Photo: Historical Museum of Fort Missoula

MISSOULA URBAN TRANSPORTATION DISTRICT URBAN STREETCAR STUDY

Final Report

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1 INTRODUCTION

Missoula has a rich streetcar history. At its peak, electric trolleys operated throughout the city, converging on Broadway and Higgins Streets in downtown and extending as far as Bonner. Many of Missoula's close-in urban neighborhoods were once easily accessible via streetcar connections to downtown.

While streetcars were once the dominant mode of transportation in many cities, the era of road-building and suburban expansion between the 1930's and 1960's resulted in the abandonment of most streetcar systems throughout the country. The same was true in Missoula, which abandoned streetcar service in 1932 in favor of buses.

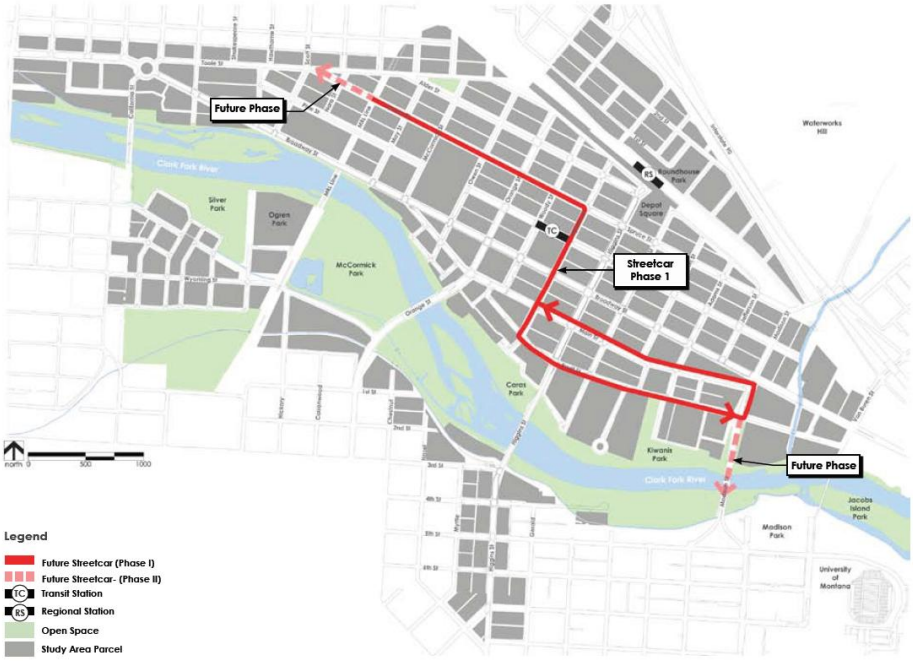
During the past decade, the citizens and leaders of Missoula have made great strides in the ongoing revitalization of the City's downtown and other adjacent close-in areas. The Greater Missoula Downtown Master Plan, completed in 2009, marks both the culmination of a major planning effort and the beginning of a multi-year period during which the City will look to implement the ideas identified in the plan.

One important concept to emerge from the Downtown Plan was the development of a central-city streetcar, a "local circulator linking major downtown destinations," with "potential future connections to the University, Airport and other Missoula destinations." Figure 1 on the next page shows the conceptual streetcar alignment included in the Downtown Plan.

Missoula is not alone in its interest in operating a new streetcar line. In the past decade, a number of American cities have opened new streetcar routes to provide a convenient and attractive means for local residents and visitors to get around, to introduce a new element of excitement in downtown, and to spur interest and significant investment by developers. Some of these cities will be discussed in Chapter 3.

This memorandum provides a further evaluation of the streetcar concept presented in the Downtown Plan and explores the development potential along the proposed alignment as well as potential extensions to the alignment. This memorandum also explores potential funding options to build and sustain an initial streetcar line, as well as the consulting team's assessment of what local conditions would be required to support this investment. The memorandum also describes the potential catalytic effects that a streetcar invest could have on property development in the downtown area.

Figure 1 Conceptual Streetcar Alignment



Source: City of Missoula Downtown Master Plan

OUTLINE OF THIS REPORT

This memorandum is organized into the following chapters:

- **Chapter 2: Why Consider Streetcar?** This chapter further describes the characteristics of modern streetcars and discusses why streetcar might be considered in Missoula.
- **Chapter 3: Where Has Streetcar Been Implemented?** This chapter provides more information on where streetcar service is in operation (in the US and Canada) and what cities are considering or building new streetcar lines.
- **Chapter 4: Potential Streetcar Alignments.** This chapter explores three potential alignments in downtown Missoula and provides more detail on operating costs, capital costs and potential ridership.
- **Chapter 5: Funding Options.** Because streetcar requires a substantial capital investment and ongoing operating revenues, this chapter explores potential local, state and federal funding sources to build and sustain a streetcar line.
- **Chapter 6: Development Context.** This chapter provides an assessment of development potential along the downtown streetcar alignment and required development that would need to occur along each potential streetcar alignment. Further, the potential catalytic effects of the proposed streetcar line on residential and commercial development are described.
- **Chapter 7: Considerations and Next Steps.** This chapter summarizes the findings in the memorandum and offers a set of considerations – either to move streetcar forward or consider other interim mobility options.

2 WHY CONSIDER STREETCAR?

WHAT IS STREETCAR?

Streetcar vehicles run on fixed-rail guideways, powered from overhead electric wires. There are a number of characteristics that are typical of modern streetcar systems in North America. They include:

- **Right-of-Way:** typically, streetcars operate in shared right-of-way, just as most buses do.
- **Service characteristics:** can vary significantly, but service is generally characterized by frequent headways, relatively short distances between stops and low operating speeds. Streetcars are designed for shorter distance circulation, rather than long haul commuting.
- **Stations:** typically more robust than a standard bus stop, but not as developed as a light rail station (some exceptions, like Tacoma). Modern systems allow for level boarding platforms.
- **Vehicles:** modern vehicles in Portland, Seattle and Tacoma are 66' with a seated capacity of 29 and maximum capacity of 170. Other manufacturers are similar, but vehicles are not typically connected in a multicar train. Skoda offers models with as many as 5 sections that can accommodate as many as 240 passengers. Modern streetcar vehicles are typically low-floor and offer boarding through multiple doors (for faster boarding/alighting). Other systems use true vintage cars from the heyday of the urban streetcar or modern replicas of the historic vehicles.
- **Infrastructure/technology:** In addition to track, streetcar requires overhead power, power sub-stations, and enhanced stations. Streetcar also requires a maintenance and storage facility – the closer to the revenue line as possible. Streetcar systems also typically utilize advanced technology to provide customers with real-time arrival information. There are a few systems that use underground power that does not require wire, but these are generally used only in very sensitive areas and only for short stretches, due to their cost.
- **Fares:** streetcar systems typically have the same fare structure other transit services, but fare payment is often more advanced. A proof of payment system is common on streetcar and modern vehicles usually have payment systems on board, thus no interaction with the driver is necessary.

Streetcar Vehicle Technology

Streetcar vehicles generally fall into one of the following three categories:

- Renovated Vintage/Historic Streetcars
- Modern Replicas of Vintage/Historic Streetcars
- Modern Streetcars

Figure 2 provides a comparison of streetcar systems from these three categories.

Figure 2 Streetcar Characteristics

	Modern	Historic	Historic (replica)
Capacity (total seated / total standing)[1]	30/85	40/65	40/65
Average speed[1]	8-12 mph		
Vehicle length	60-140 ft	30-50 ft	40-45ft
Cost per vehicle	~$3.5M	$800K-$2.0	$800K to $2.0M
Turning Radius	40-80 ft	40-50 ft	40-50 ft
Station length[2]	75-100 ft	50-90 ft	50-90 ft
Stop spacing	600-800 ft		
Station Costs	$25-40K	$25-35K	$25-35K

1. Most streetcars have the ability to travel much faster. The low estimated speeds are largely because of close stop spacing typical of downtown circulator design and are not limitations on the vehicles.

Restored Historic Vehicles

Restored historic vehicles are typically salvaged or stored streetcar vehicles that are stripped down and completely restored. These can operate on historic or new track, although there are few systems that operate regularly in urban environments that are not operating on new track. Some examples of US streetcar lines that use restored vehicles are:

- San Francisco Muni "F" Line
- Kenosha, WI
- Memphis Main Street Trolley
- Portland Historic Trolley

Figure 3 Riverfront Streetcar, Memphis

Source: Flickr, Stphen Downes

Restored vehicles have tradeoffs, including poorer ride quality than modern vehicles, lack of ADA access and lower quality temperature controls. Due to the recent increase in demand of vintage streetcars, the market value of these older vehicles has increased substantially in recent years and the availability has decreased. Most available true historic streetcars have to be entirely rebuilt to be useful in regular service.

PCCs are one class of restored historic streetcars that were originally designed under the direction of the Electric Railway Presidents' Conference Committee (PCC). The cars were designed by twenty-five U.S. and Canadian transit companies to help improve streetcar vehicles in an attempt to reverse the decline in transit use that had begun in the 1920s. Their streamlined design was attractive and they were more comfortable that older streetcars. They were also quieter and more economical, with better motors, controls, acceleration, and braking. PCC cars were first put into

[1] Seated and standing capacity varies depending on vehicle manufacturer, model and selected seating configuration.

[2] Minimal platform lengths assume fare media bought on board, not at ticket vending machines at station.

service in 1936, some of which are still operating in North American cities today, including San Francisco, Kenosha and Toronto.

Renovated historic streetcars generally have higher vehicle floors and have steps in the streetcar to board from the sidewalk. Where renovated or replicates of vintage/historic streetcars are used, special provisions such as platform ramps or lifts must be provided to meet ADA accessibility requirements. These vehicles are typically configured as single cars and usually do not have air conditioning. The historic nature of restored vehicles often hinders the installation of modern communication and GPS equipment.

Replica Historic Streetcar

Replica streetcars are vehicles designed to look very similar to historic streetcar vehicles, often mimicking those that ran in the city they were built for in the early century. Good examples streetcar lines that use replica vehicles include:

- Tampa TECO Streetcar
- Little Rock River Rail Streetcar
- Charlotte Streetcar

Gomaco Trolley Company of Iowa is a principal supplier of replica vehicles. These vehicles typically provide some accommodations for ADA, although some are designed as high-floor vehicles. Most have air conditioning systems to provide consistent passenger comfort, a feature not always available on restored historic cars. As these are modern designs and relatively new vehicles, the safety and reliability of replica cars is often better than those of restored historic streetcars. Modern communication and GPS equipment is better accommodated in replica vehicles as well.

Figure 4 River Rail Streetcar, Little Rock

Source: Flickr, cliff1066

Modern Streetcar

Modern Streetcars are new vehicles designed to operate in a similar operating environment as historic streetcar lines. Three systems in the US have recently built streetcar lines using modern vehicles (Portland, Seattle and Tacoma), while numerous other cities in the development or planning stages plan to use modern streetcars, including:

- Washington DC Streetcar (starter line in 2013)
- Tucson Modern Streetcar
- Atlanta Streetcar
- Tempe Streetcar
- Charlotte Streetcar
- Arlington (VA) Columbia Pike Streetcar

Streetcar lines using modern vehicles have generated the highest ridership and typically do the most to serve an important local transit function. They have also had the greatest impact on urban form and economic development, at times even in advance of their opening. Modern streetcars are typically articulated vehicles with multiple cars and greater passenger capacities. They are low-floor vehicles that accommodate ADA rules and reduce overall boarding times. As with replica streetcars, modern streetcars incorporate the latest technologies and passenger amenities, but are not constrained by historic design limitations.

Figure 5 South Lake Union Streetcar, Seattle

Source: Nelson\Nygaard

Streetcar versus Bus Transit

While streetcar is the focus of this memorandum, Missoula residents are most familiar with local bus operations. Figure 6 summarizes the primary differences between streetcar and bus operations. The following sections detail benefits inherent to one mode over the other.

Figure 6 Streetcar and Bus Technology Comparison

Characteristics	Streetcar	Bus
Capacity	Medium – modern (110-130 pass) Low – vintage/replica (45-80 pass)	Medium – BRT, articulated (80-110 pass) Low – standard (35-60 pass.)
Flexibility	Less flexible than bus – cannot easily move wire/tracks or deviate temporarily	More flexible than streetcar – alignment easy to modify and can move around temporary obstructions
Right-of-Way	Can operate in street or exclusive ROW	Can operate in street or exclusive ROW
Ability to Attract "Choice" Riders	Attracts 15-50% more riders than comparable bus service	Attracts fewer riders than streetcar – some specialized buses can do better
Optimal Markets	Most effective for short, local trips	Flexible – can be effective for short or regional trips
Operating Costs	Moderate – generally between 30-50% higher than bus	Lowest operating cost – Mountain Line is around $80/revenue hour
Capital Costs	Portland: ~$12.9M/track mile	Cleveland Health Line Bus Rapid Transit: ¼ to ½ the cost compared to streetcar or light rail.

Streetcar Technology Benefits

Key areas where streetcar technology excels when compared to bus modes include:

- **Streetcars generally attract at least 15 to 50 percent more riders than bus routes in the same area.** In many cases, the difference in ridership is much higher. Based on recent North American examples of streetcar implementation, there is clear ridership boost that can be attributed directly to the implementation of streetcar replacing bus service in a given corridor. In Toronto, on routes where streetcar service replaced a nearly identical bus service, ridership increased between 15-25 percent. A particularly dramatic example can be found in Tacoma, where streetcar service is running on a future light rail transit (LRT) alignment. Transit ridership in the streetcar corridor increased by over 500 percent compared to the bus route it replaced, which provided almost identical service. The route charges no fares and offers free parking, conditions that were present on the previous bus route as well.
- **Streetcars often attract private funding.** Property owners are often willing to financially contribute to a streetcar system because they realize the value that a streetcar brings to their property and to the neighborhood. In Portland and other cities, private owners were willing to "tax themselves" either through fees, benefit districts, or other forms of exactions to receive the benefits of a fixed streetcar system. Seattle's South Lake Union Streetcar is being partially funded through a Local Improvement District (LID); this has been an important funding mechanism for a number of other recent US streetcar projects.
- **Streetcars provide a visible and easy to understand routing while standard bus routes are more difficult to discern.** Rail systems in general provide a physical presence on the street that is easy to comprehend. Riders can stand at a stop and literally see where the line comes from and where it is going. Streetcar routes generally make few deviations from a straight path, giving the user more confidence. Visitors and occasional users are more inclined to use them, since there is less confusion about the streetcar than about taking one of many possible bus routes. Although trolleybuses still operate with rubber tires, the overhead wires are a clear indicator of the route, providing some of the benefit of streetcars in creating a clearly discernible route.
- **Streetcars attract a visitor market and a local user market to transit.** The fact that streetcars are easy to "understand" and often operate in areas with high visitor populations, helps attract visitors as well as local riders. Modern streetcar operations often use "vintage styled" vehicles or rehabilitated vehicles from earlier eras (such as the Waterfront Streetcar in Seattle). Some streetcar systems use very modern, but distinctive vehicles. Distinctive buses (modern or trolley replica) can often achieve a similar response, though usually to a lesser degree than rail. All of these vehicle types help attract visitors, as well as local riders, to transit.
- **Streetcars have the ability to catalyze and organize development.** Throughout their history, streetcar lines have been an organizing principle behind new development. Streetcars can help create dense pedestrian environments where access to local streetcar stops is possible by foot. Historically, bus routes are added once an area has developed and the demand is in place.
- **A number of cities with more recent streetcar investments credit the streetcar with catalyzing infill development.** Since the decision to build the streetcar was made, over $2 billion in new development has occurred around Portland's

streetcar line including retail, office and housing. In Memphis, 4,000 residential units have been built within a block of the streetcar in a formerly underused industrial area. And in Tampa, over $800 million in new private development has been built along the 2.4 mile TECO line. Although it is difficult to know whether development would have happened at the same pace without the streetcar investment, it is clear that the streetcar line provided a "focus" which organized development and assured the transit focus of new development along and spreading out from the streetcar corridor.

Bus Technology Benefits

As noted in the sections above, there are many obvious advantages to implementing a streetcar system. On the other hand, bus systems that are designed to provide a similar level of service to streetcar, have some advantages over streetcars, as discussed below:

- **Buses are more flexible than streetcar.** Streetcars cannot maneuver away from obstructions in the track, such as a stalled vehicle, extreme traffic congestion, special events, delivery vehicles or construction. Standard buses on the other hand, are much more flexible and can easily be temporarily re-routed if necessary. Trolleybuses are more flexible than streetcar, but are less flexible than standard buses and cannot operate without overhead power for long distances. Many new trolleybuses are equipped with auxiliary power units (APUs) that allow the vehicle to operate on battery power for short distances. Some trolleybuses (such as the Silver Line BRT in Boston) are hybrid trolleybus/diesel and can alternate between power sources quickly and easily.
- **Buses have a lower capital investment.** Due to the higher capital costs associated with trackwork and overhead wire, streetcar systems cost more per mile to construct than bus systems. High-quality, specialized bus lines, however, typically use unique vehicles, identity and marketing materials, which typically takes longer to implement than a standard bus service. Like streetcars, trolleybuses require overhead power wires and all associated infrastructure.
- **Standard buses do not require a unique maintenance facility.** Streetcars and trolleybuses require unique maintenance facilities that include trackwork (for streetcars) and overhead wire for both streetcar and trolleybuses, whereas standard buses can be housed at Everett Transit's garage or other standard bus garage. The additional trackwork and/or overhead wire required to reach the maintenance facility adds to the overall cost of construction.
- **Buses and trolleybuses are more suitable for steep grades.** Streetcars require gentle grades to operate and have more difficulty climbing steep hills, especially in extreme climates. Buses perform much better in these environments, and trolleybuses perform better than standard diesel buses. Seattle, San Francisco and Vancouver, B.C. maintain large trolleybus fleets primarily due to the steep grades.
- **Other perceived advantages include:** Streetcar tracks can create difficult crossing for bicycles, especially when traveling parallel to the track. In addition, some people perceive overhead wires to be aesthetically unpleasing – especially in more residential areas.

STREETCARS AND ECONOMIC DEVELOPMENT

In 2001—following a more than a half-century during which streetcars had almost disappeared from the American consciousness—the first new streetcar line of the modern era began operation in Portland, Oregon. The four-mile Portland Streetcar reintroduced the streetcar as a viable concept for urban transit, distinct from both light rail and bus service.

The Streetcar Value Proposition

Portland's streetcar and the others that have followed have been premised on a unique "value proposition" that differs from the roles of other mass transit modes (such as buses and commuter rail) in a number of important ways. Streetcars are perceived to:

- Be unique, different, and evocative of both a historic nostalgia and a desirable modern advance.
- Be capable of increasing transit ridership by attracting both traditional transit users and "choice riders"—those who have the option to drive, but choose to take transit. Critical choice rider groups include downtown white collar workers and tourists. Streetcars have been shown to increase ridership when compared with bus lines previously operating on similar alignments.
- Have a number of features that make the ride more pleasant including being relatively smooth and quiet, featuring large windows for light and views, and large doors that allow passengers to board easily at the ground or station level, rather than climbing steps. In addition, their quiet operation makes for a more pleasant environment in nearby buildings and public spaces.
- Operate in mixed-traffic flow, like buses but unlike heavier rail transit.
- Make a powerful statement to visitors about the sophistication and urbanity of a community.
- Function as a "central city circulator," rather than a linear home-to-work commuter route (although this is a matter of design, not the mode. Many early streetcars were designed as commuter services.
- Attract and catalyze development. Portland and other cities have used the streetcar to encourage significant residential and commercial real estate development within central city areas.
- Attract funding assistance from the private sector. Developers, property owners, and business sponsors have contributed to the cost of lines built in Portland, Seattle, Tampa, and elsewhere.
- Attract funding through the Federal Small Starts program (and other grant programs) when the lines being proposed have very compelling ridership or economic development impacts.

The Streetcar's Effects on Development

In order to clarify the effect of streetcar lines on real estate development and economic development, the project team drew upon the following experience and research:

- Route and TOD planning experience. Leland Consulting Group, the project lead for real estate and economic development, has participated in evaluating and planning for TOD

along multiple streetcar lines, including planned and/or completed lines in Portland, Oregon; Denver, Colorado; Salt Lake City, Utah; Sacramento, California; Everett, Washington; and other cities. Findings from developer interviews conducted in those cities were combined with take aways from developer interviews in Missoula.

- *Relationships Between Streetcars and the Built Environment,* Transit Cooperative Research Program (TCRP), Synthesis 86, 2010. This is considered to be the most authoritative analysis of this issue due to its review of streetcar systems nationwide, thoroughness, and recent completion.
- *Portland Streetcar: Development Oriented Transit,* City of Portland Office of Transportation and Portland Streetcar Inc., 2008. This study includes a detailed, parcel-by parcel analysis of the Portland streetcar's impact on nearby real estate development and has been a source of much subsequent TOD analysis. However, because of its focus on Portland, Oregon, it is not clear how easily its findings can be transferred to other cities such as Missoula.
- *Transit-Oriented Development in the United States,* Transit Cooperative Research Program (TCRP), Report 102, 2004. This is another thorough survey of TOD and its relationship to transit. While some findings may be relevant to Missoula, the study's focus is on light and heavy rail in large American cities.

National Impacts: Positive and Variable

While most analyses of streetcars and TOD have concluded that streetcars exert a positive impact on adjacent development, the general consensus is that the degree of this impact varies considerably depending on local conditions, and remains difficult to project. For example, according to *Relationships Between Streetcars and the Built Environment*:

> Because of the broad range in methodologies used and findings from various studies…it is difficult to distill conclusions that can be applied broadly. Premiums [increase in property values or related economic activity] vary by land use and range from minimal (1% to 2%) to substantial (100% plus). A key challenge in evaluating value premiums is controlling for changes in zoning or other policies permitting greater density in conjunction with new fixed guideway transit, because these alone can increase the value of land and existing properties, separate from any direct transit impacts. Other literature measuring actual changes in economic activity, such as retail sales, visitors, or job growth is nearly nonexistent.

Likewise, the nationwide survey *Transit-Oriented Development in the United States* finds that:

> The weight of evidence to date shows that development near transit stops enjoys land-value premiums and generally outperforms competitive markets. This generally holds for residential housing (especially condominiums and rental units) as well as office, retail, and other commercial activities. However, the payoffs are not automatic, and quite often a number of preconditions must be in place. One is an upswing in the economy, with plentiful demand for real estate and, importantly, worsening traffic congestion. Only then will there be market pressures to bid up land prices and a clear benefit to having good rail access as an alternative to fighting highway traffic.

Portland: Doubling Adjacent Development

The Portland Streetcar has been the most-studied streetcar line in the country, because it was one of the first of the modern streetcar lines, one of its stated purposes was to support and spur real estate development, and due to its ridership and redevelopment success. The *Portland Streetcar: Development Oriented Transit* report documents the connection between the streetcar and development near the line, employing a "before and after" approach.

Figure 7 shows one way that the authors quantify this relationship: by comparing the development densities built near the streetcar line versus those further away. Prior to 1997 (when the streetcar alignment was first identified), the residential and commercial projects built within one block of the current alignment took advantage of just over 30 percent of the maximum floor-area ratio (FAR) allowed by the city. In the years between 1997 and 2005, projects in the same area took advantage of 90 percent of the allowed FAR. By this measure, development densities approximately doubled within the streetcar's primary three-block "impact area". (Note that this area includes three blocks on either side of the alignment, or a swath of land slightly more than ¼-mile wide.) The report also tracks development using other metrics, but this analysis is the most straight forward and applicable comparable to Missoula and other cities.

Figure 7 Development Density by Proximity to the Portland Streetcar Line

The Developers' Perspective

While numerous factors affect the viability of downtown and infill redevelopment, developers interviewed for this and other streetcar projects say that the streetcar brings the following quantifiable and non-quantifiable benefits to their projects:

- **Ability to decrease parking ratios, which saves significant capital.** Each additional structured parking space costs developers $25,000 or more. Standard suburban parking ratios for residential development can be 1.6 parking spaces per unit or

higher, even in compact developments, while 1.2 units or fewer is desirable and achievable in streetcar-adjacent TOD.

- **Ability to increase density, which can increase revenues under the right conditions.** Developers believe that residents and employees are willing to accept density when high quality transit and neighborhood amenities are available. In addition, zoning is typically increased to allow greater building heights and floor-area ratios (FAR).
- **The intangible or non-quantifiable benefits are the buzz, activity, and "storytelling" opportunity that have accompanied the streetcar.** Developers talk about the place making and storytelling opportunities that the streetcar brings. Many potential residents see the streetcar as a modern and attractive transit mode that can whisk them to work, entertainment, and other destinations. TOD developers' marketing materials often feature images of the streetcar, but rarely if ever picture buses.

Other Factors Impacting Downtown Revitalization

Transit—streetcar or otherwise—is just one factor that affects a developer's decision to build, or a resident's decision to locate in a particular area. According to one extensive study of mixed-use and urban infill development, a range of factors influence the decision to develop.[3]

Therefore, the success of both Downtown Missoula as a whole and proposed potential streetcar line in attracting economic activity will depend on the interplay of all of these factors, noted in Figure 8 below. It is often observed in the field of economic development and downtown revitalization that there is no one "magic bullet." Instead, exciting urban places result from multiple mutually reinforcing efforts in the realms of transportation, urban design, branding, marketing, finance, and other fields. Conversely, if growth in economy and jobs are slow or nonexistent, other efforts such as improved transit or branding may have little effect on spurring downtown development. The factors that influence developers' decisions to build downtown are shown below, along with observations about how these factors may influence development in Downtown Missoula.

Figure 8 Factors Influencing Mixed-Use and Downtown Development

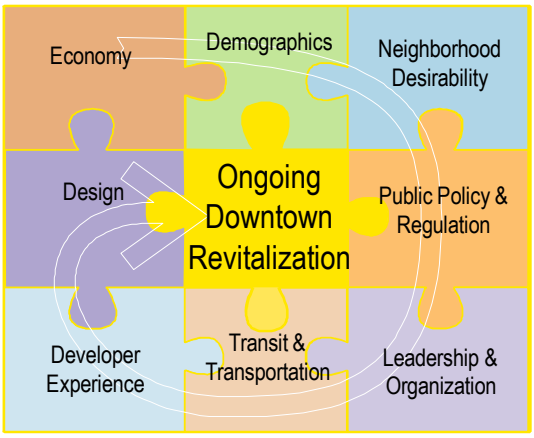
Development Factor	Considerations in Missoula
Local economy: strong job and population growth	These two issues are likely to have the greatest impact on the viability of mixed-use and downtown development in coming decades. If the City and County can create significant numbers of good-paying jobs (especially in industry sectors such as technology, professional services, and healthcare) then these businesses and employees will tend to look for office, retail, and housing space in the core.
Strong real estate market for each given land use	
Demographics	Missoula needs to retain more residents in the 25 to 44 age categories to spur high demand for downtown housing and services. According to research conducted for the Downtown Master Plan, there is net outmigration in these age groups. While Missoula does attract some residents in the 65 and older category (another key demographic for urban housing), it could perform better here too.
Regulations and other issues related to the public sector	Developers interviewed for this report stated that current regulations (allowed heights and densities, and fee structure) generally support rather than hinder downtown development. This is very positive and the City should work to maintain this advantage.
On-site synergies for the given mix of uses	These factors will affect development viability on a site-by-site basis,

[3] "Mixed-Use Development and Financial Feasibility," *Real Estate Issues*, Volume 34, Numbers 1 and 2, 2009.

Compatibility with the neighborhood	rather than Downtown generally speaking. Lenders are often hesitant to make loans on pioneering urban projects and the MRA could be of help here, by extending credit enhancement or guarantees to developers or lenders, or "education" for the private sector regarding urban development. Downtown Missoula is generally flat, with sites suitable for new development or redevelopment.
Lending issues	
Costs	
Physical features	
Phasing	

In addition, numerous national surveys of residents who live in or are considering urban neighborhoods show that these residents place a high value on the following:

- Convenient access to shopping, restaurants, parks, nightlife, and other amenities
- Convenient, central location, and shorter commutes
- Proximity to employment
- Simplicity and reduced maintenance associated with apartments, townhouses, and condominiums
- Car-free or car-light lifestyle
- Social and entertainment opportunities



Therefore, the streetcar is one among a number of factors that influence the decision to develop and revitalize an urban neighborhood. The most successful urban redevelopment occurs when most or all of the factors described above—economics, demographics, and urban amenities such as retail and entertainment—are in place to encourage new development. If all other factors are weak or discourage development at a particular time or location, rail transit alone is unlikely to alter development dynamics. According to Portland Streetcar Inc., CEO Rick Gustafson notes that, "While it was tempting to say the streetcar was responsible for leveraging all this development, that would not, of course, be entirely accurate. Rather, the streetcar was, it is said, part of a 'perfect storm' of planning and policy… The streetcar was a device for changing attitudes and development priorities and creating the right decision-making environment."

3 WHERE STREETCAR SERVICE HAS BEEN IMPLEMENTED?

While streetcar systems were largely abandoned around the country by the middle of the 20th century, they have made a strong comeback across the country in recent decades. Figure 9 below shows cities in the US and Canada that have implemented either a modern streetcar system, vintage/replica system that serves a corridor function (or is part of the larger transit system), or a vintage/replica system that is mostly for local circulation or tourists. Figure 10 shows cities across the country and in Canada that are considering streetcar or are in the development phase.

Figure 9 Streetcar Systems in Operation (US and Canada)

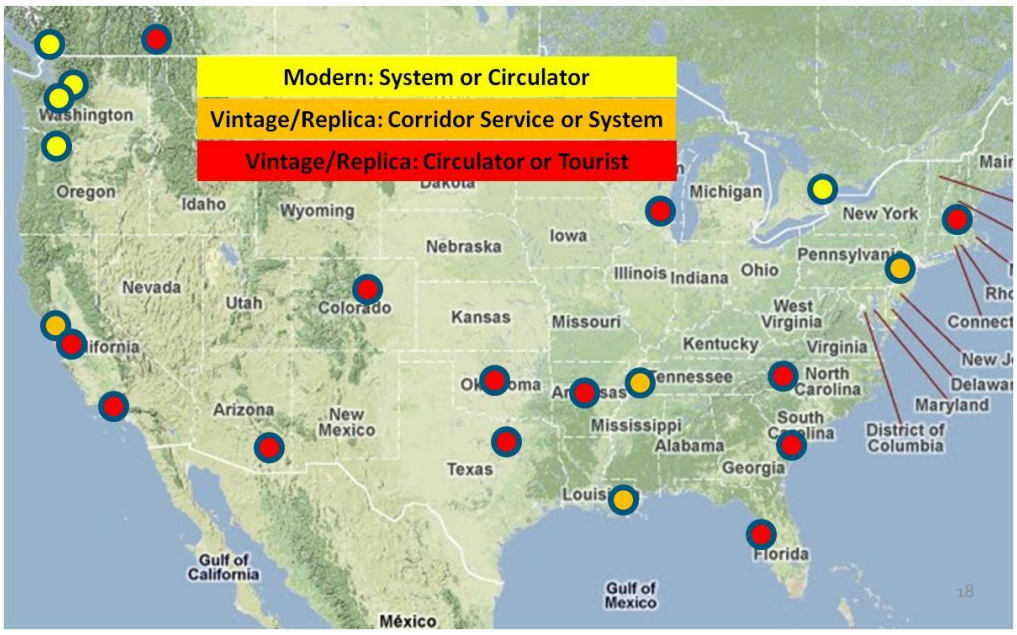


Figure 10 Streetcar Systems Planned or Under Construction (US and Canada)

While there are many streetcar examples around the country, it is important to note that most of them have been implemented in much larger urban areas and in areas with significantly higher population and employment density than Missoula and are often part of a regional high-capacity rail network. Figure 11 below presents some of the existing streetcar lines or systems as shown in Figure 9. Of the small cities with streetcar services, the focus is on local downtown circulation and the tourist market, and they generally operate limited or seasonal service.

Figure 11 Existing Streetcar Service and Operating Environment Characteristics

City	Operating Environment	Vehicle Type	Service Type & Characteristics	Connections to regional high-capacity transit?
Seattle	Very urban	Modern	Downtown circulation; high frequency and long service span	Yes: LINK Light Rail, Sounder Commuter Rail
Portland	Very urban	Modern	Downtown circulation; high frequency and long service span	Yes: MAX Light Rail
Tacoma	Urban	Modern	Downtown circulation; high frequency and long service span	Yes: Sounder Commuter Rail
San Francisco	Very urban	Vintage	Corridor service; high frequency and long service span	Yes: BART and MUNI Metro
Tucson	Urban	Vintage	Downtown circulation and tourism-focused; limited/seasonal service.	No
Dallas	Urban	Vintage	Downtown and neighborhood circulation; high frequency and long service span.	Yes: DART
Little Rock	Urban	Historic Replica	Downtown circulation, corridor service and tourism-focused; high frequency and long service span	No
Kenosha	Small city	Vintage Restored	Downtown circulation; tourism-focused; very limited/seasonal service.	Yes: Metra Commuter Rail
Memphis	Urban	Vintage Restored	Downtown circulation, corridor service and tourism-focused; high frequency and long service span	No
New Orleans	Urban	Vintage Restored	Downtown circulation, corridor service and tourism-focused; high frequency and long service span	No
Tampa	Urban	Historic Replica	Downtown circulation, corridor service and tourism-focused; high frequency and long service span	No
Savannah, GA	Small city	Vintage Restored	Downtown circulation; tourism-focused; very limited/seasonal service.	No
Charlotte	Urban	Historic Replica	Tourism-focused; very limited/seasonal service.	Yes: Lynx Light Rail
Philadelphia	Very urban	Vintage Restored and Modern	Extensive system; corridor service; high frequency and long service span	Yes: Subway and Regional Rail Lines
Toronto, ON	Very urban	Modern	Extensive system; corridor service; high frequency and long service span	Yes: TTC Subway and GO Commuter Rail

Portland, Oregon

While other modern streetcar systems have been built in Seattle and Tacoma, the Portland Streetcar remains for most purposes the best model of modern streetcar service, because it has met and exceeded the expectations set for it both as a means of transportation and a tool for redevelopment. The Portland Streetcar now carries more than 12,000 passengers on an average weekday, between major activity centers such as downtown Portland, Portland State University, Good Samaritan Hospital, the Pearl District, and the Northwest residential neighborhoods. While service operates every 15 minutes, and thus many trips along the corridor can be made just as easily by walking, many locals think of the streetcar as a "pedestrian accelerator" and will take the streetcar if it comes along.

Development Impacts

A 2008 study identified the following real estate development impacts that had taken place within three blocks of the line in the decade since the line's announcement in 1997:

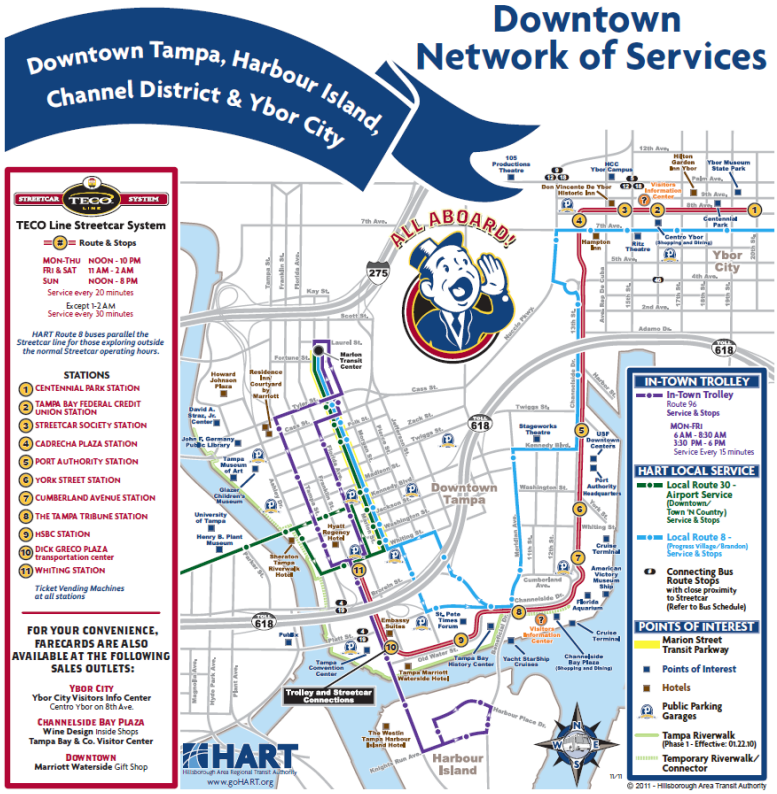
- More than $3.5 billion in total development;
- 10,212 residential units; and,
- 5.4 million square feet of office, institutional, retail, and hotel space.

A 2005 study shows that since 1997, "over half (55 percent) of all new development within the City's core has been constructed within one block of the streetcar line." New development within one block of the line has been built at more than 90 percent of the density allowed by the city, while development more than three blocks away has only used 45 percent of the allowed density.

Figure 12 Portland Streetcar

Tampa, Florida

Figure 13 TECO Line Streetcar, Tampa



The City of Tampa was motivated to implement a streetcar line by many of the same factors as Portland (need for circulation but a desire to enhance development along the corridor). However, the desire to enhance and increase the City's already strong tourism and convention businesses, offered another additional motivating factor. Therefore, the Tampa streetcar initially served many of the City's key tourism destinations—such as the Convention Center, sports arenas, cruise ship terminals, and historic Ybor District—but not downtown. In 2011, an extension opened to bring the line into downtown. Service is provided every 20 minutes Monday through Sunday starting at either 11:00 am or noon and ending at either 10:00 pm or 2:00 am, depending on the day of the week.

Development Impacts

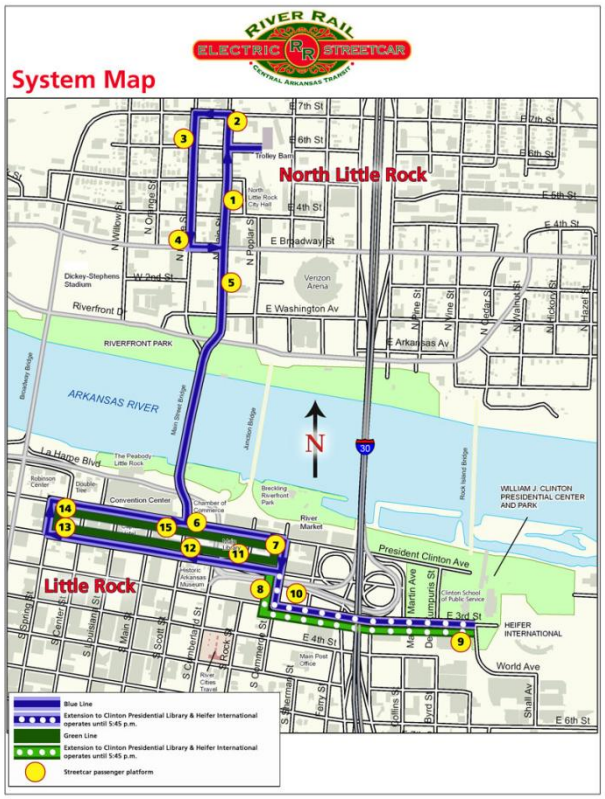
On the measures of residential development and tourism, Tampa's streetcar has been deemed a success. According to Chamber of Commerce staff, "It's like Riverwalk in San Antonio. It gives convention organizers a reason to choose Tampa." And former Tampa Planning Commissioner Michael English states that, "We wanted this part of town [Channelside] to be like LoDo in Denver. These kinds of higher density residential projects didn't exist outside of downtown until the streetcar was built. We moved very quickly from renovating a few warehouses to a development boom." As of 2008, the majority of development, including nearly 3,700 dwelling units built or under construction, had taken place within a quarter mile of the streetcar line, mostly in the Channelside area.

Little Rock, Arkansas

Operated by the Central Arkansas Transit Authority (CAT), RiverRail is a 2.5-mile streetcar system that connects downtown Little Rock with North Little Rock across the Arkansas River. There are two routes – the North Route that connects downtown with North Little Rock, and the South Route, which serves just downtown Little Rock. Service runs from approximately 11:00 am until 10:00 pm, Monday – Wednesday, 11:00 am – midnight Thursday-Saturday and 11:00 am until 5:00 pm on Sunday. One-way adult fares are $0.50.

The system opened in November, 2004, and was constructed for approximately $20 million, which includes design of the line, 3 replica streetcars, a maintenance facility, and accompanying overhead wire. Approximately 80% of capital funding came from the Federal government, of which half was from the New Starts program and the remaining from flexed STP funds and TEA 21 HPP funds. Local funding comprised the remaining 20% of the costs and was raised by Pulaski County, Little Rock and North Little Rock. Ridership that averages around 15,000 – 20,000 per month has exceeded projections.

Figure 14 River Rail Streetcar, Little Rock



The system consists primarily of single-track and one-way loops. In downtown Little Rock, streetcar service operates in a clockwise loop using two parallel streets. Single-track service is present on the Scott Street/Main Street bridge and south of Broadway Street in North Little Rock. The northern portion of the line consists of a one-way loop north of Broadway Street to 7th Street. The storage and maintenance facility is located in North Little Rock off of Main Street.

Phase II of the streetcar system was completed in 2007 and consists of a double track section between Commerce and 2nd Streets and the Clinton Presidential Library via 3rd Street.

A Feasibility Study conducted in 1997 established several goals for the future streetcar line, including service for convention visitors and tourism as well as to attract more people to live downtown. Within six months of opening the line, over $80 million in new development was announced along the line and more recently a new $28 million ballpark in North Little Rock was built within several blocks of the line as well as a large executive corporate residence complex.

Kenosha, Wisconsin

The Kenosha Streetcar was conceived as a circulator system to connect the older downtown and the Metra commuter rail station with a mixed-use area just east of downtown. Integral to the streetcar project is a transit center that also serves as the car barn/museum for the historic trolleys and as a downtown transfer station for Kenosha's fixed route bus system.

The streetcar serves the HarborPark, a redevelopment project on a 70-acre plot that was a former Chrysler auto plant. The plant has been razed, and the site is surrounded on three sides by Lake Michigan. The streetcar was planned from the beginning as an integral part of the project. The line opened in June, 2000, and cost approximately $5 million (including the transfer facility).

The system is a loop of single track, 1.7 miles long, which run from the Metra station to a park on the tip of the peninsula. The Streetcar runs in mixed-flow street right-of-way for one-quarter of its length; the remainder is in its own right-of-way. It serves the HarborPark development, as well as municipal buildings, a retail district, and a museum. City staff estimate that the HarborPark development is 75 percent built out.

Figure 15 Kenosha Streetcar

Source: Flickr user newagecrap

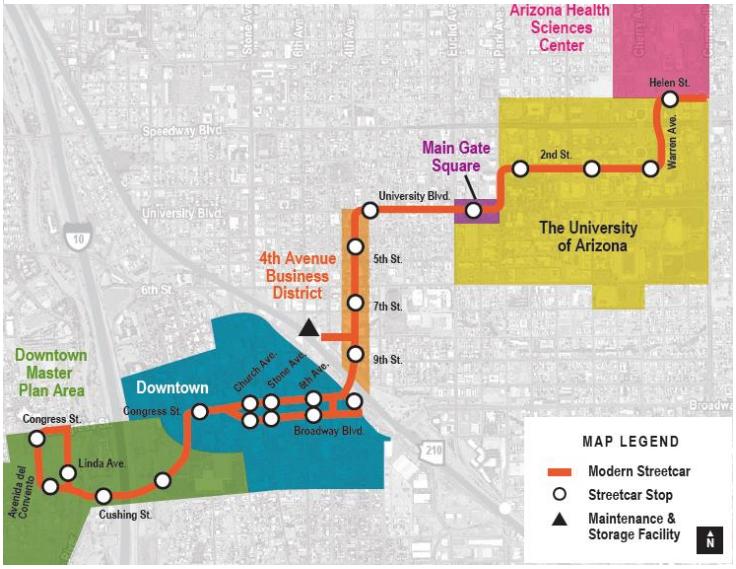
Five refurbished Toronto streetcars serve the system, and each has been painted in the color scheme of a different city's historic streetcar system. The system runs every 15 minutes, with different hours during the summer and winter. Summer hours are 11-7 weekdays, 10-5 on weekends. During the winter (January-April), service is reduced to four hours daily. 11-4 PM. Its most popular days include July 4, when many patrons ride the trolley to the park for a fireworks display.

While the Kenosha system was initially conceived to serve various markets, it has evolved to be largely a tourist attraction and mid-day circulator. Its hours of operation have been cut back from its initial schedule due to low patronage (particularly in the winter months) and operating costs. Its hours do not support commute traffic from the new residential development at HarborPark. There are no current plans to expand or extend service.

Tucson, Arizona

The Old Pueblo Trolley, a non-profit organization, was founded in 1983 with the goal of bringing a vintage trolley to Tucson as part of the 1985 University of Arizona Centennial celebration. The group was able to implement a short single-track line along Fourth Avenue, which was later extended east on University to the main gate of the University of Arizona. The line stopped short of downtown, due to original funding constraints.

Figure 16 Tucson Modern Streetcar



The Old Pueblo Trolley was clearly run more as an attraction than as a transit system (it even sold itself as a "moving museum"). However, the line served an important link between the Fourth Avenue business district and the University of Arizona. As a result, the Tucson Department of Transportation evaluated an extension of the corridor and conversion of the line to a modern streetcar system

(similar to Portland, Seattle and Tacoma). In May 2006, Tucson voters approved a ½ cent sales tax initiative to help fund final design and construction of the system and the system is currently in the construction phase.

The 3.9 mile Tucson Modern Streetcar line will operate every 10 minutes during peak periods and every 20 minutes during off-peak periods. The line is expected to be in operation by late 2013. In terms of economic development, it is estimated that more than $160 million has been invested along the corridor by private developers in the past 30 months.

4 POTENTIAL STREETCAR ALIGNMENTS

Potential streetcar alignments were developed based on a number of factors including existing travel patterns and boardings in downtown Missoula, current and projected employment and population density, feedback from the Regional Coordination Committee workshop, the Downtown Plan process, and the economic and development potential of each alignment. This chapter provides an overview of selected alignments, including capital costs, estimated ridership, and other considerations such as roadway constraints.

Review of Demographics and Travel Patterns

The Missoula Urban Transportation District's Comprehensive Operations Analysis (COA) of Mountain Line and agency Long Range Plan (LRP) were developed in conjunction with the development of potential streetcar alignments. The following documents provide a detailed assessment of key demographics and travel patterns in downtown Missoula:

- Employment, population, low-income residents, zero-car households, and other key demographics that are known to drive transit demand (COA Chapter 5)
- Boarding activity, loading by segment, and origin-destination data (COA Chapters 2 & 8)
- Projected population and employment (LRP Chapter 3)

Demographic maps in Figure 18 and Figure 19 below show that downtown and the University are among the most dense employment areas in the city. These areas also currently have the highest percentage of households without access to a car (see Figure 20).

Population in Missoula is projected to increase most relative to the current level in downtown over the next 20-30 years, but in raw numbers most growth is expected outside of downtown. The Urban Fringe Development Area (UFDA) project estimates a total increase of 15,064 new housing units between 2007 and 2035 (from 40,412 to 55,476 respectively). Per the 2012 Missoula Long Range Transportation Plan, and also in support of the "focus inward" Envision Missoula growth policy, a large portion of the projected new housing units will be built in downtown (over 2,000 units). Figure 17 shows that downtown Missoula is estimated to increase in population by 139% by 2040, while the City and County will increase 55% and 60% respectively. The roughly 5,000 new downtown residents could represent somewhere in the range of 2,500 to 3,000 housing units assuming downtown housing will attract smaller households than the citywide average. A large portion of the employment growth is also projected to be located in downtown.

Figure 17 Missoula Projected 2040 Population and Employment

Area	2010 Population	2040 Projected Population	% Population Change	2010 Employ-ment	2040 Projected Employment	% Employment Change
Downtown Missoula	3,679	8,795	139%	13,576	20,613	52%
City of Missoula	64,529	100,264	55%	52,528	92,369	76%
Missoula County	107,039	171,070	60%	71,995	129,120	79%

Source: Missoula MPO Travel Demand Model
Note: Downtown Missoula does not include the University

The Missoula Urban Transportation District's Long Range Plan developed a primary transit network (PTN) for Mountain Line, which is a conceptual network of high-quality, frequent transit routes that connect Missoula residents to jobs, shopping, entertainment, and recreation. The PTN reinforces investment where the most passengers will benefit and the City and region will receive the greatest return on investment of limited funds. The PTN was identified based on current and projected employment and population density, the presence of major activity centers (such as the University), and current boardings. High boarding areas, including downtown and the University, are shown in Figure 21 below. The proposed streetcar alignments align with the recommended PTN corridors.

Figure 18 2010 Downtown Employment Density by Census Block

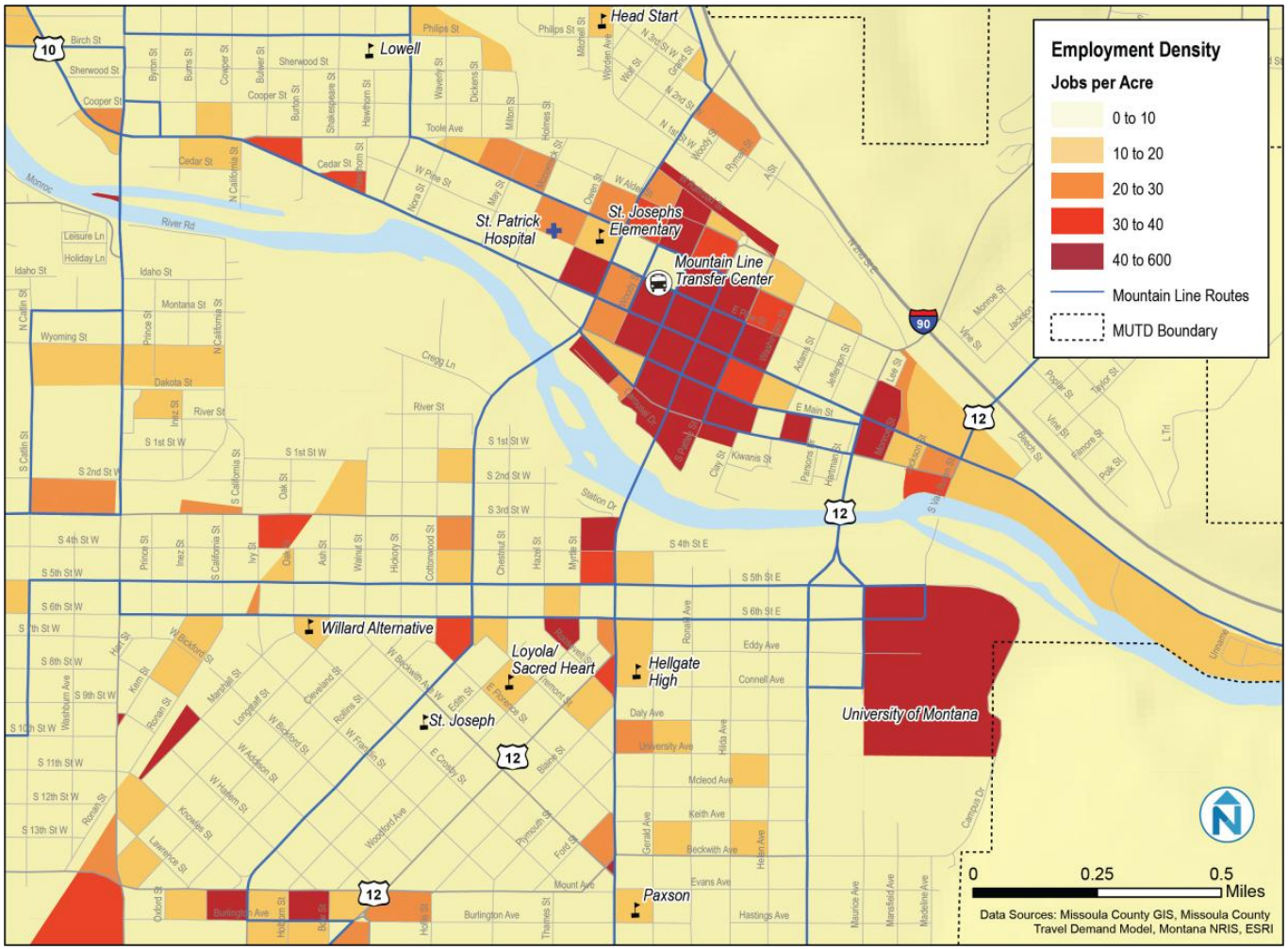


Figure 19 2010 Downtown Population Density by Census Block

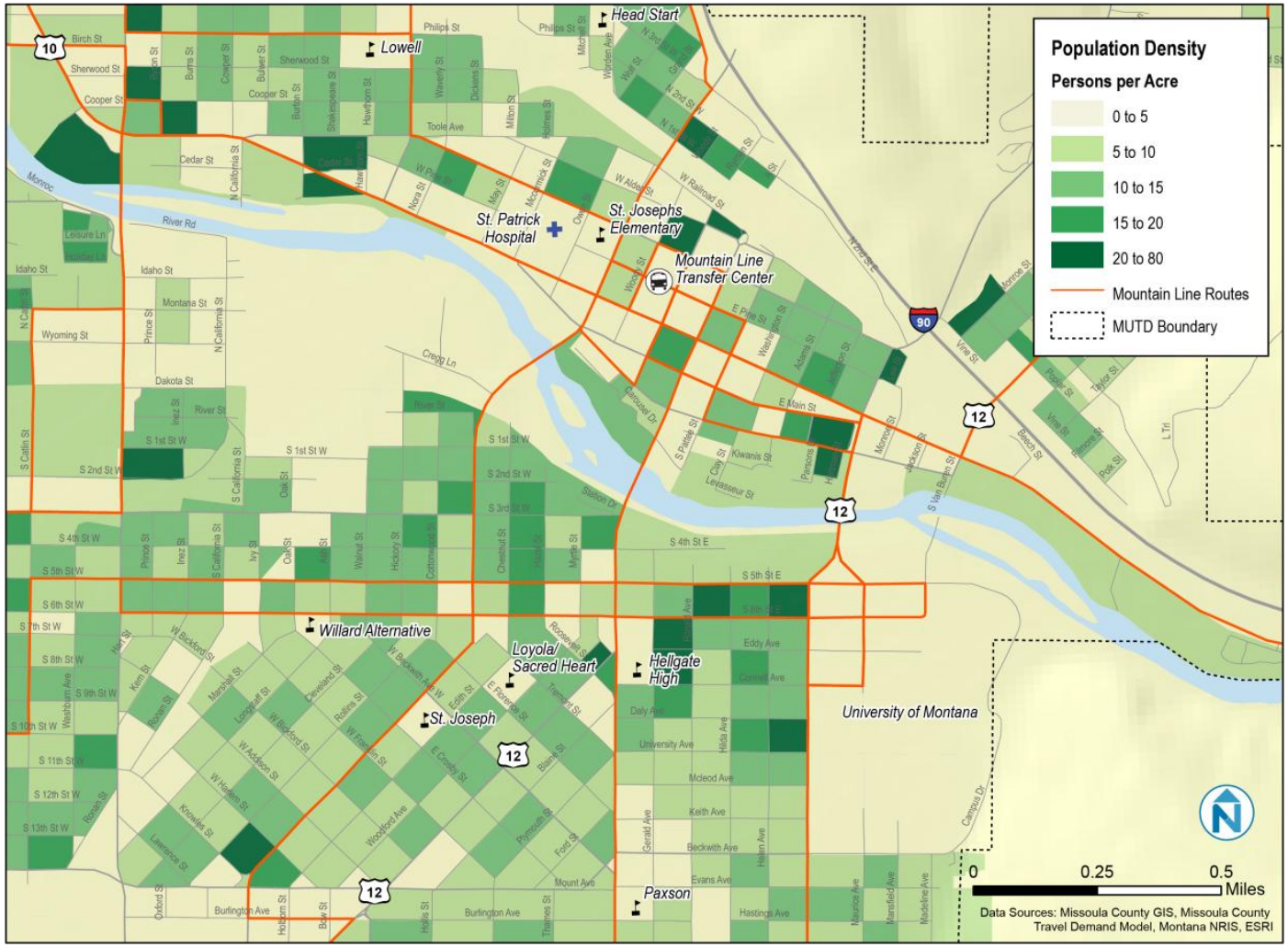


Figure 20 Percentage of Households Downtown Without Access to a Vehicle by Census Tract

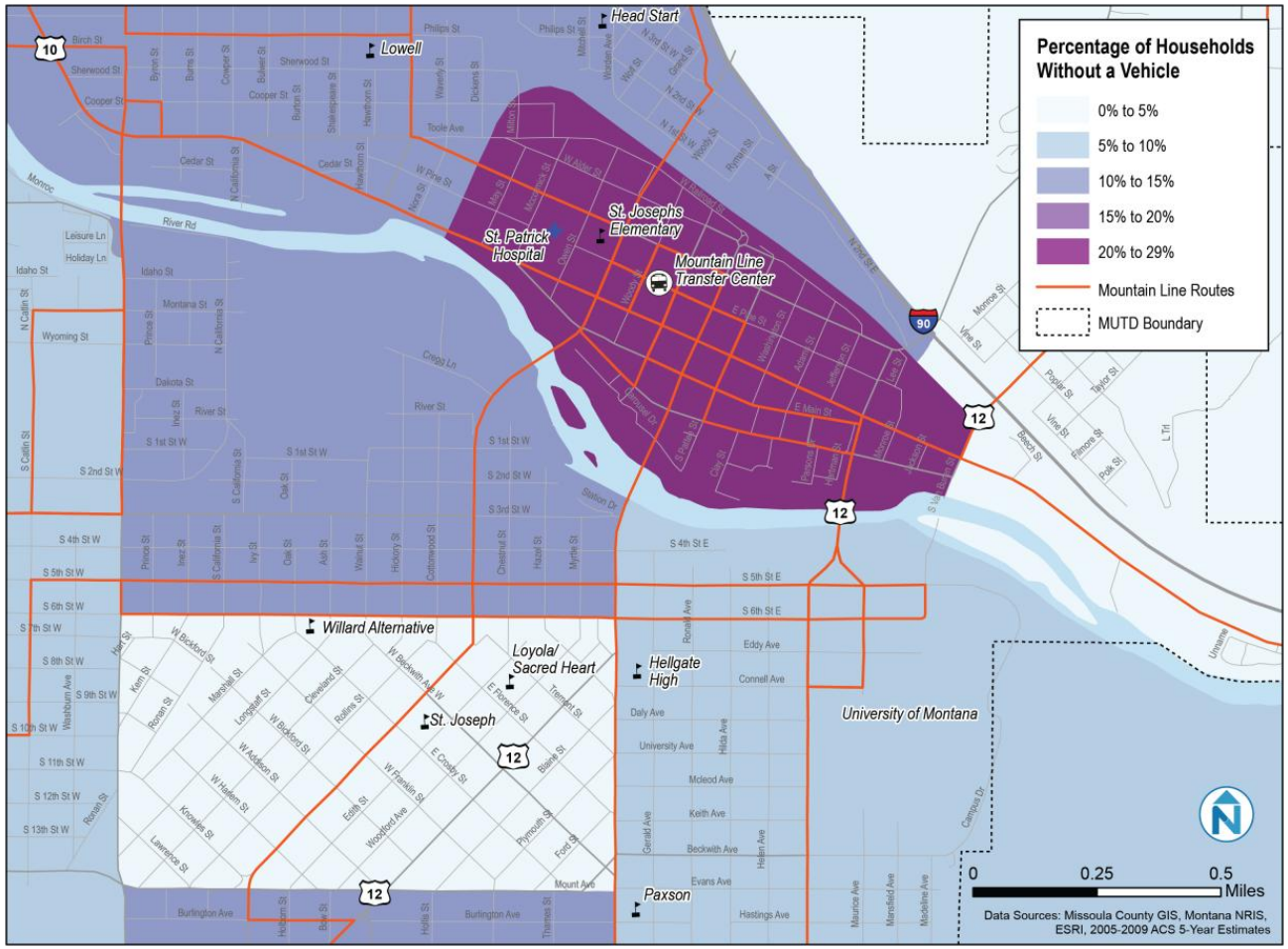
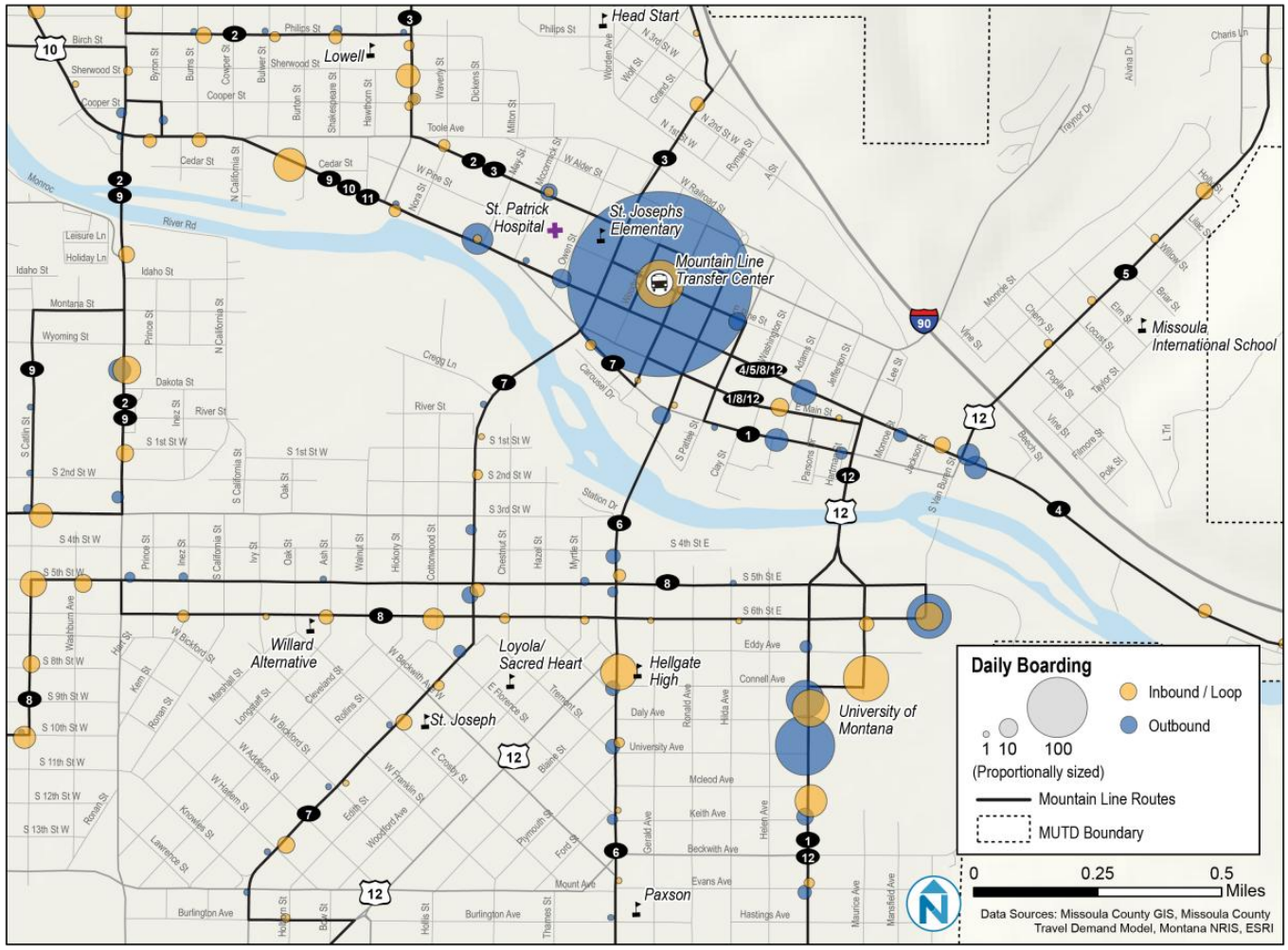


Figure 21 Weekday Boardings in Downtown Missoula



Community Support

As part of the Comprehensive Operations Analysis and Streetcar Feasibility Study, a workshop was held with the public and Regional Coordinating Committee on December 8, 2011. The purpose of the workshop was twofold: 1) to present concepts on related to the Missoula Urban Transportation District's Long Range Plan (see separate LRP report) and 2) to discuss the potential for an urban streetcar in Missoula. The workshop included a table exercise that allowed participants to plan out their own streetcar alignment and better understand the costs associated with doing so. The maps produced by workshop participants are included in Appendix A.

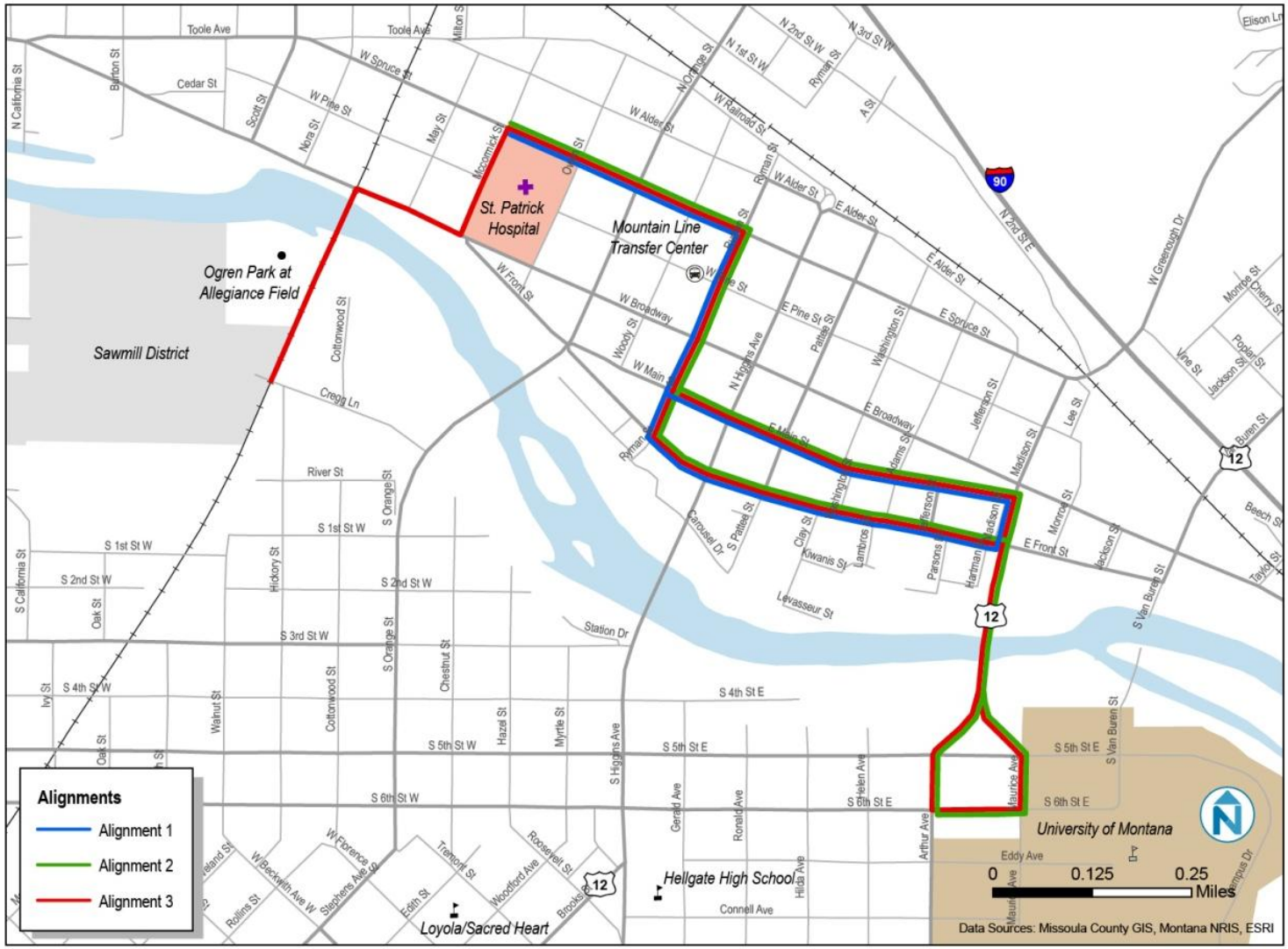
Based on the workshop, participants agreed that an initial streetcar alignment should start in downtown Missoula and connect the downtown core to St. Patrick Hospital. Other key destinations that could be served – either initially or over time – include the UM campus and the old Sawmill District.

Potential Streetcar Alignments

Based on this workshop and the demographic and travel pattern review completed as part of the COA effort, it was clear that the streetcar alignment developed through the Downtown Plan process (see Figure 1) very closely matched current community goals for streetcar, but that additional alignments to the UM campus and the old Sawmill District were also important. Further, the team's market analysis suggests that this downtown alignment represents the best opportunity to leverage development sources based on new development. As a result, this report focuses three streetcar alignments to be tested for funding viability and development impacts. These alignments could represent a phased implementation of a single system:

- **Alignment 1, East Downtown to St. Patrick Hospital (via Front/Main)** connects downtown's primary commercial and government zones with its largest employer, St. Patrick Hospital.
- **Alignment 2, UM to St. Patrick Hospital (via Madison, Front/Main).** This alignment adds to Alignment 1 by crossing the Clark Fork River (via either the Madison Street Bridge) to connect with the University of Montana, the major transit market in Missoula.
- **Alignment 3, UM to Sawmill District (via Madison, Front/Main and Montana Rail Link).** This alignment adds to Alignment 2 by crossing the river once again along the Montana Rail Link (MRL) bridge and terminating at the Sawmill District, which is anticipated to develop into a mixed-use urban district in the relatively near future.

Figure 22 Potential Downtown Missoula Streetcar Alignments



COSTING ASSUMPTIONS AND METHODOLOGY

Operating Cost Estimates

The operating cost for streetcar service, as with any type of transit service, is driven by the number of hours and miles each streetcar vehicle operates each day, and by the unit cost which is usually measured in cost per hour of service. The number of hours and miles operated by any transit service are a direct result of the assumptions included in the operating plan for service.

This section describes the assumptions used to develop the operating plan for the three identified streetcar alignment options. Each operating plan is driven by a several critical components, including:

- Frequency of service (how many round trips per hour the service operates)
- Service span (how many hours during the day the service operates)
- Round trip distance
- Estimated speed of travel
- Estimated layover and recovery time

Frequency and Service Span

The operating plans discussed below start with the assumption that 15-minute service frequencies are desired. A service that operates every 15 minutes is generally viewed as frequent enough that passengers do not need to refer to a schedule. In the case that the frequency of 15 minutes does fit within the round trip travel time, the frequency can be adjusted up or down accordingly. In general, however, it is much easier for passengers to remember standard frequencies – such as every 10 minutes, every 15 minutes, etc. – as opposed to odd frequencies like every 14 minutes, every 18 minutes, etc.

Services during the weekday are assumed to operate over a span of 15-hours on weekdays (7:00 AM to 10:00 PM) and for 12 hours on weekends (8:00 AM to 8:00 PM). These spans can be adjusted earlier or later based on further market analysis. Layover and recovery times are allocated at the ends of each trip, to provide time to return to schedule in case of delays. For the purposes of this study, at least 15 percent of the round trip running time is allocated to layover and recovery in each operating scenario. Typical urban layover times include 10% of the total trip time plus five minutes. This slightly higher number compensates for additional deadhead time required for vehicles to travel to and from a maintenance yard.

Based on these assumptions, the operating plan estimates the number of revenue hours provided, the number of vehicles needed and the resulting cost of service. Assumptions about operating speed and service frequency directly affect the number of vehicles that would be required to operate the line, since the vehicle requirement is directly dependent on how long it takes a vehicle to make a round trip cycle of the proposed line. The assumptions for travel speed and layover time are discussed in more detail below.

Travel Speeds, Running Time & Layover

Travel speed is a key variable in developing operating cost assumptions, because it determines how quickly a given vehicle can make a round trip and begin the trip again. Travel speeds include the time required for stops as well as the speed between stops. The stop spacing identified for

each proposed alignment governs how fast the street cars will travel – the more stops, the lower the average speed.

The Portland Streetcar operates at 7 miles per hour, including dwell time at stops. Streetcars in San Francisco operate at average speeds ranging from 8 to 11 miles per hour; in Kenosha, WI streetcars average 10 miles per hour; and in Tacoma, where grade separations and traffic signal priorities are employed to increase speed, streetcar achieves an average speed of 12 miles per hour. Based on these streetcar systems, it is assumed that the operating speed for a streetcar in Missoula would be about 10 miles per hour.

Layover and Recovery Time

Layover and recovery time is required at the end of each trip to allow vehicles to return to schedule if delays have occurred, for drivers to take a break and to perform vehicle inspections. Some transit systems have labor agreements in place that stipulate specific minimum layover requirements. Typically, 15 to 20 percent of the total round-trip run time is scheduled for end-of-line layover. In cases where operating segments are short some providers use a minimum of 10 percent layover plus 5 minutes as a standard. For the purposes of this report, it was assumed that the layover time was 15% of in-service running time.

Per Hour Operating Costs

Based on experiences from other cities that operate bus and streetcar service, streetcar operating costs average 35 to 50 percent higher than the companion bus costs. Even at properties that operate modern streetcars, streetcar operation tends to be more costly than bus. Generally, there are more buses in operation than streetcars, resulting in economies of scale for that mode. Additionally, streetcars require maintenance of track and wire as an additional ongoing cost of operation.

In Seattle, for example, an hour of streetcar service costs about $204, compared with about $144 for a fully allocated hour of bus service operated by King County Metro, the primary transit operator in Seattle. In this case, the streetcar includes fully allocated administrative, marketing and other ancillary expenses that are unique to the streetcar. This 42 percent “premium” for an hour of service is at the high end of what could be expected in Missoula. The premium is due to the maintenance of track-way and a unique vehicle which requires separate shop facilities, etc. as well as the lack of economies of scale that result from larger fleets.

Mountain Line bus service costs approximately $78 per hour (2011). The following analysis uses a 40 percent premium for streetcar cost, or $111 per hour.

Spare Vehicles

Vehicle fleet requirements are a combination of the peak vehicle requirement to operate service and the number of spares needed to ensure that a reliable service is maintained. Generally, a 20 percent spare ratio is required for a standard transit fleet, rounded up to the next largest whole number of vehicles. In the case of very small fleets, it is sometimes necessary to have a minimum of two spares on the property to ensure reliable service, especially if components are being maintained off-site.

Modern Skoda vehicles, such as those used in Portland and Tacoma, have excellent maintenance track records. With a comparable modern vehicle fleet, Everett could likely manage with a single

spare vehicle. Restored vintage cars have performed reliably for cities such as San Francisco, Little Rock and Memphis, but a second spare vehicle may be needed if historic cars are employed.

Capital Cost Estimates

Capital costs were estimated using the capital budget from the Portland Streetcar Loop extension, which is scheduled to open in the second half of 2012. Costs were broken down into four categories:

- Infrastructure
- Vehicles
- Maintenance Facility
- Other Major Capital Improvements

Based on these cost estimates, the capital cost associated with each alignment can be estimated. A this level of analysis, it was assumed that material costs in Missoula are similar to that in Portland or other locations, but the cost of labor is likely lower. Similarly, the scale of underground utility work (which is unknown for this corridor) could significantly impact the capital costs. For this reason, the capital costs for each alignment are shown as a range between 75% and 110% of the based estimated cost. It should also be noted that all costs are shown in 2012 dollars.

Infrastructure

Infrastructure costs are estimated from costs for the Portland Streetcar Loop extension project and are estimated to be $16.5 million per track mile. The following elements are included in this estimate:

- Trackwork
- Roadway and sidewalk improvements
- Stations and platforms
- Catenary, signals and substations
- Contingencies and soft costs
- Engineering and project management
- Right of way (assumed to be minimal since streetcar would operate in existing ROW)

Vehicles

Vehicle costs are assumed to be $3.5 million per vehicle. This is based on Oregon Iron Works' contract with Portland Streetcar to provide six streetcar vehicles for $20 million ($3.33 million per vehicle) for the Portland Streetcar Loop extension project. It is assumed that vehicles for a Missoula Streetcar would be somewhat more expensive due to the smaller order size.

Maintenance Facility

Based on maintenance facility costs for Portland streetcar projects, the maintenance facility is estimated to cost approximately $2 million for a 2 vehicle facility and $3 million for a 3 vehicle facility. The original Portland Streetcar maintenance facility cost about $4 million (in 2001 dollars), but this was a much larger facility than would be required in Missoula.

Other Major Capital Improvements

It is assumed that retrofitting the Madison Street Bridge for use by streetcars would be an additional major capital cost for Alignments 2 and 3, and a very rough estimate is $2 million. In addition, retrofitting or replacing the Montana Rail Link Bridge to the Sawmill District would be a major capital cost for Alignment 3, and a very rough estimate is $5 million. Additional study would be needed to produce more accurate cost estimates for these projects.

Ridership Estimates

To estimate ridership for the proposed Missoula streetcar options, performance on other cities with streetcar lines were used. While there are not cities of comparable size to Missoula with service that is like what is included in this memo, other cities that are as close as possible were reviewed. Figure 23 shows the range of ridership and productivity (as measured in passengers per revenue hour) for each of the three peer cities included in this analysis. Also included is a brief description of the unique factors that may contribute to each city's ridership compared to the three optional alignments in Missoula.

Figure 23 Peer System Ridership

City	Annual Ridership	Ridership (Riders/ Rev. Hour)	Factors Contributing to Ridership
Tampa	501,959	36.3	▪ More intense land use compared to Missoula ▪ Directly serves downtown Tampa ▪ Serves major tourist attractions along water ▪ Connects with specialized rubber-tired service, called "In-Town Trolley"
Kenosha	53,396	22.5	▪ Connects the downtown and commuter rail station with the HarborPark redevelopment area ▪ The system is used mostly in the summer as an attraction ▪ Limited operating hours
Little Rock	107,088	9.0	▪ Serves intense land uses in downtown Little Rock ▪ Serves tourist attractions in Little Rock and North Little Rock ▪ Relatively low population density along alignment but high employment density
Average Riders per Rev. Hour:		22.6	

Estimated Ridership for Three Potential Alternatives

Ridership estimates are pivoted off of known productivities from peer systems and then subjectively adjusted based on future conditions in Missoula. The productivities in each peer city were adjusted based on the following factors:

- Overall Corridor Density
- Development Potential

- Residential Density
- Tourists and Visitors
- Connections to Activity Centers
- Service Span and Frequency
- Fare Level

Based on this adjustment, an average productivity was calculated. Based on that average, a range of productivities was calculated based on plus or minus 10% of the average. The range of productivities are then multiplied by the total revenue hours for each optional alignment to arrive at a range of ridership. Ridership estimates for three potential streetcar alternatives in Missoula are presented in Figure 24. The detailed pivot model used to calculate ridership estimates is included in Appendix B.

Figure 24 Streetcar Ridership Estimates

		Optional Alignment		
		Alignment 1: East Downtown to St. Patrick	Alignment 2: UM to St. Patrick Hospital	Alignment 3: UM to Sawmill District
Productivity	**Low Estimate**	20	26	24
	High Estimate	24	32	30
Annual Ridership	**Low Estimate**	99,000	130,000	242,000
	High Estimate	121,000	159,000	296,000

Physical and Geometric Constraints

This section provides an overview of the design elements and geometric roadway constraints considered during the development of the streetcar alignments in Missoula. Streetcar tracks generally operate within existing travel lanes and are typically located in the right hand lane of the street. Factors to consider in the streetcar alignment design process include integration with on-street parking, pedestrians, bicyclists, cars, freight, and buses.

Figure 25 below provides an overview of the grade, geometric, and other physical barriers and requirements for streetcars in the street right of way.

Figure 25 Streetcar Roadway Constraints

Street Component	Screening Measure
Grade	▪ Grades between 7-9% over sustained lengths
Street Geometry	▪ Required turns greater than 90 degrees, or segments with required weaving/ curvature that cannot be negotiated by a modern streetcar without significant impacts

Street Component	Screening Measure
Other Physical Barriers	▪ Bridges or skyways with less than 14' 0" of overhead clearance ▪ Curb to Curb width must provide adequate space for 11 foot lane widths for shared streetcar lane and 10 ft for autos ▪ At-grade freight railroad crossing: at grade crossing of two tracks requires difficult FRA/RR approval and are not typically allowed without expensive additional signalization or grade separation
Parking Considerations	▪ Generally, a streetcar track is installed in a lane that directly abuts a curb since these lanes are commonly used for parking and loading zones. Angle in parking is not recommended adjacent to a streetcar lane, but parallel parking configurations are normal.

Downtown streets proposed as potential streetcar or electric trolley bus circulator carrying streets were reviewed and no fatal flaws relative to road geometry were found. Other than utility issues related to track design and construction, most other street design considerations are comparable for the two modes. Some specific issues that will need to be addressed in a design phase include:

- **Lane widths:** Lane widths on streets such as Main and Front are quite wide. Reducing lane widths to 12 feet for streetcar carrying streets can help to manage auto speeds and ensure that cars do not attempt to pass the streetcar or bus in lane.
- **Angle-in parking:** Streetcars frequently operate in lane parallel to street parking designed in parallel to the curb. However, it is not advised that a line operate adjacent to angle-in parking. A streetcar running on Main, for example, would require parking on one side to revert to parallel parking and would somewhat reduce the total number of stalls.
- **Street trees:** Generally designers are able to integrate catenary wire poles with small to medium sized street trees. However, some tree removal might be necessary where there are mature or overgrown street trees in place.
- **One-way streets**: Main and Front currently operate as a couplet. Streetcars operate on parallel one-way streets in Portland and could in Missoula as well. However, from a customer standpoint, a two-way operation in a single street is more transparent and focuses amenities and economic development opportunity. If Missoula considers changing Main and Front to two-way operations, Main would be best suited to carrying a two-way streetcar or bus circulator line.

- **Stations:** Near side stop locations are generally preferred and can be integrated in the sidewalk using relative basic bulb-outs into the parking lane. To accommodate the double articulated, 66' low floor streetcar vehicle, the platform length for one vehicle is generally 60' to 70' long. The integration of curb-extension platforms with existing sidewalks provides an opportunity to use the grading of the platform and the sidewalk furnishing zone into an enhanced landscape strip.

Basic streetcar platform in Portland, Oregon
Source: Light Rail Now

- **Civil elements:** Detailed street design elements can be addressed at the design phase, but streetcar and electric trolley bus modes can be integrated with relatively minor changes to lane stripping and street use dimensions.
- **Utilities:** A detailed study of utility impacts is required early in a next phase of streetcar conceptual design. Streetcars have the advantage of requiring a lower depth "cut" in the street than light rail. This can reduce the level of utility relocation required. Utility analysis should consider water, sanitary, storm, electric, gas, and other private utilities. Conflicts with overhead utility lines should also be reviewed.

Street Design Guidelines for Streetcars

Looking west on Main Street, Missoula, Montana

Integrating streetcars into urban streets is a highly context sensitive design exercise. This study is not scoped to address detailed geometric design approaches, but rather provides a planning level assessment. There are, however, excellent documents available that provide guidance for city DOT's interested in developing modern streetcar lines in existing street rights-of-way. Among the best is a 2012 document produced by the Washington, D.C. Department of Transportation (DDOT), titled DC Streetcar Design Criteria. Appendix D provides an overview of potential streetcar cross-sections.

Another important consideration for Missoula, a city that has a high rate of bicycle use, is successful integration of bicycles and streetcars. A major safety concern for streetcar design is ensuring that cycling accidents are minimized by providing designs that reduce the need for cyclists to ride in streetcar lanes and ensure that crossings are done perpendicular angles. Streetcar cities such as Seattle and Portland have developed a number of design practices that reduce bicycle and streetcar conflicts and allow the two modes to coexist safely.

Seattle's First Hill Streetcar line (under construction) includes a protected two-way cycle track parallel to the streetcar/traffic lanes.

Clear signage that warns cyclists of the dangers of crossing tracks is important.

Providing a bicycle box enables bicyclsts to queue in while waiting to cross the streetcar tracks.

POTENTIAL STREETCAR ALIGNMENTS

Alignment 1: East Downtown to St. Patrick Hospital (via Front/Main)

Alignment 1 would exclusively serve downtown Missoula by providing connections between St. Patrick Hospital and the east end of downtown. From St. Patrick Hospital (at Spruce and McCormick Streets), the alignment would travel east on Spruce before turning south on Ryman Street where it would connect to the Mountain Line Transfer Center. The alignment then continues south on Ryman Street and continue east on Front Street to Madison Street. The streetcar would layover on Madison Street (the one-way portion on the west side of the street). From here, the streetcar would return via the same alignment except it would use Main Street between Madison Street and Ryman Street. The round-trip distance for this alignment is 2.14 miles.

Operating Plan

Based on the operating assumptions discussed above, a streetcar along this alignment is assumed to operate every 15 minutes throughout the day, seven days a week. The round-trip travel time, including layover, is about 14 minutes, which would require only one vehicle. Figure 26 below summarizes operating characteristics for Alignment 1.

Figure 26 Streetcar Operating Characteristics: Alignment 1

Operating Characteristics				Annual Data		Ridership	
Round-Trip Distance	Max In-Service Vehicles	Frequency	Service Span	Revenue Hours	Estimated Operating Costs	Low	High
2.14	1	15 min	7:00 am - 10:00 pm (M-F) 10:00 am – 10:00 pm (Sat and Sun)	5,145	$571,200	99,000	121,000

Capital Costs

Based on the capital cost assumptions discussed above, which assumed $16.5 million per track mile (exclusive of vehicles and a maintenance facility), the base estimated cost of this alignment is $39.4 million.

In addition, this alignment would require two vehicles and a maintenance facility.

Vehicles

While only one vehicle is required to operate service in this alignment, one additional spare vehicle would also be necessary to account for potential breakdowns and to allow for regular maintenance to occur. The additional vehicle could also be employed to provide additional frequency or capacity for special events.

Maintenance Facility

As discussed earlier, all streetcar lines require a maintenance and storage facility. It is preferable to locate this facility as close to the revenue track as possible, since non-revenue track to access a

maintenance facility is as costly as revenue track. While a small facility would be adequate for the two vehicles required for this alignment, it would be important to locate a facility in a location that could be expanded.

Because this alignment serves the most densely developed part of Missoula, the most likely location for a maintenance facility is on the northwest of downtown near the existing industrial uses. While a specific location would require more study, one potential location is along the railroad tracks near Milton Street and Cooper Street. For the purposes of this report, it is estimated that an additional ¼ mile of non-revenue track would be required to access a maintenance facility.

The total estimated cost of this alignment, including vehicles and a maintenance facility, is $36.3 million to $53.3 million, which assumes a cost range between 75% and 110% of the base cost plus vehicles and a maintenance facility. More detail on the capital costs are provided in Figure 31.

Ridership

Based on the ridership estimation methodology, it is estimated that between 298 and 364 passengers would use this streetcar alignment on an average weekday. Ridership on Saturday is estimated to be about 80% of weekday ridership and Sunday ridership is estimated to be about 60% of weekday ridership. The total estimated annual ridership for this alignment is 99,000 to 121,000.

Alignment 2: UM to St. Patrick Hospital (via Madison and Front/Main)

Alignment 2 includes all of Alignment 1 but extends service to the UM campus via the Madison Street bridge. On the south side of the river, the alignment would make a small loop via Arthur, 6th Street and Maurice Avenue to serve the UM campus.

Operating Plan

A streetcar operating in Alignment 2 is assumed to operate every 20 minutes throughout the day, seven days a week. While it is desirable to operate more frequently than 20 minutes, the short extension to the UM campus only adds an additional 5 minutes of travel time. Thus, operating service every 15 minutes (the desired minimum frequency) would require one additional in-service vehicle, long layover times, and an inefficient use of resources. Thus, operating every 20 minutes allows operation in this corridor for the same cost as Alignment 1, even though service operates less frequently. Maintaining 15 minute service for this alignment would require an additional vehicle and increase operating costs by almost a factor of two. With an additional vehicle in operation it would provide an option to extend the alignment slightly with no net new operating cost or operate at 12 minute headways.

Figure 27 below summarizes operating characteristics for Alignment 2.

Figure 27 Streetcar Operating Characteristics: Alignment 2

Operating Characteristics				Annual Data		Ridership	
Round-Trip Distance	Max In-Service Vehicles	Frequency	Service Span	Revenue Hours	Estimated Operating Costs	Low	High
3.0	1	20 min	7:00 am - 10:00 pm (M-F) 10:00 am – 10:00 pm (Sat and Sun)	5,145	$571,200	130,000	159,000

Capital Costs

Capital costs associated with Alignment 2 are higher than Alignment 1 due to Alignment 2's greater length, as well as major capital costs associated with integrating streetcar track into the Madison Street Bridge. The total estimated capital costs for Alignment 2 are $48.0 million to $70.4 million, which includes 2 streetcar vehicles (one revenue vehicle and one spare), a maintenance facility and non-revenue track to reach the maintenance facility. More detail on the capital costs are provided in Figure 31.

Ridership

It is estimated that between 393 and 481 passengers would use this streetcar alignment on an average weekday. This estimate is significantly higher than Alignment 1 because it now connects downtown to the UM campus – the major transit generator in Missoula. Similar assumptions are made about Saturday and Sunday ridership as Alignment 1. Based on this, the total estimated annual ridership for this alignment is 130,000 to 159,000.

Alignment 3: UM to Sawmill District via Madison/Front

Alignment 3 includes all of Alignments 1 and 2 and further extends service to the old Sawmill District via McCormick Street, Broadway and the Montana Rail Link (MRL) bridge. Because the old Sawmill District site is currently undeveloped, Alignment 3 is shown terminating on the eastern edge of the development but could be extended to more directly serve this area as it develops. It is assumed that this alignment would not be considered until the old Sawmill District was developed – or at least until significant progress towards developing this site was made.

Operating Plan

Streetcar service in Alignment 3 is assumed to operate every 15 minutes throughout the day, seven days a week. Because the round-trip travel time on Alignment 3 is about 30 minutes, two vehicles would be required to operate in the entire alignment.

Figure 28 below summarizes operating characteristics for Alignment 3.

Figure 28 Streetcar Operating Characteristics: Alignment 3

Operating Characteristics				Annual Data		Ridership	
Round-Trip Distance	Max In-Service Vehicles	Frequency	Service Span	Revenue Hours	Estimated Operating Costs	Low	High
4.1	2	15 min	7:00 am - 10:00 pm (M-F) 10:00 am – 10:00 pm (Sat and Sun)	10,290	$1,142,200	242,000	296,000

Capital Costs

Capital costs associated with Alignment 3 are higher than Alignments 1 and 2 due to additional track mileage, as well as major capital costs associated with ensuring that streetcars could operate on the Montana Rail Link bridge and the Madison Street Bridge. The estimated capital cost for Alignment 3 is $68.3 million to $100.2 million, which includes 3 streetcar vehicles (two revenue vehicles and one spare), a maintenance facility and non-revenue track to reach the maintenance facility. More detail on the capital costs are provided in Figure 31.

Ridership

It is estimated that between 730 and 892 passengers would use this streetcar alignment on an average weekday. This estimate is higher than Alignments 1 and 2 because it would serve the old Sawmill District, which is expected to include a substantial amount of new development. Similar assumptions are made about Saturday and Sunday ridership as Alignments 1 and 2. Based on this, the total estimated annual ridership for this alignment is 242,000 to 296,000.

Rubber-Tire Option: UM to St. Patrick Hospital (via Madison and Front/Main)

This option assumes the same alignment as the Alignment 2 streetcar (UM to St. Patrick Hospital) but uses a different vehicle technology – either a standard diesel bus (similar to those already in service in Missoula) or an electric trolley bus.

Operating Plan

A rubber-tire vehicle (diesel bus or trolley-bus) operating in Alignment 2 is assumed to operate every 10 minutes throughout the day, seven days a week. The 10 minute headways would allow for more spontaneous travel in the corridor where the service is frequent enough that they would not need to refer to a schedule. The 10 minute headway would also meet the FTA's definition of rapid bus, which would make this project eligible for FTA Very Small Starts funding. The higher frequency service, however, would require an additional in-service vehicle (compared to streetcar operating every 15 minutes). Figure 29 below summarizes operating characteristics for a rubber-tire option in Alignment 2.

It is important to note that if this circulator service was combined with Route 1 operations, the additional operating cost would be substantially less and the likely repetitive service between Route 1 and the circulator would be eliminated.

Figure 29 Rubber-Tire Operating Characteristics: Alignment 2

	Operating Characteristics				Annual Data		Ridership	
Vehicle Type	Round-Trip Distance	Max In-Service Vehicles	Frequency	Service Span	Revenue Hours	Estimated Operating Costs*	Low	High
Diesel Bus	3.0	2	10 min	7:00 am - 10:00 pm (M-F) 10:00 am – 10:00 pm (Sat and Sun)	10,290	$813,000	130,000	159,000
Trolley Bus	3.0	2	10 min	7:00 am - 10:00 pm (M-F) 10:00 am – 10:00 pm (Sat and Sun)	10,290	$975,000	143,000	175,000

Operating costs for diesel bus is assumed to be the same as Mountain Line ($79/hour), while operating costs for trolley bus ($95/hour) are assumed to be 20% higher than Mountain Line bus.

* Could be much lower if combined with Route 1 service.

Capital Costs

Rubber-tired vehicles do not require the same level of capital investment (in terms of rail infrastructure in the street) compared to streetcar.

The diesel vehicle option requires the lowest capital cost investment since the only significant cost would be for new vehicles, stations, and platforms. It is estimated that new high-end and distinctive diesel vehicles are in the order of $400,000 each. With two in-service vehicles and one spare vehicle, the cost for vehicles is estimated at $1.2 million. The higher end stations along the alignment are estimated at $300,000 per route mile, or $900,000 for the entire 3 mile alignment. Total estimated capital costs for the diesel bus option is approximately $2.0 to $2.5 million.

Electric trolley bus would require some additional infrastructure compared to diesel bus, specifically catenary wire and substations required to power the vehicles. Trolley bus vehicles are also more expensive than a standard diesel bus. It is assumed that electric trolley buses cost $1.0 to $1.2 million per vehicle, depending on configuration. Assuming the need for three vehicles (two in-service and one spare), the cost for trolley buses is approximately $3.0-$3.6 million. The costs for stations and platforms would be the same as diesel bus, or about $900,000 for the 3-mile alignment. Finally, it is estimated that the cost for catenary wire and substations are on the order of $4.0 to $8.0 million per route mile (bi-directional service), which would be about $6.0 to $12.0 million for the 1.5 mile alignment. Thus, the total estimated capital cost for the trolley bus option is estimated at approximately $10.0 to $17.0 million (likely in the lower end of this range).

Ridership

To estimate ridership on the rubber-tire option, an adjustment factor was applied to the estimated 130,000 to 159,000 annual estimate developed for streetcar in the same alignment. However, it is assumed that the improved headway (from 15 minutes on streetcar to 10 minutes on the rubber-tired option) would increase ridership by 30-40% (based on national studies of improving headways on comparable transit services). On the other hand, streetcar has been shown to attract between 15-50% more riders than bus in comparable environments (as noted earlier in Figure 6). Based on these assumptions, it is estimated that the rubber-tire option would attract approximately the same amount of ridership as streetcar.

Another factor that could influence ridership is the potential preference for trolleybus technology over standard diesel vehicles. Although it is acknowledged that there is likely a preference for trolleybus, good data for this preference is not readily available. For the purposes of this plan, it was assumed that ridership on trolleybuses is somewhat higher (estimated at 10%).

SUMMARY OF STREETCAR ALIGNMENT OPTIONS

Figure 30 below summarizes the operating characteristics and costs for each of the three alignments. Capital cost estimates associated with each alignment are described in more detail in Figure 31. Note that the capital costs for the two rubber-tire options are provided only in that section.

Figure 30 Summary of Streetcar Alignment Operating Plans

	Weekdays			Saturdays			Sundays			Annualized Operating Cost			Annual Revenue Hours	Annual Operating Cost
Alignment	Vehicles	Revenue Hours	Operating Cost	Vehicles	Revenue Hours	Operating Cost	Vehicles	Revenue Hours	Operating Cost	Weekday	Saturday	Sunday		
1: East Downtown to St. Patrick Hospital 15-Minute Headways	1	15.00	$ 1,665	1	12.00	$ 1,332	1	12.00	$ 1,332	**$ 424,600**	**$ 69,300**	**$ 77,300**	**5,145**	**$ 571,200**
2: UM to St. Patrick Hospital 20-Minute Headways	1	15.00	$ 1,665	1	12.00	$ 1,332	1	12.00	$ 1,332	**$ 424,600**	**$ 69,300**	**$ 77,300**	**5,145**	**$ 571,200**
2: UM to St. Patrick Hospital (Diesel Bus) 10-Minute Headways	2	30.00	$ 2,370	2	24.00	$ 1,896	2	24.00	$ 1,896	**$ 604,400**	**$ 98,600**	**$ 110,000**	**10,290**	**$ 813,000**
2: UM to St. Patrick Hospital (Trolley Bus) 10-Minute Headways	2	30.00	$ 2,844	2	24.00	$ 2,275	2	24.00	$ 2,275	**$ 725,200**	**$ 118,300**	**$ 132,000**	**10,290**	**$ 975,500**
3: UM to Sawmill District 15-Minute Headways	2	30.00	$ 3,330	2	24.00	$ 2,664	2	24.00	$ 2,664	**$ 849,200**	**$ 138,500**	**$ 154,500**	**10,290**	**$ 1,142,200**

Assumptions:

1. Roundtrip Mileages: Alignment 1 - 2.1, Alignment 2 - 2.8, Alignment 3 - 4.1.
2. Cycle times include 15% layover.
3. Streetcar operating speed (10 mph) includes platform dwell time. Actual travel speeds between stops are higher.
4. Service Spans: 15 hours weekday, 12 hours Saturdays and Sundays.
5. 255 Weekdays, 52 Saturdays and 58 Sundays.
6. Vehicle requirements do not include spares.
7. Operating costs for streetcar ($111/hour) are an estimated 40% higher than Mountain Line bus ($79/hour).
8. Operating costs for diesel bus is assumed to be the same as Mountain Line ($79/hour), while operating costs for trolley bus ($95/hour) are assumed to be 20% higher than Mountain Line bus.

Figure 31 Summary of Streetcar Alignment Capital Costs

Proposed Alignment	1: East Downtown to St. Patrick Hospital			2: UM to St. Patrick Hospital			3: UM to Sawmill District		
	Single Track Miles	Cost Per Mile	**Cost**	Single Track Miles	Cost Per Mile	**Cost**	Single Track Miles	Cost Per Mile	**Cost**
	2.39	$16,500,000	$39,435,000	3.21	$16,500,000	$52,965,000	4.34	$16,500,000	$71,610,000
Major Capital Costs				1. Madison St Bridge Retrofit		$2,000,000	1. Madison St Bridge Retrofit		$2,000,000
							2. MRL Bridge Replacement or Retrofit		$5,000,000
Maintenance Facility	$2,000,000	1	$2,000,000	$2,000,000	1	$2,000,000	$3,000,000	1	$3,000,000
Vehicles	$3,500,000	2	$7,000,000	$3,500,000	2	$7,000,000	$3,500,000	3	$10,500,000
Total Project Cost (2012 $)			**$48,435,000**			**$63,965,000**			**$92,110,000**
Fully Loaded Cost Per Single Track Mile			*$20,265,690*			*$19,926,791*			*$21,223,502*
Estimated Cost Range (2012 $)		**$36,326,250**	**$53,278,500**		**$47,973,750**	**$70,361,500**		**$68,332,500**	**$100,221,000**
		75%	*110%*		*75%*	*110%*		*75%*	*110%*

Assumptions:

1. Cost per mile based on Portland Streetcar Loop extension capital costs, excluding vehicles, maintenance facility, and bridges.
2. Vehicle costs based on Oregon Iron Works contract for Portland Streetcar Loop ($20 million for 6 vehicles). It is assumed that a smaller order would have a higher cost per vehicle.
3. Maintenance facility assumed to be $2 million for a 2 vehicle facility and $3 million for a 3 vehicle facility.
4. All vehicle requirements include 1 spare (meets 20% spare ratio requirements).
5. Single track miles includes an extra 1/4 mile of non-revenue track to access the maintenance facility.
6. Bridge costs are very rough estimates. Additional study would be needed to determine more accurate cost estimates.

5 FUNDING OPTIONS

Figure 32 shows potential funding packages that could be used to pay the estimated costs for each of the three alignments. These potential funding packages are conceptual only and are intended as an exercise in determining whether a combination of local, state, and federal funding sources could realistically be assembled to pay for the streetcar. It does not imply that each of these funding sources are in place today nor does it guarantee that such funding levels are achievable in today's economic or political context. An explanation of each of the major funding sources follows. The funding packages are based on a survey of other streetcar and transit projects completed around the country, a review of funding documents produced by the City and County such as the Capital Improvement Program and budgets, interviews with City and County elected leaders and staff, and the project team's professional judgment.

The capacity of several key local funding sources (tax increment financing, impact fees, etc.) depends on the amount of real estate development that takes place along the streetcar line. Thus, this funding analysis assumes that Missoula achieves the amount of housing and commercial development projected by the Streetcar development scenario in Chapter 6. Because the length of each alignment varies, this analysis also assumes that longer alignments can take advantage of more development and more funding capacity along their lengths.

Another key variable is federal funding, through the Small Starts (or Very Small Starts) program described below. As described, these funding sources are very competitive and have historically been awarded to cities larger than Missoula. For illustrative purposes, this analysis assumes that Missoula is able to secure Small Starts funding for Alignments 2 and 3, but not for Alignment 1 to illustrate the potential funding gap. Without Small Starts funding, there is a large funding gap ($24.4 million) for Alignment 1. It will be important for Missoula to work to fill this gap locally. For example, discussions with St. Patrick about the potential benefits for reduced parking development could begin this conversation.

It should be noted that however the capital funds to build a streetcar are developed, the vast majority of the ongoing operating funds would need to be generated locally. Farebox revenue generally covers 20 percent or less of operational costs.

This section concludes with options to fund the capital costs for a rubber-tired circulator.

Capital Funding Context

Compared with other capital projects that the City expects to undertake in the near future, the streetcar is a large project. The City's current (2011-2015) Capital Improvement Program (CIP) identifies 79 major projects to be funded across all departments, totaling $118.5 million. The cost of the largest project is $10.5 million, the average is $1.5 million, and the median is $500,000. Nine projects are expected to cost more than $5 million. As Figure 32 shows, the streetcar is expected to cost between $48.4 and $92.1 million. The CIP, like this funding plan, brings together numerous funding sources in order to cover project costs. The City's largest projects (Wastewater Facility upgrades and two downtown parking structures) will be paid for by revenues generated by those facilities (utility fees and parking revenues). Therefore, the City will need to be very creative in developing a funding strategy to construct a streetcar and bring together as many of the different funding tools described below—and others—as possible.

Figure 32 Streetcar Alignments: Costs and Funding Sources

	Alignment 1 Madison to St. Patrick	2 UM to St. Patrick	3 UM to Sawmill
Capital Costs	$48,435,000	$63,965,000	$92,110,000
Revenues			
Local Sources			
Tax Increment Financing (TI)	$13,300,000	$15,200,000	$22,000,000
Special Improvement District (SID)	$3,000,000	$3,500,000	$5,000,000
Transportation Impact Fees (TIF)	-	$700,000	$1,100,000
General Fund	$3,000,000	$3,115,000	$4,010,000
Institutional Contributions	$1,000,000	$2,000,000	$3,000,000
Parking Commission	$750,000	$750,000	$1,000,000
Other Local Sources	-	-	-
Subtotal	**$21,050,000**	**$25,265,000**	**$36,110,000**
State and Federal Sources			
FTA Formula Funds	$2,500,000	$3,000,000	$4,800,000
Small Starts	-	$35,200,000	$50,700,000
Small Starts federal share	-	55%	55%
State or Federal Appropriation	$500,000	$500,000	$500,000
Subtotal	$3,000,000	$38,700,000	$56,000,000
Total Revenues	**$24,050,000**	**$63,965,000**	**$92,110,000**
Surplus or (Funding Gap)	($24,385,000)	$0	$0
Private development (Streetcar scenario)			
Total Value	$242,245,000	$276,480,000	$400,800,000
Housing units	562	675	1,124
Commercial area (sf)	406,980	430,920	478,800

Source: Leland Consulting Group. Values shown are 2012 dollars

LOCAL FUNDING SOURCES

Tax Increment Financing (TI)

Through the Missoula Redevelopment Agency (MRA), tax increment financing has been one the key tools for funding urban revitalization projects in downtown Missoula for more than 30 years, and this tool is one of the most widely used funding mechanisms for modern streetcars projects. It is well suited to streetcars and other projects that help to stimulate real estate development since tax increment funds are generated by development within a defined district. Therefore, the tool can create a "virtuous cycle" in which new development pays for the infrastructure that supports it. In this way, growth can pay for itself, if the revenues generated by growth are comparable to the costs. For this reason, and because tax increment financing is a powerful funding tool, it is assumed to be an essential part of all the funding packages outlined below.

Figure 32 in the previous section shows the amount of private development assumed to be developed for each alignment (see Chapter 6 for more information on how this projection was developed). As the line grows longer, we assume it will catalyze more development and take advantage of the new property taxes generated by this development. Development leads to tax increment funds as follows. First, based on discussions with MRA staff, tax increment is estimated to generate $110,000 of bonded capital for every $1,000,000 market value of real estate development. This is a relatively conservative estimate intended to account for fluctuations in interest rates and legislation that could change the capacity of tax increment financing. The streetcar is estimated to be able to capture 50 percent of this capital, with 50 percent going to other projects such as other transportation improvements, beautification, direct investments in housing and commercial projects, and other programs. Therefore, it is assumed that $55,000 is generated for the streetcar by every $1,000,000 in development.

One challenge is the timing of tax increment funds. Tax increment is generally generated from tax assessments *after* development has been built. Therefore, the full funding potential toward a streetcar would not be realized for many years, as the development that generates tax increment funds would be built incrementally. However, the streetcar would need all of its funding up-front when construction takes place. Both development and an urban renewal district should be in place well in advance of streetcar construction so that adequate tax increment (and therefore bonded capacity) is available when streetcar construction starts.

Recent and current revenues and expenditures made by the MRA convey a sense of scale for the figures shown. In 2005, the last year during which the original downtown urban renewal district (URD I) captured revenues, it generated more than $3,000,000. The largest projects scheduled for funding by the MRA between 2011 and 2015 are curb and sidewalk improvements surrounding the Southgate Mall ($1.35 million in URD III). Within the greater downtown area (URD II), the MRA will be allocating between $400,000 and $510,000 for downtown curbs and sidewalks, West Broadway Corridor Improvements, and the Two-Way Front and Main Streets Traffic Flow Project. There are now four urban renewal districts in operation, which cover approximately one-half of downtown. This analysis assumes that an additional URD would be formed to cover those areas of the streetcar alignment not currently within a district. Further, assuming that the City moves forward with a streetcar, this URD should be created as soon as possible in order to complete the necessary planning and legal work, and to begin to generate tax increment for construction.

Special Improvement District (SID)

A SID is an area within which properties are assessed an additional amount in order to pay for or maintain a capital improvement that confers a special benefit on those properties. The City of Missoula has implemented more than a dozen SIDs to pay for new sewer, curbs, gutters, sidewalks, streets, and parks within the City limits. Affected property owners have the opportunity to protest an SID in the event that they believe that the assessment is unfair or the improvement will not directly benefit them. SIDs (often called local improvement districts in other states) were used to pay for part of the capital costs of streetcar lines in Portland and Seattle and have been evaluated extensively in other communities. SID assessment methods can be customized to fit the situation and can be levied on the basis of property or building size, assessed value, front footage of each parcel bordering a street, or a combination of these methods.

A Downtown Business Improvement District (BID) has been in place in Missoula since 2005, and covers most of "greater downtown" Missoula, including the Higgins Hipstrip, but not the Sawmill or UM areas. The assessment framework of the BID is similar to an SID, however, BID funds are authorized to pay for operations—marketing, events, safety and security, etc.—rather than capital improvements. This BID enjoys widespread support and generates approximately $250,000 per year; this revenue stream is equivalent to a bonded capital amount of approximately $2,500,000. The assessment rate is approximately 2.5 percent of all affected properties' taxable value.

This analysis assumes that a SID is put in place throughout the greater downtown area which would then generate between $3.0 and $5.0 million for the streetcar. The rate would thus range from close to the current SID rate, to approximately twice the current SID rate.

Transportation Impact Fees (TIF)

The City of Missoula currently assesses a TIF on new residential and commercial development. The purpose is to ensure that new development pays for a reasonable share of the public infrastructure costs incurred to support the development. Under the current structure, however, the definition of "transportation" improvements is limited to "arterial and collector roads designated on the City's capital improvement program". While TIF funds can be used for sidewalks, bike lanes, transit stops, and other non-auto improvements within these roadways, impact fees could probably not be used to fund the streetcar line in most locations—for example, where new arterial or collector improvements are not planned, or on designated local streets. Other jurisdictions, have, however, used impact fees to fund streetcars and other transit capital improvements, and certainly in the case of urban infill development in which residents and employees exhibit high transit ridership, a nexus exists between the costs imposed by new development and the fees that should be paid.

For the purposes of this analysis, then, the Alignment 1 funding package is not assumed to include any TIF funds. For Alignments 2 and 3, we assume that the City's code has been amended to allow TIF funds to be expended on major transit investments such as the streetcar that are identified in the CIP. In keeping with the City's current TIF structure, fees of $2,500 per new dwelling unit and $3.00 per square foot of commercial development are assumed. (While actual fees will vary—for example, by the exact size of each dwelling unit and by type of commercial use—these are reasonable estimates.) These fees are assessed against the "private development required" shown in Figure 32. The streetcar is estimated to capture 25 percent of the TIF generated by this new urban development, with the remaining 75 percent going towards other projects.

General Fund

The City's General Fund is largely made up of property taxes and intergovernmental transfers, with support from other smaller sources. General Fund dollars are used to pay for some capital improvements; within the 2011-2015 CIP, approximately 20 projects received a combined total of $6.5 million. At $1.5 million, the Central Maintenance Vehicle Building received the largest allocation; other significant projects such as debt service for the Art Museum and Aquatics Center projects received approximately $150,000 and $661,000 respectively. This analysis assumes a General Fund allocation ranging between $2.5 million and $3.5 million. Like any other General Fund investment, the streetcar would need to compete for scarce public dollars against other worthy projects. It is assumed that, in keeping with the approach applied to other major capital projects partially funded by the General Fund, the City would pay debt service for streetcar capital costs over the course of multiple years rather than a single year.

Institutional Contributions and Corporate Sponsorships

Other streetcars—notably Portland and Tampa—have enjoyed the financial support of major institutions served by the lines or those seeking publicity through sponsorships, such as universities, hospitals, developers, and major businesses. In Portland, this included $1.5 and $1.2 million from Portland State University and Good Samaritan Hospital, respectively. In Tampa, local TECO Energy bought the naming rights for the entire line for $1 million (now the TECO Line Streetcar System), while other corporations paid between $100,000 and $250,000 for the naming rights to stations or individual cars; naming revenue has totaled in excess of $2 million. This analysis assumes a range of institutional contributions for the three alignments.

Parking Commission

The Portland Streetcar leveraged revenues from downtown public parking garages and meters to pay for approximately half of the first phase's $56.9 million cost. The philosophy was to enhance the attractiveness of downtown while creating a "park-once" environment—patrons could park downtown and then use the streetcar to travel between a range of shopping, entertainment, and leisure destinations. Based on a similar perspective but on a smaller scale, the Missoula Parking Commission (MPC) has funded projects such as the Downtown Out to Lunch shuttle, the First Night shuttle, and various transportation demand management efforts conducted by Missoula in Motion. Based on its past multi-modal investments, this funding plan assumes that MPC could allocate between $750,000 and $1.0 million future dollars to streetcar planning and development.

Mountain Line Property Tax Levy

Mountain Line currently receives approximately half of its annual revenues from a property tax levy assessed within the Missoula Urban Transportation District (MUTD), a geographic area that differs slightly from the City boundary. The MUTD could increase its mill rate through a district vote and allocate some of the additional funds towards the streetcar. Should the MUTD decide to pursue this strategy, the package of transit service and capital improvements to be funded by a levy increase should be broad and benefit residents living in all parts of the district—not just downtown; the streetcar should be only a small part. The Comprehensive Operational Analysis, of which this report is a part, should provide an opportunity look at the long-range transit needs of the community and consider whether additional funds should be pursued for a circulator and

many other service changes and capital projects. A 10 percent levy increase would generate approximately $226,000 annually or $2.2 million for capital projects. Due to the uncertainty associated with this funding source, it is not included in the funding plans here.

Other Local Sources

Funding creativity has been a hallmark of successful, built streetcar projects, just as it has been for most significant transportation projects in recent years. Cities and transit agencies around the country have used all of the local funding tools described above, as well as sales taxes, hotel taxes and other tourism-related revenues, right of way sales, and joint development on publicly-owned and transit-adjacent land. These funding sources have not been included in the preliminary funding packages considered for the Missoula Streetcar for various reasons. The sales tax—a widely-used funding source for transit capital projects and operations in other states—is not discussed here since it would require contentious statewide statutory changes. The other sources are not evaluated either because their funds are dedicated to specific types of projects or are unlikely to provide a significant source of capital. That said, the City of Missoula has shown itself to be a very creative and entrepreneurial organization in securing funds for its high priority projects, and City staff and other stakeholders should likewise seek out additional funding sources should the City decide to proceed with the streetcar.

STATE AND FEDERAL SOURCES

FTA Formula Funds

The Federal Transit Administration (FTA) allocates funding to the MUTD for Mountain Line through the Section 5307, Surface Transportation Program–Urban (STPU), and other programs. Some funds are allocated annually via formula primarily based on population and thus are relatively reliable.

In 2010, the MUTD anticipated receiving approximately $2.0 million via the STPU program for seven new Mountain Line buses. This funding plan assumes that the MUTD would be able to acquire one or more streetcar vehicles through the 5307 or STPU programs in a similar fashion. This planning level assumption is not based on a review of Mountain Line's capital fleet replacement needs or plan.

Federal: Small Starts

Small Starts is an FTA grant program that makes grants of up to $75 million for new urban rail and bus projects; recent grants have typically been for 50 or 60 percent of the total project cost, with local jurisdictions providing the remaining funding match. As Figure 32 shows on page 39, such significant federal funding assistance can dramatically change the viability of a given project and transform it from a stretch to an achievable project. For illustrative purposes, this analysis assumes that the Missoula Streetcar is able to secure Small Starts funding at 55 percent of total project costs for Alignments 2 and 3. We did not show the Small Starts funding for Alignment 1 in order to provide an example of what the funding gap would look like without Small Starts Funding. As noted earlier, there would be very heavy competition from cities that are likely to propose projects with higher ridership. Small Starts funds are not "free money"—as much as $2 to $3 million in staff and consultant time and fees is needed in order to conduct the multi-year

analysis, public outreach, and documentation required. Such project planning costs have not been included in the capital cost estimates.

The proposed Federal Transportation Bill and potential rule changes for the allocation of Small Starts monies by the Federal Transit Administration could benefit downtown circulator projects when compared with the current funding model. Three criteria are used to evaluate and rate Small Starts projects: cost-effectiveness, economic development, and land use. Below is a summary of proposed changes to the criteria:

- **Cost effectiveness** – Would be based on operating costs per trip, where cost includes changes in costs compared to either the existing transit system in the current year or both the current existing system and the no-build system in the horizon year.
- **Economic Development** – This criterion would continue to consider transit supportive polices and plans and add the potential to increase affordable housing, number of design, construction, and operational jobs created, and the impact on reducing VMT based on development patterns/improved mobility.
- **Land Use** – Would continue the use of employment and population density and add the number of publicly supported housing units.

If proposed changes put more focus on ridership, it will disadvantage Missoula when compared to major urban areas competing for these funds.

Federal: Very Small Starts

If Missoula were to focus on developing a rubber-tired circulator that provided "rail-like" features, including running way elements that provide fixed-guideway type transparency, there is another Federal capital funding program that may be applicable. Very Small Starts (VSS) is a funding program under the New Starts/Small Starts program directed toward relatively low cost corridor-based bus projects that provide high-frequency service with rail-type features in high demand bus corridors.

The study and application process for VSS is simplified and relies heavily on a current ridership metric. Applicants must prove that there are 3,000 existing benefiting riders in the corridor. Currently, Mountain Line does not have any corridors that meet this threshold; in fact the entire system ridership is less than 4,000 daily boardings. However, with likely ridership gains due to service improvements on Route 1 and if ASUM were willing to consolidate some of its services under ASUM, this target may be attainable within two to five years. We recommend a more thorough study of current and projected ridership (on both systems) in the corridor and other VSS requirements to more fully assess the viability of this funding source.

The following are a summary of VSS requirements compared to the more rigorous requirements for Small Starts applicants.

Figure 33 Overview of Very Small Starts and Small Starts Programs

Criteria	Very Small Starts	Small Starts
Project Budget	▪ Less than $50 million and less than $3 million/mile excluding vehicles	▪ Less than $250 million with no more than $75 million from FTA 5309
Eligibility	▪ Transit Project with: ○ Transit Stations	▪ 50% Fixed Guideway, or ▪ Transit Corridor Project with:

Criteria	Very Small Starts	Small Starts
	○ Low Floor/Level Boarding ○ Service Branding ○ 10/15 min peak/off-peak ○ 14 hour service span ○ 3000 Existing Riders	○ Substantial Stations ○ TSP/Priority Treatments ○ Low Floor/Level Boarding ○ Service Branding ○ 10/15 min peak/off-peak ○ 14 hour service span
Alternatives Analysis	▪ Simplified; can document plans from existing studies and planning process. LPA must be officially adopted and part of cost-feasible LRTP.	▪ Simplified but commensurate with project. Can document plans from existing studies and planning process. LPA must be officially adopted and part of cost-feasible LRTP.
Engineering	▪ Combined PE/Final Design	▪ Combined PE/Final Design
NEPA/Project Development	▪ Complete Scoping; Class of Action Determination; Document Impacts; Receive Approvals. Typically a Categorical Exclusion.	▪ Complete Scoping; Class of Action Determination; Document Impacts; Receive Approvals. Typically Environmental Assessment.
Project Management Plan	▪ Simplified, including budget, schedule, management and technical capacity, QA/QC.	▪ PMP required including budget, schedule, management and technical capacity, QA/QC.
Funding Agreement	▪ Project Construction Grant Agreement	▪ Project Construction Grant Agreement
Funding Commitment	▪ Demonstrate local capital share; O&M less than 5% of existing budget; Demonstrate fiscal capacity and capability.	▪ Demonstrate local capital share; O&M less than 5% of existing budget; Demonstrate fiscal capacity and capability.

State or Federal Grant or Appropriation

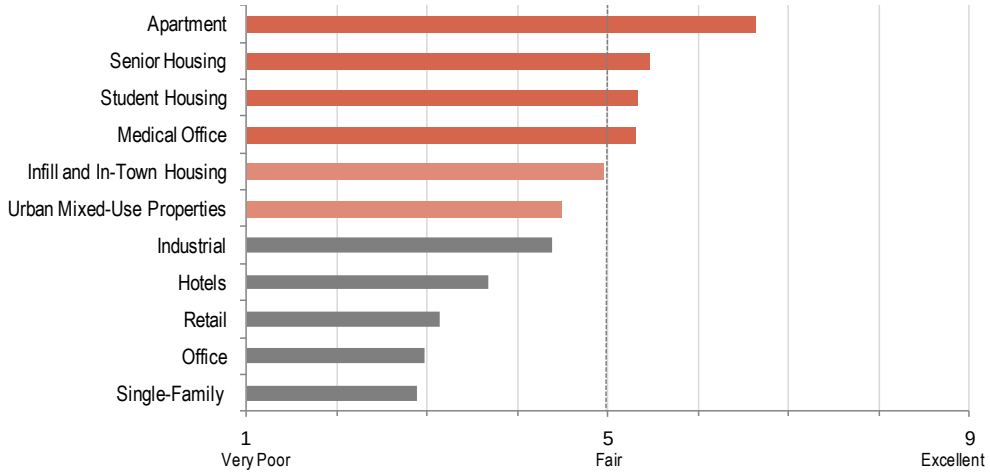
A range of state and federal grants, as well as legislative appropriations, are possible for a major capital project such as the streetcar, and therefore $500,000 is assumed in each of the three alignment alternatives. It is possible that aggressive and successful grant writing could generate more funding from state and Federal grants. Given the streetcar's potential to advance goals such as livability, environmental sustainability, mobility, and economic development, a broad range of government programs could help with funding, including:

- Congestion Mitigation and Air Quality Improvement (CMAQ), administered by the Federal Highway Administration to help improve air quality. CMAQ has funded various major transit capital projects around the nation. In Missoula, the MPO administers CMAQ funds and has directed funds (generally for between $50,000 and $200,000) to Mountain Line projects as well as programs that increase transit ridership such as Missoula in Motion.
- Sustainable Communities program, a partnership between the Environmental Protection Agency (EPA), Housing and Urban Development (HUD), and Department of Transportation (DOT). This program has funded the planning and implementation (rather than capital costs) of ambitious projects aimed at enhancing livability.
- Stimulus/ARRA. The stimulus/ARRA programs were likely a one-time occurrence; however, other comparable programs could emerge. There is speculation in Washington D.C. that another round of TIGER-type competitive funds may be available in the coming year.
- Appropriation. This is a line-item funding allocation specifically designated by a state or federal representative.
- Community Transportation Enhancement Program (CTEP). A state program that funds pedestrian and bicycle (but not transit) improvements, funding from this source could be used to improve sidewalks, signals, street crossings, and other changes that could be implemented in conjunction with the streetcar. In Missoula, CTEP is currently providing significant funding for key sidewalk, trail, bicycle, and park projects, including $3.5 million for the Bicycle Commuter Network and $4.5 million for the Fort Missoula Regional Park.
- Others. The federal government typically authorizes a new transportation bill every six years, and each new bill features some new funding programs or programmatic changes that could benefit transit in Missoula. Therefore, the City should review the next bill (which could be passed in 2012) for potential new funding sources.

6 DEVELOPMENT CONTEXT

In recent years, development in downtown Missoula—like development around the nation—has slowed rather than accelerated. Due to persistently difficult economic conditions, the development outlook for the next few years is uncertain, particularly for office, retail, and single-family home development. Figure 34 shows the annual real estate development outlook produced by the Urban Land Institute for 2012, which is consistent with most other forecasts. The forecasts prepared for downtown Missoula below reflect the assumption that demand will be greater for urban housing (including apartments, senior housing, etc.) than for office, retail, or other types of commercial space. Office development is constrained by low levels of job creation and business expansion; retail by slow growth in consumer spending, high vacancies, and the expansion of internet retailing.

Figure 34 National Development Prospects, 2012



Source: Urban Land Institute.

LOCAL CONTEXT

The value of all new development and redevelopment in greater downtown Missoula in the past decade is estimated at $72.3 million. During that time, approximately 289,100 square feet of commercial development and 42 housing units have been built in downtown.

Figure 35 Major Development in Downtown Missoula, 2000 – 2010

Project Name	Buiding Type	Year Complete	Commercial Area (sf)	Dwelling Units	Estimated Taxable Value
Garlington Building	Office	2010	52,000	-	$13,000,000
First Interstate Center	Office	2009	118,000	-	$29,500,000
The Corner	Mixed-use	2009	4,100	8	$3,025,000
Wilma Building Renovation	Mixed-use	2007	37,000	34	$17,750,000
Holiday Inn Downtown	Hotel	2007	100,000	-	$25,000,000
St. Patrick Hospital	Hospital	2002	-	-	$0
Various housing projects	Housing	2000 - 2010	-	81	$14,175,000
Subtotal			311,100	123	**$102,450,000**

Source: City of Missoula, US Census, Leland Consulting Group.

The following observations regarding the real estate development environment in greater downtown Missoula are relevant to streetcar planning:

- The majority (approximately two-thirds) of new downtown development (measured in total square footage) in the medium and long term is anticipated to be housing. This is consistent with downtown revitalization trends observed nationally during the last two decades, current real estate forecasts, and long-term demographic trends. The nation's demographics are changing: there are now far greater numbers of one and two-person households, retirees seeking to downsize, and members of Generation Y, for whom urban living is very popular.
- Interviews with local Missoula developers and brokers suggest that developers are very interested in building new housing and other real estate in downtown. The dining, nightlife, historic architecture, river access, and other activities and events create a unique place that cannot be replicated anywhere nearby. In addition, developers feel that the zoning and height regulations are appropriate, and are unlikely to severely limit development.
- However, downtown rents and sales prices are "not quite there." Apartment rents are currently $1.20 per square foot per month but would need to be at least $1.65 to justify new construction; retail and office asking rents range from $12 to $24 per square foot and would need to be a consistent $20 or more to support new commercial development. Rental or sales prices are perhaps the most important variables for developers. They are the clearest indicators of market demand, and if pricing is inadequate, developers will simply not develop (unless subsidized). Rental prices needed for urban housing are typically higher on a per square foot basis since costs (land, construction, design fees, and others) are also typically higher.
- Some projects identified above were not entirely "market driven;" for example, federal New Market Tax Credits were an important funding source for the Garlington Building. Some downtown development projects and renovations will continue to go forward. However, in the next one to three years or as long as the economy remains stagnant, they are likely to be challenging, rely on partnerships with the MRA and other public agencies, and be less ambitious.

PRINCIPLES OF URBAN REAL ESTATE

Development gravitates to some locations and avoids others. For example, hotels, second-homes, and luxury residences typically cluster around waterfronts and water views. The following principles will affect where urban infill development takes place within downtown Missoula, both along the streetcar alignments and elsewhere:

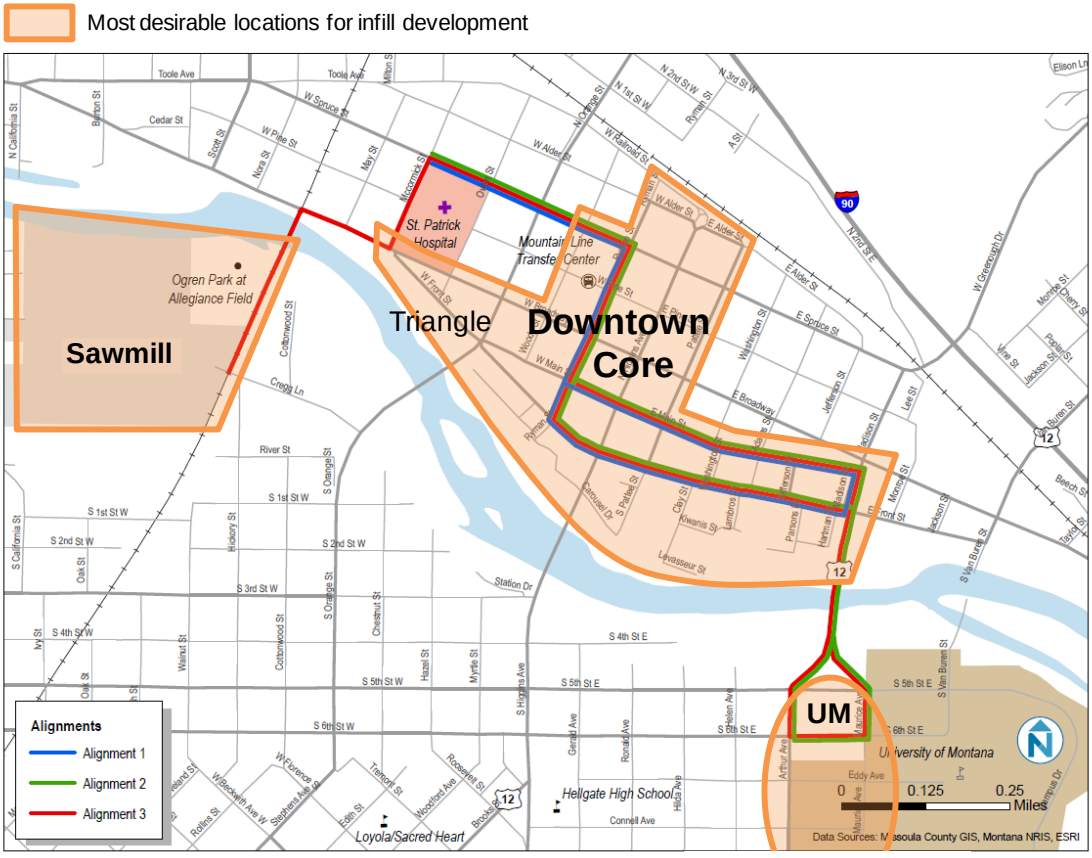
- Residents considering downtown or infill housing typically look for certain amenities such as easy access to jobs (or school), restaurants, transit and transportation, parks, recreation (such as riverfront trails), shopping, arts and culture, and nightlife. Thus, developers will try to build new urban housing as close as possible to these amenities or demand drivers. The locations in demand are typically more important than the locations where land supply is abundant. In high demand locations, developers will demolish low-value structures in order to build new housing. Again, transit is only one part of residents' and developers' decision making process.

- In urban development, retail is typically a small component of overall development. Thus, retail will usually "follow the rooftops" in greater downtown and be built where housing projects are built. One exception is cases in which historic structures (such as the old Macy's store) are adapted for new commercial uses.
- Downtown office tenants tend to cluster near existing office employment bases—which are their clients, suppliers, resource providers, collaborators, and competitors. New downtown office space is often attracted by the presence of government offices; courthouses; insurance, finance, and real estate sectors; universities; and hospitals—all present in Missoula. Office developers also like downtown because it is usually in the middle of the metropolitan region, and thus has good transportation access for most employees. They also appreciate access to a set of urban amenities similar to residents.

LOCATION – DEVELOPMENT HOT SPOTS

Based on these principles, site walks, and developer interviews, Leland Consulting Group identified the development "hot spots" shown below. The strengths and weaknesses of the three primary development hot spots, as well as adjacent areas, are described below.

Figure 36 Streetcar Alignments and Development Hot Spots



Source: Nelson Nygaard, Missoula County GIS, Leland Consulting Group.

- **Downtown Core.** The downtown core has the greatest concentration of amenities and thus will continue to be the most desirable area for housing and commercial development. Even though much of the downtown core is already built-out, vacant

properties and parking lots can be redeveloped, and low-value buildings can be redeveloped. The Triangle offers a particularly promising development opportunity due to the large amount of publicly owned land, and its river access and proximity to the downtown core.

- **Pedestrian scaled streets.** Streets such as Front, Main, and Ryman are best suited for new infill development, particularly housing. They carry significant amounts of traffic (good for commercial business exposure), but because of wide sidewalks and modest traffic speeds, are still pedestrian friendly. Therefore, they are well suited for the streetcar.
- **Broadway Street.** Broadway is wide (four plus lanes with curbside parking), has relatively narrow sidewalks, and faster traffic speeds. These characteristics make it somewhat less desirable for residential infill development. In addition, it is a state-maintained facility and thus the City may have a harder time locating streetcar tracks here. The Madison Street environment is similar to Broadway.
- **East Pine Street Historic Neighborhood.** This is a very attractive neighborhood and will be desirable for infill housing. However, because most lots are small, zoning is restrictive, and the houses here are relatively valuable and thus expensive to acquire, only a small amount of new development can be expected here.
- **St Patrick Hospital Area.** Hospitals can exert a strong pull for new senior housing, workforce housing (for nurses and other medical professionals), medical office, and other uses. However, there are fewer active ground floor uses and urban amenities in this area, and fewer historic buildings (which provide a strong sense of place). In addition, Leland Consulting Group understands that the hospital owns a considerable amount of property in the blocks that surround it, and major medical institutions sometimes keep properties undeveloped in order to provide room for future expansions. Therefore, this area is an *opportunity* where active planning and implementation could lead to major redevelopment, rather than a hot spot where private sector led development is likely to take place on its own.

- **University of Montana.** This area benefits from a large base of students who are typically interested in urban-density housing. In addition, there are several surface parking lots adjacent to the north end of the campus and near the Madison Street Bridge that could be developed. Parking can be replaced on site or elsewhere in structured garages. These sites could create a powerful sense of arrival and connect the streetcar line to the campus.

The Sawmill District. The Sawmill District, which would add approximately 500 housing units and as much as 50,000 square feet of commercial space if built as planned, is by far the largest development proposal being seriously considered in greater downtown Missoula. This area benefits from access to the river and a fairly close-in site, though there are few urban amenities within walking distance. Its biggest asset may be its size, which will allow developers to create a new place from the ground up. That said, the current plan appears to be for modest densities (such as townhouses), rather than urban densities (akin to the Palace Apartments in downtown). In fact, there is no other known residential project (of this size or smaller) in the pipeline for greater downtown. While the Sawmill District could provide a distinctive new urban community and generate significant tax revenues, it is located across the Clark Fork River from the downtown core, and a new or structurally enhanced bridge would be needed to bring the streetcar there.

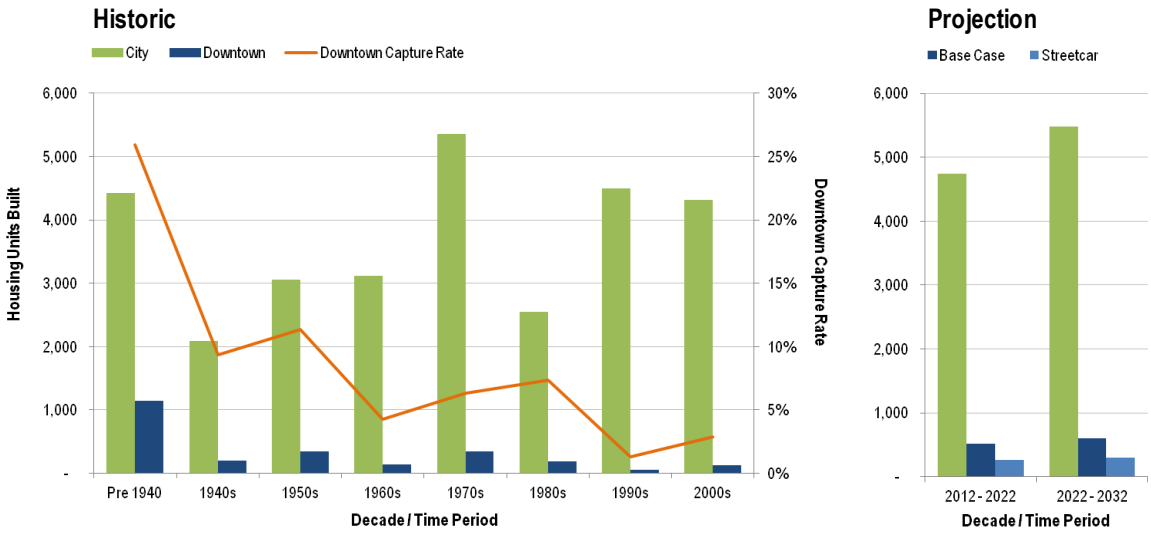
DOWNTOWN DEVELOPMENT PROJECTIONS

In order to gauge the proposed streetcar's potential effects on real estate development in Downtown Missoula, the project team researched historic development trends in the City, reviewed the impact of streetcars elsewhere, and developed several long term projections. As shown below, the team's analysis focuses on residential and commercial (including office, retail, and institutional) development.

Housing Development

Figure 37 and Figure 38 shows the historic rate of housing development in the City of Missoula and Downtown dating back to the pre-1940s era, and a projection of housing development between 2012 and 2032. Figure 37 shows the information graphically, while Figure 38 shows the raw data in tabular format. All future projections were completed beginning in 2012 based on the assumption that the streetcar alignment would be announced in 2012, and begin to affect development patterns immediately as has been observed elsewhere. This report uses the geographical boundaries of Downtown adopted in the 2009 *Missoula Greater Downtown Master Plan*, and therefore includes the Sawmill redevelopment site and Higgins Hipstrip along with the downtown core north of the Clark Fork River.

Figure 37 Missoula City and Downtown: Housing Units by Decade



Source: U.S. Census Bureau, American Community Survey, ESRI Business Analyst Online, Missoula County, Leland Consulting Group.

The historic analysis shows that, while the City's population growth has ranged between 3,000 and 5,400 housing units per decade since the 1950s, the share built within Downtown ("capture rate") has shrunk. As is typical in almost all American cities, the greatest amount of housing development in Downtown took place in the pre-war era. In the 1950s, Downtown captured just over 11 percent of all housing development; in the period between 1960 and 2010, it captured 4.4 percent; in the last two decades it captured 1.3 percent and 2.9 percent respectively.

In order to estimate future housing development, the project team used overall population growth projections prepared by Missoula County. Then, "Base Case" and "Streetcar" scenarios were developed using the following assumptions:

- **The Base Case scenario** assumes that no streetcar is built and can be considered a "low end" of future development outcomes.
- **The Streetcar scenario** assumes that the proposed Missoula Streetcar is built using Alignment 2 or 3. (Alignment 1 could be built as a first phase.) It also assumes that the other factors that encourage robust urban development are in place, including a strong economy, suitable demographics, reasonable construction costs, and continued supportive regulation and public investments from the City of Missoula and other public agencies. All of these factors have played a role in the redevelopment that has taken place surrounding the country's most successful modern streetcar lines and will be important in Missoula as well.

  The Sawmill District (with a goal of approximately 500 dwelling units) is assumed to be constructed under both scenarios. However, in the Base Case the overall units and density achieved is assumed to be about half of the developer's goal.

As Figure 38 shows, housing development under the Streetcar scenario is estimated to be two times as great as under the Base Case, in keeping with the patterns observed in Portland and other cities, where development near the streetcar alignments was two or more times the scale and density of development that occurred elsewhere.

Figure 38 Missoula City and Downtown: Housing Units by Decade (Base Case & Streetcar Comparison)

Time Period	City of Missoula Housing Units	Downtown Capture Rate		Downtown Missoula Housing Units	
Historic					
Pre 1940	4,426	25.9%		1,148	
1940s	2,093	9.4%		196	
1950s	3,060	11.3%		347	
1960s	3,119	4.3%		133	
1970s	5,358	6.3%		338	
1980s	2,548	7.3%		187	
1990s	4,493	1.3%		58	
2000s	4,311	2.9%		123	
Total through 2010	29,408	8.6%		2,530	
Projection		Base Case	Streetcar	Base Case	Streetcar
2012 - 2022	4,737	5.5%	11.0%	261	521
2022 - 2032	5,486	5.5%	11.0%	302	603
Total 2012 - 2032	10,223	5.5%	11.0%	562	1,124

Sources: U.S. Census Bureau, American Community Survey, ESRI Business Analyst Online, Missoula County, Leland Consulting Group

It is important to note that in both the Streetcar and Base Case scenarios, the rate of downtown housing development is expected to increase significantly over that seen in recent decades for several reasons. The first is the Sawmill District, by far the largest housing development opportunity to affect Downtown in decades. We assume that this project will be built in some form with or without the streetcar given its very good location and large size, but that the streetcar could influence the scale and pace of build out. Second, as described above, housing demographics and preferences are changing and swinging decidedly towards urban living. This results in Downtown capture rates that are more in line with those seen in the early- and mid-

20th Century, and is consistent with the "downtown turnarounds" documented around the country.

High end buses (electric trolley bus with modern shaped vehicle and overhead catenary) can also be an effective economic development tool. Although the development potential is not as high as it is with streetcar, research shows that an electric trolley bus could attract an estimated 50% of the new development that a streetcar could attract. Figure 39 below provides a comparison of housing development between the base case, streetcar, and electric trolley bus scenarios.

Figure 39 Missoula City and Downtown: Projected Housing Units (Base Case, Streetcar, and Electric Trolley Bus Comparison)

Year	City of Missoula Housing Units	Downtown Capture Rate			Downtown Missoula Housing Units		
		Base Case	Electric Trolley Bus	Streetcar	Base Case	Electric Trolley Bus	Streetcar
2012-2022	4,737	5.50%	8.25%	11%	261	391	521
2022-2032	5,486	5.50%	8.25%	11%	302	453	603
Total 2012-2032	**10,223**	**5.50%**	**8.25%**	**11%**	**563**	**843**	**1,124**

Sources: U.S. Census Bureau, American Community Survey, ESRI Business Analyst Online, Missoula County, Nelson\Nygaard Consulting

Commercial and Institutional Development

As shown in Figure 40, the project team also developed Base Case and Streetcar scenarios for employment-related development in Downtown Missoula, which here is defined to include commercial (office, retail, entertainment) and institutional (healthcare, education, government) uses. The following considerations were taken into account when developing these scenarios:

- Downtown Missoula has historically captured a much higher percentage of the City's employment (about 27 percent) than housing. This is consistent with the pattern of major employment and commercial development in American downtowns nationwide.
- While housing has moved back to downtowns and central city areas over the last decade, office and commercial development has been slower to do so. In fact, in many cases, employment space has continued to slowly suburbanize due to lower costs, high parking requirements, and space availability. For example, a 2008 analysis of downtown and suburban office markets nationwide by the Urban Land Institute found the amount of suburban office space is still growing faster than downtown space, even in transit-rich regions such as Seattle, Denver, Portland, and San Francisco.

Figure 40 City of Missoula and Downtown: Job Growth By Decade

Time Period	City of Missoula Jobs	Downtown Capture Rate		Downtown Missoula Jobs		Downtown Missoula Employment SF	
Historic							
2010	42,729	27.4%		11,695			
Built 2001 - 2011						311,100	
Projected		Base Case	Streetcar	Base Case	Streetcar	Base Case	Streetcar
2012 - 2022	6,200	22.0%	32.0%	1,364	1,984	306,900	446,400
2022 - 2032	7,100	22.0%	32.0%	1,562	2,272	351,450	511,200
Total 2012 - 2032	13,300	22.0%	32.0%	2,926	4,256	658,350	957,600

Source: U.S. Census Bureau, American Community Survey, ESRI Business Analyst Online, Missoula County, Leland Consulting Group.

- Streetcars and other high capacity transit have been shown to have a significant impact on the location of employment land uses, though not as direct or large as their affect on housing. Therefore, the Streetcar scenario assumes that Downtown Missoula attracts 32 percent of all new employment development, while the Base Case assumes the capture rate is 22 percent. The Streetcar scenario, therefore, results in nearly 50 percent more employment and development Downtown than the Base Case. Over 20 years, the Streetcar scenario projects the addition of about 4,250 employees to Downtown, a 36 percent increase to the 11,695 workers that the U.S. Census currently estimates are employed Downtown. Again, the Streetcar scenario assumes that the other factors that encourage robust urban development are in place, including a strong economy and suitable demographics.
- Most types of employment development—particularly office, retail, and lodging—are expected to regain momentum more slowly than other parts of the economy. Much commercial development is expected to slow in the next five years, and perhaps longer.
- Many jobs will require less space, resulting in less overall development. This is true from government jobs to office work. Many major private office employers are trying to shrink the footprint per employee from 300 square feet or more to 150 square feet, through telecommuting, "office hoteling," open floor plans, and other measures.
- According to the market analysis prepared for the *Downtown Master Plan*, about fifty percent of employment Downtown takes place in a non-taxable setting (e.g., government, hospital, or education), and this is expected to continue. While this does not affect the number of employees or area occupied by employees, it does affect the tax revenues they generate to support the streetcar.

Development Summary

In summary, total downtown development is projected to be nearly two times as great under the Streetcar scenario compared to the Base Case. As shown in Figure 41, twice as many urban housing units are projected, and nearly 50 percent more commercial and institutional development is projected. The result is approximately $400 million in development over a twenty year period, or $177.9 million in additional development. As explained above, the Streetcar scenario assumes not only the construction and operation of a streetcar but the presence of other supportive factors—economy, demographics, regulation, and others—that have helped to support ongoing urban renaissances in successful transit-oriented districts.

Figure 41 Development Summary

Time Period	Base Case	Streetcar	Net Difference
2012 - 2022	$103,500,000	$186,100,000	$82,600,000
2022 - 2032	$119,300,000	$214,800,000	$95,500,000
Total 2012 - 2032	**$222,900,000**	**$400,800,000**	**$177,900,000**

DEVELOPMENT REQUIREMENTS FOR A RUBBER-TIRED CIRCULATOR

The scope of this streetcar study was to evaluate the feasibility of funding and constructing a streetcar in Downtown Missoula. The team concluded that, in the next decade, it would be very challenging to finance capital construction of the streetcar, and that funding sufficient headway would be a significant drain on regional transit operating funds. However, the benefits of a downtown circulator in organizing new development and enhancing downtown mobility are real and valuable. Another affordable option to achieve these outcomes is a rubber-tired circulator designed with many of the same features as a rail circulator.

A high-level estimate developed to cost a rubber-tired circulator would be in the range of $4 to $8 million per route mile for a diesel bus circulator (inclusive of vehicles) and in the range of $10 to $17 million per mile for an electric trolley bus line. The major cost difference is based on the type of power and vehicle technology. The cost for catenary wire and substations for an electric trolley bus vehicle can be in the range of $4 to $8 million per mile. This feature provides a clean power source and an overhead "guideway" that would give the line a sense of permanence and transparency associated with in-street rails.

The amount of real estate development necessary to generate funding (tax increment and other) is likely in the range of $200 million, which is projected under both the Base Case and Streetcar development scenarios over the next twenty years. A number of national experts that study economic development benefits from bus rapid transit (BRT) type development have suggested that high-end bus investments can produce 30 percent to 60 percent of the development response that a rail streetcar investment would. These are professional estimates and there is no comprehensive study that would provide quantitative evidence of this affect. However, even assuming the lower end of this spectrum – 30 percent – a rail circulator would produce sufficient tax increment to fund this type of investment.

For example, the HealthLine BRT project in Cleveland's Euclid Corridor has generated approximately $5 billion in investment and redevelopment along the line since it opened in 2008. The success of the project is due, in part, to the fact that the street was reconstructed from building front to building front and included many amenities in the pedestrian way, public art, and high quality landscaping.

The HealthLin BRT in Cleveland has generated approximately $5 billion in investment and redevelopment along the line since 2008.

A rubber-tired project using diesel bus technology (~$1.5 million per mile) could thus be constructed using tax increment and other local sources viable with significantly less development. In fact, a few major projects in the downtown area could potentially develop sufficient increment to fund a major portion of capital costs for

such a project. Of course, it must be considered that there other priority projects that will compete for local improvement district funding.[4]

[4] Leland Consulting was not scoped to conduct a detailed financing or development analysis for a rubber-tired circulator. These estimates are very high level and were estimated based on streetcar development estimates and overall scale of capital cost, not modeled using a financial model.

7 RECOMMENDATIONS AND NEXT STEPS

Based on the analysis and interviews conducted for this report, the following recommendations are made regarding an urban streetcar in Missoula. These recommendations were presented to the Missoula Regional Coordinating Committee.

It is recommended that the Missoula Urban Transportation District work with its partner agencies to develop a downtown circulator that provides the quality of a fixed rail streetcar, but uses more cost effective technology. Technology and design applications could include an electric trolley bus application that provides over-head wire along the corridor, high-quality stop facilities, unified branding and wayfinding, and high –frequency service. A major strength of using rubber-tired technology for a downtown Missoula circulator is the opportunity to combine the Downtown segment with Route 1 service, which is the most productive line in the Mountain Line system. This could open up Federal funding opportunities that are not likely to be available (based on assessment of Missoula's competitiveness) for a rail streetcar project. While service may not start for 5 to 10 years, planning could start within the next two to three years.

Specific recommendations include:

1) Focus near- to mid-term implementation on rubber-tired alternatives that provide features comparable to fixed-rail transit.

As noted earlier, a number of communities across the country are considering streetcar for many of the same reasons as Missoula (downtown circulation, economic development, etc.). However, many of the communities where streetcars have been built, or are under construction, are in larger communities where development potential and ridership demand is substantially higher than Missoula.

Several comparable regions to Missoula that had previously considered streetcar have recently turned their interest to rubber-tired technologies, largely due to the high cost of streetcar and competitiveness of funding for rail projects. While bus technologies may not have the same perceived development benefit as streetcar, some higher-end bus technologies are receiving strong support from the development community.

Missoula should pursue funding for a Downtown Circulator Alternatives Analysis Study in the next 1-2 years. An Alternatives Analysis Study will provide the opportunity to apply for Small Starts Funding. The Alternatives Analysis would result in the determination of a preferred alignment, mode, street design concepts, and funding plan.

Rubber tired examples are described below.

Spokane, Washington

Rendering of electric trolley bus in Spokane, Washington
Source: Washingtonpolicy.org

Spokane has studied potential improvements to downtown transit circulation for the past 20 years. Over the past several years, the city has been conducting a federally-funded Alternatives Analysis focusing on a high performance transit service that connects major activity nodes in the central city area. For the purpose of this study, a high performance transit service is one that operates frequently (every 15 minutes or better) and for a long service day. The goals of the service are similar to those identified in Missoula:

- Stimulate new development;
- Maximize regional resources and transit mobility;
- Support local and regional land use goals, objectives, and plans;
- Is environmentally sensitive; and
- Garners broad public support.

As required by the Alternatives Analysis guidelines, multiple modes and alignments were evaluated. For the required transportation system management (TSM) alternative, other modes that were considered include streetcar, enhanced bus and trolley bus.

Based on extensive technical evaluation and public process, the Locally Preferred Alternative has been chosen. While the benefits of streetcar were clear, the community chose the electric trolley bus as the preferred mode due to the substantially lower cost compared to streetcar while still providing permanent infrastructure and electric propulsion, both of which were desired by the community.

Des Moines, Iowa

The Des Moines Area Regional Transit Authority (DART) is currently in the process of securing funding for a bus rapid transit (BRT) route that would connect downtown to several near-downtown urban neighborhoods and Drake University. While streetcar has been considered for downtown circulation purposes, the new BRT line will provide many of the same benefits at a fraction of the cost. The bi-directional loop route would operate every 10-15 minutes, feature hybrid electric-diesel buses, and unique branding specific to the BRT service.

A major goal of the new service is to attract new development in downtown and in the corridor. Several downtown and corridor stakeholders note that “development follows infrastructure” and that convenient and rapid bus service is seen as an important part of this new infrastructure. The city has noted that the need to support “unplanned” trips on frequent transit service is a critical component of building a more densely developed region.

Santa Barbara, California

The Santa Barbara Metropolitan Transit District (MTD), in partnership with the City of Santa Barbara, operates several frequent shuttles in downtown Santa Barbara. The shuttles were initiated in the early 1990’s and are operated exclusively with electric vehicles.

The Downtown Shuttle operates on busy State Street with midday frequencies of every 15 minutes (10 minutes in the summer). The Waterfront Shuttle connects with the Downtown shuttle and operates every 30 minutes (15 minutes in the summer). The MTD also operates a frequent Crosstown Shuttle that connects with the Downtown route at State Street.

While the Downtown / Waterfront shuttles are largely oriented to tourists, they also serve an important circulation function along State Street and the Waterfront area. The shuttles do not directly connect with MTD's main transit center, but the Downtown Shuttle operates on State Street, just a block away from the transit center. All regular routes in the system serve the transit center, which is also the city's Greyhound terminal.

When the shuttle routes were first initiated, the MTD used diesel buses. About a year after operation, they transitioned to the unique electric vehicles that are in operation today. When electric vehicles were introduced, ridership nearly doubled. MTD staff believes that the transition to electric vehicles was directly responsible for the huge jump in ridership.

2) Consider circulator design when evaluating street redesign options for Front and Main

We understand that Missoula will be undertaking a study of Front and Main to determine the feasibility and benefits of restoring Front and Main Streets to their original two-way traffic patterns. Like many communities around the nation, Missoula is interested in the business and pedestrian environment benefits of complete streets designed to provide two-way operations and access for local businesses. If these streets are to be rebuilt, and particularly if curbs are relocated, incorporating key design features for a circulator project could save costs later and avoid having to dismantle recently reconstructed sidewalks or street segments. One of the best documents available for engineers to review in considering the needs and design implications for integrating streetcars in a future streets is the 2012 DC Streetcar Design Criteria document produced by Washington, D.C. Department of Transportation. The document includes detailed design specifications and guidance for integrating streetcars in an urban street environment. Missoula should consider designating the proposed downtown alignment as a priority circulator route to ensure that future street redesign efforts include facilities that aid transit operations and enhance customer use, such as high quality pedestrian crossings and curb bulbs that also serve as loading platforms. (See: http://ddot.dc.gov/DC/DDOT/Publication%20Files/Projects%20and%20Planning/Standards%20and%20Guidelines/DDOT_DCStreetcarDesignCriteria_January_2012.pdf).

3) Reconsider the streetcar project when market studies show that needed development targets will be met or other financing mechanisms are identified

Our assessment is that the amount of development that would have to occur in Missoula to generate enough local funding to build the first alignment is over eight times the amount of development that Missoula saw over the past 10 years in terms of market value. Residential development would need to increase more than 40 times compared to what has been built since 2001. Our research did not identify evidence that indicates that such a dramatic increase in the amount of residential development could be achieved. This suggests that the City not move forward with implementation until major changes in the development market occur or a different funding model is identified. It may take a decade or longer before a locally funded streetcar project is viable. Again, an electric trolley-bus circulator could provide many of the same benefits as a streetcar project and be developed more immediately, serving the community for 15 years, at

which point streetcar viability could be reassessed. Further, this interim investment could help catalyze development and make a rail project more viable in the mid- to long-term.

4) Develop a coordinated local strategy to aggressively pursue grant sources that support the development of a downtown circulator

Since local development based sources may be needed to build even a bus-based circulator, strong regional consensus in support of the project will be needed. Missoula should begin having these funding conversations immediately. In the next 3-5 years, a coordinated local strategy to aggressively pursue grant and local funding sources should be pursued. The transportation bill reauthorization process and the Sustainable Communities and future TIGER type programs should be closely monitored and Missoula should be ready to pounce if the right opportunity for small and mid-size cities presents itself. Further, the downtown project should be evaluated as part of a longer-line corridor (Route 1) that might be eligible in the near future for Federal grant funds, such as funds from the Very Small Starts program. Meeting ridership requirements for Very Small Starts would require Mountain Line to collaborate with ASUM to study and request funding for a corridor based bus project that consolidated ridership markets.

3) Establish or dedicate revenue from one or more tax increment districts

If Missoula decides to move forward with a fixed guideway downtown circulator, one or more additional tax increment districts would be beneficial and should be established soon. It is critical that tax increment districts be formed as early as possible in order to maximize the potential funding available when construction begins. Districts must be in place prior to development if tax increment is to be used as a funding tool. Where districts already exist, the City should plan ahead for the streetcar or circulator and reserve budgets accordingly.

4) Revisit transportation impact fee structure

Following the example set in other cities, consider revising the City's current transportation impact fee structure so that some funds can be used for transit projects, particularly those generated by downtown or infill projects that will impose more new cost burdens on transit and pedestrian infrastructure than on auto infrastructure. Consult state enabling statues and existing studies to identify legal or logistical obstacles.

5) Continue current investment in downtown

Continue to make the types of investments that have made downtown Missoula the "heart of Missoula" for businesses, residents, and visitors, and a place where people enjoy spending time—in riverfront parks and trails, at downtown shops and restaurants, and arts and entertainment venues. These are the types of investments that build on themselves, grow the tax base, and make major capital projects like the streetcar possible. In the coming decade, focus on bringing more housing to downtown since demographic trends should encourage this, and invest in job-creating downtown industries, which will be essential for all American cities.

7) Prioritize very high frequency service

Given the compact and walkable nature of the downtown area, as well as the well-connected street network, any type of downtown transit circulator should operate very frequently in order to be competitive with walking trips. For example, assuming a 15 minute frequency on the streetcar, the average wait at any stop would be 7 ½ minutes and then the vehicle would travel at an estimated

10 miles/hour. Assuming the average person can walk 3 miles an hour, a person can walk 1/3 to 1/2 of a mile in the time it takes to wait for and travel via streetcar. With the exception of trips from the far east end of downtown to St. Patrick Hospital, most trips in downtown are within or close to 1/3 mile. Operating a downtown circulator service very frequently would reduce the wait and travel time, thus increasing the likelihood of using transit over walking. Travel on transit from UM to downtown or from downtown to the Sawmill District becomes more competitive with walking due to longer distances.

Operating costs for service options are scalable if multiplied by factors of two, so estimated operating costs can be construed by doubling the operating costs for every time headway is halved.

TIMELINE

The following is a timeline for Missoula agencies to consider as a guide to developing an urban circulator project. This timeline assumes that an electric trolley bus solution would be explored in the short term, although planning studies for that investment could further evaluate a streetcar mode. Streetcar line development would be prioritized as a longer-term investment, but supportive local improvements and policies could begin immediately. Planning for an interim, rubber-tired investment could include examination of facility design (stations, catenary, etc.) that is compatible for transition from rubber-tired vehicle to rail streetcar in the future.

Figure 42 Recommended Implementation Timeline

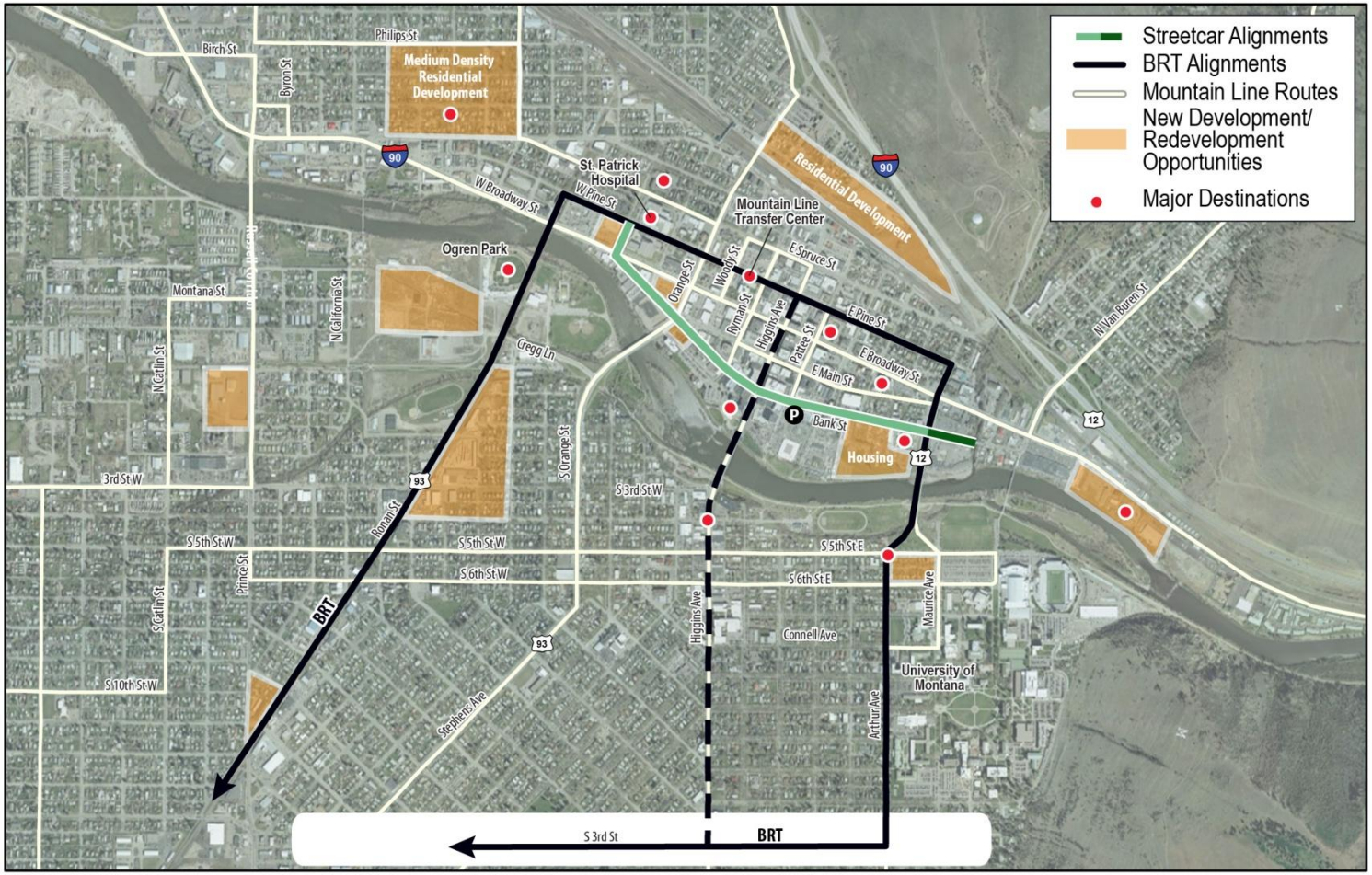
Timeline				Action	Outcome
1-2 years	3-5 years	5-10 years	10 + years		
X				Pursue funding for Downtown Circulator Alternatives Analysis Study	Funding identified for study; establish a local committee to forward urban circulator initiative
	X			Conduct Downtown Circulator Alternatives Analysis Study	Determination of preferred alignment, mode, street design concepts and funding plan; locally preferred alternative needed to pursue Federal funding for a rubber-tired circulator or streetcar
	X	X		Advance Local Funding Opportunities for Urban Circulator	A coordinated local strategy to aggressively pursue grant sources that support the development of a downtown circulator, this could include revenue dedicated from one or more tax increment districts

	X	X		Consider Circulator design as part of downtown street projects	Any major street redesign should consider compatibility with a future circulator project
X	X	X		Continue Implementation of Downtown Master Plan	Continue to make the types of investments that have made downtown Missoula the "heart of Missoula" for businesses, residents, and visitors
	X	X		Develop Partnerships with Major Employers, Institutions, and Potential Funders	Create opportunities for local funding through partnerships with organizations that stand to benefit from investment through improved access, reduced parking construction, etc.
			X	Consider transition to streetcar line	Review of development patterns, funding support, and

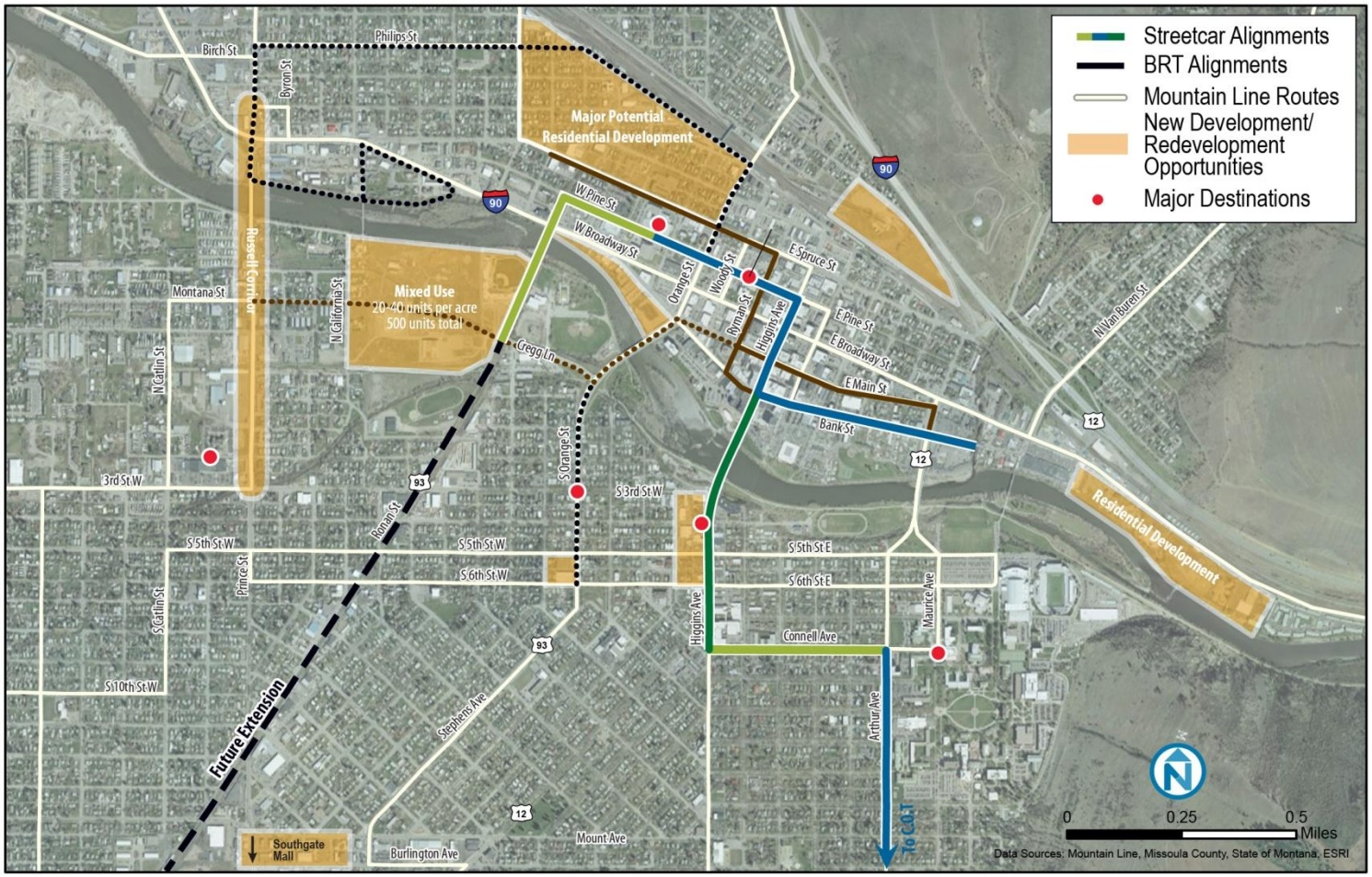
APPENDIX A WORKSHOP STREETCAR ALIGNMENTS

Group 1

Group 2


Streetcar Alignments
BRT Alignments
Mountain Line Routes
New Development/ Redevelopment Opportunities
Major Destinations
Medium Density Residential Development
Residential Development
St. Patrick Hospital
Mountain Line Transfer Center
Ogren Park
Housing
University of Montana
BRT
BRT
S 3rd St
Philips St
Birch St
Byron St
W Broadway St
W Pine St
Montana St
N California St
N Caitlin St
Cregg Ln
3rd St W
Roman St
S Orange St
S 3rd St W
S 5th St W
S 6th St W
Prince St
S Caitlin St
S 10th St W
Stephens Ave
Orange St
Woody St
Ryman St
Higgins Ave
Pattee St
E Spruce St
E Pine St
E Broadway St
E Main St
Bank St
S 5th St E
S 6th St E
Maurice Ave
Connell Ave
Arthur Ave
N Van Buren St
90
93
12

Group 3


Streetcar Alignments
BRT Alignments
Mountain Line Routes
New Development/ Redevelopment Opportunities
Major Destinations
Major Potential Residential Development
Mixed Use
20-40 units per acre
500 units total
Residential Development
Future Extension
Russell Corridor
Philips St
Birch St
Byron St
Montana St
N California St
N Catlin St
W Pine St
W Broadway St
Gregg Ln
Orange St
Woody St
Ryman St
Higgins Ave
E Spruce St
E Pine St
E Broadway St
E Main St
Bank St
N Van Buren St
3rd St W
S 3rd St W
S Orange St
Roman St
S 5th St W
S 6th St W
S 5th St E
S 6th St E
Prince St
S Catlin St
S 10th St W
Stephens Ave
Connell Ave
Maurice Ave
Arthur Ave
Mount Ave
Burlington Ave
Southgate Mall
To CBD
90
93
12
0
0.25
0.5
Miles
Data Sources: Mountain Line, Missoula County, State of Montana, ESRI

APPENDIX B RIDERSHIP PIVOT MODEL

Ridership Pivot Model											
Missoula Streetcar											
Option 1 - East Downtown to St. Patrick Hospital (via Front/Main)											
		Overall									
		Corridor	Development	Residential	Regional	Tourist	Activity	Service	Fare	Total	Relative
Peer System	Productivity	Density	Potential	Density	Connectivity	and Vistors	Centers	Span and Freq	Level	Adjustments	Productivity
		(+.25 to -.25)	(+.15 to -.15)	(+.25 to -.25)	(+.25 to -.25)	(+.2 to -.2)	(+.2 to -.2)	(+.15 to -.15)	(+.15 to -.15)		
Kenosha	22.5	0.15	0	0.1	0.1	0	0	0	0	0.35	30.38
Little Rock	9.0	0	0	0.15	0	0	0	0	0	0.15	10.40
Tampa	36.3	-0.1	0	0.1	-0.15	-0.2	-0.1	0.05	0.1	-0.3	25.38
AVERAGE	22.6										22.05
		Daily Ridership		Annual Ridership					Range	20	24
	Rev Hours	Low	High	Low	High						
Weekday	15	298	364	75,911	92,780						
Saturday	12	238	291	12,384	15,136						
Sunday	12	179	218	10,360	12,662						
				98,654	120,577						
Ridership Pivot Model											
Missoula Streetcar											
Option 2 - UM to St. Patrick Hospital (via Madison, Front/Main)											
		Overall									
		Corridor	Development	Residential	Regional	Tourist	Activity	Service	Fare	Total	Relative
Peer System	Productivity	Density	Potential	Density	Connectivity	and Vistors	Centers	Span and Freq	Level	Adjustments	Productivity
		(+.25 to -.25)	(+.15 to -.15)	(+.25 to -.25)	(+.25 to -.25)	(+.2 to -.2)	(+.2 to -.2)	(+.15 to -.15)	(+.15 to -.15)		
Kenosha	22.5	0.2	0	0.2	0.1	0.05	0.1	0	0	0.65	37.13
Little Rock	9.0	0	0	0.25	0	0	0.1	0	0	0.35	12.20
Tampa	36.3	-0.05	0	0.2	-0.15	-0.1	0	0.05	0.1	0.05	38.07
AVERAGE	22.6										29.13
		Daily Ridership		Annual Ridership					Range	26	32
	Rev Hours	Low	High	Low	High						
Weekday	15	393	481	100,294	122,581						
Saturday	12	315	385	16,362	19,998						
Sunday	12	236	288	13,687	16,729						
				130,343	159,308						
Ridership Pivot Model											
Missoula Streetcar											
Option 3 - UM to Sawmill District (via Madison, Front/Main and Montana Rail Link)											
		Overall									
		Corridor	Development	Residential	Regional	Tourist	Activity	Service	Fare	Total	Relative
Peer System	Productivity	Density	Potential	Density	Connectivity	and Vistors	Centers	Span and Freq	Level	Adjustments	Productivity
		(+.25 to -.25)	(+.15 to -.15)	(+.25 to -.25)	(+.25 to -.25)	(+.2 to -.2)	(+.2 to -.2)	(+.15 to -.15)	(+.15 to -.15)		
Kenosha	22.5	0.15	0.05	0.1	0.1	0.05	0.1	0	0	0.55	34.88
Little Rock	9.0	0	0.05	0.15	0	0	0.1	0	0	0.3	11.75
Tampa	36.3	-0.1	0.05	0.1	-0.15	-0.1	0	0.05	0.1	-0.05	34.45
AVERAGE	22.6										27.02
									Range	24	30
		Daily Ridership		Annual Ridership							
	Rev Hours	Low	High	Low	High						
Weekday	30	730	892	186,065	227,413						
Saturday	12	584	713	30,354	37,099						
Sunday	12	438	535	25,392	31,035						
Total				241,811	295,547						

APPENDIX C MISSOULA DEVELOPMENT SCENARIO WITH STREETCAR

This appendix provides an example of what a base case development scenario would generate in taxable value and the likely additional development needed to support a streetcar funded largely through tax increment financing. This is presented as an illustrative example, recognizing that a more diverse funding package would likely be pursued and required to support a rail streetcar circulator.

REQUIRED DEVELOPMENT

Figure 43 shows the actual development observed in downtown Missoula between 2000 and 2010, as well as the amount of development that would be required in the coming decade to generate the tax increment and impact fee amounts shown above for each of the three alignments. In addition, the table shows a 10-year development potential based on the *Downtown Master Plan*.[5]

Figure 43 Actual and Required Development, Downtown Missoula

Development Scenario	Time Period	Commercial SF	Housing Units	Taxable Value
Observed	2000 - 2010	311,100	123	$102,450,000
Base Case*	2012 - 2022	306,900	261	$103,500,000
Streetcar*		446,400	521	$186,100,000
Required for Alignment 1		914,000	1,830	$685,455,000
Required for Alignment 2		1,174,000	2,350	$880,273,000
Required for Alignment 3		1,702,000	3,400	$1,276,545,000
Master Plan, 10-Year Potential		509,200	1,140	$469,488,000

Source: Leland Consulting Group.

In order to achieve the amount of development required to generate the tax increment and impact fees shown for Alignment 1, downtown
development would have to increase dramatically:

Palace Apartments, Missoula, Montana

Commercial. The amount of downtown commercial development in the coming decade would need to be about three times greater than the previous decade, to approximately 900,000 square feet in the coming decade. This is equivalent to more than seven First Interstate Centers, the largest office building in downtown. It is difficult to imagine this scale of development since the current national demand for new office development is still very modest.

As Figure 43 shows, higher levels of development would be needed to support Alignments 2 and 3. For example, in order to build Alignment 2, the total value of all development would need to be more than 11 times greater than the value of development in the previous decade. Therefore, Leland Consulting Group does not believe that the development levels needed for any of the alignments is realistic in the coming decade.

FUNDING EXAMPLE: THE SAWMILL DISTRICT

As stated above, the Sawmill District is by far the most ambitious project currently being proposed for greater downtown. Figure 44 shows the tax increment and transportation impact fees that could be generated by the Sawmill District. While these revenues are significant, they are revenue negative to the streetcar funding model, since the additional track distance and upgrades to the MRL bridge are anticipated to add approximately $27.1 million in capital costs.

Figure 44 Tax Increment and Impact Fees Generated by the Sawmill

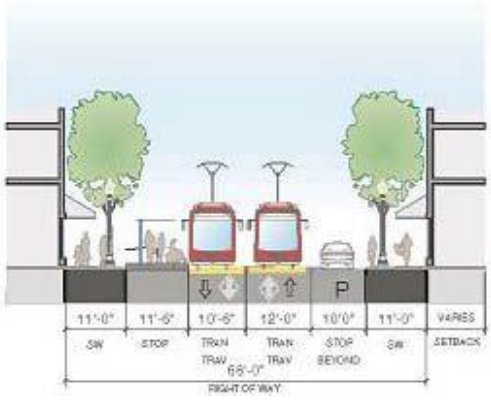
Total Market Value	$174,500,000
Total Tax Increment Funds Generated	$17,450,000
Streetcar Share	50%
Tax Increment Funds Available for Streetcar	$8,725,000
Transportation Impact Fees Available for Streetcar	$300,000
Total Capital Generated for Streetcar	**$9,025,000**

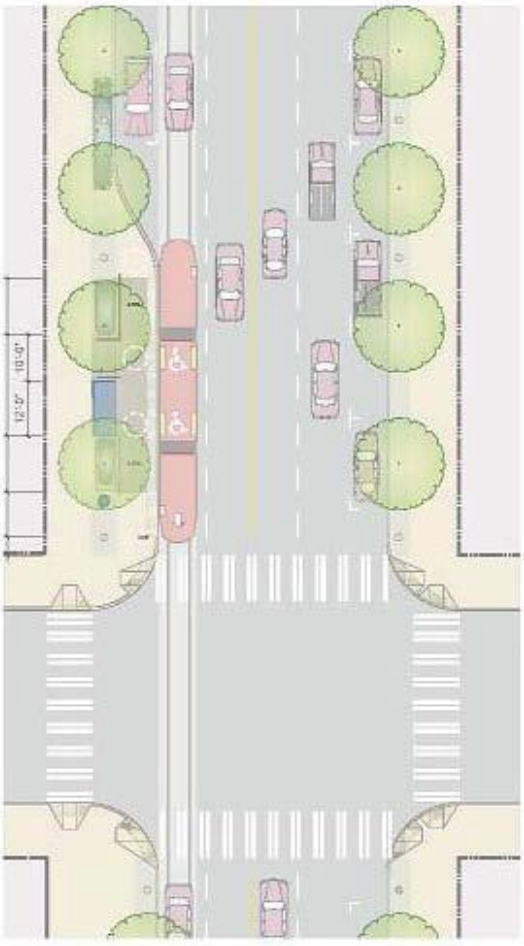
Source: Missoula Redevelopment Agency, Leland Consulting Group.

APPENDIX D STREETCAR CROSS SECTIONS

This Appendix provides a number of basic streetcar cross section diagrams. More information can be found at: http://ddot.dc.gov/DC/DDOT/Publication%20Files/Projects%20and%20Planning/Standards%20and%20Guidelines/DDOT_DCStreetcarDesignCriteria_January_2012.pdf).

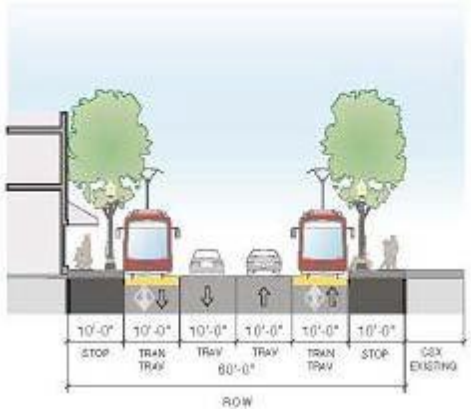
Curb Extension Design:

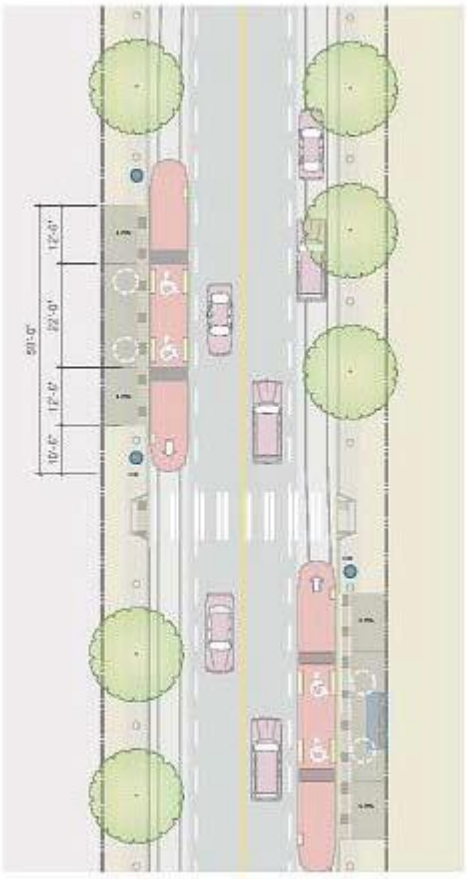




Source: DC Streetcar Design Criteria (January 2012)

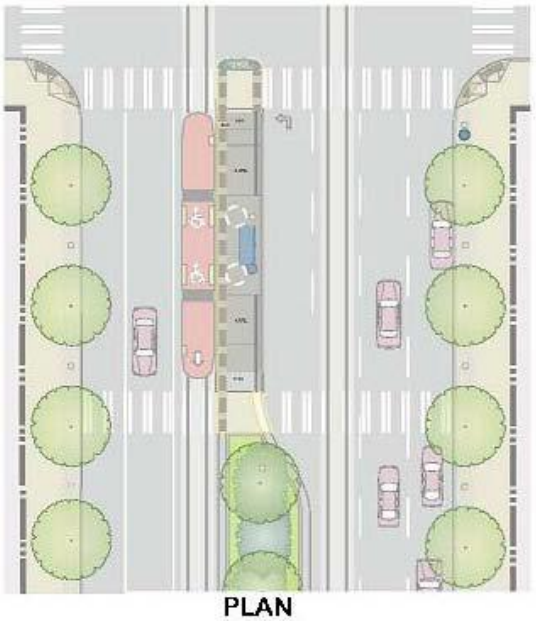
Curbside Design

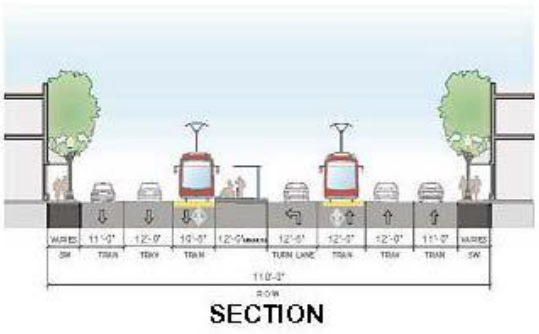




Source: DC Streetcar Design Criteria (January 2012)

Median Design





Source: DC Streetcar Design Criteria (January 2012)