


M-1 RAIL STREETCAR

# M-1 Rail Streetcar Project Business Plan

*Developed to support the 90-day project validation effort*

**APRIL 20, 2012**

**DEVELOPED IN COOPERATION WITH:**
Federal Transit Administration
Michigan Department of Transportation
Detroit Economic Growth Corporation

**PREPARED BY: M-1 RAIL**

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*Detroit's Woodward Avenue of the Future*

## MISSION

*The mission of M-1 RAIL is to create a catalyst for investment, economic development and urban renewal that positively impacts Detroit through the construction of a streetcar running from Downtown, through Midtown, to the New Center area, and connecting all points along Woodward Avenue.*




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# M-1 RAIL STREETCAR

Executive Summary | Spring 2012

M-1 RAIL STREETCAR

> "THE M-1 RAIL PROJECT IS AN OPPORTUNITY TO INVEST IN THE FUTURE OF DETROIT WITH AN EFFICIENT AND MODERN TRANSIT ALTERNATIVE THAT REESTABLISHES KEY LINKAGES BETWEEN DOWNTOWN, CULTURAL DESTINATIONS, HEALTH AND EDUCATIONAL FACILITIES, AND STADIA. IT WILL COMPLEMENT AND SUPPORT INTERCITY PASSENGER RAIL SERVICES AND FUTURE ENVISIONED ROLLING RAPID TRANSIT WITHIN THE REGION."
> MATT CULLEN, PRESIDENT AND CEO, M-1 RAIL

M-1 RAIL, a 501(c)(3) corporation, intends to construct and operate a streetcar system along Woodward Avenue in close coordination with MDOT and the City of Detroit. Private funding sources for construction and operations during a start-up period will be supplemented by a federal TIGER Grant and federal tax credits.

THE WOODWARD AVENUE CORRIDOR PROVIDES A DIRECT LINK TO **125,000** JOBS AND **275,000** RESIDENTS. THE M-1 RAIL PROJECT WILL BE A CATALYST FOR CONTINUED JOB GROWTH, ECONOMIC VITALITY AND IMPROVED MOBILITY.

*Source: Greater Downtown TOD Strategy, prepared by Hamilton Anderson, prepared for DEGC and DDP, December 2011*

This unique partnership between the philanthropic and business communities in Detroit, and city, state and federal agencies, will help create a modern, regional transit system in which rail, bus, vehicle, bicycle and pedestrian forms of transportation are integrated to build a vibrant, walkable, accessible environment.

M-1 RAIL is a key part of and catalyst for a regional mobility strategy that includes the creation of a regional transportation authority and a Rolling Rapid Transit system of improved city-to-suburb and suburb-to-suburb bus service.

An investment in fixed-guideway transit in an area like Woodward Avenue will foster additional private development, generating new residential and retail options, creating new jobs and adding significantly to the City's tax base. It is anticipated that M-1 RAIL will:

- Provide safe and convenient transportation for residents and visitors.
- Attract more people, businesses and investment, increasing the City's tax base at a critical time.
- Connect with existing Amtrak service.
- Support transit-oriented developments along the corridor, attracting new residents to the City and retaining the young talent needed to fuel and grow Detroit's economy.
- Reduce traffic congestion and parking demand in the Downtown and along the corridor.
- Provide an environmentally responsible transportation alternative that is energy-efficient, clean and quiet.



## PROJECT DESCRIPTION

The 3.31-mile (one way) streetcar route will include 11 stations, and will provide links among key destinations along Woodward Avenue. The streetcar will serve curb-side stations for nearly the entire length of the route, transitioning to center-running at the north and south ends of the system. A one-way trip will take approximately 15-16 minutes, depending on the time of day.

Key features of the streetcar system include:

- Ridership estimated to build to 3 million trips annually or more, as development occurs in the corridor.
- A coordinated fare system with local buses, the People Mover and future Rolling Rapid Transit regional bus service to allow for seamless transfers.
- Ticket vending, weather protection and "next train" technology at all stations.
- Designed to allow future extensions at the north and south ends.




## VEHICLES

Modern streetcar vehicles will be used, similar to those operating in Seattle and Portland. Up to five vehicles will operate at a time along the route. Vehicle features will include:

- Level boarding from ADA-accessible curbside platforms.
- Multiple doors for fast boarding.
- Clean and quiet electric power operations.
- Mixed traffic, to preserve on-street parking and access to corridor businesses, residential properties, and parking facilities.
- On-board wi-fi service.

## OPERATING HOURS and HEADWAYS

| DAYS | HOURS | TIME UNTIL NEXT STREETCAR |
|---|---|---|
| Monday - Friday | 6 a.m. to 3 p.m. | 7.5 minutes |
| | 3 to 7 p.m. | 8 minutes |
| | 7 to 10 p.m. | 12 minutes |
| Saturday | 8 a.m. to 7 p.m. | 9 minutes |
| | 7 to 10 p.m. | 12 minutes |
| Sunday | 8 a.m. to 10 p.m. | 12 minutes |

## PEER CITIES

Portland, Seattle, and Tacoma all have seen development occur near their streetcar systems. Since 1997, Portland has had over $3.5 billion in new investment within two blocks of the streetcar route. Milwaukee is designing a 3.5-mile system and anticipates over $3.35 billion in new investment by 2030, with the potential for over $200 million in new tax revenue by 2030.

M-1 RAIL STREETCAR

## PROJECT COSTS

The capital cost for the M-1 RAIL streetcar is estimated at $135 million. It is estimated that a significant majority of funds will come from private sources. Construction will be closely coordinated with the planned MDOT reconstruction of Woodward Avenue in 2013.

THIS LEVEL OF PRIVATE FUNDING SUPPORT FOR PUBLIC TRANSIT IS UNPRECEDENTED, AND IT IS INDICATIVE OF THE STRONG COMMITMENT FROM LOCAL BUSINESS LEADERS AND THE REGION'S PHILANTHROPIC COMMUNITY TO SECURE DETROIT'S FUTURE AS A LIVABLE AND DESIRABLE PLACE TO LIVE AND WORK.

The annual operating cost for the streetcar is estimated at $5.1 million. This cost is anticipated to be covered by a combination of fare box revenue, private funding support, and grants from the State of Michigan. The project assumes a fixed fare policy of $1.50 per ride with transit pass options for frequent riders.

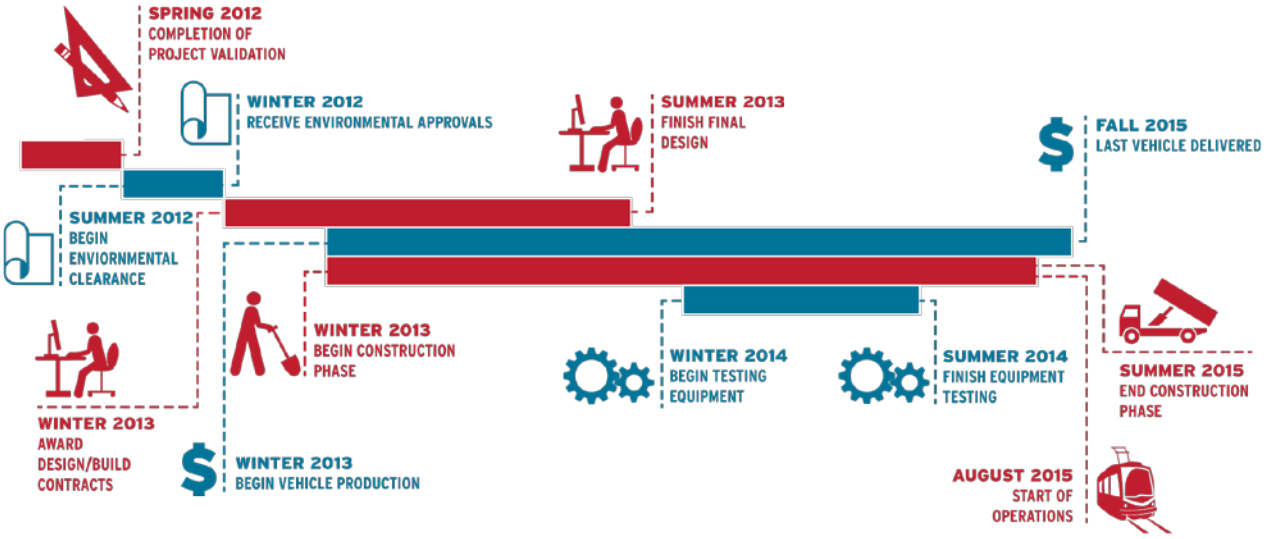
**ESTIMATED CAPITAL and OPERATING COSTS** (in millions of 2012 dollars)

| | |
|---|---|
| Total Capital Cost | $135 million |
| Annual Operating Cost | $5.1 |

### FUNDING COMMITMENTS

Funding commitments from foundation, corporate, institutional, and Detroit Development Authority (DDA) sources will be combined with federal TIGER Grants and tax credits to implement the project.

## PROJECT TIMELINE



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# 1 ACKNOWLEDGEMENTS

M-1 RAIL wishes to thank and acknowledge the following project partners for their efforts in the development of this 90-day project validation report:

- USDOT Secretary Ray LaHood
- Southeast Michigan's Congressional Delegation
- Federal Transit Administration and their respective Project Management Oversight Consultants
- Governor Snyder and his administration including the Michigan Department of Transportation
- Mayor Bing and the Detroit Economic Growth Corporation
- Southeast Michigan Council of Governments
- State Historic Preservatio Office
- Downtown Detroit Partnership
- Kresge Foundation
- Quicken Loans
- Roger Penske
- Detroit Edison
- Wayne State University
- Henry Ford Hospital
- M-1 RAIL Finance Team
- M-1 RAIL Communications Team
- M-1 RAIL Legal Team
- M-1 RAIL Fundraising Team
- M-1 RAIL Technical Team

The results of this report reflect the work and progress made since January 6, 2012 to validate whether a modern streetcar system along the Woodward Avenue corridor can be both technically and financially constructed and operated by a private entity within Detroit. M-1 RAIL appreciates the valuable insight provided by the FTA and their respective PMOC's into this assessment to identify potential fatal-flaws or high risk elements associated with the delivery and the future operations of this project. As part of this validation effort, FTA has identified potential elements of increased project risk based on the agency's institutional experience delivering fixed-rail projects across the country. These perspectives have helped M-1 RAIL further define all elements of the project, including the project scope, service plan, costs and project delivery approaches.

It should be noted, however, that several of the comments and assumed risk areas identified by the FTA throughout the 90-day validation process reflect a variance from the FTA's standard project delivery model for an FTA funded project. The M-1 RAIL project is not your standard New Starts project. While

certain elements of the M-1 RAIL Business Plan do follow proven peer city approaches (i.e., Portland, Tacoma, New Orleans, etc.) the overall approach represents a new different model to deliver and operate a modern streetcar project.

Futher, there are two sides to assessing risk that should be recognized; threats and opportunities. M-1 RAIL believes this project has many opportunities that if fully leveraged will minimize the risks identified by FTA in their 60-day assessment of the project. Some of these key opportunities that are discussed in further detail in this Business Plan include:

- Constructing the M-1 RAIL project concurrent with MDOT's $20 million reconstruction project of Woodward Avenue
- Delivering the project cooperatively with key project partners including MDOT and DTE
- Utilizing the full suite of project delivery tools from our project partners including MDOT and the City of Detroit's utility franchise agreements
- Capitalizing on current market conditions including the recent city of Cincinnati vehicle procurement
- Capitalizing on the abundance of automible manufacturing labor within the greater Detroit area to minimize the overall needs and the associated capital costs of a Vehicle Storage Maintenance Facility
- Capitalizing on the Private and Philanthropic relationships that exist as part of the M-1 RAIL Team to help build community support for the project
- Capitalizing on the available "Pure Local Match" that M-1 RAIL can bring to a New Starts funded RRT project

The M-1 RAIL project is not your traditional New Starts funded fixed rail transit project. Rather, it is an innovative partnership that is being driven by the private and philanthropic community of Detroit that sees it as an opportunity to reinvest in the Woodward Avenue corridor, the City of Detroit, and Southeast Michigan. It is this group of project investors that will demand the project is delivered using a different model; one that is efficient and cost-effective, yet still adheres to all local, state, and federal regulations. Therefore, M-1 RAIL working with its public project partners is very confident it can deliver the project and achieve the corresponding assumptions included within this Business Plan.

# 2 INTRODUCTION

M-1 RAIL proposes to create a catalyst for investment, economic development and urban renewal that posively impacts not only the Woodward Avenue corridor, but greater Southeast Michigan through the construction of a modern streetcar system running from Dowtown to the New Center area of Detroit. This Business Plan states the case for why an investment is needed, what that investment will look like, and how the M-1 RAIL Streetcar Project will be designed, constructed and operated for a period of up to 10 years. The M-1 RAIL Streetcar Project is an innovative partnership between the region's most prominent philanthropic and business community leaders and the public agencies that own the underlying assets that when implemented transform the Woodward Avenue corridor by increasing mobility, economic development and improving the quality of life.

This Business Plan also documents the results of a 90-day validation effort, conducted cooperatively by M-1 RAIL with the Federal Transit Administration (FTA), the State of Michigan and the City of Detroit, to describe and verify a proposal prepared by M-1 RAIL to construct a 3.31 mile (one-way distance) streetcar line along Woodward Avenue between Downtown Detroit and the New Center area, as shown in **Figure 2.1**. The M-1 RAIL Streetcar Project will use modern vehicle technology to link cultural, entertainment, health care, and educational activity centers along the corridor. The proposed M-1 RAIL Streetcar Project is substantially similar to a proposal originally put forth by M-1 RAIL in 2009, which was subsequently expanded to reflect a longer light rail route and assessed in an environmental impact statement process that concluded in 2011. Complete documentation of the Concept of Design, Basis of Design and 20% design plans prepared for the expanded light rail alternative are included in the **Appendices** for reference.

As described in detail in this Business Plan, M-1 RAIL intends to construct the streetcar line in close coordination with the Michigan Department of Transportation (MDOT) and the City of Detroit, relying substantially on private funding sources to support construction and operations during a start-up period. M-1 RAIL intends to ultimately transfer operations and maintenance responsibility for the streetcar line to a public entity, as discussed herein. M-1 RAIL is also committed to coordinating system design and operations with the proposed Regional Rapid Transit (RRT) system as appropriate in the future.

## 2.1 What is the Purpose of M-1 RAIL?

The M-1 RAIL Streetcar Project will be critical to Detroit's future by supporting the following mission, vision and goal.

Mission

The mission of M-1 RAIL is to create a catalyst for investment, economic development and urban renewal that positively impacts the entire region through the construction of a streetcar circulator

system running along and connecting all points of Woodward Avenue from the Riverfront to the New Center area. The M-1 RAIL Project is envisioned to be a single project within a program of bigger transit investments to occur within the Southeast Michigan region.

Vision

The M-1 RAIL Project is envisioned to be one element of a future modern, world-class regional transit system where all forms of transportation, including rail, bus, vehicle, bicycle and pedestrian, are considered and utilized to build a vibrant, walkable region that includes a thriving Downtown Detroit. This city center is envisioned by supporters of M-1 RAIL to become a foundation for growth and prosperity throughout the surrounding neighborhoods, from the Central Business District through Midtown, and on to New Center.

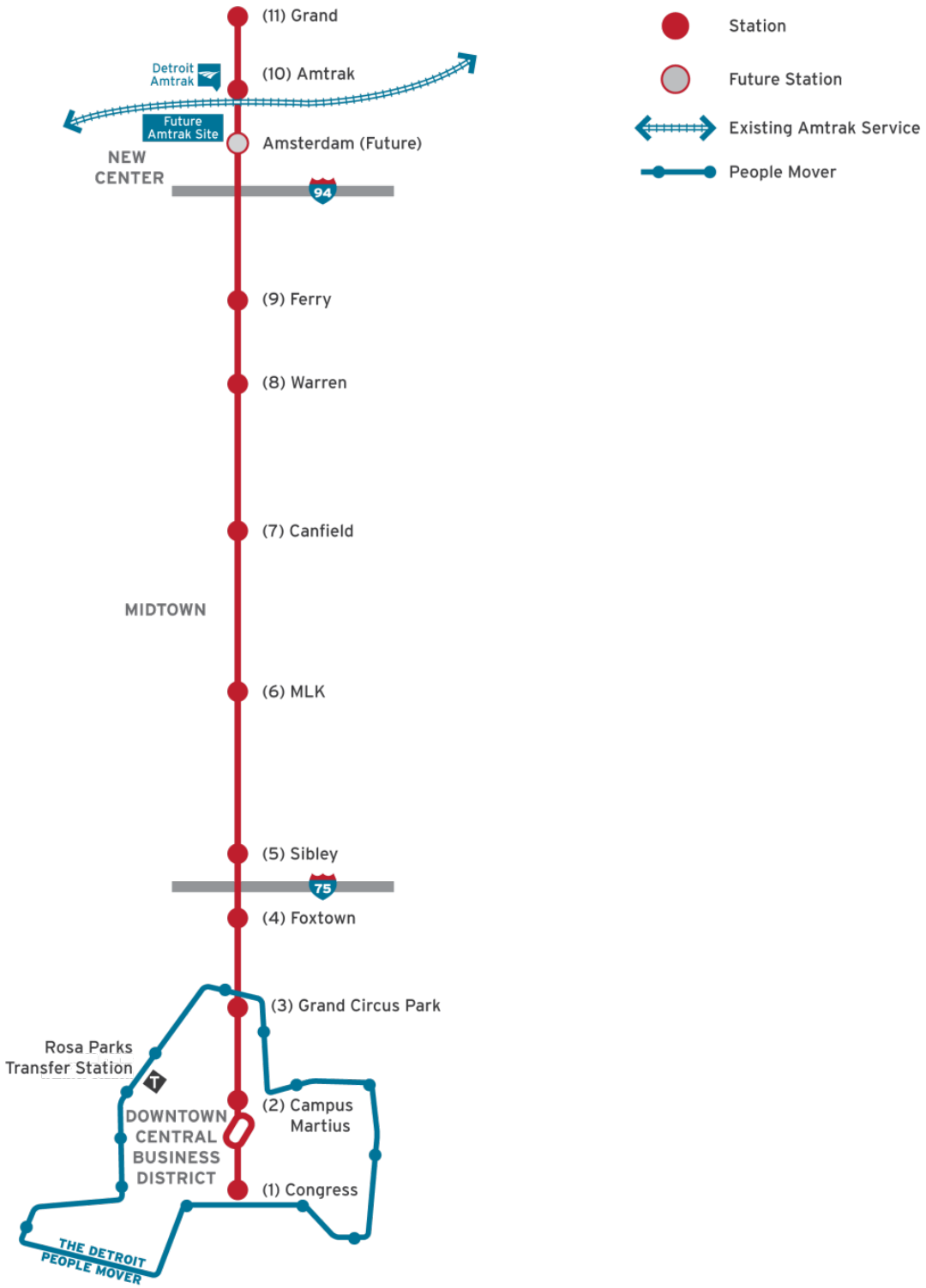
Goal

Making this vision a reality requires a strategic approach that expedites critical components of the regional transit system. The goal of the supporters of M-1 RAIL is to construct the M-1 RAIL Project as the initial step, cementing the foundation of a regional system and creating a 21st century living and working environment in the heart of Detroit along the region's most active, iconic, and dynamic corridor. This initial focus on the M-1 RAIL Project will create a city center that attracts more people, businesses, and investment. The M-1 RAIL Streetcar Project will increase the City's tax base at a critical time to enable greater economic development throughout the City and beyond.

## 2.2 What Will M-1 RAIL Look Like?

As illustrated in **Figure 2.1**, the M-1 RAIL Streetcar Project will construct an urban fixed rail circulator system connecting Downtown Detroit to the New Center area along the region's main artery, Woodward Avenue (M-1). The route is 3.31 miles long with 11 station stops. The streetcar system is envisioned to run on both sides of the street in the curb lane, with median running at the north and south ends. No business or residential dislocations are expected. The streetcar service will be co-mingled with vehicular traffic. M-1 RAIL envisions providing premium transit service along the corridor with 7.5-minute headways during peak periods and 12-minute headways during off-peak periods. The annual ridership is projected to be 1,800,000 in the first year of operations in 2015, growing to a projected 3,000,000 annual riders by 2035.

**Figure 2.1 M-1 RAIL Streetcar Project Diagram**



## 2.3 How Can M-1 RAIL Support Future Regional Transit On Woodward Avenue?

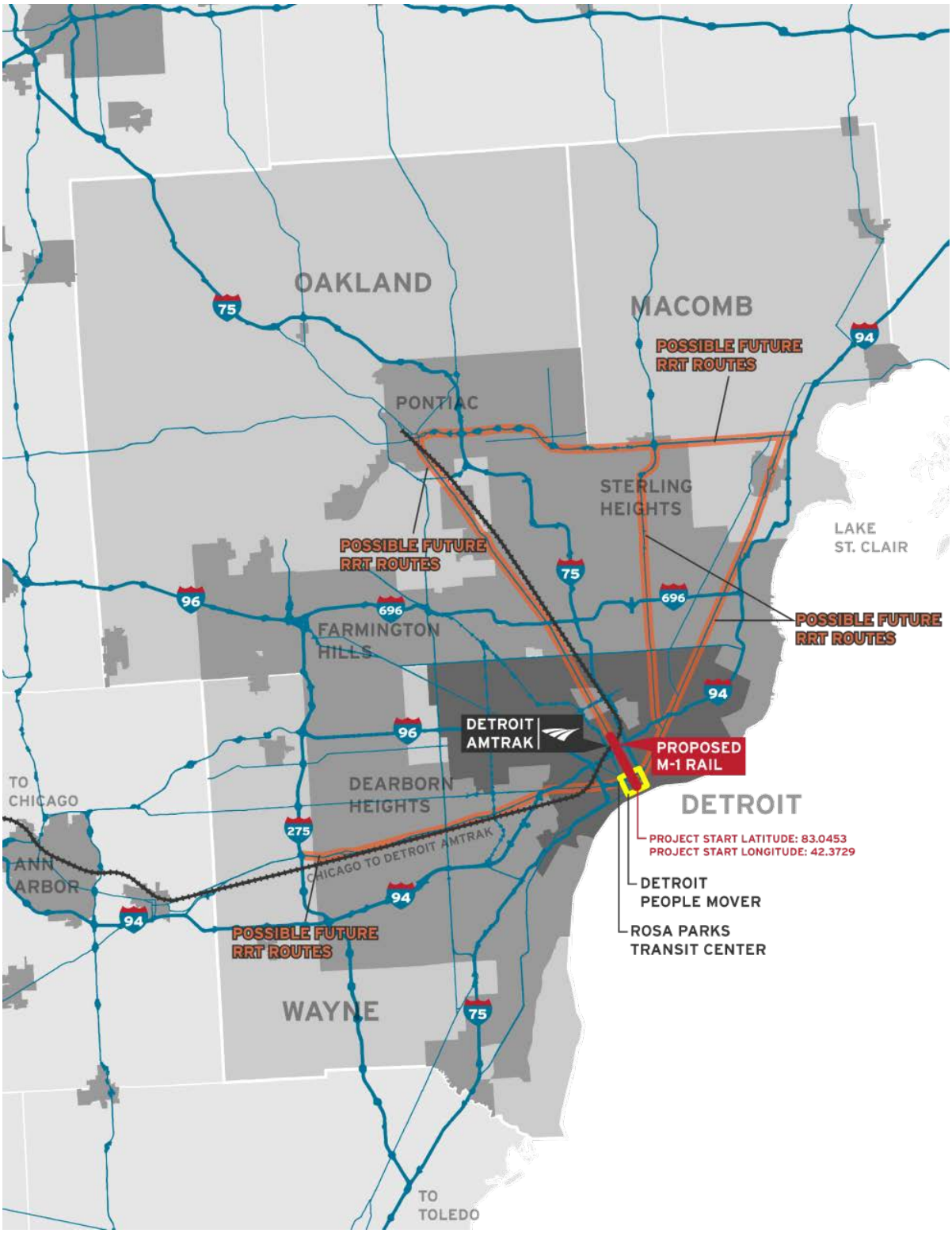
In December 2011, a regional transportation strategy was unveiled that seeks to provide fast, frequent, comfortable transit service along four corridors within metro Detroit that will generate high transit use. The Southeast Michigan Regional Transit Authority (RTA) concept seeks to establish a regional authority to provide service to 22 communities in four counties along the Michigan Avenue, Woodward Avenue, Gratiot Avenue, and M-59 corridors.

RRT service will connect communities throughout Southeast Michigan and will provide greater amenities such as enhanced stations, transit signal priority, next bus information, and hybrid vehicles with more amenities than a normal transit bus. Station spacing of one-half (1/2) mile to one mile or more will allow higher speeds and faster travel times. Local buses operated by DDOT and SMART will overlap with the RRT system, providing increased service frequency along Woodward Avenue and other corridors. The Rosa Parks Transit Center would serve as the system hub. Two potential levels of service (ART and BRT) are being considered as part of this RRT concept. Arterial Rapid Transit (ART), which operates in mixed traffic, is envisioned to be the backbone of the system, with some future segments of Bus Rapid Transit (BRT), which runs in a dedicated lane.

The RRT concept is built upon the regional transit vision contained within the Comprehensive Regional Transit Service Plan developed by the Regional Transit Coordinating Council (RTCC) in 2008. As illustrated in **Figure 2.2**, the RTCC's regional transit plan recommended implementation of a light rail system along Woodward Avenue from Downtown to the New Center area of Detroit to complement the identified RRT corridors. The M-1 RAIL Project will serve an important purpose within this larger envisioned Southeast Michigan regional transit system, which can and should be pursued in parallel with regional efforts related to the proposed regional Rolling Rapid Transit (RRT) system. First and foremost, the M-1 RAIL Streetcar Project provides an opportunity to more rapidly implement the region's comprehensive transit vision as outlined in the RTCC. Fixed guideway transit on Woodward also will benefit the RRT with increased ridership and passenger boardings at the Rosa Parks Transit Center, and/or by having each BRT route cross over Woodward as it traverses the Downtown. Coordination of RRT routing with M-1 station locations in the Downtown will reduce overall costs, maximize transfer opportunities and support use of both systems.

The Consolidated Appropriations Act of 2010 also established that the private and philanthropic investments being secured by M-1 RAIL could be counted as a connected project for a New Starts funded light rail or RRT system. Specifically, Section 168 of the Act requires the Secretary, when determining the local share of costs for the rating process for New Starts, to consider any portion of the corridor advanced entirely with non-federal funds. M-1 RAIL estimates the pure local match associated with the current project to provide over $60 million in local matching funds, bringing the total project benefit to at least $120 million for a future New Starts funded RRT system.

**Figure 2.2 Regional Context Map**



## 2.4 What Benefits Will the M-1 RAIL Streetcar Project Provide?

### *2.4.1 Regional Benefits*

Metro Detroit, defined as the Detroit-Warren-Livonia Metropolitan Statistical Area (MSA), ranks as the 14th largest metropolitan economy in the United States. With a Gross Metropolitan Product (GMP) of approximately $190 billion, Metro Detroit's economy is roughly the same size as that of the Minneapolis-St. Paul MSA. In the Midwest region, only Chicago boasts a larger GMP ($514 billion). St. Louis, Pittsburgh, and Cleveland have GMPs below $130 billion. Metro Detroit accounts for about half of Michigan's Gross State Product (GSP) of roughly $380 billion (12th largest in the country). Despite its economic significance, Metro Detroit receives disproportionately low levels of state-support. For instance, only one out of every three dollars spent on infrastructure in the state of Michigan flows into Metro Detroit. The difference between this ratio and Metro Detroit's contribution to GSP places Detroit among the most "underfunded" metros in the country.

Despite its size and historical economic prominence, recent economic growth trends suggest continued economic decline in the region. Over the last decade, Metro Detroit has ranked near the bottom of more than 350 metro areas in average annual GMP growth rate at less than 1%. Recent years show an intensification and acceleration of this trend as domestic economic woes have hit the region hard. Metro Detroit saw a 5.4% drop in GMP between 2007 and 2009 with only tepid growth of about 2% per year in 2010 and 2011. There has been no major city in America more devastated by the economic downturn than Detroit. The most pressing challenges affecting near- and long-term decisions include:

- Access to jobs and job retention
- Limited resident mobility and insufficient public transportation infrastructure
- Conversion or growth of new and existing economic sectors
- Neighborhood stability and the elimination of blight
- Changes to the lending environment and loss of real estate valuation
- Access to quality and safe education
- Regional cooperation

Detroit's unemployment rate remains one of the highest in the nation. The official unemployment rate for Detroit remains above 20%, with estimates of true unemployment within the City of Detroit as high as 50%. A tourniquet has been applied to all types of lending in Southeast Michigan as the national credit freeze is exacerbated by uncertainty about the valuation of real estate and other assets as collateral for loans, as well as the impact of job losses on people's ability to repay. The physical condition of neighborhoods continues to deteriorate from the impact of foreclosure and abandonment, threatening the health of historically stable neighborhoods while extending the conditions of blight and crime in others. The City's resources are strained. School enrollment continues to decline. And at the metropolitan scale, the region continues to be severely divided by race and class. Policies and practices

that have historically promoted sprawl have created a three-county area where many suburban areas have begun to experience economic shrinkage similar to that of Detroit.

The M-1 RAIL Streetcar Project is foundational to Metro Detroit's collective efforts to transform the City and the Southeast Michigan region into a place that serves current and future residents as well as any other place in the country. Specifically the M-1 RAIL Streetcar Project is envisioned to provide the region with:

- Improved access to jobs within the Central Business District, MidTown, and New Center areas of Detroit,
- Improved mobility and a reliable public transportation option for commuters, transit dependent riders, and visitors to Detroit,
- Focused mixed use real estate development in the Woodward Avenue corridor that supports City efforts to concentrate infrastructure and services in more sustainable patterns,
- Added growth for new and existing economic sectors,
- Improved neighborhood stability along the Woodward Avenue corridor, and
- Improved access to lending capital and the turn-around of real estate valuation for properties located along Woodward Avenue.

As illustrated in **Figure 2.2**, the M-1 RAIL Streetcar Project has been developed in a manner that supports existing transit assets along the Woodward Avenue corridor. Specifically, the streetcar line will support connections to DDOT, SMART, the Detroit People Mover (DPM), and Amtrak's Wolverine intercity passenger rail line.

As the M-1 RAIL Streetcar Project is envisioned to be a single component within a program of regional transit investments, the streetcar line has also been designed to support possible future system extensions at both the northern and southern terminals to provide connections to key land use and transportation destinations within the City of Detroit, including the Rosa Parks Transit Center. The M-1 RAIL Streetcar Project will also support future extensions north along Woodward Avenue, including future Regional Rapid Transit.

### *2.4.2 Woodward Avenue Corridor Benefits*

Within the corridor, the Detroit Economic Growth Corporation and the Downtown Detroit Partnership completed a *Greater Downtown TOD Strategy* in 2011. The Plan outlined a strategy to double the residential population in the greater Central Business District, Midtown, and New Center areas of Detroit in the next ten years by leveraging the streetcar investment to catalyze growth of existing districts and neighborhoods. The Plan stated that *"implementation of M-1 RAIL will permanently connect the major regional destinations, employment, educational and medical centers in the greater downtown area with neighborhoods, improve access to jobs and services for residents along the corridor, and offer a new opportunity to live in a walkable environment."*

The following are key excerpts from the Plan that are supportive of the need for the M-1 RAIL Streetcar Project:

> *With a direct link to 140,000 jobs, 27,000 residents, destinations attracting 15 million annual visitors and 15 distinct neighborhoods that include several National Historic Districts, cultural destinations, schools, places of worship and community institutions, the Woodward corridor represents an opportunity to rethink how people move in Detroit— between home, work, shopping and recreation. The investment in fixed rail on Woodward Avenue represents much more than a better way to get from point A to point B. When successfully planned and executed, M-1 RAIL will be a catalyst for neighborhood/city building and placemaking initiatives, including:*
>
> - *Creating a catalyst for job growth in the Woodward Corridor*
> - *Establishing the Woodward Corridor's role in the region as the best transit served area and urban/walkable place to live*
> - *Enhancing the Corridor's economic vitality through the growth of its greater downtown core and revitalization of its many diverse neighborhoods*
> - *Enhancing the Corridor as tourist destination and a regional gathering place*
> - *Beginning the dialogue between the many residents, businesses and stakeholders for whom the Woodward Corridor is part of their daily lives and creating new partnerships between them*
> - *Serving as an example or template for additional light rail corridors in the City and the region*
>
> *In short, M-1 RAIL is an opportunity to reposition the Woodward Corridor and the City of Detroit as a contemporary, healthy and livable urban center that inspires residents, workers and visitors alike.*
>
> ***A Denser Greater Downtown***
> *The core principle of the Greater Downtown TOD Strategy is to use increased density to create vibrant and walkable districts and neighborhoods.*
>
> *As part of the TOD planning process, Planning Group members representing the public, private and philanthropic sectors have set a goal of doubling the Greater Downtown residential population in the next ten years from 27,000 to 46,000 Greater Downtown residents. This goal is aligned with parallel Greater Downtown initiatives such as Hudson-Webber's "15 by 15" (15,000 new residents by 2015) and Live Midtown/Live Downtown residential financial incentives programs offered to Greater Downtown employees to move Downtown.*
>
> *However, while setting targets for increased residential population in the Greater Downtown is important, the distribution of that increased population must be targeted to achieve higher densities in specific areas and thus add a critical mass of new residents to improve street vitality, walkability and subsequently spur an increase in market-rate housing values to sustain future development. Over the last ten years, the Greater Downtown has added over 4,000 new housing units. While this number is strong from an economic development standpoint, the new housing units have been spread out over nearly four square miles and have not succeeded in creating*

*sufficient density in any one area to achieve a critical mass of residents in order to create contiguous areas of walkability.*

***Greater Downtown Transit-Oriented Development Strategy***
*The two major objectives of the Corridor TOD Strategy are:*

1. *Focus development to create density in three Core Districts: CBD, Midtown and New Center. Develop each Core District starting with the District Center, then build out from the Center per the recommended phasing.*
2. *Provide infrastructure to connect all other districts and neighborhoods back to the District Center and Woodward Light Rail. Use these infrastructure investments to leverage future development after the build-out of the Core District.*

As illustrated in **Figure 2.3**, the population growth is clustered along Woodward Avenue. If all of the growth were to occur within convenient walking distance of the M-1 RAIL Streetcar Project, weekday comparison with peer streetcar systems suggests that ridership could exceed the buildout estimate of 3 million unlinked trips per year.

Following this implementation strategy, the TOD working group projects to add 8,250 new housing units in 10 years. The M-1 RAIL Streetcar Project is envisioned to directly support this future housing growth.

### *2.4.3 Intermodal Connectivity and Transportation Benefits*

The State of Michigan has a comprehensive passenger rail vision that seeks to deliver intercity passenger rail service to Michigan's citizens better, faster, cheaper, safer and smarter.

Currently the 304-mile Chicago-Detroit/Pontiac rail corridor travels through nine different Michigan counties and has an existing Amtrak station on Woodward Avenue. In 2011, a record number of Amtrak passengers (503,290) utilized this passenger rail service. MDOT working cooperatively with FRA, its sister state agencies in Indiana and Illinois, Amtrak, and several of the Class I Railroads plans to invest over $952 million in this corridor to increase speed, frequency, and reliability of service along this corridor. These investments are expected to lead to continued growth in Amtrak ridership.

The M-1 RAIL Streetcar Project directly supports intermodal connectivity with a streetcar station immediately adjacent to the existing Amtrak station to facilitate seamless transfers.

**Figure 2.3 Greater Downtown TOD Stratgy Target Residential Density**
(Source: *Greater Downtown TOD Strategy*, December 2011)

As the M-1 RAIL Streetcar Project is envisioned to be a single project within a program of bigger transit investments, the M-1 RAIL system has also been designed to support possible future system extensions at both the northern and southern terminus to provide connections to key land use and transportation destinations within the City of Detroit, including the Rosa Parks Transit Center. The M-1 RAIL system would also support future extensions north of the route terminus including future Regional Rapid Transit, as well as a possible Light Rail Transit route consistent with the LPA identified within the Woodward Avenue Light Rail Transit Project Environmental Impact Statement. While plans for Regional Rapid Transit (RRT) or Bus Rapid Transit (BRT) have not been finalized along the Woodward Avenue corridor, M-1 RAIL believes the operation plan and service levels proposed for the M-1 RAIL Streetcar Project can be achieved when future RRT/BRT operations is added to the corridor.

M-1 RAIL is committed to working cooperatively with the agency or agencies that ultimately will implement either RRT or BRT services along the corridor. Specifically, station placement and route coordination will be key to assess during the planning stages of the RRT/BRT. Coordination options to consider during the upcoming Woodward Avenue RRT Alternatives Analysis Study being led by the Southeast Michigan Council of Governments (SEMCOG) include shared stations along the corridor, and opportunities to utilize parallel routes (i.e., Cass Avenue south of Warren Avenue) for RRT service to provide improved transit services along the corridor, and desired connections to the Rosa Parks Transit Center.

## 2.5 Organization of the Business Plan

The 90-day validation effort included a thorough review of previous project documentation, additional analysis as required to update and verify important assumptions, a thorough risk assessment (as documented in the **Appendices**), and the development of an updated proposal that anticipates approval for further project development by the FTA. The business plan has been built up from research, analysis, and preliminary design started in 2007, including the development of a Basis of Design Document, and a more refined Concept of Design Document, including the development of 20% preliminary plans. Concept of Design Documents are also included in the Appendices.

Included in this Business Plan are the following:

- A detailed Project Definition;
- A detailed Service Plan;
- An assessment of expected Ridership;
- A Capital Budget, Operating & Maintenance Budget and Financial Plan;
- A discussion of Project Delivery, Project Schedule and Systems Operation and Management;
- An outline of Next Steps required to move the M-1 RAIL Streetcar Project forward, including NEPA clearance; and
- Appendices containing supporting information, as referenced within this document.

# 3 PROJECT DEFINITION

The M-1 RAIL design connects Detroit's central business district with the New Center area, utilizing a streetcar vehicle operating in a curb-side (second) travel lane for nearly the entire length of the route. The Project Definition in this section provides a complete description of the Project, but includes a focus on adjustments to the 2009 design. It also highlights new information developed in response to questions raised during the 90-day validation period (January 2012 to April 2012) by the FTA, MDOT and the City of Detroit. Exhibits illustrating the M-1 RAIL Streetcar alignment, station locations, and VSMF location are included in **Appendix A.1**. Proposed cross sections are shown in **Appendix A.2**.

The M-1 RAIL Streetcar Project will be undertaken in close coordination with MDOT's Woodward Avenue reconstruction from Chandler to Sibley. This project is in the TIP for reconstruction in 2013 with an estimated cost of $19,546,000. Coordination will result in cost efficiencies accruing to both projects. In a key component of this coordination effort, MDOT and the City of Detroit will utilize their respective franchise authority to require private utilities located within the public right-of-way to relocate at the cost of the utility company. A full explanation of scope items provided by MDOT as a result of this coordination effort is described in **Section 6.2**.

The M-1 RAIL Streetcar Project description is organized using FTA's Standard Cost Categories (SCC) as follows:

10 Guideway and track elements
20 Stations, stops, terminal, intermodal
30 Support facilities: yards, shops, administration
40 Sitework and special conditions
50 Systems
60 Right-of-way, land, existing improvements
70 Vehicles

## 3.1 10 Guideway and Track Elements

Embedded Track – 115 T-rail

The track will be primarily double track running in the curb-side (second) lane along Woodward Avenue, entirely located within the existing road right-of-way (ROW). Due to Buy America requirements, the proposed rail type for the entire system will be 115-lb. T-rail. The rail design is likely to have similar design elements as proposed in 2009. The rail will likely be installed in an 8-foot wide by roughly 12 to 24-inch deep track slab with 4'-8.5" standard track gauge. Although 115-lb. T-rail is currently the preferred rail type, the M-1 RAIL Team will continue to monitor the performance of 112-Tram rail that is rolled in Steeleton, Pennsylvania, and was recently installed in Portland, Oregon. During the final design phase, M-1 RAIL will make a final determination as to the type of rail to utilize.

Conceptual Alignment Adjustments

*New Crossovers*

As shown in **Figure 3.1**, a crossover has been added between Henry Street and Adelaide Street to improve operational flexibility. This feature is called the Sibley Crossover. The alignment adjustments create a storage/pocket track on the east side of the street in the parking lane for both emergency operations and special event operations near the Stadium/Fox District. The storage track is adjacent to the crossover to allow an impaired vehicle to be towed from either direction of the route. This provides the flexibility near the middle of the route to remove trains from the roadway.

Additionally, a northbound platform with capacity for two vehicles was added near Henry Street to allow for special event/game-day management. The platform is designed to be located out of the through travel lanes as a siding. This configuration will provide M-1 RAIL with operational flexibility to potentially stack two vehicles for increased passenger capacity during special events in the adjacent Stadium/Fox Districts.

A second crossover has also been added south of Gratiot Avenue to accommodate special events that result in the full closure of Woodward Avenue at Campus Martius. The crossover is envisioned by M-1 RAIL to only be used when Woodward Avenue is closed and would provide access to the Campus Martius station, which would temporarily become the line's southern terminus when Woodward Avenue is closed.

*South Terminus*

As shown in **Figure 3.2**, the South Terminus will terminate with a median station between Congress and Larned Streets. The median station was placed at this location to minimize operational impacts associated with existing transit stops and traffic conflicts near the Coleman A. Young Municipal Center. The southern terminus has been designed to accommodate up to three vehicles to provide system redundancy and operational efficiencies. The south terminus will also provide storage track at the end of the line for disabled vehicles and will allow the vehicle turnaround movements to occur within the median between Congress and Larned Streets. This design option also allows ADA access ramps from both the intersections at Congress and Larned Streets.

To provide further operational flexibility, M-1 RAIL included a full crossing on the north side of the Congress platform. This will allow for simultaneous boarding and alighting of two vehicles while also allowing for the storage of a disabled vehicle on the south end of the route. The platform will be designed to accommodate vehicles on both the east and west side, allowing vehicles to double up during recovery from service irregularities. Additionally, two 25-meter turnouts were added to the northbound track to allow the vehicle on the east side of the platform to proceed north onto the mainline.

*RR Viaduct/North Terminus*

At the northern end of the route, the trackway is proposed to transition from a curb-side alignment to a median running alignment from Burroughs Street to the end of the line at the north terminus. This design modification (as illustrated in **Figure 3.3**) was made to improve operational efficiencies, minimize costs and avoid potential impacts to the RR viaduct. As discussed further in this section, the Michigan Department of Transportation will be completing a reconstruct of Woodward Avenue in conjunction with the M-1 RAIL Project. This reconstruction will increase the existing underclearance to 14'6". The median running trackway can be designed to accommodate OCS under the viaduct and will avoid impacts to the bridge pier footings (as shown in **Figure 3.10**). Additionally, the alignment is designed to accommodate a possible lead track if the maintenance facility were to be located at the Amsterdam site. Other modifications include adjusting the curb-side stop platforms at Baltimore and Grand Boulevard to median platforms. M-1 RAIL also is proposing to utilize off-wire technology within its preferred vehicle to operate under the Norfolk Southern, CN-Shared Asset Railroad viaduct located just north of Amsterdam Street (see **Section 3.7**).

*Switches*

The current design includes spring switches at turnouts along the corridor, consistent with streetcar systems around the world. Spring switches can be hand operated in any direction and set for spring throw in any direction. The point or points are connected to a hand throw mechanism with a spring so that if the streetcar wheels go against the point while it is set against the wheels, it moves over as if it were thrown by the hand mechanism but springs back to it preset position. As with other types of switches, they will be equipped with track switch heaters to keep the points and mechanism clear and free of ice/snow. In most cases, this feature will prevent the dangerous situation in which an operator would need to get out of the streetcar in traffic to throw a track switch. As a back-up, each vehicle will be equipped with a manual switch bar to allow the driver to manually change the switch in cases were the spring switch is facing the wrong direction.

**Figure 3.1 Sibley Crossover**

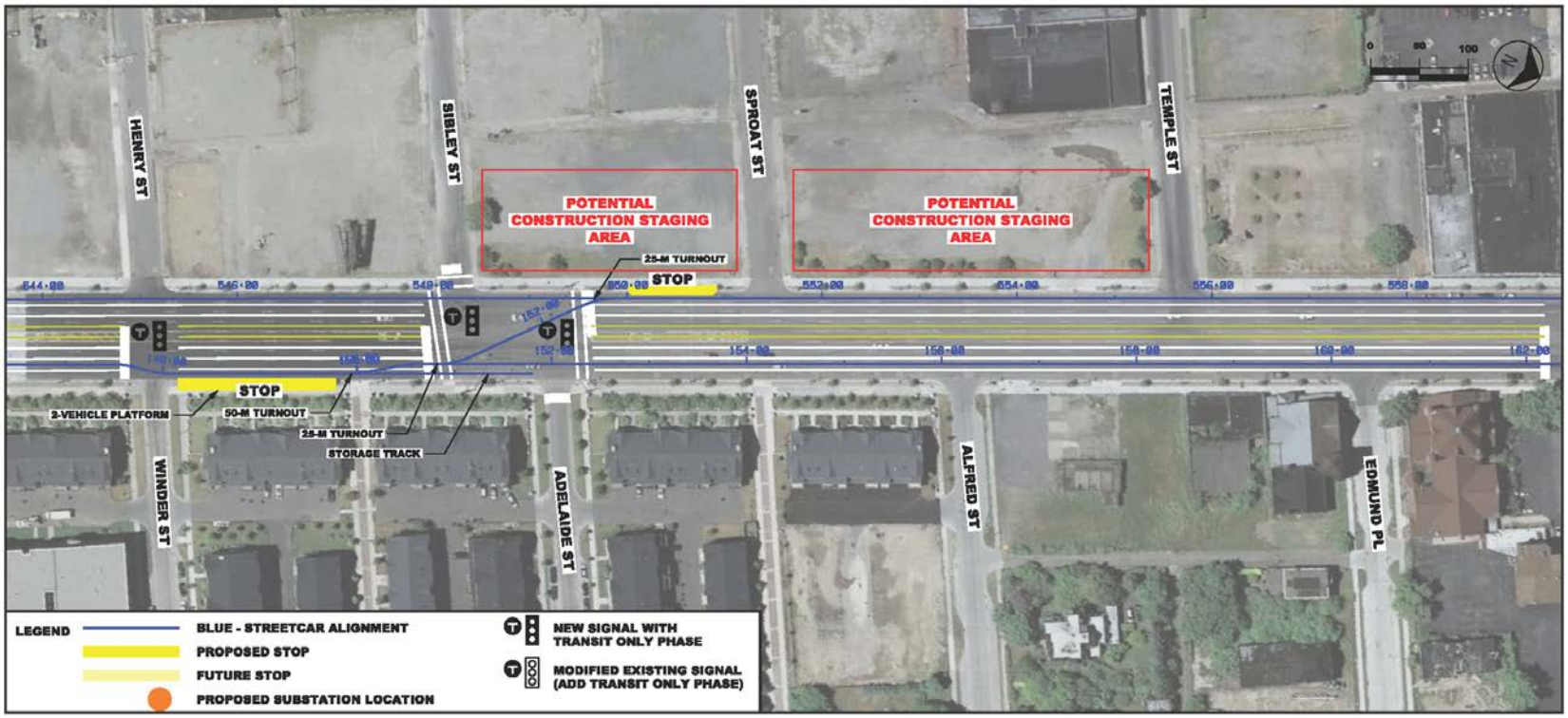


**Figure 3.2 South Terminus**

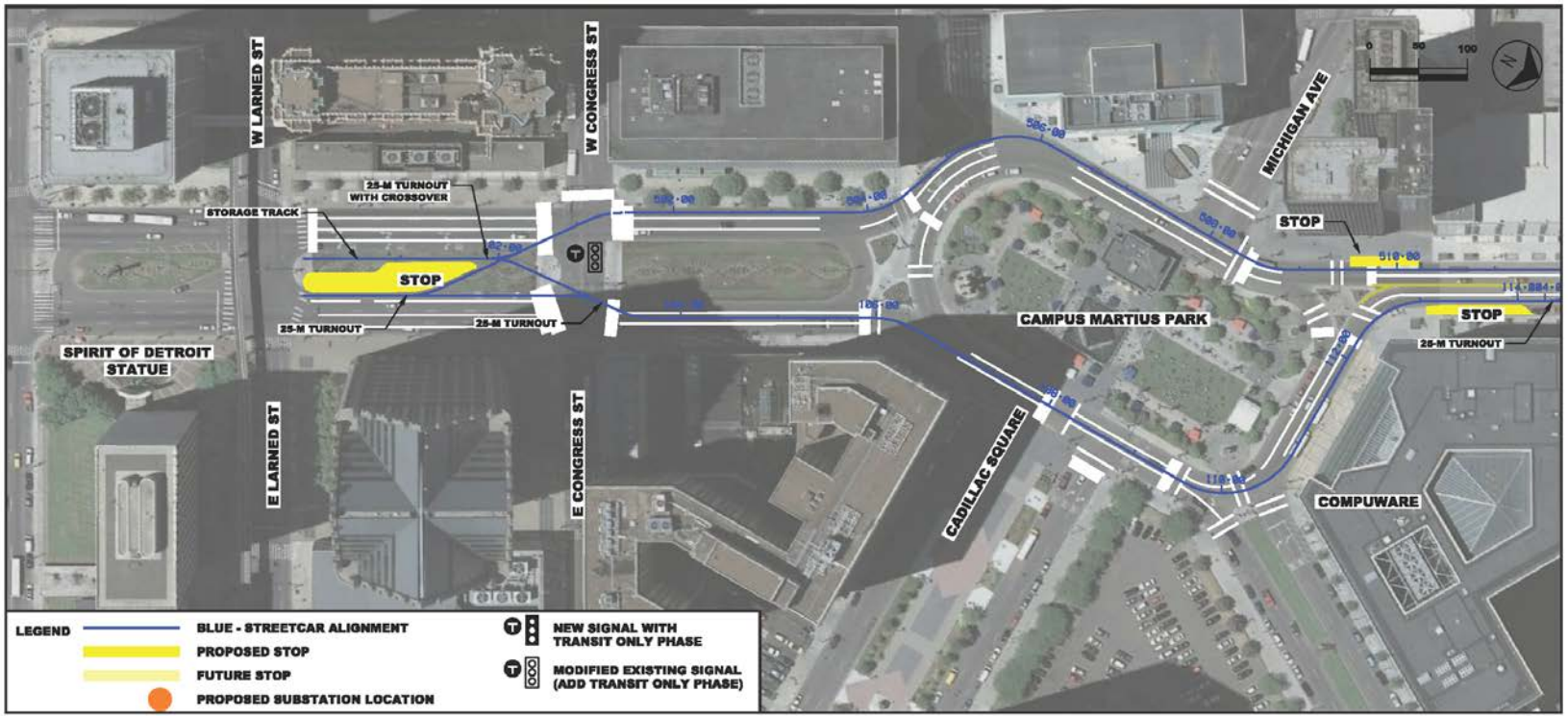
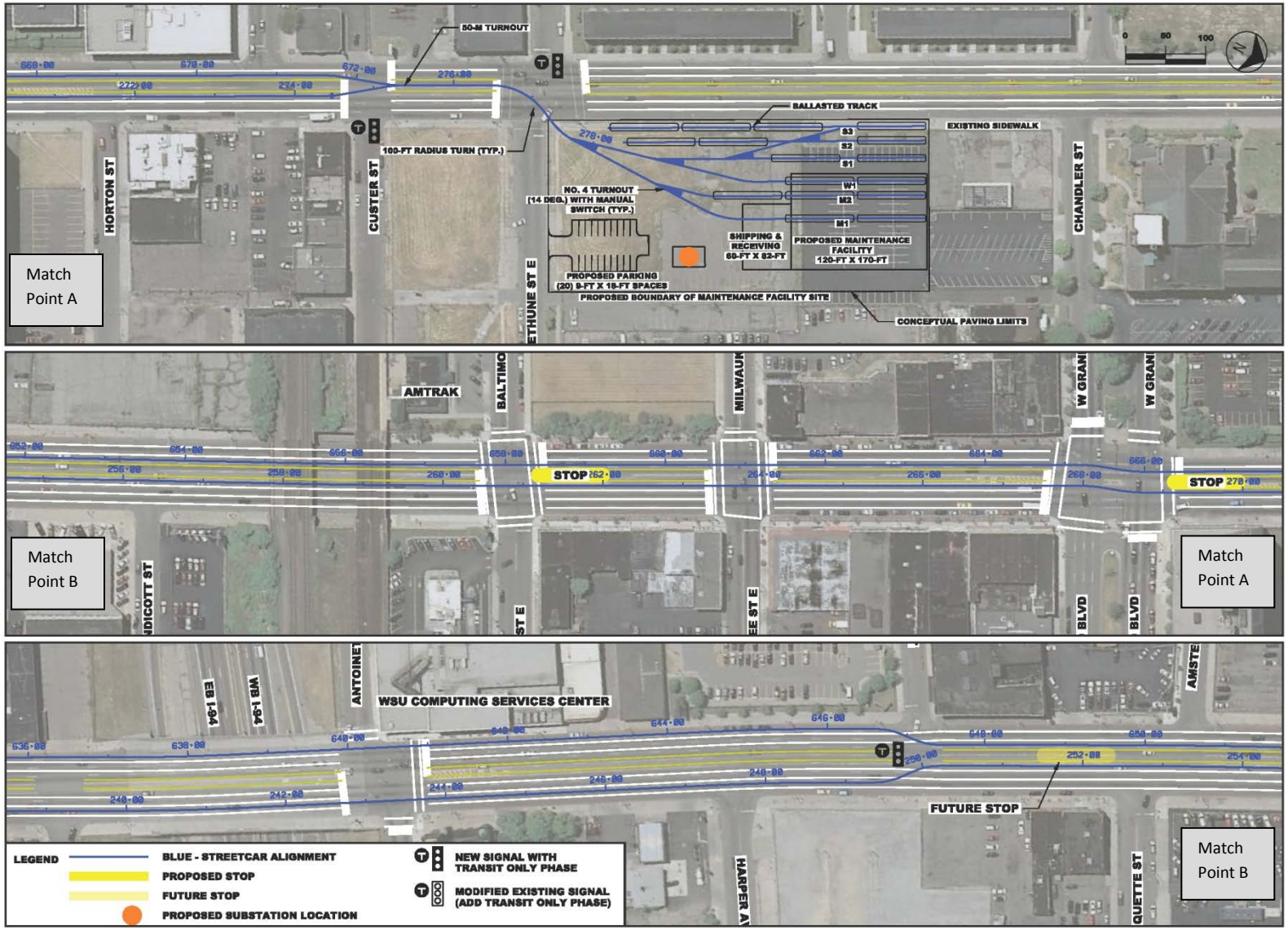


**Figure 3.3 Viaduct/North Terminus**



System Connectivity & Flexibility for Expansion

As shown in **Figure 3.4**, the M-1 RAIL system has been developed in a manner that supports existing transit assets along the Woodward Avenue corridor. Specifically, M-1 RAIL will support connections to DDOT, SMART, the Detroit People Mover (DPM) and Amtrak's Wolverine intercity passenger rail line. During the design phase, M-1 RAIL will coordinate with DDOT, SMART, and the DPM to discuss specific operational and design issues and resolve coordination issues, including station design, ticketing, and transfer policies.

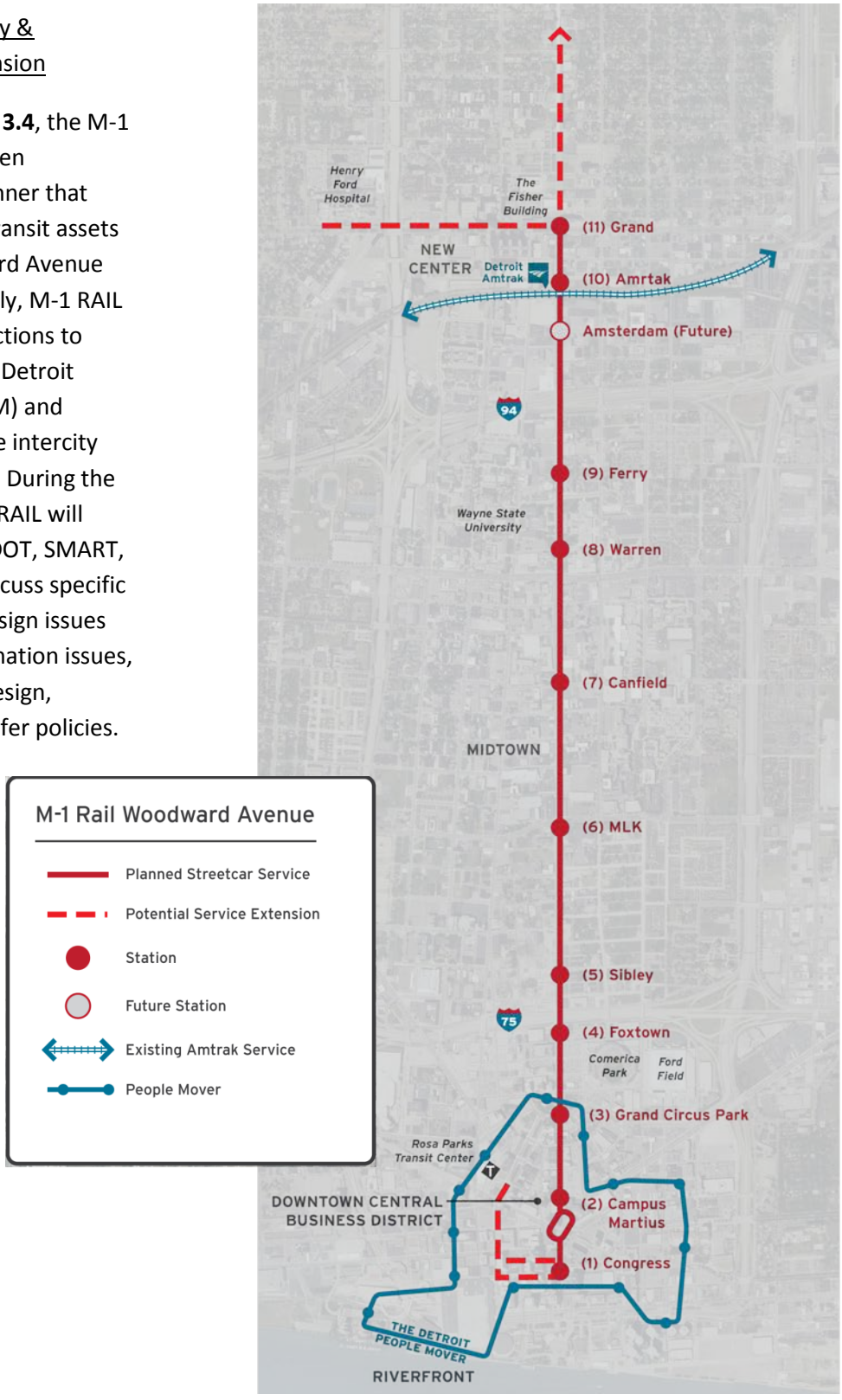



**Figure 2.4 System Connectivity & Possible Future Extensions**

As the M-1 RAIL Project is envisioned to be a single project within a program of bigger transit investments, the M-1 RAIL line has also been designed to support possible future system extensions at both the northern and southern terminus to provide connections to key land use and transportation destinations within the City of Detroit, including the Rosa Parks Transit Center. The M-1 RAIL system would also support future extensions north of the route terminus including future Regional Rapid Transit, as well as a possible Light Rail Transit route consistent with the LPA identified within the Woodward Avenue Light Rail Transit Project Environmental Impact Statement.

## 3.2 20 Stations, Stops, Terminal, Intermodal

Stops/Stations

The current design has 11 stop locations along the route, as depicted and described in **Figure 3.5** and **Table 3.1**, respectively. One additional location has been identified as a potential future stop (Amsterdam Street) contingent upon the relocation of the Amtrak station to the south side of the tracks on the parcel of land bounded by Amsterdam on the south and the railroad tracks to the north. Eight of the locations have a pair of curbside platforms, and three locations have median platforms near both the southern and the northern ends of the line. The platforms are designed for level boarding and are ADA compliant. The platform heights will be 14 inches from the top of rail and the length will be a minimum of 60 feet with a preferred length of 80 feet. Stop layouts will be further refined during the next phase, which is dependent upon the selected vehicle.

At a minimum, every platform will include a station name, ADA ramps, station signage, lighting, LED message boards, closed circuit security system, emergency phone and a covered ticket vending machine. Additional design features, such as a covered seating area, radiant heat for passenger comfort (and to assist with snow melt), media/information cube, bicycle storage, architectural lighting, wi-fi and additional station branding, can be added at selected stations where station sponsors have agreed to pay for upgrades from the “base” design. Base stations will be designed and constructed with the necessary infrastructure to accommodate future station enhancements if either station sponsors desire future upgrades or stations need to be modified to accommodate RRT/BRT operations. Future maintenance costs for features above the base station design will be the responsibility of the individual station sponsor. The M-1 RAIL Team is currently seeking sponsorships for stations with enhanced designs.

**Figure 3.5 M-1 RAIL Station Locations**



**Table 3.1 Station Descriptions**

| Station Cross Street or Landmark | Station ID | Curb / Median | | Direction | | Location | | |
|---|---|---|---|---|---|---|---|---|
| | | Curb | Median | North Bound | South Bound | Near Side | Far Side | Midblock |
| Congress Street | 1 | | ● | ● | ● | | | |
| Campus Martius (Woodward and Michigan) | 2E | ● | | ● | | ● | | |
| Campus Martius (Woodward and Michigan) | 2W | ● | | | ● | | ● | |
| Grand Circus Park (Witherell Street and Park Avenue) | 3E | ● | | ● | | | ● | |
| Grand Circus Park (Witherell Street and Park Avenue) | 3W | ● | | | ● | ● | | |
| Foxtown (Montcalm Street / Comerica Park / Fox Theatre) | 4E | ● | | ● | | | | ● |
| Foxtown (Montcalm Street / Comerica Park / Fox Theatre) | 4W | ● | | | ● | | | ● |
| Sibley Street (Winder Street) | 5E | ● | | ● | | ● | | |
| Sibley Street | 5W | ● | | | ● | ● | | |
| MLK (Martin Luther King Jr. Boulevard and Mack Avenue) | 6E | ● | | ● | | ● | | |
| MLK (Martin Luther King Jr. Boulevard and Mack Avenue) | 6W | ● | | | ● | | ● | |
| Canfield Street (Canfield Street & Willis Street) | 7E | ● | | ● | | ● | | |
| Canfield Street (Canfield Street & Willis Street) | 7W | ● | | | ● | | ● | |
| Warren Avenue (Warren Avenue & Farnsworth Street) | 8E | ● | | ● | | ● | | |
| Warren Avenue (Warren Avenue & Hancock Street) | 8W | ● | | | ● | | ● | |
| Ferry Street | 9E | ● | | ● | | ● | | |
| Ferry Street | 9W | ● | | | ● | ● | | |
| Amsterdam Street | Future Stop | | ● | ● | ● | | | |
| Amtrak (Baltimore Street) | 10 | | ● | ● | ● | | | |
| Grand Boulevard | 11 | | ● | ● | ● | | | |

M-1 RAIL has also received interest in incorporating local art into station designs that would add a local context to each station. While M-1 RAIL envisions utilizing a uniform base design for all of its stations, M-1 RAIL is open to further exploring the incorporation of public art adjacent to stations. This is similar to what other cities with active streetcar systems have implemented. During the project delivery phase, M-1 RAIL will work cooperatively with the underlying owner of the public right-of-way (MDOT and City of Detroit) to coordinate requests to incorporate public art within the overall station footprint without compromising safety or accessibility features such as compliance with ADA requirements.

All station/stop locations were located to be in compliance with the agreements identified in the Woodward Avenue LRT FEIS and to avoid impacts to private driveways. The current stop locations do not impact any driveway locations and would require replacing approximately 23 existing street trees.

## 3.3 30 Support Facilities: Yards, Shops, Administration

Vehicle Storage Maintenance Facility (VSMF)

The preferred site for the vehicle storage and maintenance facility (VSMF) is at the northern terminus, immediately east of Woodward Avenue between Bethune and Chandler Streets. The VSMF is envisioned to be a facility providing light maintenance repairs with indoor and outdoor storage and administrative offices. The facility will have the ability to wash cars and make general repairs. For more complex and heavy maintenance needs, M-1 RAIL envisions outsourcing these services as part of an overall fleet management approach. The life-cycle cost effectiveness of including a car wash and other features will be evaluated in the next phase of project development. Construction cost estimates in **Section 6** reflect the equipment needs of a light maintenance facility.

The current VSMF layout has been designed to accommodate a modern streetcar vehicle based on the dimensions of the Siemens S-70 Ultrashort. M-1 RAIL believes the S-70 vehicle dimensions and specifications represent the largest potential vehicle that will be considered for Detroit's system, and thus represents the most conservative design assumptions to base preliminary system feasibility and cost estimating decisions. As envisioned by M-1 RAIL, the maintenance facility will have capacity for maintaining and storing up to 12 vehicles, with the majority of the storage being located outdoors. The current design requires vehicle storage for only 6 vehicles, so the site will be designed to accommodate additional vehicles for potential increases in service in the future or any additional extensions of the streetcar route. The site will be analyzed as part of the Supplemental EA, as it was not part of the City of Detroit's Woodward Avenue Light Rail FEIS project design. The yard and shop track is proposed to be ballasted track to save on cost and will utilize Number 4 turnouts. In order to be sensitive of the surrounding context of this site, M-1 RAIL proposes to utilize off-wire technology within the yard area to reduce the visual impacts to adjacent properties. The site also will accommodate outdoor storage for extra equipment necessary for the system. Parking requirements for employees and visitors will be evaluated further during the design phase. The site is large enough to accommodate the envisioned needs of the current M-1 RAIL design.

A preliminary layout at a nearby alternate site has also been developed in the event that M-1 RAIL is not able to reach agreement with the current owner to acquire the land. The alternate site is located along Woodward Avenue at Amsterdam Street between Cass and Woodward Avenues. The site is approximately 3 acres and is owned by the Michigan Department of Transportation (MDOT), and was identified in the FEIS as the location of a temporary maintenance facility.

## 3.4 40 Sitework and Special Conditions

Demolition

MDOT is proposing to reconstruct Woodward Avenue from Sibley Street to Chandler Street a distance of 2.54 miles within M-1 RAIL's project scope. As such, all demolition work required for the M-1 RAIL Streetcar Project within this segment will take place during MDOT's reconstruction project. Additionally, demolition of the track slab will take place south of Sibley Street to the terminus of the route near Congress Street. As little of roadway as possible will be reconstructed south of Sibley Street to the southern terminus, depending on the existing condition of Woodward Avenue pavement and the extent of the roadway's cross slope.

The current M-1 RAIL Project design does not require demolition of any properties outside of the ROW.

Public & Private Utilities

As the M-1 RAIL Streetcar Project will be constructed almost entirely within the existing road right-of-way along Woodward Avenue, it will likely have impacts to both existing public and private utilities. M-1 RAIL has reviewed survey and utility data completed in late 2011/early 2012 as part of the Woodward Avenue Light Rail project. Using these survey and utility data, M-1 RAIL completed a utility assessment to identify size, age and horizontal location of all underground utilities. This analsyis is documented in the Utilities technical memorandum found in **Appendix A.3**. M-1 RAIL understands the possible risks associated with the utilities along this corridor, and is committed to working cooperatively with providers to develop a strategy for maintaining, protecting and/or relocating the utilities during the construction phases of the M-1 RAIL Streetcar Project.

The construction cost estimate in **Section 6** reflects utility relocation criteria used in similar projects and cities, but a larger contingency has been built into the capital cost estimate to account for potential risks. The M-1 RAIL Team will use cost mitigation techniques to minimize utility relocation costs. Additionally, MDOT and the City of Detroit will utilize their respective franchise authority to require private utilities located within the public right-of-way to relocate at the cost of the utility company. The cost estimate also assume DTE will be an in-kind partner in the construction of the M-1 RAIL Project.

As part of the 2009 work, M-1 RAIL completed preliminary utility investigations and coordination with the following providers; Detroit Edison, City of Detroit Public Lighting Department, Detroit Water and Sewerage Department, Detroit Thermal, and numerous telecom providers. As part of the next phases of

the project, M-1 RAIL commits to working with MDOT and the City of Detroit to initiate utility relocation efforts.

Hazardous Materials

A Phase I Environmental Site Assessment (ESA) identified Recognized Environmental Conditions (REC), indicating the presence of hazardous materials along the route and at some of the Traction Power Substation System (TPPS) sites identified in the FEIS.

If selected, the Bethune VMSF will be analyzed as part of the Supplemental EA and the real estate acquisition phase, as it was not part of the LRT FEIS project alternatives. A Phase II Environmental Site Assessment (ESA) will be conducted at other sites as needed to establish whether and to what extent contamination is present.

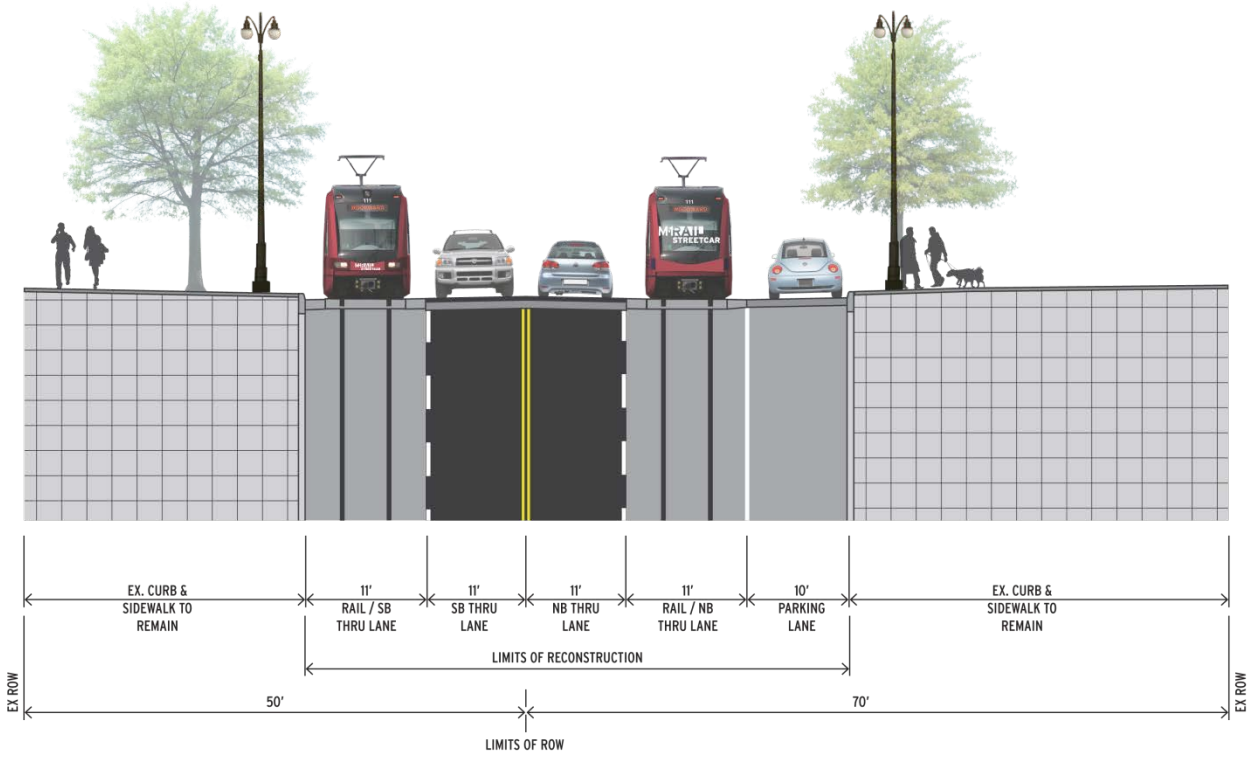
The construction cost estimates in **Section 6** reflect both a cost for hazardous waste mitigation at either of the VSMF sites as well as a specific contingency factor until a Phase I ESA is completed for the selected VSMF. Additionally, due to the age of Detroit's infrastructure, the cost estimate includes a contingency for unforeseen hazardous waste costs associated with construction of the track zone.

Roadway Modifications

Woodward Avenue has two distinct cross-sections within the M-1 RAIL Streetcar Project area. Between Campus Martius and Park Avenue, Woodward Avenue has two lanes in each direction and metered parking located within curb cutouts on the northbound side of the street only. North of Park Avenue, Woodward Avenue has three to four through lanes in each direction and a continuous center left-turn only lane. Typically, the outside lane in both directions has either unrestricted parking or metered parking, reducing the number of through lanes to either two or three through lanes in each direction. The right-of-way within this section of Woodward Avenue is 120 feet. M-1 RAIL is committed to working with MDOT to meet all of the design principles identified within the Woodward Avenue Light Rail EIS planning process.

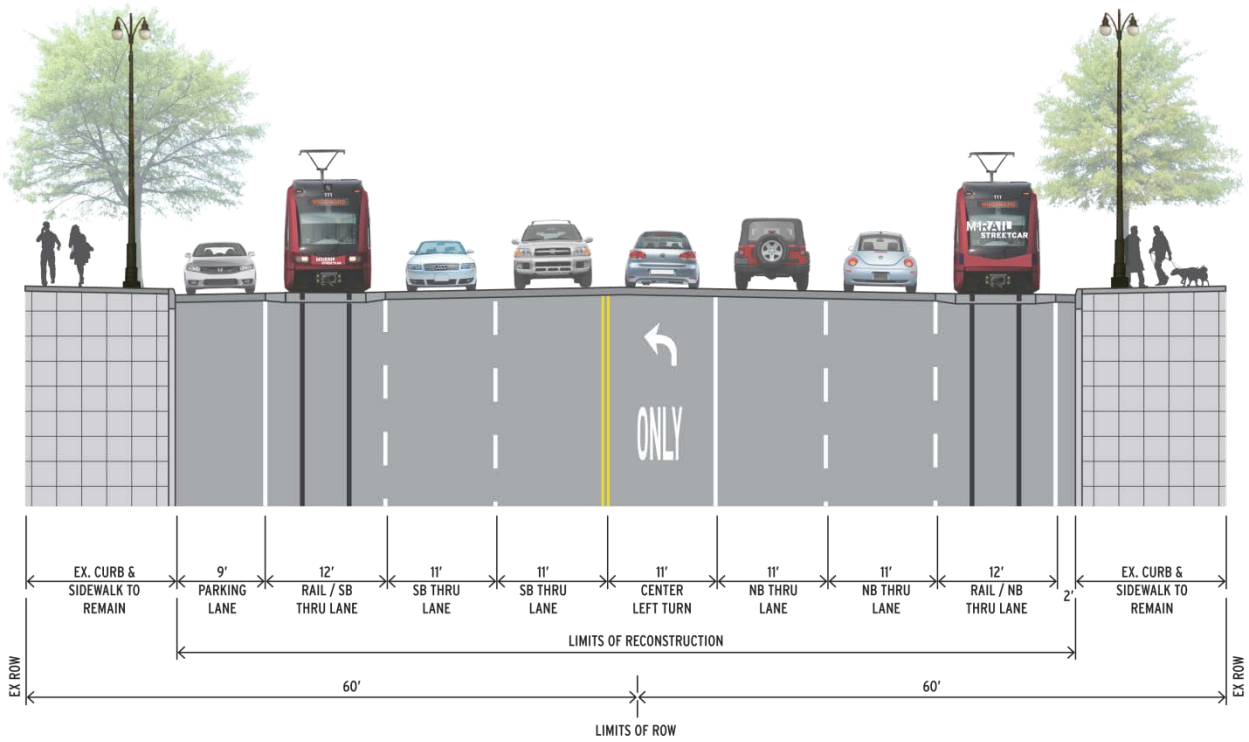
Within the section of Woodward Avenue between Campus Martius Park and Park Avenue in the Downtown area, the cross-section will consist of two 11-foot-wide general-use lanes and a 11-foot-wide streetcar shared-use lane on each side of the street. A 10-foot wide parking lane will be provided on one side of the street only. This cross-section will retain the existing curb line and sidewalk widths on both sides of the street. This cross-section will conform to all of the design principles, and was therefore advanced for further analysis. This side-running alternative cross-section is depicted in **Figure 3.7**. More detailed cross-sections are included in **Appendix A.2**.

**Figure 3.7 Side-Running M-1 RAIL Cross-Section in Downtown Area**



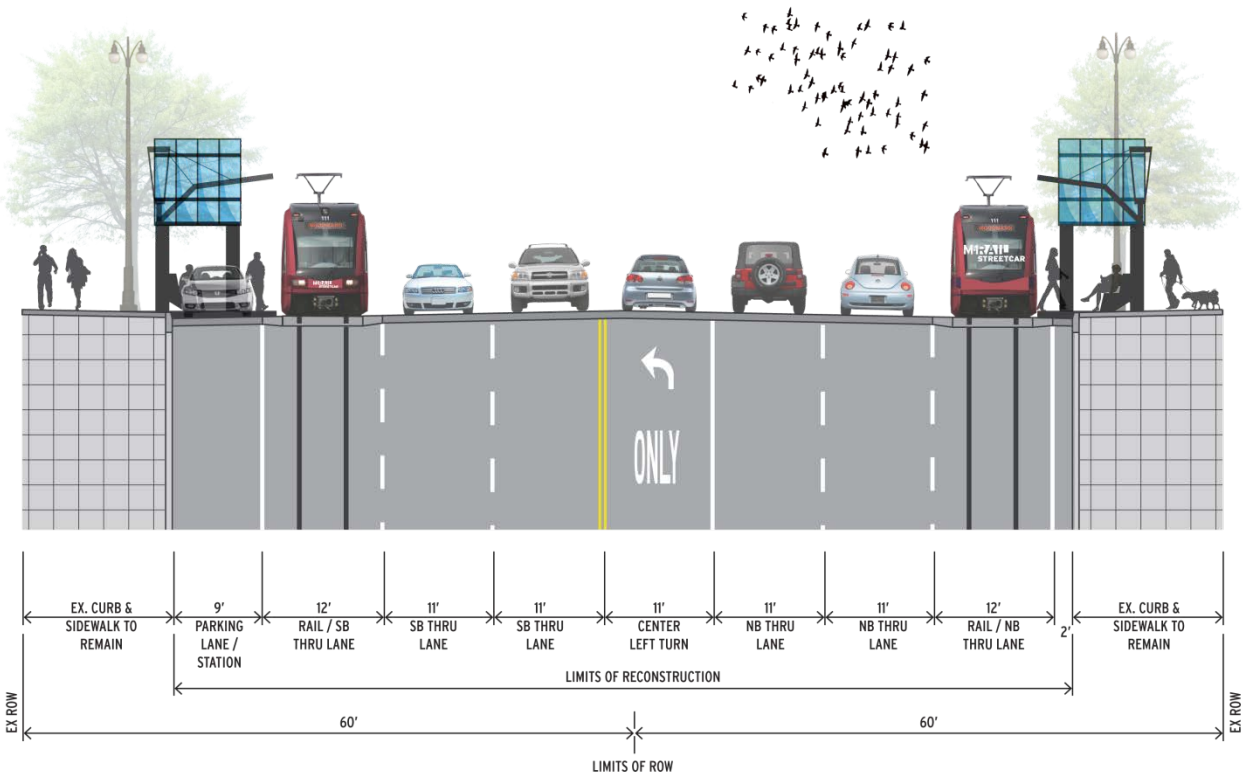

Within the section of Woodward Avenue between Adams Street and Burroughs Street, the cross-section will consist of four 11-foot-wide general-use travel lanes, a 11-foot center left turn lane, and a 12-foot-wide streetcar shared-use lane on each side of the street. A 9-foot wide parking lane will be provided on one side of the street only. A two-foot strip will be provided on the side opposite of where parking is permitted to provide additional room to partially accommodate side-platform stations. This cross-section will retain the existing curb line and sidewalk on both sides of the street, except where station bump-outs will be required on the southbound section. This cross-section will conform to all of the design principles, and was therefore advanced for further analysis. The typical side-running alternative cross-section is depicted in **Figure 3.8**. More detailed cross-sections are included in **Appendix A.2**.

**Figure 3.8 Typical Side-Running M-1 RAIL Cross-Section Between Stations**



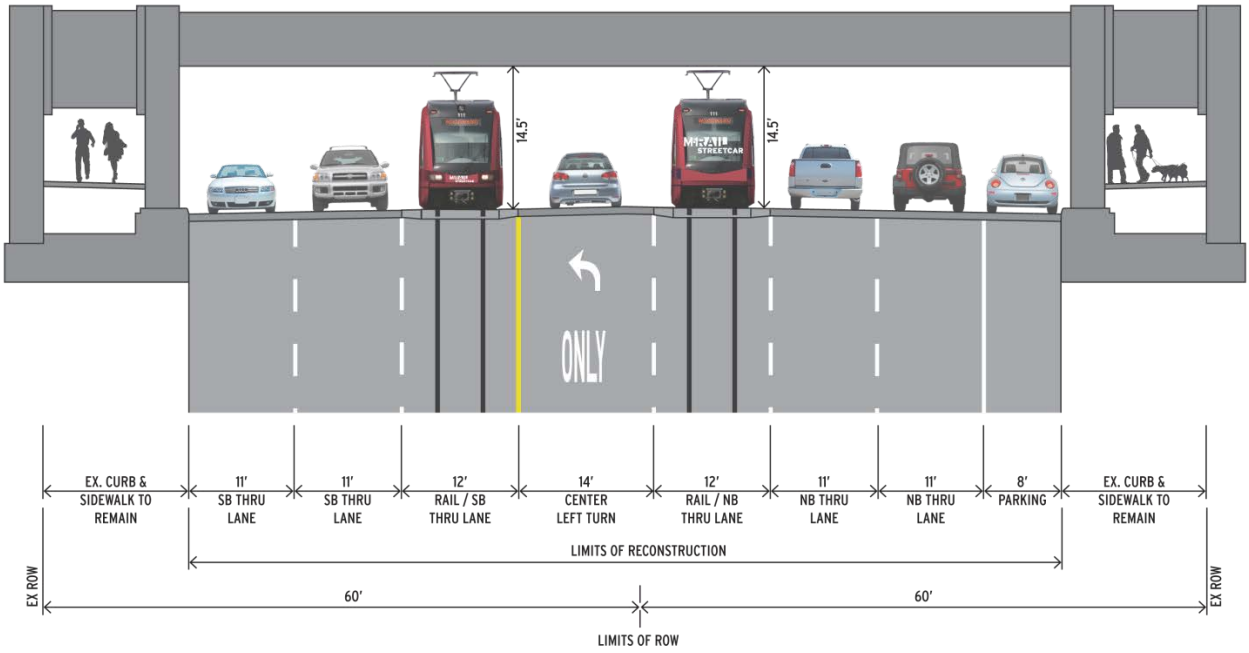

At station locations along Woodward Avenue between Adams Street and Burroughs Street, the cross-section will also consist of four 11-foot-wide general-use travel lanes, an 11-foot center left turn lane, and a 12-foot-wide streetcar shared-use lane on each side of the street. At station locations, a bump-out to accommodate the boarding platform and passenger shelter will occupy the 9-foot parking lane, or will bump out into the two-foot strip where there is no parking lane (to minimize impacts on the adjacent sidewalk). This cross-section will conform to all of the design principles, and was therefore advanced for further analysis. This typical side-running alternative cross-section at stations is depicted in **Figure 3.9**. More detailed cross-sections are included in **Appendix A.2**.

**Figure 3.9 Typical Side-Running M-1 RAIL Cross-Section at Stations**




For the section of Woodward Avenue between Burroughs Street and the northern project limits, the alignment will transition to a center-running alternative. The cross-section has two 12-foot general-use lanes in each direction, two shared 12-foot streetcar/shared use lanes, a 14-foot center left turn lanes/median station footprint, and a ten-foot parking lane in those areas without a station. This typical cross-section fits within the existing 72-foot curb-to-curb pavement width on Woodward Avenue north of Grand Boulevard without impacts to the existing curb lines or sidewalk widths, and does not require any modifications to meet the design principles commitments contained within the EIS. The typical center-running alternative cross-section is depicted in **Figure 3.10** as it travels under the railroad viaduct, and in **Figure 3.11** at the median station adjacent to the Amtrak station. As previously indicated, in this section MDOT will be completing a reconstruct of Woodward Avenue in conjunction with the M-1 RAIL Project. This reconstruction will increase the existing under-clearance to 14'6". More detailed cross-sections are included in **Appendix A.2**.

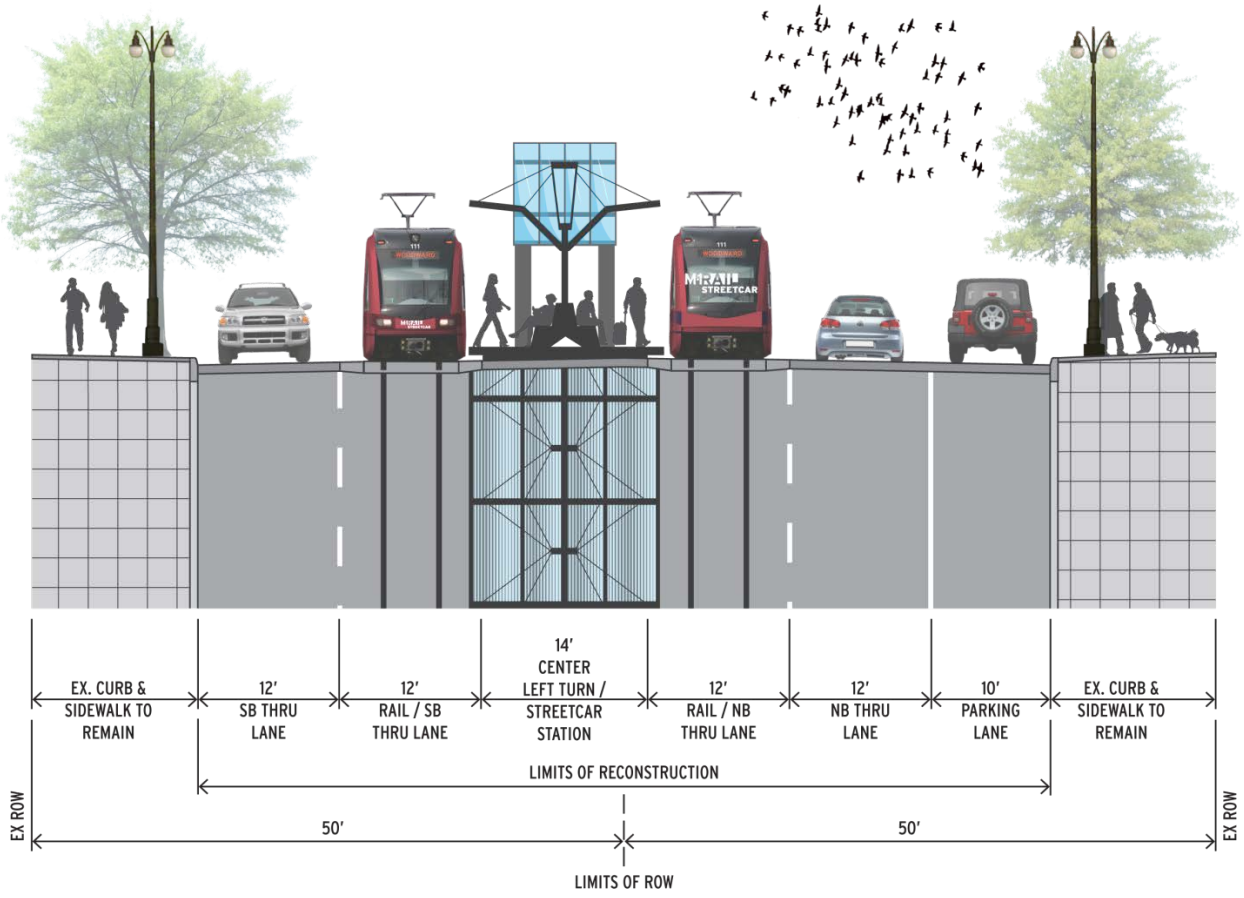
**Figure 3.10 Center-Running M-1 RAIL Cross- Section at Railroad Viaduct**




As indicated in **Section 3.1**, M-1 RAIL anticipates minimal vertical grade changes will be needed to lower the trackway/roadway to accommodate a modern streetcar vehicle with dimensions similar to a Siemens S-70 beneath the railroad viaduct located between Amsterdam and Baltimore Streets. M-1 RAIL proposes to utilize off-wire technology to operate under the railroad viaduct. In the event that off-wire technology can not be accommodated at this location, M-1 RAIL has completed preliminary engineering analysis of how OCS infrastructure can be attached to the railroad viaduct and still meet minimum vertical clearance requirements to accommodate both the streetcar and traffic operations.

Additonally, this median running alignment and the associated horizontal and vertical alignments were evaluated extensively as part of the Woodward Avenue Light Rail Project. This previous analysis found that the adjacent intersections of Endicott Avenue and Baltimore Street will not require closure due to vertical grade changes, but rather access could be modified to a right-in/right-out configuration to mitigate the resulting changes in site distance at both of these intersections.

**Figure 3.11 Typical Center-Running M-1 RAIL Cross-Section**




As indicated in the **Section 3.4**, as a cost containment measure, roadway reconstruction south of Sibley Street will be limited to the minimum needed to accommodate track construction. South of Park Avenue, the roadway was completely reconstructed a few years ago. Between Sibley Street and Park Avenue, reconstruction activities are likely to include limited milling and overlay around the track zone and utility relocations

The segment north of Sibley Street will be completely reconstructed as part of the MDOT's road reconstruction project programmed to begin in 2013. The road reconstruction work north of Sibley Street will be coordinated with the M-1 RAIL scope. The M-1 RAIL budget estimates included in **Section 6** only reflect the cost of the track zone. The M-1 RAIL Team is committed to working with MDOT to have one coordinated project delivery approach (see **Section 9**) using a single contractor that will deliver both the road reconstruction and streetcar project elements.

As MDOT is a partner in this project, discussions and coordination have already begun on how best to deliver the future phases of both projects. In cooperation with MDOT and the City, M-1 RAIL completed a Risk Assessment session to identify key project risks associated with the scope and schedule of both the streetcar and the reconstruction project.

The construction cost estimate in **Section 6** assumes that any road reconstruction costs outside of the M-1 RAIL track envelope north of Sibley Street will be the responsibility of MDOT. The roadway reconstruction costs south of Sibley Street include an allowance for limited repairs.

Pedestrian/Bicycle Accommodations

At the present time there are no designated bicycle lanes along Woodward Avenue within the project limits. During the Woodward Avenue LRT EIS, extensive analysis was completed and numerous alternatives were evaluated to determine how best to accommodate bicycle interaction with light rail operations. Consideration was given to the addition of a designated bicycle lane along the corridor. In order to accommodate bicycle lanes within the existing curb-to-curb width, the previous study found travel lanes will need to be narrowed to under 11 feet, which would violate the design principles agreed to by the City, MDOT, and the Federal Highway Administration.

The EIS evaluated the feasibility of creating dedicated bicycle lanes on parallel routes to Woodward Avenue. Over the length of most of the M-1 RAIL Streetcar Project limits, Cass Avenue and John R run parallel with Woodward Avenue. The EIS found that creating dedicated bicycle lanes on the parallel roads would be an improvement to the overall study area; however, bicyclists could not be prohibited from travel along Woodward Avenue in accordance with the State of Michigan *Vehicle Code*.

Currently, no bicycle lanes are proposed along the project route. M-1 RAIL believes the best option to address bicycle traffic is to install signage in the vicinity of Amsterdam Street/Piquette Street to encourage bicyclists to use Cass Avenue and John R to avoid safety conflicts with track. During the design phase, M-1 RAIL intends to complete a peer review of best practices for accommodating bicycle traffic with a modern streetcar system. As part of the EIS re-evaluation process, M-1 RAIL will partner with the City of Detroit to assess the feasibility of identifying alternative parallel routes that can be designated as bicycle facilities.

Temporary Facilities (During Construction)

The FEIS identified two potential temporary staging areas along the currently designed route. One is located along Woodward Avenue between Sibley Street and Sproat Street. The second location is along Woodward Avenue near Bethune Street. The M-1 RAIL Team will coordinate with the City of Detroit and private landowners to identify staging sites. Given current real estate market conditions in and near the corridor, there is considerable opportunity to obtain suitable land at reasonable cost to the project. The construction cost estimate in **Section 6** assumes costs for providing temporary facilities for construction staging activities.

## 3.5 50 Systems

Traffic Signals (including Traffic Signal Priority)

Traffic signal modifications will be minor as the route is relatively short and does not include any left turns off-of Woodward Avenue for the streetcar vehicle. The only signal upgrades in the current M-1 RAIL design are for the inclusion of transit signal phases or new traffic signals at certain intersections. The current proposal recommends modifications to three existing traffic signals at Congress, Montcalm and Bethune streets and the addition of five new traffic signals at Henry, Sibley, Adelaide, Burroughs and Custer Streets. All modifications and new signals will include transit signal priority (TSP) for the rail vehicles. Due in part to the level of current and planned bus service on Woodward Avenue (approximately one bus every one to two signal cycles during peak periods), TSP is not included at other signal locations. If the Rolling Rapid Transit project introduces additional TSP capabilities in the corridor, the M-1 RAIL Streetcar Project could benefit in terms of reduced travel times. M-1 RAIL has discussed these proposed signal changes with MDOT at a series of scope verification and risk meetings for the project during the 90-day validation period. M-1 RAIL believes any operational impacts resulting from the addition of the transit only signals at the Sibley cross-over, near Burroughs Street and north of Grand Boulevard will be minimal and can be mitigated during the design phase of the project.

M-1 RAIL will coordinate with MDOT during the reconstruction of Woodward Avenue from Sibley to Chandler Streets to assure signal upgrades are completed as part of MDOT's scope of work for the reconstruct can accommodate future preemption technology should future corridor operations warrant.

Traction Power Supply System (Substations - TPSS)

The Traction Power Supply System (TPSS) will consist of four power substations located along the route and will be connected via distribution circuits to local power utility sources. The TPSS will include DC feeder cables in underground ductbanks that connect to the Overhead Contact System (OCS). Each substation will include the equipment necessary to transform and rectify the AC voltage to DC voltage. The substations will be located approximately one mile apart and about ½ mile from the ends of the line. Three of the potential sites identified in the FEIS could be used for TPSS sites. A fourth location near the northern terminus may be required depending on the results of a final load flow simulation to be conducted during the next phase of project development.

HNTB conducted a preliminary load flow analysis to validate the number of substations that will be needed for the project. This preliminary analysis, included as **Appendix A.4**, used the proposed vehicle specifications to identify a nominal system voltage of 750 Vdc, with a minimum operating voltage of 525 Vdc. Under the normal operation outlined in the M-1 RAIL Project Definition, the analysis found that voltage will drop to 641 Vdc, which is above the minimum operating voltage.

This capacity analysis found the maximum current draw by a streetcar occurs when it is accelerating. Assuming that there are two streetcars drawing current from the same substation, one with full load (1400 Amps) and the other coasting (100 Amps) then the total current drawn at the substation will be 1500 Amps. The one-minute rating of a rectifier is 300% of its continuous (100%) rating. So considering 1500 Amps to be the 300% current, the substation power rating can be calculated as follows:

Power = voltage * current

Voltage = 750 V

Current = 1500 Amps for one-minute (300%)

= 1500/3

= 500 Amps continuous (100%)

Power = 750 V * 500 Amps

= 375 KW

Therefore, 4 substations (3 feeding the system) are capable of handling the voltage drop and the power demand of the streetcars.

As discussed further in **Section 3.7**, M-1 RAIL intends to incorporate specifications into the vehicle proposals that allow for portions of the streetcar system to operate with off-wire capabilities, similar to other proposed systems such as the Seattle First Hill Streetcar.

The possible segments that would not include an Overhead Contact System are:

- From Congress St. to Montcalm St. – approximately 8,100 continuous linear track feet(1.53 miles), or at a point north of I-75 near Sibley Street at approximately 10,100 continuous linear track feet(1.91 miles)
- From Piquette St. to Baltimore St. – approximately 1,000 continuous linear track feet in both directions
- In the maintenance facility yard – approximately 1,470 track feet

The off-wire capability could reduce the cost of OCS along all three segments due to less physical infrastructure, but would still require an underground feeder cable to join the sections together such that any one section of OCS can be supplied by more than one substation. This would provide for the required system redundancy during maintenance and equipment repairs when a substation is out of service. In addition, this will enable the OCS to provide power for the capacitor charging stations at the streetcar stations/stops if required.

Assuming the off-wire segments indicated above, the voltage and capacity analysis documented above would still remain valid, due to the following considerations:

1. The use of vehicle batteries to power the vehicles in some areas would lighten the overall load on the applicable TPSS, but would not reduce the peak per the calculation above.

2. The power to the off-wire charging system would not be expected to be 750Vdc; therefore the substation/power requirements would also be different, possibly requiring local low voltage utility supplies.
3. For a system with just five vehicles operating during peak periods, the requirement for a dedicated substation in the maintenance facility yard is not considered necessary. The use of the last substation feeding both the yard and the mainline should be considered. The use of off-wire technology in the yard would also support this approach.

Traction Power Distribution (OCS)

The OCS will be designed for integration into the existing streetscape environment to minimize impacts. M-1 RAIL proposes to utilize a Simple Catenary type throughout the project limits. Joint use poles shared with street lights will be utilized to save on cost and to minimize sidewalk and visual clutter. M-1 RAIL also is evaluating the feasibility of using off-wire vehicle technology for the segment of the corridor south of Park Avenue and under the railroad viaduct near the northern terminus.

For the purposes of the Capital Cost estimate presented in **Section 6**, M-1 RAIL assumes that off-wire vehicle technology will be utilized from I-75 south to the southern route terminus, under the railroad bridge north of Amsterdamn Street, and within the VSMF yard.

Communications/Central Control System (CCS)

The Communications and Central Control System (CCS) includes communications equipment, the remote I/O equipment, and the human interface equipment to help allow controllers to monitor wayside systems and facilities and supervise revenue rail operation.

The System will include a room at the maintenance facility for the central communications center (CCC). The CCC will be connected to the system via a fiber optic network housed in conduit within the track zone. A wireless network will be developed to connect the Closed Circuit Television (CCTV) with the CCC. Real time information will be provided through a Global Positioning System (GPS)-based Automatic Vehicle Location (AVL) for dispatching and customer use. A radio system will be created for use by train operators and agency employees for staff communications. An emergency telephone system will be available at all station platforms to communicate with the 911 dispatch.

Fare Collection System

The fare collection system will be efficient and cost effective. Each stop platform will contain a ticket vending machine (TVM). All passengers will pay their fare prior to boarding and will validate their ticket on the vehicle. Fare enforcement will occur through random checks on-board the vehicles.

## 3.6 60 Right-of-Way, Land, Existing Improvements

Purchase or Lease of Real Estate

The M-1 RAIL Project may require the acquisition or lease of land for the VSMF, substation and construction staging locations.

The construction cost estimate in **Section 6** includes costs for land acquisition for the Bethune site. If the Bethune site is not selected and the Amsterdam site is ultimately utilized for the VSMF, M-1 RAIL anticipates a no cost agreement with MDOT to acquire the rights to the site.

The construction cost estimate also includes costs for some construction staging and mobilization. M-1 RAIL anticipates an agreement with the City of Detroit to donate land for temporary staging sites, which will help to minimize construction staging costs.

Relocation of Households or Businesses

No relocation of households or businesses is anticipated due to this project.

## 3.7 70 Vehicles

M-1 RAIL has evaluated numerous different vehicle options as part of its preliminary planning efforts dating back to 2007. M-1 RAIL has retained the consulting services of LTK who has in-depth knowledge of the existing modern streetcar and light rail vehicle market and is currently involved in multiple existing vehicle procurements around the country. LTK brings to M-1 RAIL "bench strength" to assist in identifyinng an appropriate modern streetcarcar vehicle.

For system feasibility, operational planning, and cost estimating purposes, M-1 RAIL has based all of its preliminary design assumestions around the dimensions and operational specifications of the Siemens S-70 Ultrashort vehicle. The S-70 is approximately 80 feet in length, not including the couplers. As the S-70 likely repsents the largest and heaviest design vehicle M-1 RAIL would consider for operations within Detroit, M-1 RAIL believes it has developed its vehicle operatonal and cost estimating assumptions on a consertative platform. Additionally this design vehicle also allows flexibility to accommodate the future addition of light rail to the system the carbody width should specified as 8'-7" (2.65 m) and turning radii for joint use trackage should be held at a minimum of 82' (25 m). It would also allow for the preferable boarding height of 14" (356 mm) to allow for level boarding without bridgeplates.

Another key element of M-1 RAIL's vehicle assumptions will be the use of off-wire technology. M-1 RAIL working with LTK has completed a preliminary assessment of the market and believes incorporating off-wire technology into the project design is feasible. Vehicle cost estimating assumptions in **Section 6** have assumed additional costs per vehicle to accommodate this feature.

The current project schedule (**Section 10**) allows sufficient time for M-1 RAIL to enter the market and request a preliminary statement of interest from vehicle vendors to determine the feasibility of M-1 RAIL procuring vehicles independently with their own requirements rather than adapting their anticipated operation to meet the available options (i.e., piggybacking). Based on current market conditions, M-1 RAIL is planning for supplier responses to a 24-30 month procurement of an off-the-shelf streetcar model with only modifications required by local conditions has been acceptable with multiple proposals received by other cities.

In parallel to this effort, M-1 RAIL also plans to reach out to several cities with open procurements to discuss further potential piggybacking options. The M-1 RAIL Team has evaluated the availability of streetcar vehicles that meet this general design under current market conditions. There are several current procurements in progress and anticipated to be completed in the near term for both streetcars and light rail vehicles (LRVs). Some may present opportunities for M-1 RAIL to obtain cars without initiating its own procurement process.

One such city that may provide M-1 RAIL with an opportunity to piggyback off of is the city of Cincinnati. Cincinnati is currently finalizing a contract with CAF in response to proposals received for federally-funded, Buy America-compliant streetcars. The Request For Proposals (RFP) attracted offers from five suppliers with CAF being the recommendation of the Evaluation Committee. The Cincinnati RFP also includes assignable options which may be utilized by M-1 RAIL, an option which may result in cost savings from having to proceed with an independent procurement process. Delivery of the Cincinnati's five vehicles is required to be completed within 27 months of Notice to Proceed (NTP). This delivery schedule meshes well with the current M-1 RAIL schedule outlined in **Section 10** of this Business Plan.

M-1 RAIL assumes Cincinnati to issue an NTP to CAF by the end of May. The Special Provisions of the RFP allows Cincinnati to exercise an option for up to five additional vehicles at the base contract price within the first six months. Combining design review and construction oversight with Cincinnati may produce additional cost savings for M-1 RAIL.

CAF also offers an off-wire option to their propulsion system which relies on ultra-capacitor technology and recharging at passenger stations. The City of Seville, Spain uses this option to eliminate interferences of the overhead wire with their annual parade in the city center.

<u>Other Developments</u>

In addition to Bombardier, Inekon, Siemens and United Streetcar, there are several other manufacturers looking to enter the streetcar market. Broadcast of some of these is still confidential because they are in the middle of public agency procurement processes (in which M-1 RAIL's vehicle consultant LTK is engaged). One supplier, Kinkisharyo, who has provided light rail vehicles to Boston, Dallas, Newark NJ, Phoenix, San Jose and Seattle, has developed a prototype streetcar with onboard battery energy storage they have named the AmeriTRAM. The configuration is a 100% low floor, double-ended, double-sided car. The prototype is 20m long and 2.65m wide, but the manufacturer states that it is based on a

modular design that can be adapted to various lengths and widths as preferred by the customer. It is designed to North American standards and claimed to meet Buy America requirements. The prototype is currently being stored in Newark where Kinkisharyo holds a contract for maintenance of LRVs for New Jersey Transit's Hudson-Bergen light rail service.

M-1 RAIL's next step in the vehicle procurement process following awardof a TIGER grant will be to poll possible suppliers to gauge interest in a 5-6 vehicle order and capabilities of their current off-wire systems. M-1 RAIL intends to develop an outline specification that captures the key vehicle features noted above and develop a description of the off-wire segment to get meaningful feedback from the market. This vehicle specification will follow closely the vehicle specification which was utilized for the Cincinnati vehicle procurement (included within **Appendix A.5**). Based on the results of this outreach, a detailed specification will be prepared and possibly broadcast for additional industry review and comment, and then finalized for formal procurement.

# 4 SERVICE PLAN

The M-1 RAIL Team has developed a revised service plan based upon a review and reevaluation of the running time, service frequency, and vehicle fleet requirements assumptions associated with the 2009 proposal and the Woodward Avenue Light Rail FEIS Preferred Alternative. Reflecting proposed additional Rolling Rapid Transit (RRT) service in the Woodward Avenue corridor, the service plan provides a service level that rationalizes the difference between the original 2009 M-1 RAIL proposal and the FEIS Preferred Alternative.

## 4.1 Approach and Methodology

An analysis was conducted to simulate the round-trip running time, cycle time (including layover time), and number of vehicles needed for operation of the M-1 RAIL Streetcar Project. The analysis was conducted using a spreadsheet-based running-time model that considers the effects of vehicle acceleration and deceleration, station dwell time, slow zones through curves and turnouts, posted speed limits, and intersection traffic delay. One-way running time estimates were developed for the weekday AM Peak, Mid-Day, PM Peak, and off-peak time periods.

Layover times at each terminal were added to the one-way running time estimates to produce both round-trip running time and cycle time estimates. Layover times were set at a minimum of two minutes to absorb schedule deviations and allow time for the operator to reverse the vehicle.

A preferred service frequency range and vehicle fleet size were established for each time period such that more vehicles would be in service during peak times, allowing headways between vehicles to be shorter. For example, at a round trip running time of 35 to 40 minutes, five vehicles would be needed to achieve a preferred service frequency of 7 to 8 minutes during peak periods. Layovers were then "rounded up" to correspond with the multiple of vehicle headway and vehicles in service.

Service statistics, including revenue vehicle-hours, revenue vehicle-miles, and vehicles operated in maximum service, were developed for weekdays, Saturdays, and Sundays/holidays based on the service levels assigned to each time period. The service statistics are used as cost drivers in the O&M cost estimate in **Section 7**.

The service plan was evaluated using time-space (stringline) diagrams to evaluate the berthing requirements at each terminal. The stringline analysis was used to evaluate the need for additional layover capacity during recovery from service irregularities.

## 4.2 Running Time

The running time model developed by M-1 RAIL combines information on vehicle acceleration and deceleration, station dwell time, slow zones through curves and turnouts, posted speed limits, and intersection traffic delay to produce station-to-station running times and schedule data.

Alignment features, station locations and streetcar vehicle characteristics were based on the current design described in **Section 3** and assumed running in mixed traffic along Woodward Avenue. Dwell times were assumed to be 20 seconds at each intermediate station. The speed limit is assumed to be 25 mph in the Downtown core (south of the Fisher Freeway) and 35 mph for the remainder of the alignment.

Information on anticipated traffic conditions was obtained from traffic simulations performed for the curb-running rail alternative (Alternative B3) during the FEIS. Intersection delays were estimated from VISSIM traffic simulation model runs conducted by Parsons Brinckerhoff in 2009 for the FEIS. The service modeled in these simulation runs was a curb-running light rail vehicle in a shared lane with transit priority at signalized intersections. The model runs were conducted under forecast 2030 AM peak and PM peak traffic conditions. The delay information that is available from these VISSIM model outputs is the average intersection delay for all vehicles (including both transit and private vehicles) on each intersection approach. This delay includes stopped time as well as deceleration and acceleration time. It was assumed for this travel time analysis that the average delay experienced by all vehicles at an intersection approach is representative of the delay experienced by the streetcar on this approach. Future VISSIM analysis could be used to identify delays specific to transit vehicles at each intersection.

Where transit stops are located at the near-side of an intersection, it was estimated that the transit vehicle would experience one-half (1/2) of the average intersection delay identified in the VISSIM output, in addition to the station delay. Where transit stops are located at the far-side of an intersection, it was estimated that the transit vehicle would experience the average intersection delay in addition to the station delay.

**Table 4.1** shows the one-way running time (not including non-revenue segment and layover time) in each direction during each time period. The average speed ranges from 11.2 miles per hour in the PM Peak period to 12.2 miles per hour during off-peak periods.

**Table 4.1 One-Way Running Time Estimates**

| | AM Peak | Mid-Day | PM Peak | Off-Peak |
|---|---|---|---|---|
| Running Time (minutes) | | | | |
| Northbound | 15:52 | 15:37 | 16:29 | 15:22 |
| Southbound | 15:44 | 15:29 | 16:37 | 15:14 |
| Average Speed (mph) | | | | |
| Northbound | 11.8 | 11.9 | 11.3 | 12.1 |
| Southbound | 11.9 | 12.1 | 11.2 | 12.2 |

Based on 2030 traffic forecasts, no traffic signal priority.

## 4.3 Service Level

Service levels were established that fall between the aggressively frequent streetcar service in the original 2009 M-1 RAIL proposal (5-minute peak and 10-minute off-peak headways), and the relatively less frequent light rail service in the FEIS Preferred Alternative (10-minute peak and 15-minute off-peak headways). Although service level details of the RRT proposal are limited at this time, the M-1 RAIL Team understands that RRT may serve only a few stations in the Woodward Avenue corridor segment served by the M-1 RAIL Streetcar Project, with service frequencies comparable to the FEIS Preferred Alternative.

For the purposes of this analysis M-1 RAIL assumed RRT would have the following stops along the Woodward Avenue corridor:

- near New Center/Amtrak (Grand Boulevard area),
- near Wayne State University (Warren Avenue area),
- near Grand Circus Park (Adams Street area),
- near Campus Martius (Michigan Avenue area)

With this level of envisioned RRT service, combined with the continuation of some local bus service at intermediate stops, the current M-1 RAIL design has developed its service plan to provide streetcar service every 7 to 8 minutes during peak periods and every 12 to 13 minutes or less at other times.

Based on the one-way running times shown in **Table 4.1** and minimum layover time assumptions, five (5) vehicles are needed to provide the preferred headway range during peak periods. During off-peak periods, three (3) vehicles are needed.

## 4.4 Service Plan

Based on design decisions on the peak and off-peak service frequency, the M-1 RAIL Team developed a Weekday, Saturday, and Sunday/Holiday operating schedule for the streetcar service that transitions between the peak and off-peak service levels and vehicle requirements. With round trip cycle times (round-trip including layovers) typically between about 36 and 40 minutes throughout the week,

changes in service frequency will be accomplished by taking one or two vehicles out of service during off-peak times.

Service frequency may thus be adjusted as demand conditions become better understood after service begins by choosing to keep more vehicles in service for more of the day or week.

A preliminary assessment of line capacity suggests that the five-vehicle fleet would meet peak demand at LOS E as defined in the *Transit Capacity and Quality of Service Manual*. As shown in **Table 4.2**, this is based on an annual ridership of 3 million trips (the 2009 ridership estimate prepared by M-1 RAIL), an annualization factor of 300 weekdays per year, a peak hour factor of 10% (see **Section 5.2.1**), full demand at the peak load point along the line, and a vehicle seating capacity of 60 seats and 149 passengers at 4 passengers/$m^2$ based on Siemens S-70 Ultra Short vehicle specifications. The preliminary line capacity assessment will be reviewed when more detailed ridership estimates and a final vehicle specification are developed.

**Table 4.2 Preliminary Peak Demand Analysis**

| Item | Value | Unit |
|---|---|---|
| *Demand* | *2009 M-1 RAIL Ridership Estimate* | |
| Annual Ridership Estimate | 3,000,000 | trips |
| Annualization Factor | 300 | trips/weekday |
| Weekday Ridership | 10,000 | trips |
| Peak Hour Factor | 10% | peak trips/daily trips |
| Peak Hour Demand | 1,000 | passengers/hour |
| Service Frequency | 8.0 | vehicles/hour |
| Peak Demand per Vehicle | 125.0 | passengers/vehicle |
| Peak Load Point Factor | 1.0 | |
| **Peak Load** | **125.0** | **passengers/vehicle** |
| *Supply* | *Siemens S-70 Ultra Short Streetcar* | |
| Seats | 60 | passengers/vehicle |
| Capacity at 4/$m^2$ | 149 | passengers/vehicle |
| Standees | 89 | passengers/vehicle |
| Area ($m^2$) | 22.25 | $m^2$ |
| Standees at 3/$m^2$ | 66.75 | passengers/vehicle |
| **Capacity at Design LOS** | **126.75** | **passengers/vehicle** |

The M-1 RAIL dispatcher will use a GPS-based automatic vehicle location (AVL) system to maintain even headways based on actual travel times (with allowances for layovers) and the number of vehicles operating during each time period. Therefore, headways will vary between about 7 to 8 minutes in the weekday peak, for example, as traffic conditions require. During other times, headways will be allowed to stretch to 10 or 12 minutes during off-peak times by taking one or two vehicles out of service.

The proposed service plan reflects 133 weekday round trips, 24,062 annual revenue vehicle-hours and 254,793 annual revenue vehicle-miles. The service plan is summarized in **Table 4.3**.

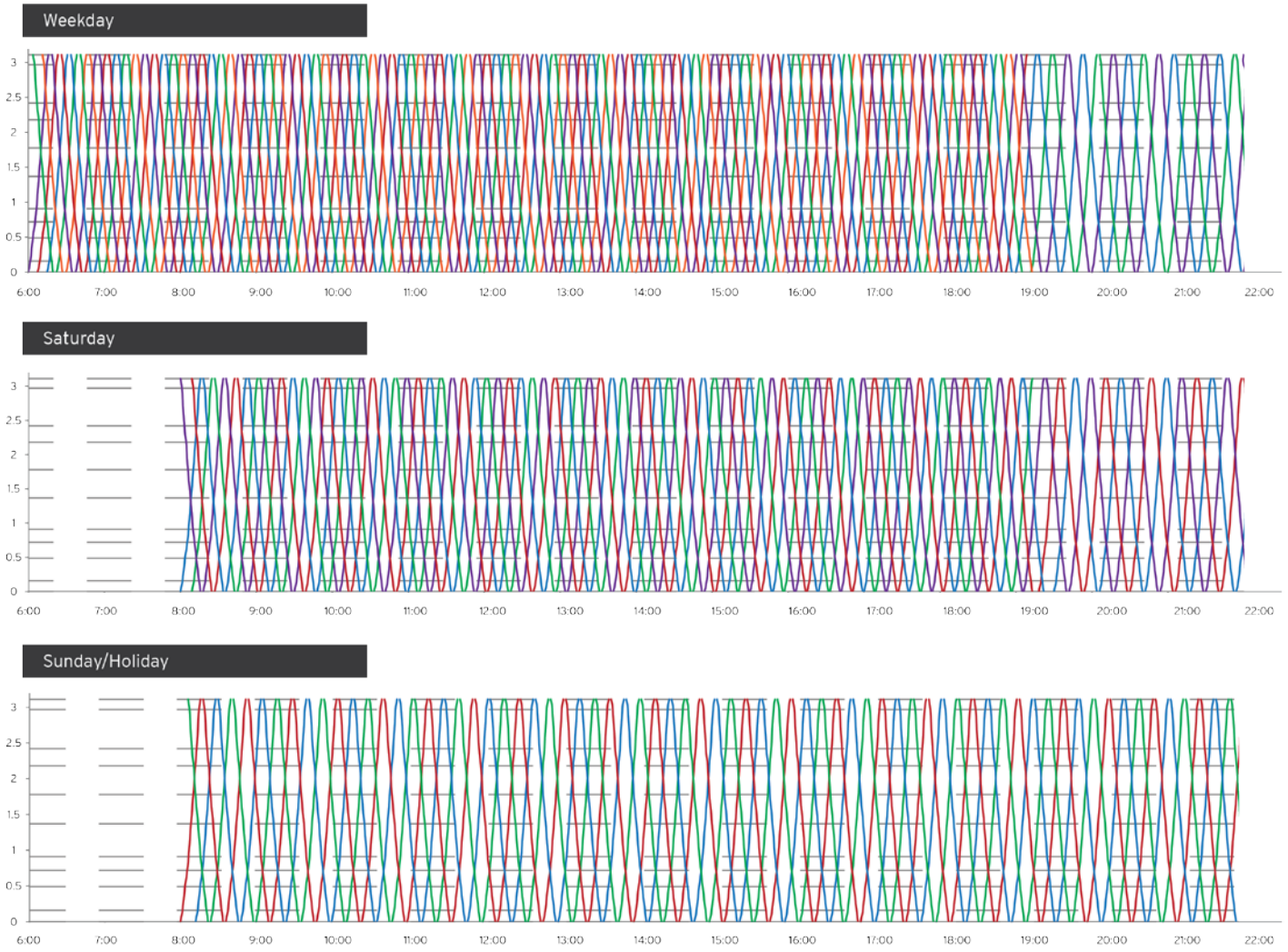
**Table 4.3 M-1 RAIL Service Plan**

| Period | Start Time | End Time | Round Trip Running Time | Headway | Vehicles Required | Revenue Hours | Revenue Miles | Days per Year |
|---|---|---|---|---|---|---|---|---|
| *Weekday* | | | | | | | | 255 |
| AM Peak | 6:00 | 9:00 | 37.5 | 7.5 | 5 | 15 | 159 | |
| Mid-Day | 9:00 | 15:00 | 37.5 | 7.5 | 5 | 30 | 318 | |
| PM Peak | 15:00 | 19:00 | 40 | 8 | 5 | 20 | 199 | |
| Evening | 19:00 | 22:00 | 36 | 12 | 3 | 9 | 99 | |
| **Weekday Total** | | | | | | **74** | **775** | |
| *Saturday* | | | | | | | | 52 |
| AM Peak | 8:00 | 9:00 | 36 | 9 | 4 | 4 | 44 | |
| Mid-Day | 9:00 | 15:00 | 36 | 9 | 4 | 24 | 265 | |
| PM Peak | 15:00 | 19:00 | 36 | 9 | 4 | 16 | 177 | |
| Evening | 19:00 | 22:00 | 36 | 12 | 3 | 9 | 99 | |
| **Saturday Total** | | | | | | **53** | **585** | |
| *Sunday/Holiday* | | | | | | | | 58 |
| AM Peak | 8:00 | 9:00 | 36 | 12 | 3 | 3 | 33 | |
| Mid-Day | 9:00 | 15:00 | 36 | 12 | 3 | 18 | 199 | |
| PM Peak | 15:00 | 19:00 | 36 | 12 | 3 | 12 | 132 | |
| Evening | 19:00 | 22:00 | 36 | 12 | 3 | 9 | 99 | |
| **Sunday/Holiday Total** | | | | | | **42** | **463** | |
| **Annual Total** | | | | | | **24,062** | **254,793** | |

Based on 2030 traffic forecasts, no traffic signal priority.
Revenue miles based on 3.31 route miles (Congress to Grand), which includes the non-revenue segment from Grand to VSMF.

**Figure 4.1** shows stringline diagrams for each period of a typical week. The movements of each of the five vehicles used in peak service are indicated by a different color line. The stringline analysis suggests that one layover berth will be needed at each terminal during normal operations.

**Figure 4.1 Typical Week Stringline Diagram**



## 4.5 Special Events Operations

During special events at the Downtown stadiums, streetcar service may operate between Grand Boulevard and Sibley Street. One-way running time on this segment during the PM Peak (worst case time period) is estimated at 9:35 northbound and 10:01 southbound. Based on a round trip cycle time of 25 minutes (including layover time), headways of 5 minutes could be achieved using 5 vehicles at times of peak demand.

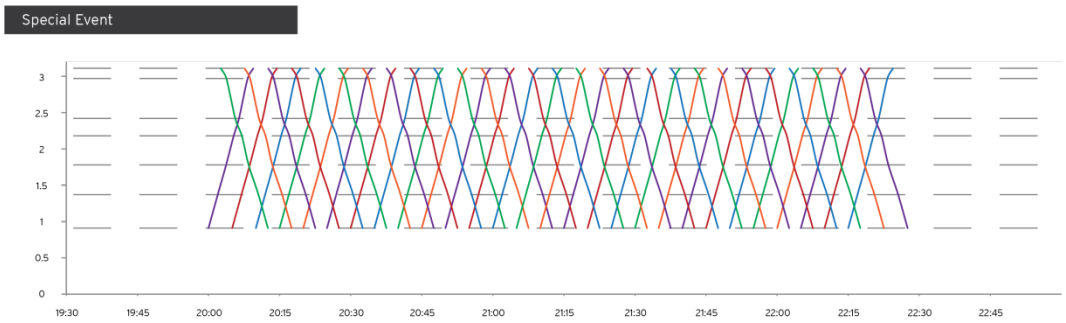
Additionally during special events that close Woodward Avenue near Campus Martius, the southern terminus would be temporarily relocated to the Campus Martius station and running times along the entire corridor would be shortened. As described in **Section 3**, this movement would be facilitated with the addition of a crossover placed just south of Gratiot Street. M-1 RAIL envisions this movement would take place twice a year during the Motown Winterblast Festival and the International Jazzfest.

No special event service is currently scheduled or included in the cost estimates or financial plan. **Table 4.4** shows the effect of the incremental service compared to base Sunday/Holiday service during each time period. If special event service were operated for six hours during the mid-day period on a Sunday, it would add 12 revenue vehicle-hours and 278 revenue vehicle-miles to regularly scheduled service. **Figure 4.2** shows a stringline diagram for operations during a special event.

**Table 4.4 M-1 RAIL Special Event Service Option**

| Period | Start Time | End Time | Round Trip Running Time | Headway | Vehicles Required | Revenue Hours | Revenue Miles |
|---|---|---|---|---|---|---|---|
| *Special Event* | | | | | | | |
| AM Peak | 6:00 | 9:00 | 25 | 5 | 5 | 15 | 238 |
| Mid-Day | 9:00 | 15:00 | 25 | 5 | 5 | 30 | 477 |
| PM Peak | 15:00 | 19:00 | 25 | 5 | 5 | 20 | 318 |
| Evening | 19:00 | 22:00 | 25 | 5 | 5 | 15 | 238 |
| *Difference from Sunday* | | | | | | | |
| AM Peak | | | | | | 12 | 205 |
| Mid-Day | | | | | | 12 | 278 |
| PM Peak | | | | | | 8 | 185 |
| Evening | | | | | | 6 | 139 |
| **Total** | | | | | | **38** | **759** |

**Figure 4.2 Special Event Stringline Diagram**




## 4.6 Emergency Operations Plan

With the addition of the Gratiot Street and Sibley Street crossovers, system redundancy has been built into the project to provide for shortened operations should an incident require closure of the line within either the CBD south of Campus Martius or around the I-75/Woodward Avenue intersection. If an incident were to close Woodward Avenue north of the Sibley Street crossover, M-1 RAIL could still operate in a shortened operational mode strictly within the CBD until the incident is removed and Woodward Avenue is reopened to traffic.

In the event of a complete closure of Woodward Avenue (i.e. major fire along the corridor), M-1 RAIL envisions its dispatch operations area would coordinate closely with first responders and worst case the system would be required to stop providing the service until it was deemed safe to resume operations by both M-1 RAIL and the emergency services providers.

In the event of schedule delays due to incidents or other disturbances along the line, the configuration of the southern terminus, with two platform edges, storage for a third vehicle and a crossover, provides operational flexibility while the M-1 RAIL dispatcher restores normal operations. The VSMF provides similar flexibility at the north end of the line. Stringline analysis suggests that a range of schedule adherence scenarios can be accommodated by adjusting the headway between vehicles following a delay of several minutes or more. The ability to layover two vehicles at each end of the line allows the dispatcher to compress headways to as little as two minutes if needed.

During the project's next phase, M-1 RAIL will develop a comprehensive Safety and Security Plan that addresses these features throughout the life of the project, including during the construction and operations phase of the project. M-1 RAIL envisions coordinating with emergency service providers along the corridor to assure both short-term and longer term safety and security items are incorporated into the *Design Criteria Manual* that will be prepared as part of the *Design/Build Procurement Documents*.

## 4.7 Coordination with Future RRT/BRT Operations

While plans for Regional Rapid Transit (RRT) or Bus Rapid Transit (BRT) have not been finalized along the Woodward Avenue corridor, M-1 RAIL believes the operation plan and service levels discussed within this section can be achieved when future RRT/BRT operations is added to the corridor. M-1 RAIL is committed to working cooperatively with the agency or agencies that ultimately will implement either RRT or BRT services along the corridor. Specifically, station placement and route coordination will be key to assess during the planning stages of the RRT/BRT. Coordination options to consider during the upcoming Woodward Avenue RRT Alternatives Analysis Study being led by the Southeast Michigan Council of Governments (SEMCOG) include shared stations along the corridor, and opportunities to utilize parallel routes (i.e., Cass Avenue south of Warren Avenue) for RRT service to provide improved transit services along the corridor and desired connections to the Rosa Parks Transit Center.

# 5 RIDERSHIP

M-1 RAIL has identified a range of potential ridership levels based on a "constellation" of estimates derived using various methods. The analysis focuses on data from several different sources including existing and historical transit ridership trends, and recent studies of light rail and streetcar conducted in Detroit and other cities. Further detail regarding this analysis is included in **Appendix B**. SEMCOG conducted a peer review of the ridership analysis and findings described below.

## 5.1 Approach and Methodology

The ridership analysis is based on three approaches:

1. Existing Transit Ridership: The first approach focuses on historical transit ridership trends for existing transit systems in the Woodward Avenue corridor, including the Detroit People Mover, City of Detroit (DDOT) buses and, to some extent, suburban SMART buses.
2. Streetcar Systems in Peer Cities: The second approach includes a review of observed streetcar ridership in eight peer cities, and analyzes observed streetcar ridership with adjustments for population and employment in walkable area for Detroit.
3. Corridor Ridership Forecasts: The third approach provides a review of Woodward Corridor streetcar or light rail ridership estimates as shown in the Woodward Transit Catalyst Project, Woodward Avenue Light Rail Alternatives Analysis (WALR AA), and the WALR Final Environmental Impact Study (FEIS). The previous studies are supplemented by a station-level forecast prepared for M-1 RAIL during the 90-day validation period using a regression model based on existing modern streetcar systems in the United States.

## 5.2 Ridership Analysis

### *5.2.1 Existing Transit Ridership*

A summary of the existing transit ridership for DDOT buses, the People Mover and selected SMART bus routes are provided in this section. In cases where data is unavailable or is anticipated in the future, previous ridership studies that include summaries of existing ridership data are cited.

The M-1 RAIL Team obtained boarding data from SEMCOG on DDOT bus routes in the Woodward Avenue corridor, SMART bus routes in the corridor, and the Detroit People Mover (DPM). Data was requested for DDOT Route 53, and SMART bus routes 450, 465, 475, 495, and 610.

Existing Boardings by Route

The primary market from which existing transit riders would likely shift to the M-1 RAIL Streetcar is the DDOT 53 Woodward bus route. Based on the estimated boarding data received from SEMCOG, about 3,000 of the 12,466 daily unlinked trips on DDOT Route 53 are between origins and destinations that are both within a quarter-mile walk distance buffer of the proposed streetcar (24 percent). As the streetcar is proposed to provide a premium experience at similar frequency (service every 7 to 8 minutes throughout most of the weekday) and fare level (base fare of $1.50) to the existing DDOT service, many of these riders could be expected to shift to streetcar service.

The Detroit People Mover (DPM) currently carries 5,506 riders on an average weekday, based on the 2010 National Transit Database (NTD). With annual ridership of 2,161,440 unlinked trips, about 35 percent of DPM's boarding activity (or more than 750,000 unlinked trips per year) occurs on weekends, including special events. The M-1 RAIL service would serve a similar downtown circulation market as the DPM. Although the base fare is higher for the streetcar (the DPM base fare is $0.75 per ride), the two-way streetcar service at surface level is expected to be more attractive for some trips, particularly those with origins and destinations near Woodward Avenue.

Since the SMART bus services by definition provide transit service between Detroit and the suburbs, it does not really share the same market as the streetcar. Consequently, it is anticipated that the shift from SMART buses to the proposed streetcar will be minimal. However, if the streetcar is connected with efficient bus rapid transit to the suburbs that makes only a few stops in the corridor, the potential market for the streetcar could increase substantially as an access/egress mode for the proposed Rolling Rapid Transit (RRT) service.

Existing Transit Trips by Time of Day

Data available from the Expanded LPA report by URS (April 2009) provided information from surveys from SEMCOG about observed transit trips by mode and time of day (Table 8-8 in Expanded LPA report for the WALR project). Based on this data from SEMCOG, about 0.8 percent of all daily trips in the SEMCOG regional travel demand model are transit trips. **Table 5.1** shows a breakdown of transit trips by time of day calculated from the observed transit trips (for the entire SEMCOG model) presented in the Expanded LPA report.

**Table 5.1 SEMCOG Model Transit Trips by Time Period**

| Time of Day | Linked Transit Trips | Percentage of Daily Transit Trips |
|---|---|---|
| AM | 23,146 | 16.4% |
| MD | 55,978 | 39.7% |
| PM | 40,829 | 28.9% |
| OP | 21,175 | 15.0% |
| Daily | 141,128 | 100.0% |

Using the boardings data from Route 53 (provided by SEMCOG), the peak period and off-peak period trips were calculated. **Table 5.2** shows roughly the same pattern as seen in the SEMCOG time of day transit trip tables presented above.

**Table 5.2 DDOT Route 53 Boardings by Time of Day**

| Time of Day | Ridership on DDOT Route 53 | Percent of Daily Ridership |
|---|---|---|
| AM | 2,718 | 22% |
| PM | 3,667 | 29% |
| Off-Peak | 6,081 | 49% |
| Daily | 12,466 | 100% |

The agreement between available data sources for ridership during the three-hour PM peak period supports the assertion contained in **Section 4.4** that about 10 percent of daily trips are expected to occur during the peak hour.

Private Shuttle Services

With the presence of the Henry Ford and Vanguard health care facilities, Wayne State University's main campus and medical campus, and the Center for Creative Arts located adjacent to the corridor, a large number of employees, patients and students currently travel the Woodward Avenue corridor. Many employees, students and patients are required to travel between the many different buildings and facilities that make up both the medical campuses and the educational facilities. Currently the following providers operate private shuttle service to transport employees, patients and students between facilities. **Table 5.3** provides an overview of the existing private shuttle services operating along or in close proximity to the Woodward Avenue corridor.

**Table 5.3 Existing Private Shuttle Providers Along the Woodward Avenue Corridor**

| Provider | Route | Hours | Vehicles | Frequency | Estimated Daily Ridership |
|---|---|---|---|---|---|
| Wayne State University | WSU to Henry Ford Hospital to DMC | 7am-9pm | 2 25-passenger vans | Main route: Every 15 minutes<br>DMC route: Every 30 minutes | 200-250 |
| College of Creative Studies | Woodward (between Kirby and Baltimore) | 24 hours<br>(3) 7am-3pm<br>(2) 3pm-11 pm<br>(1) 11pm-7am | (3) 3 14-passenger vehicles,<br>(2) 2 14-passenger vehicles,<br>(1) 1 9-passenger vehicle | Every 10 minutes | 1,500 |
| Vanguard (DMC) | Circulator between Mack and Warren Avenue (just east of Woodward Ave.) | 24 hours Mon.-Fri. | 5 24-passenger vans | AM Peak: Every 10 minuntes<br>PM Peak: Every 15-20 minutes | 2,000-2,500 |

M-1 RAIL envisions its urban circulator service will provide the headways and service levels to eliminate the need for many of these existing private shuttles, resulting in future ridership growth along the corridor.

### *5.2.2 Streetcar Systems in Peer Cities*

A comparison of daily ridership in six cities in the United States with existing streetcar service provides some guidance on the ridership range that could be anticipated for the proposed M-1 RAIL service. Three of the systems (Portland, Seattle and Tacoma) are "modern" streetcars. Three of the systems (Memphis, Little Rock and Tampa) operate historic trolley equipment.

**Table 5.4** illustrates average daily ridership and several service characteristics, including opening year, one-way route length (in miles), weekday trains in each direction and weekday service span (in hours) as derived from current schedules, average headway (in minutes) based on daily trains and service span, and average fare and weekday boardings derived primarily from 2010 NTD data. The proposed characteristics of the M-1 RAIL service are provided for comparison. There is wide variation in the service characteristics of the existing streetcar systems.

**Table 5.4 Peer System Ridership and Service Levels**

| City, State | Opening Year | One-Way Length | Weekday Trains per Direction | Weekday Service Hours | Average Headway | Average Fare | 2010 Average Weekday Boardings |
|---|---|---|---|---|---|---|---|
| M-1 RAIL | 2015 | 3.1 | 117 | 16 | 8.2 | $1.50 | |
| Portland, OR | 2001 | 4.0 | 75 | 18.5 | 14.8 | $1.28 | 11,916 |
| Seattle, WA | 2007 | 1.3 | 60 | 15.0 | 15.0 | $0.70 | 1,428 |
| Tacoma, WA | 2003 | 1.6 | 74 | 15.5 | 12.6 | $0.00 | 2,392 |
| Kenosha, WI | 2000 | 1.0 | 56 | 7.5 | 8.1 | $0.28 | 165 |
| Little Rock, AR | 2004 | 3.4 | 67 | 8.0 | 7.2 | $0.50 | 294 |
| Memphis, TN | 1993 | 7.0 | 228 | 17.0 | 4.5 | $0.66 | 3,164 |
| New Orleans, LA | 1835 | 12.7 | 254 | 18.5 | 4.4 | $0.80 | 19,066 |
| Tampa, FL | 2002 | 2.4 | 30 | 10.0 | 20.0 | $1.17 | 1,376 |

- **Portland:** The Portland Streetcar represents the first of the "modern" streetcar systems in the United States, opening in 2001. The service operates over a 4-mile route through downtown Portland between neighborhoods on the periphery of the urban core and makes connections with Tri-Met light rail services. About 39 percent of boardings are in a free fare zone, but base fare for those who board or alight outside the fare free zone is about 40 percent higher than the proposed M-1 RAIL fare. It also operates less frequently than the proposed M-1 RAIL service, with 13-minute headways throughout most of the day.

- **Seattle:** The Seattle Lake Union Streetcar is the newest "modern" streetcar service in the group, opening in late 2007. The line operates between a light rail terminal in downtown Seattle and the Lake Union shore in a dense corridor along which significant employment growth is expected. Since opening, average weekday ridership has grown at a compound annual rate of about 20 percent. By 2011 ridership had increased to about 2,400 riders per day.
- **Tacoma:** The Tacoma Link is a free "modern" streetcar service that operates through downtown Tacoma and connects with the Tacoma Amtrak and Sounder commuter rail stations. It is about half of the length of the proposed M-1 RAIL service and operates less frequently.
- **Kenosha:** The Kenosha Streetcar is a historic streetcar service that operates through downtown, linking a new adjacent urban development. It also connects with a Metra commuter rail station that offers frequent service to Chicago. The service operates at roughly the same frequency as the proposed M-1 RAIL service but has a lower fare and fewer hours of service.
- **Little Rock:** The River Rail is a historic streetcar service operating on two lines through downtown Little Rock. Service frequency is limited by fleet size, with the overlapping segment through downtown approaching a combined frequency of about six vehicles per hour. Base fare is less than that proposed for the M-1 RAIL service.
- **Memphis:** The Memphis Trolley is a historic streetcar service operating on three lines through downtown Memphis. Due to the interaction of services on overlapping segments, service frequency through downtown is comparable to the proposed M-1 RAIL service during much of the day. Other segments operate less frequently. Base fare is less than that proposed for the M-1 RAIL service.
- **New Orleans:** New Orleans streetcars have been in continuous operation since 1835. The system currently consists of 3 lines radiating from downtown and connecting historic neighborhoods. The service is more frequent and offers longer service hours, and fares are lower than the proposed M-1 RAIL service.
- **Tampa:** The TECO Trolley is a historic streetcar service that operates between downtown Tampa, a cruise ship port, and an entertainment district. The service is less frequent, offers fewer hours of service, operates on a shorter route, and has a lower fare than the proposed M-1 RAIL service.

Ridership experience on each system was adjusted to reflect conditions in the Woodward Avenue corridor by applying factors associated with activity level (total population and employment served), service level (headway elasticity), and fare level (fare elasticity). By applying these adjustments, the current ridership conditions of the peer systems

**Table 5.5** shows the population and employment within a ¼ mile radius of each streetcar system and daily boardings for the existing streetcar systems in the peer cities. These values were calculated by including the population and employment in all Census tracts within a ¼ mile area of the streetcar systems in each city using the most recent nationally consistent GIS data available, the 2010 Census and the 2000 Census Transportation Planning Package (CTPP).

The four systems with the highest current ridership (Portland, Tacoma, Memphis and New Orleans) show a relatively consistent relationship between total population and employment (residents and jobs) and daily ridership. For these systems, the average "activity" to weekday ridership ratio is in the 14-19 range. Two systems (Seattle and Little Rock) are both used about one-tenth as much by those in their respective corridors (about 140 residents or jobs per rider), although Seattle's rising ridership is causing its ratio to approach that of Tampa (about 60). A similar pattern holds when population or employment per boarding are evaluated in isolation.

**Table 5.5 Peer System Activity Level Adjustment**

| City, State | Daily Boardings | Population based on Census 2010 data | Employment based on CTPP 2000 data | Population + Employment | Activity Level Factor | M-1 RAIL Activity Level-Adjusted Boardings |
|---|---|---|---|---|---|---|
| M-1 RAIL | | 22,632 | 122,500 | 145,132 | 1.00 | |
| Portland, OR | 11,916 | 49,382 | 131,040 | 180,422 | 1.24 | 9,600 |
| Seattle, WA | 1,428 | 51,568 | 153,690 | 205,258 | 1.41 | 1,000 |
| Tacoma, WA | 2,392 | 8,900 | 35,820 | 44,720 | 0.31 | 7,800 |
| Kenosha, WI | 165 | 11,203 | 7,675 | 19,303 | 0.13 | 1,200 |
| Little Rock, AR | 294 | 5,910 | 35,805 | 41,715 | 0.29 | 1,000 |
| Memphis, TN | 3,164 | 12,450 | 32,765 | 45,215 | 0.31 | 10,200 |
| New Orleans, LA | 19,066 | 95,844 | 165,295 | 261,139 | 1.80 | 10,600 |
| Tampa, FL | 1,376 | 18,100 | 64,885 | 82,985 | 0.57 | 2,400 |

Population based on GIS buffer analysis of 2010 Census data.
Employment based on GIS Buffer analysis 2000 Census Transportation Planning Package data

To adjust peer system experience to conditions on Woodward Avenue, the peer system ridership was divided by an adjustment factor that reflects the ratio of peer system population and employment served to population and employment along the M-1 RAIL route. When peer system ridership is adjusted to reflect existing conditions along Woodward Avenue, experience in Portland, Tacoma, Memphis and New Orleans suggests ridership of 7,800 to 10,600 per weekday. As noted above, other systems are substantially lower.

**Table 5.6** applies a similar adjustment based on service level. An arc elasticity of -0.5 of changes in ridership to changes in headway was applied to existing ridership in the peer systems to estimate the effect of a change to the proposed M-1 RAIL service level on its ridership.[1] Portland's experience suggests that if it could achieve the typical 7-8 minute headways proposed for Woodward Avenue, ridership could reach nearly 16,000 per day. Most other systems are in the 2,000 to 3,000 range.

[1] Typical headway elasticity value based on *TCRP Report 95: Traveler Responses to Transportation System Changes*, Chapter 9 "Transit Scheduling and Frequency", 2004.

**Table 5.6 Peer System Service Level Adjustment**

| City, State | Daily Boardings | Weekday Service Hours | Daily Service Level (weekday trains per direction) | Average Headway | Service Level Factor | M-1 RAIL Service Level-Adjusted Boardings |
|---|---|---|---|---|---|---|
| M-1 RAIL | | 16 | 117 | 8.2 | 1.00 | |
| Portland, OR | 11,916 | 18.5 | 75 | 14.8 | 0.75 | 15,900 |
| Seattle, WA | 1,428 | 15 | 60 | 15.0 | 0.74 | 1,900 |
| Tacoma, WA | 2,392 | 15.5 | 74 | 12.6 | 0.81 | 3,000 |
| Kenosha, WI | 165 | 7.5 | 56 | 8.1 | 1.01 | 200 |
| Little Rock, AR | 294 | 8 | 67 | 7.2 | 1.07 | 300 |
| Memphis, TN | 3,164 | 17 | 228 | 4.5 | 1.35 | 2,400 |
| New Orleans, LA | 19,066 | 18.5 | 254 | 4.4 | 1.36 | 14,000 |
| Tampa, FL | 1,376 | 10 | 30 | 20.0 | 0.65 | 2,100 |

**Table 5.7** applies a similar adjustment based on fare level. An arc elasticity of -0.4 of changes in ridership to changes in fare cost was applied to existing ridership in the peer systems to estimate the effect of a change to the proposed M-1 RAIL fare level on their ridership.[2] Although Portland and New Orleans would remain above 11,000 with a base fare of $1.50, most other systems would remain in the 1,000 to 2,000 range.

**Table 5.8** combines the effects of activity level, service level, and fare level adjustment factors to translate the ridership experience in their markets to the M-1 RAIL Streetcar Project. The results suggest a wide range of potential ridership on the M-1 RAIL service. Historic streetcar systems in Tampa and Memphis suggest ridership in the 3,000 to 5,000 range. Modern streetcar systems in Portland and Tacoma suggest ridership in the 4,000 to 12,000 range. The relatively small systems in Little Rock and Kenosha, the relatively new system in Seattle and the older, established system in New Orleans appear to be outliers.

[2] Typical headway elasticity value based on *TCRP Report 95: Traveler Responses to Transportation System Changes*, Chapter 12 "Transit Pricing and Fares", 2004.

**Table 5.7 Peer System Fare Level Adjustment**

| City, State | Daily Boardings | Base Fare | Fare Level Factor | M-1 RAIL Service Level-Adjusted Boardings |
|---|---|---|---|---|
| M-1 RAIL | | $1.50 | 1.00 | |
| Portland, OR | 11,916 | $1.28 | 1.07 | 11,200 |
| Seattle, WA | 1,428 | $0.70 | 1.34 | 1,100 |
| Tacoma, WA | 2,392 | $0.00 | 2.33 | 1,000 |
| Kenosha, WI | 165 | $0.28 | 1.76 | 100 |
| Little Rock, AR | 294 | $0.66 | 1.37 | 200 |
| Memphis, TN | 3,164 | $0.50 | 1.50 | 2,100 |
| New Orleans, LA | 19,066 | $0.80 | 1.28 | 14,900 |
| Tampa, FL | 1,376 | $1.17 | 1.10 | 1,200 |

**Table 5.8 Combined Adjustment**

| City, State | Daily Boardings | Activity Level Factor | Service Level Factor | Fare Level Factor | M-1 RAIL Adjusted Boardings |
|---|---|---|---|---|---|
| M-1 RAIL | | 1.00 | 1.00 | 1.00 | |
| Portland, OR | 11,916 | 1.24 | 0.75 | 1.07 | 12,000 |
| Seattle, WA | 1,428 | 1.41 | 0.74 | 1.34 | 1,000 |
| Tacoma, WA | 2,392 | 0.31 | 0.81 | 2.33 | 4,100 |
| Kenosha, WI | 165 | 0.13 | 1.01 | 1.76 | 700 |
| Little Rock, AR | 294 | 0.29 | 1.07 | 1.37 | 700 |
| Memphis, TN | 3,164 | 0.31 | 1.35 | 1.50 | 5,000 |
| New Orleans, LA | 19,066 | 1.80 | 1.36 | 1.28 | 6,100 |
| Tampa, FL | 1,376 | 0.57 | 0.65 | 1.10 | 3,300 |

### *5.2.3 Ridership Forecast*

Several studies have been conducted as to ridership for the light rail or streetcar services on Woodward Avenue. A brief synopsis of each of these studies, focusing on ridership estimates for the Downtown to New Center segment of the Woodward Avenue corridor.

Woodward Transit Catalyst Project

The Woodward Transit Catalyst Project study in 2007 estimated that the a streetcar service with 12 stations between Hart Plaza in the downtown riverfront area and Grand Boulevard in the New Center area would attract approximately 1.8 million riders in its opening year, rising to 3 million boardings by the fifth year of operation.[3] The service was planned to operate with headways of 4 minutes in the peak period and 10 minutes at other times. The estimate was based on a comparison with ridership on the People Mover (cited as 2.4 million boardings per year) and existing Woodward Avenue bus service (cited as 6 million boardings per year).

M-1 RAIL operations and maintenance cost estimates in 2009 assumed an annualization factor of 300 typical weekdays per year.[4] Using this annualization factor, the 2007 estimate reflects an average weekday ridership of about 6,000 unlinked trips in the opening year and 10,000 unlinked trips after five years.

M-1 RAIL Ridership Projection Analysis

M-1 RAIL conducted a review of the Woodward Transit Catalyst Project ridership in 2009.[5] The analysis developed an independent estimate of potential ridership on the streetcar line using a comparison of annual boardings per route mile on several peer systems. The analysis reached the same conclusion as the 2007 estimate, with 1.8 million riders in the opening year, rising to 3 million boardings by the fifth year of operation. As above, this would translate into 6,000 unlinked trips in the opening year and 10,000 unlinked trips after five years. The 2009 ridership analysis is described in more detail in **Appendix B.1**.

M-1 RAIL Station-Level Forecast

M-1 RAIL contracted with Fehr & Peers to conduct an independent ridership estimate using a Direct Ridership Forecasting (DRF) model calibrated and validated to existing streetcar systems in Portland, Seatlte, and Tacoma. Direct Ridership Models (DRMs) are directly and quantitatively responsive to land use and transit service characteristics within the immediate vicinity and within the catchment area of transit stations. They can predict ridership at individual stations based on local station area and system

[3] The Regional Area Link (TRAIL). *Woodward Transit Catalyst Project: System Plan.* Prepared by University of Detroit Mercy and Deloitte & Touche LLP, November 2007.
[4] M-1 RAIL. "TRAIL High Level Operating and Maintenance Cost Estimate." Prepared by LTK Engineering Services, draft January 22, 2009.
[5] M-1 RAIL. "Ridership Projection Analysis." Prepared by Anderson Consulting, May 2009.

characteristics. DRMs are based on empirical relationships found through statistical analysis of station ridership and local station characteristics. The analysis methodology and results are described in more detail in **Appendix B.2**.

The DRF model uses a regression approach to produce forecasrs at the station level as well as for total corridor ridership for both opening year and a future horizon year. Independent variables assembled in the M-1 RAIL corridor for 2014 and 2022 include:

- Feeder Rail Lines – a measure of the regional transit connections
- Urban Density – a measure of retail intensity and residential density of the station area
- Stop Distance – the distance between stations
- College Enrollment – a measure of the magnitude of a college or university served by the station
- Hospital Beds – a measure of the magnitude of hospitals served by the station
- Hotel Rooms – a measure of the magnitude of hotel rooms served by the station
- Center Size – a measure of the magnitude of events centersserved by the station
- Free/Paid – a binary variable indicating whether the station is free or paid (but not providing information about the level of fare)

The DRF model was applied to two scenarios reflecting the effects of special events and college breaks. The Baseline Scenario forecasts a day when colleges are not in session, theater attendance is low and no sports events are occurring. The High Activity Scenario forecasts a day when colleges are in session, theater attendance is high and events (most notably baseball and hockey games) are occurring at Comerica Park and the Joe Louis Arena. The results are presented in **Table 5.9**.

**Table 5.9 Direct Ridership Forecast Model Results**

| Year | Baseline Scenario | High Activity Scenario |
|---|---|---|
| 2014 | 5,370 | 7,980 |
| 2022 | 5,740 | 8,340 |

Detroit Woodward Avenue LRT Model Review and Update

AECOM was tasked with reviewing and adapting the SEMCOG model that was developed by URS and SEMCOG as part of the WALR Alternatives Analysis effort.[6] AECOM forecasted a reduced 2030 ridership of 10,400 for the light rail project between downtown Detroit and Eight Mile Road, compared to the URS forecast of 11,100 riders per day. The service was assumed to operate with headways of 10 minutes in the peak period and 15 minutes at other times. Because of the difference in corridor extents, this estimate is not considered to provide much insight for the M-1 RAIL Project ridership.

[6] "Detroit Woodward Avenue LRT Model Review and Model Revision." Prepared by AECOM, draft November 8, 2010 (with minor editorial changes 7/22/2011).

## 5.3 Local Factors Influencing Ridership

The Woodward Avenue corridor is considered the central artery of Detroit; as such many of the City's existing cultural, medical, educational and entertainment attractions are located along this corridor. Because of the envisioned frequent and reliable urban circulator service levels proposed, M-1 RAIL projects that opening day ridership will be higher than what is currently supported on existing DDOT/SMART transit service located in the corridor due in part to the following localized factors:

More Convenient Service than Existing Options

Because of the streetcar's greater comfort and convenience, the existing DDOT Route 53 bus ridership in the corridor could be expected to establish a very conservative lower bound for potential M-1 RAIL ridership. Likewise, the streetcar's more direct, surface-level operation could cause it to attract more ridership than the existing DPM, which operates on a one-way elevated loop. The streetcar's ability to connect areas like midtown, the theater/stadium district, the cultural center, the Detroit Institute of Arts (DIA), New Center, and Wayne State University (WSU) to discretionary venues such as restaurants and lounges with attractive, premium service is also not taken into account. For example, visitors to the DIA or students at WSU may use this service to visit a restaurant a few blocks away or on Broadway or Grand Circus Park rather than using their cars and dealing with parking.

Private Shuttle Ridership

The M-1RAIL Streetcar service is expected to provide a compelling alternative to the operation of private shuttle services in the Woodward Avenue corridor. **Table 5.10** presents a comparison of the estimated cost of the private shuttle services identified in **Table 5.3** with the potential fare costs for replacement streetcar service under an employer or institutional universal pass program (e.g. Eco-Pass or U-Pass) scenario. Universal pass programs charge employers or institutions a flat annual rate for unlimited access to transit service by all eligible faculty, staff, or students. The annual cost to the employer or institution is typically negotiated based on estimated total annual usage, often using the previous year ridership as a guide. Rates per expected passenger are typically based on the fare cost offered to individuals, and may reflect a monthly pass or other discount from the walk-up fare.

**Table 5.10 Comparison of Existing Private Shuttle Costs and Proposed M-1 RAIL Pass Program Costs**

| Provider | Annual Revenue Vehicle Hours | Annual Operating Cost | Annual Ridership | Operating Cost per Passenger | Pass Program Cost | Pass Program Cost per Passenger | Annual Savings from Pass Program |
|---|---|---|---|---|---|---|---|
| Wayne State University (WSU) | 7,140 | $357,000 | 57,375 | $6.22 | $86,063 | $1.50 | $270,938 |
| College of Creative Studies (CCS) | 12,240 | $612,000 | 382,500 | $1.60 | $573,750 | $1.50 | $38,250 |
| Vanguard (DMC) | 18,360 | $918,000 | 573,750 | $1.60 | $860,625 | $1.50 | $57,375 |
| **Total** | **37,740** | **$1,887,000** | **1,013,625** | **$1.86** | **$1,520,438** | **$4.50** | **$366,563** |

Assuming an operating and maintenance cost of $50 per revenue vehicle hour (compared to $64 and $90 per hour for DDOT and SMART paratransit services using similar vehicle types, respectively, based on the 2010 National Transit Database) and 255 days per year (weekdays only), the cost of the shuttle services range from $1.60 per passenger for the College of Creative Studies (CCS) and Vanguard (DMC) services to more than $6.00 per passenger for the less used Wayne State University shuttle.

At an annual cost per existing passenger equal to the proposed M-1 RAIL base fare of $1.50 (no discount), a universal pass program for the streetcar would provide a compelling value proposition to each of the existing shuttle operators. Total savings could exceed $360,000 per year and could bring more than 1 million riders (unlinked trips) to the M-1 RAIL Streetcar Project.

With potential annual savings of more than $270,000 based on its current ridership, Wayne State University would likely find the opportunity to reduce or eliminate its shuttle service by introducing a U-Pass program as a replacement most attractive of the current operators. However, because the streetcar service would not be as direct to Henry Ford Hospital as the existing shuttle, it may need to maintain at least some of its current service and operating costs.

The CCS and DMC shuttles could each save about 6% of their operating costs by adopting a universal pass program arrangement with M-1 RAIL. If their cost structures are closer to DDOT paratransit services, yielding cost per passenger of more than $2.00, savings could increase to more than 25% of operating costs.

Special Event Ridership

Woodward Avenue is the main north-south arterial that provides access to downtown Detroit for more than 15 million annual visitors a year. Many of Detroit's major special event generators are located along the M-1 RAIL route and would be expected to generate ridership:

- Detroit Tigers home games ( average 81 home games a year)
- Detroit Lions home games (average 8 home games a year)
- Numerous Concerts held in Comerica Park/Ford Field
- Fox Theater performances
- Target Freedomfest Fireworks (estimated annual attendance of 1,000,000)
- Motown Winterblast (estimated annual attendance of 75,000)
- Detroit's International Jazzfest (estimated annual attendance of 75,000)

MidTown, Inc/DDP's Live Downtown Incentive Program

Through a collaborative partnership, MidTown, Inc. and the Detroit Downtown Partnership have developed and implemented an incentive program designed to accelerate revitalization efforts in Downtown Detroit and Midtown. The program seeks to attract and retain talent, increase economic development, spark retail development and is seen as a catalyst to renovate and convert vacant

downtown buildings to new housing units. Initiated in 2010, the current project is a five-year, more than $4 million initiative that will provide cash incentives to employees who choose to move to Downtown Detroit and live where they work.

The companies currently involved in the program are Blue Cross Blue Shield of Michigan, Henry Ford Hospital, Detroit Medical Center, Wayne State University, Compuware, DTE Energy, Quicken Loans and Strategic Staffing Solutions. About 16,000 full- and part-time employees of the five participating companies who work in Southeast Michigan are eligible to participate in Live Downtown. Those who choose to move Downtown or who already live here can use the following incentives.

- New homeowners receive a $20,000 forgivable loan toward the purchase of their primary residence
- New renters receive a $2,500 allowance of funding toward the cost of their apartment in the first year followed by additional funding of $1,000 for the second year
- Existing renters receive a $1,000 allowance of funding for renewing a lease in 2011
- Existing homeowners receive matching funds of up to $5,000 for exterior improvements for projects of $10,000 or more.

Eligible neighborhoods are Corktown, Downtown, Eastern Market, Lafayette Park, Midtown and Woodbridge. The M-1 RAIL route is envisioned to provide direct transit service to the Downtown and Midtown neighborhoods and indirect service via transfers to the others. As of February 2012, the Live Downtown Incentive Program has no open slots for new enrollees and is believed to be one of the contributing factors to the less than 5% vacancy rate in existing Midtown condominium units.

Existing Housing & Commercial Developments Under Construction

There are several projects currently under development along the Woodward Avenue that will attract additional residents and visitors to the greater downtown area, including:

***Downtown (Under Construction)***

- Capitol Park Development, 3 buildings (250 residential units)
- David Whitney (120 residential units)
- David Broderick (127 residential units)
- East Riverfront (250 residential units)

***Midtown (Under Construction)***

- Auburn (58 residential units)
- Brentwood (38 residential units)
- Newberry (28 residential units)
- Willis Development (5 residential units)

- Willys (55 residential units)

***Midtown (Planned)***

- Erskine (8 residential units)
- 4265 Woodward (4 residential units)
- 69 Willis (24 residential units)
- 70 Alexandrine (126 residential units)
- Cass Plaza (47 residential units)
- Century (18 residential units)
- Fisher Kahn (12 residential units)
- Forest Arms (75 residential units)
- Garden Block (61 residential units)
- Kirby Street Historic Rehab (27 residential units)
- Medical Center Village (100 residential units)
- Sherbrooke (14 residential units)
- Sugar Hill Phase 2 (74 residential units)
- Woodward-Willis (11 residential units)

M-1 RAIL expects all of the aforementioned developments to be completed by the envisioned opening day of operations for the streetcar system, and thus will add to the initial ridership of the system.

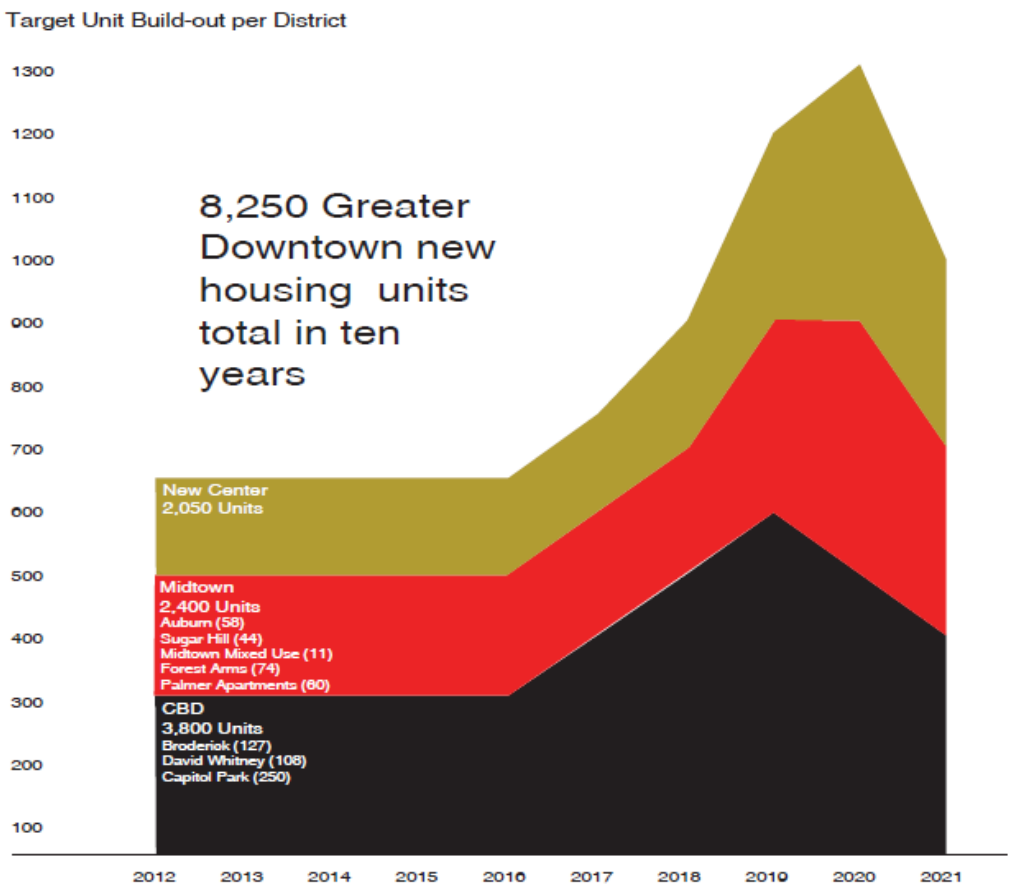
Comprehensive TOD Growth Strategy

The Detroit Economic Growth Corporation and the Downtown Detroit Partnership completed a *Greater Downtown TOD Strategy* in 2011.[7] The plan outlined a strategy to double residential population in the greater Central Business District, Midtown, and New Center areas of Detroit in the next ten years by leveraging the streetcar investment to catalyze growth of existing districts and neighborhoods. The population growth is anticipated to be clustered along Woodward Avenue. If all of the growth were to occur within convenient walking distance of the M-1 RAIL Streetcar Project, the adjusted boardings computed by the method above would range from 1,900 to 11,000 per average weekday.

Following this implementation strategy, the TOD working group projects to add 8,250 new housing units in 10 years (as illustrated in **Figure 5.1).** The M-1 RAIL system is envisioned to directly support this future housing growth. The Executive Summary of the Greater Downtown TOD Strategy has been included in **Appendix B.3** of this report for reference.

[7] Detroit Economic Growth Corporation and the Downtown Detroit Partnership. *Greater Downtown TOD Strategy.* Prepared by Hamilton Anderson, December 2011.

**Figure 5.1 Housing Development Projection (2012 – 2021)**




*Source: Greater Downtown TOD Strategy, December 2011.*

Recent Employment Growth in Downtown Detroit

Within the last two years (since 2010 Census data was collected), several major employers have relocated to Detroit's Central Business District. These employers include: Quicken Loans (5,000 employees) and Blue Cross/Blue Shield (6,500 employees). This new employment base is expected to add to M-1 RAIL's initial ridership.

Wayne State University Growth

Located within the heart of the M-1 RAIL Streetcar Project area is Wayne State University (WSU). WSU currently has a full-time undergraduate population of approximately 13,200 students, 7,500 part-time undergraduate students, and a graduate student population over 11,000.

According to Wayne State University's current strategic plan, WSU has plans to expand its future enrollment to position Wayne State University as a premier destination and university of opportunity including by expanding opportunities by increasing student enrollment up to 40,000, including an expanded residential population. This future enrollment growth with an emphasis on increasing the university's residential population along the Woodward Avenue campus will directly support a higher level of future M-1 RAIL ridership.

## 5.4 Range of Estimated Ridership

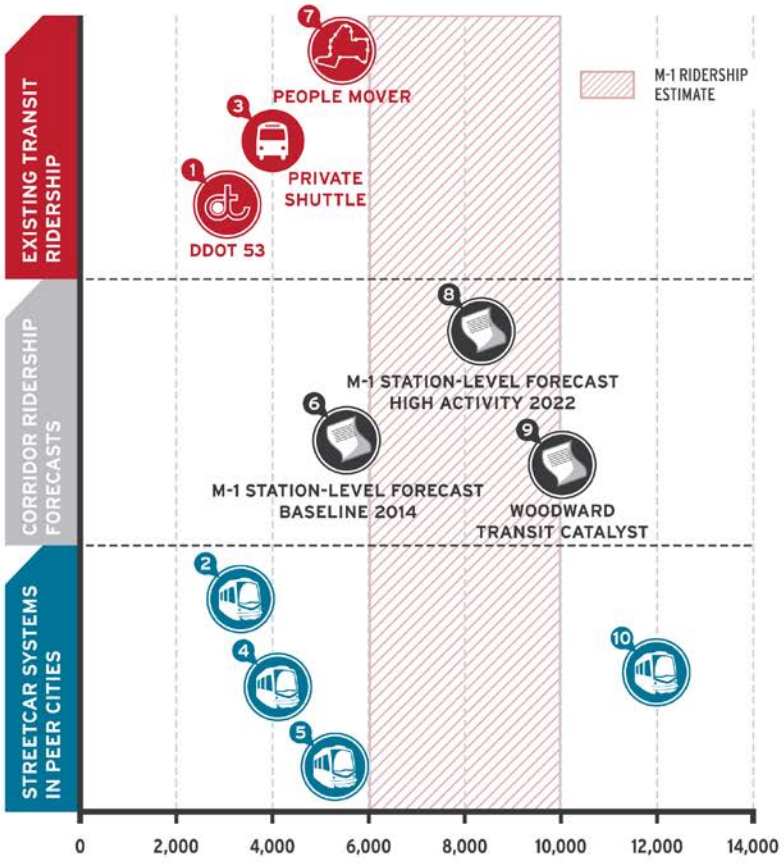
**Table 5.11** and **Figure 5.3** summarize the "constellation" of data points on potential ridership for the M-1 RAIL Streetcar Project based on the methods described in the previous sections.

**Table 5.11 Summary of Estimates**

| Method | Weekday Unlinked Trips |
|---|---|
| Existing DDOT Route 53, Streetcar Segment | 3,000 |
| Tampa, Adjusted Ridership | 3,200 |
| Existing Private Shuttles | 4,000 |
| Tacoma, Adjusted Ridership | 4,100 |
| Memphis, Adjusted Ridership | 5,300 |
| M-1 RAIL Station-Level Forecast – Baseline 2014 | 5,400 |
| Existing People Mover | 5,500 |
| M-1 RAIL Station-Level Forecast – High Activity 2022 | 8,300 |
| Woodward Transit Catalyst Project | 10,000 |
| Portland, Adjusted Ridership | 12,000 |

Based on the evidence assembled to date including the unique local factors that currently influence Woodward Avenue, weekday M-1 RAIL ridership is likely to build over time as the Greater Downtown TOD Strategy is implemented. The strong ridership on existing bus and circulator services in the corridor appears to establish a lower bound for initial ridership in the 5,000 to 6,000 range, similar to the existing People Mover ridership. Over time, ridership could build to 10,000 or more as experienced in Portland and initially estimated in the Woodward Transit Catalyst study.

**Figure 5.3 Estimated M-1 RAIL Ridership**




**RIDERSHIP**

| | | |
|---|---|---|
| 1 | **Existing DDOT Route 53** [Streetcar Segment] | 3,000 |
| 2 | **Tampa** [Adjusted Ridership] | 3,200 |
| 3 | **Existing Private Shuttle** | 4,000 |
| 4 | **Tacoma** [Adjusted Ridership] | 4,100 |
| 5 | **Memphis** [Adjusted Ridership] | 5,300 |
| 6 | **M-1 Station-Level Forecast - Baseline 2014** | 5,400 |
| 7 | **Existing People Mover** | 5,500 |
| 8 | **M-1 Station-Level Forecast - High Activity 2022** | 8,300 |
| 9 | **Woodward Transit Catalyst** | 10,000 |
| 10 | **Portland** [Adjusted Ridership] | 12,000 |

This ridership assessment has not identified sufficient evidence to suggest that the previous ridership estimates for the M-1 RAIL service should be substantially revised. The robust level of existing weekday Route 53 and DPM ridership that would benefit from the streetcar service, the presence of substantial special event ridership activity in the corridor, the strong shuttle market that would be replaced with streetcar service, the recent momentum of downtown employment, and credible plans for increases in residential development in the corridor all suggest that approximately 6,000 riders per day (or 1.8 million unlinked trip per year) could be expected in the first few years of operation. Based on the experience of other modern streetcar corridors where economic development has rapidly occurred, this ridership level could be expected to build to the 10,000 riders per day (3 million unlinked trips per year) level suggested in the Woodward Transit Catalyst Project by 2035. On a linear trajectory, boardings in 2022 would be about 90% of the M-1 RAIL station-level forecast prepared during the 90-day validation (midpoint of the two scenarios).

# 6 CAPITAL BUDGET

A revised capital cost estimate has been prepared for the M-1 RAIL Streetcar Project based on updated quantities that reflect the project definition described in **Section 3**, a review of unit costs from comparable projects, and escalation to 2012 dollars. M-1 RAIL has developed the revised estimate using a design (top down) approach. This estimate was then validated using a contractor (bottom up) approach. Additonally, a review of modern streetcar peer city systems has been included to provide another source of validation of M-1 RAIL's capital cost estimate.

## 6.1 Previous Capital Budget Estimate

The preliminary capital cost estimate developed by M-1 RAIL in 2009 was $120 million. A confirmation of the Capital Cost estimates was completed in December 2011 and was included in the Concept of Design report as shown in **Appendix A.6.** The analysis was an assessment of the reasonableness of the 2009 Capital Cost Estimate. The planning level analysis vetted the $120 million project costs against industry standards and comparable projects in other cities.

The analysis found the 20% level preliminary engineering cost estimates prepared by M-1 RAIL in 2009 to be generally comparable with more conceptual cost estimates from other cities developed for the review. Although there were differences associated with the allocation of costs to individual categories, the total cost estimates and overall costs per route mile were nearly identical. The analysis provided some confidence that the project cost estimates that had been prepared in 2009 were within a reasonable cost range.

The updated capital cost estimate in this section is an independent estimate from M-1 RAIL and completely separate from the December 2011 cost confirmation analysis.

## 6.2 Design (Top Down) Approach Cost Estimate

M-1 RAIL utilized the services of HNTB, one of America's leading transportation infrastructure design firms, to develop an independent cost estimate for the M-1 RAIL Streetcar Project from an architecture/engineering (A/E) perspective. This estimate was developed using a top down approach based on M-1 RAIL's currently defined project scope (further defined in **Section 3** and in the following sections). M-1 RAIL pulled preliminary quantities from the 20% design plans completed in 2009 and updated to reflect current scope chages developed as part of the current 90-day validation effort. The unit costs are primarily derived from comparable projects taken from HNTB's proprietary database, however, where applicable M-1 RAIL developed estimates based on local conditions (i.e. real estate acquisition for the VSMF, utility unit costs, and station/stop costs) have been incorporated into the cost estimate. HNTB's project cost estimating database and a comparable streetcar project cost estimate developed in 2011 for a 30% design phase were used in the development of M-1 RAIL's estimate. The comparable project is a modern streetcar project located in the Midwest and used a standard FTA WBS

approach. Once linear foot unit costs were developed they were escalated to 2012 dollars using a 3% inflation rate.

As discussed previously in **Section 3**, MDOT will be reconstructing 2.54 miles of Woodward Avenue within M-1 RAIL's 3.31 mile project area. MDOT's reconstruction project is included in SEMCOG's 2013 Transportation Improvement Program (TIP). MDOT's current reconstruction cost estimate is $17.8 million in 2013$. M-1 RAIL has assumed the following elements will be completed by MDOT as part of the reconstruction scope or work for the portion of M-1 RAIL's project area located between Sibley and the northern project limits:

- Demoloition costs
- Driveway/curb impacts
- Drainage impacts
- Utility coordination and relocation assistance
- Paving costs outside of M-1 RAIL's track envelope
- Mobilization
- Maintenance of Traffic

MDOT's preliminary cost estimate for the reconstruction project is included in **Appendix C.1**.

### *6.2.1 Methodology*

This section describes the current level of design for the M-1 RAIL Streetcar Project and the steps taken to develop the costs.

- Step 1 was to develop the quantities based on the current streetcar design.
- Step 2 included the development of a per-mile unit cost estimate from a database of peer projects and primarily from a specific project that recently (2011) completed its 30% Plans and detailed Work Breakdown Structure.
- Step 3 was to compare the cost estimate to similar modern streetcar project's actual and estimated costs.

<u>Current Level of Design</u>

In July 2009, M-1 RAIL completed a series of Basis of Design Technical Reports and the M-1 (Woodward Ave.) Light Rail, 20% Basis of Design Review Plans. Below is a description of the elements completed to date.

Technical Reports completed in 2009 by M-1 RAIL:

- *Civil Basis of Design Technical Report*
- *Station Basis of Design Technical Report*
- *Maintenance Facility Basis of Design Technical Report*
- *Systems Basis of Design Technical Report*

- *Vehicle Matrix Technical Report*
- *Concept of Design for Rail Overpass near Amsterdam*
- *Conceptual O&M Cost Estimate Technical Report*
- *Operating Technical Report*
- *Contracting Services Technical Report*
- *Streetcar Fare Systems Technical Report*
- *Fare Considerations Technical Report*

Following the development of the Technical Reports, M-1 RAIL's Design Team completed conceptual 20% Plans for the preferred alternative based on the criteria developed in the Technical Reports.

The 20% Design Review Plan Elements include: the existing and proposed roadway cross sections, track details, special track work details, and maintenance facility track details. The proposed alignment plans details the location of the track, proposed stop locations, modifications to traffic signals, curbs, travel lanes and configurations substation locations and the maintenance facility site plan.

Also included in the 20% Plans are the plan and profile sheets for the roadway. On the plan and profile sheets are the roadway and trackway elevations for the entire route and the associated k-values. The 20% plans also include the preliminary pole layout and wire placement for the overhead contact system (OCS).

2012 Design Revisions

Updates to the design have occurred in 2012 to further improve the project. The revisions include adjustments to the track alignment, adding in crossovers and tail track, minor station location adjustments and storage track for disabled streetcar vehicles. However, the basic design approach for the project has not changed significantly from the 20% Design Plans developed in 2009. The design is intended to be a modern streetcar system designed to fit within the existing roadway right-of-way, similar to other modern streetcar projects like those constructed in Portland, Seattle and Tacoma. The M-1 RAIL Streetcar Project is also similar to many systems that are under construction or being proposed, including Cincinnati, Atlanta, Milwaukee, Charlotte and Tucson.

Basis of Estimate

The Current Baseline Estimate is an order-of-magnitude Preliminary Engineer's Estimate developed at the 20% level of design, and assumed contingencies reflect the ongoing advancement of the project. The structure of the Current Baseline Estimate has been developed to follow the FTA Standardized Cost Categories (SCC) for items of work. This structure will provide a baseline document that can be used for tracking the cost impact of various changes during design development of the Preliminary and Final Design.

The Basis of Estimate defines the estimate parameters, scope of work, estimate structure, assumptions and exclusions. A detailed Work Breakdown Cost Structure estimate will commence once the project has completed the 30% Design. The cost estimates will advance as the design advances. A final report will be

delivered at each key milestone when an estimate is required. Separate reports may be developed if new alternatives are evaluated during the design development process.

**Baseline Parameters**

**1. Segments**
The M-1 RAIL Project is not segmented at this time and is an approximately 3.31 mile modern streetcar project.

**2. Stops**
Basic Curb Stops – 16
Median - 3

**3. Track Work**
Embedded Track – approximately 75,734 Track Feet

a. Pre-curved rail
b. Restraining rail
c. Special trackwork
d. Embedded bridge track
e. Embedded or ballasted yard track
f. Embedded shop track
g. Pedestal shop track

**Scope of Work**

For consistency purposes, the scope of work follows the FTA Standard Cost Categories (SCC).

**10. Guideway and Track Elements**
.10 – Track Work – Includes all track work for the project except Special Track work and the yard. Embedded track segments are per the alignment. Supplier pricing for the track includes all pre-curved and restrained rail sections required. The Typical track is an embedded track of 8' width and is to be installed to generally match the existing street grades.

.12 – Special Track work – See estimate for assumed quantities of special track work (does not include special track work in the yard). The configuration for special track work will be finalized during future design phases, however concepts are provided in the 20% plans including the special track work design and the amount of turnouts assumed to be needed. A unit cost derived from similar projects recently bid, an estimate provided by a supplier and designer/contractor suggestions were weighed into this estimate.

**20. Stations, Stops, Terminals, Intermodal**
.01 – Base Stations/Stops - At Grade – The scope of the project includes 22 Basic platforms. Basic platforms are typically 60-ft long and 9-ft wide. Median platforms are approximately 60-ft long by 12 to 14-ft wide. M-1 RAIL assumed the costs of median platforms will be equal to two side platform stations, thus the reason why the cost estimate includes 22 stations as compared to the 19 stations identified in the project definition section.

.02 – Landscaping – This line item accounts for reconstruction of private driveways and street trees. Currently, 0 driveways are anticipated to be impacted and 23 street trees are likely to be replaced.

**30. Support Facilities: Yards, Shops, Administrative Buildings**

.02 - Light Maintenance Facility -

- **Central Control** - Contains SCADA, network devices, radios, fire alarm control and security control**,**
- **Doors/Windows** - Interior and exterior doors, windows, storefront and hardware,
- **Electric** - Conduit, wire, transformers, panel boards, light fixtures and general electric devices,
- **Equipment** - Minor Shelving and a $750,000 allowance to be used at the Owners Discretion for building equipment,
- **Exterior** - Wall panels - both translucent and metal,
- **Finishes** - Drywall, carpet, paint and tile for the interior,
- **Fire Protection** - Building Fire Sprinkler System,
- **Generator** - A 500 KW Generator (for back-up electricity) and accessories,
- **HVAC** - Heating, cooling and ventilation equipment, ductwork and devices**,**
- **Inspection Pit** - Walls and rail for the Lowered Inspection Pit,
- **Inspection Platform** - Concrete and structural steel for the raised inspection platform,
- **Masonry** - Block Partitions and precast sills,
- **Plumbing** - Compressed Air, Roof Drainage, Sanitary Sewer, Gas, Plumbing Fixtures and equipment, Wash water recycle allowance for reclaiming/treating wash water of $150,000,
- **Roof** - EPDM Adhered roof and related blocking,
- **Service Pit** - Slab and Rails,
- **Site Grading** - Cut/Fills for site,
- **Specialties** - Includes lockers, toilet accessories, fire extinguisher, casework, etc.,
- **Steel** - Structural Steel and Decking,
- **Utility Allowance** - Site utilities including storm, water and sewer,
- **Wash Bay Pit** – Pit concrete work and rail for the wash bay,
- **Concrete** - Building foundations and slabs.

.03 – Track Work – Includes all track work for the yard except Special Track work. Assumed to be ballasted track, however, the price currently assumes embedded track costs.

.04 – Special Track work – See estimate for assumed quantities of special track work in the yard.

.05- Environmental - Soils conditions below the proposed vehicle maintenance facility location are undefined. An allowance of 16,000 ton has been included in the estimate. A Phase 1 and possibly a Phase II is needed to determine if hazardous materials are present and need to be managed.

**40. Site work and Special Conditions**

.01 – Demolition, Clearing, Earthwork – Scope includes Demolition of all existing roadwork and sidewalks as indicated on the drawings, excavation of all roadway areas within the track zone,

localized dewatering, and site preparation and cleanup. A separate Cost Breakdown Structure was created for the following areas:

- Guideway 10' (curb running,
- Guideway Double 20’ (median running),

.02 – Public Utilities, Public Utility Relocation – Refer to the *Utility Technical Memo* in **Appendix A.3**.

.03 – Environmental - Soils conditions below pavement sections are undefined. An allowance of 8,000 ton has been included in the estimate. A Phase 1 and possibly a Phase II is needed to determine if hazardous materials are present and need to be managed.

.07 – Roadways - The scope of work includes a mill-and-overlay from curb flange to curb flange, excluding the area within the streetcar track zone. Assume that sidewalks shall be reconstructed on all four corners of four-way intersections for a distance of ½ the roadway width. Sub categories include:

- Intersection Reconstruction,
- Roadway,
- Roadway Median,
- Signage/Striping

.08 – Temporary facilities and other indirect costs – Assume the project will be constructed under traffic, access to properties shall be maintained throughout construction. Alternate cross-streets can be closed to traffic. The project will consist of multiple major contracts over multiple years. Until this planning is completed (usually at 60%) 15% has been applied to the estimate (labor and equipment) as a staging and phasing premium. Additionally, a per mile cost for the entire 3.31 mile project for mobilization, work zone and erosion control has been allocated for temporary facilities. MDOT includes mobilization and MOT in their cost estimate from Sibley Street to Chandler Street, and therefore subtracted out from the line item.

**50. Systems**

.02 – Traffic Signals – The basis of this estimate is for installation of matched system components to provide a traffic signal priority control system. This will require equipping each streetcar with an infrared emitter, and mounting infrared detectors at each intersection that will require priority capability. The existing traffic control cases at these selected intersections will require installation of a phase controller within the controller cabinet. A control cable will be installed connecting the infrared detector to the phase controller. Required interface software will be provided to program the phase controllers. Training will be provided by the manufacturer for installation, maintenance, and operations personnel.

.03 – Traction Power Supply – Substations (TPSS) – HNTB completed a preliminary load flow analysis as part of the 90-day validation period (see **Appendix A.4**). This assessment identified the need for four (4) TPSS along the Woodward Avenue corridor to power the M-1 RAIL Streetcar Project. The current scope of work includes four substations at the following locations:

- Substation 1 at the maintenance facility will be a standard substation,
- Substation 2 is currently proposed to be at the Amsterdam site,

- Substation 3 is proposed to be near the Wayne State University campus, possibly at Stinson Street and,
- Substation 4 is currently proposed to be located at the former Hudson Department store site near Gratiot Avenue in downtown Detroit.

The final number of required substations and exact placement will be decided in the final design phase of the project.

.04 – Traction Power Distribution – OCS (Overhead Contact System) – Scope includes contact wire and traction power distribution cable in a 4 inch conduit in the track slab. This item also includes corrosion control for the embedded track and OCS Poles and foundations. The current scope does not include OCS poles and wires from Congress Street to just north of I-75 and within the yard of the vehicle maintenance facility.

.05 – Communications – The Communications System includes the electronic communications, data processing, and human interface systems to enable the monitoring and supervision of the M-1 RAIL operations. Also included are voice and data communication systems in support of customer service, security and administrative functions. The initial assumptions for the communications system will include the following basic elements:

- **Communications Transmission System** – Consists of fiber optic backbone and specialized point-to-point systems for the transmission of voice and data for other communications systems. This will also include fiber cable drop for future traffic signal controller interconnections.
- **Supervisory Control and Data Acquisition System (SCADA)** – SCADA provides data transmission capabilities between the Rail Operations Central Control Center, each traction power substation (4), and streetcar stops.
- **Radio System** – Includes a radio system that allows for voice communication between field personnel and the operations and maintenance facility.
- **Passenger Information Systems** – Provides next streetcar arrival and service exception information (visual or audio) directly to passengers at stops, over the internet and on mobile devices.
- **Central Control System (CCS)** – Enables Operations to remotely monitor and/or control power, facilities and related systems.
- **Security Systems** – Detects intruders and limits access into sensitive areas to authorized individuals with CCTV and/or access control systems. Examples of facilities with access control include shop buildings, traction power rooms, and control centers.
- **Public Paging** – Includes control panel at Central Control, speakers and interconnect system. Speakers are located at the Maintenance Facility, Platforms and TPSS sites.
- **Security/CCTV** – Includes cameras, data recording devices and system interconnect. Cameras are located at the Maintenance Facility, Platforms and TPSS Sites.

.06 – Fare Collection – Fare collection is included in the estimate as allowance of $440,000 for fare collection equipment.

.07 – Central Control – See Communications Section 50.05.

**60. ROW, Land, Existing Improvements**
An allowance of $250,000 per acre has been included for land purchase for the maintenance facility. No additional land outside of the existing ROW is anticipated to be needed. Substation locations are currently identified for locations controlled by partners in the M-1 RAIL Project.

Step 1 – Quantities

The quantities shown in **Table 6.3** were taken from the M-1 RAIL 2012 Design and alignment updates. Microstation (Inroads) software was utilized to develop quantities for each of the SCC categories necessary for the estimate. Most of the unit cost information was derived from a similar scoped project at the 30% Design phase. The procedures used in the development of the cost estimate for that project were consistent with the Association for the Advancement of Cost Engineering (AACE) as well as accepted FTA practices.

Step 2 – Unit Costs

The unit costs shown in **Table 6.3** were developed from various sources. The majority of the values were derived from a Work Breakdown Structure developed from similar modern streetcar projects.

**10 Guideway and track elements**

- Track – The track unit cost estimate was derived from a peer system, the unit cost for the track included an estimated 2011 Cost of $410 per linear foot. 3% escalation to 2012 for a unit price of $425 per linear foot.

- Turnouts – A supplier provided a cost estimate of $90,000 to $120,000 for 25 meter turnouts in the fall of 2011. The cost estimate assumes the high-end of the range and $65,000 allocation for installation, for an installed 2012 unit price of $185,000 per turnout. Additionally, the estimate assumes 50 meter turnouts at $185,000 per unit cost, which is a conservative assumption.

**20 Stations, stops, terminal, intermodal**

- Stops – The stop estimate is based off the 2009 Base Design Option and includes the following costs:
    - General Requirements - $28,000
    - Concrete - $60,000
    - Exterior Finish - $2,000
    - Metals - $15,000
    - Roof & Gutters - $15,000
    - Base Signage - $22,000
    - Mechanical - $10,000
    - Electrical - $23,0000
    - Total = $175,000 per stop location

- Landscaping – Assumes $300 per street tree to be replaced.

**30 Support facilities: yards, shops, administration**

- Vehicle Storage and Maintenance Facility – The VSMF is planned to be similar in scale and function to other light maintenance facilities completed for modern streetcar projects, such as: Portland, Seattle and Tacoma. The current facility is designed to be 25,320 sq. ft. including two maintenance bays, a car wash and shipping/receiving area. It is very likely that the scale of the maintenance facility could be reduced, as the current site design was developed to store and maintain approximately 12 streetcar vehicles. The current project scope anticipates needing only six (6) vehicles to operate within the current service plan. The installed 2012 square foot cost is estimated at $250. The Basis of Design Report completed by LTK estimated the maintenance facility cost to be $5.913 million in 2008 dollars. The 2012 estimate is $8.835 million and includes the building and yard track. For comparison, the Seattle facility cost $3.5 million in 2005 dollars, according to the *Seattle Streetcar PE Capital Cost Estimate Report*, and the Portland Expansion cost approximately $4.1 million in 2007 dollars, according to the 2008 *Faith & Gould Risk Assessment Report*.

- Track – The current cost estimate assumes $425 per linear foot for track in the maintenance facility yard. This is a conservative estimate as the current design assumes ballasted track and not embedded track. Ballasted track is typically significantly cheaper than embedded track.

- Hazardous Materials – The cost estimate assumes the entire 145,675 sq. ft. site x 5 feet of depth of fill will be removed at 45 lbs per cubic foot. The $36 cost per ton includes: labor, contaminated soil/material transport, landfill fees and equipment costs to complete the work.

**40 Sitework and special conditions**

- Demolition Costs - The demolition unit price of $6 was obtained through the peer project's Work Breakdown Structure. The area of influence required for demolition to be paid for by M-1 RAIL is the track zone area: 2' deep by 10' wide for the segment outside of the MDOT reconstruction: from Congress to Sibley.

- Utilities – The utility unit costs were derived from the peer project's cost estimates and discussions with the local utilities. The unit cost for steam of $1,000 per linear foot was confirmed through meetings with Detroit Thermal staff in March of 2012. Refer to the *Utility Technical Memo* for detailed information in **Appendix A.3**.

  The current cost estimate includes all Public Utilities, as M-1 RAIL anticipates working with the City of Detroit and MDOT on utilizing current Franchise Agreements to ensure that the relocation of Private Utilities is not considered a project cost. The estimate currently includes a cost associated with the assumed relocation of some Detroit Thermal (steam) infrastructure improvements.

  MDOT's current cost estimate does not include public utilities; therefore, this estimate assumes all of the public utility costs from Congress Street to Bethune Street. Through continued discussions with MDOT and other public partners, it may be possible to share some of the costs required to relocate public utilities.

- Hazardous Materials – The cost estimate assumes that 25% of track zone from Congress to Sibley is contaminated by old streetcar rail or other hazardous materials. At 56,110 sq. ft. and 45lbs per cubic foot. Similar to the estimate for the maintenance facility the $36 unit cost per ton includes: labor, contaminated soil/material transport, landfill fees and equipment costs to complete the work.

- Roadway Costs - This assumes a mill/overlay cost for the segment from Congress to Sibley. It includes all intersections being reconstructed and sections along the track zone, including the portions outside of the track zone to match into the existing cross slopes at $5 per linear foot of roadway.

- Temporary Facilities – The cost estimate allocation that was provided by a General Contractor that is experienced in the construction of modern streetcar facilities. The estimate is assumed on a per mile basis, as the estimate was provided for a similar project in the fall of 2011.

**50 Systems**

- Traffic Signals – New traffic signals in an urban environment cost approximately $85,000 per unit. Additionally, the cost to include a transit priority phase is estimated at $15,000 per unit.

- Traction Power – A *Basis of System Design Technical Memo* was completed in 2009. The 58-page report provides potential design parameters for M-1 RAIL's Systems Design. The document details the proposed traction power supply and the overhead catenary power distribution system. The design is consistent with typical LRT/Modern streetcar systems, which have substations approximately every mile along the route. The current design assumes a typical traction power cable feeder system with substations spaced every mile, including three (3) substations dispersed along the 3.3-mile route and a fourth ($4^{th}$) substation at the maintenance facility. Typical industry standards indicate a cost range of $500,000 to $1,000,000 per unit; the current estimate assumes the high end of the range. The current estimate assumes $1 million per unit installed. Some modern streetcar systems (Portland) provide smaller more frequent (1/2 mile) substations along the route, which can be more expensive. However, they are able to reduce the cost of the OCS component of the project.

- Traction Power Distribution (OCS) – The cost estimate was from the peer city and the price per square foot included an estimated 2011 Cost of $110, a 3% escalation to 2012 $ for an installed 2012 square foot cost estimated at $115.

- Communications - The cost estimate was from the peer city and the price per square foot included an estimated 2011 Cost of approximately $28, a 3% escalation to 2012 $ for the installed 2012 square foot cost estimated at $30.

- Fare Collection System – The project cost estimate includes a $20,000 allowance per fare box, multiplied by the 19 stop locations. It is anticipated that the fare boxes are simple systems similar to those used for the Seattle Streetcar system.

- Central Control – Assumes a $550,000 allowance for the central control center.

**60 Right-of-way, land, existing improvements**

- VSMF Site – The project costs assumes $250,000 per acre for the Custer/Bethune maintenance facility site.

- Substation Sites – The project has four substations planned to provide power throughout the streetcar system. The south substation is planned for the Hudson's property, which is currently controlled by an M-1 RAIL investor. The two northern substations are planned for the Amsterdam (controlled by MDOT) site and the VSMF site. A real estate cost is accounted for in the capital cost budget for the maintenance facility. The substation toward the center of the streetcar route is intended to be located on land currently controlled by an M-1 RAIL investor. It is anticipated that these sites will be acquired or leased by M-1 RAIL for substations at no cost to the project.

- Other Purchase of Real Estate – No additional real estate is anticipated to be purchased for this project. The Basis of Design for this project indicates most of the construction for the project will occur from curb to curb within the existing ROW. Construction outside of the curb limits will primarily be limited to Stop (Station) Platform construction. Due to the lack of turning movements along the straight route and the large available ROW in the Woodward Avenue corridor, the project can be designed within the existing ROW.

- Staging Areas – The construction staging sites are planned for publicly controlled sites. Therefore, no additional real estate acquisition costs need to be included in the cost estimate.

**70 Vehicles**

- Vehicles – Through further analysis by LTK, they have suggested a cost estimate of $4,275,000 per vehicle, which includes off-wire compatibility.

- Spare Parts – An additional 10% of the total vehicle cost is allocated for vehicle spare parts at $2,565,000.

The unit costs derived from the similar projects' Work Breakdown Structures included additional mark-up costs in the unit costs. These elements are not broken out for each of the individual elements due to the preliminary nature of this cost estimate, however the following assumptions were integrated into the cost estimate:

- Sales Tax allocation of 5.6% on Materials,
- Permit allocation of .05% on the Total Project Costs,
- Consumables allocation of 1% on Labor,
- Phasing Premium allocation of 15% on Labor and Equipment,
- Bond allocation of .75% on Labor, Material, Subcontractors and Equipment,
- General Conditions allocation of 5% on Labor, Material, Subcontractors, Equipment and Process Equipment,
- Trade Labor allocation of 32% on the Labor.

Step 3 – Similar Modern Streetcar Systems

Capital cost information was assembled for modern streetcar, heritage streetcar and light rail systems in various stages of completion in 12 cities. The systems are idenitifed by technology and level of completion in **Table 6.1**.

**Table 6.1 Peer Systems for Capital Cost Comparison**

| Technology | Completed | Under Construction | In Design |
|---|---|---|---|
| Modern Streetcar | Portland (4 phases)<br>Seattle<br>Tacoma | Portland (1 phase)<br>Tucson<br>Cincinnati | |
| Heritage Streetcar | Kenosha<br>Little Rock<br>Tampa | | |
| Other Streetcar | | Atlanta | Milwaukee |
| Light Rail | Minneapolis<br>Norfolk | | |

### *6.2.2 Assumptions*

**Table 6.2** lists the specific capital budget assumptions that went into the development of the current capital cost estimate.

**Table 6.2 Key Capital Budget Assumptions**

| | |
|---|---|
| **10 GUIDEWAY & TRACK ELEMENTS (route feet)** | |
| 10.10 Track: Embedded -<br>34,950 linear feet of 115lb embedded track | Includes the following: rebar, concrete, broom finish, rail boot, steel angle, stone base, 115# Rail, track welds, Ironhorse supports, HDPE coiled pipe |
| 10.101 Track: Embedded -<br>582 linear feet of embedded track crossovers, storage track | Includes the following: rebar, concrete, broom finish, rail boot, steel angle, stone base, 115# Rail, track welds, Ironhorse supports, HDPE coiled pipe |
| 10.12 Track : Special (switches, turnouts) -<br>25M turnouts | Installed cost estimate - turnout is $90K to $120K |
| 10.121 Track : Special (switches, turnouts) -<br>50M turnouts | Installed cost estimate - turnout is $90K to $120K |
| 10.122 Track : Special (switches, turnouts) -<br>No. 4 turnouts | Installed cost estimate - turnout is $90K to $120K |
| **20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)** | |
| 20.01 Base Stations -<br>22 platforms | Base Station Estimate from M-1 RAIL, includes: General Requirements, exterior finish, metals, roof and gutters, base signage, mechanical & electrical |
| **30 SUPPORT FACILITIES: YARDS, SHOPS, ADMINISTRATIVE BUILDINGS** | |
| 30.02 Light Maintenance Facility | See below (30.021 & 30.022) |
| 30.021 Pre-Fabricated Building (Structure, Vehicle Pit, Office Elements, etc.) | Includes: site preparation, building foundations, building & finishes, building mechanical, electrical and plumbing |
| 30.022 Equipment Allowance (Overhead Crane, Car Wash Machine, etc.) | $750,000 allocation that includes: car wash, overhead crane, portable jacks, general machinery, parts storage & specialty tools |

**Table 5.2 Key Capital Budget Assumptions (continued)**

| | |
|---|---|
| 30.02 Yard and Yard Track - 2,335 linear feet of 115lb ballasted track | Includes the following: rebar, concrete, broom finish, rail boot, steel angle, stone base, 115# Rail, track welds, Ironhorse supports, HDPE coiled pipe |
| 30.05 Track: Special (switches, turnouts) - No. 4 turnouts | Supplier estimate per turnout is $90K to $120K. |
| 30.04 Hazardous materials, contaminated soil removal/mitigation - 14,000 tons of contaminated soil | Assumes the 145,675 site x 5 feet of depth of fill removed at 45lbs per cubic foot. Includes: labor, contaminated soil/material transport, landfill fees and equipment costs to complete the work. |
| **40 SITEWORK & SPECIAL CONDITIONS** | |
| 40.01 Demolition, Clearing, Earthwork - (11,222 LF - 2 x 10 track slab) Congress to Sibley | Includes: demolition of the 2 x 10 foot track zone from Congress Street to Sibley Street |
| 40.02a Public Utilities, Utility Relocation | M-1 RAIL is still evaluating impacts based on data obtained from Woodward LRT project |
| 40.021 COD - Communications - yet to be identified | Public communications systems tend to be buried near the roadway surface, full utilities still need to be reviewed to determine if there are any impacts. |
| 40.022 DWSD - Water mains - 8,540 LF (includes parallel/ perpendicular mains & laterals) | This estimate assumes a 10' clearance from pipe to the edge of track, including parallel mains, perpendicular mains and service laterals. Impacts still need to be confirmed. |
| 40.023 PLD/MDOT - Street Lighting (Buried cables) - yet to be identified | Street lighting/Traffic Signal cables tend to be buried near the roadway surface, full utilities still need to be reviewed to determine if there are any impacts. |
| 40.024 PLD - Electric - yet to be identified | PLD owns the electric infrastructure for sections of downtown, full utilities still need to be reviewed to determine if there are any impacts. |
| 40.025 DWSD - Sewer Manhole Adjustments - 37 manholes | This assumes all sewer manholes that fell within the 8' track zone would need to be adjusted, this includes 24 storm sewer manholes and 13 sanitary sewers. Impacts still need to be confirmed. |
| 40.026 DWSD - Sewer Lining - 1,435 LF | This includes re-lining for any sewers less than 4' in diameter that fall within the 8' track zone. Sewers larger than that were assumed to be combined and very deep. Impacts still need to be confirmed. |
| 40.02b Private Utilities, Utility Relocation | All non-public utilities are assumed to be paid for by the private entities. |
| 40.027 Detroit Thermal - Steam | The cost for Detroit Thermal's steam conflicts is discussed in the Utility Technical Memo and provided. |
| 40.028 DTE - Gas | All non-public utilities are assumed to be paid for by the private entities. |
| 40.029 DTE - Electric | All non-public utilities are assumed to be paid for by the private entities. |
| 40.03 Hazardous materials, contaminated soil removal/mitigation. Ground water treatments - 8,000 tons | Assumes the 25% of track zone from Congress to Sibley is contaminated by old rail, etc. At 56,110 sq. ft. and 45lbs per cubic foot. Includes: labor, contaminated soil/material transport, landfill fees and equipment costs to complete the work. |
| 40.07 Roadways - Mill/Overlay only - (Does not include MDOT's Reconstruct from Sibley to Chandler) | This assumes a mill/overlay cost for the segment from Congress to Sibley. It includes all intersections being reconstructed and sections along the track zone, including the portions outside of the track zone to match into the existing cross slopes. |
| 40.08 Temporary Facilities and other indirect costs during construction | See below (40.081, 40.082, 40.083) |
| 40.081 Mobilization/Staging Costs - 3.31 miles | Linear foot costs provided by a contractor estimate for similar project. |
| 40.082 Work Zone Traffic Controls - 3.31 miles | Linear foot costs provided by a contractor estimate for similar project. |
| 40.083 Erosion Control - 3.31 miles | Linear foot costs provided by a contractor estimate for similar project. |

**Table 5.2 Key Capital Budget Assumptions (continued)**

| | |
|---|---|
| **50 SYSTEMS** | |
| 50.02 Traffic Signals | See below (50.021, 50.022) |
| 50.021 Modify Existing Signals with Transit Priority - 3 locations | $15K for transit signalization at Congress & Montcalm |
| 50.022 New Signals with Transit Priority - 6 locations | $15K for transit signalization and $85K for new traffic signals at Henry, Sibley, Adelaide, Burroughs and Custer |
| 50.03 Traction power supply: substations (4 - new 350KW) | Material and install cost for a new substation |
| 50.04 Traction power distribution: OCS - 37,755 LF | Material and install cost for 456 poles and single wire system |
| 50.05 Communications - 34,950 LF | Cost for 4" conduit and pvc for systems communications, fiber optic, SCADA, Visual Messaging System and Vehicle Radio System & Network Node. |
| 50.05 Fare collection system and equipment - 19 fare boxes | Provides a $20,000 allocation per fare box. |
| 50.06 Central Control System (at Maintenance Facility) | |
| **60 ROW, LAND, EXISTING IMPROVEMENTS** | |
| 60.01 Purchase or lease of real estate - 3.5 acres for Maintenance Facility | Assumes estimated value of real estate based on market comparable properties |
| **70 VEHICLES (number)** | |
| 70.01 Modern Street Cars - 6 vehicles with off-wire capabilities | Assumes a modern streetcar vehicle with off-wire capabilities. |
| 70.02 Spare parts - Assumed 10% of total cost | The cost estimate assumes an allocation of 10% of the cost of all the vehicles indicated in item 70.01 for spare parts. |
| **80 PROFESSIONAL SERVICES (applies to Categories 10-50)** | |
| 80.01 Prelim. Engineering (20-60%) - 5% | This line item provides an allocation of 5% of the construction costs for Preliminary Design to update the current Design elements to the 60% level. |
| 80.02 Final Design (60-100%) -5% | This line item provides an allocation of 5% of the construction costs for Final Design to bring the plans to the 100% Design. |
| 80.03 Project Management for Design and Construction - 5% | The Project Management line item provides an allocation of 5% of the construction costs for Project Management and Oversight during Design and Construction of the streetcar project. |
| 80.04 Construction Administration & Management - 7% | The Construction Administration & Management line item provides an allocation of 7% of the construction costs for Project Management and Oversight and Construction Administration during the construction of the streetcar project. |
| 80.05 Professional Liability and other Non-Construction Insurance - 1% | The Professional Liability line item allocates 1% of the construction costs. |
| 80.06 Legal; Permits; Review Fees by other agencies, cities, etc. | The line item doesn't allocate any funding, as the project currently assumes these elements will be in-kind services provided by local entities, such as the City of Detroit, SEMCOG and MDOT. |
| 80.07 Surveys, Testing, Investigation, Inspection - 1% | The Survey, Testing, Investigation and Inspection line item allocates 1% of the construction costs. |
| 80.08 Start Up - 1% | Although Operations Start-up costs are not traditional capital costs, they are anticipated costs expected prior to revenue service. This line item allocates $750,000 Start-up costs. |

### *6.2.3 Cost Estimate*

Based on the assumptions and risks identified in the sections above, M-1 RAIL has developed the capital cost estimate presented in **Table 6.3**.

**Table 6.3 – M-1 RAIL Capital Cost (2012 $)**

| WBS Item | Quantity | Unit Costs | Cost (2012$) | % of Const. Costs | % of Project Costs |
|---|---|---|---|---|---|
| **10 GUIDEWAY & TRACK ELEMENTS** | | | **$17,121,100** | **30%** | **14%** |
| 10.10 Track: Embedded - 115lb embedded track | 34,950 LF | $425 | $14,853,750 | | |
| 10.101 Track: Embedded - 115lb embedded track crossovers, storage track | 982 LF | $425 | $417,350 | | |
| 10.12 Track : Special (switches, turnouts) - 25M turnouts | 8 | $185,000 | $1,480,000 | | |
| 10.121 Track : Special (switches, turnouts) - 50M turnouts | 1 | $185,000 | $185,000 | | |
| 10.122 Track : Special (switches, turnouts) - No. 4 turnouts | 1 | $185,000 | $185,000 | | |
| **20 STATIONS, STOPS, TERMINALS, INTERMODAL** | | | **$3,856,900** | **7%** | **3%** |
| 20.01 Base Stations - 22 platforms | 22 | $175,000 | $3,850,000 | | |
| 20.02 Landscaping - (Trees replaced at Platforms) | 23 | $300 | $6,900 | | |
| **30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN.** | | | **$8,835,375** | **16%** | **7%** |
| 30.02 Light Maintenance Facility | | | $6,342,000 | | |
| *30.021a Pre-Fabricated Building (Structure, Vehicle Pit, Office Elements, etc.)* | *20,400 SF* | *$250* | *$5,100,000* | | |
| *30.021b Shipping and Receiving Area* | *4,920 SF* | *$100* | *$492,000* | | |
| *30.022 Equipment Allowance (Overhead Crane, Car Wash Machine, etc.)* | *LS* | | *$750,000* | | |
| 30.02 Yard and Yard Track - 115lb ballasted track | 2,335 LF | $425 | $992,375 | | |
| 30.05 Track: Special (switches, turnouts) - No. 4 turnouts | 5 | $185,000 | $925,000 | | |
| 30.04 Hazardous materials, contaminated soil removal/mitigation | 16,000 CF | $36 | $576,000 | | |
| **40 SITEWORK & SPECIAL CONDITIONS** | | | **$16,394,795** | **29%** | **13%** |
| 40.01 Demolition, Clearing, Earthwork - Congress to Sibley | 224,440 SF | $6 | $1,346,640 | | |
| 40.02a Public Utilities, Utility Relocation | | | $10,201,505 | | |
| *40.021 COD - Communications - yet to be identied* | *0* | *$240* | *$0* | | |
| *40.022 DWSD - Watermains (includes parallel/perpindicular mains & laterals) - Congress to Bethune* | *5,859 LF* | *$400* | *$2,343,600* | | |
| *40.023 PLD/DTE - Street Lighting (Buried cables) - Congress to Bethune* | *2,997 LF* | *$65* | *$194,805* | | |
| *40.024a PLD/DTE - Electric - Congress to Sibley* | *3,247 LF* | *$1,000* | *$3,247,000* | | |
| *40.024b PLD/DTE - Electric - Sibley to Bethune* | *3,820 LF* | *$1,000* | *$3,820,000* | | |
| *40.025 DWSD - Manhole Adjustment - Congress to Bethune* | *34* | *$5,000* | *$170,000* | | |
| *40.026 DWSD - Sewer Lining - Congress to Bethune* | *4,261 LF* | *$100* | *$426,100* | | |

**Table 6.3 – M-1 RAIL Capital Cost (2012 $)**

| WBS Item | Quantity | Unit Costs | Cost (2012$) | % of Const. Costs | % of Project Costs |
|---|---|---|---|---|---|
| 40.02b Private Utilities, Utility Relocation | | | $750,000 | | |
| *40.027 Detroit Thermal - Steam - Congress to Bethune* | *750 LF* | *$1,000* | *$750,000* | | |
| *40.028 DTE - Gas (Assumes In-Kind Donation)* | *NA* | *NA* | *$0* | | |
| *40.029 DTE - Electric (Assumes In-Kind Donation)* | *NA* | *NA* | *$0* | | |
| 40.03 Hazardous materials, contaminated soil removal/mitigation. Ground water treatments | 8,000 CF | $36 | $288,000 | | |
| 40.07 Roadways - Mill/Overlay only - (Excludes MDOT's Reconstruct from Sibley to Chandler) | 299,675 SF | $5 | $1,498,375 | | |
| 40.08 Temporary Facilities/Indirect costs during const. - (Exludes MDOT's $2.758M portion) | | | $2,310,275 | | |
| *40.081 Mobilization/Staging Costs* | *17,477 LF* | *$230* | *$4,019,710* | | |
| *40.082 Work Zone Traffic Controls* | *17,477 LF* | *$45* | *$786,465* | | |
| *40.083 Erosion Control* | *17,477 LF* | *$15* | *$262,155* | | |
| *40.084 MDOTs Portion - Sibley to Chandler (includes MOT & Misc. - LS)* | | | *$2,758,055* | | |
| **50 SYSTEMS** | | | **$10,088,040** | **18%** | **8%** |
| 50.02 Traffic Signals | LS | | $545,000 | | |
| 50.021 Modify Existing Signals with Transit Priority | 3 | $15,000 | $45,000 | | |
| 50.022 New Signals with Transit Priority | 5 | $100,000 | $500,000 | | |
| 50.03 Traction power supply: substations | 4 | $1,000,000 | $4,000,000 | | |
| 50.04 Traction power distribution: OCS (Assumes off-wire from south of I-75 & within the yard) | 30,996 LF | $115 | $3,564,540 | | |
| 50.05 Communications | 34,950 LF | $30 | $1,048,500 | | |
| 50.05 Fare collection system and equipment - fare boxes | 19 | $20,000 | $380,000 | | |
| 50.06 Central Control System (at Maintenance Facility) | LS | | $550,000 | | |
| **Construction Subtotal (10-50)** | | | **$56,296,210** | **100%** | **45%** |
| **60 ROW, LAND, EXISTING IMPROVEMENTS** | | | **$835,000** | | **1%** |
| 60.01 Purchase or lease of real estate | 3.34 AC | $250,000 | $835,000 | | |
| **70 VEHICLES (number)** | | | **$28,215,000** | | **23%** |
| 70.01 Modern Street Cars - with off-wire capabilities | 6 | $4,275,000 | $25,650,000 | | |
| 70.02 Spare parts - Assumed 10% of total cost | | 10% | $2,565,000 | | |
| **80 PROFESSIONAL SERVICES (applies to 10-50)** | | | **$14,261,090** | | **11%** |
| 80.01 Preliminary Engineering (20-60%) | | 5% | $2,814,810 | | |
| 80.02 Final Design (60-100%) | | 5% | $2,814,810 | | |
| 80.03 Project Management for Design and Construction | | 5% | $2,814,810 | | |
| 80.04 Construction Administration & Management | | 7% | $3,940,735 | | |
| 80.05 Professional Liability and other Non-Construction Insurance | | 1% | $562,962 | | |

**Table 6.3 – M-1 RAIL Capital Cost (2012 $)**

| WBS Item | Quantity | Unit Costs | Cost (2012$) | % of Const. Costs | % of Project Costs |
|---|---|---|---|---|---|
| 80.06 Legal; Permits; Review Fees by other agencies, cities, etc. | | 0% | $0 | | |
| 80.07 Surveys, Testing, Investigation, Inspection | | 1% | $562,962 | | |
| 80.08 Start Up | LS | | $750,000 | | |
| **Subtotal (60-80)** | | | **$43,311,090** | | **35%** |
| **Subtotals (10-80)** | | | **$99,607,300** | | |
| **Total Project Cost (10-80) without Contingency / Escalation** | | | **$99,607,300** | | |
| **90 UNALLOCATED CONTINGENCY** | | | **$24,901,825** | | **20%** |
| **Construction & Professional Services Costs** | | | **$24,901,825** | | |
| **Subtotal (90)** | | | **$24,901,825** | | **20%** |
| **Total Project Cost (10-100) without Escalation / Financing** | | | **$124,509,125** | | **100%** |

## 6.3 Refined (Bottom Up) Capital Budget Estimate

M-1 RAIL utilized the services of Walbridge, one of America's largest privately owned construction companies, to develop an independent cost estimate for the project from a contractor's perspective, as validation of the design approach described above. Walbridge used preliminary design documents produced by M-1 RAIL in 2009 and updated in 2012, combined with a bottom up estimating approach using a preliminary work breakdown structure (WBS) to develop this estimate. This bottoms-up estimate was divided into the following three major components:

1. Mainline Rail – All work associated with installing the rail, which was further broken down into roadway, bridge, rail, overhead catenary system and utility packages for subcontractor quotation.
2. Rail Stations – All work associated with the installation of the stations, which was further broken down into roadway & sidewalk, structural steel, and electrical packages for subcontractor quotation.
3. Vehicle Maintenance and Storage Facility (VMSF) – All work associated with construction of the VMSF, which was further broken down into PEMB, site, rail, masonry, crane and utility packages for subcontractor quotations.

### *6.3.1 Methodology*

Walbridge's primary methodology for preparing the cost estimates involved detailed in-house conceptual and quantity take-offs based on the firm's historical unit cost pricing database. Walbridge as a firm stays current with pricing by competing in the marketplace every day through bidding and procuring, both material and subcontracts. The secondary method for verification of the in-house

estimates involved regular contact with key suppliers and subcontractors in the local Detroit market to confirm current pricing and trends. In addition, Walbridge's estimators applied market indices, such as the Associated General Contractors (AGC's) Producer Price Index (PPI) for specific construction inputs and comparative Consumer Price Indexes (CPI). These were developed by the Bureau of Labor Statistics (BLS) to track current and projected trends with regards to construction materials and installation futures.

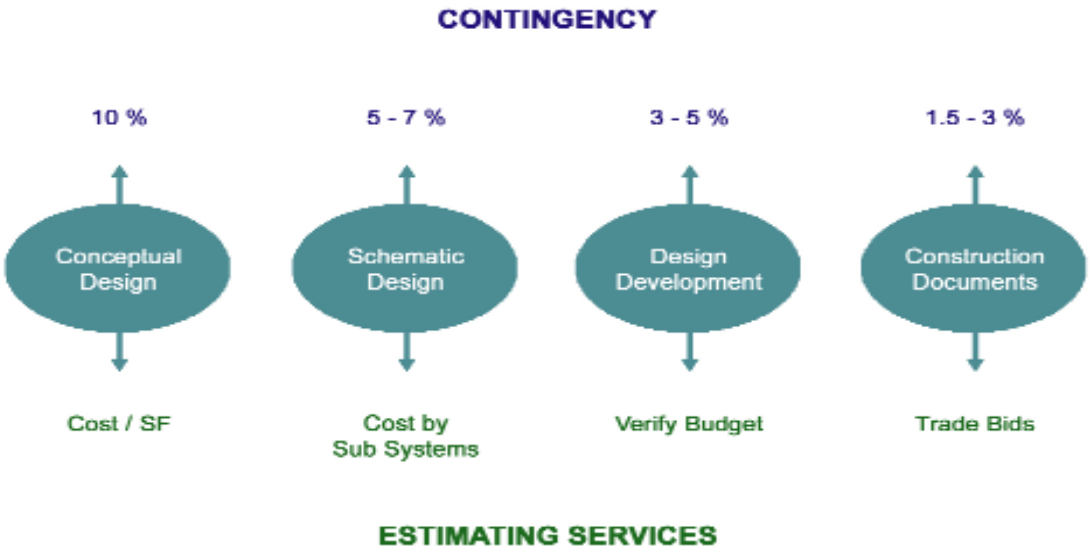
### *6.3.2 Allowances*

Allowances were established to account for work scope, schedule or other project constraints that will be required yet are undefined. The allowances at this stage represent an order of magnitude of the budget based on historical data for similar product/trade.

### *6.3.3 Contingencies*

Contingencies are used to predict potential additional costs due to unspecified or unknown conditions, schematic system designs and preliminary specifications. **Figure 5.1**. details the method Walbridge uses to develop appropriate contingencies depending on the point in the project delivery process. The contingencies will be adjusted throughout the preconstruction phase as the design is further developed.

**Figure 6.1 Contingency Level by Project Development Phase**




### *6.3.4 Cost Estimate*

Walbridge's current bottoms-up construction cost estimate for the M-1 RAIL Project is $98.6 million dollars which does not include vehicle acquisition costs. Additional documentation of Walbridge's cost breakdown by the three categories identified above can be found in **Appendix C.2.**

## 6.4 Peer Comparison

**Table 6.4** shows a comparison of modern streetcar projects. When including all of the M-1 RAIL Project costs, including financing costs (see **Section 8**), at $137.8 million, the estimate comes out to approximately $41.6 million per mile for the 3.31-mile system, which is within an acceptable range of the overall average for modern streetcar system costs at $41.6 million and shown in **Table 6.4**.

## 6.5 Budget Risk Factors

M-1 RAIL has developed an overall risk matrix for the project which is located in **Appendix F.2.** Specific risks however, that may impact future capital costs are identified below by SCC:

- **10 Guideway and track elements**
  - Turnouts – Few companies manufacture 25-meter turnouts for embedded track that meet the Buy America requirement, which could cause price fluctuations.
- **20 Stations, stops, terminal, intermodal**
  - There are still relative unknowns for the alignment design and the limits of the sidewalk impacts. Once a vehicle type is selected and the alignment is further along in the design process, the limits of the impacts to the sidewalks will be better understood, and therefore a more accurate cost estimate will be developed for this element.
- **30 Support facilities: yards, shops, administration**
  - A Phase I Environmental Analysis has not been conducted within the project's defined limits. Currently an assumption is being made that hazardous materials exist at the maintenance facility site and along a portion of the streetcar route. The allocated costs assume the contaminated soils will be hauled from the project site to an appropriate site.
  - Owners may know the VSMF site has been identified and may be difficult to negotiate with.
- **40 Sitework and special conditions**
  - Demolition: Assumes demolition costs for the track zone area at 2' of depth by 10' of width from Congress Street to Sibley Street.
  - Utilities: There are still unknowns about the utility impacts, including the following: accuracy of mapping, clearance requirements, and age and condition of existing facilities. The current assumption is that private utilities will pay for their own rehabilitation/relocations.
  - Hazardous Materials: Phase I and Phase II have not been conducted along the route which could result in additioanal costs associated with encountering more hazardous materials, i.e. former streetcar track, fuel leaks, etc.
  - Roadway Costs: The 20% Plans have not identified the cross slope/limit of potential impacts. Additionally, utility relocations may cut up the remaining sections of roadway and require mill/overlay for larger sections.

**Table 6.4 – Capital Cost Estimates for Modern Streetcar Projects**

| Streetcar Projects | Completed | Route Length (miles) * | Fleet size | Stations | Stops (Plat-forms) | Est. Total Capital Cost | Est. Cost Per Route Mile | Capital Costs (2012$)** | Est. Cost Per Route Mile (2012$) | Est. Cost Per Track Mile (2012$) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Modern Systems* | | | | | | | | | | |
| Portland - Phase I | 2001 | 2.4 | 5 | 18 | 33 | $56,900,000 | $23,708,333 | $78,762,907 | $32,817,878 | $16,408,939 |
| Portland - Phase 2 (River Place) | 2005 | 0.6 | 2 | 3 | 3 | $16,000,000 | $26,666,667 | $19,677,982 | $32,796,636 | $16,398,318 |
| Portland - Phase 3 (Gibbs) | 2006 | 0.6 | 2 | 2 | 2 | $15,800,000 | $26,333,333 | $18,866,026 | $31,443,377 | $15,721,689 |
| Portland - Phase 4 (Lowell) | 2007 | 0.4 | 1 | 3 | 5 | $14,450,000 | $36,125,000 | $16,751,510 | $41,878,776 | $20,939,388 |
| **Total - Built** | | **4** | **10** | **26** | **43** | **$103,150,000** | **$25,787,500** | **$134,058,426** | **$33,514,606** | **$16,757,303** |
| Portland - Phase 5 (Eastside Loop) | Under Construction | 4 | 7 | 15 | 26 | $150,000,000 | $37,500,000 | $150,000,000 | $37,500,000 | $18,750,000 |
| **Overall Portland - Total** | | **8** | **17** | **41** | **69** | **$253,150,000** | **$31,643,750** | **$284,058,426** | **$35,507,303** | **$17,753,652** |
| Tucson | Broken Ground | 3.9 | 7 | 17 | 33 | $196,500,000 | $50,384,615 | $196,500,000 | $50,384,615 | $25,192,308 |
| Seattle | 2009 | 1.3 | 3 | 7 | 12 | $50,500,000 | $38,846,154 | $55,182,714 | $42,448,241 | $21,224,121 |
| Tacoma | 2004 | 1.6 | 3 | 5 | 8 | $78,200,000 | $48,875,000 | $99,061,420 | $61,913,388 | $30,956,694 |
| Cincinnati | Broke Ground/Design | 3.1 | 5 | 16 | 32 | $110,400,000 | $35,612,903 | $110,400,000 | $35,612,903 | $17,806,452 |
| **Modern Systems Avg.** | | **17.9** | | | | **$688,750,000** | **$38,477,653.63** | **$745,202,560** | **$41,631,428** | **$20,815,714** |
| *Heritage Systems* | | | | | | | | | | |
| Tampa | 2002 | 2.4 | 11 | 11 | 22 | $48,300,000 | $20,125,000 | $64,911,161 | $27,046,317 | $13,523,159 |
| Kenosha | 2000 | 1 | 3 | NA | 17 | $6,200,000 | $6,200,000 | $8,839,717 | $8,839,717 | $4,419,859 |
| Little Rock | 2004 | 3.4 | 5 | 10 | 15 | $28,000,000 | $8,235,294 | $35,469,562 | $10,432,224 | $5,216,112 |
| *Other Streetcar Projects* | | | | | | | | | | |
| Atlanta | Broken Ground/Design | 1.31 | 4 | 7 | 12 | $78,316,866 | $59,783,867 | $78,316,866 | $59,783,867 | $29,891,934 |
| Milwaukee(30% Design Level) | Proposed | 3.5 | 7 | 20 | 40 | $125,400,000 | $35,828,571 | $125,400,000 | $35,828,571 | $17,914,286 |
| *LRT Projects* | | | | | | | | | | |
| Hiawatha (Minneapolis) | 2004 | 12.3 | 32 | 19 | 38 | $715,000,000 | $58,130,081 | $905,740,608 | $73,637,448 | $36,818,724 |
| TIDE (Norfolk) | 2010 | 7.4 | 9 | 11 | 22 | $318,500,000 | $43,040,541 | $337,896,650 | $45,661,709 | $22,830,855 |

* Note that route length should typically be doubled to reflect track miles

** Assumes 3% annual inflation

- **50 Systems**
  - TPSS: A preliminary substation load analysis was completed as part of this assessment to determine the preliminary substation requirements (see **Appendix A.4**). As part of the next phase a final load study will be completed to determine the number and locations of TPSS.
  - OCS: M-1 RAIL has assumed two sections of the project would operate off-wire.
- **60 Right-of-way, land, existing improvements**
  - Assumes $250,000 per acre for the Custer/Bethune site. This cost could go up due to the public knowledge of interest in the properties identified for the maintenance facility.

# 7 OPERATING & MAINTENANCE BUDGET

A revised operating and maintenance cost estimate has been developed for the M-1 RAIL Streetcar Project using a "bottom up" methodology based on the service plan described in **Section 4**, a simplified resource build-up based methodology that combines elements from the 2009 M-1 RAIL cost estimate and recent cost estimates prepared for other streetcar systems, and escalation to 2012 dollars.

## 7.1 Synopsis of Previous O&M Budgets

M-1 RAIL developed an operating and maintenance budget in 2009 as part of the original streetcar project development effort. [8] The service plan at the time included 5-minute peak / 10-minute off-peak headways. The estimate was developed using a simplified resource build-up approach that estimated labor costs based on staffing levels derived from the service plan, explicit productivity assumptions, and experience of similar streetcar operations. Other costs were developed using cost allocation methods from similar systems. A 20 percent contingency was included to reflect the preliminary level of design. **Table 7.1** shows the original cost estimate and escalation to 2012 dollars.

**Table 7.1 Summary of Original Cost Estimate from 2009**

| Category | 2009 Dollars | 2012 Dollars | Share of Total |
|---|---|---|---|
| Transportation | $3,671,250 | | 48% |
| Purchased Power | $245,807 | | 3% |
| Maintenance | $1,687,750 | | 22% |
| General & Administration | $787,521 | | 10% |
| Contingency (20% of above) | $1,278,466 | | 17% |
| **Total** | **$7,670,794** | **$8,040,000** | **100%** |
| *Cost per Revenue Vehicle-Hour* | *$154* | *$162* | |

The 2009 estimate was reviewed using a comparison with "top down" conceptual O&M cost estimates that were developed using unit costs from the National Transit Database (NTD). The review found that the costs were reasonable when compared with average costs at light rail and streetcar systems around the United States.

[8] M-1 RAIL. *TRAIL High Level O&M Cost Estimate*. Prepared by LTK Engineering Services, January 22, 2009.

## 7.2 Methodology and Assumptions

The conceptual operating cost model was developed using a combination of calculations done by LTK engineering in 2009 and research conducted for the Milwaukee Streetcar. Costs are presented in 2010 dollars, escalated from 2008 dollars using a factor of 1.06 from the Bureau of Labor Statistics Consumer Price Index. All costs were then escalated to design year (2012) costs, based on an assumed 3% inflation rate.

Wage and fringe information was obtained from both the City of Milwaukee and cost data from existing systems in Seattle, Tacoma, and Portland. In the event that a range of salaries were identified, the median of that range was assumed. The data is based on information gathered from 2008 and 2009 annual reporting in the National Transit Database (NTD), as well as information obtained directly from the respective agencies. For vehicle operations labor productivities, additional NTD data was supplemented from Tampa, Little Rock and Memphis.

### *7.2.1 Employees and Unit Costs*

The number of employees and unit costs for expenses were developed from NTD data, where available, for eight modern and heritage streetcar systems. The modern systems are Portland, Seattle, and Tacoma. The historic systems are Kenosha, Little Rock, Memphis, New Orleans, and Tampa. These statistics are summarized in **Table 7.2**.

### *7.2.2 Cost Driver Operating Statistics*

Annualized cost driver operating statistics, including fleet size, vehicle revenue miles, and vehicle revenue hours were developed from the service plan and route characteristics as indicated in **Section 4**. These statistics are summarized in **Tables 7.3 to 7.7**. The cost estimate does not reflect any additional costs associated with increased service during special events. Incremental costs are expected to be covered by event sponsors, subject to negotiation on a case by case basis.

**Table 7.2: NTD Employment Statistics and Expense Unit Costs of Comparable Streetcar Systems**

| Cost Category | Annual Rev Hours | Track Maint. Employees | Vehicle Maint. Employees | Admin-istration Expense | Pro-pulsion Power | Operations Expense | Operations Expense | Vehicle Maint. Expense | Vehicle Maint. Expense | Track Maint. Expense | Liability |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit of Measure | per Peak Operator | per Route Mile | per Peak Vehicle | percent | per Revenue Mile | per Revenue Mile | per Peak Vehicle | per Revenue Mile | per Peak Vehicle | per Track Mile | per Revenue Hour |
| *Column* | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* |
| Portland | 1,894 | 1.54 | 1.88 | 26% | $0.45 | $0.02 | $1,493 | $0.58 | $47,141 | $23,374 | $0.62 |
| Seattle | 628 | 1.30 | 1.55 | 9% | | $0.53 | $15,030 | $1.40 | $39,654 | $9,368 | $2.32 |
| Tacoma | 1,033 | 0.19 | 0.60 | 47% | $0.36 | | | $2.89 | $135,938 | $1,944 | $11.44 |
| Kenosha | 1,673 | 0.11 | 0.42 | 13% | $1.27 | | | $0.02 | $111 | | $13.04 |
| Little Rock | 1,471 | | 0.47 | 23% | $1.14 | $0.10 | $1,846 | $0.75 | $13,174 | | $5.32 |
| Memphis | 1,847 | | | 15% | $0.44 | | | $0.69 | $25,582 | $6,499 | $0.50 |
| New Orleans | 1,820 | 0.47 | 1.38 | 18% | $0.43 | $0.01 | $279 | $0.32 | $10,881 | $5,017 | $13.42 |
| Tampa | 1,013 | 0.88 | 0.75 | 11% | $1.17 | $0.03 | $271 | $2.03 | $20,746 | $3,949 | $5.10 |
| **Average** | **1,422** | **0.75** | **1.01** | **20%** | **$0.75** | **$0.14** | **$3,784** | **$1.08** | **$36,653** | **$8,359** | **$6.47** |

### Table 7.3: Service Parameters

| Parameter | Value |
|---|---|
| Line Miles | 3.31 |
| Car Stops | 11 |
| Vehicles In Fleet | 6 |

### Table 7.4: Service Parameters

| Day of Week | Daily | Day/Yr | Annual |
|---|---|---|---|
| Weekday | 10,000 | 255 | 2,550,000 |
| Saturday (50% Weekday) | 5,000 | 52 | 260,000 |
| Sunday/Holiday (33% Weekday) | 3,300 | 58 | 190,000 |

### Table 7.5: Operations Cycle Statistics

| Statistic | AM Peak | PM Peak | Mid-Day | Saturday | Sunday/ Evening |
|---|---|---|---|---|---|
| *Service Type Code* | *AM* | *PM* | *MD* | *SAT* | *SN/EV* |
| a - Cycle Time (minutes) | 37.5 | 40 | 37.5 | 36 | 36 |
| b - Miles per Cycle | 6.62 | 6.62 | 6.62 | 6.62 | 6.62 |
| c - Avg Speed (mph) | 10.6 | 9.9 | 10.6 | 11 | 11 |
| d - Headway (minutes) | 7.5 | 8 | 7.5 | 9 | 12 |
| e - Cars in Service | 5 | 5 | 5 | 4 | 3 |
| f – Departures per Hour per Direction | 8.0 | 7.5 | 8.0 | 6.7 | 5.0 |
| g – Cycles per Hour per Car in Service | 1.6 | 1.5 | 1.6 | 1.7 | 1.7 |
| h - Car Miles in 1 Hour | 53.0 | 49.7 | 53.0 | 44.1 | 33.1 |

### Table 7.6: Daily Revenue Vehicle Hours and Miles

| Period | Service Type | Start | End | Revenue Hours | Revenue Miles |
|---|---|---|---|---|---|
| *Weekday* | | | | | |
| AM Peak | *AM* | 6:00 | 9:00 | 15 | 159 |
| Mid-Day | *MD* | 9:00 | 15:00 | 30 | 318 |
| PM Peak | *PM* | 15:00 | 19:00 | 20 | 199 |
| Evening | *SN/EV* | 19:00 | 22:00 | 9 | 99 |
| *Saturday* | | | | | |
| AM Peak | *SAT* | 8:00 | 9:00 | 4 | 44 |
| Mid-Day | *SAT* | 9:00 | 15:00 | 24 | 265 |
| PM Peak | *SAT* | 15:00 | 19:00 | 16 | 177 |
| Evening | *SN/EV* | 19:00 | 22:00 | 9 | 99 |
| *Sunday* | | | | | |
| AM Peak | *SN/EV* | 8:00 | 9:00 | 3 | 33 |
| Mid-Day | *SN/EV* | 9:00 | 15:00 | 18 | 199 |
| PM Peak | *SN/EV* | 15:00 | 19:00 | 12 | 132 |
| Evening | *SN/EV* | 19:00 | 22:00 | 9 | 99 |

### Table 7.7: Annual Revenue Vehicle Hours and Miles

| Day of Week | Revenue Hours | Revenue Miles |
|---|---|---|
| Weekdays | 18,870 | 197,508 |
| Saturdays | 2,756 | 30,408 |
| Sundays/Holidays | 2,436 | 26,877 |
| **Fleet Total** | **24,062** | **254,793** |
| *Total per Car* | *4,010* | *42,465* |

### *7.2.3 Vehicle Operations*

Labor

Vehicle operations costs include the salaries and wages for streetcar operators and include costs often allocated to "other operations" by other transit properties, reflecting additional costs such as those that may be incurred depending on how fare inspections may be conducted. Wage and fringe rates for these positions are based on City of Milwaukee labor cost a comparable community.

In lieu of a staffing operations plan, data from **Table 7.2** was averaged to determine how many annual revenue hours are produced by each operator. This was calculated to be 1,422 annual revenue hours per operator, as shown in Column 1 of **Table 7.2**. In addition, it was assumed that there would be one operating supervisor and one fare collector per shift with three shifts per day.

The City of Milwaukee has light duty vehicle drivers and supervisors. Labor cost estimates for vehicle operations is based on range of salaries for comparable positions in the City of Milwaukee including:

- Tractor Operator ($52,224, 2010$)
- Equipment Operations Supervisor I ($44,194 - $61,871, 2010$)

Salary data for fare inspectors on comparable systems was not readily available. In many cases, such as Portland, there is no dedicated staff for fare collection. Therefore, the fare inspector salary used by LTK in 2009 was escalated to 2010 dollars and used here.

- Fare Inspector ($46,350, 2010$)

Materials and Services

The costs of services and materials may be estimated on a per mile or per peak vehicle basis. These costs are based on average expenditures data from streetcar operation experience from **Table 7.2**.

For the purposes of this estimation, it is assumed that half of the cost is attributed to revenue miles and half is attributed to peak vehicles. Therefore, each of the unit costs in Columns 6 and 7 in **Table 7.2** are divided by two and used in conjunction.

- Materials cost per vehicle revenue mile ($0.07, 2010$), half of the average value in Column 6
- Services cost per peak vehicle ($1,892, 2010$), half of the average value in Column 7

Propulsion

The propulsion cost is based on the rate charged for energy usage and how much energy is expended per vehicle mile. The power use is assumed to be 7 kWh per vehicle mile, which is a common specification for modern streetcar vehicles. The unit cost of power per kWh is assumed to be $.09 per

DTE Energy's 2012 residential rate. At a cost of $0.63 per vehicle mile, the estimate is 84% of the average shown in Column 5 of **Table 7.2**.

- Propulsion Power per kWh ($0.09, 2012$)

### *7.2.4 Vehicle Maintenance*

M-1 RAIL has assumed the following vehicle maintenance assumptions as part of the development of the O&M costs which are similar to modern streetcar operations and maintenance costs from other comparable systems.

Labor

The labor cost estimate for vehicle maintenance is based on a range of salaries for City of Milwaukee comparable positions including:

- Custodial Worker III ($34,466 - $37,956, 2010$)
- Vehicle Service Technician – Heavy ($39,408 - $44,336, 2010$)
- Fleet Repair Supervisor II ($47,109 - $65,957, 2010$)

In order to determine the number of employees within each category, the methods shown from the 2009 LTK report were used: one supervisor for every five maintenance staff, one technician for every two vehicles, and one custodian for every eight combined vehicles and stations. These three categories were then verified with the average number of vehicle maintenance employees from Column 3 in **Table 6.2**, which is 1.01 employees per vehicle.

Materials and Services

This cost category includes activities associated with revenue and non-revenue vehicle maintenance. This includes servicing (cleaning, fueling, etc.) vehicles. Costs in this category are based on an average of maintenance expenditures from **Table 7.2**, and divided by two to attribute costs to vehicles and hours.

- Materials and Services cost per peak vehicle ($18,327, 2010$), half of the average value in Column 9
- Materials and Services cost per vehicle revenue hour ($0.54, 2010$), half of the average value in Column 8
- Casualty and Liability costs were averaged from Column 11 on a per revenue hour basis
- Casualty and Liability cost per vehicle revenue hour ($6.47, 2010$)

### *7.2.5 Non-Vehicle Maintenance*

M-1 RAIL is considering the use of enhanced design standards at selected stations where sponsors agree to provide extra funding to cover the additional capital and operating costs. No allowance for increased

maintenance costs at upgraded stations has been included. Station sponsors will be responsible for increased costs over the base station design.

Labor

Labor costs for vehicle maintenance, including fringe rates, are based on maintenance labor data from Milwaukee County Transit System (MCTS). The maintenance staffing level was determined as 0.75 staff per track mile from the average value in Column 2 of **Table 7.2**.

The City of Milwaukee has positions comparable to employees that would be needed for right-of-way maintenance.

- Track Maintainer ($28,868 - $45,340, 2010$)

Materials and Services

The materials and services needed for maintenance of track-way, structures, stops, and communication systems are included in non-vehicle maintenance expenditures. Data for non-vehicle maintenance is based on the average value in Column 10 of **Table 7.2**.

- Materials cost per track mile ($8,359, 2010$)

### *7.2.6 General Administration*

Administrative Multiplier

An administrative overhead rate of 20% was based on the average in Column 4 of **Table 7.2**. These systems were used because they have a small number of administrative positions and are likely to more closely resemble Detroit's experience.

The multiplier is calculated using the ratio of administrative costs to total system operation costs minus administrative costs. This figure can be multiplied through the subtotal of operational costs derived in the model to obtain an estimate of administrative costs. The subtotal of operational costs plus the administrative multiplier will give an estimate of total cost to operate the system annually.

**Table 7.8** summarizes the model inputs used for estimating annual operating and maintenance costs.

**Table 7.8 Operations and Maintenance Cost Model Inputs**

| Parameter | Value |
|---|---|
| Annual Rev. Hours per Operator | 1,422 |
| Fringe Benefit Rate | 65.0% |
| 2010-2012 Growth Rates | |
| Operations | 4.85% |
| Vehicle Maintenance | 5.26% |
| Non-Vehicle Maintenance | 6.95% |
| Design Year | 2012 |
| Management/Support Overhead | 20% |

**Table 7.9** and **Table 7.10** summarize the annual cost calculations for labor expenses and other expenses.

**Table 7.9 Labor Expense Calculations**

| Job Title | Basis | Staff | 2010 Salary | 2012 Salary | Total Comp. | Annual Cost |
|---|---|---|---|---|---|---|
| Streetcar Operator | Car Hours | 17 | $52,224 | $55,000 | $91,000 | $1,547,000 |
| Operating Supervision | 3 Shifts | 3 | $53,033 | $56,000 | $92,000 | $276,000 |
| Fare Inspector/Conductor | 3 Shifts | 3 | $46,350 | $49,000 | $81,000 | $243,000 |
| Electromechanic | 0.5/Car | 3 | $41,872 | $44,000 | $73,000 | $219,000 |
| Maintainer | 0.75/Track Mile | 5 | $37,104 | $40,000 | $66,000 | $330,000 |
| Cleaner/Helper | (Cars+Stops)/8 | 2 | $36,211 | $38,000 | $63,000 | $126,000 |
| Maintenance Supervision | (Maint. Emp)/5 | 2 | $56,533 | $60,000 | $99,000 | $198,000 |
| Management & Support Staff | % of All Labor | 7 | | $51,000 | $84,000 | $588,000 |
| **Total** | | **42** | | | | **$3,527,000** |

**Table 7.10 Other Expense Calculations**

| Category | Basis | Quantity | 2010 Unit Cost | 2012 Unit Cost | Annual Cost |
|---|---|---|---|---|---|
| *Vehicle Operations* | | | | | |
| Services-Supplies-Misc | $/Revenue Mile | 254,793 | $0.07 | $0.08 | $20,000 |
| | $/Vehicles | 6 | $1,892 | $2,000 | $12,000 |
| *Vehicle Maintenance* | | | | | |
| Services-Supplies-Misc | $/Revenue Mile | 254,793 | $0.54 | $0.59 | $151,000 |
| | $/Vehicles | 6 | $18,327 | $20,000 | $120,000 |
| *Track Maintenance* | | | | | |
| Services-Supplies-Misc | $/Track Mile | 6.62 | $8,359 | $9,000 | $60,000 |
| *Energy* | | | | | |
| Propulsion Power | 7 kWh/Revenue Mile | 1,783,549 | $0.09 | $0.10 | $176,000 |
| *Liability* | | | | | |
| Injuries/Damages | $/Revenue Hour | 24,062 | $6.47 | $7.11 | $171,000 |
| **Total** | | | | | **$710,000** |

## 7.3 Budget Risk Factors

M-1 RAIL has developed an overall risk matrix for the project which is located in **Appendix F.2.** Specific risks however, that may impact future operations and maintenance costs are identified below:

- **Project does not meet expected level of service**
  - If ridership exceeds projections, M-1 RAIL may need to acquire additional vehicles and incur additional operating costs to maintain acceptable passenger loads during peak periods.
- **Project unable to handle special event peak loads**
  - Although the turnouts provide some operational flexibility for special events, M-1 RAIL may need to acquire additional vehicles and incur additional operating costs to accommodate passenger demand.
- **Streetcar running times exceed estimates**
  - Higher running times may require longer headways or additional vehicles and operating expenses than shown in the current service plan.
- **Labor costs exceed estimates**
  - Actual contract labor rates may result in higher operations and maintenance costs.

To address many of these risks, M-1 RAIL will consider including options for additional vehicles in its procurement contract. A decision on the need for additional vehicles to meet passenger demand, headway goals, or maintenance needs will be made using actual operating experience following the start of operations.

## 7.4 O&M Cost Estimate

The headways and service hours presented in **Tables 7.3 to 7.7** result in a total of 34,428 runs per year for the streetcar, and this number is used to annualize the service parameters for calculating annual O&M costs. Annual operations and maintenance cost estimates for M-1 RAIL service are presented in **Table 7.11**, and in greater detail in **Appendix D.1**.

**Table 7.11 Annual Streetcar Operations and Maintenance Cost Estimate**

| Category | | | Cost |
|---|---|---|---|
| Labor Expenses | | | $3,527,000 |
| Other Expenses | | | $710,000 |
| Contingency | % of Total | 20% | $847,000 |
| **Total O&M Cost** | | | **$5,084,000** |
| *Cost per Unlinked Trip* | | | *$1.69* |
| *Cost per Revenue Vehicle Hour* | | | *$211.29* |
| *Cost per Revenue Vehicle Mile* | | | *$19.95* |

## 7.5 Comparison with Peer Systems

The operating and maintenance cost estimate for the M-1 RAIL Project was compared with eight peer using available budget information from recent years. As shown in **Table 7.12**, the M-1 RAIL cost estimate is higher on a cost per revenue vehicle-hour basis than some of the vintage streetcar systems, but lower than some of the modern streetcar systems.

**Table 7.12 Peer System Cost per Revenue Vehicle Hour**

| System | Type | Source | Estimated O&M Cost per Revenue Vehicle Hour (2012$) |
|---|---|---|---|
| M-1 RAIL | Modern Streetcar | Estimate | $214 |
| Portland | Modern Streetcar | 2009 Budget | $156 |
| Seattle | Modern Streetcar | NTD | $216 |
| Tacoma | Modern Streetcar | NTD | $265 |
| Kenosha | Vintage Streetcar | NTD | $128 |
| Little Rock | Vintage Streetcar | 2010 Budget | $105 |
| Memphis | Vintage/LRT | NTD | $94 |
| New Orleans | Vintage Streetcar | NTD | $216 |
| Tampa | Vintage Streetcar | 2011 Budget | $156 |

Portland, Seattle and Tacoma are all modern streetcar systems, while Kenosha, Little Rock, New Orleans and Tampa are vintage style streetcar systems. Memphis operates both a vintage streetcar style line and LRT line. The modern systems in Seattle, Tacoma and Portland are more comparable to what is being proposed by M-1 RAIL. Labor rates are the primary element that influences operating cost. It is understood that both Seattle and Tacoma utilize union labor, while Tampa, Little Rock and Memphis do not. It is anticipated that M-1 RAIL will not be required to utilize union labor; however it is likely that the labor rates for M-1 RAIL will be similar to the labor rates of existing transit services.

Portland's operating and maintenance costs are lower than Seattle and Tacoma due to a unique organizational structure. The system is operated by 501(c)3 organization called Portland Streetcar Inc., which oversees the system operations and maintenance. Additionally, Portland has a number of efficiencies that other systems do not have due to their experienced knowledge from operating urban rail systems for over 30 years.

# 8 CAPITAL & OPERATING FINANCIAL PLAN

The Financial Plan described in the following sections brings together the Project Definition, Service Plan, Ridership forecast, Capital Budget, and the Operating and Maintenance Budget estimate described in previous sections with the Project Delivery method presented in **Section 9**, the Project Schedule detailed in **Section 10**, and the Systems Operations and Management plans discussed in **Section 11**.

## 8.1 Background

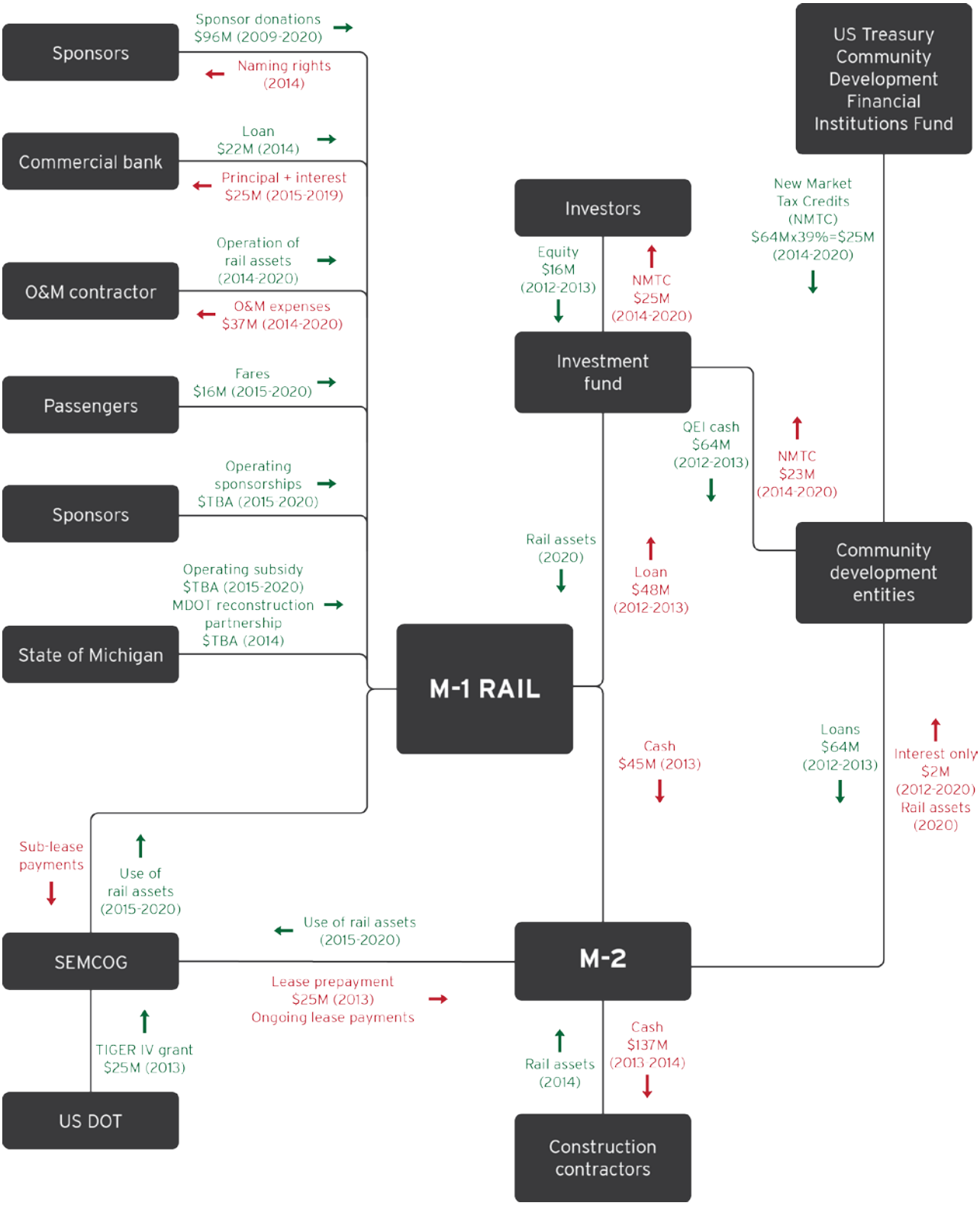
The M-1 RAIL Streetcar Project is extraordinary in its level of private funding support, oversight of construction and initial system operations by a non-profit private entity, the need to efficiently coordinate streetcar construction with MDOT reconstruction work on Woodward Avenue, and the eventual transfer of operations and management responsibility to a public entity after a start-up period. These factors have all influenced the Financial Plan.

Financial commitments and risk factors are discussed below, along with a detailed explanation of sources and uses of funds for both the Capital Financial Plan and the Operating Financial Plan. The analysis period focuses on the project development, construction and start-up operations period of the project. M-1 RAIL plans to donate the project assets and operating responsibility to a public agency, such as the proposed regional transit authority (RTA), within 10 years after construction completion. In accordance with the provisions of FTA Circular 5200.1A, Section 5309 of Title 49, U.S.C., and the FTA *Guidance for Transit Financial Plans* dated June 2000, capital and operating cash flows are shown for a 20-year construction and operations period through 2031.

The Financial Plan contains conservative baseline assumptions and sensitivity tests of potential cost overruns or revenue shortfalls. Preliminary sensitivity tests have been conducted, as described in **Section 8.4**. The project has the capacity to handle even the upper bound of ridership projections, and more analysis will be completed during the project's next phase to further tighten the financial confidence interval as M-1 RAIL refines revenue forecasts.

M-1 RAIL plans to use innovative finance techniques, including design-build project delivery and a New Market Tax Credit transaction, to reduce or defray some of the cost of the project and to manage risk. To resolve conflicts between FTA grant requirements and other sources of funding, M-1 RAIL plans to enter into a long-term lease and service agreement with SEMCOG. The financial structure of the project delivery approach is illustrated in **Figure 8.1**. The figure shows the parties involved in the project, the nature of the financial transactions between the parties, and the approximate magnitudes of cash flows during the construction and start-up period.

**Figure 8.1 M-1 RAIL Streetcar Project Delivery Financial Structure**



## 8.2 Capital Financial Plan

This section summarizes the assumptions and methodologies used to develop the Capital Financial Plan. The purpose of this section is to demonstrate that M-1 RAIL has the financial capacity to fund the construction costs of the M-1 RAIL Streetcar Project. The capital plan cash flows are presented from the perspective of M-1 RAIL, the entity that will be responsible for constructing and initially operating the streetcar.

### *8.2.1 Capital Funding Sources (Revenues)*

Committed Funds

M-1 RAIL is supported in a significant way by commitments of private and public donations to cover project development and construction costs, as described in detail in the following sections. Current financial commitments are described in **Table 8.1**.

**Table 8.1 Committed Foundations, Donors, and Sponsors**

| Organization | Total Commitment |
|---|---|
| Kresge Foundation | $35,100,000 |
| Detroit Development Authority (DDA) | $9,000,000 |
| Compuware | $3,000,000 |
| Detroit Medical Center | $3,000,000 |
| Henry Ford Health System | $3,000,000 |
| Ilitch Holdings | $3,000,000 |
| Quicken Loans | $3,000,000 |
| Penske Corporation | $3,000,000 |
| Wayne State University | $3,000,000 |
| General Motors | $3,000,000 |
| Ford Foundation | $3,000,000 |
| Kellogg Foundation | $3,000,000 |
| Blue Cross Blue Shield | $3,000,000 |
| Wayne County | $3,000,000 |
| Hudson Webber Foundation | $1,000,000 |

The funding commitments described above reflect a total commitment of $81.1 million toward project development and construction of the M-1 RAIL Streetcar Project. Expenditures incurred by M-1 RAIL to date include planning, design, preliminary engineering and administrative expenses. With the federal TIGER grant funding described below ($25 million), the committed funds in aggregate ($106.1 million) correspond approximately to the base construction cost of the project ($108 milllion in YOE dollars), not

including the project contingency. No inflation adjustment has been applied to these nominal-dollar commitments in the cash flow analysis.

**Appendix E.1** provides a complete matrix of probable donors, and **Appendix E.2** includes additional documentation executed by senior authorities of each organization, and/or irrevocable funding agreements.

Expected Funds

M-1 RAIL has identified additional private funding from existing and new sources to be used in the event that the project construction costs exceed the amount of funds already raised. New corporate, foundation, and institutional prospects of $15 million are included based on M-1 current discussions and expectations of future sponsorships. No inflation factor has been applied.

Sponsor recognition may be included on stations and other project elements. The value of any naming rights or sponsor recognition would offset a portion of the sponsorship revenue if the project is considered as local match for any linked federally funded transit project in the corridor, such as Rolling Rapid Transit.

New Market Tax Credits

M-1 RAIL plans to use a leveraged New Market Tax Credits (NMTC) project financing structure as a supplementary source of funding. To meet FTA requirements on the uses of TIGER funds, the typical leveraged NMTC structure has been adapted in coordination with FTA legal staff to include a master project lease with the TIGER 2012 grantee, SEMCOG. The general outline of the project financing structure is described below. Documents developed earlier in the project development process that describe the proposed NMTC transactions in more detail are included in **Appendix E.3** and **Appendix E.4**. **Appendix E.5** includes a Flow of Funds report prepared by Deloitte in support of this financial plan.

A total equity investment of $16 million from corporations is anticipated, in exchange for federal New Market Tax Credits (NMTCs). A subsidiary entity of M-1 RAIL (a Qualified Low-Income Community Business, or QALICB, referred to as M-2) will be created in order to construct and acquire the project facilities and equipment. M-2 will own all project assets for tax purposes.

Some of the sponsor funding received by M-1 RAIL (about $48 million) will be collected and loaned to one or more Investor Limited Liability Entities (Investment Fund), generating the companion equity investments of $16 million. The proposed $64 million will then be invested in one or more Community Development Entities (CDEs) which receive an allocation of New Markets Tax Credits totaling approximately $64 million. A sample of the NMTC allocates from which M-1 RAIL expects to draw is included in **Table 8.2**. Announcement of FTA's TIGER grant award will allow M-1 RAIL to advance negotiations with these sources of NMTC funding during the next phase of project development.

**Table 8.2 NMTC Allocatees in Preliminary Discussions with M-1 RAIL**

| Organization | Total Allocation |
|---|---|
| Invest Detroit | $10,000,000 |
| PNC Bank | $8,000,000 |
| Local Initiatives Support Corporation (LISC) | $10,000,000 |
| JP Morgan Chase | $??? |
| Bank of America | $??? |

M-2 will enter into a master project lease with SEMCOG in exchange for an upfront payment of $25 million (funded by the TIGER grant described below) to supplement funding from the NMTC transaction. The agreement will be a capital lease for FASB purposes to meet FTA requirements. The agreement will be an operating lease for tax purposes so that M-2 is the owner of the property for NMTC purposes. The agreement will provide SEMCOG with the benefit of a complete and functional streetcar project worth more than $130 million in exchange for the initial $25 million payment from the TIGER grant and a series of relatively modest lease payments during the operations period funded by M-1 RAIL.

M-2 will borrow about $64 million from the CDEs. These Qualified Equity Investments (QEIs) by the CDEs in M-2 will be interest-only for seven years, with payments deferred during the construction period. As owner of the assets, M-2 will have the right to offer the project assets as collateral to the lenders (CDEs). In the TIGER grant agreement and M-2 lease, FTA and SEMCOG will subordinate their claims to the assets, but maintain continuing control through a non-disturbance clause.

M-2 will receive about $45 million from M-1 RAIL to cover the remaining construction costs of the project. Total revenues from SEMCOG, the CDEs, and M-1 RAIL amount to about $134 million, which corresponds to the total project cost (in YOE dollars), excluding M-1 RAIL's commercial loan finance charges.

M-1 RAIL will enter into a sublease and a service agreement with SEMCOG under which M-1 RAIL will operate the streetcar and make lease payments during the operations period to SEMCOG for the right to use the assets. SEMCOG will pass the lease payments through to M-2 to cover debt service on its loan from the CDEs. The sublease will be structured to show a profit motive for SEMCOG.

The exit from the NMTC transaction will occur after a federally required, seven-year compliance period expires. At that time, put/call provisions of the Investment Entity(s) and CDE(s) will trigger their exit, and debts M-1 RAIL owes to itself (through M-2) will be eliminated. M-2 will transfer the rail assets to M-1 RAIL. The equity investments made in the Investment Entity(s) will have been repaid and the investors will exit.

The NMTC transaction has the effect of reducing construction expenditures made directly by M-1 RAIL. Approximately $64 million of rail assets will be constructed and made available to M-1 RAIL at the

expense of the $48 million loan to the Investor Entity and lease payments to M-2 that reflect only nominal interest on the value of the leased rail assets.

The Capital Financial Plan reflects $16 million of net proceeds for the benefit of the M-1 RAIL Streetcar Project from the NMTC transaction. The proceeds are expected to be realized in two equal tranches of $8.0 million in 2012 and 2013. The precise value of the transaction will be identified following further discussions with NMTC tax credit allocatees during the next phase of project development.

TIGER 2012 Grant

A discretionary grant funding of $25 million is planned, based on an application for a TIGER 2012 grant that was submitted on March 19, 2012. SEMCOG will be the designated recipient of the TIGER grant, which will be directly applied to the M-1 RAIL Streetcar Project through the master project lease agreement with M-2. The sublease and service agreement with M-1 RAIL will require the entities to continue operations of the streetcar system for its useful life and in full compliance with FTA regulations. As it is M-1 RAIL's intention to donate the project to a future RTA or other public agency within ten years, the agreements will define financial terms through at least the NMTC compliance period. Funding for continued operations, including sources of additional public support, will be subject to negotiation at that time.

The federal discretionary grant totaling $25 million is assumed to be received in 2013. Proceeds from the TIGER grant will not be loaned to the Investor Limited Liability Entities or used to make loan repayments on any commerical loans or credit facilities obtained during the project implementation process.

### *8.2.2 Capital Funding Uses (Expenditures)*

The construction cost estimate presented in **Section 6** is $124.5 million in 2012 dollars. The cost does not include approximately $3.8 million of project development costs already incurred by M-1 RAIL, which have been funded by sponsorship revenues received since 2009. The cost estimate includes $750,000 (2012 dollars) for commissioning and testing costs prior to the initiation of operations. The project cost is detailed by cost category and is spread across quarters based on a preliminary design-build project schedule described in **Section 10**. **Table 8.3** shows capital expenditures by year during the project development and construction period.

M-1 RAIL has the opportunity to partner with the Michigan Department of Transportation (MDOT) on the reconstruction of Woodward Avenue. Combination of the road reconstruction with the construction of track and other elements of the M-1 RAIL Streetcar Project provides an opportunity to achieve schedule and cost savings that would not be available if the projects were built separately. M-1 and MDOT plan to combine the delivery of the projects in a single contract. Although the road elements add approximately $20 million to the overall cost of the combined contract, no additional revenue or cost to the M-1 RAIL Streetcar Project is reflected in the Capital Financial Plan.

The schedule assumes a service start date of August 1, 2015. Constant 2012 dollar costs were escalated to year of expenditure dollars (YOE$) using a two-part inflation rate. The first part of inflation is the growth of costs in the overall economy, reflected in the Bureau of Labor Statistics' Consumer Price Index for Urban consumers (CPI-U). The model uses inflation projections through 2022 from the Congressional Budget Office. Over the 2012-2022 projection horizon, the average inflation rate is approximately 2% per year. Inflation figures beyond 2022 are assumed to be equal to the 2022 figure of 2.2%. The second part of inflation represents the escalation of costs above and beyond CPI-U inflation (real growth). For capital costs, the real annual escalation rate of 1.53% is derived from the 2003-2010 U.S. Army Corps of Engineers Civil Works Construction Cost Index System for Roads, Railroads, and Bridges, adjusted for Michigan, adjusted for historic CPI-U inflation.

The introduction of construction cost escalation over the project schedule increases the total project cost, including expenditures to date and financing costs to $136.9 million in YOE$.

Because the newly construction facilities will need minimal capital replacement during the start-up period, no allowance is made for ongoing capital investments needed to maintain the system in a state of good repair. M-1 RAIL intends to donate the assets to a public entity, such as the proposed regional transit authority (RTA), within 10 years after construction completion. Capital replacement will be the responsibility of the recipient.

### *8.2.3 Capital Financing*

The Capital Financial Plan includes a loan from one or more commercial banks or other sources during the construction period. The loan will be used to advance revenue from sponsorship receivables to fund construction expenditures by M-2. M-1 RAIL plans to borrow a principal amount of $22 million in 2014. The Capital Financial Plan assumes a 5-year repayment schedule at 5.0% interest.

The commercial loan may be refinanced with a Transportation Infrastructure Finance and Innovation Act (TIFIA) program loan following the start of operations. If available and approved, the TIFIA loan could reduce M-1 RAIL's borrowing costs or offer more favorable terms. M-1 RAIL submitted a TIFIA Letter of Interest with its TIGER 2012 discretionary grant application on March 19, 2012.

M-1 RAIL will use FTA's commitment through the TIGER grant award with those of its other sponsors to negotiatefavorable loan terms with specific lenders during the project's next phase.

### *8.2.4 Capital Cash Flow*

The sources and uses of capital funds are reflected in **Table 8.4**. Total project revenues exceed total project expenditures. As suggested by relatively small negative balances in the 2017-2019 period, some refinements will be made to sponsorship timing and borrowing assumptions to smooth cash flows during the project's next phase.

## Table 8.3 Project Capital Costs

| SCC Category | 2009-2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 Guideway & Track Elements | $0 | $0 | $8,836,024 | $9,107,467 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$17,943,491** |
| 20 Stations, Stops, Terminals, Intermodal | $0 | $0 | $3,981,013 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$3,981,013** |
| 30 Support Facilities: Yards, Shops, Admin. Bldgs | $0 | $0 | $9,119,693 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$9,119,693** |
| 40 Sitework & Special Conditions | $0 | $0 | $16,922,371 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$16,922,371** |
| 50 Systems | $0 | $0 | $5,206,334 | $5,366,272 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$10,572,606** |
| 60 Row, Land, Existing Improvements | $0 | $835,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$835,000** |
| 70 Vehicles | $0 | $0 | $0 | $30,017,601 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$30,017,601** |
| 80 Professional Services | $3,800,000 | $4,145,448 | $6,233,381 | $2,831,299 | $729,937 | $0 | $0 | $0 | $0 | $0 | $0 | **$17,740,065** |
| 90 Unallocated Contingency | $0 | $1,245,112 | $12,574,704 | $11,830,660 | $388,195 | $0 | $0 | $0 | $0 | $0 | $0 | **$26,038,671** |
| 100 Finance Charges | $0 | $0 | $0 | $0 | $1,009,790 | $806,564 | $592,941 | $368,388 | $132,346 | $0 | $0 | **$2,910,028** |
| Project Startup | $0 | $0 | $0 | $0 | $822,843 | $0 | $0 | $0 | $0 | $0 | $0 | **$822,843** |
| **Project Total** | **$3,800,000** | **$6,225,560** | **$62,873,519** | **$59,153,299** | **$2,950,766** | **$806,564** | **$592,941** | **$368,388** | **$132,346** | **$0** | **$0** | **$136,903,381** |

| Construction Package | 2009-2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Package 1 - Vehicles | $0 | $339,733 | $3,431,047 | $33,245,633 | $105,920 | $0 | $0 | $0 | $0 | $0 | $0 | **$37,122,332** |
| Package 2 - VSMF and Stations | $0 | $152,826 | $14,644,133 | $1,452,102 | $47,647 | $0 | $0 | $0 | $0 | $0 | $0 | **$16,296,708** |
| Package 3 - Site, Track, MDOT Road & Bridges, OCS | $0 | $1,370,083 | $36,368,665 | $19,557,925 | $166,826 | $0 | $0 | $0 | $0 | $0 | $0 | **$57,463,498** |
| Professional Services | $3,800,000 | $4,362,919 | $8,429,675 | $4,897,639 | $797,739 | $0 | $0 | $0 | $0 | $0 | $0 | **$22,287,971** |
| Finance Charges | $0 | $0 | $0 | $0 | $1,009,790 | $806,564 | $592,941 | $368,388 | $132,346 | $0 | $0 | **$2,910,028** |
| Project Startup | $0 | $0 | $0 | $0 | $822,843 | $0 | $0 | $0 | $0 | $0 | $0 | **$822,843** |
| **Project Total** | **$3,800,000** | **$6,225,560** | **$62,873,519** | **$59,153,299** | **$2,950,766** | **$806,564** | **$592,941** | **$368,388** | **$132,346** | **$0** | **$0** | **$136,903,381** |

## Table 8.4 Capital Funding Sources and Uses

| | 2009-2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Sources of Funds* | | | | | | | | | | | | |
| Committed Foundations, Donors, and Sponsors | | | | | | | | | | | | |
| Kresge Foundation | $18,100,000 | $5,500,000 | $5,500,000 | $6,000,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$35,100,000** |
| Detroit Development Authority | $0 | $900,000 | $900,000 | $900,000 | $900,000 | $900,000 | $900,000 | $900,000 | $900,000 | $900,000 | $900,000 | **$9,000,000** |
| Compuware | $0 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Detroit Medical Center | $0 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Henry Ford Health System | $0 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Ilitch Holdings | $0 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Quicken Loans | $1,000,000 | $1,000,000 | $1,000,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Penske | $1,000,000 | $1,000,000 | $1,000,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Wayne State University | $0 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $0 | $0 | $0 | $0 | **$3,000,000** |
| General Motors | $0 | $600,000 | $600,000 | $600,000 | $600,000 | $600,000 | $0 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Ford Foundation | $0 | $0 | $0 | $1,000,000 | $1,000,000 | $1,000,000 | $0 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Kellogg Foundation | $0 | $0 | $1,000,000 | $1,000,000 | $1,000,000 | $0 | $0 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Blue Cross Blue Shield | $0 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $500,000 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Wayne County | $0 | $3,000,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$3,000,000** |
| Husdon Webber Foundation | $0 | $0 | $200,000 | $200,000 | $200,000 | $200,000 | $200,000 | $0 | $0 | $0 | $0 | **$1,000,000** |
| Additional Foundations, Donors, and Sponsors | $0 | $1,000,000 | $3,500,000 | $5,500,000 | $4,000,000 | $1,000,000 | $0 | $0 | $0 | $0 | $0 | **$15,000,000** |
| *Subtotal Foundations, Donors, and Sponsors* | *$20,100,000* | *$16,000,000* | *$16,700,000* | *$18,200,000* | *$10,700,000* | *$6,700,000* | *$4,100,000* | *$900,000* | *$900,000* | *$900,000* | *$900,000* | ***$96,100,000*** |
| Expense Reductions and Reimbursables | | | | | | | | | | | | |
| TIGER Grant | $0 | $0 | $25,000,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$25,000,000** |
| NMTC Proceeds | $0 | $8,000,000 | $8,000,000 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$16,000,000** |
| DTE In-Kind | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| *Subtotal Expense Reductions and Reimbursables* | *$0* | *$8,000,000* | *$33,000,000* | *$0* | *$0* | *$0* | *$0* | *$0* | *$0* | *$0* | *$0* | ***$41,000,000*** |
| **Total Project Revenues** | **$20,100,000** | **$24,000,000** | **$49,700,000** | **$18,200,000** | **$10,700,000** | **$6,700,000** | **$4,100,000** | **$900,000** | **$900,000** | **$900,000** | **$900,000** | **$137,100,000** |
| *Uses of Funds* | | | | | | | | | | | | |
| **Total Project Expenditures (incl. Loan Interest)** | **$3,800,000** | **$6,225,560** | **$62,873,519** | **$59,153,299** | **$2,950,766** | **$806,564** | **$592,941** | **$368,388** | **$132,346** | **$0** | **$0** | **$136,903,381** |
| **EOY Amount Available for Capital and Operations** | **$16,300,000** | **$17,774,440** | **($13,173,519)** | **($40,953,299)** | **$7,749,234** | **$5,893,436** | **$3,507,059** | **$531,612** | **$767,654** | **$900,000** | **$900,000** | **$196,619** |
| **Cumulative Cash Flow Available before Financing** | **$16,300,000** | **$34,074,440** | **$20,900,922** | **($20,052,377)** | **($12,303,143)** | **($6,409,707)** | **($2,902,647)** | **($2,371,035)** | **($1,603,381)** | **($703,381)** | **$196,619** | |
| *Financing* | | | | | | | | | | | | |
| Loan Proceeds | **$0** | **$0** | **$0** | **$22,000,000** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$0** | **$22,000,000** |
| Principal Repayment | **$0** | **$0** | **$0** | **$0** | **($3,972,216)** | **($4,175,442)** | **($4,389,065)** | **($4,613,618)** | **($4,849,660)** | **$0** | **$0** | **($22,000,000)** |
| *EOY Financing Funds Available* | *$0* | *$0* | *$0* | *$22,000,000* | *($3,972,216)* | *($4,175,442)* | *($4,389,065)* | *($4,613,618)* | *($4,849,660)* | *$0* | *$0* | ***$0*** |

## 8.3 Operating Financial Plan

This section summarizes the assumptions and methodologies used to develop the Operating Financial Plan. The purpose of this section is to demonstrate that M-1 RAIL has the financial capacity to fund the ongoing operations and maintenance costs of the M-1 RAIL Streetcar Project during the start-up period. The operating plan cash flows are presented from the perspective of M-1 RAIL, the entity that will be responsible for constructing and initially operating the streetcar. Additional supporting documentation can be found in Appendix E.6.

### *8.3.1 Operating Funding Sources (Revenue)*

Fare Revenues

The streetcar will use a proof-of-payment fare enforcement system with ticket vending machines at each station. M-1 RAIL will also encourage major employers, institutions, and Wayne State University to participate in pre-paid transit pass programs similar to the Eco-Pass and U-Pass programs that are successfully used elsewhere in North America.

Fare revenues are computed using an annual ridership estimate and an annually-adjustable average fare level. Opening year (2015) ridership is assumed to be 6,000 unlinked trips per weekday. Weekday ridership is adjusted to annual ridership using an annualization factor of 300 weekdays per year. Annual ridership in 2015 would thus be 1.8 million unlinked trips if the service operated all year in its opening year. Ridership is assumed to build in a linear manner to the 3 million trips reflected in the 2007 *Woodward Transit Catalyst* study by 2035. Walk-up customers (those who are not participants in universal pass programs) are assumed to pay an average fare of $1.50 in 2015, increasing with CPI in $0.05 increments every two years.

M-1 RAIL plans to initiate a universal pass program with one or more of the existing shuttle operators, as well as other major employers or institutions in the Woodward Avenue corridor. Based on the analysis in **Section 5.3**, the Financial Plan assumes that pass programs will attract 900,000 annual riders (unlinked trips) to the streetcar. This is equivalent to about 89% of the existing shuttle riders in the corridor and 94% of the ridership on the two largest shuttle systems (CCS and DMC). This participation level is assumed to remain constant (no growth) over time. As a result, the 50% of total riders who are assumed to be participants in universal pass programs in 2015 transitions gradually to 30% by 2035 as total ridership builds. The Financial Plan also assumes that universal pass program revenue will amount to 90% of the base cash fare per passenger to allow for negotiated discounts or differences between the ridership on which the annual fee was computed and actual ridership. Riders who are participants in universal pass programs are thus assumed to generate $1.35 of fare revenue per unlinked trip in 2015, increasing with CPI annually.

Fare revenue is estimated to include $1.3 million from walk-up customers and $1.1 million from pass programs in 2015, or a total of $2.4 million. This increases by 50% to $3.6 million by 2021. A prorated revenue is included in 2015 based on the service start date.

System-Generated Revenues

M-1 RAIL will take advantage of the positive image created by the streetcar to encourage static and electronic advertising on stations, vehicle exteriors, vehicle interiors, website, and promotional materials. Although M-1 RAIL will acknowledge some sponsorships with advertising, much of the space on the system will be sold at market rates. Annual revenue from advertising, short-term naming rights, concessions, or other sources is assumed to be $500,000, rising with CPI inflation. This estimate is based on discussions with potential advertisers and general market intelligence in the Detroit metropolitan market.

State of Michigan Support

Legislation in 2008 authorized the State of Michigan to provide up to eight percent (8%) of the capital investment in a non-profit street railway as an annual subsidy for operations and maintenance. The legislation did not identify a dedicated funding source for the purpose and any appropriation is subject to the annual appropriation process.

Based on recent discussions with the Governor's office, an annual subsidy of $1.5 million (2015 dollars, increasing with CPI inflation) is estimated to be made available every year in which the service is in operation. M-1 RAIL is coordinating with the State of Michigan to secure state operating assistance from a variety of sources, including some that are not subject to annual appropriation. As an alternative, M-1 RAIL will seek annual funding through a MDOT budget line item (currently zero) created following the 2008 legislation.

M-1 RAIL Operating Support

M-1 RAIL will use the proceeds of long-term naming rights for the streetcar line and other sponsorship revenues to cover the annual O&M costs of the service that remain after funds from other sources have been applied. Interest earned on any fund balance , and principal as needed, will be drawn down to cover funding shortfalls. The balance in the fund is assumed to earn interest at an annual rate of 2%.

The Operating Financial Plan assumes that M-1 RAIL will raise a total of $12.7 million in donations from sponsors to cover O&M shortfalls through the first ten years of operations in 2024. M-1 RAIL has identified potential sponsors willing to contribute for up to ten years.

In addition, M-1 RAIL has identified at least $15 million in potential funding for capital cost overruns, as described in **Section 8.2.1**. If the project comes in under budget, this funding may be used for operations support. M-1 RAIL will build on FTA's commitment through the TIGER grant award to secure commitments for these expected funds during the next phase of project development.

### *8.3.2 Operating Funding Uses (Expenditures)*

M-1 RAIL Administration

Annual administration expenses of $500,000 (2012 dollars) are included to cover the activities of M-1 RAIL as it administers the operating contract and the M-2 leasing company. This expense increases at the rate of escalation of administration expenses of other light rail and streetcar systems based on NTD data described above.

M-2 Lease Payments

M-1 RAIL will make an annual lease payment to M-2 through SEMCOG for use of the rail assets constructed under the NMTC transaction. The lease payment of $300,000 reflects a nominal interest rate on the value of the assets. The lease payments will cease at the end of the seven-year NMTC compliance period.

Operations Contract

A $5.1 million annual cost (2012$) is included based on the O&M cost estimate in **Section 5**. Constant 2012 dollar costs were escalated to year of expenditure dollars (YOE$) using a two-part inflation rate. The first part of inflation is the growth of costs in the overall economy, reflected in the Bureau of Labor Statistics' Consumer Price Index for Urban consumers (CPI-U). The model uses inflation projections through 2022 from the Congressional Budget Office. Over the 2012-2022 projection horizon, the average inflation rate is approximately 2% per year. Inflation figures beyond 2022 are assumed to be equal to the 2022 figure of 2.2%. The second part of inflation represents the escalation of costs above and beyond CPI-U inflation (real growth). Real growth rates are derived from 2002-2010 NTD unit cost data for light rail systems serving cities between 500,000 and 5 million population. Rates range from zero for Vehicle Operations and Vehicle Maintenance costs to 1.07% for Non-Vehicle Maintenance and 2.95% for General Administration. The introduction of cost escalation increases O&M costs to $6.5 million by 2022. A prorated expense is incurred in 2015 based on the service start date.

Reserve Fund

Working capital needs will be covered by the M-1 RAIL operating fund. No contributions to a separate reserve fund are included.

### *8.3.3 Operating Cash Flow*

The sources and uses of operating funds reflected in **Table 8.5**. Under the assumptions described above, the operating funding to be raised from corporate, foundation, and institutional sources is expected to maintain sustainable funding for system operations through 2024 when private sponsors cease their operating support. By this time, M-1 RAIL expects to donate the project assets and operating responsibility to a public agency, such as the proposed RTA.

## Table 8.5 Operating Funding Sources and Uses

| (millions of YOE dollars) | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Operating Expenditures* | | | | | | | | | | | | | | | | | | |
| M-1 RAIL Administration Expense | $0.3 | $0.6 | $0.6 | $0.6 | $0.7 | $0.7 | $0.7 | $0.8 | $0.8 | $0.8 | $0.9 | $0.9 | $0.9 | $1.0 | $1.0 | $1.1 | $1.1 | **$13.5** |
| Lease Payments to M-2 | $0.3 | $0.3 | $0.3 | $0.3 | $0.3 | | | | | | | | | | | | | **$1.5** |
| Streetcar Operations Contract | $2.4 | $5.5 | $5.7 | $5.8 | $6.0 | $6.2 | $6.3 | $6.5 | $6.7 | $6.9 | $7.1 | $7.3 | $7.5 | $7.7 | $8.0 | $8.2 | $8.4 | **$112.3** |
| Reserve Fund Contribution | | | | | | | | | | | | | | | | | | **0** |
| **Total operating costs** | **$3.0** | **$6.4** | **$6.6** | **$6.8** | **$7.0** | **$6.9** | **$7.1** | **$7.3** | **$7.5** | **$7.7** | **$8.0** | **$8.2** | **$8.5** | **$8.7** | **$9.0** | **$9.3** | **$9.6** | **$127.4** |
| *Operating Revenues* | | | | | | | | | | | | | | | | | | |
| Fare Revenues | $1.2 | $2.7 | $2.9 | $3.0 | $3.2 | $3.3 | $3.6 | $3.7 | $3.9 | $4.1 | $4.4 | $4.5 | $4.7 | $4.9 | $5.2 | $5.4 | $5.7 | **$66.4** |
| Other System-Generated Revenues | $0.2 | $0.5 | $0.5 | $0.6 | $0.6 | $0.6 | $0.6 | $0.6 | $0.6 | $0.6 | $0.6 | $0.7 | $0.7 | $0.7 | $0.7 | $0.7 | $0.7 | **$10.3** |
| State Operating Assistance | $1.5 | $1.5 | $1.6 | $1.6 | $1.6 | $1.7 | $1.7 | $1.7 | $1.8 | $1.8 | $1.8 | $1.9 | $1.9 | $2.0 | $2.0 | $2.1 | $2.1 | **$30.2** |
| M-1 RAIL Endowment Drawdown | $0.1 | $1.7 | $1.6 | $1.6 | $1.6 | $1.3 | $1.2 | $1.2 | $1.2 | $1.2 | | | | | | | | **$12.7** |
| **Total operating revenues** | **$3.0** | **$6.4** | **$6.6** | **$6.8** | **$7.0** | **$6.9** | **$7.1** | **$7.3** | **$7.5** | **$7.7** | **$6.9** | **$7.1** | **$7.3** | **$7.5** | **$7.9** | **$8.1** | **$8.6** | **$119.6** |
| **Prior Year Cash Balance** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **-$1.1** | **-$2.3** | **-$3.4** | **-$4.6** | **-$5.6** | **-$6.7** | |
| **Deficit/surplus from operations** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***-$1.1*** | ***-$1.2*** | ***-$1.1*** | ***-$1.2*** | ***-$1.1*** | ***-$1.1*** | ***-$1.0*** | **-$7.7** |
| **End of Year Cash Balance without Borrowing** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **-$1.1** | **-$2.3** | **-$3.4** | **-$4.6** | **-$5.6** | **-$6.7** | **-$7.7** | |

## 8.4 Financial Risk Factors

Several risk factors have been assessed, in order to proactively consider potential changes in funding strategy, and contingency plans have been developed to enable effective mobilization of alternative strategies should the need arise. A detailed "register" of the risk factors identified, and the proposed mitigation strategy to be employed should the need arise, is included in **Appendix F.2**. A sensitivity analysis was conducted to understand the potential magnitude of impact for some of the risk factors and to identify appropriate responses.

### *8.4.1 Sensitivity Analysis Results*

Two preliminary sensitivity scenarios were developed to illustrate "pessimistic" outcomes in the capital and operating cash flows, to facilitate contingency planning and/or appropriate adjustments to the project. These are based on an understanding of the least certain (or "riskiest") aspects of the project. The sensitivity scenarios include:

- **Base Scenario –** This scenario reflects the assumptions described above. The capital and operating expenditures are generally matched by revenues in each year through 2031.
- **Less Capital Funding (LessCap) Scenario –** This scenario reflects the same assumptions as the Base scenario, except without any NMTC Funding. This is comparable to a $16 million (YOE$) construction cost overrun (about 13 percent of total construction costs). The capital funding gap grows to about $16 million and would require additional fundraising from existing donors and corporate, foundation, and institutional prospects.
- **Less Operating Funding (Less Ops) Scenario –** This scenario reflects the same assumptions as the Base scenario, except with a 50% reduction in ridership and fare revenue. This is comparable to the elimination of any state operating subsidy. M-1 RAIL would need to approximately double annual operating support from corporate, foundation, and institutional sources. This increases the total to about $16 million through 2020, when the NMTC complicance period expires.

### *8.4.2 Risk Evaluation and Controls*

Although the Financial Plan uses conservative assumptions to minimize potential risk impacts, M-1 RAIL has a number of options available to address revenue shortfalls, cost increases, or timing differences as the project delivery process continues. These include:

- More fundraising from existing donors and corporate, foundation, and institutional prospects
- Additional allocation of NMTCs
- Requests for public agency participation, such as through the original TIGER 1 grant
- Application of existing public operating funding sources, such as Congestion Mitigation and Air Quality (CMAQ) grants through SEMCOG

- Creation of new public funding sources, such as a benefit assessment district in the Woodward Avenue corridor
- Lower cost borrowing through public or non-profit sources, such as TIFIA, state authorities or foundation programs
- Reduction in project scope, fleet size, or service level to match expenditures with expected revenues.

# 9 PROJECT DELIVERY

A project management plan (PMP) has been developed to guide the implementation of the project. The plan demonstrates M-1 RAIL's organizational and technical capabilities to implement the project and accounts for all major phases of design, construction and start-up for the project.

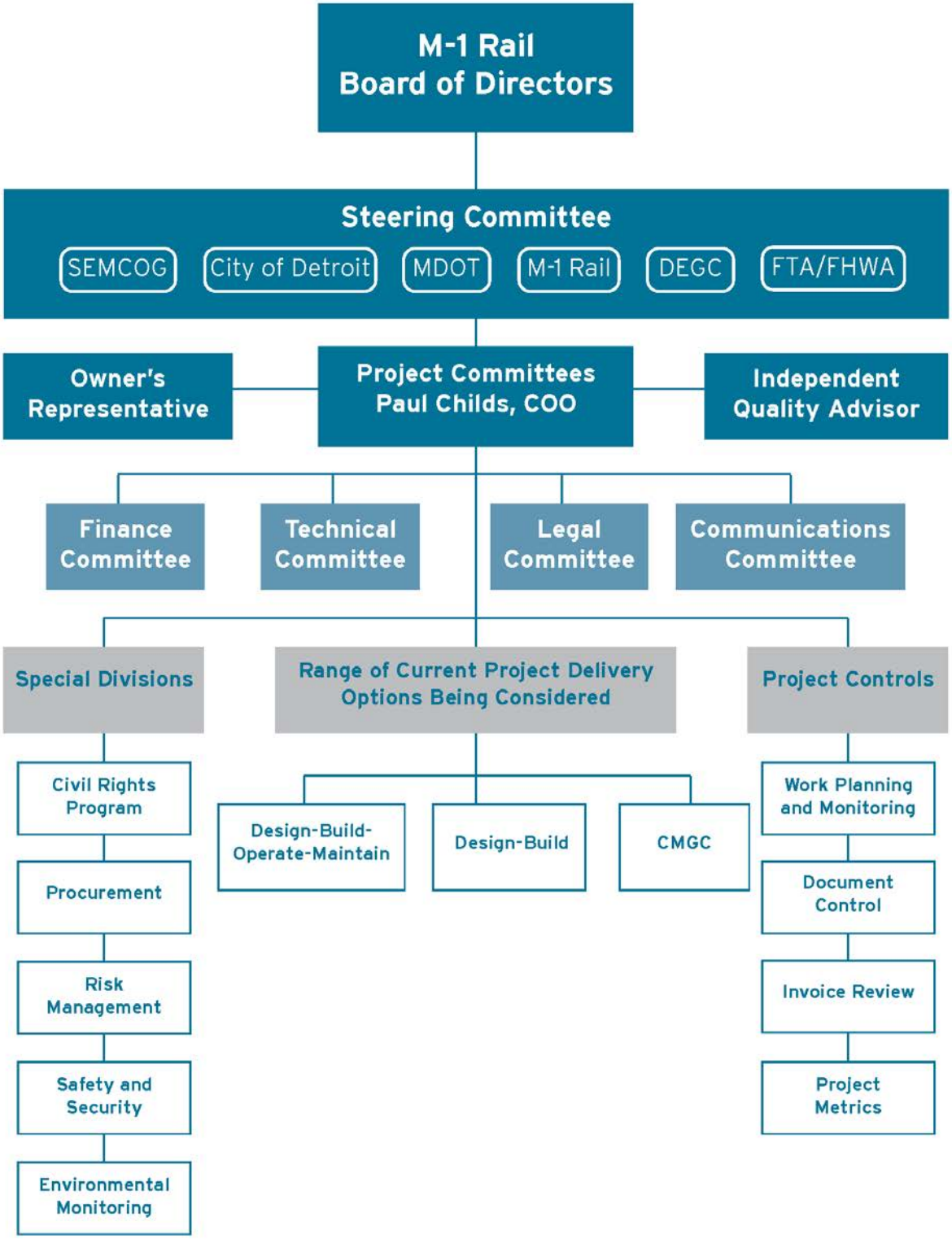
## 9.1 Project Organization

This section discusses how the M-1 RAIL Streetcar Project will be organized and staffed for the final design, construction and testing/start-up phases. As the project proceeds, the organization will evolve to maximize the efficient use of personnel and adjust to the changing workload. The project management plan will be updated prior to each phase to reflect changes in the organization. Additionally, and because of the nature of the project funding, M-1 RAIL has built multiple project validation points, or "toll gates," into the project schedule where the M-1 RAIL Technical Team and Board will perform a business assessment of whether or not the project remains technically and financially feasible to implement. Key envisioned toll gates include:

- TIGER IV Grant Award
- Signature of MOU with City of Detroit/State of Michigan outlining key tenets of project delivery, risk sharing, and requirements for issuance of operating permits
- Completion of NEPA environmental clearance
- Land acquisition for project elements
- Completion of Financing Agreements with respective funders/lenders
- Upon receipt of final bids from CMGC & D/B firms for Delivery Packages 1 (Vehicles), 2 (VSMF), & 3 (Mainline Site/Civil work)

In order to efficiently manage the quality of scope, budget and schedule for this project, M-1 RAIL envisions implementing the project structure outlined in **Figure 9.1**. Details of this proposed project structure are discussed in subsequent sections below.

**Figure 9.1 Conceptual Project Organization**



### *9.1.1 Project Governance and Oversight*

Project implementation will be undertaken and overseen by the M-1 RAIL Corporation (M-1 RAIL). M-1 RAIL is a non-profit public/private partnership 501(c) 3 that is enabled by Michigan legislation to design, build, operate and maintain a street railway in the public right of way. Legislation allows an annual operating subsidy of up to eight percent (8%) of the capital costs of the M-1 RAIL Streetcar Project to be allocated in the state budget for M-1 RAIL operations.

M-1 RAIL proposes to utilize a three-tier governance structure to deliver the project. The governance structure is described below:

- **M-1 RAIL Board of Directors**: M-1 RAIL currently has an independent Board of Directors with four officers - a CEO, CFO, COO and Vice President. Existing membership on the Board of Directors includes representation from MDOT, the City of Detroit, and the Detroit Economic Growth Corporation. M-1 RAIL is exploring the existing composition of the board to make sure all major interests along the corridor are represented. The scope of the M-1 RAIL Board of Directors is to provide overarching policy direction and strategic direction to the Steering Committee and to serve as the fiduciary agent for M-1 RAIL.
- **M-1 RAIL Steering Committee**: The scope of the Steering Committee is to oversee the M-1 RAIL Committees, assist with eliminating project implementation barriers and addressing scope, schedule, legal and financial issues that arise throughout the course of the project development process.
- **M-1 RAIL Committees:** The M-1 RAIL Streetcar Project will utilize the Project Committees to ensure the development and use of common systems in support of the M-1 RAIL vision. Committees will serve as consistent arbitrators and decision-making bodies throughout the multiple phases of the Project. As the Project advances to revenue service, additional committees related to topics such as development, operations and maintenance will likely be formed. The scope of the Committees will be to design, construct, and deliver the project and be responsible for day-to-day operations of the M-1 RAIL system once constructed.

### *9.1.2 Project Director*

The project director, also called the Chief Operating Officer (COO), will be responsible for the overall management and delivery of the project. This position will be assisted by the finance, technical, legal and communications project committees and an owner's representative that will be hired for the project. The owner's representative will assist the COO in managing the day-to-day project activities.

As issues or concerns arise on the project, the project director will report to the M-1 RAIL Committees discussed in **Section 9.1.3** to seek their guidance and potential solutions. The project director and the chair of the committee will determine if the issue should be elevated to the steering committee.

### *9.1.3 M-1 RAIL Committees*

M-1 RAIL has established four committees - Finance, Communications, Technical and Legal. M-1 RAIL has created Project Committees to ensure collaboration throughout the project delivery process, to maximize cost effectiveness. The Project Committees will be led by designated representatives from M-1 RAIL. The existing Project Committees are described below:

- **Technical Committee** (Paul Childs, Chair): The scope of the Technical Committee is to develop and review common technical elements for the system, synchronize design and construction schedules, ensure compliance with the requirements of agencies with jurisdiction over the Project, and provide the necessary support required by the other committees. The Technical Committee is comprised of senior technical experts from city, state and federal agencies, and is responsible for ensuring the reliability of technical methods, assumptions and results of work.

  The work of the Technical Committee is currently supported by the TOD subcommittee, with additional subcommittees convened in the future as needs arise.

- **Finance Committee** (Tom McNulty, Chair): The Finance Committee is currently made up of representatives from M-1 RAIL, MDOT, and the City; membership may change as the project progresses and new funding sources are identified (i.e., SEMCOG – TIGER IV grant). The Finance Committee is charged with developing a project financial model, securing the necessary funds for the Project, completing all necessary financial reporting, as well as overseeing the allocation of those funds.

- **Communications Committee** (Laura Trudeau, Chair): The Communications Committee has been established to link the Project to residents and businesses in the corridor. In addition, the Communications Committee focuses on methods, assumptions, findings, and impacts of the Project in such areas as economic development, land use and zoning, visual and aesthetic conditions, and neighborhood quality of life. The group helps to communicate study findings to the public and interested organizations, gives feedback and makes recommendations to the Technical Committee on issues that arise as the Project progresses.

- **Legal Committee** (Cam Piggott, Chair): The Legal Committee will assist M-1 RAIL in compliance with all local, state, and federal regulations. Legal counsel will be needed for all project development phases and during revenue service. Counsel will be provided by contract. The following types of legal services may be required for the project:
  - **Planning:** Legislation development and review, funding agreements, and interagency agreements such as a TIGER IV grant agreement or necessary MOU's with the SHPO and other agencies.

- **Final Design:** consultant contracts; dispute resolution; zoning changes; inter-agency cooperation and funding agreements.
- **Construction:** Right of way appraisals, acquisition and occupancy agreements; third-party construction agreements (e.g. utility relocation); acquisition of permits, licenses and required approvals; construction and procurement contracts; dispute resolution; litigation; joint real estate development contracts; development of financing instruments.

### *9.1.4 Owner's Representative*

M-1 RAIL will hire a professional services firm to act as the project owner's representative in accordance with the Brooks Act of 1972. The owner's representative will facilitate all phases of the project and report to the project director. M-1 RAIL envisions the owner's representative will assist with the following tasks:

- Updating of current 30% level design plans for the site/civil work,
- Preparing procurement documents for the selection of a design/build contractor,
- Providing Construction Engineering and Inspection services during the construction phases,
- Assisting M-1 RAIL with compliance with Project Control and Special Division duties,
- Assisting M-1 RAIL with procurement of vehicles, and
- Assisting M-1 RAIL with procurement of an O&M vendor

### *9.1.5 Independent Quality Advisor*

M-1 RAIL envisions hiring a professional services firm, also in accordance with the Brooks Act of 1972, to act as an Independent Quality Advisor (Advisor). The primary purpose of the advisor is to give independent advice to the project director and project committees at key milestones as they receive information from the owner's rep and project team.

### *9.1.6 Project Controls*

Project Controls includes four sections. The Work Planning and Monitoring section is responsible for the development and implementation of policies and procedures to control and manage work tasks, schedule and budget. The Document Controls section will be responsible for developing and maintaining a system for the storage, retrieval, reproduction and distribution of project documents and correspondence. The Invoice Review section will process all invoices and the Project Metrics section will be responsible for tracking project metrics. A project controls manager will be assigned by the project director and task leads will be assigned to the four sections.

### *9.1.7 Special Divisions*

Special Divisions is made up of five different sections. The project director will assign a Special Divisions manager that will work with the task leads for the different sections. The Special Divisions managers will report to the owner's representative. The make-up of each section is discussed below.

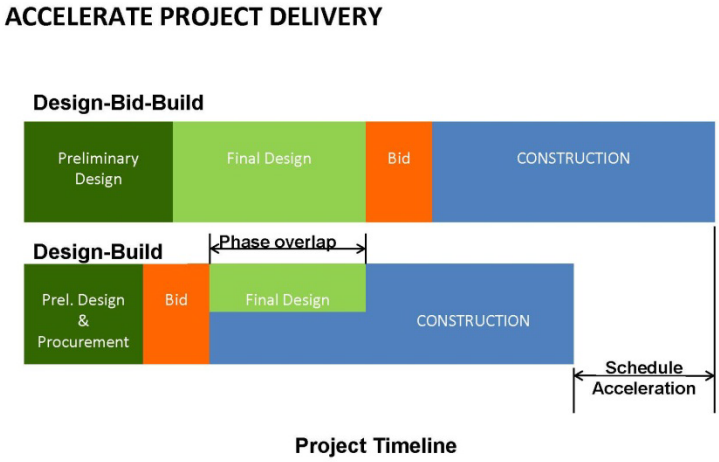
- **Civil Rights Program** – M-1 RAIL will comply with the Code of Federal Regulations 49, Part 26, which requires all recipients of US Department of Transportation (DOT) federal assistance funds to implement and enforce a Disadvantaged Business Enterprises (DBE) program. M-1 RAIL will track DBE contracting throughout all project phases.
- **Risk Management** – M-1 RAIL will appoint a Risk Manager to identify and manage project risk. The Risk Manager will appoint a risk team that is made up of individuals from various disciplines and program areas from the M-1 RAIL Streetcar Project. The risk manager will be responsible for all risk related documentation and reporting throughout all project phases.
- **Procurement** – This section will oversee the policies and procedures related to the procurement of professional services, construction contracts, and the purchase of equipment, materials and supplies related to the M-1 Streetcar Project. The project director will appoint a procurement manager.
- **Safety and Security** – The project director will appoint a Safety and Security Officer that will be responsible for providing safety and security oversight and documentation for all project phases.
- **Environmental Monitoring** - The project director will appoint an individual to oversee environmental monitoring. This division will be responsible for tracking and monitoring the mitigation commitments outlined in the Environmental Impact Statement and for making sure all conditions from the project's permits and approvals are being met.

## 9.2 Project Delivery Approach

### *9.2.1 Background*

The M-1 RAIL team has explored a variety of project delivery mechanisms, including a variety of design-build mechanisms that could lead to increased project cost savings and/or accelerated project delivery, as depicted in **Figure 9.2.** Since the M-1 RAIL Streetcar Project is not part of the FTA New Start's process, it has the flexibility to use alternative delivery methods.

**Figure 9.2 Illustrative Design-Build Schedule Savings**




Working with its project partners including the State of Michigan (MDOT), the City of Detroit, the Detroit Economic Growth Corporation, the Southeast Michigan Council of Governments (SEMCOG) and other potential partners, M-1 RAIL has developed a governance/partnership model that is capable of delivering and maintaining this project for a period of 7 to 10 years to satisfy the requirements associated with the New Market Tax Credits and to account for the development of a Regional Transit Authority which could ultimately assume ownership of the M-1 RAIL Streetcar system. M-1 RAIL is committed to implementing a staffing plan to deliver the project in a manner that will comply with federal requirements that may be imposed on federal TIGER funds which may be applied to the project, including Buy America, Title VI, and other provisions.

### *9.2.2 Assumptions*

M-1 RAIL has developed its preferred project delivery structure around the following project assumptions:

- M-1 RAIL receives approval by FTA, the State of Michigan and the City of Detroit to move forward with the M-1 Streetcar Project by May 2012.
- M-1 RAIL receives a TIGER grant in the amount of $25 million. SEMCOG is assumed to be the federally recognized grant recipient with whom M-1 RAIL will develop a subrecipient grant agreement.
- M-1 RAIL will apply New Market Tax Credits to fund a portion of the capital costs and thus will be required to own the asset for a period of seven years.
- MDOT, City of Detroit, and SEMCOG will be active partners in facilitating expedited reviews, permitting process, and TIGER grant reporting requirements.

- MDOT and the City of Detroit concur with a design-build or construction management general contractor (CMGC) project delivery approach.
- MDOT and the City of Detroit will issue M-1 RAIL the necessary operational agreements to operate a streetcar within MDOT/City owned right-of-way.

### *9.2.3 Project Delivery Options*

The M-1 RAIL team has explored numerous delivery mechanisms to implement the M-1 RAIL Streetcar Project. This includes a traditional Design-Bid-Build approach as well as other alternative delivery approaches that could lead to increased project cost savings and/or accelerated project delivery such as:

- Design-Build
- Design-Build- Operate and Maintain
- CMGC
- Variable Scope/Fixed Price
- Construction Manager At-Risk

The planned project delivery approach is discussed in the following section.

### *9.2.4 Project Delivery Approach and Phases*

The M-1 RAIL Streetcar Project delivery approach must address and be responsive to the assumptions identified in **Section 9.1**. Also, it must consider the current political and technical landscape in Detroit, the sources of proposed project funding, and the current streetcar manufacturing market conditions. As a result, M-1 RAIL is proposing to utilize a hybrid project delivery approach.

M-1 RAIL has met with MDOT to discuss the opportunities, constraints and risks associated with the hybrid project delivery approach and is currently considering a four package approach to deliver the project as depicted in **Figure 9.3**.

Recognizing the timeframe for the procurement of the streetcar vehicles is likely to be the project's critical path, Package 1 proposes to proceed separately with the procurement of the vehicles. M-1 RAIL's project schedule accommodates a project specific procurement by M-1 RAIL, however, piggybacking on another city's contract to order streetcar vehicles will also be considered. As discussed in **Section 3**, M-1 RAIL intends to request informal letters of interest from the streetcar vendor market following the completion of the 90-day validation effort to test the level of interest in the market.

Package 2 proposes to construct the project's major vertical elements – the vehicle storage and maintenance facility (VSMF) and systems elements of the project including design and construction of the OCS and the TPSS - using a Design-Build approach. The benefit of separating the major vertical and systems elements from the site/civil work is that a specialized contractor will be able to expeditiously begin work on the VSMF. Also, by separating the vertical construction out from the site/civil work, this

approach should expedite the review of the site/civil packages with MDOT as it performs limited vertical construction work or OCS/TPSS work on a regular basis.

Package 3 would include all site/civil work and station work that would occur within the MDOT and the city of Detroit rights-of-way. Breaking out this work from the other project elements allows M-1 RAIL and MDOT to move forward to develop the roadway designs to a 75% plan development level, which is required to reach an agreement on a cost sharing. Also, it expedites agency reviews as the road and engineering reviews completed by MDOT and the City of Detroit will focus on familiar scope items. M-1 RAIL is evaluating both Design/Build and CMGC approaches for Package 3 because the plans for Package 3 will be developed to a 75% design level.

Finally, Package 4 brings on board an operations and maintenance (O&M) vendor to provide oversight and insight into the design, procurement and construction phases to assure capital elements of the project are designed and constructed in a manner that will not add long-term O&M costs. M-1 RAIL anticipates contracting with an O&M vendor for a period of no less than seven years to satisfy the requirements of New Market Tax Credits. M-1 RAIL envisions soliciting for O&M services prior to the completion of project design deliverables so the O&M operator can have an opportunity to provide input into the project design.

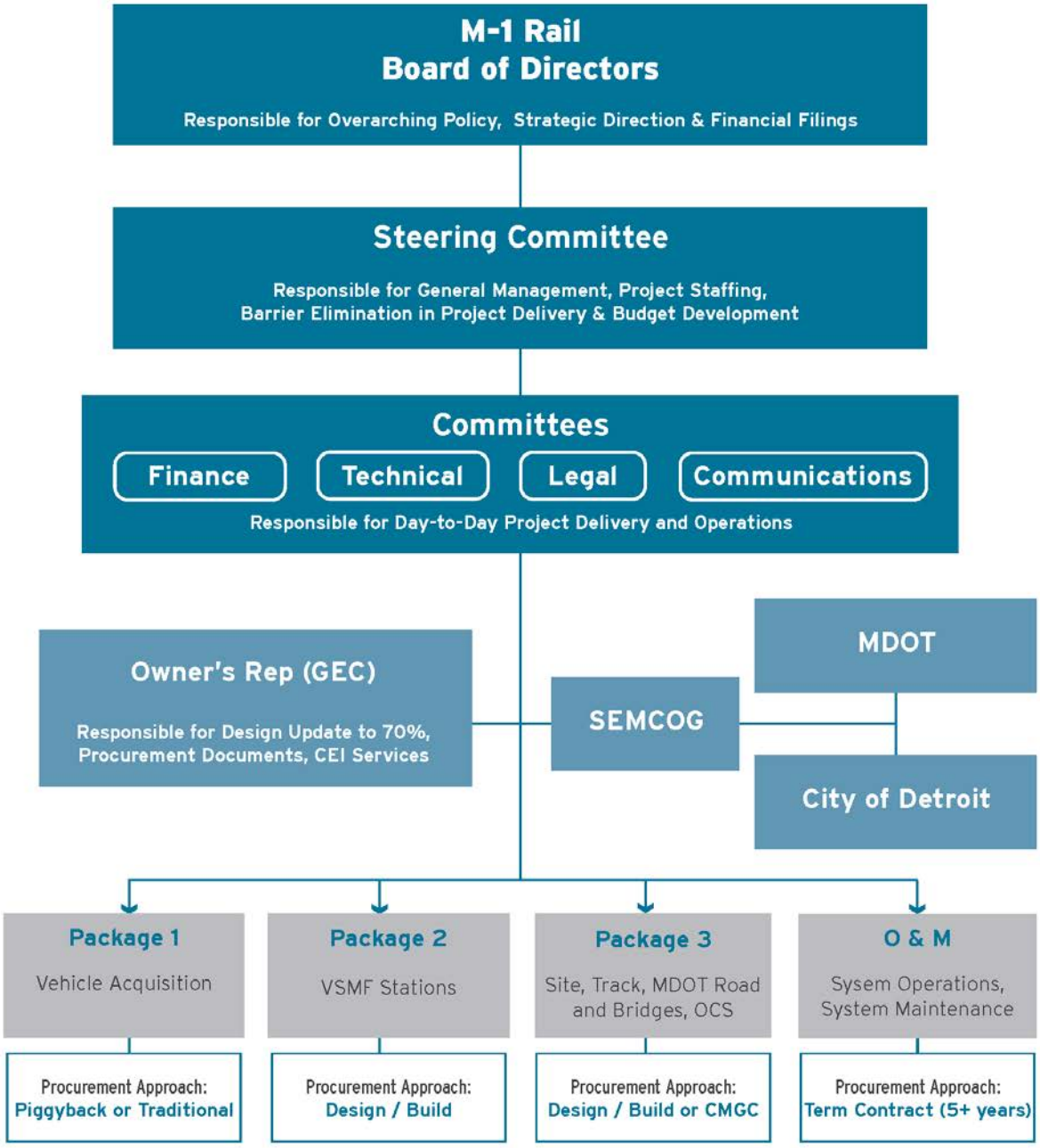
## 9.3 Procurement and Contract Management

Procurement and contract management will be an essential component of the M-1 RAIL Streetcar Project. All procurement will be jointly managed by M-1 RAIL with assistance from an Owner's Representative. Contracting procedures will adhere to federal regulations and comply with the Federal Transit Administration Circular 4220.1F, Third Party Contracting Guidance. All solicitations and contract documents developed for this project will be checked for compliance.

### *9.3.1 Selection of Vendors*

M-1 RAIL envisions using a best value selection process for a majority of its contracting needs for this project. M-1 RAIL and its affiliates have a history of using this approach on other projects they have partnered with public agencies on, including the Detroit Conservancy Riverfront project. M-1 RAIL envisions the project will be advertised via the M-1 RAIL website and any other necessary source determined by the type of service. A selection team will be established that will rate the vendor based on predetermined evaluation criteria including understanding of the service to be provided, qualifications of the vendor's team, past performance, and location.

**Figure 9.3 –Preferred Project Delivery Approach**



### *9.3.2 Compliance with the Brooks Act*

M-1 RAIL will adhere to Federal procedures and regulations as they relate to procurement activities on the Project, including the Brooks Act (Public Law 92-582), also known as Qualifications Based Selection (QBS). The Brooks Act establishes the procurement process by which architects and engineers(A/Es) are selected for design contracts with federal design and construction agencies. The Brooks Act establishes a qualifications-based selection process, in which contracts for A/Es are negotiated on the basis of demonstrated competence and qualification for the type of professional services required at a fair and reasonable price. Under QBS procurement procedures, price quotations are not a consideration in the selection process.

M-1 RAIL has several options to comply with the Brooks Act for this project, including conducting its own procurement, join with other systems in a consortium procurement led by one of the participants (i.e., vehicle piggybacking), or using the MDOT's administered procurement process.

M-1 RAIL will utilize the following resources to guide its procurement approaches as is moves into the next phases of the project:

FTA's *Best Practices Procurement Manual*

Regulations

- Project Management Oversight, 49 C.F.R. Part 663
- Major Capital Investment Projects. 49 C.F.R. Part 611
- Joint FTA/FHWA regulations, Metropolitan Planning, 23 C.F.R. Part 450
- Joint FTA/FHWA regulations, Environmental Impact and Related Procedures, 23 C.F.R. Part 771
- U.S. DOT regulation, Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally Assisted Programs. 49 C.F.R. Part 24

FTA Circulars

- C4220.1F, Third Party Contracting Guidance

### *9.3.3 Types of Contracts*

M-1 RAIL will evaluate a variety of different contract types, including Labor Rates only, Lump Sum and Cost + Fixed Fee to deliver the project. M-1 RAIL will coordinate with MDOT to assure any non-standard contract meets all federal funding requirements.

Any change in the scope, character or term of a contract or in the maximum amount will only be awarded by a written amendment to the contract by the parties. All contracts will include Termination for Cause and Termination for Convenience provisions.

### *9.3.4 Performance Reporting*

By the tenth day of each month, M-1 RAIL will require its contractors to submit a monthly progress report to the project director outlining the work accomplished during the previous month. The report identifies progress made in the preceding month, and problems, real or anticipated, that are associated with the project performance. Any deviations from the agreed upon work plan and schedule are identified. In the event of an identified problem, the contractor will be required to submit a plan to correct the issue.

In the event that termination of a contract is necessitated by any wrongful breach, failure, default, or omission by the contractor, M-1 RAIL will be entitled to pursue whatever remedies are available to it, including, but not limited to, withholding funds or off-setting against funds owed to the contractor under their contract, as well as any other existing or future contracts between the contractor and M-1 RAIL, for any and all damages and costs incurred or sustained by M-1 RAIL. In the event of termination, and/or any authorization(s), M-1 RAIL may procure the professional or other services from other sources and hold the contractor responsible for any damages or excess costs occasioned thereby.

In the event that the contractor disagrees with M-1 RAIL regarding a determination of the completeness or value of services completed, or the amount of reimbursement that is eligible, the contractor may invoke an alternative "dispute resolution" process.

### *9.3.5 Contract Closeout*

Prior to the final payment, the M-1 RAIL project director will complete a project closeout audit. This review will be performed to assure the project was delivered in compliance with all contracts.

## 9.4 Managing Cost, Budget and Schedule

A work breakdown structure (WBS) will be developed during the project's next phase and prior to the procurement phases to provide a framework to estimate costs and develop schedule in relation to the work tasks. The WBS will be revised and updated by the project managers as project conditions change for each project phase, in coordination with the project controls program area.

### *9.4.1 Project Management Controls*

The Project Management Controls are comprised of four sections. The *Work Planning and Monitoring* section is responsible for the development and implementation of policies and procedures to control and manage work tasks, schedule and budget. The *Document Controls* section will be responsible for developing and maintaining a system for the storage, retrieval, reproduction and distribution of project documents and correspondence. The *Invoice Review* section will process all invoices and the *Project Metrics* section will track project metrics. A project controls manager will be designated by M-1 RAIL to lead the four sections.

### *9.4.2 Project Reporting and Tracking*

A key element of the project controls for the M-1 RAIL Streetcar Project is a project reporting and tracking structure. The project manager for each project phase in coordination with the project controls manager will provide monthly progress reports on the project status. The intent of the monthly reporting is to provide timely project control information to the M-1 RAIL project management team so that action is taken to prevent schedule and budget slippage and manage quality issues as they arise. The report will include a narrative executive summary that rolls up detailed monthly reporting on:

- **Project Activities and Deliverables** – the detailed monthly report will identify project activities underway and completed during the reporting period. The report will also provide a preview of activities and deliverables for the upcoming two-month period. Change orders will be included, along with a summary of implications to project schedule and budget.
- **Action Items and Outstanding Issues** – this portion of the report will include a clearly formatted listing of items and issues requiring action or resolution, the responsible person(s), and due dates. Once action items are complete and/or resolved, they will be dropped from the agenda, but the project manager will maintain a log of action items to document procedures and decisions on actions and issues.
- **Project Schedule** – the monthly report will include a project schedule, in Gantt chart format, that integrates design and construction contract milestones. The schedule format will illustrate how potential delays affect the overall project schedule. The schedule will be updated, as needed for monthly report and the schedule status will report the overall project completion percentage versus the latest approved plan percentage. The completion percentages will be based on detailed completion schedules for major activities, including design contracts, construction, public outreach and environmental monitoring. The report will outline reasons for schedule delays and actions implemented to eliminate or reduce delays.
- **Project Cost** – Project costs will be reported using an Earned Value Management approach. This approach links scheduled tasks with the budget assigned to those tasks. The approach allows the project manager to monitor the current approved budget against the baseline budget and projected cost estimates to complete tasks. The report will explain differences between budgeted and projected costs and, if needed, summarize plans to manage costs where they exceed the budget.
- **Project Quality** – Project QA/QC activities will be summarized in the monthly report, and will identify quality deficiencies and a plan to correct them.

Other status reports that may be included in the monthly updates include DBE usage, environmental mitigation compliance and monitoring, public outreach activities and issues, design and construction reviews, compliance with federal grant requirements and safety performance. M-1 RAIL will determine the type and frequency of additional reporting requirements through further coordination with FTA.

## 9.5 Design QA/QC

Quality Assurance and Quality Control (QA/QC) procedures are conducted throughout the life of the M-1 RAIL Streetcar Project, including design, procurement, inspection, construction and testing of the project. M-1 RAIL, in coordination with the envisioned QA/QC Independent Consultant, is ultimately responsible for the development of QA/QC procedures. M-1 RAIL envisions establishing a Quality Assurance Oversight Committee (a component of the Technical Committee) specifically responsible for QA/QC oversight. The QA/QC process will comply with the FTA "Quality Assurance and Quality Control Guidelines," FTA-IT-90-5001-02.1, February 2002.

The Quality Assurance Oversight Committee will develop a QA/QC Plan and will oversee implementation through management activities and quality assurance audits. The plan establishes guidelines and practices to be implemented by the project phase managers, consultants, and contractors to assure that the streetcar design products, equipment and services meet the project design criteria and M-1 RAIL expectations in a cost-effective and timely manner.

The Quality Assurance Oversight Committee will review and approve all design consultant and contractor quality plans for consistency with the QA/QC Plan, the PMP and FTA requirements. The Quality Assurance Oversight Committee will ensure that quality audits are planned, scheduled and completed as outlined in the plan. Results of quality audits will be reported through monthly project reporting to the Steering Committee. M-1 RAIL's project manager will ensure follow-up on identified quality problems and will participate in resolving issues of non-conformance, deviations and waivers that potentially change design and quality requirements.

The project director will be responsible for the design oversight of the streetcar system. The QA/QC responsibilities will include oversight of conformance with design criteria, alignment design; surveying and mapping; right-of-way engineering; geotechnical surveys and test borings; vehicle storage and maintenance requirements; facilities engineering and architecture; vehicle engineering; system engineering; engineer's estimates of capital costs; review of standard specifications and development of special provisions; utility coordination; environmental commitments and local, state, and federal approvals and permits.

Consistent with FTA guidance and the Streetcar QA/QC Plan, the design QA/QC procedures will include:

- Design standards and criteria.
- Procedures for preparing and checking individual plans, specifications, estimates, calculations and other submittal items.
- Procedures for preparing and checking unique or highly specialized designs.
- Procedures for coordinating work performed by different persons for related tasks, to ensure that conflicts, omissions, or errors do not occur between drawings or between drawings and other design documents.

- Procedures for coordinating and obtaining permits from permitting agencies, utility companies, and railroad companies. The procedures will also outline how permitting, utility, and railroad requirements are incorporated into the design of the project; and how the project phase manager will oversee coordinating submittals and agency reviews such that the overall project schedule is not delayed.
- Level, frequency, and methods of review of the adequacy of the total project design. Methods by which all final design documents will be independently reviewed; verified for constructability, completeness, clarity, and accuracy; and back-checked.
- Level and frequency of audit and oversight design reviews (concerning QA/QC and validity of consultant payments) to be performed by the project phase manager, independent consultants, and/or other agencies.
- Procedures for reviewing and checking design drawings and documents required during construction.
- Qualifications for all key design personnel.
- Documentation and submission procedures to ensure that the established design QA/QC procedures have been followed.

## 9.6 Construction QA/QC

The M-1 RAIL project director will work with the appropriate package project manager for construction to use experienced professionals who will oversee QA/QC procedures for that phase. Although construction contractor firms will be responsible for assuring the quality of their work, the Independent QA/QC Consultant and the Quality Assurance Oversight Committee will be responsible for making sure quality assurance procedures are being followed. In addition, the Quality Assurance Oversight Committee is responsible for conducting formal Quality Assurance audits at regular intervals. These audits will assess compliance with the Streetcar QA/QC Plan.

The construction project manager will prepare a Construction QA/QC Plan. The plan will outline construction QA/QC procedures that adhere to FTA guidelines. This includes QA/QC for construction materials, materials testing, construction inspection, signals and systems, constructability reviews, the level and frequency of QA audits and oversight construction reviews and contract close out.

## 9.7 Environmental Management

The FTA issued a Record of Decision for the Woodward Avenue Light Rail (WALR) Project Locally Preferred Alternative (LPA) on August 31, 2011 consistent with the requirements of the National Environmental Policy Act (NEPA) of 1969. The M-1 RAIL Streetcar Project was very similar to one of the alternatives (“B3”) evaluated in the Final Environmental Impact Statement for that project. The current M-1 RAIL Streetcar Project scope is slightly different and hence FTA has determined that additional

analysis is required to document the social, economic, and environmental impacts of the M-1 RAIL Project.

### *9.7.1 Preparation of NEPA Documents*

Upon issuance of a TIGER IV grant, M-1 RAIL will initiate a Supplemental Environmental Assessment (EA) to evaluate the impacts of the M-1 RAIL scope of work. The scope of work for this EA will focus on justifying to the public and other agencies:

- Why M-1 RAIL is changing course from the environmentally-preferred median running alternative to a combination curb-running/median running alternative.
- How a streetcar alternative running entirely on Woodward Avenue fulfills the purpose and need that was included in the WALR.
- How a downtown streetcar fulfills the purpose and need bullet of transportation equity and adheres to the newly passed Complete Streets legislation in Michigan.

As part of the development of the EA, M-1 RAIL intends to develop a robust public outreach program that will be sensitive of the context of Woodward Avenue, including a focus on coordinating with environmental justice communities and Section 106 (historic resources) stakeholders.

### *9.7.2 Compliance with Environmental Mitigation Commitments*

M-1 RAIL, working with its public partners, will comply with environmental mitigation commitments that will be developed as part of the Supplemental EA/FONSI document. M-1 RAIL intends to use the project committee structure discussed in **Section 9.1** (Special Divisions, Environmental Monitoring) to assure compliance with environmental commitments are met throughout the life of the project delivery schedule.

## 9.8 Land Acquisition

The only land acquisition required for the M-1 RAIL Streetcar Project is for the VSMF. In the event that land acquisition is required for the Bethune or Amsterdam sites for the maintenance facility, M-1 RAIL will follow acquisition procedures consistent with the Federal Uniform Relocation and Real Property Acquisition Policies Act and guidance of FTA Circular C5010.1D. If required, M-1 RAIL will develop a Real Estate Acquisition Management Plan (RAMP). The RAMP will be the guide to establish acquisition methods and help with early identification of issues that could affect the project scope, schedule and budget.

## 9.9 Safety and Security

As M-1 RAIL prepares for the start of revenue service several steps must be taken to ensure safe and efficient operation of the streetcar system. Ensuring the safe operation of the system requires both

training of personnel and testing of equipment. As during the design phase, personnel training and testing plans will be developed. M-1 RAIL will coordinate with both MDOT and the City of Detroit during the development of all training and testing plans.

## 9.10 Traffic Management

Since the project will be built and operated in active traffic lanes, maintenance of traffic and communicating construction activities to a variety of stakeholders will be important. M-1 RAIL will require the Owner's Representative and design project phase manager to prepare maintenance of traffic (MOT) plans as part of the contract documents. The MOT will include coordination procedures during design and construction regarding placement of temporary signing and traffic control devices, and restrictions during special events. The MOT procedures also will outline coordination and communications with emergency service providers. The MOT plan will include an incident management plan for emergency procedures and measures to avoid and minimize accidents. The construction contractor will be required to implement and comply with MDOT plans (for the section of the corridor north of Adams Street) and the City of Detroit (for south of Adams Street) throughout the life of project construction.

During construction, the contractor will coordinate with the project phase manager to review conformance with, and effectiveness of MOT plans. The contractor will provide regular updates to the construction project phase manager and Public Involvement/Media Relations, who will maintain traffic updates with media outlets. The contractor will also provide updates to project manager for project reporting discussed in **Section 8.3**.

## 9.11 Project Communications

Steering Committee Communications

The M-1 RAIL Communications Team envisions holding monthly project updates with the Project Steering Committee. All Steering Committee communications, including agenda's, meeting material, and proposed external project communication material will be routed through the M-1 RAIL COO. Copies of all formal correspondence and meeting minutes with the Project Steering Committee will be part of the project file.

Committee Communications

During the project delivery phase, M-1 RAIL envisions holding weekly coordination and project progress meetings between M-1 RAIL Project Committee members and the design/build consultant and contractor team(s). At the outset of the project delivery phase (envisioned to be some form of design/build), the M-1 RAIL project director will determine the need and frequency of additional, more focused meetings such as technical team meetings and public involvement team updates. All proposed

communication for these meetings will be routed through the M-1 RAIL COO, Technical and Communications Team as appropriate. The M-1 RAIL Communications Team will schedule regular communication protocol/update meetings between the Design/Build Delivery Contractor Teams, M-1 RAIL Team Members, key MDOT project delivery staff, and key City of Detroit technical staff as needed to assure clear lines of communications are maintained throughout the project. Minutes of those meetings will be kept. Draft versions of those minutes will be circulated among the attendees for comments and corrections prior to their formal distribution and inclusion into the project file.

The Project Communications strategy is described in more detail in **Appendix G.3**.

## 9.12 Community Relations

Public outreach, and in particular to community stakeholders, has been an important component of the M-1 RAIL Streetcar Project from the onset through the current project phase. Moving forward, the objective of the communication effort is to develop and implement a plan to provide information about the project that is accurate, transparent and as complete as possible.

M-1 RAIL's Communications Team, working closely with the M-1 RAIL COO, MDOT's Office of Communication, and the City of Detroit, will be responsible for all media and public information (internal and external) efforts for the project in order to provide "one voice" for the project. M-1 RAIL's Communications Team also will serve as a contact with the City of Detroit Mayor's Office and the Governor's Executive Office. The Communication Team will work closely with the M-1 RAIL Legal Team to coordinate communication with elected/appointed officials.

News and updates regarding the M-1 RAIL Streetcar Project will be communicated via media advisories and news releases; postings to the project Web site (www.M1RAIL.org) and the MDOT Web site (www.michigan.gov/mdot) under the Active Construction Projects Tab; PowerPoint presentations to key corridor stakeholders, fact sheets, flyers, and brochures; and, other print or electronic communications. Any required legal notices posted regarding the project will be coordinated with the M-1 RAIL Legal Team, SEMCOG, and MDOT.

Communications are envisioned to revolve around information about the project timeline; scheduled milestone completion dates; significant contracts advertised, awarded or completed; and total cost projections.

Another goal of the M-1 RAIL Communications Team will be to work cooperatively with MDOT to proactively convey commuter and traffic information, including traffic pattern changes, periods of lane closures, alternate routes and alternate forms of transportation available along the Woodward Avenue corridor. This will be achieved via media alerts, news releases and postings to MDOT's Mi Drive traffic Web site (www.michigan.gov/drive).

Other communication vehicles that the M-1 RAIL Communications Team may consider and employ during the project delivery phases include:

- Surveys
- Public meetings
- Project tours
- Media briefings
- Project newsletter
- Public information and citizens' advisory meetings
- Ribbon-cuttings and groundbreaking ceremonies

Use of these products will be developed as the project implementation proceeds.

## 9.13 Civil Rights Program

Should the M-1 RAIL Streetcar Project receive federal funding, M-1 RAIL will abide by federal hiring and labor requirements. Furthermore, M-1 RAIL also will comply with other federal labor requirements regardless of funding source.

M-1 RAIL will comply with the Code of Federal Regulations 49, Part 26, which requires all recipients of US Department of Transportation (DOT) federal assistance funds to implement and enforce a Disadvantaged Business Enterprises (DBE) program. The DBE program must seek to ensure nondiscrimination in contract awards that are federally funded and create a level playing field on which DBEs can compete fairly for DOT-assisted contracts.

M-1 RAIL shall not discriminate on the basis of race, color, national origin, or sex in the award and performance of any DOT-assisted contract or in the administration of its DBE program through the requirements of 49 CFR Part 26. M-1 RAIL shall take all necessary and reasonable steps under 49 CFR Part 26 to ensure nondiscrimination in the award and administration of DOT assisted contracts.

Other applicable federal programs that M-1 RAIL and its design consultants and contractors will adhere to include:

- Section 19 of the Surface transportation Assistance Act of 1978 which states that no person on the basis of race, color, creed, national origin, sex or age, shall be excluded from participation in, be denied the benefits of, or be subject to discrimination under any project, program, or activity funded in whole or in part through FTA financial assistance;
- Title VI of the Civil Rights Act of 1964;
- Equal Employment Opportunity;
- Buy America
- Americans with Disabilities Act of 1990.

M-1 RAIL and its design consultants and contractors will also comply with federal compensation requirements, such as the Davis-Bacon Act, 40 USC; the Copeland Act, 18 USC Section 874, at Seq. as supplemented by the Department of Labor regulations set forth in 29 CFR Parts 1 ,3, 5, 6 and 7.

M-1 RAIL will require its consultants and contractors to collect and maintain documentation to demonstrate compliance with applicable federal rules and programs.

## 9.14 Closeout Plan

As the M-1 RAIL Streetcar Project nears substantial completion, the contractor will require a pre-final inspection to be conducted by M-1 RAIL and their Owner's Representative, the project phase manager, the contractor and other third parties, as appropriate. If M-1 RAIL concurs that the project is substantially complete, it will provide certification and a list of remaining items to be completed or corrected. The certification assures that the work performed complies with contract documents, as well as modifications due to change orders. If M-1 RAIL and their Owner's Representative determine that the project is not substantially complete, then it will conduct a second pre-final inspection when outstanding items are satisfactorily completed.

Once the contractor has completed the list remaining tasks from the pre-final inspection, it will request a final inspection from M-1 RAIL. After M-1 RAIL and its inspection team confirm that work is satisfactorily completed, M-1 RAIL will issue a certificate of completion, indicating final acceptance.

It may be necessary for M-1 RAIL to take beneficial occupancy of facilities prior to final completion. This may be necessary (beneficial occupancy of the maintenance facility, for example) in order to allow equipment installation, testing and start-up procedures by other contractors. M-1 RAIL would take beneficial occupancy as permitted by contract specifications.

## 9.15 Project Documentation

The Project Controls area includes a Document Controls section. This section will develop a system for the storage, retrieval, reproduction and distribution of M-1 RAIL Streetcar Project documents and correspondence. Project phase managers, design consultants and contractors will be required to coordinate project documents with the Document Controls section.

At project close out, the Document Controls section will coordinate with each contractor project manager to prepare a complete set of record documents to reflect the as-built/as-installed conditions of the contract, and prior to final acceptance. The Document Controls section will confirm that records are complete, legible, machine readable, and, as appropriate, CADD system compatible. The project records will be filed at M-1 RAIL's offices located within the offices of the Detroit Downtown Partnership.

## 9.16 Agency/Stakeholder Agreements and Coordination

M-1 RAIL has teamed with the City of Detroit (via DEGC), the Michigan Department of Transportation (MDOT), and SEMCOG to promote and advance the M-1 RAIL Streetcar Project along the Woodward Avenue corridor. The following section describes each relevant agency/stakeholder and their respective project responsibilities as part of the M-1 RAIL Streetcar Project.

- **SEMCOG:** SEMCOG is proposed to be the Federal Grantee of the TIGER IV grant, if awarded. M-1 RAIL will work cooperatively with SEMCOG and FTA to develop a sub-recipient grant agreement between each agency.
- **MDOT:** MDOT will be required to issue an operational permit to operate a Streetcar System within MDOT's right of way from Adams Street north to the northern project limits near Bethune Street. Additionally, close coordination will occur with MDOT during the design and construction phases to assure MDOT's reconstruction project and the M-1 RAIL Streetcar Project is closely coordinated. A funding agreement will also be required between the State of Michigan (potentially MDOT) and M-1 RAIL if an annual operating subsidy is provided. The project will also be required to meet the State Safety Oversight (SSO) requirements in coordination with the SSO Officer as administered by MDOT.
- **City of Detroit:** The City of Detroit will be required to issue an operational permit to operate a Streetcar System within the City's ROW from Adams Street south to Congress Street. Additionally, several city departments will have review functions during the design phase and will need to be coordinated with regarding the relocation of existing City assets (i.e., utilities, partial vacation of city street, etc.) M-1 RAIL also anticipates on coordinating with several City Departments during the design phase including: Parking, Traffic and Engineering, Public Lighting Department, Fire Department, Public Works, Planning Department, and DWSD.
- **DEGC:** DEGC is a private non-profit organization that is dedicated to creating new investment and jobs in the City of Detroit by providing technical, financial and development assistance to the City and business community. By combining public sector policy and direction with private sector leadership, DEGC is able to actively strengthen Detroit's economic base. For the M-1 RAIL Streetcar Project, DEGC's technical assistance will consist of providing technical and financial reviews, negotiating and establishing any required development agreements between the City of Detroit and M-1 RAIL.
- **FTA:** The Federal Transit Administration will provide oversight of the TIGER grant and will assure compliance with Federal procurement requirements including Buy America. If awarded, M-1 RAIL will be required to enter into an agreement between FTA and SEMCOG to transfer the TIGER IV funding to M-1 RAIL.
- **FHWA:** The Federal Highway Administration will provide technical and financial accounting oversight of MDOT's reconstruction scope of work. M-1 RAIL will coordinate with MDOT and FHWA to assure necessary documentation is provided to meet FHWA review requirements.

- **DTE:** Detroit Edison will be the power provider for the M-1 RAIL Streetcar system. M-1 RAIL has initiated preliminary discussions with DTE, and they intend to be a financial partner in the project.
- **SHPO:** M-1 RAIL envisions entering into a Memorandum of Agreement with the State Historic Preservation Office (SHPO) to provide required mitigation for adverse impacts to historic resources located along the Woodward Avenue corridor.

M-1 RAIL will own and operate the streetcar service utilizing a contracted private operator. **Table 9.1** describes each relevant agency/stakeholder and their respective project responsibilities as part of the delivery of the M-1 RAIL Streetcar Project.

## 9.17 Joint Development Program

M-1 RAIL has identified several opportunities for joint development along the Project corridor. There may be additional opportunities for joint development of property on or adjacent to the Project's right-of-way by current or future landowners or developers. M-1 RAIL will promote and encourage transit-oriented joint development, and quality public and private projects at and around M-1 RAIL facilities to enhance communities, build transit ridership and aid economic development. The potential for joint development created by the Project will be analyzed further during the design phase. Among the types of benefits that could be derived from joint development are:

- Donation of real estate in exchange for location and design adjustments favoring the donor;
- Joint-development of a station site plan such that the other party's commercial holdings gain increased benefit due to the station patrons; and
- Use of right-of-way for new utility lines or fiber-optic facilities.

Opportunities for joint development will be evaluated with regard to the probability of enhancing transit use and satisfying community goals, revenue generation/cost reduction potential, legal and administrative feasibility, public acceptability, and likelihood of implementation. Emphasis will be placed on identifying prime opportunities for joint development from a list of candidate options.

## 9.18 Federal Compliance

The M-1 RAIL Streetcar Project will be completed in accordance with all applicable federal laws, rules, and procedures, including, but not limited to the Brooks Act, Buy America, Title VI, Davis-Bacon, and DBE.

## 9.19 Project Liability

M-1 RAIL will carry all project liability requirements during the course of the project delivery phases.

## Table 9.1 - Program and High-Level Project Management Responsibilities

| Task | M-1 RAIL | MDOT | SEMCOG | City of Detroit | FTA | FHWA | Contractor/ O&M | Owners Rep/ GEC | QA/QC Reviewer |
|---|---|---|---|---|---|---|---|---|---|
| NEPA Clearance | Perform | Participate/ Review | Support | Participate/ Review | Approve | Participate | | Prepare | |
| Project Management | Manage | Participate | Support | Participate | Participate | Participate | Perform | Perform | |
| Owner's Rep. Procurement | Perform/ Manage/ Approve | Support | | Support | | | | Participate | |
| Mainline D/B Procurement | Oversee/ Accept | Accept | | Accept | Support | Support | Perform | Prepare | |
| VSMF D/B Procurement | Oversee/ Accept | Accept | | Accept | Support | | Perform | Prepare | |
| TIGER Grant Agreement | Accept | Review | Accept | Review | Approve | Support | | | |
| Mainline Design | Accept | Approve | | Approve | Participate | Participate | Manage/ Prepare | Perform/ Oversee | |
| VSMF Design | Accept | Review | | Review | Participant | | Manage/ Prepare | Perform/ Oversee | |
| Design QA/QC | Accept | Approve | | Approve | Participate | Participate | Prepare | Perform | Perform/ Manage |
| Vehicle Procurement | Accept | Support | | Support | Participant | | Prepare | Manage | Perform/ Manage |
| MDOT Operational Permit | Manage | Approve | Support | Support | Support | Participate | Perform | Perform | |
| CoD Operational Permit | Manage | Support | Support | Approve | Support | Participate | Perform | Perform | |
| Mainline Construction | Oversee/ Approve | Oversee/ Accept | | Oversee/ Accept | Participate | Participate | Perform/ Manage | Perform/ Oversee | |
| VSMF Construction | Oversee/ Approve | Support | | Support | Participate | | Perform/ Manage | Perform/ Oversee | |
| Construction Management | Oversee | Approve | | Approve | Participate | Participate | Perform | Perform/ Manage | |
| Construction QA/QC | Oversee | Approve | | Approve | Participate | Participate | Perform | Perform | Perform/ Manage |
| Testing & Commissioning | Approve/ Accept | Participate | | Participate | Oversee | Oversee | Manage | Perform | |
| Safety/Security Certification | Oversee | Accept | | Support | Accept | Support | Perform | Perform | |
| Operational Readiness | Perform/ Accept | Approve | | Approve | Participant | Participant | Support | Support | |

**Definitions of roles and responsibilities:**

Accept: Concur or resolve issue per enabling legislative authority or executed MOU

Approve: Accept before work can proceed

Manage: Direct day-to-day task completion

Oversee: Monitor task completion

Participate: Take part in task completion

Perform: Conduct task as specified in procedure or contract documents

Prepare: Develop necessary documents

Review: Read or become familiar with a work item

Support: Respond to requested items and actions

# 10 PROJECT SCHEDULE

M-1 RAIL desires to advance the project to the construction phase as quickly as possible to utilize the capital funding commitments made by its funding partners and to coordinate with MDOT's reconstruction project. M-1 RAIL commits to maintain a project schedule that will be responsive to updated conditions and information, address known schedule risk factors, and incorporate best practices and current market conditions for infrastructure project delivery that could expedite the timeline.

## 10.1 Project Schedule

As shown in **Figure 10.1**, and provided in complete detail in **Appendix F.1,** M-1 RAIL has developed an updated project schedule which accounts for the following factors:

- M-1 RAIL's built in "toll gate" milestones
- M-1 RAIL's preferred hybrid project delivery approach
- M-1 RAIL's innovative private/philanthropic funding and project delivery approaches
- MDOT's reconstruction project
- Current market conditions related to vehicle acquisition
- Buy America and other federal project delivery requirements, and the
- Factors and risks identified in **Sections 9.2** and **9.3**, respectively.

## 10.2 Factors Impacting Schedule

M-1 RAIL has identified the following factors by phase that may influence the overall duration of the project schedule. These factors have been accounted for during the development of the updated project schedule:

**Environmental Clearance Phase**: M-1 RAIL will need to obtain environmental clearance for the M-1 RAIL Streetcar Project. FTA has recommended to M-1 RAIL that a Supplemental EA to the Record of Decision issued in 2011 for the WALR project is the appropriate level of documentation. M-1 RAIL's schedule assumes commencing the development of the Supplemental EA in June once the TIGER IV grant awards have been announced. M-1 RAIL is hopeful FTA will be able to issue a Finding of No Significant Impact (FONSI) by late 2012.

**Finance Team Actions:** Following completion of the 90-day validation effort, M-1 RAIL's Finance Team will assemble an implementation plan to deliver the necessary capital funds. The finance portion of M-1 RAIL will continue in parallel with all other project elements as the project progresses to satisfy the

project's proposed cash flow needs. The schedule assumes a series of "toll gates" that will require approval by the M-1 RAIL Board.

**M-1 RAIL Board Actions:** M-1 RAIL's schedule incorporates a series of M-1 Board Approval actions as well as quarterly update meetings to keep the board updated as the project progresses. The project schedule also has multiple project validation points or "toll gates" where the M-1 RAIL Board will conduct a business assessment to determine whether or not the project remains technically and financially feasible to implement. Key toll gates included in this schedule, requiring M-1 RAIL Board approval to proceed, include:

- Signature of TIGER IV Grant Award Subrecipient Agreement with SEMCOG
- Signature of MOU with City of Detroit/State of Michigan outlining key tenets of project delivery, risk sharing, and requirements for issuance of operating permits
- Land acquisition for project elements
- Completion of Financing Agreements with respective funders/lenders
- Upon receipt of final bids from CMGC & D/B firms for Delivery Packages 1 (Vehicles), 2 (VSMF), & 3 (Mainline Site/Civil work)

**Design & Construction Phases:** M-1 RAIL will need to update its 20% complete design plans to reflect the Project's current scope of work and to reflect updates agreed upon as part of the 90-day validation, including:

- Median running to the north of Burroughs Street to the project's northern terminus
- Final VSMF location
- Cross-overs (near Sibley, Gratiot and Congress Streets)
- Median southern terminus south of Campus Martius
- Updated station and TPSS locations
- Removal of OCS if a hybrid off-wire vehicle is deemed feasible
- Changing rail type (Tee Rail or 112 TRAM block rail)

As currently constructed, the schedule divides the design and construction of the M-1 RAIL Project into two tracks, a Construction Management/General Contractor (CM/GC) Track for the road and mainline rail and a Design-Build Track for the Vehicle Maintenance Storage Facility (VMSF) and the nineteen (19) stations. The two tracks will be run concurrently thru design and construction, with the critical path progressing through the CM/GC activities.

Additionally, M-1 RAIL will need to work with MDOT to update and incorporate MDOT's desired 4R reconstruction between Chandler Street and Sibley within the project limits. MDOT currently has a completed plan set for a mill and resurface project; however, this design will need to be updated to reflect the new reconstruction scope of work. In order to accurately develop a cost-sharing agreement between the M-1 RAIL Streetcar Project and the MDOT reconstruction project between Chandler and Sibley Streets, M-1 RAIL and MDOT have agreed to take the site/civil plan elements through the

Preliminary Plan phase (75% complete) and hold a Grade Inspection (GI) meeting to review the plan deliverables. Taking the design plans to this level of development prior to soliciting bids for a D/B contractor will document the appropriate cost-sharing between the projects and reduce overall risk as part of the project delivery process.

**Site/Civil Work Using a CM/GC Project Delivery Approach:** Design will be completed to a Preliminary Plan (75% level) during development of the CM/GC Procurement Document Proposal. The proposal documents will include, but not be limited to, drawings and specifications for track, traffic, utilities, and the stations. After the proposal letting process is complete, the selected CM/GC will assist in developing and finalizing the design documents and acquiring necessary permits for construction.

## 10.3 Schedule Assumptions

The following summarizes assumptions made during the development of the schedule.

- M-1 RAIL has assumed construction will commence with the northbound rail alignment, followed immediately by the southbound rail alignment. Three crews will work concurrently to reconstruct Woodard Avenue and install rail. One crew will be working from Congress Street to Adams Avenue, south of I-75, while the other two crews will start at Willis Street and progress in opposing directions to the VMSF and Adams Avenue. In addition, the reconstruction of the I-94 and I-75 overpasses, and installation of the OCS and substations will start and complete within the time allotted for northbound mainline alignment construction.
- Like the northbound phase, the southbound Woodward Avenue reconstruction and rail installation will start at Congress Street and Willis Street, immediately following the completion of the northbound alignment between Adams Avenue and the VMSF. Two crews will start at Willis and progress in opposing directions to Burroughs Plaza and Adams Avenue, while a third crew will construct the southbound rail line between Congress Street and Adams Avenue. As with the northbound alignment, reconstruction of the I-94 and I-75 overpasses, and installation of the OCS and substations will start and complete during the southbound mainline alignment construction.
- Critical to the design and construction of the rail stations will be the selection of the final vehicle. The current schedule shows station construction commencing approximately two months after the northbound road and rail construction, to allow for demolition and curbside utility activities to stay ahead of station construction. Once the station construction commences, M-1 RAIL has assumed that a minimum of two and maximum of three stations will be under construction at the same time, to ensure they are completed in support of the commissioning activities for the entire system.

Following the aforementioned assumptions, the critical path for the project runs through the CM/GC Track, starting with RFP development and design completion and then traveling through the Adams to

VMSF northbound alignment and Adams to Burroughs southbound alignment, before finishing with commissioning and closeout activities.

## 10.4 Schedule Phases

Key phases of the Project Schedule are described below, and depicted in **Figure 10.1**.

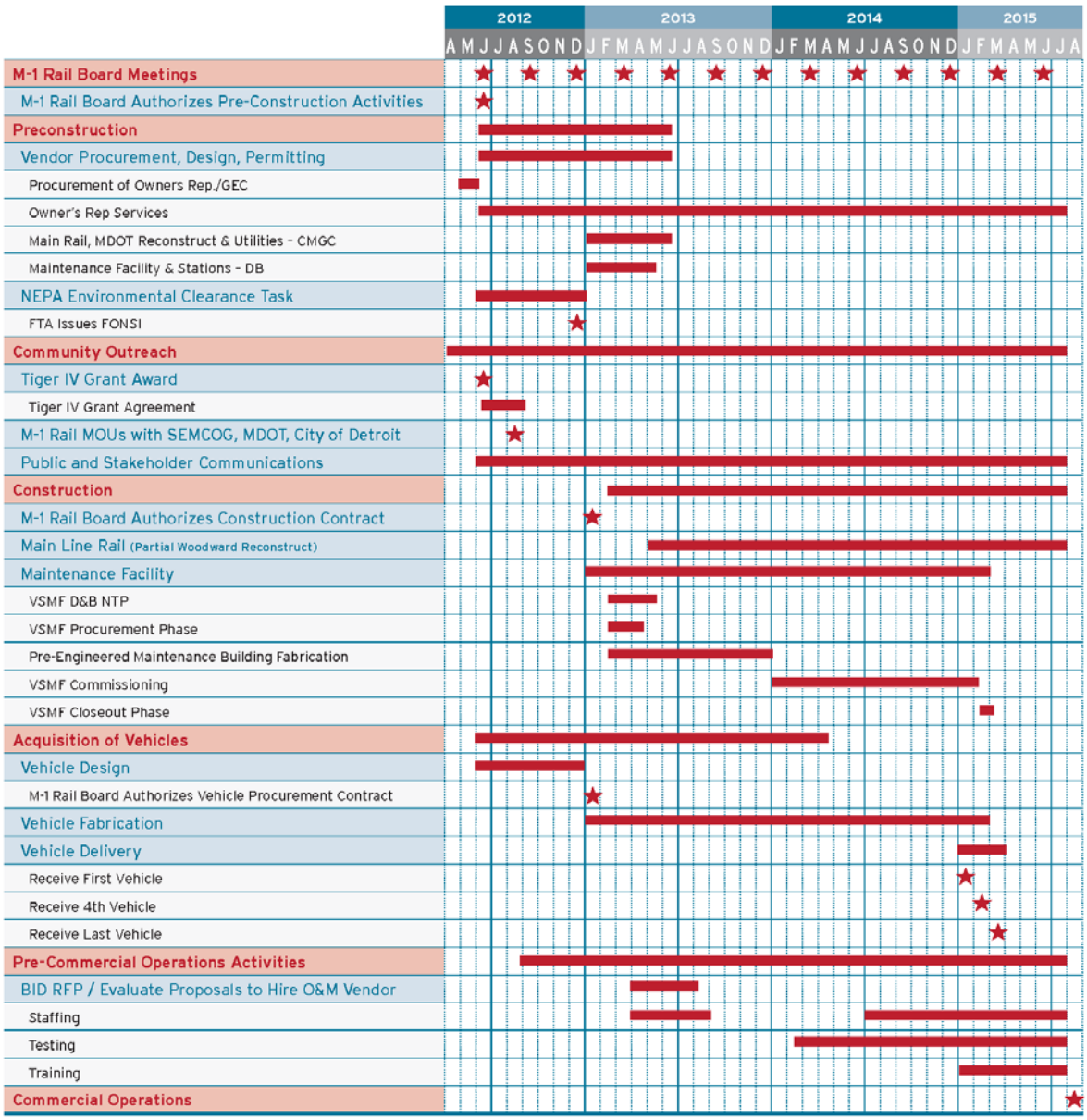
**Design-Build VSMF & Operational Systems**: Concurrent with the development of the CM/GC design and RFP, the Design-Build documents for the VMSF and system elements (OCS & TPSS) will progress to a 30% level of completion before the RFP is issued. Following award to the successful Design-Build contractor, M-1 RAIL assumes the design will be broken into two design packages. Design Package 1 (DP-1) will be a fast track package for site, utilities, foundations and structural frame. DP-2 Design will include all remaining work (i.e. mechanical, electrical, plumbing, architectural, etc...) and will proceed concurrently with DP-1 design. While DP-1 will progress to 95% to 100% design completion before its initial review, to expedite the start of construction, DP-2 will include an interim (50% design complete) and final design review period and subsequent meeting. However, DP-2 will be completed so as to support continued construction of the VMSF.

Construction activities at the VMSF site will start immediately after the M-1 RAIL Board acceptance of the DP-1 design documents. As shown in the schedule, M-1 RAIL anticipates that the VMSF will be a pre-engineered building (PEMB), and as such, M-1 RAIL will expect that the professionally stamped design drawings for the PEMB will be submitted and accepted as part of the DP-1, thereby permitting fabrication to also commence upon board acceptance of DP-1. As would be expected for a building of this size, the critical path for the VMSF will travel through the foundations, steel erection, enclosure, interior wall and utility rough-in, building finishes, commissioning and closeout.

**Vehicle Acquisition:** M-1 RAIL has built enough time into its project schedule to allow for both a traditional vehicle procurement approach or piggybacking onto an existing vehicle order. M-1 RAIL realizes the vehicle procurement lead times are a major constraint and are likely to be the project schedule's critical path for commissioning and commencing operation of the streetcar system.

**Real Estate Acquisition Phase:** The project schedule was developed accounting for time to acquire necessary permanent and temporary real estate needed in accordance with the Uniform Relocation Act for specific project elements including, but not limited to; the Vehicle Storage and Maintenance Facility, traction substations, and construction staging areas.

**Figure 10.1 M-1 RAIL Key Project Schedule Elements**



**Commissioning/Start-up Phase**: As discussed in **Section 9**, M-1 RAIL intends to hire an operator who will be responsible for the comprehensive operations and maintenance requirements of the streetcar system. The schedule has built in time to allow for the necessary commissioning activities that must occur before commercial operations begin. M-1 RAIL has incorporated its preliminary vision for staffing, training, and a preliminary startup plan that incorporates both facility and vehicle testing.

With all of the aforementioned activities, M-1 RAIL estimates that the earliest date for commercial operations on the M-1 RAIL system to begin would be August 1, 2015.

## 10.5 Schedule Risk Factors

M-1 RAIL has coordinated with MDOT and the City of Detroit to identify initial project risks associated with the scope, schedule and budget. A complete listing of all risks identified during these risk sessions can be found in **Appendix F.2**. The identified risks that are likely to impact the project schedule include:

- Design updates need to be completed to bring the M-1 RAIL and MDOT plan sets up to a consistent deliverable that contractors can bid on,
- MDOT has design plans completed for a 3R (mill and resurface) fix only. MDOT expects the M-1 RAIL designer/contractor to update the plans for a 4R reconstruct,
- Added reviews by MDOT/City of Detroit that may limit efficiency of Design-Build approaches,
- Limited specialized streetcar/rail experience (i.e., electrification, communications, etc.) within review agency's likely to add time to approve Design-Build documents,
- ROW acquisition at parcels north of Bethune Street needed to accommodate VMSF,
- Utility relocations,
- Woodward Avenue Bridge over I-94 is scheduled to be reconstructed in 2021 to accommodate the I-94 Modernization Project, and
- Buy America reporting requirements will need to be satisfied which could add time to procurement

As the project advances into the next phase, these risks will be tracked and appropriate risk mitigation strategies will be developed to minimize overall schedule delays.

# 11 SYSTEMS OPERATIONS AND MANAGEMENT

## 11.1 Project Operations Organization

This section discussed how the M-1 RAIL Streetcar Project will be organized and staffed for project operations and maintenance. As the project proceeds, this section will be modified to reflect operations and maintenance agreements and further descriptions of responsibilities.

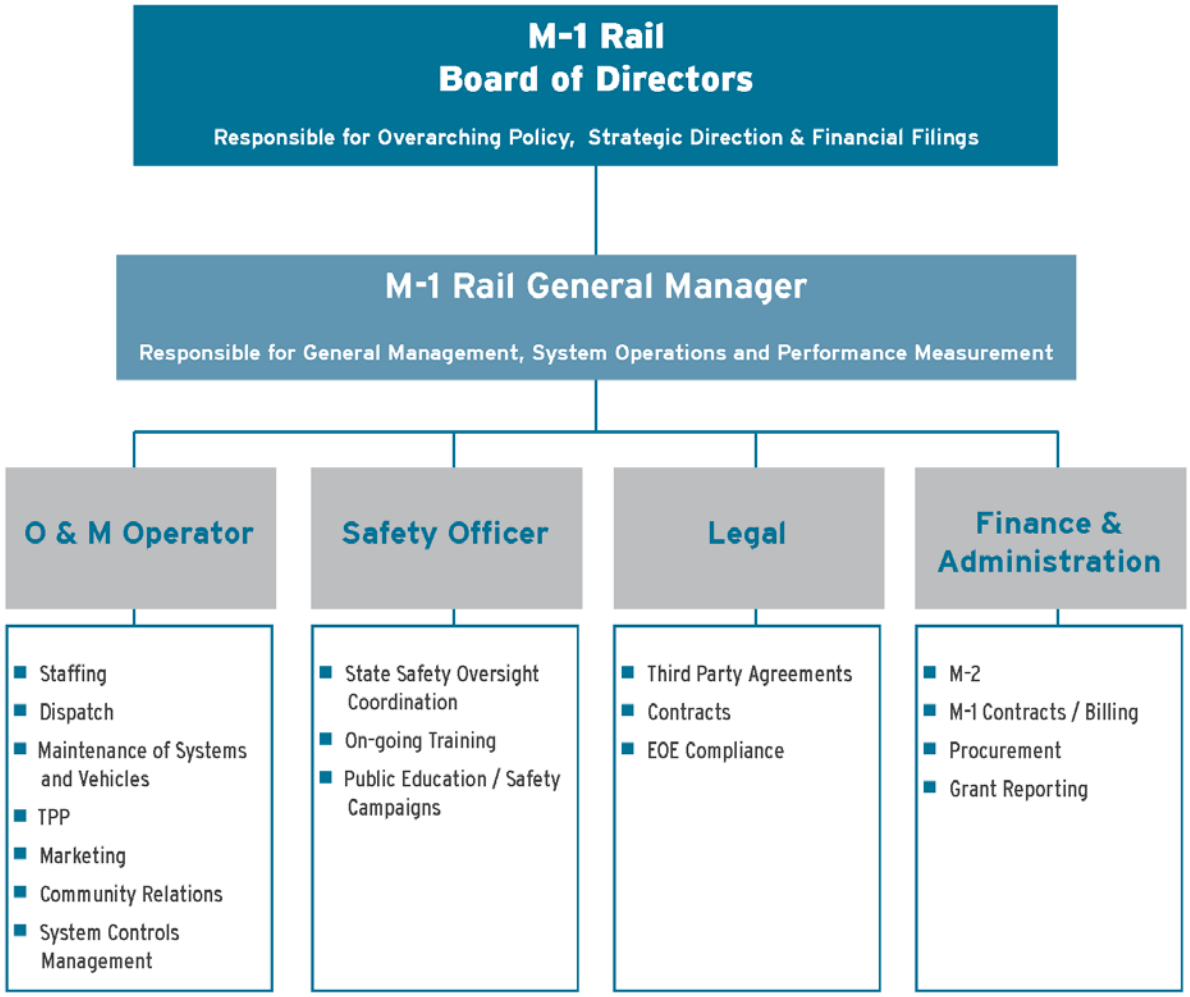
### *11.1.1 Short Term Operations (Years 1-10)*

Systems Operations and Management will initially be undertaken and overseen by M-1 RAIL. M-1 RAIL is a non-profit public/private partnership 501(c)(3), enabled by Michigan legislation to design, build, operate, and maintain a street railway in the public right-of-way. Legislation allows an annual operating subsidy in the annual state budget for M-1 RAIL. In addition, the legislation permits additional MDOT expenditures to support M-1 RAIL. As depicted in **Figure 11.1**, M-1 RAIL envisions hiring a General Manager who will responsible for the near term operations of the system.

M-1 RAIL intends to hire a vendor to initially provide operations and maintenance functions for the Project. The O&M vendor will be responsible for development of a staffing plan. The O&M vendor will also be responsible for developing plans for training of operation and maintenance personnel of the Project will be developed for implementation prior to revenue service. A key element that will be included is “hands-on” training, in which operations and maintenance personnel will become familiar with the vehicles and equipment which will be used to provided streetcar service. Training will be developed for all operators, supervisors, dispatchers, and maintenance staff. Maintenance training will include, at a minimum:

- Electrical systems;
- Signal systems;
- Track;
- Shop equipment;
- Revenue vehicle operations and maintenance;
- Fare collection systems;
- Normal and emergency communications systems;
- Security systems; and
- Non-revenue vehicles operations and maintenance.

**Figure 11.1 M-1 RAIL O&M Organizational Chart**



Test Program Plan

During the design phase, following the hiring of an O&M vendor, M-1 RAIL will develop a Test Program Plan (TPP). This plan will:

- Establish the process for conducting, monitoring, and coordinating the test program.
- Define the test organization and specify its authority and responsibilities.
- Describe the administrative requirements of the test program.

The TPP will ensure that management and technical resources are applied in a coherent and organized manner to achieve the test program objectives. The test program will:

- Identify and define test requirements;
- Identify system integration tests;
- Establish a test program administration system, and
- Develop testing sequence and schedules.

### *11.1.2 Long Term Operations (Years 11-20)*

M-1 RAIL envisions long term systems Operation and Management will be performed by a Regional Transit Authority (RTA).

## 11.2 System Operations & Management of Operating Revenue and Expenditures

Daily streetcar operations will be performed by contract with a private operator. M-1 RAIL will develop a request for proposals to select a qualified operator to run and maintain streetcar service. The project manager for the operations consultant will report to the project director. Daily operations will include:

- Operation of the streetcar service -
  Streetcar service operation will include operations and staffing to maintain service plan expectations, fare collection and maintenance of streetcar stops and shelters. The operator will also be responsible for maintaining the streetcar infrastructure, including the track and overhead contact system.
- Maintenance of the streetcar vehicle -
  Vehicle maintenance will include daily cleaning and service of streetcar vehicles, along with annual maintenance requirements, such as wheel truing.
- Maintenance of the streetcar maintenance facility –
  Maintaining the streetcar maintenance facility will include daily cleaning, upkeep and maintenance of the building interior, exterior and yard. Also included will be elements related to maintaining and servicing vehicles, including managing spare parts and maintenance equipment.

## 11.3 Transition Strategy

M-1 RAIL is committed to owning and operating the M-1 RAIL Streetcar Project for a period of up to ten (10) years. At or before that time, M-1 RAIL intends to transition operations and maintenance responsibility for the Project to a newly formed Regional Transportation Authority, or another public transportation gency within Southeast Michigan.

## 11.4 Agency/Stakeholder Agreements and Coordination

<M. Webb to update>

## 11.5 Project Liability

If M-1 RAIL delivers the project, M-1 RAIL envisions holding liability for project delivery elements related to the M-1 RAIL Streetcar Project as well as operating and maintaining the system. M-1 RAIL has included cost within its O&M estimate for self-insuring the operations of the M-1 RAIL Streetcar Project.

# 12 RECOMMENDATIONS & NEXT STEPS

This section highlights the key work-in-progress items that will be further updated as project design and coordination effort scontinue during the project's next phase.

## 12.1 Technical Team Actions

During the project's next phase, the M-1 RAIL technical team will address the following items:

- Development of location-specific layout plans at each station platform site, including bus stop coordination, ADA facilities, and sidewalk interfaces
- Coordination with MDOT on development of detailed roadway geometric, drainage, and utility relocation designs for Woodward Avenue reconstruction project
- Continued cordination with MDOT on utility relocation cost sharing opportunities
- Selection of a preferred vehicle type
- Continued modification of design concept based on selection of preferred vehicle type
- Continued investigation of VMSF needs and cost estimate based on selection of preferred vehicle type
- Possible modification of station locations based on coordination with SHPO
- Detailed traffic operations analysis using updated VISSIM simulations to refine TSP requirements, bus operations, and running times
- Development of a vehicle procurement specification and related detailed VSMF requirements
- Continued refinement of capital cost estimates as design proceeds
- Continued refinement of operations and maintenance cost estimates, including detailed exploration of local labor costs
- Continued refinement of ridership forecast with a second independent analysis to be completed by Fehr & Peers
- Continued refinement of capital/O&M costs including further investigation of potential impacts of utilities and other SCC categories
- Continued refinement of project delivery and PMP lite sections of this document
- Finalizing a NEPA strategy
- Coordination with SEMCOG on the further investigation of ridership forecasts and sensitivity analysis using a the regional travel demand model
- Coordination with RRT system planning, to ensure compatible service plans and station design

## 12.2 Fundraising Team Actions

During the project's next phase, the M-1 RAIL fundraising team will address the following items:

- Continue efforts to raise funds and solidify commitments needed for project capital and O&M elements

## 12.3 Finance Team Actions

During the project's next phase, the M-1 RAIL finance team will address the following items:

- Development of a detailed project cash flow forecast and flow of funds analysis for M-1 project management and planning purposes
- Continued efforts to secure NMTC tax credits
- Outreach to commercial banks and other lenders to negotiate loan terms
- Explore universal pass program opportunities with major employers and institutions in the corridor
- Develop fare policy in coordination with SEMCOG, DDOT, DPM, and RRT system planners
- Continued analysis of alternative financing strategies and scenarios
- Validation of the Business Plan
- Development of a more complete Financial Business Plan, which will include a more detailed cash flow analysis

## 12.4 Legal and Legislative Team Actions

During the project's next phase, the M-1 RAIL legal and legislative team will address the following items:

- Continued discussions with the State of Michigan and City of Detroit regarding availability of annual operating subsidy
- Continued discussions with the State of Michigan regarding RTA legislation and how M-1 RAIL may be impacted by a future RTA
- Continued discussions regarding Federal match eligibility

## 12.5 Communications Team Actions

During the project's next phase, the M-1 RAIL communications team will address the following items:

- Continued coordination with key stakeholders along the corridor
- Development of a public outreach strategy needed to support the NEPA strategy

# APPENDICES

**Appendix A: Project Definition**

- Appendix A.1 Proposed M-1 RAIL Alignment
- Appendix A.2 Proposed Cross-Sections
- Appendix A.3 Utilities Technical Memorandum (HNTB)
- Appendix A.4 Traction Power Substation Load Analysis (HNTB)
- Appendix A.5 Vehicle Market Assessment Technical Memorandum (LTK)
- Appendix A.6 Concept of Design Report
- Appendix A.7 20% Design Plans
- Appendix A.8 Basis of Design (URS memoranda)

**Appendix B: Ridership**

- Appendix B.1 2009 Ridership Analysis
- Appendix B.2 Fehr & Peers 2012 Station-Level Ridership Analysis
- Appendix B.3 Executive Summary, *Greater Downtown TOD Strategy*

**Appendix C: Capital Budget**

- Appendix C.1 MDOT Reconstruction Cost Estimate
- Appendix C.2 Detailed Bottoms-Up Capital Estimate (Walbridge)

**Appendix D: Operating & Maintenance Budget**

- Appendix D.1 Detailed O& M Estimate Spreadsheet (HNTB)
- Appendix D.2 FTA Fare Guidance

**Appendix E: Financial Plan**

- Appendix E.1 Matrix of Probable Donors
- Appendix E.2 Commitment Letters from Probable Donors
- Appendix E.3 New Market Tax Credit Documentation (Nixon-Peabody memo)
- Appendix E.4 New Market Tax Credit Documentation (Deloitte memo)
- Appendix E.5 Flow of Funds Report (Deloitte)
- Appendix E.6 Supporting Documentation (HNTB)
- Appendix A.7 TIGER IV Grant Application

**Appendix F: Project Schedule**

- Appendix F.1 Detailed Project Schedule
- Appendix F.2 Risk Matrix

**Appendix G: Environmental Clearance & Community Outreach**

- Appendix G.1 NEPA Comparison Maps
- Appendix G.2 NEPA Comparison Matrix
- Appendix G.3 Proposed Community Outreach Strategy

**Appendix H: Other Supporting Documentation**

- Appendix H.1 03/01/2012 Comment Tracking Matrix
- Appendix H.2 FTA 60-Day Report