demand, Traffic and Transit Forecasts Technical Memorandum.* The forecast identifies the number of commuter transit trips and then distributes them based upon parking supply assumptions for each alternative. This distribution is driven by the number of remote and peripheral parking spaces around the downtown area. The transit operating plans are described in detail in *Transit Circulation Study: Transit Operations Plans.*

Alternative Characteristics

Physical and operational characteristics are summarized below for the following alternatives:

- Transit Alternative Phase 1 (TAP 1)
- DMC Modified Tram Alternative
- Scenario A Bus Rapid Transit (BRT)
- Scenario D Elevated Autonomous Vehicle

Transit Alternative Phase I (TAP 1)

This alternative represents the initial phase of the DMC circulator bus service expansion that is needed to meet the growing transit needs of the community, consistent with the transit circulator options described in this report. This service is supplemented by express bus service required to accommodate future DMC commuter demand that exceeds the capacity of the other transit services. Much of this option is drawn from the *City of Rochester Comprehensive Plan 2040 (Draft 2017)* and the *RPT Transit Development Plan 2017-2021*. This alternative establishes a low-capital transit alternative to provide a base for comparison with the proposed future phases of circulator alternatives.

The major components of the TAP 1 alternative are shown in **Figure 9**. New express service originates from five express park-and-ride lots identified on the map, along with possible express routes to downtown. Additional remote park-and-ride facilities are located east and northeast of downtown, but are not anticipated to provide express service. In addition, two PTN BRT routes are shown running north and south, and east and west through downtown. These are low-cost BRT routes offering enhanced service such as branded buses and shelters, higher travel speeds, and expanded amenities. This alternative does not include a circulator, however, the PTN BRT routes address some of the initial phases of circulator service functions within the DMC boundaries.

In addition to the increased fixed-route public bus service, privately operated regional express bus service such as that operated by RCL is anticipated to double in frequency. This combined public and private transit service expansion carries over into the other alternatives with some modifications, dependent upon the unique characteristics of each transit option.

DMC Modified Tram Alternative

Physical Characteristics

Mode: Tram. A single steel wheel on steel rail vehicle similar to the modern streetcar and light rail.

Route: The DMC Modified alternative follows the route shown in **Figure 10**. The route provides service between St. Marys and downtown, and extends to parking sites 1, 3, and 4. It also provides both east/west and north/south circulation within the downtown area. Conceptual engineering of the Tier 1 concept resulted in a small change in this option, shifting the alignment formerly departing from parking site 1 along the rail right-of-way to Civic Center Drive. Each of the Tier 1 circulator routes carried forward were modified in this manner.

Figure 9. Transit Alternative Phase 1 (TAP 1)

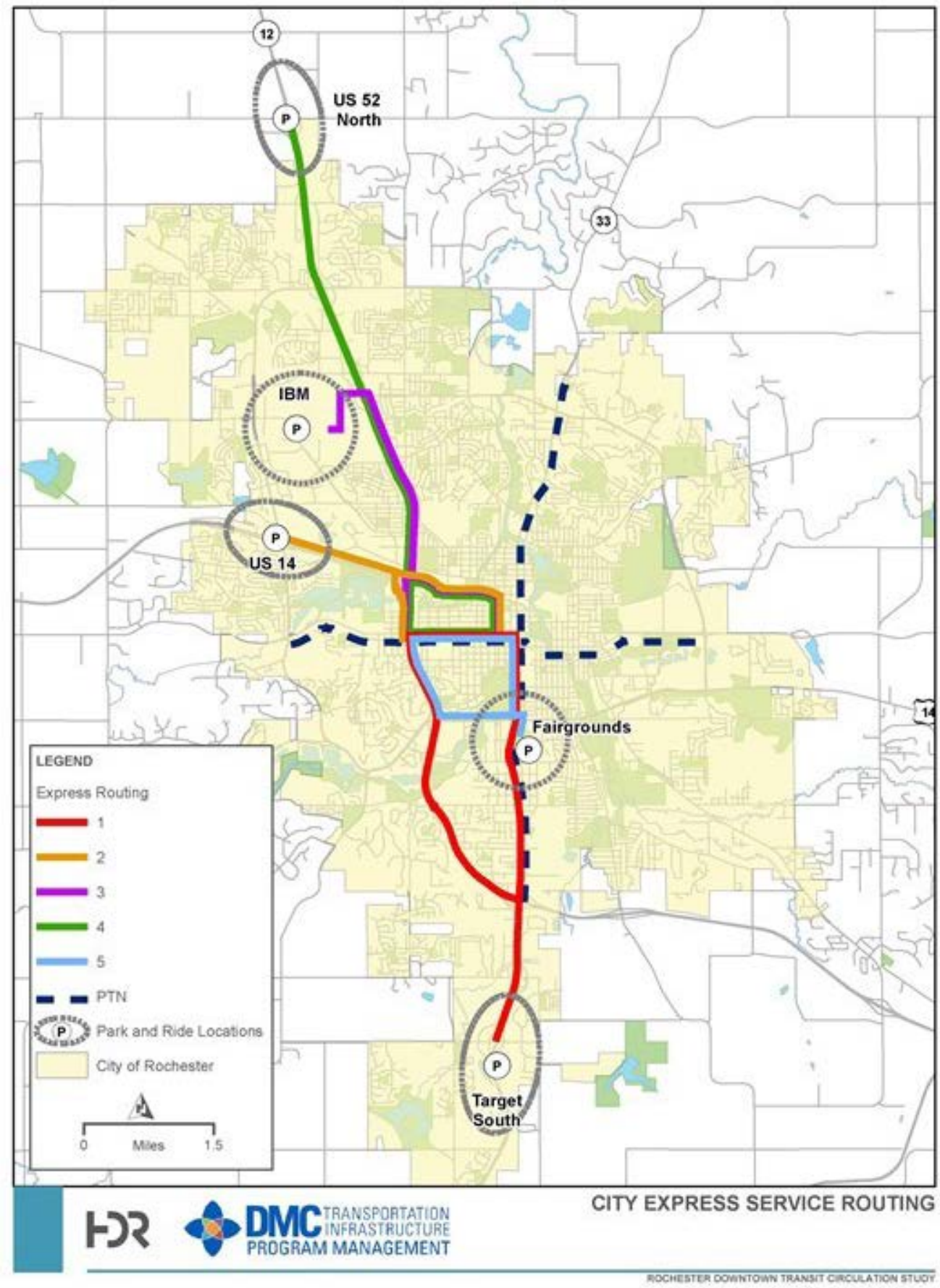
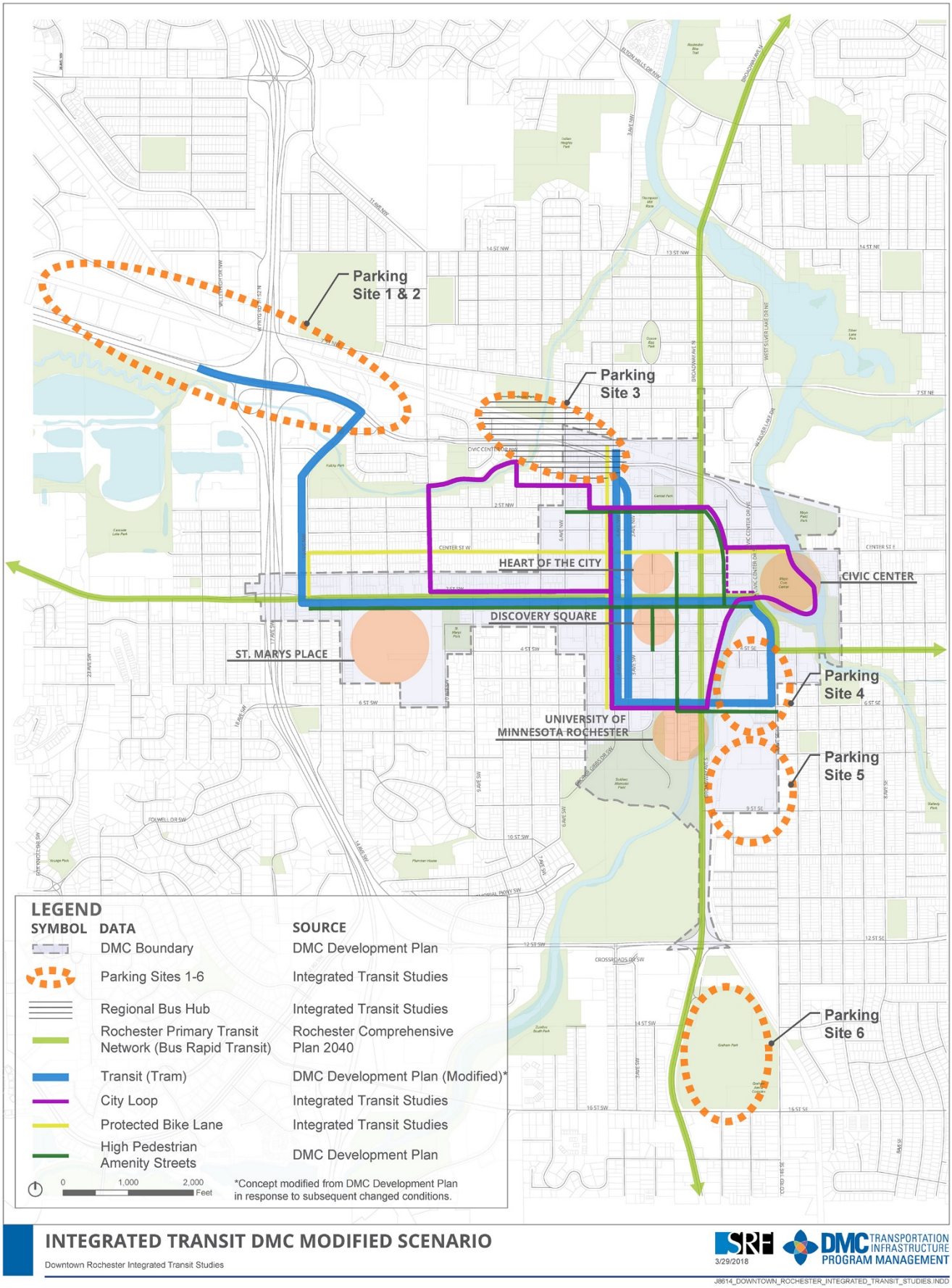


Figure 10. Tier 2 DMC Modified Tram Route



Location within the Street: Generally double track in dedicated lanes located in the center of the street with areas of mixed traffic along 3rd/4th Avenue SW, as follows:

- 0.8 route miles of exclusive guideway (center running)
- 2.7 route miles of semi-exclusive guideway (center running)
- 0.75 route miles of mixed traffic guideway (side running)

Both exclusive and semi-exclusive lanes are used only by transit vehicles. Exclusive transit lanes are totally separated from all other traffic, while semi-exclusive lanes intersect with local streets where auto traffic can cross the transit lane. Mixed traffic lanes are shared by auto, truck, and transit traffic.

Cross Section: The typical section for the DMC Modified option is shown in **Figure 11**. A portion of the route would run in the curb lane as the route splits between 3rd and 4th Avenues as show in **Figure 12**.

Station Locations: The tram stations are preliminarily located at the following locations:

- Within parking site 1
- 16th Avenue SW Between W Center Street and 1st Street SW
- 2nd Street SW/11th Avenue SW
- 2nd Street SW Between 3rd and 4th Avenues
- 2nd Street SW/S Broadway
- 3rd Avenue SE/4th Street SE
- 6th Street SW Between 2nd and 1st Avenues
- 3rd Avenue SW/2nd Street SW
- 4th Avenue SW/2nd Street SW
- 3rd Avenue NW/W Center Street
- 4th Avenue NW/W Center Street
- Within parking site 3

Right-of-way Requirements: Right-of-way will be required for a vehicle maintenance facility, the location of which will be identified at a later design phase. Right-of-way needs will need to be coordinated with the requirements for the Parking, City Loop, and Streets Use studies.

Figure 11. DMC Modified Tram Typical Section in Median

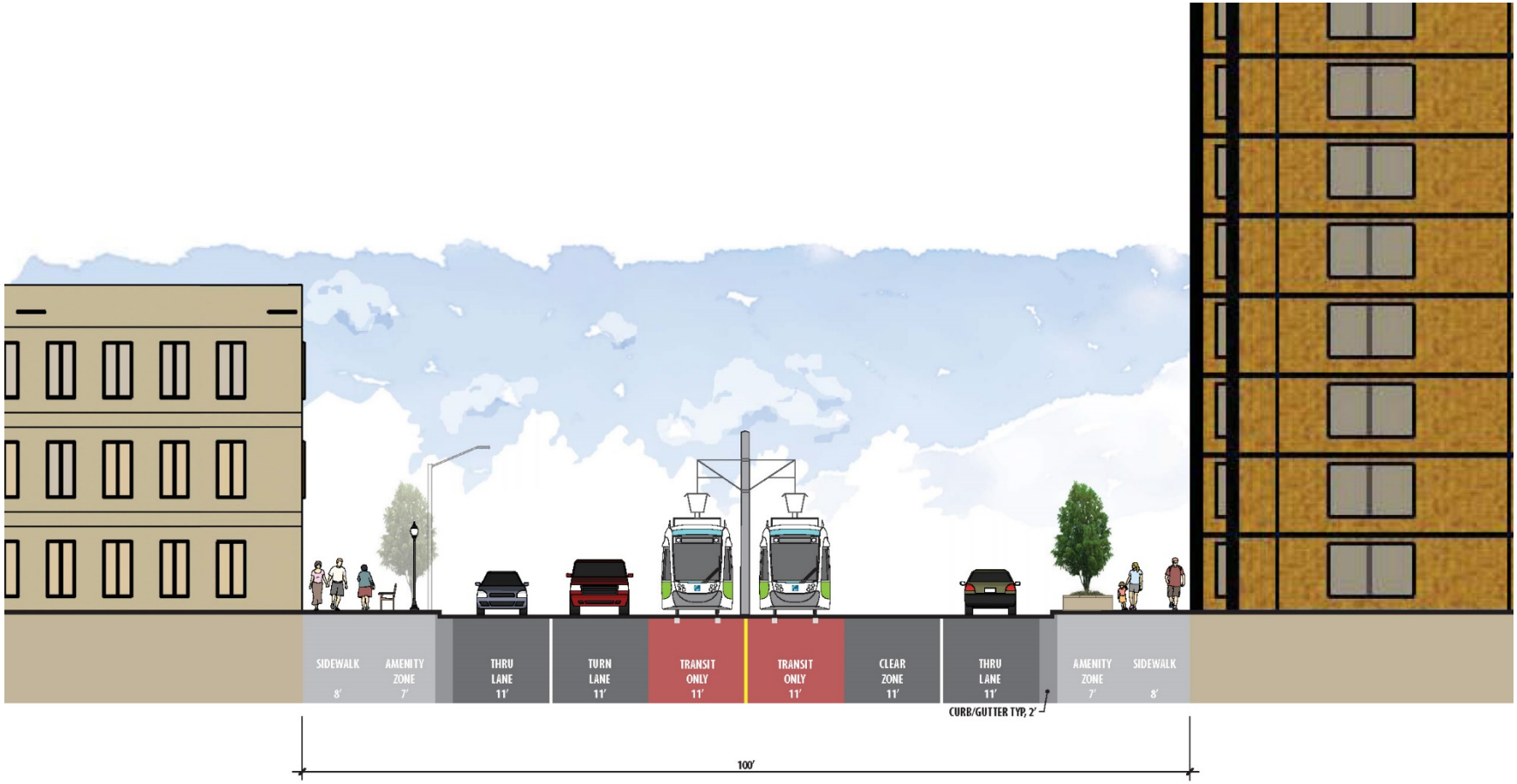
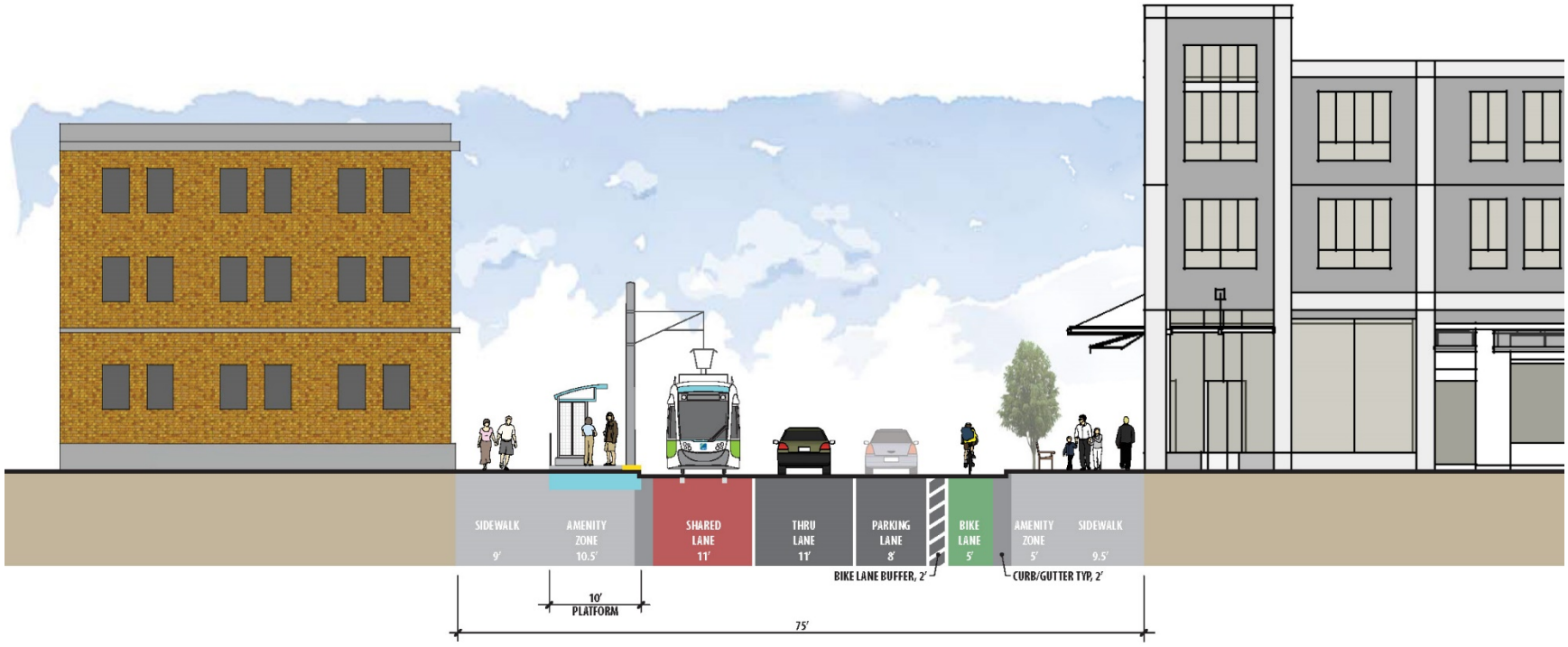


Figure 12. DMC Modified Tram Typical Section in Curb Lane



Tram | 3rd Avenue NW, north of W Center Street

facing north

March 14, 2018

Utilities: A general survey was conducted of utilities that may be impacted by the various alternatives. The analysis is documented in the *DMC Rochester Utility Analysis*. The Tram option is likely to have the most utility impact, followed by the Scenario A BRT and the Scenario D Autonomous Vehicle. When a preferred alternative is identified, additional investigations will be needed to determine the exact location of the utilities. Coordination with each impacted utility company will be necessary to make final determinations of any necessary modifications or relocations and to include these in the overall project schedule. Any new utility construction should take into consideration the *DMC Integrated Transit Plan* to minimize the potential for additional impacts.

Order of Magnitude Capital Costs: The order of magnitude capital cost estimate includes the transit circulator project costs from design through construction and vehicle testing. This includes engineering, utilities, structures, stations, traction power and communication systems, vehicles, fare collection equipment, rights-of-way, professional services, and contingencies.

The TAP 1 PTN BRT cost estimate reflects a general cost per mile for comparable BRT projects. The remaining alternatives which were developed in more detail used the Federal Transit Administration Standard Cost Category (SCC) format, which documents each of the project elements that sum to the total cost. The costs were estimated in both the current year (2017) as well as in the year of expenditure (YoE) dollars, and are based on historic cost data for similar projects. The project costs do not include costs associated with the concurrent studies or betterments, such as realigning the US 14/52 on-ramps. Capital costs are summarized in **Table 3** for all alternatives. These estimates include roadway improvements directly related to the transit guideway, communications, and traffic signal priority. They do not include modifications to adjacent traffic lanes, bridges, or right-of-way costs.

Table 3. Preliminary Capital Cost Estimates for Circulators

Alternative	Length (Route Miles)	Capital Cost ($2017)
TAP 1	10.3	$73.6 M
DMC Modified Tram	4.18	$262.7 M
Scenario A BRT	2.90	$101.1 M
Scenario D Autonomous Vehicle	3.11	$486.4 M

As noted earlier, TAP 1 does not include a distinct circulator element. The TAP 1 cost data in **Table 3** reflects the entire PTN BRT routes which

provide some of the circulator functions. Only a portion of these routes fall within the circulator area.

A detailed summary of the project costs by major SCC cost categories per alternative can be found in the appendix. Once the implementation plan has been developed and the project scope has been determined, it is recommended that an engineering estimate be completed to provide a cost estimate that encompasses that phase of construction.

Operational Characteristics

- Circulator: Tram vehicles operating in dedicated transit lanes on 2nd Street SW and in mixed traffic elsewhere. Vehicles stop at all stations.
- RPT Local Service: Maintains the increase in local bus frequency and span of service identified in the Transit Development Plan (TDP), included in TAP 1. Local bus service will operate in the general traffic lane, not in the transit lane.
- PTN Service: Reduced frequency from TAP 1 due to overlap with new circulator service. The PTN buses will operate in the transit lane with the tram service.
- RPT Express: Significant reduction from TAP 1 because some express riders are assumed to drive to remote and peripheral parking and use circulator. The express buses will operate in the general traffic lane, not in the transit lane.
- Regional Express Service: Change in downtown operations with St. Marys buses using off-street terminals at two new parking ramps (east of St. Marys at 11th Avenue SW and at Discovery Square). Daytime bus staging off-street. Buses may use dedicated transit lane on 2nd Street SW outside of downtown, but will not use stations.

Scenario A BRT

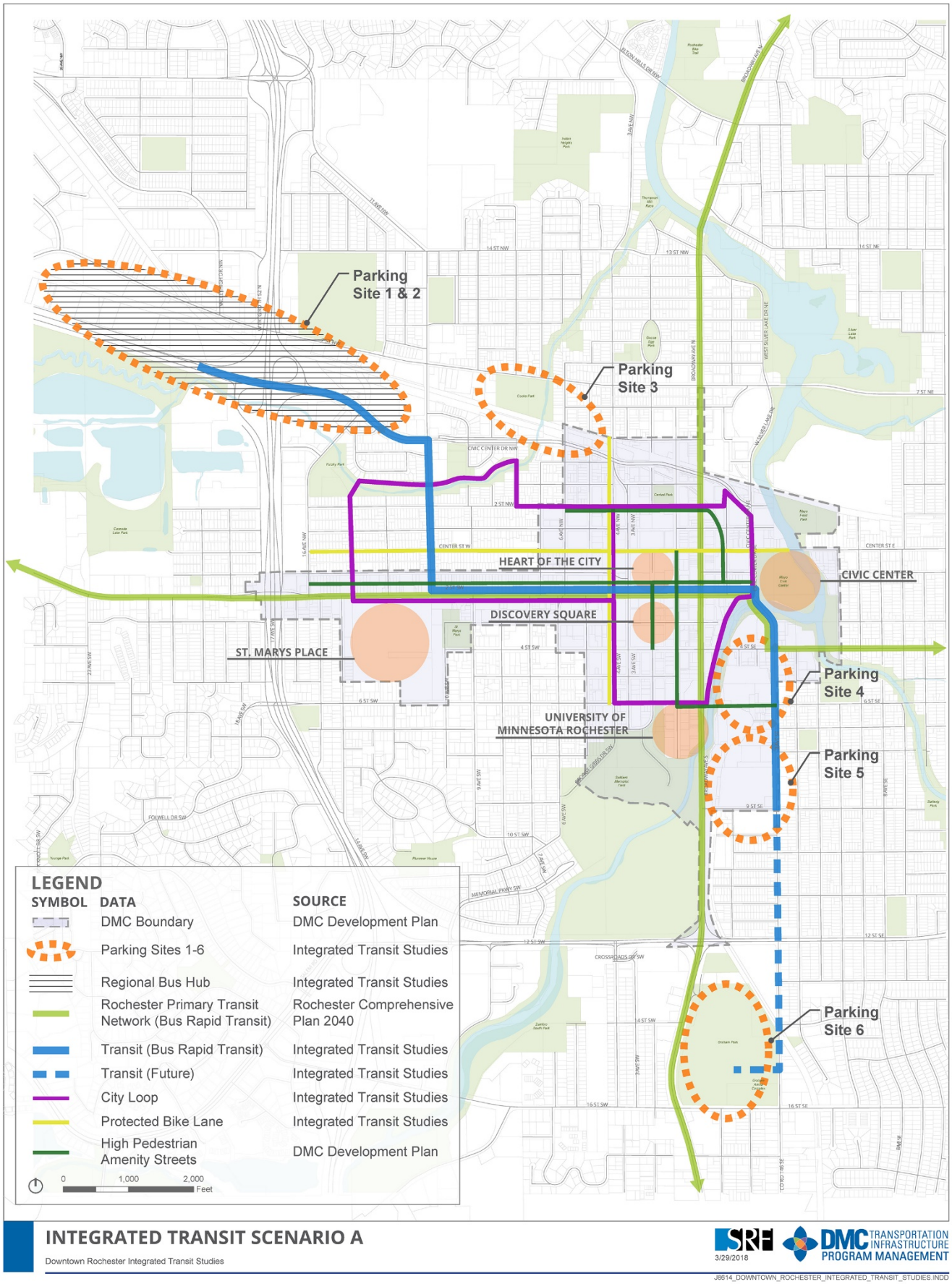
Physical Characteristics

Mode: Bus Rapid Transit. A 40 or 60 foot bus with premium amenities and a dedicated guideway.

Route: The Scenario A BRT alternative follows the route shown in **Figure 13**. The route is unchanged from Tier 1, with the exception of following Civic Center Drive from site 1 parking to 11th Avenue NW rather than using the railroad right-of-way to the north. It provides service between the east edge of the St. Marys Hospital Campus and downtown, and

connects to commuter parking sites 1, 4, and 5. It also provides east/west circulation within the downtown area.

Figure 13. Scenario A BRT Route



Location within the Street: Generally will operate in a two lane exclusive guideway located in the center of the street, as follows:

- 0.8 route miles of exclusive guideway (center running)
- 2.1 route miles of semi-exclusive guideway (center running)

Both the exclusive and semi-exclusive travel lanes are used only by transit vehicles. Exclusive lanes are not impacted by cross street travel at intersections while semi-exclusive lanes have crossing traffic at intersections.

Cross Section: The typical section developed for Scenario A (BRT) along 2nd Street is shown in **Figure 14**. The median application along 11th Avenue connecting to 2nd Street is shown in **Figure 15**.

Station Locations: The Scenario A stations are preliminarily located at the following locations:

- Within parking site 1
- 11th Avenue NW/Civic Center Drive NW
- 2nd Street SW/11th Avenue SW
- 2nd Street SW/ 6th Avenue SW
- 2nd Street SW Between 2nd and 4th Avenues
- 2nd Street SW/S Broadway
- 3rd Avenue SE/4th Street SE
- Within parking site 5

Right-of-way Requirements: Right-of-way needs will need to be coordinated with the requirements for the Parking, City Loop, and Streets Use studies.

Order of Magnitude Costs: The order of magnitude capital cost estimate includes the transit circulator project costs from design through construction and vehicle testing. This includes standard or articulated buses with enhanced operating conditions that may include level or near-level boarding, off-board fare collection, real time passenger information, traffic signal priority, lane dedication, and branded buses and stations. Capital costs vary significantly depending on project characteristics. The cost estimates developed for the BRT alternatives were based on Minneapolis C Line and Albuquerque Rapid Transit (ART) BRT projects. Costs are shown in **Table 3** above.

A detailed summary of the project costs by major SCC cost categories per alternative can be found in the appendix. Once the implementation plan has been developed and the project scope has been determined, it is recommended that an engineering estimate be completed to provide a cost estimate that encompasses that phase of construction.

Figure 14. Scenario A (BRT) Typical Section In 2nd Street SW Median

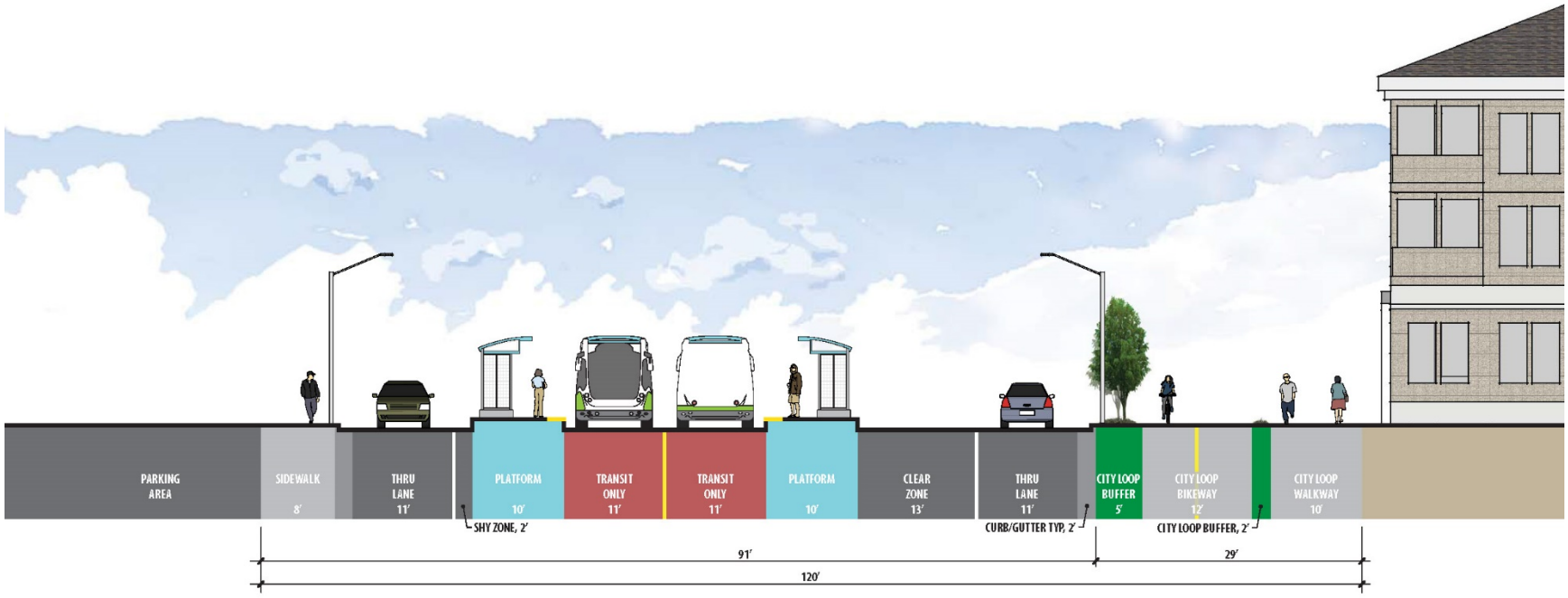
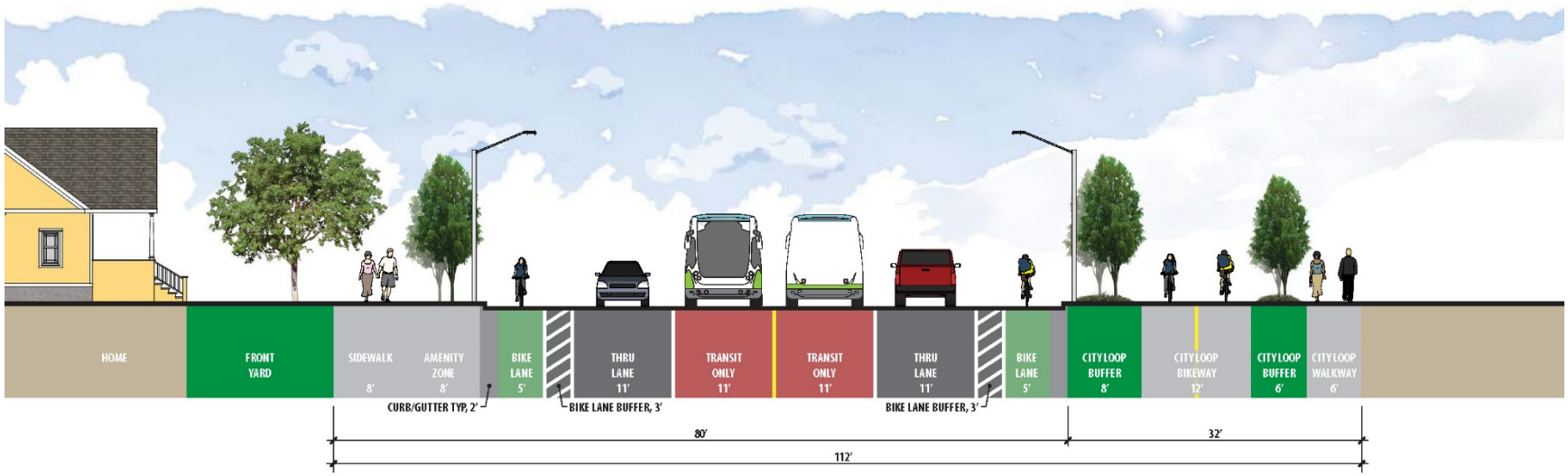


Figure 15. Scenario A (BRT) Typical Section in 11th Avenue Median



Bus Rapid Transit | 11th Avenue NW, between 1st and 2nd Streets NW

facing north

March 14, 2018

Operational Characteristics

- Circulator: BRT buses operating in dedicated transit lanes on 2nd Street and in mixed traffic elsewhere. Vehicles stop at all stations.
- RPT Local Service: Maintains the increase in local bus frequency and span of service identified in the TDP, included in TAP 1. Local buses will travel in the dedicated transit lanes and stop at stations. Transit lane performance will be monitored as the vehicle frequency increases.
- PTN BRT Service: Reduced frequency from TAP 1 due to overlap with new circulator service. PTN BRT buses will travel in the dedicated transit lanes and stop at stations.
- RPT Express: Significant reduction from TAP 1 because some express riders drive to remote and peripheral parking and use circulator. RPT Express buses will travel in the dedicated transit lanes and stop at stations.
- Regional Express Service: Change in operations with buses serving St. Marys using an off-street terminal at a new St. Marys parking ramp over the existing lot east of the hospital, and diverting from 2nd Street to reach bus stops north or south of downtown. The new downtown stop may be located at Blocks 95 and 96 northeast of downtown. The regional express buses may use the dedicated transit lane on 2nd Street SW between St. Marys and 3rd Avenue, but will not use the BRT stations.

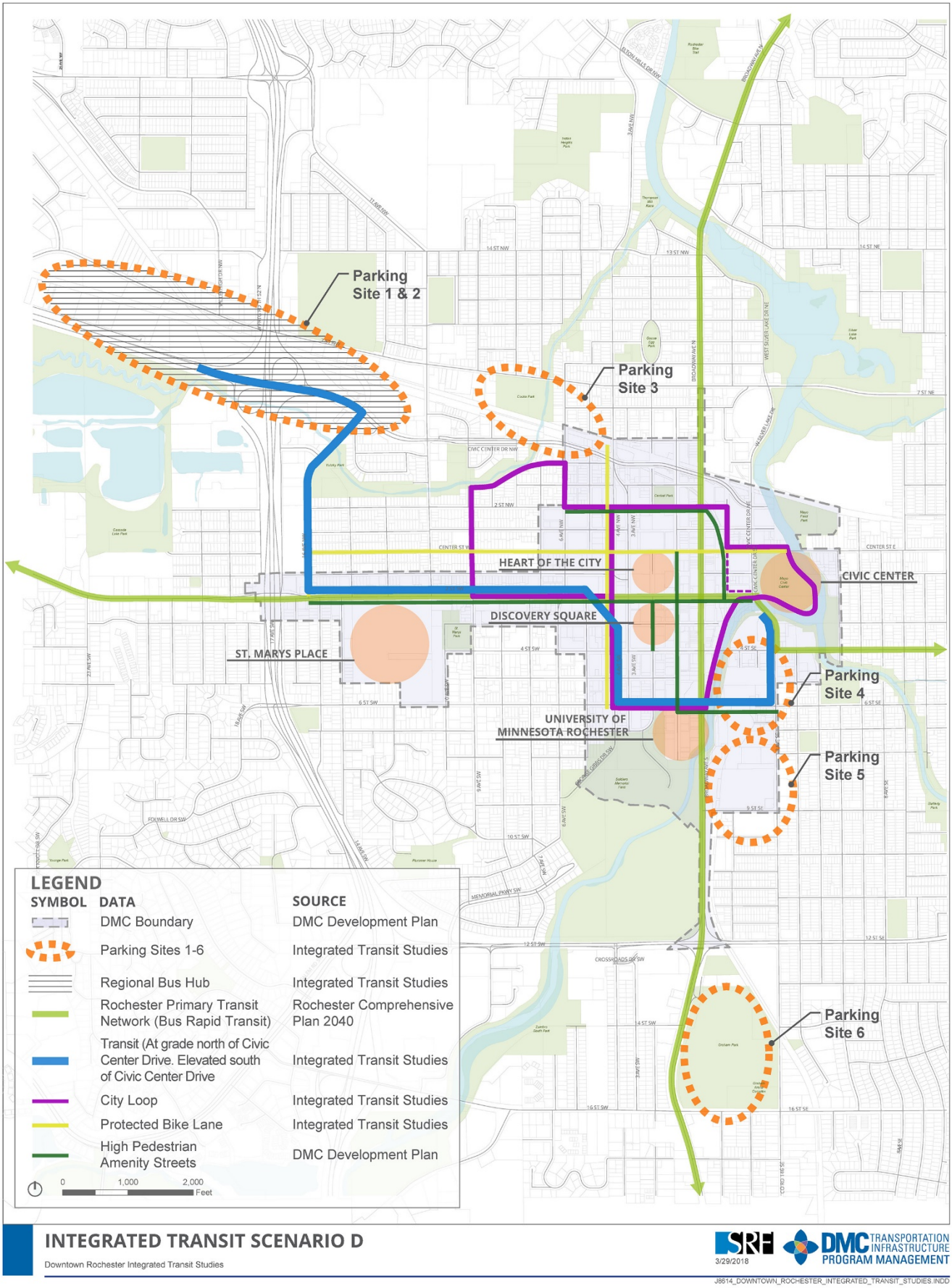
Scenario D Autonomous Vehicle

Physical Characteristics

Mode: The autonomous vehicle is a rubber tired shuttle that is approximately 30 feet long. The elevated guideway was generally designed to allow flexibility in vehicle selection; however, to provide for compatibility, it is recommended that the vehicle procurement criteria be established prior to designing the structure.

Route: The Scenario D Autonomous Vehicle alternative follows the route shown in **Figure 16**. Like the Tier 2 BRT, the Tier 2 Autonomous Vehicle follows the same path as the Tier 1, with the exception of shifting to the Civic Center right-of-way from parking site 1 to 16th Avenue NW. The route provides service between the north side of the St. Marys campus and downtown, and extends to parking sites 1 and 4. It also provides limited east/west circulation within the downtown area.

Figure 16. Scenario D (Autonomous Vehicle) Route



Location within the Street: Generally is a 26 foot elevated guideway offset to the right-of-way line. The northern section along Civic Center Drive operates above the median with the exception of the small segment under US 52, as follows:

- 3.1 route miles of aerial structure
- 200 feet of at-grade exclusive guideway

Cross Section: **Figure 17** shows the typical section for Scenario D (Autonomous Vehicle).

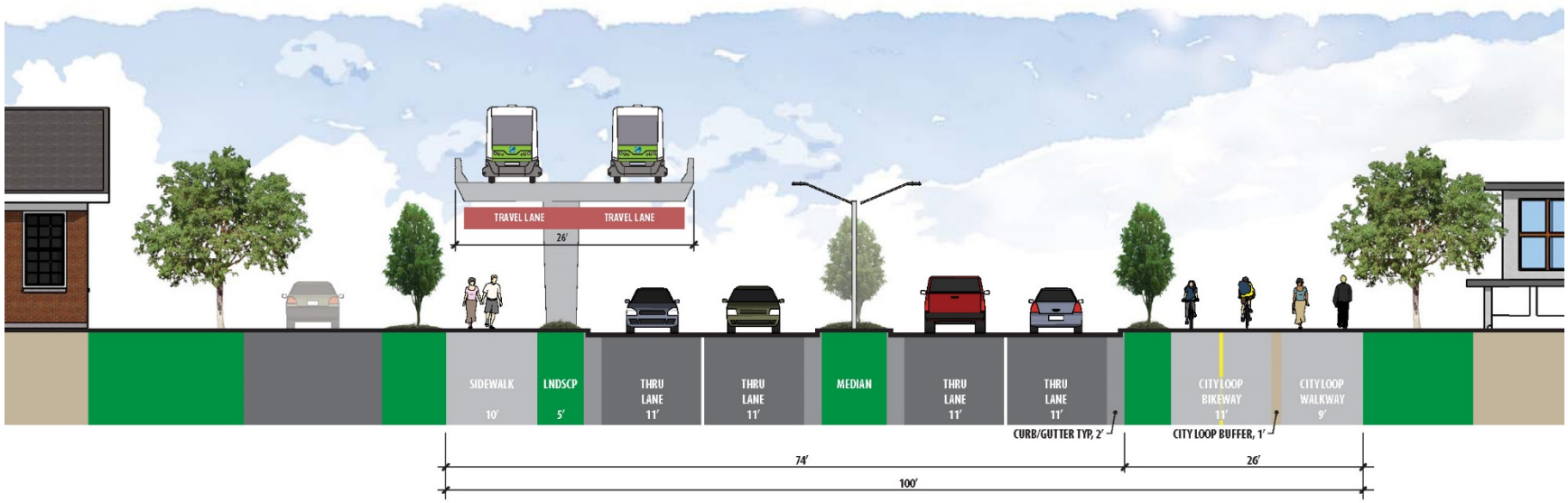
Station Locations: The Scenario D stations are preliminarily located at the following locations (7 Aerial Stations):

- Within parking site 1
- 16th Avenue SW Between W Center Street and 1st Street SW
- 2nd Street SW Between 11th Avenue SW and 9th Avenue SW
- 2nd Street SW Between 5th Avenue SW and 4th Avenue SW
- 6th Street SW Between 1st Avenue and S Broadway
- Within parking site 4
- Government Center

Right-of-way Requirements: The elevated guideway requires the most right-of-way of the scenarios considered. The unique nature of an elevated guideway results in two types of right-of-way needs:

1. Physical right-of-way requirements – This would be for piers to support the elevated guideway. These right-of-way needs may or may not overlap with those related to the Parking, City Loop, and Streets Use study recommendations.
2. Air rights – Locations where the structure overhangs adjacent properties

Figure 17. Scenario D Autonomous Vehicle Typical Section



Elevated Autonomous | 2nd Street SW, just west of 7th Avenue SW

facing west

March 14, 2018

Order of Magnitude Costs: The order of magnitude capital cost estimate includes the transit circulator project costs from design through construction and vehicle testing. In addition to the difference in vehicle type, the autonomous vehicle system would require additional features compared to BRT and tram due to the elevated guideway and the operating environment. Stations require a means of egress via both stairs and elevator; additional guideway to allow vehicles to bypass a station; piers sized to support spans near 100 feet in length; and construction of potentially complex bridge connections in a dense urban area abutting to buildings and business access. In addition, utilities under the structure's zone of influence would likely be relocated.

There are currently no elevated autonomous vehicle systems from which to draw cost data. The guideway and station costs reflect structures sized to accommodate projected ridership demand and allow for two-way operation of the vehicles, with additional passing lanes at stations. Vehicle costs were based upon current autonomous vehicles, increased proportionally with the larger capacity assumed for this system.

A detailed summary of the project costs by major SCC cost categories per alternative can be found in the appendix. Once the implementation plan has been developed and the project scope has been determined, it is recommended that an engineering estimate is completed at that time to provide a cost estimate that encompasses that phase of construction.

Operational Characteristics

- Circulator: Autonomous vehicles operate in exclusive lanes on an elevated guideway. Vehicles go directly between trip origin and destination and do not stop at intermediate locations. A variable message sign on the front of the vehicle confirms the vehicle destination.
- RPT Local Service: Maintains the increase in local bus frequency and span of service identified in the TDP, included in TAP 1.
- PTN BRT Service: Reduced frequency from TAP 1 due to overlap with new circulator service.
- RPT Express: Significant reduction from TAP 1, because some express riders drive to remote and peripheral parking and use circulator. More express service than DMC Modified or Scenario A due to reduced availability of remote and peripheral parking compared to those alternatives.

- Regional Express Service: Change in downtown operations with all buses going to nearest remote or peripheral lot served by the circulator as determined by their approach to downtown.

The key performance characteristics of the Tier 2 circulators are summarized below in **Table 4**. The cost characteristics for the TAP 1 PTN BRT system are not included because most of their costs fall outside of the DMC boundaries. The TAP 1 ridership reflects the circulator trips served by the PTN BRT.

Table 4. Performance Comparison of Tier 2 Circulator Options

Alternative	Circulator Capital Cost ($2017)	Circulator Operating Cost ($2017)	Daily Circulator Ridership
TAP 1	NA	NA	6,010
DMC Modified Tram	$262.7M	$3.4M	27,500
Scenario A BRT	$101.1M	$3.7M	21,750
Scenario D Autonomous Vehicle	$486.4M	$3.5M	26,170

Several characteristics stand out. TAP 1 does not serve many circulator trips. Both the DMC Modified Tram and the Scenario D Autonomous Vehicle have high ridership, however, both also require a substantial capital investment. Scenario A BRT provides an attractive balance of ridership and capital cost. In addition, the BRT technology will have more flexibility to incorporate autonomous vehicle technology than the tram as it continues to develop.

Development of Hybrid Alternative

Based upon the Tier 2 performance characteristics, the Scenario A BRT circulator was selected to advance for further development. Several "hybrid" options were developed from the Scenario A base, incorporating the increased coverage of the DMC Modified Tram route. The north/south DMC Modified Tram element along 3rd and 4th Avenues was added, with an extension from 4th Avenue to Mobility Hub A along Civic Center Drive. This effectively created the ability to have a single loop operation extending from parking site 1 to parking site 5. This single loop connects parking sites 1, 3, 4, and 5, St. Marys, and downtown.

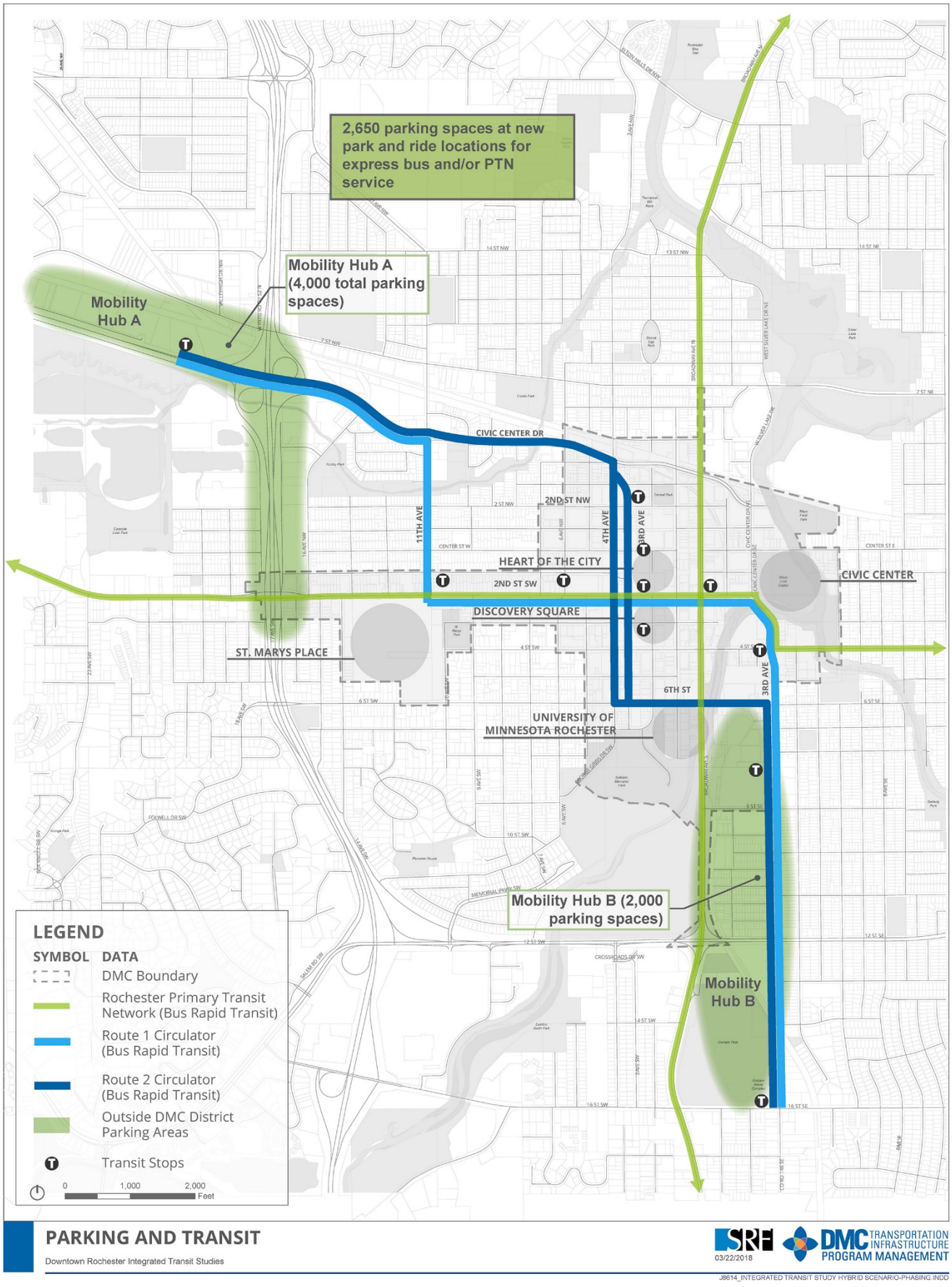
Because a loop operation would require a consistent headway along its entire length, the loop was split into two routes as shown in **Figure 18**. This allows the service frequency on each of the two routes to be adjusted individually based upon ridership in each service area.

During the development of the alternatives, the parking facilities at each end of the circulator were further developed to provide a wide range of services. In addition to offering commuter parking, enclosed transfer centers are envisioned to enhance the traveler experience as they change modes between their cars and the variety of transit services that may be available (Rochester Public Transit [RPT] local and express, circulator BRT, Primary Transit Network [PTN], BRT, and/or Rochester City Lines [RCL]). In addition, commuter-oriented retail services may be provided at these locations. The parking sites were renamed Mobility Hubs to reflect their expanded role.

Hybrid Route 1 follows the same path as the Scenario A BRT. Like Route 1, Route 2 begins at Mobility Hub A, and continues east along Civic Center Drive. Instead of turning south at 11th Avenue NW, however, Route 2 extends along Civic Center to 4th Avenue NW. Route 2 then turns south on 4th Avenue to connect to 6th Street SW. The BRT travels east on 6th Avenue SW/SE, and south on 3rd Avenue SE to Mobility Hub B. The circulator then reverses its route running in the same corridors except it utilizes 3rd Avenue SW/NW to Civic Center Drive instead of 4th Avenue.

The addition of the second route to the original Scenario A BRT offers several service advantages. Downtown commuters have direct access from Mobility Hub A using Route 2, rather than stopping first at St. Marys. Route 2 also provides closer parking shuttle service from both Mobility Hubs A and B to downtown work destinations north and south of 2nd Street SW. The north/south orientation of Route 2 also offers more circulator access beyond 2nd Street SW for non-commuter trips within downtown. The University of Minnesota Rochester campus will have convenient access to downtown using this route.

Figure 18. BRT Hybrid



Splitting the Scenario A BRT service between two routes will reduce the frequency of service, although a high level of service will be available on both routes. This reduction in frequency will also reduce the number vehicles operating on 2nd Street SW in the peak hour, however. As in Scenario A BRT, Route 1 operates in exclusive lanes. Route 2 also operates in exclusive lanes for a significant portion of the trip, but runs in shared Business Access and Transit (BAT) lanes along 3rd and 4th Avenues.

The characteristics of the Hybrid BRT are compared with the Scenario A BRT in **Table 5** below.

Table 5. Comparison of Scenario A BRT and Hybrid BRT Circulator Performance

	Scenario A BRT	Hybrid BRT
Capital Cost ($2017)	$101.1M	$142.0M
Operating Cost ($2017)	$3.7M	$7.1M
Daily Ridership	21,750	22,600

The Hybrid BRT ridership increases slightly from the Scenario A BRT. Both the capital and operating cost increase compared to Scenario A. Hybrid BRT service advantages not included in this table are described above.

Appendix: Detailed Cost Estimate

This page is intentionally blank.

1/18/2018 J8621 Rochester Transit Study: Order of Magnitude Cost Back-Up

			Modified DMC - Tram								Current Year		Inflation Rate
4.2 Route Miles			Approximately $63 Million Per Route Mile (Current Year)	Approximately $77 Million Per Route Mile (YoE)							2017.00 (YR)		3.00%
SCC	SCC Sub	Item #	Item Description	Unit	Unit Cost	Quantity	Item Cost	A. Cont.	Item Cont.		Subtotal	YoE	Subtotal YoE
10			**GUIDEWAY & TRACK ELEMENTS (Route Miles)**				**$34,938,826**		**$7,602,765**		**$42,541,591**		**$52,320,791**
	10.01		Guideway: At-grade exclusive right-of-way				$5,752,841		$1,150,568		$6,903,409		**$8,490,322**
		10.01.01	Tram Guideway (Double Track with Barrier)	RM	$7,500,000	0.8	$5,752,841	20%	$1,150,568		$6,903,409	2024	**$8,490,322**
	10.02		Guideway: At-grade semi-exclusive (allows cross-traffic)			0	$18,626,894		$3,725,379		$22,352,273		**$27,490,476**
		10.02.01	Tram Guideway (Double Track)	RM	$7,000,000	2.7	$18,626,894	20%	$3,725,379		$22,352,273	2024	**$27,490,476**
	10.03		Guideway: At-grade in mixed traffic				$4,409,091		$881,818		$5,290,909		**$6,507,151**
		10.03.01	Tram Guideway (Single Track Embedded)	TM	$3,000,000	1.5	$4,409,091	20%	$881,818		$5,290,909	2024	**$6,507,151**
	10.04		Guideway: Aerial structure			0	$2,700,000		$810,000		$3,510,000		**$4,316,857**
		10.04.01	Existing Structure Rehab Allowance - Low	EA	$500,000	1.0	$500,000	30%	$150,000		$650,000	2024	**$799,418**
		10.04.02	Existing Structure Rehab Allowance - Medium	EA	$1,350,000	1.0	$1,350,000	30%	$405,000		$1,755,000	2024	**$2,158,429**
		10.04.03	BRT and Tram Additional cost for Ramps to Parking Structure	EA	$850,000	1.0	$850,000	30%	$255,000		$1,105,000	2024	**$1,359,011**
	10.12		Track: Special (switches, turnouts)				$3,450,000		$1,035,000		$4,485,000		**$5,515,984**
		10.12.01	Powered Turnouts	EA	$250,000	5.0	$1,250,000	30%	$375,000		$1,625,000	2024	**$1,998,545**
		10.12.02	Diamond Crossing	EA	$200,000	8.0	$1,600,000	30%	$480,000		$2,080,000	2024	**$2,558,138**
		10.12.03	Allowance for Freight Rail Crossing Track Adjustments	EA	$150,000	4.0	$600,000	30%	$180,000		$780,000	2024	**$959,302**
20			**STATIONS, STOPS, TERMINALS, INTERMODAL (number)**				**$3,780,000**		**$756,000**		**$4,536,000**		**$5,578,708**
	20.01		At-grade station, stop, shelter, mall, terminal, platform				$3,780,000		$756,000		$4,536,000		**$5,578,708**
		20.01.01	Tram Station (Side Platform)	EA	$225,000	12.0	$2,700,000	20%	$540,000		$3,240,000	2024	**$3,984,791**
		20.01.02	Tram Station (Center Platform)	EA	$270,000	4.0	$1,080,000	20%	$216,000		$1,296,000	2024	**$1,593,917**
30			**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**				**$18,000,000**		**$3,600,000**		**$21,600,000**		**$26,565,275**
	30.02		Light Maintenance Facility				$18,000,000		$3,600,000		$21,600,000		**$26,565,275**
		30.02.01	Tram MSF Allowance	LS	$18,000,000	1.0	$18,000,000	20%	$3,600,000		$21,600,000	2024	**$26,565,275**
40			**SITEWORK & SPECIAL CONDITIONS**				**$39,941,284**		**$3,260,400**		**$43,201,684**		**$53,132,623**
	40.01		Demolition, Clearing, Earthwork			0	$4,180,000		$1,254,000		$5,434,000		**$6,683,135**
		40.01.01	At-Grade Guideway Prepartation BRT/Tram	RM	$1,000,000	4.2	$4,180,000	30%	$1,254,000		$5,434,000	2024	**$6,683,135**
	40.02		Site Utilities, Utility Relocation				$9,196,000		$1,922,800		$11,118,800		**$13,674,722**
		40.02.02	High Utility Corridor Ranking	RM	$2,000,000	4.2	$8,360,000	20%	$1,672,000		$10,032,000	2024	**$12,338,095**
		40.02.05	On-Street Drainage Modification Allowance	RM	$200,000	4.2	$836,000	30%	$250,800		$1,086,800	2024	**$1,336,627**
	40.04		Environmental mitigation, e.g. wetlands, historic/archeologic, parks			0	$418,000		$83,600		$501,600		**$616,905**
		40.04.01	At-Grade Guideway Mitigation Allowance	RM	$100,000	4.2	$418,000	20%	$83,600		$501,600	2024	**$616,905**
	40.08		Temporary Facilities and other indirect costs during construction				$26,147,284		$0		$26,147,284		**$32,157,862**
		40.08.01	Temporary Maintenance of Traffic	LS	5.0%	$124,510,878	$6,225,544	0%	$0		$6,225,544	2024	**$7,656,634**
		40.08.02	Contractor Indirects (Staff, Office, etc.)	LS	15.0%	$124,510,878	$18,676,632	0%	$0		$18,676,632	2024	**$22,969,901**
		40.08.03	Art in Transit (1% of Construction)	LS	1.0%	$124,510,878	$1,245,109	0%	$0		$1,245,109	2024	**$1,531,327**

1/18/2018 J8621 Rochester Transit Study: Order of Magnitude Cost Back-Up

			Modified DMC - Tram								Current Year		Inflation Rate
4.2 Route Miles			Approximately $63 Million Per Route Mile (Current Year)	Approximately $77 Million Per Route Mile (YoE)							2017.00 (YR)		3.00%
SCC	SCC Sub	Item #	Item Description	Unit	Unit Cost	Quantity	Item Cost	A. Cont.	Item Cont.	Subtotal	YoE	Subtotal YoE
50			SYSTEMS				$12,591,423		$2,915,325	$15,506,747		$19,071,343
	50.02		Traffic signals and crossing protection				$5,820,400		$1,561,120	$7,381,520		$9,078,339
		50.02.01	Traffic Signal Allowance (Install New)	EA	$250,000	6.0	$1,500,000	20%	$300,000	$1,800,000	2024	$2,213,773
		50.02.02	Traffic Signal Allowance (Major Modification)	EA	$125,000	12.0	$1,500,000	30%	$450,000	$1,950,000	2024	$2,398,254
		50.02.03	Traffic Signal Allowance (Minor Modification)	EA	$50,000	7.0	$350,000	20%	$70,000	$420,000	2024	$516,547
		50.02.04	Transit Signal Priority Allowance	RM	$280,000	4.2	$1,170,400	30%	$351,120	$1,521,520	2024	$1,871,278
		50.02.05	Install Active Crossing	EA	$250,000	2.0	$500,000	30%	$150,000	$650,000	2024	$799,418
		50.02.06	Install Active Crossing with Cantilevers	EA	$400,000	2.0	$800,000	30%	$240,000	$1,040,000	2024	$1,279,069
	50.03		Traction power supply: substations				$2,522,727		$504,545	$3,027,273		$3,723,164
		50.03.01	Streetcar TPSS Allowance (Off-Wire for 1 mile segments)	RM	$1,200,000	2.1	$2,522,727	20%	$504,545	$3,027,273	2024	$3,723,164
	50.04		Traction power distribution: catenary and third rail				$3,048,295		$609,659	$3,657,955		$4,498,823
		50.04.01	Streetcar OCS Allowance (Off-Wire for 1 mile segments)	RM	$1,450,000	2.1	$3,048,295	20%	$609,659	$3,657,955	2024	$4,498,823
	50.06		Fare collection system and equipment				$1,200,000		$240,000	$1,440,000		$1,771,018
		50.06.02	Fare Collection (Assume Simple TVMs at Stops)	EA	$75,000	16.0	$1,200,000	20%	$240,000	$1,440,000	2024	$1,771,018
	Construction Subtotal (10-50)						$109,251,533		$18,134,490	$127,386,023		$156,668,740
60			ROW, LAND, EXISTING IMPROVEMENTS				$2,090,000		$627,000	$2,717,000		$3,341,567
	60.01		Purchase or lease of real estate				$2,090,000		$627,000	$2,717,000		$3,341,567
		60.01.01	Streetcar VMF Right of Way Allowance	RM	$500,000	4.2	$2,090,000	30%	$627,000	$2,717,000	2024	$3,341,567
70			VEHICLES (number)				$38,000,000		$3,800,000	$41,800,000		$51,408,728
	70.01		Light Rail				$38,000,000		$3,800,000	$41,800,000		$51,408,728
		70.01.01	Modern Streetcar Vehicle Allowance	EA	$4,750,000	8.0	$38,000,000	10%	$3,800,000	$41,800,000	2024	$51,408,728
80			PROFESSIONAL SERVICES (applies to Cats. 10-50)				$47,000,622		$0	$47,000,622		$57,804,837
	80.01		Preliminary Engineering				$4,700,062		$0	$4,700,062		$5,780,484
		80.01.01	Percentage of Direct Costs SCC (10-50)	LS	3%	$156,668,740	$4,700,062	0%	$0	$4,700,062	2024	$5,780,484
	80.02		Final Design				$12,533,499		$0	$12,533,499		$15,414,623
		80.02.01	Percentage of Direct Costs SCC (10-50)	LS	8%	$156,668,740	$12,533,499	0%	$0	$12,533,499	2024	$15,414,623
	80.03		Project Management for Design and Construction				$9,400,124		$0	$9,400,124		$11,560,967
		80.03.01	Percentage of Direct Costs SCC (10-50)	LS	6%	$156,668,740	$9,400,124	0%	$0	$9,400,124	2024	$11,560,967
	80.04		Construction Administration & Management				$9,400,124		$0	$9,400,124		$11,560,967
		80.04.01	Percentage of Direct Costs SCC (10-50)	LS	6%	$156,668,740	$9,400,124	0%	$0	$9,400,124	2024	$11,560,967
	80.05		Professional Liability and other Non-Construction Insurance				$1,566,687		$0	$1,566,687		$1,926,828
		80.05.01	Percentage of Direct Costs SCC (10-50)	LS	1%	$156,668,740	$1,566,687	0%	$0	$1,566,687	2024	$1,926,828
	80.06		Legal; Permits; Review Fees by other agencies, cities, etc.				$3,133,375		$0	$3,133,375		$3,853,656
		80.06.01	Percentage of Direct Costs SCC (10-50)	LS	2%	$156,668,740	$3,133,375	0%	$0	$3,133,375	2024	$3,853,656
	80.07		Surveys, Testing, Investigation, Inspection				$3,133,375		$0	$3,133,375		$3,853,656
		80.07.01	Percentage of Direct Costs SCC (10-50)	LS	2%	$156,668,740	$3,133,375	0%	$0	$3,133,375	2024	$3,853,656
	80.08		Start up				$3,133,375		$0	$3,133,375		$3,853,656
		80.08.01	Percentage of Direct Costs SCC (10-50)	LS	2%	$156,668,740	$3,133,375	0%	$0	$3,133,375	2024	$3,853,656
	Subtotal (10-80)						$196,342,155		$22,561,490	$218,903,645		$269,223,872
90			UNALLOCATED CONTINGENCY	LS	20%					$43,780,729		$53,844,774
100			FINANCE CHARGES							*Current Year Total*		*YoE Total*
	Segment Totals (10-100)									$262,684,374		$323,068,646

			Scenario A - BRT							Current Year		*Inflation Rate*
			2.9 Route Miles Approximately $35 Million Per Route Mile (Current Year)	Approximately $43 Million Per Route Mile (YoE)						*2017.00 (YR)*		*3.00%*
SCC	SCC Sub	Item #	Item Description	Unit	Unit Cost	Quantity	Item Cost	A. Cont.	Item Cont.	Subtotal	YoE	Subtotal YoE
10			**GUIDEWAY & TRACK ELEMENTS (Route Miles)**				**$14,703,523**		**$3,125,705**	**$17,829,227**		**$21,927,701**
	10.01		Guideway: At-grade exclusive right-of-way				$3,681,818		$736,364	$4,418,182		**$5,433,806**
		10.01.02	BRT Guideway (Exclusive BRT with Barrier)	RM	$4,800,000	0.8	$3,681,818	20%	$736,364	$4,418,182	2024	**$5,433,806**
	10.02		Guideway: At-grade semi-exclusive (allows cross-traffic)			0	$9,171,705		$1,834,341	$11,006,045		**$13,536,048**
		10.02.02	BRT Guideway (Exclusive BRT)	RM	$4,300,000	2.1	$9,171,705	20%	$1,834,341	$11,006,045	2024	**$13,536,048**
	10.04		Guideway: Aerial structure			0	$1,850,000		$555,000	$2,405,000		**$2,957,847**
		10.04.01	Existing Structure Rehab Allowance - Low	EA	$500,000	2.0	$1,000,000	30%	$300,000	$1,300,000	2024	**$1,598,836**
		10.04.03	BRT and Tram Additional cost for Ramps to Parking Structure	EA	$850,000	1.0	$850,000	30%	$255,000	$1,105,000	2024	**$1,359,011**
20			**STATIONS, STOPS, TERMINALS, INTERMODAL (number)**				**$3,420,000**		**$684,000**	**$4,104,000**		**$5,047,402**
	20.01		At-grade station, stop, shelter, mall, terminal, platform				$3,420,000		$684,000	$4,104,000		**$5,047,402**
		20.01.03	BRT Station (Side Platform)	EA	$225,000	14.0	$3,150,000	20%	$630,000	$3,780,000	2024	**$4,648,923**
		20.01.04	BRT Station (Center Platform)	EA	$270,000	1.0	$270,000	20%	$54,000	$324,000	2024	**$398,479**
30			**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**				**$4,200,000**		**$840,000**	**$5,040,000**		**$6,198,564**
	30.02		Light Maintenance Facility				$4,200,000		$840,000	$5,040,000		**$6,198,564**
		30.02.03	Per Bus Allowance for Modifications to Existing Bus Garage	EA	$300,000	14.0	$4,200,000	20%	$840,000	$5,040,000	2024	**$6,198,564**
40			**SITEWORK & SPECIAL CONDITIONS**				**$17,333,681**		**$1,682,000**	**$19,015,681**		**$23,386,889**
	40.01		Demolition, Clearing, Earthwork			0	$2,900,000		$870,000	$3,770,000		**$4,636,624**
		40.01.01	At-Grade Guideway Prepartation BRT/Tram	RM	$1,000,000	2.9	$2,900,000	30%	$870,000	$3,770,000	2024	**$4,636,624**
	40.02		Site Utilities, Utility Relocation				$3,480,000		$754,000	$4,234,000		**$5,207,286**
		40.02.03	Medium Utility Corridor Ranking	RM	$1,000,000	2.9	$2,900,000	20%	$580,000	$3,480,000	2024	**$4,279,961**
		40.02.05	On-Street Drainage Modification Allowance	RM	$200,000	2.9	$580,000	30%	$174,000	$754,000	2024	**$927,325**
	40.04		Environmental mitigation, e.g. wetlands, historic/archeologic, parks			0	$290,000		$58,000	$348,000		**$427,996**
		40.04.01	At-Grade Guideway Mitigation Allowance	RM	$100,000	2.9	$290,000	20%	$58,000	$348,000	2024	**$427,996**
	40.08		Temporary Facilities and other indirect costs during construction				$10,663,681		$0	$10,663,681		**$13,114,983**
		40.08.01	Temporary Maintenance of Traffic	LS	5.0%	$50,779,435	$2,538,972	0%	$0	$2,538,972	2024	**$3,122,615**
		40.08.02	Contractor Indirects (Staff, Office, etc.)	LS	15.0%	$50,779,435	$7,616,915	0%	$0	$7,616,915	2024	**$9,367,845**
		40.08.03	Art in Transit (1% of Construction)	LS	1.0%	$50,779,435	$507,794	0%	$0	$507,794	2024	**$624,523**
50			**SYSTEMS**				**$4,712,000**		**$1,251,100**	**$5,963,100**		**$7,333,861**
	50.02		Traffic signals and crossing protection				$3,587,000		$1,026,100	$4,613,100		**$5,673,531**
		50.02.01	Traffic Signal Allowance (Install New)	EA	$250,000	2.0	$500,000	20%	$100,000	$600,000	2024	**$737,924**
		50.02.02	Traffic Signal Allowance (Major Modification)	EA	$125,000	11.0	$1,375,000	30%	$412,500	$1,787,500	2024	**$2,198,400**
		50.02.04	Transit Signal Priority Allowance	RM	$280,000	2.9	$812,000	30%	$243,600	$1,055,600	2024	**$1,298,255**
		50.02.05	Install Active Crossing	EA	$250,000	2.0	$500,000	30%	$150,000	$650,000	2024	**$799,418**
		50.02.06	Install Active Crossing with Cantilevers	EA	$400,000	1.0	$400,000	30%	$120,000	$520,000	2024	**$639,534**
	50.06		Fare collection system and equipment				$1,125,000		$225,000	$1,350,000		**$1,660,330**
		50.06.02	Fare Collection (Assume Simple TVMs at Stops)	EA	$75,000	15.0	$1,125,000	20%	$225,000	$1,350,000	2024	**$1,660,330**
	Construction Subtotal (10-50)						**$44,369,204**		**$7,582,805**	**$51,952,009**		**$63,894,418**

			Scenario A - BRT								Current Year		*Inflation Rate*
		2.9 Route Miles	Approximately $35 Million Per Route Mile (Current Year)	Approximately $43 Million Per Route Mile (YoE)							*2017.00 (YR)*		*3.00%*
SCC	SCC Sub	Item #	Item Description	Unit	Unit Cost		Quantity	Item Cost	A. Cont.	Item Cont.	Subtotal	YoE	Subtotal YoE
70			VEHICLES (number)					$11,900,000		$1,190,000	$13,090,000		$16,099,049
	70.04		Bus				0	$11,900,000		$1,190,000	$13,090,000		**$16,099,049**
		70.04.01	BRT Vehicle Allowance	EA	$850,000		14.0	$11,900,000	10%	$1,190,000	$13,090,000	2024	**$16,099,049**
80			PROFESSIONAL SERVICES (applies to Cats. 10-50)					$19,168,325		$0	$19,168,325		$23,574,622
	80.01		Preliminary Engineering					$1,916,833		$0	$1,916,833		**$2,357,462**
		80.01.01	Percentage of Direct Costs SCC (10-50)	LS	3%		$63,894,418	$1,916,833	0%	$0	$1,916,833	2024	**$2,357,462**
	80.02		Final Design			$	-	$5,111,553		$0	$5,111,553		**$6,286,566**
		80.02.01	Percentage of Direct Costs SCC (10-50)	LS	8%		$63,894,418	$5,111,553	0%	$0	$5,111,553	2024	**$6,286,566**
	80.03		Project Management for Design and Construction			$	-	$3,833,665		$0	$3,833,665		**$4,714,924**
		80.03.01	Percentage of Direct Costs SCC (10-50)	LS	6%		$63,894,418	$3,833,665	0%	$0	$3,833,665	2024	**$4,714,924**
	80.04		Construction Administration & Management			$	-	$3,833,665		$0	$3,833,665		**$4,714,924**
		80.04.01	Percentage of Direct Costs SCC (10-50)	LS	6%		$63,894,418	$3,833,665	0%	$0	$3,833,665	2024	**$4,714,924**
	80.05		Professional Liability and other Non-Construction Insurance			$	-	$638,944		$0	$638,944		**$785,821**
		80.05.01	Percentage of Direct Costs SCC (10-50)	LS	1%		$63,894,418	$638,944	0%	$0	$638,944	2024	**$785,821**
	80.06		Legal; Permits; Review Fees by other agencies, cities, etc.			$	-	$1,277,888		$0	$1,277,888		**$1,571,641**
		80.06.01	Percentage of Direct Costs SCC (10-50)	LS	2%		$63,894,418	$1,277,888	0%	$0	$1,277,888	2024	**$1,571,641**
	80.07		Surveys, Testing, Investigation, Inspection			$	-	$1,277,888		$0	$1,277,888		**$1,571,641**
		80.07.01	Percentage of Direct Costs SCC (10-50)	LS	2%		$63,894,418	$1,277,888	0%	$0	$1,277,888	2024	**$1,571,641**
	80.08		Start up			$	-	$1,277,888		$0	$1,277,888		**$1,571,641**
		80.08.01	Percentage of Direct Costs SCC (10-50)	LS	2%		$63,894,418	$1,277,888	0%	$0	$1,277,888	2024	**$1,571,641**
	Subtotal (10-80)							$75,437,529		$8,772,805	$84,210,334		$103,568,089
90			UNALLOCATED CONTINGENCY	LS	20%						$16,842,067		$20,713,618
100			FINANCE CHARGES								*Current Year Total*		*YoE Total*
	Segment Totals (10-100)										$101,052,401		$124,281,707

1/18/2018 J8621 Rochester Transit Study: Order of Magnitude Cost Back-Up

			Scenario D - AV							Current Year		*Inflation Rate*
3.1 Route Miles			Approximately $156 Million Per Route Mile (Current Year)	Approximately $192 Million Per Route Mile (YoE)						*2017.00 (YR)*		*3.00%*
SCC	SCC Sub	Item #	Item Description	Unit	Unit Cost	Quantity	Item Cost	A. Cont.	Item Cont.	Subtotal	YoE	Subtotal YoE
10			**GUIDEWAY & TRACK ELEMENTS (Route Miles)**				**$122,384,000**		**$36,715,200**	**$159,099,200**		**$195,671,948**
	10.04		Guideway: Aerial structure			0	$122,384,000		$36,715,200	$159,099,200		**$195,671,948**
		10.04.04	Elevated Guideway Structure	RM	$34,400,000	3.1	$106,984,000	30%	$32,095,200	$139,079,200	2024	**$171,049,873**
		10.04.05	Elevated Guideway Widened Structure Allowance at Stations	EA	$2,200,000	7.0	$15,400,000	30%	$4,620,000	$20,020,000	2024	**$24,622,075**
20			**STATIONS, STOPS, TERMINALS, INTERMODAL (number)**				**$42,000,000**		**$8,400,000**	**$50,400,000**		**$61,985,643**
	20.01		At-grade station, stop, shelter, mall, terminal, platform				$42,000,000		$8,400,000	$50,400,000		**$61,985,643**
		20.01.05	Elevated Guideway Stops	EA	$6,000,000	7.0	$42,000,000	20%	$8,400,000	$50,400,000	2024	**$61,985,643**
30			**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**				**$2,000,000**		**$600,000**	**$2,600,000**		**$3,197,672**
	30.02		Light Maintenance Facility				$2,000,000		$600,000	$2,600,000		**$3,197,672**
		30.02.02	AV MSF Allowance for Modifications to 14/52 Parking Structure	LS	$2,000,000	1.0	$2,000,000	30%	$600,000	$2,600,000	2024	**3197672.05**
40			**SITEWORK & SPECIAL CONDITIONS**				**$67,464,062**		**$2,488,000**	**$69,952,062**		**$86,032,212**
	40.02		Site Utilities, Utility Relocation				$7,775,000		$2,177,000	$9,952,000		**$12,239,705**
		40.02.04	Low Utility Corridor Ranking	RM	$500,000	3.1	$1,555,000	20%	$311,000	$1,866,000	2024	**$2,294,945**
		40.02.06	Elevated Guideway Utility Relocation Allowance	RM	$2,000,000	3.1	$6,220,000	30%	$1,866,000	$8,086,000	2024	**$9,944,760**
	40.04		Environmental mitigation, e.g. wetlands, historic/archeologic, parks			0	$1,555,000		$311,000	$1,866,000		**$2,294,945**
		40.04.02	AV Guideway Mitigation Allowance	RM	$500,000	3.1	$1,555,000	20%	$311,000	$1,866,000	2024	**$2,294,945**
	40.08		Temporary Facilities and other indirect costs during construction				$58,134,062		$0	$58,134,062		**$71,497,563**
		40.08.01	Temporary Maintenance of Traffic	LS	5.0%	$276,828,865	$13,841,443	0%	$0	$13,841,443	2024	**$17,023,229**
		40.08.02	Contractor Indirects (Staff, Office, etc.)	LS	15.0%	$276,828,865	$41,524,330	0%	$0	$41,524,330	2024	**$51,069,688**
		40.08.03	Art in Transit (1% of Construction)	LS	1.0%	$276,828,865	$2,768,289	0%	$0	$2,768,289	2024	**$3,404,646**
50			**SYSTEMS**				**$975,000**		**$195,000**	**$1,170,000**		**$1,438,952**
	50.02		Traffic signals and crossing protection				$450,000		$90,000	$540,000		**$664,132**
		50.02.03	Traffic Signal Allowance (Minor Modification)	EA	$50,000	9.0	$450,000	20%	$90,000	$540,000	2024	**$664,132**
	50.06		Fare collection system and equipment				$525,000		$105,000	$630,000		**$774,821**
		50.06.02	Fare Collection (Assume Simple TVMs at Stops)	EA	$75,000	7.0	$525,000	20%	$105,000	$630,000	2024	**$774,821**
	Construction Subtotal (10-50)						**$234,823,062**		**$48,398,200**	**$283,221,262**		**$348,326,428**

1/18/2018 J8621 Rochester Transit Study: Order of Magnitude Cost Back-Up

			Scenario D - AV							Current Year		*Inflation Rate*
	3.1 Route Miles		Approximately $156 Million Per Route Mile (Current Year)	Approximately $192 Million Per Route Mile (YoE)						*2017.00 (YR)*		*3.00%*
SCC	SCC Sub	Item #	Item Description	Unit	Unit Cost	Quantity	Item Cost	A. Cont.	Item Cont.	Subtotal	YoE	Subtotal YoE
70			**VEHICLES (number)**				**$16,000,000**		**$1,600,000**	**$17,600,000**		**$21,645,780**
	70.05		Other			0	$16,000,000		$1,600,000	$17,600,000		**$21,645,780**
		70.05.01	Autonomous Vehicle Allowance	EA	$500,000	32.0	$16,000,000	10%	$1,600,000	$17,600,000	2024	**$21,645,780**
80			**PROFESSIONAL SERVICES (applies to Cats. 10-50)**				**$104,497,928**		**$0**	**$104,497,928**		**$128,519,271**
	80.01		Preliminary Engineering				$10,449,793		$0	$10,449,793		**$12,851,927**
		80.01.01	Percentage of Direct Costs SCC (10-50)	LS	3%	$348,326,428	$10,449,793	0%	$0	$10,449,793	2024	**$12,851,927**
	80.02		Final Design				$27,866,114		$0	$27,866,114		**$34,271,806**
		80.02.01	Percentage of Direct Costs SCC (10-50)	LS	8%	$348,326,428	$27,866,114	0%	$0	$27,866,114	2024	**$34,271,806**
	80.03		Project Management for Design and Construction				$20,899,586		$0	$20,899,586		**$25,703,854**
		80.03.01	Percentage of Direct Costs SCC (10-50)	LS	6%	$348,326,428	$20,899,586	0%	$0	$20,899,586	2024	**$25,703,854**
	80.04		Construction Administration & Management				$20,899,586		$0	$20,899,586		**$25,703,854**
		80.04.01	Percentage of Direct Costs SCC (10-50)	LS	6%	$348,326,428	$20,899,586	0%	$0	$20,899,586	2024	**$25,703,854**
	80.05		Professional Liability and other Non-Construction Insurance				$3,483,264		$0	$3,483,264		**$4,283,976**
		80.05.01	Percentage of Direct Costs SCC (10-50)	LS	1%	$348,326,428	$3,483,264	0%	$0	$3,483,264	2024	**$4,283,976**
	80.06		Legal; Permits; Review Fees by other agencies, cities, etc.				$6,966,529		$0	$6,966,529		**$8,567,951**
		80.06.01	Percentage of Direct Costs SCC (10-50)	LS	2%	$348,326,428	$6,966,529	0%	$0	$6,966,529	2024	**$8,567,951**
	80.07		Surveys, Testing, Investigation, Inspection				$6,966,529		$0	$6,966,529		**$8,567,951**
		80.07.01	Percentage of Direct Costs SCC (10-50)	LS	2%	$348,326,428	$6,966,529	0%	$0	$6,966,529	2024	**$8,567,951**
	80.08		Start up				$6,966,529		$0	$6,966,529		**$8,567,951**
		80.08.01	Percentage of Direct Costs SCC (10-50)	LS	2%	$348,326,428	$6,966,529	0%	$0	$6,966,529	2024	**$8,567,951**
	Subtotal (10-80)						**$355,320,990**		**$49,998,200**	**$405,319,190**		$498,491,479
90			**UNALLOCATED CONTINGENCY**	**LS**	**20%**					**$81,063,838**		**$99,698,296**
100			**FINANCE CHARGES**							***Current Year Total***		***YoE Total***
	Segment Totals (10-100)									**$486,383,028**		**$598,189,775**

			Combined Hybrid							Current Year		*Inflation Rate*
5.4 Route Miles			Approximately $26 Million Per Route Mile (Current Year)	Approximately $32 Million Per Route Mile (YoE)						*2017.00 (YR)*		*3.00%*
SCC	SCC Sub	Item #	Item Description	Unit	Unit Cost	Quantity	Item Cost	A. Cont.	Item Cont.	Subtotal	YoE	Subtotal YoE
10			**GUIDEWAY & TRACK ELEMENTS (Route Miles)**				**$21,151,800**		**$4,400,360**	**$25,552,160**		**$31,425,934**
	10.01		Guideway: At-grade exclusive right-of-way				$3,940,800		$788,160	$4,728,960		**$5,816,024**
		10.01.02	BRT Guideway (Exclusive BRT Two Lanes with Barrier)	RM	$4,800,000	0.74	$3,532,800	20%	$706,560	$4,239,360	2024	**$5,213,878**
		10.01.03	BRT Guideway (Exclusive BRT Single Lane with Barrier)	LM	$2,400,000	0.17	$408,000	20%	$81,600	$489,600	2024	**$602,146**
	10.02		Guideway: At-grade semi-exclusive (allows cross-traffic)				$13,786,000		$2,757,200	$16,543,200		**$20,346,049**
		10.02.02	BRT Guideway (Exclusive BRT Two Lanes)	RM	$4,300,000	3.18	$13,674,000	20%	$2,734,800	$16,408,800	2024	**$20,180,754**
		10.02.05	BRT Guideway (Single Lane Exclusive BRT)	LM	$2,800,000	0.04	$112,000	20%	$22,400	$134,400	2024	**$165,295**
	10.03		Guideway: At-grade in mixed traffic				$1,725,000		$345,000	$2,070,000		**$2,545,839**
		10.03.02	BRT Guideway (Shared Guideway Two Lanes)(Part of Streets Estimate)	RM	$0	0.79	$0	20%	$0	$0	2024	**$0**
		10.03.03	BRT Guideway (Shared Guideway Single Lane)(Part of Streets Estimate)	LM	$0	0.09	$0	20%	$0	$0	2024	**$0**
		10.03.04	BRT Guideway (Single Lane BAT Guideway)	LM	$1,500,000	1.15	$1,725,000	20%	$345,000	$2,070,000	2024	**$2,545,839**
	10.04		Guideway: Aerial structure			0	$1,700,000		$510,000	$2,210,000		**$2,718,021**
		10.04.03	BRT and Tram Additional cost for Ramps to Parking Structure	EA	$1,700,000	1	$1,700,000	30%	$510,000	$2,210,000	2024	**$2,718,021**
20			**STATIONS, STOPS, TERMINALS, INTERMODAL (number)**				**$5,850,000**		**$1,170,000**	**$7,020,000**		**$8,633,715**
	20.01		At-grade station, stop, shelter, mall, terminal, platform				$5,850,000		$1,170,000	$7,020,000		**$8,633,715**
		20.01.03	BRT Station (Side Platform)	EA	$225,000	26.0	$5,850,000	20%	$1,170,000	$7,020,000	2024	**8633714.535**
30			**SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS**				**$4,800,000**		**$960,000**	**$5,760,000**		**$7,084,073**
	30.02		Light Maintenance Facility				$4,800,000		$960,000	$5,760,000		**$7,084,073**
		30.02.03	Per Bus Allowance for Modifications to Existing Bus Garage	EA	$300,000	16.0	$4,800,000	20%	$960,000	$5,760,000	2024	**$7,084,073**
40			**SITEWORK & SPECIAL CONDITIONS**				**$27,999,887**		**$3,153,170**	**$31,153,057**		**$38,314,331**
	40.01		Demolition, Clearing, Earthwork				$5,436,500		$1,630,950	$7,067,450		**$8,692,072**
		40.01.01	At-Grade Guideway Preparation BRT/Tram	RM	$1,000,000	5.4	$5,436,500	30%	$1,630,950	$7,067,450	2024	**$8,692,072**
	40.02		Site Utilities, Utility Relocation				$6,523,800		$1,413,490	$7,937,290		**$9,761,866**
		40.02.03	Utility Modification Allowance for BRT	RM	$1,000,000	5.4	$5,436,500	20%	$1,087,300	$6,523,800	2024	**$8,023,451**
		40.02.05	On-Street Drainage Modification Allowance	RM	$200,000	5.4	$1,087,300	30%	$326,190	$1,413,490	2024	**$1,738,414**
	40.04		Environmental mitigation, e.g. wetlands, historic/archeological, parks			0	$543,650		$108,730	$652,380		**$802,345**
		40.04.01	At-Grade Guideway Mitigation Allowance	RM	$100,000	5.4	$543,650	20%	$108,730	$652,380	2024	**$802,345**
	40.08		Temporary Facilities and other indirect costs during construction				$15,495,937		$0	$15,495,937		**$19,058,048**
		40.08.01	Temporary Maintenance of Traffic	LS	5.0%	$73,790,176	$3,689,509	0%	$0	$3,689,509	2024	**$4,537,630**
		40.08.02	Contractor Indirects (Staff, Office, etc.)	LS	15.0%	$73,790,176	$11,068,526	0%	$0	$11,068,526	2024	**$13,612,891**
		40.08.03	Art in Transit (1% of Construction)	LS	1.0%	$73,790,176	$737,902	0%	$0	$737,902	2024	**$907,526**

			Combined Hybrid								Current Year		Inflation Rate
5.4 Route Miles			Approximately $26 Million Per Route Mile (Current Year)	Approximately $32 Million Per Route Mile (YoE)							2017.00 (YR)		3.00%
SCC	SCC Sub	Item #	Item Description	Unit	Unit Cost	Quantity	Item Cost	A. Cont.	Item Cont.		Subtotal	YoE	Subtotal YoE
50			SYSTEMS				$4,772,220		$1,236,666		$6,008,886		$7,390,172
	50.02		Traffic signals and crossing protection				$2,822,220		$846,666		$3,668,886		$4,512,267
		50.02.04	Transit Signal Priority Allowance	RM	$280,000	5.4	$1,522,220	30%	$456,666		$1,978,886	2024	$2,433,780
		50.02.05	Install Active Crossing	EA	$250,000	2.0	$500,000	30%	$150,000		$650,000	2024	$799,418
		50.02.06	Install Active Crossing with Cantilevers	EA	$400,000	2.0	$800,000	30%	$240,000		$1,040,000	2024	$1,279,069
	50.06		Fare collection system and equipment				$1,950,000		$390,000		$2,340,000		$2,877,905
		50.06.02	Fare Collection (Assume Simple TVMs at Stops)	EA	$75,000	26.0	$1,950,000	20%	$390,000		$2,340,000	2024	$2,877,905
	Construction Subtotal (10-50)						$64,573,907		$10,920,196		$75,494,103		$92,848,224
60			ROW, LAND, EXISTING IMPROVEMENTS (Not in Estimate)				$0		$0		$0		$0
70			VEHICLES (number)				$13,600,000		$1,360,000		$14,960,000		$18,398,913
	70.04		Bus			0	$13,600,000		$1,360,000		$14,960,000		$18,398,913
		70.04.01	BRT Vehicle Allowance	EA	$850,000	16.0	$13,600,000	10%	$1,360,000		$14,960,000	2024	$18,398,913
80			PROFESSIONAL SERVICES (applies to Cats. 10-50)				$27,854,467		$0		$27,854,467		$32,376,184
	80.01		Preliminary Engineering				$2,785,447		$0		$2,785,447		$3,043,733
		80.01.01	Percentage of Direct Costs SCC (10-50)	LS	3%	$92,848,224	$2,785,447	0%	$0		$2,785,447	2020	$3,043,733
	80.02		Final Design				$7,427,858		$0		$7,427,858		$8,610,923
		80.02.01	Percentage of Direct Costs SCC (10-50)	LS	8%	$92,848,224	$7,427,858	0%	$0		$7,427,858	2022	$8,610,923
	80.03		Project Management for Design and Construction				$5,570,893		$0		$5,570,893		$6,458,192
		80.03.01	Percentage of Direct Costs SCC (10-50)	LS	6%	$92,848,224	$5,570,893	0%	$0		$5,570,893	2022	$6,458,192
	80.04		Construction Administration & Management				$5,570,893		$0		$5,570,893		$6,651,938
		80.04.01	Percentage of Direct Costs SCC (10-50)	LS	6%	$92,848,224	$5,570,893	0%	$0		$5,570,893	2023	$6,651,938
	80.05		Professional Liability and other Non-Construction Insurance				$928,482		$0		$928,482		$1,014,578
		80.05.01	Percentage of Direct Costs SCC (10-50)	LS	1%	$92,848,224	$928,482	0%	$0		$928,482	2020	$1,014,578
	80.06		Legal; Permits; Review Fees by other agencies, cities, etc.				$1,856,964		$0		$1,856,964		$2,029,155
		80.06.01	Percentage of Direct Costs SCC (10-50)	LS	2%	$92,848,224	$1,856,964	0%	$0		$1,856,964	2020	$2,029,155
	80.07		Surveys, Testing, Investigation, Inspection				$1,856,964		$0		$1,856,964		$2,283,832
		80.07.01	Percentage of Direct Costs SCC (10-50)	LS	2%	$92,848,224	$1,856,964	0%	$0		$1,856,964	2024	$2,283,832
	80.08		Start up				$1,856,964		$0		$1,856,964		$2,283,832
		80.08.01	Percentage of Direct Costs SCC (10-50)	LS	2%	$92,848,224	$1,856,964	0%	$0		$1,856,964	2024	$2,283,832
	Subtotal (10-80)						$106,028,374		$12,280,196		$118,308,570		$143,623,321
90			UNALLOCATED CONTINGENCY	LS	20%						$23,661,714		$28,724,664
100			FINANCE CHARGES								*Current Year Total*		*YoE Total*
	Segment Totals (10-100)										$141,970,284		$172,347,985

Appendix E. Federal and State Environmental Review Process Class of Action Recommendation Technical Memorandum

This page is intentionally blank.

Technical Memorandum

DMC Project No. J8621 Rochester Downtown Transit Circulation Study

To: Doug Moore, Project Manager
HDR

From: Jeanne Witzig and Rachel Dammel
Kimley-Horn
jeanne.witzig@kimley-horn.com
651-643-0447

Date: May 31, 2018

Subject: Federal and State Environmental Review Process Class of Action Recommendation

Cc: Mona Elabbady, SRF Consulting Group

Introduction

The intent of this document is to recommend the appropriate National Environmental Policy Act (NEPA) class of action for the Rochester Downtown Transit Circulation Project. The format of this document is generally consistent with the ultimate submittal to the Federal Transit Administration (FTA) for the final class of action determination. A recommended approach to comply with the Minnesota Environmental Policy Act (MEPA) is also provided.

Project Purpose and Need

The purpose of the Rochester Downtown Transit Circulation Project is to provide a high quality downtown transit service for residents, commuters, businesses, patients, students, and visitors. The project will support the City of Rochester and Destination Medical Center (DMC) district transportation, economic development, and livability goals and will substantially increase transit use downtown.

The need for this transportation investment is driven by dramatic growth anticipated in downtown Rochester. Over the next 20 years, downtown employment is forecasted to grow by about 65 percent, while residential development is expected to increase by 30 percent. Both the City of Rochester Downtown Master Plan and the DMC Development Plan identified the need for an aggressive increase in transit mode share, capturing 23 to 30 percent of all downtown commuters on transit. As a result, transit ridership on both the local and regional transit systems will need to nearly double, requiring more transit capacity.

The following five factors contribute to the need for the Rochester Downtown Transit Circulation Project:

1. Implementation of the DMC Development Plan will significantly increase travel to downtown.
2. The existing transportation network cannot fully accommodate DMC Plan development.

3. Existing parking programs and policies encourage the continued use of private automobiles.
4. Existing transit services cannot effectively capture a large portion of the increased travel demand to downtown.
5. Implementation of the DMC Development Plan without strategic transportation investment will result in severe congestion at downtown entry points and along some primary streets.

These factors necessitate implementation of a high-quality, high-capacity transit service that can attract downtown commuters from their cars and reduce demand on the local street network. Investment in the Rochester Downtown Transit Circulation Project will facilitate successful implementation of the DMC Development Plan by maintaining downtown access, ensuring mobility within downtown, and increasing land availability for office and commercial development.

Preferred Alternative Selection Process

Building on the DMC Development Plan, the City of Rochester is conducting four integrated transit studies to refine concepts identified in the DMC Development Plan. The four studies include the Transit Circulator Study, City Loop Study, Street Use and Operations Study, and Parking and Transportation Management Authority Study.

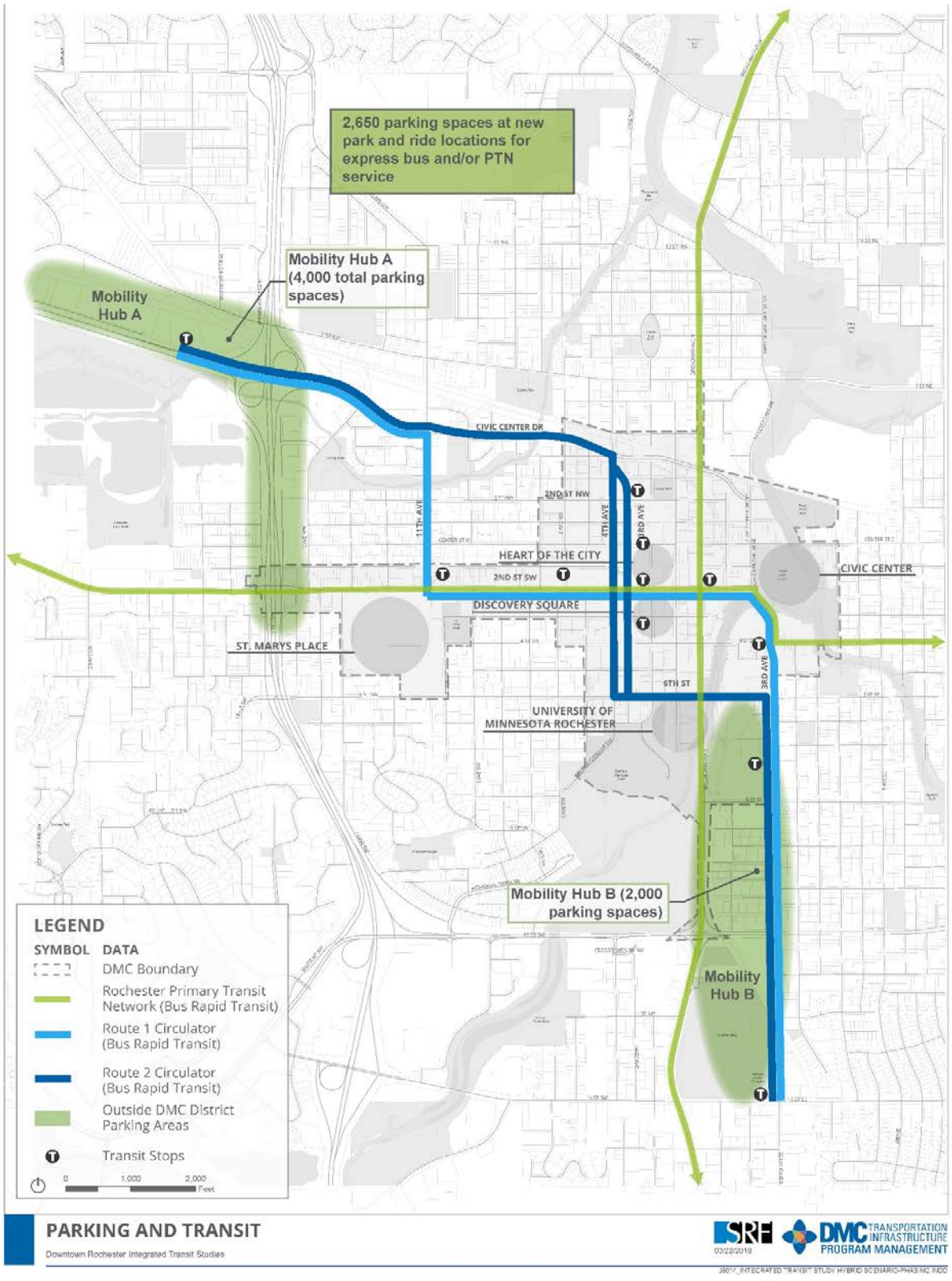
The City of Rochester is the ultimate decision-making body in this process and is in the process of selecting a preferred alternative as part of the Transit Circulator Study. For purposes of this class of action recommendation, we have assumed the project, as defined in the Project Description section of this document, advances for further analysis.

Project Description

The proposed transit Circulator is shown in **Figure 1**. The Circulator consists of two bus rapid transit (BRT) routes. Each route extends from Mobility Hub A in the vicinity of Highway 14/52, through downtown to Mobility Hub B at Graham Park. Route 1 travels along Civic Center Drive, turning south on 11th Avenue NW. The route then turns east along 2nd Street SW, and continues along 3rd Avenue SE to Graham Park. Route 2 also departs from Mobility Hub A along Civic Center Drive, but travels further east to 3rd and 4th Avenues NW. Inbound buses travel down 4th to 6th Street SE, while outbound buses travel back to Mobility Hub A using 3rd Avenue NW. The lines are combined on 6th Street SW, and continue to 3rd Avenue SE. Route 2 then follows the same alignment as Route 1 to Graham Park. Both Routes 1 and 2 offer service in each direction between Mobility Hubs A and B.

The BRT will use articulated vehicles with unique branding. BRT stations will feature level boarding, off-board fare collection, real-time passenger information, and other amenities. The BRT vehicles using Route 1 will operate primarily in dedicated transit lanes. Much of Route 2 will also use dedicated lanes, although along 3rd and 4th Avenues the buses will share lanes with cars accessing curb-side businesses and parking, or making right turns.

Figure 1. Proposed Circulator



Preliminary Impacts of Proposed Action

Preliminary impacts of the proposed action are summarized in Table 1 based on the environmental review conducted in April 2018.

Table 1. Summary of Environmental Review for the Proposed Action

Topic	Findings
Noise and Vibration	• 148 noise sensitive receptors, 5 highly sensitive vibration receptors, and 60 vibration sensitive receptors within the screening distances for Route 1 • 127 noise sensitive receptors, 8 highly sensitive vibration receptors, and 45 vibration sensitive receptors within the screening distances for Route 2 • Minimal operating phase impacts anticipated because of rubber tire vehicles
Historic Properties	• 2 National Register of Historic Places (NRHP)-listed properties, 1 historic district, 1 proposed downtown historic district, and 199 parcels (including 1 bridge) with structures over 50 years of age within study area
Recreational Resources	• Direct impact to 0.76 acre of parkland and 301 feet of trail
Federally- and State-Listed Threatened, Endangered, and Special Concern Species	• No known habitat for any federally-listed species is located within the study area • Six state-listed species have recorded observations within the study area
Surface Waters	• 0.40 acre of wetland and 3 rivers or streams have the potential to be impacted • 7.4 acres of floodplain and 6.3 acres of floodway within the study area
Contaminated Sites	• 37 potentially contaminated sites or hazardous waste generators within the study area
Environmental Justice	• 10 of 14 block groups in the study area have a concentration of minority and/or low-income residents[1] • No block groups have over 50 percent minority or low-income residents
Land Use	• 7.6 acres of right-of-way acquisition from 168 parcels required
Business Impacts	• 211 on-street parking spaces eliminated out of 1,076 on-street parking spaces in the DMC boundary • 81 residential driveways, 49 business driveways, and 20 roadways converted from full access to partial access
Visual Resources	• BRT infrastructure would be generally consistent with the downtown setting and existing infrastructure • Change views to/from two NRHP-listed properties

[1] In order to determine if a concentration of minority residents is present, the percentage of minority residents in the block group was compared against the percentage of minority residents in the city of Rochester (22 percent). Similarly, to determine if a concentration of low-income residents is present, the percent of low-income residents in the block group was compared against the percentage of low-income residents in the city of Rochester (10 percent).

Proposed NEPA Class of Action

The following assumptions were made when considering the appropriate NEPA class of action:

- Federal funding would be pursued through the FTA's Small Starts program or other capital funding programs
- Two alternatives would be evaluated (No Build Alternative and Preferred Alternative)
- Elements associated with the project and assumed in the ridership estimates would be evaluated (i.e., proposed bike paths, parking areas, and transit hubs)

Considering the number of noise- and vibration-sensitive receptors within FTA screening distances, the presence of two NRHP-listed properties and minority and/or low-income populations, the need for right-of-way acquisition, the potential for parking and access impacts, and the high level of public interest, an Environmental Assessment (EA) is recommended due to the potential for significant environmental effects and the public involvement required as part of the EA process. A Categorical Exclusion would not be appropriate because there is the potential for significant environmental effects. However, it is anticipated that these effects could be minimized/mitigated so they are less than significant; therefore, an Environmental Impact Statement would not be required.

Proposed MEPA Process

Assuming FTA funding is pursued, the City of Rochester would work cooperatively with FTA to prepare one environmental document that meets both federal and state environmental review requirements in accordance with Minnesota Rules, part 4410.3900, subparts 1 and 2. The proposed project does not meet or exceed any thresholds for a mandatory Environmental Assessment Worksheets (EAW) or Environmental Impact Statement (EIS) under MEPA per Minnesota Rules, parts 4410.4300 and 4410.4400. However, given the level of interest in this project, the potential impacts identified based on conceptual design of the preferred alternative, and consistent with practice of preparing joint federal/state environmental documents on previous transit projects in the state of Minnesota, the preparation of a federal EA/state EAW is recommended for the proposed action. Under Minnesota Environmental Rules, the designated Responsible Governmental Unit (RGU) would make the determination on the level of environmental review required for the project. Hence, consultation with the City of Rochester, the assumed RGU, would be required to confirm this recommendation.