RideKC STREETCAR

KANSAS CITY STREETCAR MAIN STREET EXTENSION

Corridor Planning Analysis

November 2018

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Summary

What is the Kansas City Streetcar Main Street Extension?

The Kansas City Downtown Streetcar starter line went into service on May 6, 2016. The 2.2 mile line has provided more than 5 million trips in the 2+ years since opening day (over twice the projections). Due to overwhelming support and enthusiastic public interest in extending the streetcar route, the City of Kansas City, Missouri (KCMO), the Kansas City Area Transportation Authority (KCATA), and the Kansas City Streetcar Authority (KCSA) have formed a Project Team to extend the streetcar approximately 3.5 miles south from its current terminus. The proposed alignment would continue south along Main Street, ending at the Country Club Plaza / University of Missouri – Kansas City (Plaza/UMKC) area. The Main Street extension project would connect the City's two largest activity centers and would extend the community benefits already being seen from the Downtown Streetcar starter line. The expansion of streetcar in the Main Street corridor was identified and extensively studied in the NextRail KC study completed in 2013 (described below),and is included in the region's adopted long-range transportation plan, Transportation Outlook 2040. A request to enter Project Development, as part of the Federal Transit Administration (FTA) Capital Improvements Grant program, was submitted by the project Team and approved in December 2017. The Main Street extension was included in the RideKC Smart Moves 3.0 Transit and Mobility Plan for the Kansas City Region; and MARC adopted the Locally Preferred Alternative into the regional Long-Range Transportation Plan on March 20, 2018.

In 2012 and 2013, KCMO, in coordination with KCATA, Mid-America Regional Council (MARC), and Jackson County, initiated a $1.9 million planning study called NextRail KC to evaluate the potential impacts, feasibility, and cost of streetcar expansions in eight designated corridors. Through a phased process that included public/ stakeholder engagement, systems overview, route screening, and detailed route analysis, the Main Street corridor streetcar extension, along with two others, was selected by the City Council for endorsement.

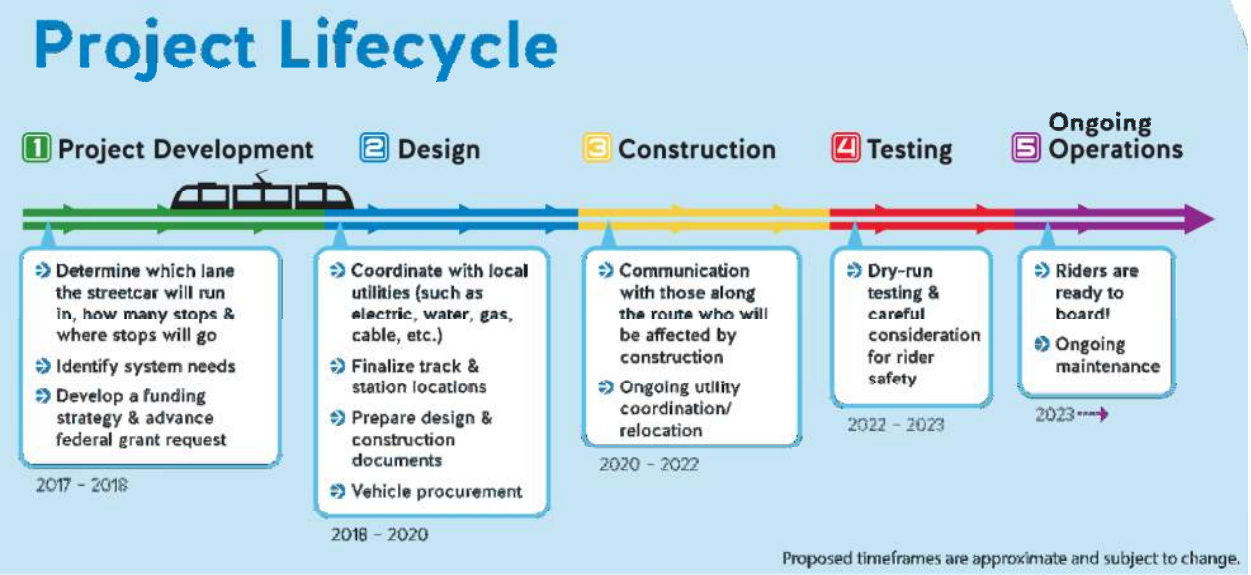
The Project Team has conducted the following activities as part of Project Development, which are documented further in this report:

- Purpose and Need (Chapter 1)
- Environmental Screening (Chapter 2)
- Alignment Planning (Chapter 3)
    - Station-Stop Locations (Chapter 3.1)
    - Best Lane Analysis (Chapter 3.2)
    - Traffic and Parking Analysis (Chapter 3.3)
    - Vehicle Maintenance Facility Analysis (Chapter 3.4)
    - Power Systems (Chapter 3.5)
- Operational Planning (Chapter 4)
- Ridership Analysis (Chapter 5)
- Capital and Annual Operating Cost Estimates (Chapter 6)
- Regional Transit Coordination Planning (Chapter 7)
- Public Engagement (Chapter 8)

What is next?

The KC Streetcar project team submitted a formal application to the Federal Transit Administration (FTA) for the New Starts Capital Investment Grants (CIG) Program, seeking $151 million dollars in federal funding and inclusion in the federal 2020-year budget to support the estimated $316 million-dollar project. The New Starts grant program funds transit capital investments including heavy rail, commuter rail, light rail, streetcars and bus rapid transit systems. Both federal and local funding are needed to move this project into design and

construction. Local funding was approved by the voters in the establishment of the Main Street Rail Transportation Development District (TDD). The project team will continue to advance project planning, completing an environmental analysis under the National Environmental Policy Act (NEPA), and beginning more detailed design in late 2018. If federal funding is secured construction would begin in 2020 and the extension would be in service in 2023.



Chapter 1: Purpose and Need

A project partnership team consisting of The City of Kansas City, the Kansas City Streetcar Authority (KCSA), and the Kansas City Area Transportation Authority (KCATA) are advancing planning and engineering services for the Kansas City Streetcar Main Street Extension project. The following is a statement of the purpose and need for the project.

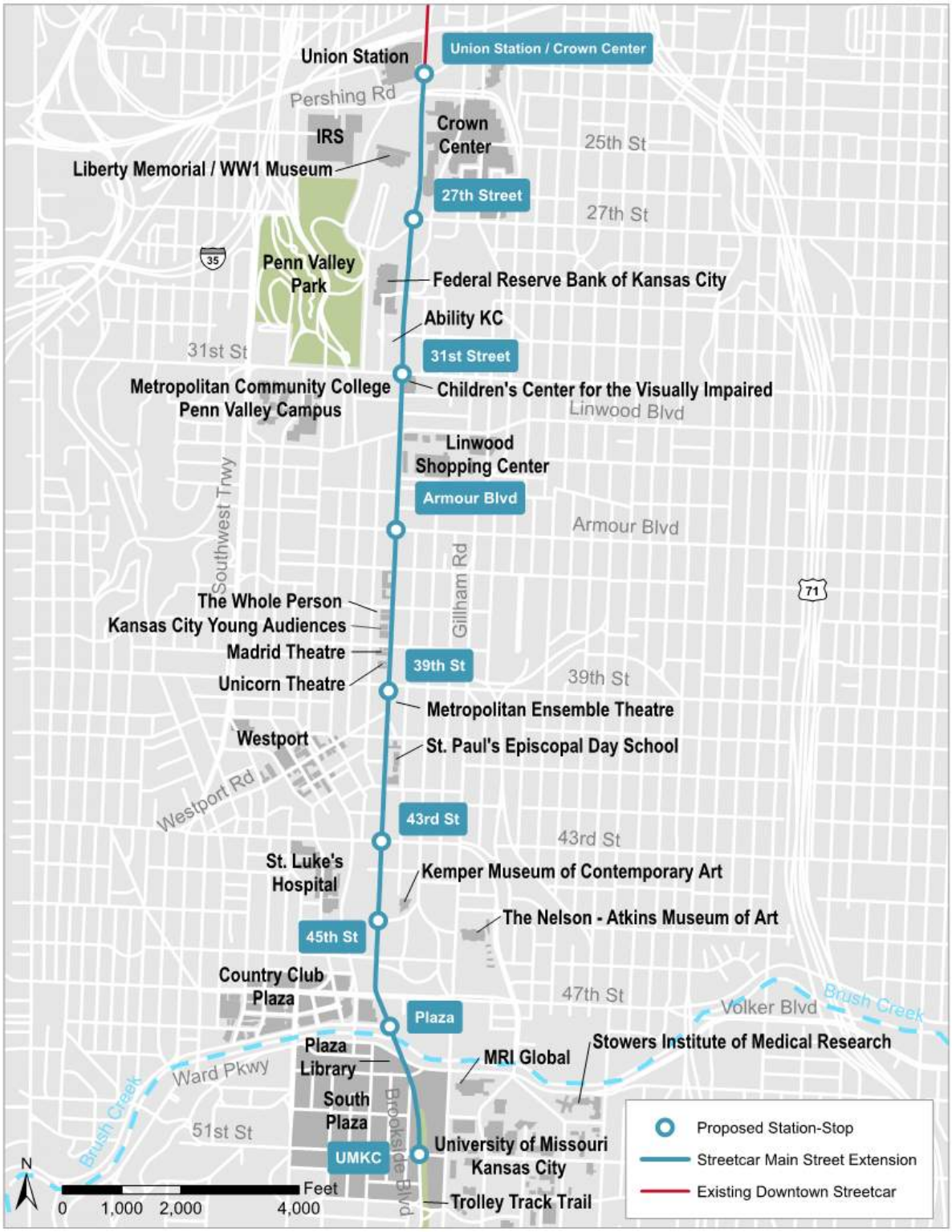
What are the project limits and how were they selected?

For more than three decades, transit planning studies have identified the River Market to Country Club Plaza corridor as the highest priority for fixed-guideway transit improvements. In May 2016, the Kansas City Downtown Streetcar starter line opened, providing fixed-guideway service from the River Market to Union Station, primarily along Main Street.

While final design and construction were progressing on the Downtown Streetcar starter line, the City of Kansas City, Missouri began to examine potential corridors for extending the starter line. Through a rigorous alternatives analysis process called *NextRail KC Streetcar Expansion*, eight corridors were evaluated. Factors such as cost, funding potential, community support, economic development, community revitalization, land use, transportation and mobility improvements, and other data points were compiled to determine which corridors were best suited for streetcars. This study concluded that the next streetcar capital investments should occur on: Independence Avenue, Linwood Boulevard/31st Street, and/or Main Street. In August 2017, voters along the Main Street corridor approved the formation of a new streetcar taxing district that would provide local funding for a streetcar extension along the Main Street corridor.

The project limits for the proposed Main Street Extension are from the current Union Station terminus at the Main Street/Pershing Road intersection south to the intersection of 51st Street/Brookside Boulevard just south of the Country Club Plaza area and in the vicinity of the University of Missouri – Kansas City (UMKC). Based on previous studies, the area near the 51st Street/Brookside Boulevard intersection serves as a logical terminus, i.e., the rational end point for the next segment of transit improvement.

Figure 1. Proposed Kansas City Streetcar Extension



What is the purpose of the project?

The primary purpose of the project drives the project, and reflects the fundamental reason why the project is being pursued.

Upon completion of the downtown starter line, the corridor quickly cemented its status as a major hub for downtown residents, visitors, commuters, and development activity. The downtown starter line serves a number of important functions including access to employment, neighborhoods, commerce, and downtown activity centers. With midtown's synergetic energy, the midtown Main Street corridor is primed for expansion, and expanding the streetcar system is an infrastructure investment that would continue to positively enhance the mobility and economics of the Main Street corridor.

Building on the downtown starter line, the Purpose of the Main Street Extension is to:

- Expand mobility choices for the metropolitan area and provide greater options for future connections to regional transit
- Provide improved accessibility for all users
- Provide efficient, reliable and safe transit service
- Enhance the region's transit system by creating a significant central spine around which to organize and integrate regional service
- Provide better transit service to UMKC's urban campus and to the Plaza – the two largest employment and activity centers in the region – with strong connections throughout the region
- Develop underutilized and vacant property, while supporting existing residential and commercial activity
- Enhance the desirability of the corridor for employment and residential growth.

Why is the project needed?

This project is needed to continue Kansas City's initial four Streetcar themes: connect, develop, thrive, and sustain. The need for the Main Street Extension is to continue efforts to provide mobility and connectivity, economic development and growth, community amenities and improved livability, and sustainability. In short, the Main Street Extension seeks to build upon downtown's success, connecting neighborhoods in the urban core.

Connect:

As noted in the NextRail study, the Main Street corridor between the current terminus and the Plaza / UMKC area includes some of the densest residential neighborhoods and employment centers in the region, as well as an academic center. This density supports high transit ridership today, and is reinforced by strong existing commuting patterns. The Federal Transit Administration's (FTA's) STOPS ridership forecasting model indicates that an extension of the streetcar could significantly increase transit ridership on Main Street, especially if the employment centers and regional destinations on Main Street can be connected operationally to dense populations in other transit corridors.

A continuation of the downtown starter line south on Main Street would create stronger connections for midtown residents, employees, and visitors; connect many of the city's key cultural attractions located in downtown and midtown with the rest of the city; link major educational institutions, including the area's largest university, to midtown, downtown and the rest of the city; and connect two of the city's primary activity centers – downtown and the Country Club Plaza.

An expansion of the streetcar to midtown would also expand mobility choices for the metropolitan area and provide greater options for future connections to regional transit. The system would be designed to seamlessly integrate with existing and future RideKC transit service. In addition, a fixed rail transit system would:

- connect transit-dependent populations with the city's highest density employers;
- connect neighborhoods to major activity centers;
- reduce vehicle miles traveled, thus improving traffic congestion and minimizing the number of traffic accidents, with the added benefit of reduced pollution; and,
- expand mobility choices and help to improve the pedestrian and bicycle environment.

Develop:

Significant economic expansion has occurred from the River Market to Union Station as a result of the downtown streetcar investment. Main Street throughout midtown has numerous additional opportunities for transit-oriented development infill of vacant buildings and lots, as well as redevelopment. Extension of the streetcar would strengthen the demand for higher densities and a broader mix of uses, and would build upon recent streetscape investments to support a more active and walkable environment throughout the midtown corridor. Furthermore, future development/redevelopment along the midtown corridor would benefit from access between downtown and the Plaza / UMKC. An infrastructure investment that improves this connection and improves mobility would solidify current development's success and enhance future development potential. In addition, this existing, planned and future development would further increase the population of the downtown and midtown area.

Thrive:

Streetcar expansion can help to create a more effective transit system by providing higher levels of service, increased accessibility, elevated transit visibility, and improved connectivity in the corridor. Beyond the improved level of transit service, strategic integration of streetcar service with other transit resources can help to maximize the benefit of the streetcar investment, and enhance the overall transit system by creating a significant central spine around which to organize service. The integration of bus and streetcar service with regard to potential fares, transfers, public information, and physical bus/streetcar connections will allow streetcar and bus service to coordinate as part of an integrated transit system. In some cases, streetcar service may replace all or part of existing bus routes. This coordinated service provides convenience and simplicity for

transit users, and ultimately enhances the ability of the local and regional transit system to improve mobility and connect people and places.

Sustain:

A sustainable city is at the core of Kansas City's identity. In 2013, the Mayor, along with the City Manager and elected officials, released a report called *Sustainability in Kansas City*, where it is recognized that sustainability is a good business model, that sustainable projects save money and improve efficiency, and that sustainability is a crucial approach to making Kansas City a better place. In 2014, the Sustainable Cities Institute published a summary of 18 objectives that fall within Kansas City's approach to sustainability. Among them are expanding public transit, including the streetcar system. *Smart Moves 3.0*, an update to the region's long-range transit plan published in September 2017, seeks to further the sustainable initiatives associated with improved transit and mobility by, among other things, increasing development and redevelopment along high-capacity corridors and near mobility hubs. Long-term sustainable development patterns that connect population centers, business areas, and living areas are needed for the city's residents, employees, and visitors. Achieving a more transit-oriented corridor and central spine will contribute greatly to that long-term goal. In addition, transit contributes to a decrease in greenhouse gas emissions and other transportation-related pollutants. Improved transit and mobility services helps reduce fuel use by attracting new transit riders, thereby reducing the number of vehicles on the road, resulting in lower emissions and fewer vehicle miles traveled.

Chapter 2: Environmental Constraints

This chapter summarizes the environmental evaluation which was conducted to determine if major environmental issues are present that would pose a problem for constructability within the Main Street Extension corridor alignment. Desktop screening reviews of environmental database maps, records, and other information were conducted for this corridor.

For the purpose of this study, the following environmental resources were analyzed:

- Potential Hazardous Material Sites
- Water Quality
- Floodplains
- Parks and Boulevards (4(f) Resources)
- Historic Architectural Resources

The purpose of this environmental evaluation is to inform preliminary design and engineering considerations for a potential streetcar extension on Main Street.

More detailed environmental evaluation will be performed in the next phase of Advanced Conceptual Design which will require environmental clearance in compliance with the National Environmental Policy Act (NEPA) process.

The following is a discussion of the previously referenced environmental resources which are also displayed on **Figure 2-1.**

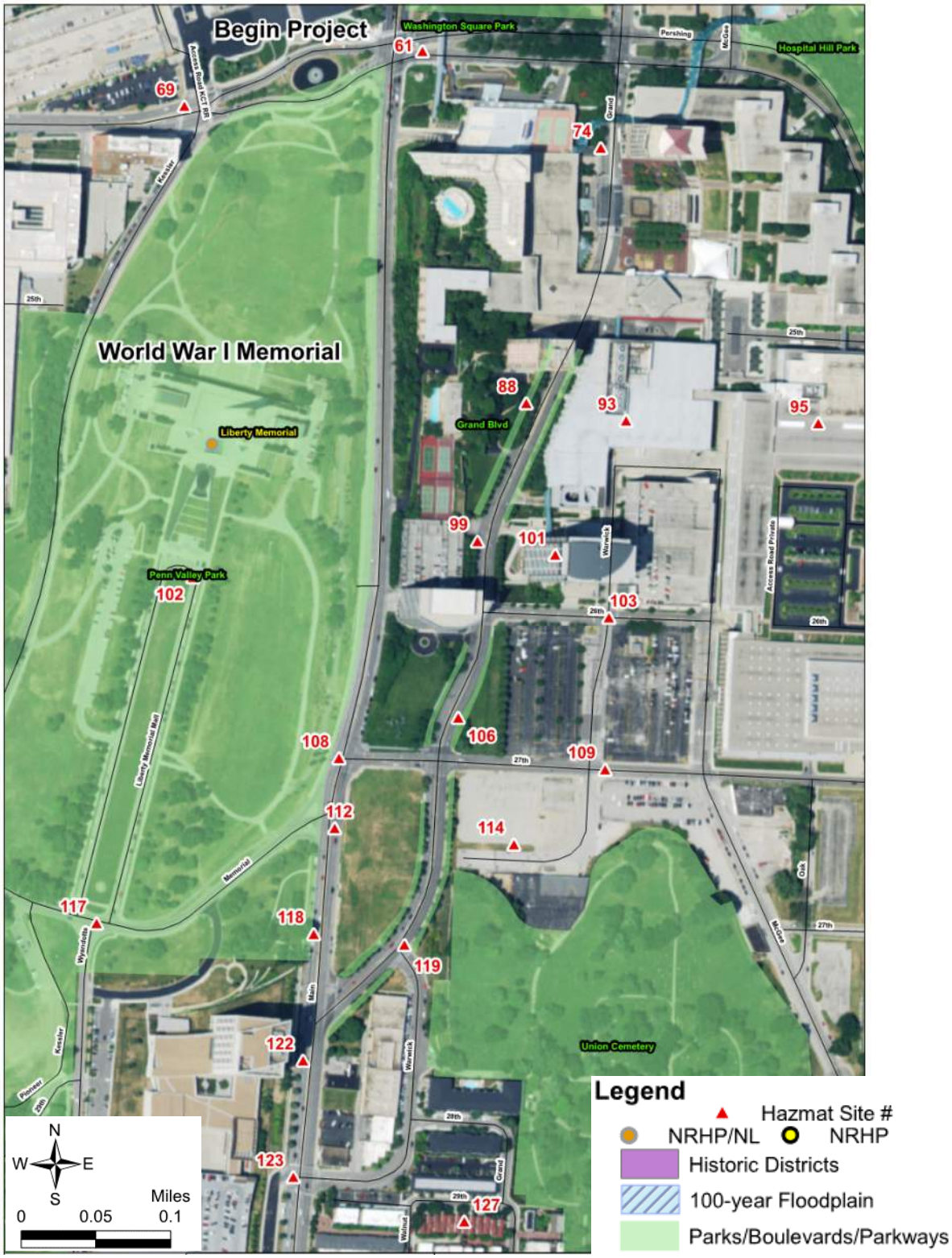


Figure 2-1a: Environmental Resources, Union Station to Warwick Trafficway

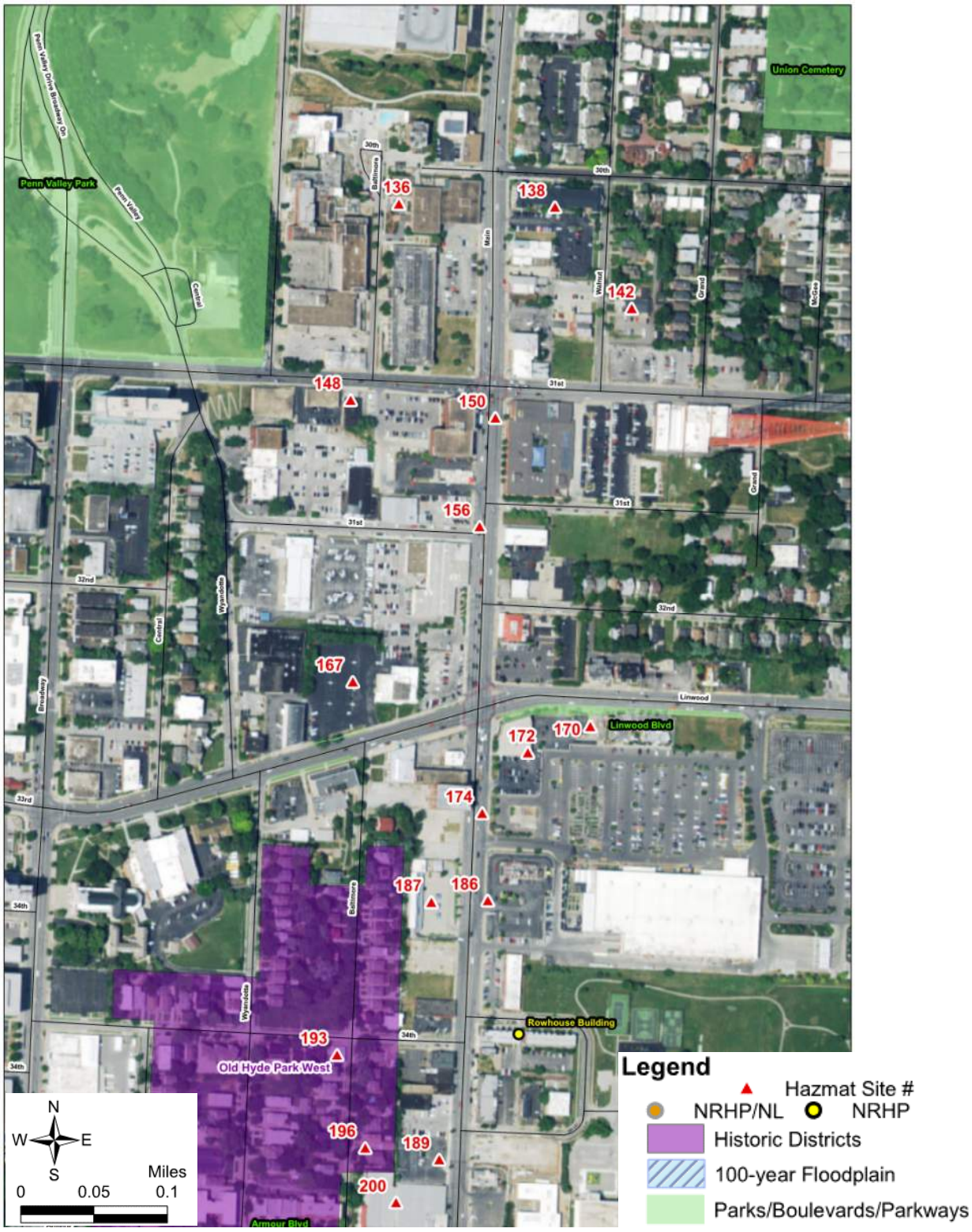


Figure 2-1b: Environmental Resources, 30th Street to 34th Street

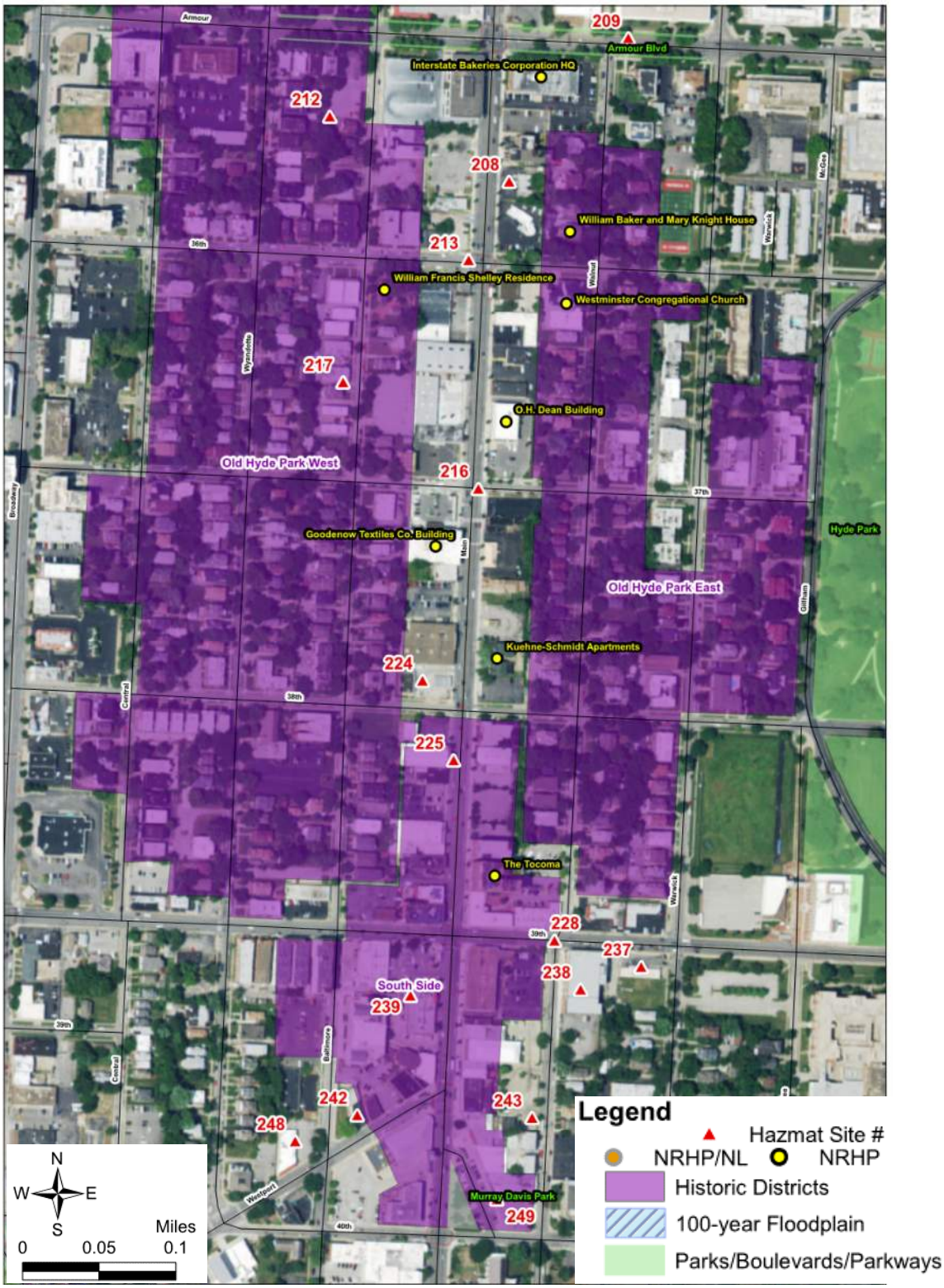


Figure 2-1c: Environmental Resources, Armour Boulevard to 40th Street

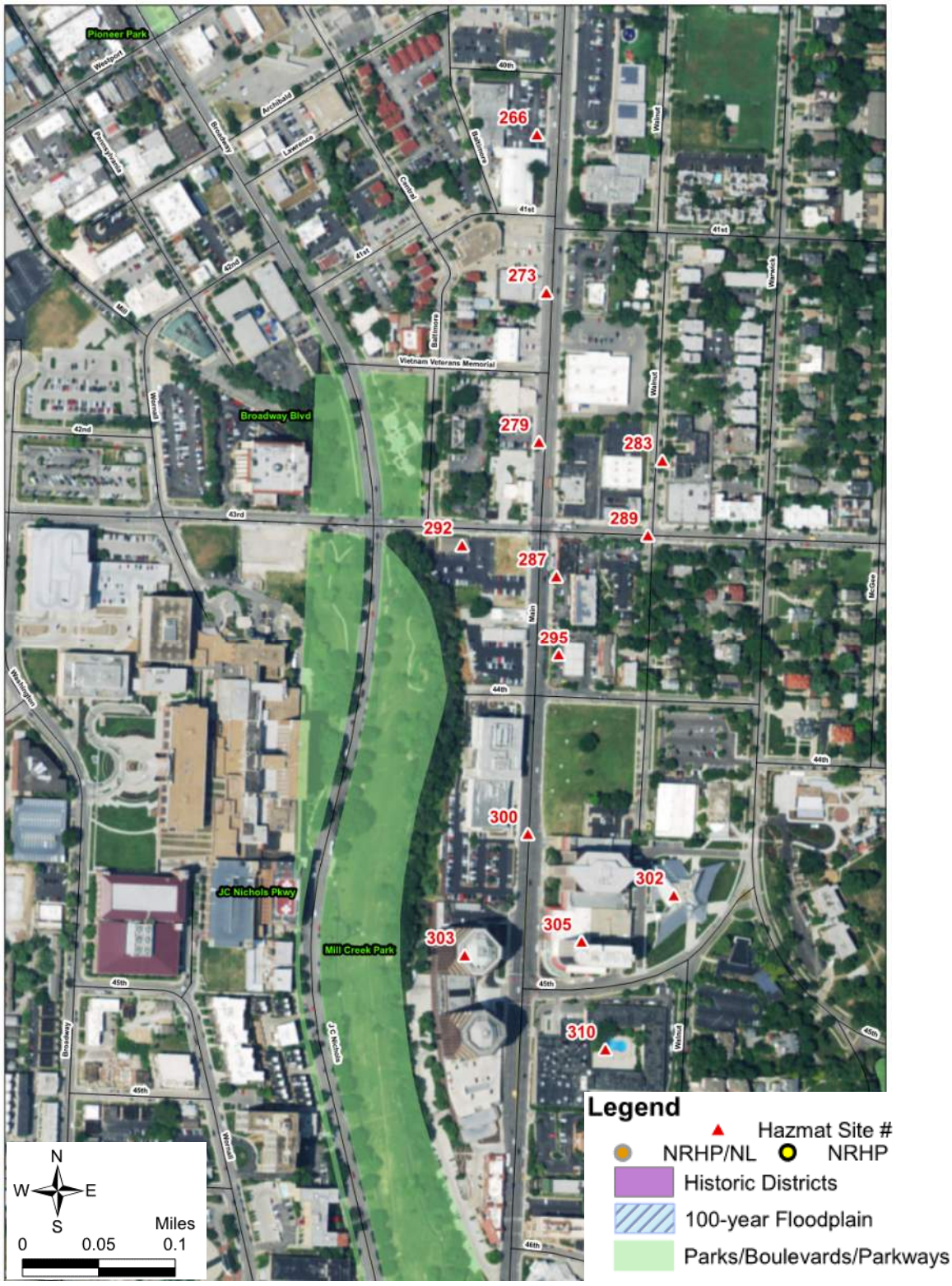


Figure 2-1d: Environmental Resources, 40th Street to 46th Street

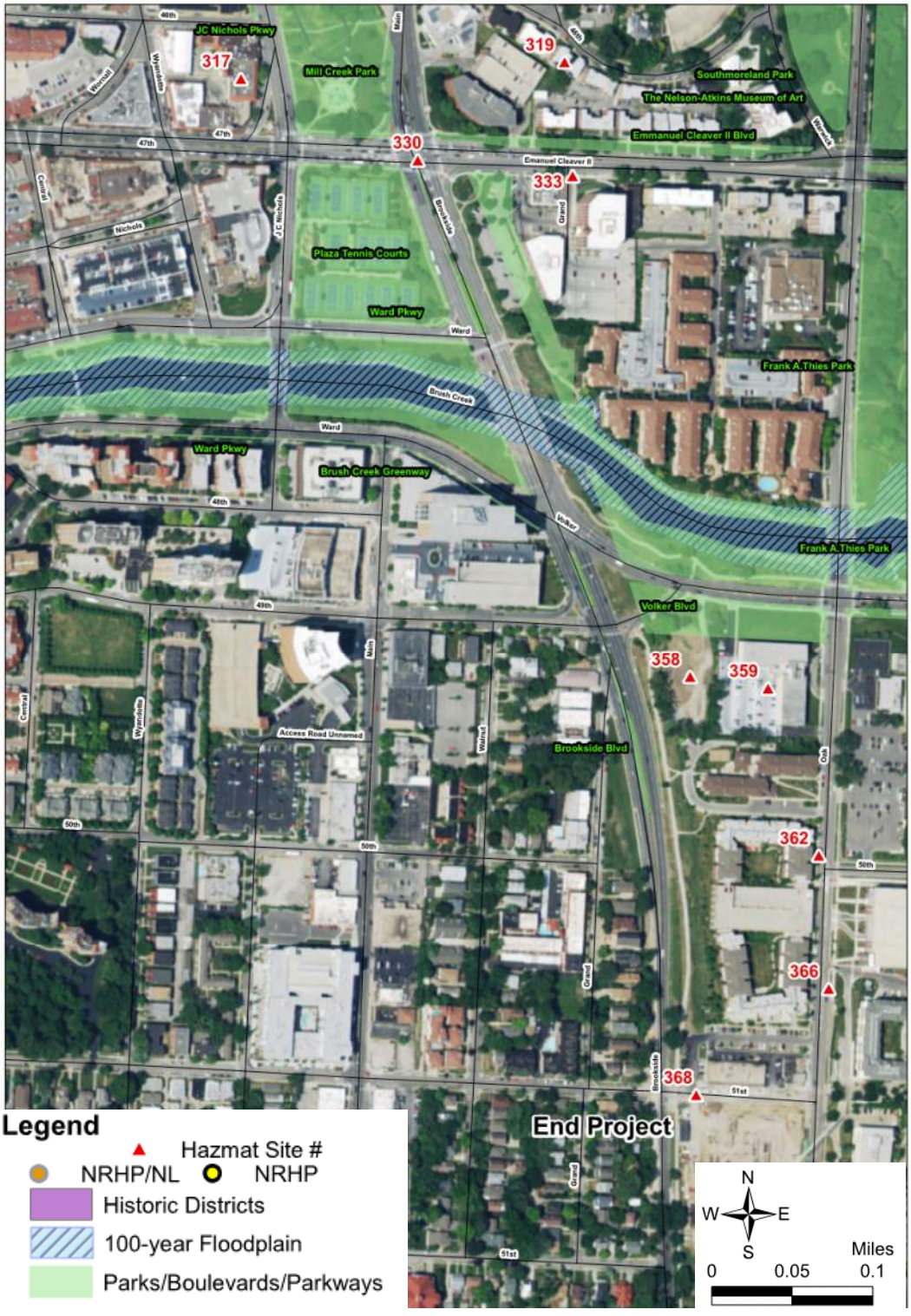


Figure 2-1e: Environmental Resources, Emmanuel Cleaver II Boulevard to 51st Street

Potential Hazardous Material Sites

There is no single comprehensive source of information available that identifies all known or potential sources of environmental contamination within a geographic area. However, Environmental Data Resources Inc. (EDR) was retained to provide a search of over 100 federal and state environmental databases containing known and suspected sites with hazardous materials and/or environmental contamination.

The database search included sites identified or evaluated as federal or state Superfund sites; facilities that generate, store, treat or dispose of hazardous wastes; solid waste landfills; facilities that have active, closed, or leaking aboveground storage tanks (ASTs) or underground storage tanks (USTs); sites actively undergoing cleanup; spills involving potentially hazardous materials; and a number of other activities that might be indicators of a hazardous condition.

The review of the database focused on those uses that have a moderate to high potential to have resulted in soil and/or groundwater contamination within the study corridor. The study corridor for the evaluation was defined as 1 ½ blocks east and west of Main Street from Pershing Road, south to the point where Main Street and Emmanuel Cleaver II Boulevard (47th Street) intersect and Main Street transitions to Brookside Boulevard, then south on Brookside Boulevard to 51st Street.

In general, sites identified within the study corridor can be categorized as follows:

Historic/Current Dry Cleaners

Dry cleaners, rug cleaners and laundries are known to use and/or have used solvents such as perchloroethylene (PCE), trichloroethylene (TCE), naptha, ethylene glycol, propylene glycol, and gasoline for stain removal. The institutional laundries of the past generated steam using coal and oil fired boilers, which presents the potential for oil-contaminated soil.

Historic / Current Auto and Petroleum Storage Tank Facilities

Filling stations, auto repair, auto service and auto cleaning facilities, including detailing and auto washing, produce oil waste, oil-contaminated water and solvents, and usually include bulk storage of petroleum oil, which may leak or spill out onto the ground. Underground Storage Tanks (USTs) and ASTs were/are commonly used at these types of facilities.

Hazardous Waste Generators

These are facilities that are registered as generating, storing, transporting or disposing of small to large quantities of hazardous wastes. Facilities can vary in nature – for example, from a small photo finishing operation/drug store/apartment complex to large-scale industrial-size printing or manufacturing operations. These facilities may generate any number of wastes considered hazardous including spent volatile organic compounds, semivolatile organic compounds, petroleum-related compounds, or metals. Only those hazardous waste facilities handling large quantities of hazardous waste, documented contamination, or numerous reported hazardous waste violations have been identified within the study corridor.

Reported Spills

These sites include reported spills of potentially hazardous materials made from a variety of sources regarding a number of different incidents and materials. They represent releases of hazardous substances reported to the Missouri Department of Natural Resources (MDNR) Emergency Response section.

Missouri Volunteer Cleanup Program (VCP) and Site Management and Reporting System (SMARS)

These are sites participating in the MDNR's VCP as well as a database that currently houses information for Superfund, Federal Facility, Brownfields VCP and Missouri's other state response programs.

FINDINGS

Review of the EDR database report revealed 75 locations (many with several properties relatively close to each other or appearing in multiple databases) within 1 ½ blocks either side of Main Street/Brookside Boulevard (south of Emmanuel Cleaver II Boulevard/47th Street) as follows:

- Historic Cleaner Sites – 101
- Dry Cleaner Sites – 6
- Historic Auto Sites – 131
- Aboveground Storage Tank (AST) Sites – 1
- Underground Storage Tank (UST) Sites – 34
- Leaking Underground Storage Tank (LUST) Sites – 26
- Large Quantity Hazardous Waste Generators with Incidents of Contamination– 1
- Spill Sites – 31
- Missouri VCP/SMARS Sites - 3

In the next phase of the project, hazardous environmental concerns will be studied in more detail, looking at past uses as well as existing uses of the properties in relation to United States Environmental Protection Agency (USEPA) and MDNR records.

Although it is unlikely none of the hazardous environmental concerns that exist in the corridor would pose a major problem with regard to constructability of the project, traditional land-use practices such as auto repair, gas stations, dry cleaners, printers and others have had the potential to affect soil and/or groundwater on or near the proposed streetcar alignment. Examples where contaminated soils and/or groundwater may be encountered include excavation and removal of contaminated groundwater during dewatering operations, or excavation during utility line construction activities. It is anticipated that construction activities associated with the implementation of the streetcar system expansion may include excavation up to 15 to 20 feet in depth (for the poles that support the overhead catenary system, in particular). To minimize the potential for contamination during construction, requirements for safety procedures and protection of human health and the environment would be established in accordance with USEPA and MDNR regulations to ensure that there would be no further contamination and to provide a safe working environment during construction. All solid waste

materials generated during construction of the project will be recycled or properly disposed of in accordance with federal, state and local regulations.

Water Quality

Potential effects on water quality could be a factor in the Main Street Extension corridor because of the possibility of runoff reaching water bodies in the area. However, the potential effects on water quality are anticipated to be minor since track construction would be almost exclusively within the existing street right-of-way and most auxiliary components (e.g., platforms and poles) would be integrated into existing sidewalks.

A review of the US Fish and Wildlife Service National Wetland Inventory (NWI) maps and the USGS quadrangle maps indicate that there are no wetlands within the proposed alignment of the Main Street Extension. The only surface water is Brush Creek, which flows under Brookside Boulevard between Ward Parkway North and Volker Boulevard (Ward Parkway South). All other streams have been previously enclosed in underground storm sewer systems. Stormwater runoff from the proposed streetcar alignment would flow through the sewer system and eventually reach the Missouri River.

The MDNR 2012 303(d) lists of impaired water bodies (approved by the USEPA) were reviewed and it was determined that there are no impaired water bodies within the proposed Main Street Extension corridor. However, the Missouri River and the Blue River are on the 303(d) list as having the Escherichia coli (E.coli) bacterial pollutant which is associated with urban runoff and storm sewers, and are impaired for whole body recreation. Although the Main Street Extension corridor project would not result in direct runoff into these rivers, runoff into Brush Creek would eventually flow into the Blue River then on to the Missouri River.

Construction activities have the potential to impact water quality due to erosion of areas cleared and operation of heavy equipment in these areas. In accordance with Best Management Practices and the requirements of the National Pollutant Discharge Elimination System (NPDES) permit, erosion control measures will be undertaken. These measures could include but are not limited to erosion control blankets, curb inlet filters, coir logs, seeding and mulching. The erosion control methods used will be tailored to the circumstances at the project site and may vary throughout the corridor to best suit the needs of the specific location. Erosion control measures will be implemented at the outset of construction and will be maintained throughout the entirety of construction.

Floodplains

According to the Federal Emergency Management Agency (FEMA) floodplain maps, the Main Street Extension corridor (Pershing to 51st Street) crosses Brush Creek and its associated 100-year and 500-year floodplain. Development in a 500-year floodplain does not require any permitting. However, any development within the 100-year floodplain will require a Floodplain Development Permit which is obtained through the City's FEMA Floodplain Administrator. Also, direct effects to Brush Creek and its floodplain may require a Section 404 Permit from the US Army Corps of Engineers.

Parks and Boulevards

Lists and maps of parks and boulevards from the City's Parks and Recreation Department were reviewed to locate these resources along the Main Street Extension corridor. Parks and boulevards present in the corridor are listed below:

- Washington Square Park – Pershing & Grand/Main (5 acres)
- Memorial Hill / Penn Valley Park (Liberty Memorial) – Pershing & Main St (49.96 acres)
- Murray Davis Park – 40th & Main St (0.09 acre)
- Mill Creek Park – JC Nichols Parkway from 43rd St to Ward Parkway (11.43 acres)
- Brush Creek Greenway – Adjacent to Brush Creek from Brookside Blvd to the Blue River (285.85 acres)

In addition there are several boulevards/parkways that traverse the Main Street corridor and one within a portion of the corridor (i.e., Brookside Boulevard). While not technically parks, these facilities fall under the jurisdiction of the City Parks and Recreation Department and require consideration/coordination with the City Parks and Recreation Department. These boulevards and parkways are listed below:

- Grand Boulevard
- Linwood Boulevard
- Armour Boulevard
- Emmanuel Cleaver II Boulevard
- Ward Parkway
- Volker Boulevard
- Brookside Boulevard – Main Street from Emmanuel Cleaver II Boulevard/W. 47th Street south to 51st Street and beyond.

Publicly owned parks and recreation areas are considered Section 4(f) resources. Section 4(f) of the US Department of Transportation (USDOT) Act of 1966 protects parks which are publically-owned and open to the public. If a park or recreation area is being converted to a transportation use, an evaluation of avoidance alternatives is required. However, if certain impact thresholds are met and can be considered *de minimis* (minimal) by FTA then avoidance alternative analysis is not required. Measures to minimize harm and mitigation must still be considered and those mitigation measures could include replacement and/or relocation of park features, such as landscaping, activities or attributes of the park.

Historic Architectural Resources

An analysis of architectural and cultural resources for the Main Street corridor was conducted for the study area. While not an intensive level survey of all properties in the study area, the analysis represents an inventory of all properties located within the study area. As such, there are 296 properties/parcels that have been identified within the study area. Properties that are listed in the National Register of Historic Places, either as a single site or part of a historic district as a contributing resource, are identified. It is important to note that the scope for this study did not include any eligibility assessments and/or determinations.

Because this inventory does not fall under Section 106 activities, no evaluation of the possible effects of the proposed project on any identified historic resources and/or districts were identified as part of this study. However, historically, streetcars were instrumental in the development of the greater Kansas City metropolitan area, thus the reintroduction of modern streetcars would not generally be incompatible with the area.

Study Area

In general the study area covers approximately 300 feet from the centerline of Main Street from Pershing Road south to 51st Street and Brookside Boulevard, thereby generally including the western portion (1/2 parcel) of Baltimore Avenue and the eastern portion (1/2 parcel) of Walnut Street.

In compiling the inventory of properties located in the study area, data was gathered from several sources including the following:

- **KIVA, Kansas City, MO.** A GIS database that contains parcel maps and boundaries. This site also provides a filter layer that indicates National Register of Historic Places listings.
- **Jackson County GIS.** This site was used for parcel identification.
- **MO State Historic Preservation Office.** The website for the MO SHPO provides National Register of Historic Places nominations and Historic Survey links.
- **Previous Streetcar Studies.**

Field Study was also undertaken within the study area.

FINDINGS

In the study area, the following were identified: Ten (10) NRHP single sites; Ninety-seven (97) properties listed as contributing resources within a National Register Historic District; Fifteen (15) properties listed as non-contributing resources within a National Register of Historic Places District; and one (1) National Historic Landmark site. The National Register listed historic districts within the study area include the Old Hyde Park West Historic District, the Old Hyde Park East Historic District and the South Side Historic District. Maps and additional data regarding these nominations can be found on the Missouri State Historic Preservation Office website: https://dnr.mo.gov/shpo/jackson.htm.

In the next phase of the project, NEPA will require consideration of important historic, cultural, and natural aspects of our national heritage. Important aspects of our national heritage that may

be present in the study area must also be considered under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and the implementing regulations, 36 CFR 800. This act requires Federal agencies to “take into account” the “effect” that an undertaking would have on “historic properties.” The NHPA mandates that agencies initiate the Section 106 process, identify historic properties, assess adverse effects, and resolve adverse effects. Section 106 encourages, but does not require, the preservation of historic properties. When adverse effects on historic properties are unavoidable, those adverse effects must be mitigated.

Chapter 3: Alignment Planning

Chapter 3.1: Station-Stop Locations

During the planning for the Downtown streetcar Line, locating station-stops was largely an "internal" effort of the project team, with focused localized stakeholder feedback in certain areas helping to guide final locations (especially as the project went into design). This situation has changed dramatically during the Main Street Extension planning. There is now corridor-wide interest in where the station-stops will be located, and the study team has received many expressions of preference for station-stop locations, as stakeholders have now seen the economic and community benefits of having a nearby station-stop. Thus, the selection of station-stop locations has become a matter of more intense early public scrutiny – and a defensible, transparent, criteria-based methodology is needed to aid the process.

Downtown Process

The Downtown line's stop locations were based on a fairly simple process. An initial principle of two-block spacing was developed based on the experience of streetcars in other cities and the desire for the streetcar to function as a "pedestrian accelerator", enhancing walkability and connectivity throughout downtown. As a starting point, even-numbered streets were initially proposed through most of the route (8th, 10th, 12th, 14th, 16th, 18th, 20th). As the project moved into environmental planning, and then conceptual and detailed design, items such as development plans, stakeholder business operations, and bus operations began to influence station-stop location – and the final locations evolved and experienced one consolidation (7th, 9th, 12th, 14th, 16th, 19th).

Station-Stop Quantities vs. Larger Goals

As a southward extension on Main Street is contemplated, the effect of the route nearly tripling in length must be taken into account in the selection of station-stop locations. In contrast to Downtown, streetcar operations through Midtown will be a delicate balance between serving short (Downtown-like "pedestrian accelerator" scale) and longer (public transit scale) trips. Having too many station-stops could unnecessarily add expense (approximately $300,000 in capital costs per station-stop, plus ongoing maintenance) as well as dwell-time delays (30-50 seconds per location) affecting running time and reliability. Having too few station-stops could result in curtailed access and reduced development/redevelopment opportunities. The system must be efficient, reliable and safe – key elements of the Purpose and Need – but it cannot sacrifice mobility, convenience and economic development – also key elements of the Purpose and Need. The system must also truly function as an upgrade from the Main MAX bus service it will largely supplant – not only from perspectives such as accessibility and ridership attractiveness, but also in terms of perceived reliability and operational efficiency.

General Spacing Considerations

The 2014 NextRail process, which evaluated the Main Street Extension along with several other potential extensions, included conceptual drawings showing station-stops at Grand Boulevard, Linwood Boulevard, Armour Boulevard, 39th Street, 43rd Street, 45th Street, Ward Parkway North, and 51st Street. This layout largely mimicked the Main MAX stop layout, which generally has stops spaced at about a half-mile, or every four blocks. The Main MAX stops, in turn, were chosen based on the general principle that no person on the route should need to walk more than one-quarter mile, or two blocks, to a MAX stop. This is a fairly standard distance used for walking to transit – for example, FTA indicates that bus or streetcar passengers are usually willing to walk up to ¼ mile or five minutes to reach stops – and the streetcar study team adopted it early in the process as a reasonable spacing for station-stops. Thus, the NextRail station-stops appeared to be a good starting point for the current effort.

However, given the larger goals of the current study, the study team wanted to be thorough about evaluating potential locations. It was possible that conditions had changed since the MAX stops were laid out, or since NextRail was completed; or that additional variables needed to be considered. Thus, in evaluating potential stop locations, the study team looked at essentially every public-street intersection along the corridor, with the exception of a few minor "T" intersections.

It is important to note that, for this evaluation exercise, the study team was only focused on intersections – in other words, what intersections the station-stop would be near. Station-stops will ultimately be placed in the vicinity of intersections, but the evaluation was not concerned with near-side vs. far-side, or proximity to the intersection proper.

The evaluation took place in multiple steps: (1) An initial technical screening, (2) Formal and informal public engagement, and (3) A refined evaluation that incorporated additional system-level considerations.

Step 1: Initial Screening

Initial Criteria and Evaluation

As stated previously, the initial station-stop screening effort involved looking at essentially every intersection of public streets along the route, to ensure a holistic evaluation of suitability throughout the corridor. The analysis was conducted by the study team, but was also vetted by a Working Group, composed of corridor stakeholders, at several key milestones. The analysis was at a high level – for example, detailed economic impact evaluations weren't conducted, and qualitative metrics were used for several of the criteria. The intent of the evaluation was to be comparative, so that potential station-stops would be evaluated against each other. Any intersection along the corridor would likely be an excellent candidate for a station-stop, but only a finite number can be implemented – thus, measures were developed to help establish distinctive features of locations that would be most suitable.

Six primary criteria were evaluated:

Regional Connectivity | Bus Integration | Potential Ridership |
Pedestrian Demand | Economic Development | Local Expressed Desire

Two additional criteria – Spacing and Curb Stop Need – were also considered during this evaluation, but at a lesser level (a "pass-fail" consideration of sorts) as described later.

For each intersection, each of the six primary criteria were evaluated on a 1-5 scale, with a rating of "5" indicating "best meets" and a rating of "1" indicating "least meets". The evaluation criteria, and the resulting scores for each, are described below.

Regional Connectivity

Regional connectivity was defined as being in close proximity to, and providing connections to, other transit routes connecting beyond the immediate area. These are routes that have regional significance in the transit network. Additionally, locations that would address future regional transit needs, as identified by the ATA or in the Smart Moves long-term plan, also scored well. The score was a subjective evaluation based on these elements. **Table 3.1-1** summarizes the evaluation of this criterion. Very few locations along the corridor provide significant regional connectivity – the areas near the Plaza, 39th Street, and 31st Street / Linwood Boulevard are the standout locations.

Table 3.1-1: Initial Station-Stop Evaluation Criterion: Regional Connectivity

Location		Score	Justification
1	27th	2	Potential connections to regional routes; MAX stop at 29th
2	Grand	2	
3	Warwick	2	
4	30th	1	No regional connectivity
5	31st	4	#31 service to Blue Ridge Crossing in Independence (transfer hub); Important transfer location in core system; MAX Stop
6	Linwood	4	MAX stop
7	E 34th	1	No regional connectivity
8	Armour	1	No regional connectivity
9	36th	1	No regional connectivity
10	37th	1	No regional connectivity
11	38th	1	No regional connectivity
12	39th	4	#39 serves KCK by the KU Medical Center; Important transfer location in core system; High transfer location; MAX stop
13	Westport	1	No regional connectivity
14	40th	1	No regional connectivity
15	41st	1	No regional connectivity
16	43rd	1	No regional connections
17	44th	1	No regional connectivity
18	45th	1	No regional connections
19	46th	1	No regional connectivity
20	Cleaver II	5	#35, #47, #55, and #401 serve this location; This location would become a very important node; Potential connection for new streetcar connector to Waldo/Brookside; Plaza MAX stop
21	Ward	5	
22	Volker	2	Would allow for regional connectivity and continuous access along Brush Creek, but not as good transfer location as existing Plaza stop or stop on the north side of the Creek
23	49th	2	
24	51st	2	Terminus stop; New streetcar connector to Waldo/Brookside could serve this location; UMKC shuttle serves this location

Bus Integration

Bus integration was evaluated on three measures, as shown in **Table 3.1-2**:

- *Connections* – The number of existing (and planned) bus routes with connections serving the location.
- *Transfers to Main MAX* – The daily number of passengers transferring between the current Main MAX service and existing conventional bus routes is an indicator of anticipated bus integration with the proposed streetcar extension, because the streetcar will have service characteristics somewhat similar to those of the MAX. Transfers are not a comprehensive measure, though, because they only occur in the vicinity of current MAX stops and data is not available at non-MAX locations.
- *Weekday Service Levels* – The frequency and span of bus service in the vicinity of the location.

The locations that scored highly for regional connectivity (the areas near the Plaza, 39th Street, and 31st Street / Linwood Boulevard) also scored well for bus integration. A second tier of locations with all-day service but lower frequencies (30-45 minutes) also scored fairly well for this criterion. A location to note is the area of Crown Center (27th Street to Grand Boulevard), which is an important location for ATA's operations and serves a great number of routes, but most of the routes are either infrequent, don't cover the full day, or both – so those intersections received relatively low scores.

Ridership

The anticipated number of riders, based on streetcar ridership markets, is also a key differentiator in selecting station-stop locations. At the time of the initial station-stop location evaluation, the study team was in the midst of developing a ridership forecasting model; thus, only preliminary estimates were available. Furthermore, the way ridership models are built is not completely conducive to making an intersection-by-intersection comparison: models assume a set of stops, and then forecast ridership based on the market served by that set of stops. It is not practical to model every possible combination of potential station-stops to determine some "optimal" ridership-conducive arrangement. Thus, un-modeled intervening potential locations were evaluated on a more qualitative basis based on the model's output and the evaluation team's knowledge of the local ridership markets.

At this preliminary stage, the team used daily Main MAX boardings as one indicator of ridership potential, tempered and supplemented by ongoing ridership forecasting and corridor knowledge. **Table 3.1-3** summarizes the evaluation.

Table 3.1-2: Initial Station-Stop Evaluation Criterion: Bus Integration

Location		Score	Connections	Transfers to MMAX	Weekday Service Levels (freq = frequency)
1	27th	2	Routes 77, 201, 236, 237, 229 & JoCo (404, 435, 519, 563, 569, and 595) serve this location	0	**#77:** 1-hr freq (5:30a-12:30a); **#201:** 30-min freq (5a-11:30p); **#236:** 30-min freq (6:15a-7:15a & 4:30p-5:30p); **#237** 2 trips in peak periods; **#229:** 30-60-min freq (5a-11:45p); **#404:** 30-min freq (5:45a-7:45a) & 1-hr freq (3:15p-5:15p); **#435:** 1 trip in midday; **#519:** 20-min freq (5:30a-6:45a) & 30-min freq (3:15p-6:15p); **#563:** 2 trips in AM & PM; **#569:** 30-min freq (5:45a-7:45a & 3:45p-5:45p); **#595:** 30-min freq (5:45a-7:45a & 3:30p-6p)
2	Grand	2		0	
3	Warwick	2		0	
4	30th	1	Non-continuous. Routing crosstown routes would require a route deviation from the existing alignment.	NA	NA
5	31st	5	Route 31; Major crosstown route	230	#31: 15 min freq for most of service period (4:30a-12:30a)
6	Linwood	5	Equivalent of #31	Equivalent of #31	Would have equivalent of #31 service, although not quite as direct
7	E 34th	1	Non-continuous. Routing crosstown routes would require a route deviation from the existing alignment.	NA	NA
8	Armour	3	Route 35; Good east-west connectivity; Connects Westport & Plaza (major activity centers); MAX stop	70	#35: 30 min freq (4:45a-10:00p)
9	36th	1	Residential neighborhood road, not a major arterial, more stop signs and less priority given to E-W movement (compared to Armour)	NA	NA
10	37th	2	Route 35; Based on 35th Street; Minimal need for transit integration, assumption that 35 should/would connect at 35th Street		
11	38th	2	Non-continuous. Routing crosstown routes would require a route deviation from the existing alignment	NA	NA
12	39th	5	Route 39; Major crosstown route	340	#39: 20 min freq (5:00a-12a)
13	Westport	3	Moderate need for transit integration, based on Route 35		
14	40th	1	Non-continuous. Would make for difficult routing alignments for crosstown routes.	NA	NA
15	41st	1		NA	NA
16	43rd	1	MAX stop	NA	NA
17	44th	1	Non-continuous. Would make for difficult routing alignments for crosstown routes.	NA	NA
18	45th	2	MAX stop; Non-continuous cross street	NA	NA
19	46th	1	Non-continuous. Would make for difficult routing alignments for crosstown routes.	NA	NA
20	Cleaver II	5	Route 35, 47, 55, 401, and the future Waldo-Brookside connector; Would become very important node	100	#47: 30 min freq for most of service period (4:30a-11:00p)
21	Ward	5			
22	Volker	2	Routing connecting bus routes would be difficult, but feasible	NA	NA
23	49th	2		NA	NA
24	51st	3	Waldo-Brookside connector and UMKC Shuttle service	Unknown for Shuttle	UMKC Shuttle: 45 min frequency (7:00a-7:30p)

Table 3.1-3: Initial Station-Stop Evaluation Criterion: Potential Ridership

Location		Score	Total MMAX Ons	Notes
1	27th	4	NA	Rationale: Future development on east side along 27th Street and will capture rides on south side of Crown Center
2	Grand	4	25	
3	Warwick	4	NA	
4	30th	2	NA	Further away from Linwood shopping center than 31st (a large driver of ridership in the area). Proximity to Union Hill and Fed. Reserve would not offset loss in ridership, resulting in a lower projected ridership.
5	31st	5	320	High percentage of ridership is from transferring passengers. Serves CCVI, Union Hill, Ability KC
6	Linwood	5	180	Linwood Shopping Center (Costco, Home Depot) is large driver of ridership
7	E 34th	3	NA	Further away from Linwood Shopping Center (than Linwood), but still within proximity. Also in proximity to residential on Armour & new residential on Main Street, but may lose transferring passengers from #35.
8	Armour	4	310	Gathers residential riders and provides access to major activity centers.
9	36th	2	NA	Would still serve residential neighborhoods, but is further away from higher-density residential along Armour.
10	37th	2	NA	Lower rating than Armour, because assumes most transfers from route #35 will happen at Armour.
11	38th	3	NA	Would still capture transferring riders from 39th Street cross-town route, but would be an inconvenient transfer. Still serving commercial area on Main Street, capturing some of the same ridership that the 39th Street stop captures on MMAX.
12	39th	5	580	--
13	Westport	3	NA	Assumed high ridership (#35 & #39), but less convenient transfer from #39 than on 39th Street. Lower rating than Armour, assumes most transfers from route #35 will happen at Armour.
14	40th	2	NA	Still in proximity to Westport, but located south of Westport Rd, which is the "main" entrance to Westport from the East; probably equal ridership potential as 41st
15	41st	2	NA	--
16	43rd	3	219	43rd provides access to St. Luke's to the west and light commercial in the proximity of the intersection. Existing ridership is relatively high on the corridor with no crosstown route.
17	44th	2	NA	More difficult (than 43rd Street) to get to St. Luke's, because many riders will not want to cut through park. No signalized crossing point/access for pedestrians.
18	45th	3	50	Potential to serve museums, Art Institute, and residential to the east. Serves employment at node (Century Towers, hotels, etc.)
19	46th	2	NA	Does not directly serve the Plaza, nor does it well serve the employment to the north. Would capture some residential to the east.
20	Cleaver II	5	450	Serves the Plaza
21	Ward	5	NA	
22	Volker	3	NA	Potential to serve the public library and commercial/employment in the SW quadrant; would serve research center and offices to east on Volker, unlikely to well-serve areas north of Brush Creek
23	49th	3	NA	
24	51st	4	104	Serves UMKC and residential/commercial to west around Main Street

Pedestrian Demand

Existing pedestrian demand is an indicator of potential high-activity areas that could be well-suited for station-stop locations. A new streetcar station-stop would be expected to induce pedestrian demand (and even spur new development that generates new pedestrian activity), but areas with already high activity have the best chance for initial and long-term success. The best information available on this measure comes from peak-period traffic counts conducted in the fall of 2017. These counts included pedestrians crossing each leg of each intersection evaluated. The evaluation summed these counts for both the a.m. and p.m. peak hours for use as an indicator for each intersection. Note that, at a small number of intersections, pedestrian volumes had to be estimated because counts were not available. The summed peak-hour values were normalized to a 1-to-5 scale, with values of 200 and above receiving a rating of 5.

The evaluation is summarized in **Table 3.1-4**. At several locations – 31st Street, Armour Boulevard, 39th Street – activity is likely heavily influenced by the existing high-use bus stops. Other locations – 43rd Street, 45th Street, Cleaver II Boulevard, and 51st Street, are affected by significant nearby pedestrian generators (the Plaza, hotels, UMKC, and St. Luke's hospital, to name a few). Two other high-activity areas are located near gas stations with convenience stores (44th Street and 38th Street).

Table 3.1-4: Initial Station-Stop Evaluation Criterion: Pedestrian Demand Levels

	Location	Score	Pedestrian Demand Levels (AM + PM Intersection Volumes)
1	27th	2	58
2	Grand	1	2
3	Warwick	2	67
4	30th	2	40*
5	31st	4	162
6	Linwood	3	141
7	E 34th	3	100*
8	Armour	5	226
9	36th	2	74
10	37th	3	100
11	38th	4	150*
12	39th	5	543
13	Westport	2	86
14	40th	2	85
15	41st	3	100*
16	43rd	4	189
17	44th	4	175
18	45th	5	272
19	46th	2	72
20	Cleaver II	4	162
21	Ward	2	84
22	Volker	1	21
23	49th	2	74
24	51st	5	467

** Estimated based on available information*

Economic Development

Streetcars have been shown to spur economic development, particularly near station-stops. This has certainly been the case with the Downtown Starter Line, and is one of the motivations behind the desire to extend the line. The team evaluated the economic development potential near each intersection at a simplistic high level, using information extracted from the City's Main Street Corridor Overlay District document, the purpose of which is to guide future development along Main Street. The document identifies three types of "zones" along Main Street, as defined below and mapped at right:

A. Neighborhood Main Street (least dense): Critical mass of walkable service for adjacent neighborhood.
B. Transit Node (most dense): An appropriate mixture of density and uses around rapid transit stops to support transit investment.
C. Transitional: A balanced transition from Transit Nodes to Neighborhood Main Streets.

To arrive at a score for a particular intersection, each of the intersection's four quadrants, if considered a strong candidate for development or redevelopment, was assigned a point value based on its zone type (A = 1, B = 3, C = 2). The four quadrant scores were summed, and the resulting intersection totals were normalized on a 1-to-5 scale. **Table 3.1-5** summarizes the results of the analysis. The two highest-scoring areas were Linwood Boulevard and 44th Street. Areas near Crown Center (27th Street and Grand Boulevard) and 36th Street also scored well.

Main Corridor Overlay Zones

Table 3.1-5: Initial Station-Stop Evaluation Criterion: Economic Development

	Location	Score	Overlay District Development Types	# of Redevelopment "Quadrants"
1	27th	3	B	2
2	Grand	3	B	2
3	Warwick	2	A B	1
4	30th	2	A B	1
5	31st	3	B	2
6	Linwood	5	B	4
7	E 34th	2	A B C	2
8	Armour	2	C	2
9	36th	3	A C	4
10	37th	2	A	3
11	38th	2	A B	2
12	39th	2	B	1
13	Westport	1	B	0
14	40th	1	C	0
15	41st	2	C	2
16	43rd	2	B	1
17	44th	4	B	3
18	45th	1	B C	0
19	46th	1	C	0
20	Cleaver II	2	B	1
21	Ward	1	NA	0
22	Volker	1	NA	0
23	49th	1	A	1
24	51st	2	B	1

Local Expressed Desire

As mentioned previously, with the success of the Downtown line, public interest in station-stop locations has intensified, and the vast majority of comments the study team has heard regarding station-stops have been requesting or favoring a particular location. Given the effect local stakeholder opinions had on the starter line, the team felt it was important to reflect positive or negative indications received from stakeholders in the station-stop evaluation, and denoted this criterion "Local Expressed Desire". The team used a fairly simple scoring approach to this criterion:

5: Stakeholders were strongly in support of a given location and felt it was important.

4: A stakeholder or stakeholders expressed a strong preference for a station-stop location, but were not adamant about it in light of the competing interests along the route.

3: No special preference was heard from stakeholders regarding the station-stop.

2: Opposition to the station-stop location was heard from one or more stakeholders.

1: Strong opposing feedback was received regarding the station-stop.

It is important to note that these assessments were based on individual interactions with stakeholders in the months leading up to the first public meeting. The public meeting feedback, and the team's response to it, are described in a later section.

Table 3.1-6: Initial Station-Stop Evaluation Criterion: Local Expressed Desire

Location		Score	Notes
1	27th	5	Crown Center and MainCor have expressed a strong desire for 27th Street (as opposed to Grand Ave) to better serve potential future development.
2	Grand	2	
3	Warwick	3	--
4	30th	3	--
5	31st	4	CCVI has expressed an interest in a stop nearby to serve their frequent field trips to teach children cane skills. Union Hill has also expressed interest in a stop in this vicinity.
6	Linwood	4	MainCor has suggested a stop somewhere between 31st and Linwood to serve both corridors.
7	E 34th	3	--
8	Armour	5	MAC apartments have hundreds of apartment units on Armour and are highly desirous of a stop there
9	36th	3	--
10	37th	4	The Whole Person has expressed a desire for a stop close to their location if possible to serve their employees and clients.
11	38th	3	--
12	39th	3	--
13	Westport	3	--
14	40th	3	--
15	41st	3	--
16	43rd	4	Capitol Federal has expressed interest in a stop near their location to serve their customers along the corridor.
17	44th	2	Nelson-Atkins, Kemper, and KCAI strongly desire a stop at 45th Street to connect to with the Arts Ribbon, and have expressed a concern about the desirability of a 44th Street stop.
18	45th	5	
19	46th	3	--
20	Cleaver II	5	A Plaza stop is a fairly universal goal expressed by stakeholders interested in the extension.
21	Ward	3	--
22	Volker	3	Plaza Library expressed a strong desire for a Library stop right before the public meeting, after the initial evaluation had been completed.
23	49th	3	--
24	51st	5	UMKC considers 51st Street as the northernmost place the streetcar could stop and effectively serve the University. VanTrust (developer of property on SE corner) expressed support for a stop at this location.

Two additional criteria were proposed by the team at the beginning of the initial screening.

Spacing

This criterion was initially envisioned as one that could be used to generally ensure reasonable station-stop spacing, to balance transit access with efficient operations. Near the outset of the analysis, it was decided that inter-stop spacing on the order of a half-mile (four blocks, more spread out than the two/three-block spacing on the Downtown Starter Line) would be a reasonable target to consider. This would translate to roughly a quarter-mile (two-block) walk from any spot on Main Street to a station-stop, a very reasonable and common distance for access to transit. The thinking was that spacing considerations could only be truly examined after a set of station-stops had been developed, to ensure that the recommendations arising from the other criteria were within reasonable tolerances.

This measure did not evolve into an initial criterion for individual station-stops, because that could lead to a situation in which two station-stops deemed to be poorly spaced could both score poorly. Instead, for the initial evaluation, the main spacing-related consideration was whether the stops generally achieved the goal for half-mile spacing, given the strength of the other ratings. As detailed in later sections, this goal was determined to be met conceptually during the initial evaluation, but was revisited more quantitatively during the refined evaluation (Step 3) described later.

Physical Capacity

This criterion was included to address any potential “pinch points” along the corridor where a stop might not be able to fit within the right-of-way. As the initial evaluation proceeded, none of the intersections presented themselves as “fatal flaws” at which a stop couldn’t somehow be made to fit – given that stops could potentially “slide” up and down the corridor. Thus, all intersections were on essentially on equal footing and this criterion didn’t come into play.

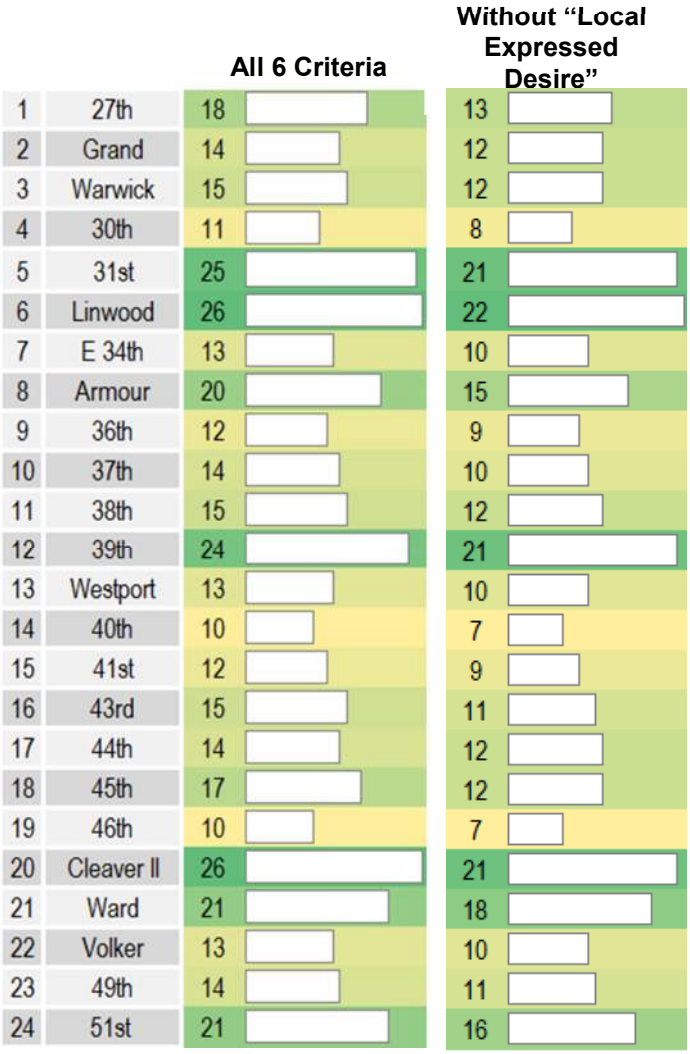
Figure **3.1-1** maps the ratings for the initial six criteria.

Figure 3.1-1: Initial Screening of Potential Stop Locations

For each of the 24 intersections evaluated, the team summed the scores for the six criteria described above, resulting in a composite score. The chart on the left side of **Figure 3.1-2** illustrates each stop's composite score resulting from this calculation.

The study team was also interested in the scoring of just the technical considerations without the stakeholder opinions. Thus, the chart on the right side of **Figure 3.1-2** illustrates the sum without the "Local Expressed Desire" criteria.

Figure 3.1-2: Initial Composite Scoring of Potential Stop Locations (north to south)



The results organized themselves into the following patterns:

- Three high-scoring isolated locations: Armour Boulevard, 39th Street, and 51st Street.
- Two high-scoring pairs of adjacent intersections: 31st Street / Linwood Boulevard, and Cleaver II Boulevard / Ward Parkway.
- Two moderate-scoring clusters of nearby intersections, at approximately reasonable spacing to fill in the gaps of the other five: 27th Street / Grand Boulevard / Warwick Trafficway, and 43rd Street / 44th Street / 45th Street.

As the team considered these results, some of the multi-intersection issues seemed easily resolved:

- 27th Street / Grand Boulevard / Warwick Trafficway: Based on several factors – the strong preference expressed by Crown Center and other stakeholders for 27th Street, the large development site adjacent to the intersection, and the favorable spacing from Union Station – 27th Street was identified as the recommended location.
- Cleaver II Boulevard / Ward Parkway: These intersections are close together, and both have fairly similar access to the Country Club Plaza; thus, they were considered as essentially one location, because the station-stop could shift either way.

The remaining two multi-intersection clusters were harder to resolve, and the study team invested more time analyzing their relative benefits as described in the following sections.

Initial Focused Evaluation: 31st Street / Linwood Boulevard

31st Street and Linwood Boulevard received equally strong ratings. However, due to the stops' mutual proximity, the project team evaluated a consolidated station-stop at either cross-street, or between cross-streets. A consolidated station-stop was supported by the previously mentioned Working Group. The following information helped inform the initial decision on where to locate a consolidated station-stop in the vicinity of the 31st Street and Linwood Boulevard area.

Ridership Market, 31st Street / Linwood Boulevard

The existing Main MAX has stops at both 31st Street and Linwood Boulevard. The 31st Street stop has approximately 66 percent more ridership than the Linwood Boulevard stop (**Table 3.1-7**). However, based on 2017 Automated Pedestrian Counters (APC), 80-85% of Main MAX riders at the 31st Street stop are transfer passengers with the 31st Street route; signifying the importance of connecting to the local east-west connector in the area.

Table 3.1-7: 31st Street & Linwood Boulevard Main Max Ridership

	31st Street			*Linwood Boulevard*		
	On	**Off**	**Total**	**On**	**Off**	**Total**
Northbound	129	159	288	98	86	184
Southbound	190	123	313	81	97	178

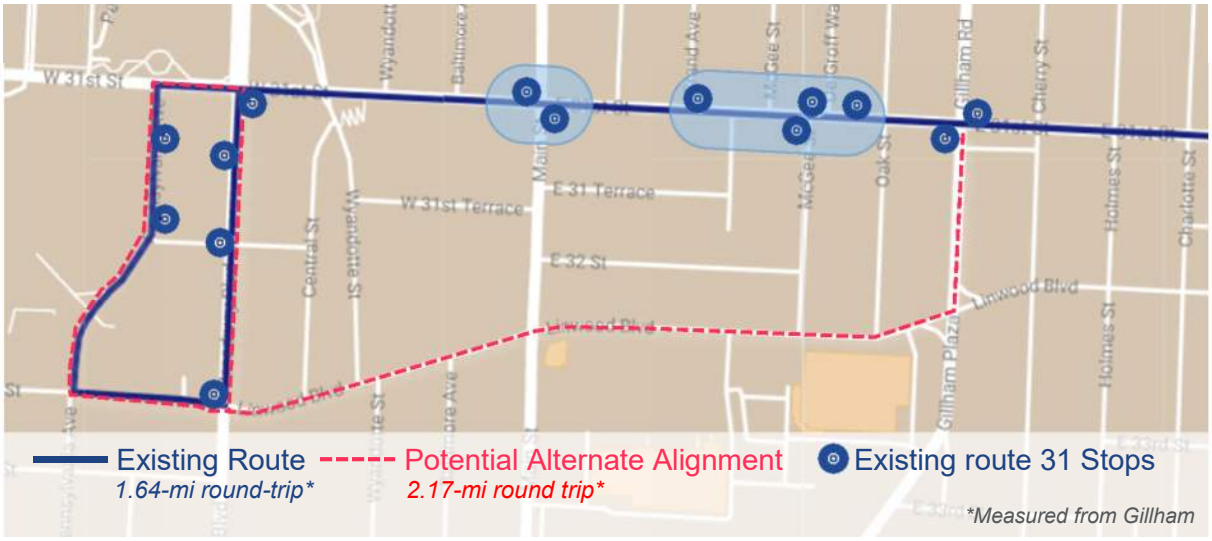
The Main MAX Linwood Boulevard stop has high ridership, all of which originates or is destined for the immediate surrounding area (no transfers). This is likely due to the greater number of jobs and activity in the Linwood Shopping Center than near 31st Street. However, both intersections have future economic development potential.

Route 31 (31st Street)

Connections to local routes, particularly the 31st Street route, are important to ensure the streetcar is a fully integrated, functioning, core route of the RideKC transit system. While Route 31 (Blue Ridge to Penn Valley) currently runs on 31st Street in the vicinity of Main Street, there is potential for the route to run on Linwood Boulevard at the west end of the route to connect to a potential Streetcar station at Main Street and Linwood Boulevard (**Figure 3.1-3**).

The stops that would be affected by a new alignment on Linwood Boulevard are highlighted in light blue in the Figure. The ridership on Route 31 between Gillham Road and Main Street is relatively small (34 total on/offs, or 17 round trips). Of the total ridership on Route 31 at Main Street, 480 to 510 trips are transfers which could be facilitated at a Linwood Boulevard streetcar station-stop. The remaining 90 to 120 trips (45 to 60 passengers) would be required to make a longer walk (roughly one-quarter mile to a Linwood Boulevard station-stop on Main Street).

Figure 3.1-3: Route 31 Existing and Potential Routing – West End



31 Eastbound Stops	Ridership		
	On	Off	Total
Pennsylvania at 32nd NB	65	56	121
Pennsylvania at 31st NB	99	45	144
31st at Broadway EB	22	1	22
31st at Main EB	222	27	249
31st at McGee EB	11	1	13
31st at Gillham Plaza EB	41	13	56

31 Westbound Stops	Ridership		
	On	Off	Total
31st at Gillham Rd WB	17	32	49
31st at DeGroff Way WB	0	0	0
31st at McGee WB	1	12	13
31st at Grand WB	0	8	8
31st at Main WB Farside	16	236	252
Broadway btw 31st/32nd SB	3	28	31
Broadway at 32nd SB	2	21	23
Broadway at Linwood SB	13	36	49

A 31st Street streetcar station-stop would require all existing ridership on Main MAX at Linwood – 360 trips (180 passengers) – to walk the one-quarter mile distance. In summary: A 31st Street Streetcar station-stop would require a further walk for 180 passengers, while a Linwood Boulevard streetcar station-stop would require 60-75 passengers to walk an additional distance.

The suggested alternate routing on Linwood Boulevard (red dash in **Figure 3.1-3**) would likely add 1-2 minutes of running time in each direction. However, based on the current running times, headways, and minimum layover, the schedules could likely absorb an additional four minutes (round trip) without needing an additional bus. This is not to ignore the fact that some riders would experience longer travel times.

Initial Recommendation: Linwood Boulevard

The study team considered the preceding information in conjunction with the overall evaluation matrix, and reached the following initial conclusions and recommendation:

- Although there are existing Main MAX stops at 31st Street and Linwood Boulevard, consolidation of those two stops to a single streetcar station-stop is sensible from an operations and investment standpoint.
- A station-stop is needed somewhere between 27th Street and Armour Boulevard, and either 31st Street or Linwood Boulevard would be a good choice (acknowledging that Linwood Boulevard results in a less regular spacing). Since either could work, the decision comes down to "tie-breakers".
- The study team initially preferred Linwood Boulevard because it appears to have greater economic development / redevelopment potential (a lot of surface parking). Also, the fact that a portion of the Route 31 bus line could be re-routed to Linwood Boulevard meant that the important functions of the 31st Street MAX stop could be transplanted to Linwood Boulevard, addressing one of the key concerns about omitting a 31st Street station-stop.
- The study team and the Working Group acknowledged that the drawback of a Linwood Boulevard station-stop is that it would not serve the Union Hill neighborhood as well as a 31st Street station-stop would.

Initial Focused Evaluation: 43rd Street / 45th Street

The study team also examined the area between 43rd Street and 45th Street, which appears to warrant a streetcar station-stop based on the evaluation matrix and the spacing goals. The existing Main MAX route has stops at both 43rd Street and 45th Street. However, due to the two intersections' proximity, the project team evaluated a consolidated station-stop at either intersection, or at 44th Street. A consolidated station-stop was supported by the Working Group. The following information was used to consider the best configuration through this section of the corridor in more detail.

Ridership Market, 43rd Street / 45th Street

Based on 2017 APC, the existing Main MAX 43rd Street stop has almost four times more ridership than the 45th Street MAX stop (**Table 3.1-8**). The area has no existing cross-town routes, the closest being Route 39 (39th Street) to the north and Route 47 (47th Street) to the south.

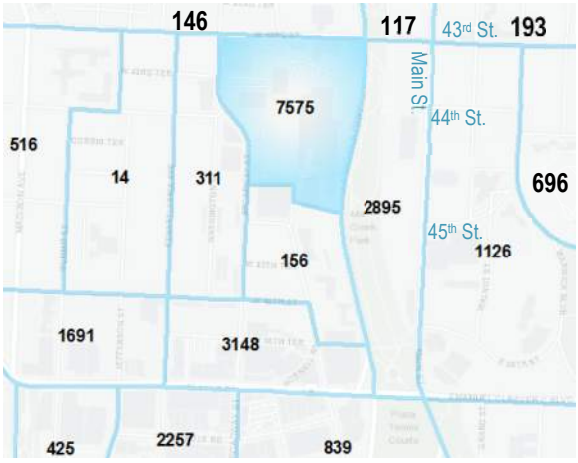
Table 3.1-8: 43rd Street and 45th Street Main Max Ridership

	43rd Street			45th Street		
	On	Off	Total	On	Off	Total
Northbound	172	40	213	45	12	57
Southbound	46	162	208	5	47	52

Access Issues: 43rd Street / 44th Street / 45th Street

Based on the existing roadway network, 43rd Street has a major benefit of providing access to Saint Luke's Hospital and associated medical facilities, the largest employment site in the area (**Figure 3.1-4**). A 43rd Street streetcar station-stop would also better serve the northern portion of the Southmoreland Neighborhood (nearly 900 residents between 41st Street and 43rd Street).

Figure 3.1-4: Employment – Vicinity of St. Luke's



While a 44th Street or 45th Street station-stop would provide access to the American Century Towers and surrounding hotels, the market is "single-loaded", limited by Mill Creek Park. If a 44th Street or 45th Street station-stop were to be pursued (without a 43rd Street station-stop), an enhanced pedestrian connection would be necessary to connect riders to the Saint Luke's Hospital area. A pedestrian connection would be better facilitated at 44th Street than at 45th Street, but would likely require a signalized crossing of Main Street.

Figure 3.1-5: 44th Street Right-of-Way (ROW)

A paved, ADA-accessible trail could provide access through Mill Creek Park, or a covered sky bridge could provide direct access from the station-stop to the hospital. There is right-of-way (ROW) for 44th Street west of Main Street (**Figure 3.1-5**) that could be used for the connection.

Figure 3.1-6: Cultural District Access

There are plans for a Cultural District "Art Ribbon" connecting key art destinations on the east side of Main Street, including the Kemper Museum of Contemporary Art, the Kansas City Art Institute, and the Nelson-Atkins Museum of Art. The preferred station-stop location for access to the Art Ribbon, as expressed by the three institutions, is 45th Street; however, a station at 44th Street could also provide easy access (see **Figure 3.1-6**).

A 45th Street station-stop would provide a connection to the Art Ribbon, serve downtown visitors staying at the nearby hotels, and serve employment near the 45th Street intersection. A 43rd Street stop might have greater ridership potential and would likely better serve the Saint Luke's Hospital (compared to 45th Street), the largest employer in the area. 44th Street has the potential to serve both markets, but, as stated earlier, the effectiveness of a 44th Street station-stop would rely on a significant investment in pedestrian connections through Mill Creek Park.

Initial Recommendation: Retain Both 43rd Street and 45th Street

The study team considered the preceding information in conjunction with the overall evaluation matrix, and reached the following initial conclusions and recommendation:

- Although there are existing Main MAX stops at 43rd Street and 45th Street, the study team and Working Group at first recommended that consolidation of those two stops to a single streetcar station-stop would be sensible from an operations and investment standpoint.
- A station-stop is needed somewhere between 39th Street and the Plaza, and either 43rd Street or 45th Street would be a good choice (acknowledging that 45th Street results in a less regular spacing).
- Given that the 43rd and 45th Street station-stops would serve two very different ridership markets (43rd: St. Luke's, Southmoreland; 45th: hotels, large office buildings, Cultural District), the study team, with the concurrence of the Working Group, reversed the decision to consolidate the stops and carried forward a recommendation of providing station-stops at both 43rd Street and 45th Street.

Initial Overall Station-Stop Recommendations

Based on the preceding analysis, the study team's initial recommendation included the following new streetcar station-stop locations:

- 27th Street
- Linwood Boulevard
- Armour Boulevard
- 39th Street
- 43rd Street
- 45th Street
- Country Club Plaza (Cleaver II Boulevard / Ward Parkway N.)
- 51st Street

The next steps of the process resulted in refinements to these recommendations.

Step 2: Formal Public Engagement

As mentioned previously, the study team met with numerous stakeholders "one-on-one" during the initial months of the evaluation. These meetings influenced the initial screening results presented in the previous section. The Working Group also had input and feedback at several milestones during the initial screening.

After developing initial station-stop recommendations, the study team shared them with the public at an open house on April 3, 2018. Station-stop locations were just one piece of the overall information shown at the open house, which also presented an overview of the study process, the TDD, and the Best Lane analysis. The open house information was also posted on-line for another 17 days to encourage feedback from those unable to participate. In addition, several emails and letters, as well as a petition, were received after the open house, and a few additional stakeholder meetings were held. The following is a summary of feedback received from these various forums:

Open House

Of the 49 participants who provided comments on proposed stop locations:

- 19 expressed support for the recommendations as presented.
- 23 were specific to stop locations.
- 7 could be considered/addressed in design when finalizing actual locations (vs. intersections) and/or mid-block stops.

The top three requests for station-stops in the open house comments were locations that were not in the initial recommendations. This is not surprising, since participants desiring a station-stop and not seeing it on the list would be the most likely individuals to request that station-stop, while participants satisfied with the list would generally be more likely to give blanket approval (even if they had focused interest in a specific station-stop location). These three stops were:

- 31st Street (5 comments)
- 49th Street/Plaza Library (5 comments)
- Westport Rd (4 comments)

On-line Survey

A total of 187 unique participants took part in the survey in the days following the open house. The majority of respondents who provided feedback on proposed station-stop locations strongly encouraged an additional station-stop at 31st Street; many respondents specifically indicated/referred to this addition as a "Union Hill" stop. This additional station-stop was referenced in 133 surveys.

Station-stop highlights from the survey included:

- *General:* 36 respondents were in support of the station-stops as presented/recommended.
- *Linwood / 31st Street:*
  - 82 respondents indicated a preference for 30th Street and/or 31st Street – many specifically referencing Union Hill, plus a few references to Longfellow.
  - 40 respondents specifically preferred 31st Street as an additional station-stop location.
  - 11 respondents indicated a preference of 31st Street over Linwood Boulevard.
  - 3 of the respondents in support of the station-stops as presented/recommended specifically indicated a support for a Linwood Boulevard station-stop.
- *43rd Street / 45th Street:* 5 respondents recommended consolidation of these station-stops.
- *Plaza Library:* An additional station-stop at this location was referenced twice.

Email

Twenty (21) email comments were received via info@kcstreetcar.org. Of these comments, 16 (76%) were related to station-stop location – all of them requesting a stop at 31st Street. Two of the other comments were related to station-stops – they recommended/requested station-stop names (*Unicorn Theater Stop/39th Street* and *Westport/39th Street*).

Letters

Letters were received on behalf of organizations/neighborhoods along the extension. Below is a list of letters received to date related to station-stop locations:

- *31st Street (9 letters, 10 entities):*
  - Ability KC Board of Directors in support of a station-stop north of the intersection of Main Street and 31st Street
  - BMO Financial Group (on behalf of Ability KC via current chair of facilities committee) in support of an addition of a 31st Street station-stop
  - Fairfield Inn by Marriott in support of a station-stop north of 31st Street
  - JE Dunn Construction Company in support of a 31st Street station-stop
  - Kansas City KBS (KCPT) in support of a 31st Street station-stop

- One Park place Homeowners Association in support for the addition of a 31st Street station-stop
- Shops at Union Hill in support for the addition of a 31st Street station-stop
- Union Hill Properties in support for the addition of a station-stop north of 31st Street
- Co-signed on behalf of Union Hill Homes and the Union Hill Neighborhood requesting addition of a 31st Street station-stop

- *45th Street (1 letter, 3 entities):*
  - Co-signed on behalf of Nelson-Atkins Museum of Art, Kemper Museum of Contemporary Art, and the Kansas City Art Institute expressing support for the extension and reinforcing a 45th Street Stop – proposing a unique visual identity that would distinguish it as a gateway to the "Art Walk" initiative connecting the institutions.

Petition

A petition was initiated by the Union Hill neighborhood with support from the nearby neighborhoods/resident, requesting the addition of a 31st Street stop. The petition included 370 signatures when it was hand-delivered to the KC Streetcar Authority on April 20, 2018.

Follow-up Meetings

As is evident above in the preceding descriptions, the idea of a 31st Street station-stop received significant feedback in various public forums. In the days and weeks following the public meeting, the study team met with interested parties including representatives of Union Hill, CCVI, Ability KC, and development interests to obtain more information as the station-stop decisions were refined. These meetings revealed valuable information on development plans, equity concerns, accessibility issues, and current employment patterns.

A follow-up meeting was also held with a Westport business owner. Among the items discussed were the initial station-stop locations.

Step 3: Refined Evaluation

Step 1 of the process arrived at a set of potential station-stops through a series of numeric rankings based on both quantitative and qualitative data. These station-stops were, on average, spaced at distances felt to be reasonable for the corridor. Step 2 exposed this set of station-stops to the public, allowing the team to further understand the criteria that truly mattered to the public in selecting station-stop locations.

As the study team considered the next round of refinements, the evaluation hinged on overarching considerations of operational effectiveness, stop spacing and equitable access to service. Although the initial station-stop list met criteria and provided reasonable operational spacing, should any adjustments be considered from the standpoint of improving operational performance, spacing, and equitable access to service? Specific questions the study team formulated included:

- Would there be gaps in access based on the goal of having a station-stop accessible from anywhere on the corridor within a five-minute walk?
- Would there be additional opportunities for stop consolidation and improved operational efficiencies while meeting the five-minute-walk goal?

To evaluate equity issues, the study team examined walk-sheds, as described in the following section.

Walk-Shed Analysis

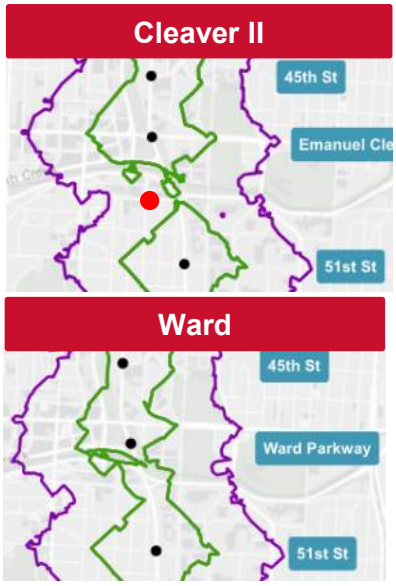
The study team developed comparisons of alternative station-stop walk-sheds along the entire proposed extension route. These walk-sheds accounted for the terrain/topography and the current pedestrian network in computing walk times. The alternatives varied in the vicinities of 31st Street / Linwood Boulevard, 43rd Street / 45th Street, and Cleaver II Boulevard / Ward Parkway.

Figure 3.1-7 illustrates the nine initially proposed station-stops as shown at the public meeting. The figure shows walk-shed boundaries representing areas within which walk times of 5 and 10 minutes to/from the station-stop can be achieved. Notable on the figure are two gaps in the 5-minute walk-time contours: one in the area of 31st Street, and a smaller one in the vicinity of 49th Street (near the Plaza Library).

Figure 3.1-7: Walk-Sheds for Station-Stops Presented at Public Meeting

The following discussion describes the walk-shed effects, and additional considerations, related to several variant station-stop configurations.

- *Cleaver II Boulevard / Ward Parkway North:* The study team has always considered this "the Plaza stop" and therefore has been assuming it could slide north or south as needed to optimize operations while serving the Plaza. In fact, as **Figure 3-2** showed, Cleaver II Boulevard and Ward Parkway North scored similarly in the initial screening – reflecting the idea that either location could serve a similar function. As the image at right shows, shifting the station-stop to Ward Parkway would close a small walk-shed gap and would provide better access south of Brush Creek. Furthermore, in the period since the public meeting, the study team has been considering conceptual layouts of different alignment options, which has included physically locating stops from a feasibility standpoint. Through these efforts, it has become clear that locating the Plaza station-stop in the vicinity of Ward Parkway North, just north of Brush Creek, has several advantages: (1) it avoids the complicated and congested Cleaver II Boulevard intersection, (2) it can potentially provide better pedestrian connections to both the Plaza and a potential transit hub just east of Main Street, and (3) it better serves the Plaza Library, by virtue of being situated approximately 600 feet away from the east walkway to that facility (in contrast to a Cleaver II Boulevard location, which would be over 1,200 feet away). *Thus, the study team recommends showing the Plaza station-stop between Cleaver II Boulevard and Ward Parkway.*



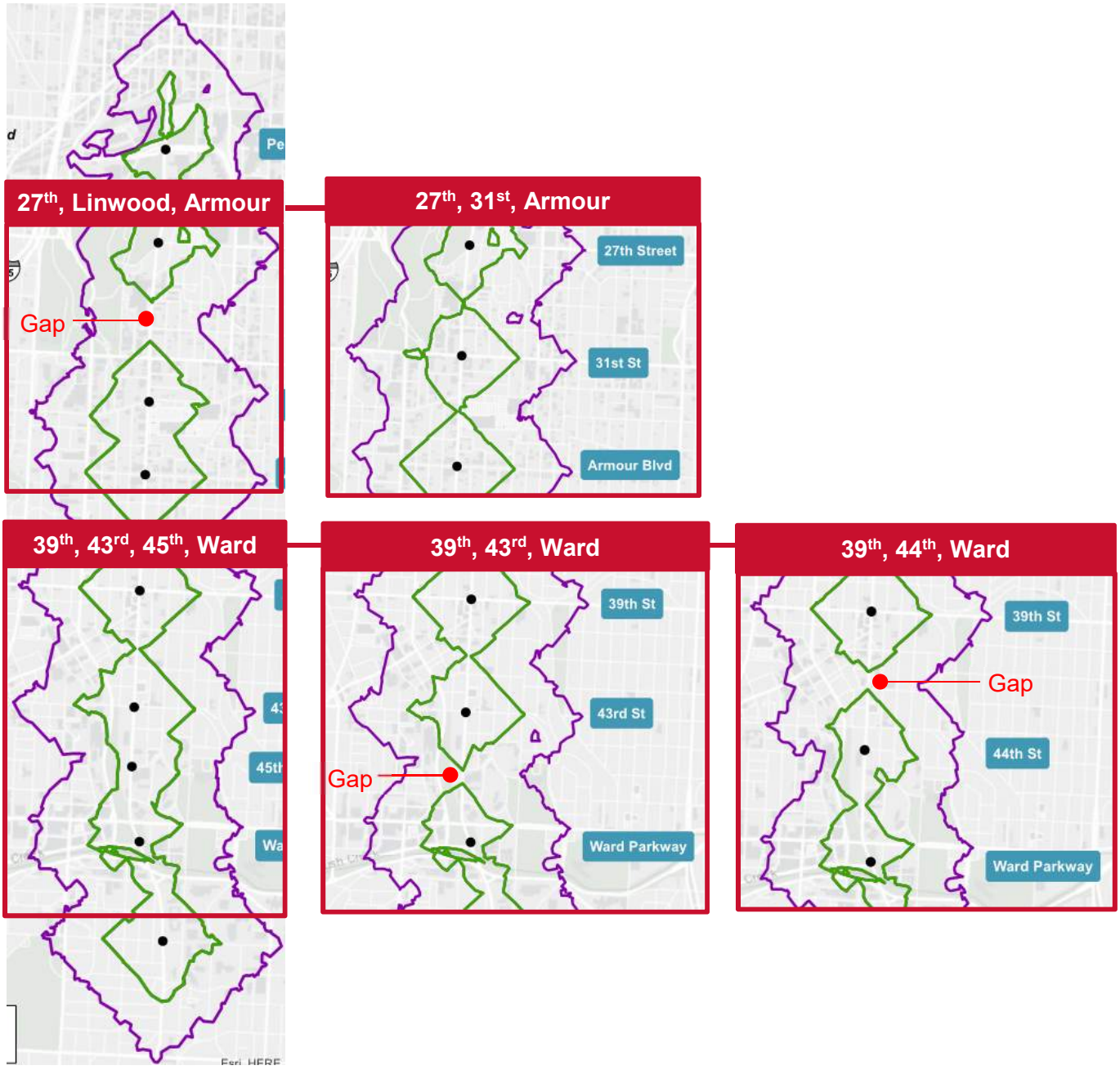
- *31st Street / Linwood Boulevard:* As mentioned previously, **Figure 3.1-7** revealed a walk-shed gap along Main Street near 30th Street. As shown in **Figure 3.1-8**, relocating the previously proposed Linwood Boulevard station-stop to 31st Street would eliminate this gap. The study team had already previously concluded that, operationally and financially, a consolidated station-stop would be superior to two station-stops. Given that a single station-stop at 31st Street provides better walk-shed coverage than a Linwood location, shifting to 31st Street would address both the efficiency and equity considerations. *Thus, the study team recommends shifting the station-stop previously shown at Linwood Boulevard to 31st Street.*

- *43rd Street / 44th Street / 45th Street:* The inclusion of the 45th Street station-stop has been questioned from an operational efficiency standpoint, given that it is within two blocks of 43rd Street, rather than the four blocks more typically being used along this corridor. As previously mentioned, consolidation of these two station-stops was initially considered by the study team and Working Group, but was discarded based on ridership markets served. A further examination of walk-sheds, illustrated in **Figure 3.1-8**, lends support to retaining both locations:
  - As the figure illustrates, eliminating the 45th Street station-stop, and consolidating at 43rd Street, would result in a walk-shed gap right in the vicinity of 45th Street. The grade on Main Street south of 45th Street contributes to this gap, because walking speeds are slower on the steep hill.
  - One alternative would be to consolidate the station-stops at 44th Street, which could possibly serve both the 43rd Street and 45th Street markets, and would have potential

connections to the proposed Art Ribbon. However, as the figure shows, this arrangement would create a walk-shed gap in the vicinity of 41st Street.

The only arrangement that eliminates walk-shed gaps between 43rd Street and 45th Street is to retain the two station-stops as shown at the public meeting. However, for operational reasons, these station-stops should not get any closer to each other than shown on the maps. As planning and design proceeds, the principle of keeping the 43rd Street station-stop at or north of its intersection and keeping the 45th Street station-stop at or south of its intersection should be guarded in order to facilitate efficient operations. *Thus, the study team recommends retaining station-stops at both 43rd Street and 45th Street with this important caveat.*

Figure 3.1-8: Walk-Sheds for Stop Variants



Refined Recommendation

Based on the preceding analysis, the study team refined its recommendations to support the following station-stop locations (shown in **Figure 3.1-9**):

- 27th Street
- 31st Street
- Armour Boulevard
- 39th Street
- 43rd Street
- 45th Street
- Ward Parkway North
- 51st Street

It is important to emphasize that the initial recommendations were also rational and would serve the corridor well, but the walk-shed mapping revealed that the refined set of station-stops would provide 5-minute walk times or better from anywhere along Main Street to a station-stop, while the initial recommendations left gaps.

As a check on the coverage of the initial and refined station-stop sets, the study team compared the population and employment bases within the walk-sheds of the two scenarios. **Table 3.1-9** presents that comparison. It is important to note that this data is based on census estimates and census geography, which (especially in the case of population) is not extremely fine-grained in comparison to the walk-shed areas. Because only part of a census block or block group may extend into a given walk-shed, a standard methodology was used to apportion data to the walk-shed based on the ratio of the intersected area to the overall block or blockgroup area. This method inherently assumes an even distribution of population over block groups, and employment over blocks – an obvious (but expedient) oversimplification.

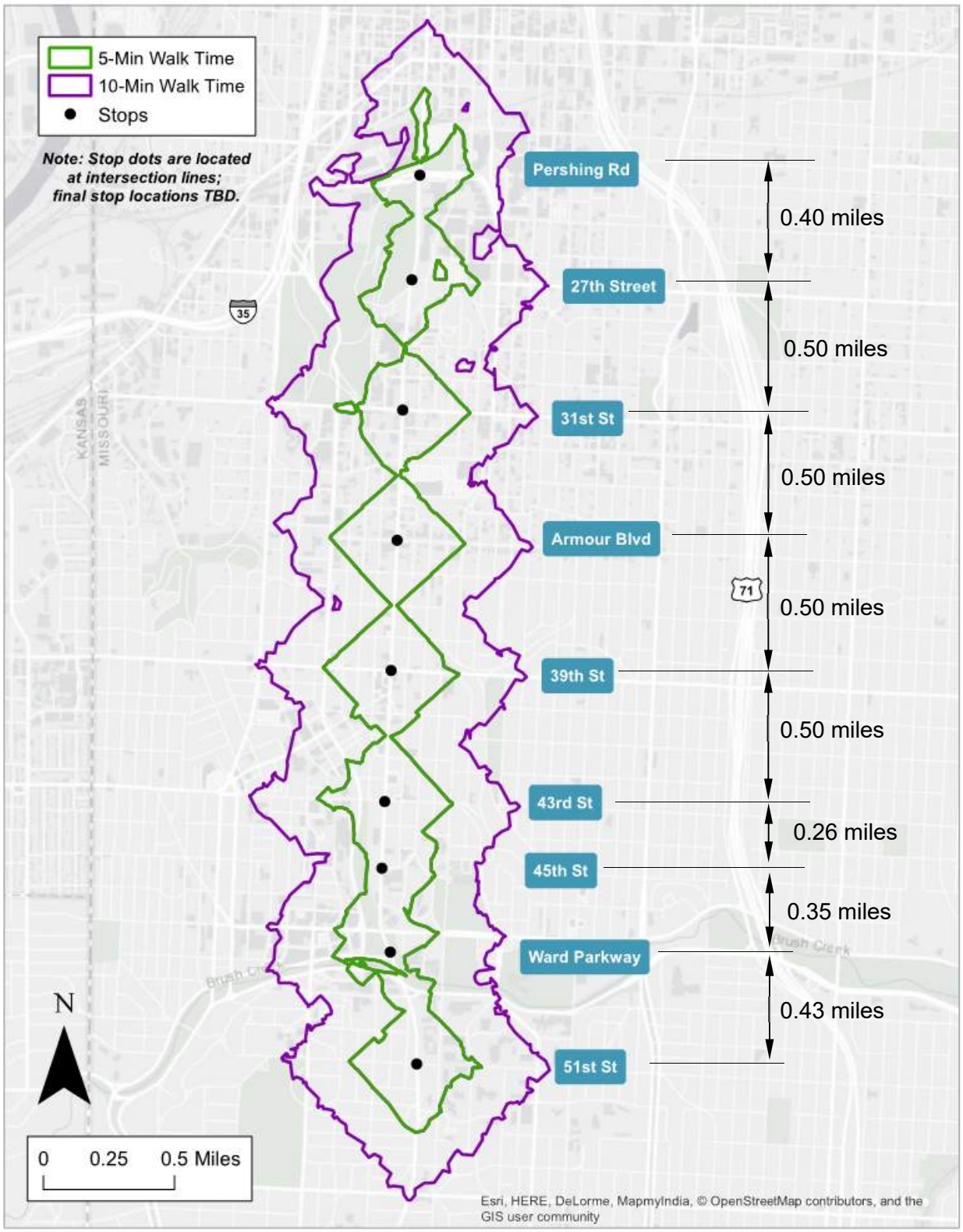
With the above caveats in mind, the overall population and employment totals within the walk-sheds of the two scenarios are very similar – within two percent in all cases but one (which is within five percent). Thus, the study team concluded that the configuration shown in **Figure 3.1-9** serves an essentially equivalent population and employment base to the initial configuration shown at the public meeting, with the additional benefit of providing a five-minute walk time to a station-stop from anywhere along Main Street.

Table 3.1-9: Walk-Shed Population / Employment Comparison: Initial vs. Refined Recommendation

	Population		Employment	
	Initial	Refined	Initial	Refined
Within 5-minute walk	5,660	5,814	12,908	13,538
Within 10-minute walk	16,947	16,919	42,552	42,199

Source:
Population - American Community Survey 5-Year Estimates (2012-2016), Block Group data
Employment - LEHD Workplace Area Characteristics (2015), Block data
See memo text regarding the granularity of the census geography vs. the size of the walk-sheds.

Figure 3.1-9: Walk-Sheds for Refined Recommendation



Key Outcomes of Refined Stop Recommendations

To summarize, the refined evaluation produced a slightly revised list of station-stops with the following key outcomes:

- Provides for equitable access to streetcar service for the entire corridor (five-minute walk or better from anywhere on the alignment)
- Fills gaps in coverage that existed in the initial recommendations
- Responds directly to public input received
- Serves a greater number of people and jobs within a five-minute walk than the initial recommendations
- Improves station-stop spacing and route-wide operational performance
- Directly supports initial evaluation criteria related to regional connectivity, bus integration, ridership, pedestrian demand, and economic development
- Defines the approximate location of station-stops that will be carried forward into the design phase.

Figure 3.1-10: Station Stop Locations Recommendation

Chapter 3.2: Best Lane Analysis

This document focuses on which lane of the street is preferable for Kansas City's Main Street streetcar extension, describing the multi-step process taken to identify the "best lane" position.

Background

For the original Downtown Streetcar line, determining lane positioning for the tracks was a largely "internal" project-team effort. Because the curb-to-curb cross-section of the route was fairly narrow (approximately 54 feet through the Crossroads District, and much narrower in other sections), the choice was often obvious:

- Circling the River Market, only one vehicle lane per direction existed, so there was only one lane in which the streetcar could operate.
- Throughout the Crossroads, the project team determined that a "road diet", converting the existing four-lane undivided roadway to a three-lane section (one lane per direction plus a turn lane) was warranted by the traffic volumes and would improve traffic flow and safety. Once this decision was made, there was only one lane in each direction in which the streetcar could operate.
- Within the CBD, the situation was more complicated due to varying corridor widths. Generally, a road-diet strategy was used south of 10th Street, resulting in only one lane choice for the streetcar. North of 10th Street to Independence Avenue, the four-lane section was retained. Based on available widths for station-stops, the fact that the remainder of the station-stops were on the outside, and other factors, the study team decided to position the streetcar in the outside lane through this five-block section.

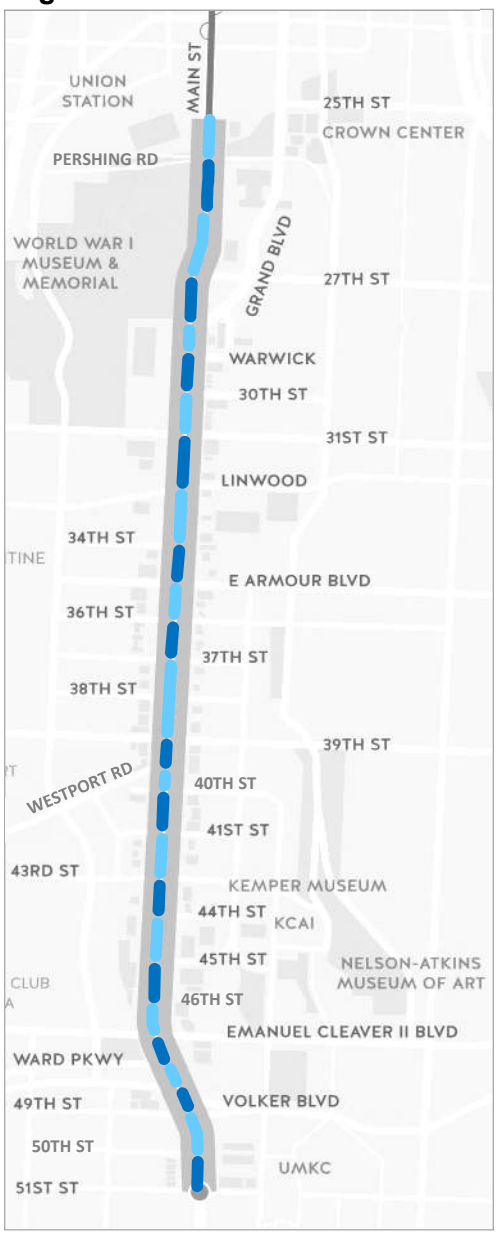
More options exist for the proposed Main Street extension, largely because the majority of the proposed extension corridor is wider curb-to-curb than the Downtown corridor. Main Street is a four- to six-lane roadway, with turn lanes in many portions, and will generally need to retain at least two travel lanes in each direction. Thus, there is a very real question of which lane the streetcar should use – the "best lane".

The process to select the "best lane" differed somewhat from the station-stop decision-process. It more broadly encompassed evaluations of the overall cross-section of each segment of Main Street, considering how the ultimate design of the street could facilitate not just the streetcar, but also the other modes of transportation along this key Midtown artery.

As with the station-stop analysis, the lane-position analysis involved the study team, a Working Group composed of key stakeholders, and the public.

To facilitate the “best lane” analysis, the corridor was divided into 26 segments as shown in **Figure 3.2-1**.

Figure 3.2-1: Corridor



Step 1: Initial Segment Needs Identification

The starting point for the lane-position analysis was an examination of the cross-sectional "needs" of each segment. Since the street will need to be restriped (and to some extent, repurposed) to accommodate the streetcar, the elements competing for street width – parking, vehicles, turn lanes, non-motorized modes – need to be considered. Because needs vary along the corridor, the study team felt that an initial segment-by-segment analysis would be a good starting point. It was acknowledged up front that these needs would, in many cases, represent trade-offs; and those trade-offs were what the team was eager to identify and discuss, both internally and publicly.

The following criteria were evaluated in determining segment needs:

Parking/Loading | Through Lanes | Driveway Access | Intersection Left Turns
Utilities | Bike Integration | Pedestrian Space | Curb Stop Needed

For each intersection, needs relating to each of the criteria were evaluated on a 1-5 scale, with a rating of "5" indicating a high need for the given element (e.g., parking/loading) and a rating of "1" indicating a low need. The evaluation criteria, and the segment-by-segment needs evaluation for each, are described below.

Parking/Loading

Along much of the streetcar extension route, on-street parking is currently allowed in the outside lane during most of the day. During peak times, in the peak direction (northbound in the AM, southbound in the PM), parking is prohibited to allow the outside lane to be used by Main MAX (and turning vehicles). In contrast to buses, streetcars cannot operate in a lane that allows parking, even time-of-day restricted parking. If parking is to be maintained once the streetcar extension is constructed, it will need to be separate from the streetcar travel-way.

For the initial analysis, parking/loading needs were evaluated based on existing on-street parking/loading patterns. This included a parking inventory that covered the entire corridor over several parts of a typical weekday. The study team acknowledged that existing parking usage is not likely reflective of future parking usage, for several reasons:

- The streetcar is expected to spur redevelopment, potentially increasing parking demand in some areas.
- There is a large number of off-street parking spaces in surface lots immediately adjacent to the corridor. Surface parking is not considered the "highest and best" use for many such locations, meaning these lots could someday be replaced by buildings, potentially relying more heavily on on-street parking.

The geographic specifics of these considerations are not easily predictable. Therefore, as a starting point, current areas of high parking occupancy were used as indicators of higher need. **Table 3.2-1** summarizes the parking needs evaluation, which was conducted separately for each side of the street.

Table 3.2-1: Initial Segment Need Evaluation Criterion: Parking

	Location		Need Score		Composite Parking Occupancy	
			W. Side	E. Side	W. Side	E. Side
1	"24th"	Pershing	1	4	NA	*
2	Pershing	"25th"	1	1	NA	NA
3	"25th"	27th	1	5	NA	35-40%
4	27th	Grand	1	1	0-5%	0-5%
5	Grand	Warwick	1	1	0-5%	0-5%
6	Warwick	30th	1	1	0-5%	0-5%
7	30th	31st	1	3	0-5%	10-15%
8	31st	Linwood	1	1	0-5%	0-5%
9	Linwood	E 34th	1	1	0-5%	0-5%
10	E 34th	Armour	1	4	0-5%	25-30%
11	Armour	36th	1	1	0-5%	0-5%
12	36th	37th	2	1	5-10%	0-5%
13	37th	39th	3	3	10-15%	10-15%
14	39th	Westport	3	3	10-15%	10-15%
15	Westport	40th	1	1	0-5%	0-5%
16	40th	41st	1	5	0-5%	30-35%
17	41st	43rd	1	1	0-5%	0-5%
18	43rd	44th	1	1	0-5%	0-5%
19	44th	45th	1	4	0-5%	25-30%
20	45th	46th	4	2	20-25%	5-10%
21	46th	Cleaver II	1	1	NA	NA
22	Cleaver II	Ward	1	1	NA	NA
23	Ward	Volker	1	1	NA	NA
24	Volker	49th	1	1	NA	NA
25	49th	"50th"	1	1	NA	NA
26	"50th"	51st	1	1	NA	NA

** Segment not counted but known to be high occupancy.*

Through Lanes

As mentioned above, the original Downtown Streetcar project resulted in a "road diet" on portions of Main Street, reducing the number of automobile through lanes on a large portion of the corridor. This was done to improve corridor safety and better accommodate the streetcar by providing dedicated left-turn lanes for autos (reducing traffic friction) – but it was also supported by traffic volume data indicating that the lane reduction was appropriate.

A similar investigation was made for the Main Street Extension. To allow the paved street width to be put to its best use, the study team evaluated traffic flows along the corridor and computed the minimum number of through lanes that would allow traffic to flow at acceptable levels. The evaluation centered on intersection capacity, using level-of-service (LOS) analysis to determine intersection performance, with LOS D or better considered acceptable.

The majority of the corridor is currently striped with three through lanes in each direction. However, as mentioned previously, the outside lane is used for on-street parking during off-peak times and is a dedicated bus lane during the peak hours. Therefore, through traffic is essentially limited to two lanes per direction (for most of the corridor) in its current configuration.

Table 3.2-2:
Initial Segment Need Evaluation Criterion: Auto Through Lanes (per Direction)

	Location		Need Score (per direction)		Lanes needed per direction
			Need >1 thru lanes	Need >2 thru lanes	
1	"24th"	Pershing	5	1	2
2	Pershing	"25th"	1	1	1
3	"25th"	27th	1	1	1
4	27th	Grand	1	1	1
5	Grand	Warwick	1	1	1
6	Warwick	30th	1	1	1
7	30th	31st	5	1	2
8	31st	Linwood	5	1	2
9	Linwood	E 34th	5	1	2
10	E 34th	Armour	5	1	2
11	Armour	36th	5	1	2
12	36th	37th	5	1	2
13	37th	39th	5	1	2
14	39th	Westport	5	1	2
15	Westport	40th	5	1	2
16	40th	41st	5	1	2
17	41st	43rd	5	1	2
18	43rd	44th	5	1	2
19	44th	45th	5	1	2
20	45th	46th	5	1	2
21	46th	Cleaver II	5	5	3
22	Cleaver II	Ward	5	1	2
23	Ward	Volker	5	1	2
24	Volker	49th	5	1	2
25	49th	"50th"	5	1	2
26	"50th"	51st	5	1	2

Table 3.2-2 summarizes the evaluation. To facilitate computations in later steps, the needs were divided into binary categories ("Does the segment need more than one through lane?" and "Does the segment need more than two through lanes?"). As the table indicates, several segments in the northern portion of the corridor could operate acceptably with one lane per direction, while the majority of the corridor would need two lanes per direction. The segment near Cleaver II Parkway was found to need three lanes per direction, as the intersection of Main Street and Cleaver II Parkway is a major intersection with congestion issues during peak hours.

Driveway Access

Driveway access is prevalent along much of the corridor, and is viewed as important by many of the business owners and operators. Certain portions of the corridor include a center two-way left-turn lane, while others do not. The potential need for a center turn lane is an important part of cross-section evaluation. As an indicator of existing areas where access needs are high, the study team assessed the current number of driveways per mile, or "driveway density."

The study team acknowledged that this snapshot of existing access conditions may not reflect the long term. With a streetcar in place, properties may redevelop, and access points may be moved, consolidated, or closed. Furthermore, the fact that numerous driveways exist does not necessarily mean that they are all needed. However, as a starting point for examining desirable cross-sections, driveway density was felt to be a reasonable proxy for access needs.

Table 3.2-3 summarizes the results of the analysis. Ironically, the central portion of the corridor (34th Street to 44th Street) has the highest driveway density but also is the portion without a center turn lane.

Table 3.2-3: Initial Segment Need Evaluation Criterion: Mid-block Driveway Access

	Location		Score	Driveway Density (per mi)
1	"24th"	Pershing	1	0
2	Pershing	"25th"	1	6.6
3	"25th"	27th	1	4.1
4	27th	Grand	1	0
5	Grand	Warwick	2	37.1
6	Warwick	30th	2	22.6
7	30th	31st	2	39.8
8	31st	Linwood	2	32.5
9	Linwood	E 34th	4	62.1
10	E 34th	Armour	3	50.1
11	Armour	36th	3	56.3
12	36th	37th	4	64.2
13	37th	39th	4	76.5
14	39th	Westport	2	35.0
15	Westport	40th	2	37.2
16	40th	41st	3	48.3
17	41st	43rd	5	89.5
18	43rd	44th	4	77.3
19	44th	45th	2	36.6
20	45th	46th	2	34.8
21	46th	Cleaver II	2	20.5
22	Cleaver II	Ward	1	0
23	Ward	Volker	1	0
24	Volker	49th	1	0
25	49th	"50th"	1	0
26	"50th"	51st	1	8.0

Intersection Left Turns

Currently, at the northern and southern extremities of the corridor (north of 34th Street and south of 43rd Street), left-turn lanes are provided on Main Street at signalized intersections. However, through the middle section of the corridor, where the street is narrower, there are no exclusive turn lanes and left turns are generally restricted during certain times of the day. In addition to street width considerations, the need for left-turn lanes imposes an operational constraint: if the streetcar tracks were to occupy the inside lanes, intersection left turns could no longer be allowed from a non-exclusive lane at any time of day.

In determining this semi-qualitative need score, the study team assessed the existing left-turn lane provisions, peak-hour left-turn traffic counts, and other demand factors. At locations where left turns are currently prohibited, violations also helped indicate demand. **Table 3.2-4** summarizes the results of the analysis; intersection left-turn lane needs were found to be fairly high for much of the corridor.

Table 3.2-4: Initial Segment Need Evaluation Criterion: Intersection Left-Turn Lanes

	From	To	Score	Existing Conditions	Peak-Hour Left-Turn Volume: AM(PM)
1	"24th"	Pershing	5	Signal & turn lane @ Pershing	
2	Pershing	"25th"	4	Signal & turn lane @ Pershing	Pershing NB: 65 (108)
3	"25th"	27th	4	Signal & turn lane @ 27th	27th SB: 75 (17)
4	27th	Grand	3	Unsignalized left-turn lane @ Memorial	*Not available*
5	Grand	Warwick	3	SB signalized LT lane @ Warwick	Warwick SB: 13 (11)
6	Warwick	30th	4	Ex signalized LT lane @ Warwick, unsignalized LT lane @ 30th	Warwick NB: 169 (0)
7	30th	31st	4	Existing signalized LT lanes at both ends	31st SB: 30 (262)
8	31st	Linwood	5	Existing High-demand SB LT @ Linwood	31st NB: 168 (161)
9	Linwood	E 34th	5	Existing High-demand NB LT @ Linwood	Linwood NB: 180 (158)
10	E 34th	Armour	4	Armour provides important connection to US-71	Armour SB: 1 (11)
11	Armour	36th	2	Neighborhood connection	Armour NB: 3 (0)
12	36th	37th	2	Neighborhood connection	36th NB: 18 (15)
13	37th	39th	4	39th an important E-W connection including US-71	37th NB: 10 (25)
14	39th	Westport	4	39th an important E-W connection	39th NB: 1 (1)
15	Westport	40th	3	Violations indicate demand	Westport NB: 17 (8)
16	40th	41st	2	Neighborhood/school connections	40th NB: 5 (8)
17	41st	43rd	3	43rd an important cross-street (hospital)	"41st" NB: 50 (9)
18	43rd	44th	4	43rd an important cross-street (hospital); High SB LT at QuikTrip	43rd NB: 11 (8) 44th SB: 38 (71)
19	44th	45th	4	Existing signalized lefts at 45th	44th NB: 20 (10)
20	45th	46th	3	45th = American Century entrance	45th NB: 19 (11)
21	46th	Cleaver II	5	High-demand signalized SB LT lane @ Cleaver	Cleaver SB: 87 (127)
22	Cleaver II	Ward	5	High-demand signalized NB LT lane @ Cleaver	Cleaver NB: 171 (155)
23	Ward	Volker	5	High-demand signalized LT lanes @ both ends	Ward NB: 497 (508)
24	Volker	49th	1	No intersection left-turns needed; need some shadowing of NB LT lane @ 49th	NA
25	49th	"50th"	4	Existing NB LT lane @ 49th	49th NB: 58 (39)
26	"50th"	51st	4	Recent addition of left-turn lanes at 51st	51st SB: 30 (75)

Utilities

Construction in general, and specifically placement of the track slab for the streetcar, may have an impact upon shallow or large utilities, and therefore the location of utilities is potentially an important consideration in the best lane analysis. Although utility information has begun to be gathered, at the initial stage of the evaluation there was not sufficient information to conclusively identify areas of potential concern, especially down to the granularity of potential conflicts in specific lanes. Thus, initially, all segments were ranked as “unknown” for utilities.

Bike Integration

Two policy documents were considered in the evaluation of bike needs:

- The City’s adopted Complete Streets Policy indicates that all transportation projects should strive to meet Complete Streets goals. With regard to bicycles, this often means including bike lanes or other dedicated facilities – but in some cases, it means designing to facilitate bicyclists to the extent possible.

- Bike KC, the City’s Bike Plan, is expected to be completed in the summer of 2018. A preliminary bike facility map from the plan development (see excerpt at right) shows a robust bicycle network surrounding the Main Street corridor, but does not show facilities on Main Street itself. This is intentional, as the framers of the plan recognize the expectation of a streetcar on Main Street and its potential conflicts with bicycle traffic.

Given the exclusion of explicit bicycle facilities on Main Street in Bike KC, the study team decided to rate bike needs along the segments as “low/unknown” at this stage. It was felt that, as the project moved into detailed design, logical segments for bicycle facilities might emerge, and the team would strive to accommodate bicycle travel as much as feasible.

Two additional criteria were proposed by the team at the beginning of the initial screening.

Pedestrian Space

The availability of adequate holding space either along the curb or in a center median for waiting riders, as well as pass-by pedestrians, could conceivably impact which lane is best suited for the streetcar. For example – if room is unavailable for an adequately sized center platform, then an inside-running option could be unsupportable. (Similar issues could exist with a curb platform.) However, these issues are highly localized and it was difficult to identify specific potential issues early in the evaluation. Thus, this criterion was not evaluated initially, but was carried forward as an issue to keep in mind as the evaluation progressed.

Curb Stop Needed

Along certain blocks, a curb stop could potentially be required due to outside influences including local development, shared bus stops, or system considerations. If a stop must be located along the curb, then the streetcar must also operate in the curb lane in that location. As with pedestrian space, this issue is highly localized. Thus, this criterion was also not evaluated initially, but was carried forward as an issue to keep in mind as the evaluation progressed.

Initial Evaluation Summary

Figure 3.2-2 presents a graphical roll-up of the evaluation described above.

Figure 3.2-2: Initial Evaluation of Segment Needs

Step 2: Initial Segment-by-Segment Cross-Section Selection

The previous step established a basis of need for each study segment. The next steps broadly involved identifying potential street cross-sections for each segment, evaluating how well each would meet that need, and developing an initial set of recommended cross-sections for the corridor. The detailed steps are described below.

Development of Potential Cross-Sections. Curb-to-curb widths along the corridor vary from 50 feet to 90 feet. The study team graphically developed a series of potential cross-sections for street widths throughout this range, using blocks of color to represent different uses of the street (parking, automobile lane, exclusive streetcar lane, etc.). **Figure 3.2-3** illustrates this visual approach along with an example of how the elements can be configured to represent a cross-section.

Figure 3.2-3: Cross-Section Visual Representation Method

Rating of Potential Cross-Sections vs. Need Criteria. The study team scored each of the potential cross-sections against each of the need criteria described in Step 1 (Parking, Driveway Access, etc.). For example, **Figure 3.2-4** shows the ratings for a series of 60-foot cross-sections.

Figure 3.2-4: Sample Ratings (60-foot Cross-Sections)

Cross-Section	Need Criteria Rating*										
	Parking: W. Side	Parking: E. Side	Need >1car thru lanes/dir	Need >2car thru lanes/dir	Mid-block Business Access Needs	Intersection Left Turn Needs	Utility Issues - W. Curb	Utility Issues - Center	Utility Issues - E. Curb	Bike Needs	Stops must be at curb?
8 11 11 11 11 8	●	●	●	○	◕	◔	◑	●	◑	○	●
8 10 11 10 11 10	●	○	●	○	●	●	●	◑	●	◔	○
10 11 10 11 10 8	○	●	●	○	●	●	●	◑	●	◔	○
8 11 10 10 10 11	●	○	●	○	●	●	◑	●	○	○	●
11 10 10 10 11 8	○	●	●	○	●	●	○	●	◑	○	●
8 11 11 11 11 8	○	○	●	○	◑	○	●	○	●	◕	○
8 10 24 10 8	○	○	○	○	○	○	●	○	●	◕	○
8 10 24 10 8	●	●	○	○	○	○	●	○	●	◔	○
8 11 11 11 11 8	●	●	○	○	◕	◔	◑	●	◑	◔	●
11 10 10 10 11 8	○	●	○	○	●	●	○	●	◑	◔	●
6 11 10 6 10 11 6	○	○	○	○	◕	◔	○	●	○	◑	●
11 38 11	○	○	○	○	○	○	●	○	●	◔	○
11 10 18 10 11	○	○	○	○	●	●	○	●	○	◔	●

**Ratings on a 1-5 basis; darker colors represent higher needs.*

Scoring of Potential Cross-Sections vs. Segment Needs. Unlike the station-stop evaluation, in which the evaluation criteria could be summed to determine the highest score, the cross-section analysis needed to determine how well each cross-section met the needs of each criterion for a given segment. For example, a cross-section that provided on-street parking would score very highly for a street segment that had a high identified parking need, but would score lower for a segment on which parking was not identified as a priority – and this needed to be considered for each criterion. This evaluation resulted in a single combined score for each potential cross-section on every segment

Selection of Cross-Sections and Smoothing. Based on the cross-section analysis, the study team's algorithm selected the top two scoring cross-sections for each segment and assembled them into two initial "raw" corridor layouts. As anticipated, these layouts did not always represent a rational streetcar lane-position strategy: the streetcar was found to switch from outside to center several times throughout the raw layouts, resulting in an inefficient design. The team worked to manually "smooth" the corridor layout based on the highest-scoring cross-sections that made sense from a system operations standpoint. This led to the two alternatives shown in **Figure 3.2-5**, and briefly described below:

- Alternative 1 was center-running throughout, meaning the streetcar would generally travel in the inside (left) lane – with an automobile travel lane to its right, and either a left-turn lane or median to its left.

- Alternative 2 was outside-running throughout, meaning the streetcar would generally travel in the outside (right) lane – with an automobile travel lane to its left, and either an on-street parking lane or a curb to its right.

The algorithm tended to recommend dedicated streetcar lanes wherever width would allow, since such a configuration minimizes traffic conflicts with the streetcar, and therefore can improve the streetcar's overall travel time through the corridor. In fact, the results divided the corridor into three natural segments – segments that are very reasonable to those who know the corridor:

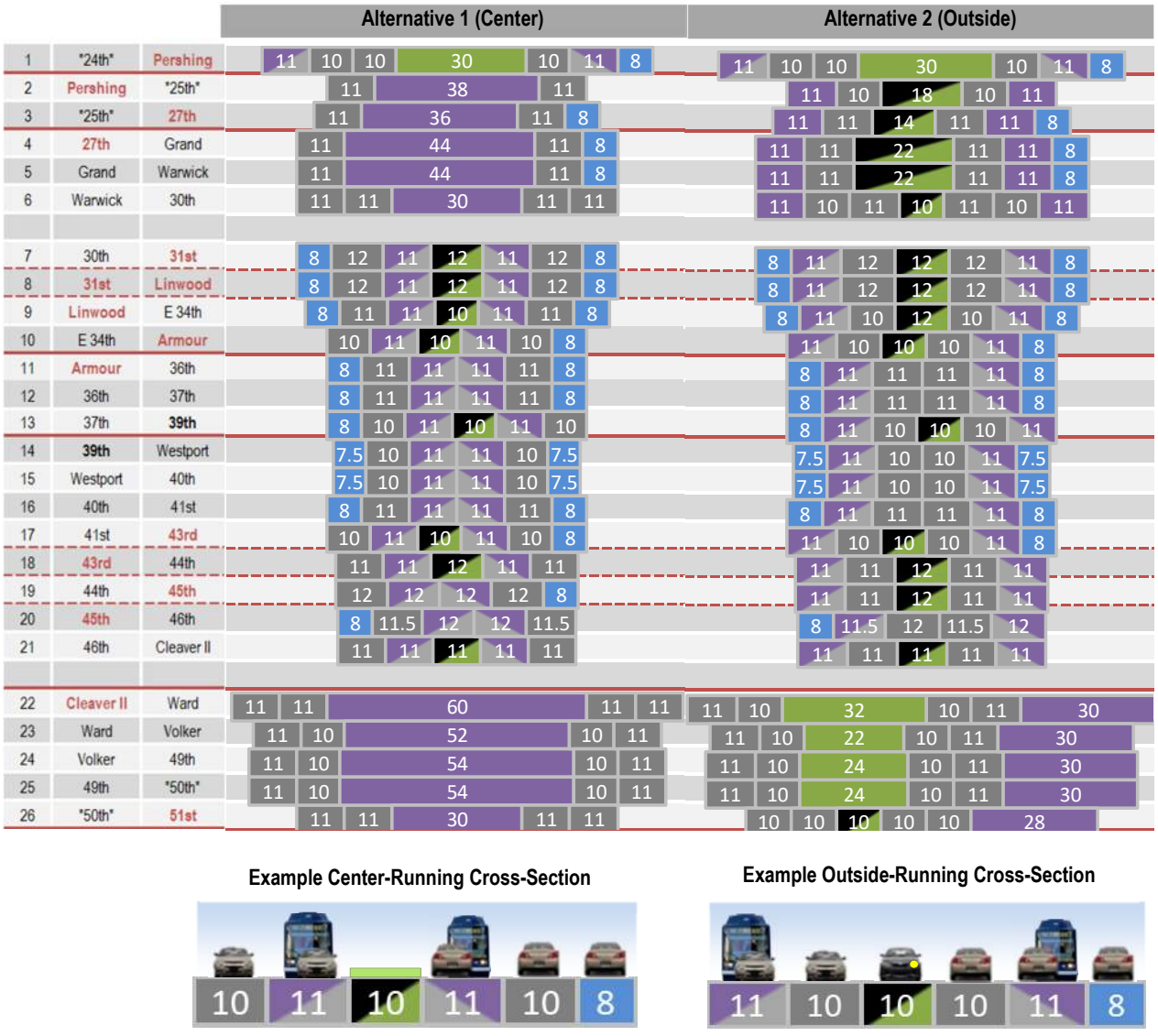
- *North End:* Between Pershing Boulevard and roughly 30th Street, the corridor is generally fairly wide with very few driveways and cross-streets. It also has some of the lowest traffic demand on the corridor. Given the available width and the other needs through these segments, a dedicated streetcar lane is potentially feasible in this portion of the corridor. Note that there is currently a long stretch of "missing" sidewalk on the east side of Main Street north of Grand Boulevard. Even at this early point in the process, it was assumed that the street would be narrowed to allow construction of such a sidewalk.

- *Middle:* The middle portion of the route, from 30th Street to Cleaver II Boulevard (roughly two miles long), is characterized by narrower cross-sections, frequent business access (driveways), and generally higher demand for on-street parking. In this section, running the

streetcar in mixed traffic is likely the most logical way to allow the needed cross-section elements to fit.

- *South End:* South of Cleaver II Boulevard, there are no driveways along the route, no on-street parking is allowed, and the street is fairly wide except for the segment south of what could be considered "50th Street." As with the north end, the available width and the limited need for other cross-section elements make the south end a candidate for a dedicated streetcar lane. In addition, this section features the Country Club right-of-way, a linear swath of land owned by the Kansas City Transportation Authority (KCATA), generally preserved with the intention of reintroducing rail transit. This right-of-way figures in to street width assumptions south of Volker Boulevard.

Figure 3.2-5: "Smoothed" Initial Generated Alternative Cross-Sections



Step 3: Public Meeting #1

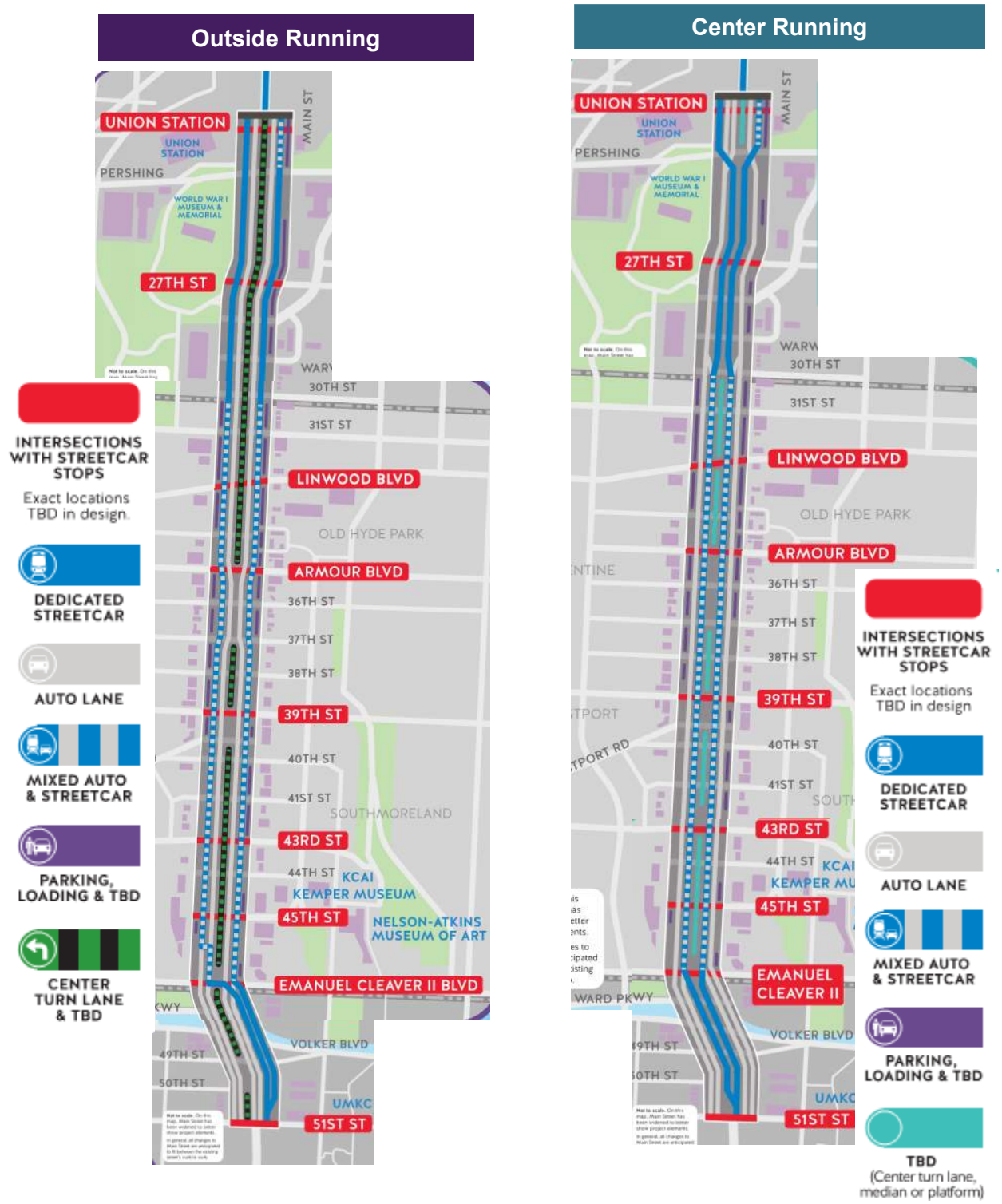
To present these lane-positioning ideas to the public, the study team developed a set of hybrid maps – conceptual diagrams somewhere between the colored block maps of Step 2 and a full-blown set of scaled concept drawings. The purpose of these maps was to begin to convey the types of trade-offs that might be involved with different streetcar lane positioning options and the associated effects on other cross-section elements, given existing street-width constraints.

Figure 3.2-6 illustrates the maps of the two alternatives. The maps use continuous line segments to indicate traffic lanes (some shared with streetcar tracks), parking/loading (or other curb space use), potential center turn lanes and medians, and dedicated streetcar lanes. Stop locations (as proposed at the time these maps were created) are also illustrated.

These maps were presented to the public on April 3, 2018. The maps were divided into the three sub-sections described in Step 2 (north, middle, south) – with the idea that these sub-sections each had a measure of operational independence and could possibly be interchanged in a final concept. Both the northern and southern portions included dedicated streetcar lanes regardless of lane position; the middle portion assumed mixed-traffic operations for either lane-position option.

The three maps were accompanied by the three evaluation matrices shown in **Tables 3.2-5a through 3.2-5c**, which examined the criteria described in Step 1 and provided a brief narrative comparison of the two alternatives. Where one alternative appeared to be clearly superior to the other with respect to a particular criterion, this distinction is highlighted in the tables.

Figure 3.2-6: Public Meeting #1 Evaluation Maps (Collage)



KC Streetcar Main Street Extension

Table 3.2-5a: Public Meeting #1 Evaluation Matrix – North Section (Pershing Rd to 30th St)

CRITERIA RANKING: FAIR GOOD BETTER

CRITERIA	CENTER RUNNING in a Dedicated Lane	OUTSIDE RUNNING in a Dedicated Lane
ON-STREET PARKING/LOADING Is there a need for on-street parking and/or loading on one or both sides of the street?	On-street parking is currently limited in this section and the need is therefore lower. However, opportunities are available.	On-street parking is currently limited in this section and the need is therefore lower. However, opportunities are available. **Policy decisions could restrict parking adjacent to the dedicated lane.**
THROUGH LANES How many auto through lanes are needed?	Both alternatives can provide one through lane for auto traffic in each direction. **A road diet, or elimination of through lanes, is being recommended for this section under both alternatives.**	Both alternatives can provide one through lane for auto traffic in each direction. **A road diet, or elimination of through lanes, is being recommended for this section under both alternatives.**
DRIVEWAY ACCESS & INTERSECTION LEFT TURNS Is there a need to access businesses or driveways?	**Less** conducive to left-turn movements onto & off Main Street. Overall, the effect of these alternatives on access and turns in this section is not large, due to the limited number of driveways & intersections.	**More** conducive to left-turn movements onto & off Main Street. Overall, the effect of these alternatives on access and turns in this section is not large, due to the limited number of driveways & intersections.
PEDESTRIAN NEEDS Does the alternative meet pedestrian needs?	**Center stop platforms may not provide adequate space for waiting passengers during busy events; may not be able to share bus stops.** Both options add a sidewalk on the east (where none currently).	Stops are accessed from the sidewalk & typically accommodated via a curb "bump-out." Both options add a sidewalk on the east side between Pershing & Grand (where it does not currently exist).
UTILITIES Would existing utilities create conflicts with streetcar tracks in a given lane?	Based on preliminary inventory, neither alternative would have greater conflict with utilities. A detailed utility assessment will occur during Design.	Based on preliminary inventory, neither alternative would have greater conflict with utilities. A detailed utility assessment will occur during Design.
SYSTEM CONSIDERATIONS		
OPERATIONAL EFFICIENCY How is travel time impacted?	On-street parking/loading & left turns are not a significant factor on this section due to limited parking & fewer driveways. **Center running may offer less delay from illegal on-street parking.**	On-street parking/loading & left turns are not a significant factor on this section due to limited parking & fewer driveways.
COST Does either alternative pose significant cost considerations for this section of the corridor?	Alternatives relatively equal in this respect. Variances will be due to final design & policy decisions.	Alternatives relatively equal in this respect. Variances will be due to final design & policy decisions.
CONSTRUCTABILITY Are there any significant characteristics that would impact construction?	None identified during this Project Development Phase.	None identified during this Project Development Phase.

Table 3.2-5b: Public Meeting #1 Evaluation Matrix – Middle Section (30th St to Cleaver II Blvd)

CRITERIA RANKING: FAIR GOOD BETTER

CRITERIA	CENTER RUNNING in Mixed Traffic	OUTSIDE RUNNING in Mixed Traffic
ON-STREET PARKING/LOADING Is there a need for on-street parking and/or loading on one or both sides of the street?	On-street parking is currently available along many blocks of this section; some is time restricted for bus use. **Center running may provide more where stop platforms are in the center of the street (vs. curb).**	On-street parking is currently available along many blocks of this section; some is time-restricted for bus use. **Outside running may provide more in areas where a center lane is not necessary.**
THROUGH LANES How many auto through lanes are needed?	Both alternatives can provide two through lanes for auto traffic in each direction.	Both alternatives can provide two through lanes for auto traffic in each direction.
DRIVEWAY ACCESS & INTERSECTION LEFT TURNS Is there a need to access businesses or driveways?	**Less** conducive to left turns onto & off Main Street. Center stop platforms are slightly wider & must connect to crosswalks - this can reduce space for turn lanes at intersections.	**More** conducive to left turns onto & off Main Street. May preserve more access to existing driveways. Provides more opportunity for left turns at intersections.
PEDESTRIAN NEEDS Does the alternative meet pedestrian needs?	Center stop platforms at high-demand stops may not be able to provide adequate waiting space for passengers during peak times.	Curbside stop platforms allow pedestrians to wait on sidewalks during peak times.
UTILITIES Would existing utilities create conflicts with streetcar tracks in a given lane?	Based on preliminary inventory, neither alternative would have greater conflict with utilities. A detailed utility assessment will occur during Design.	Based on preliminary inventory, neither alternative would have greater conflict with utilities. A detailed utility assessment will occur during Design.
SYSTEM CONSIDERATIONS		
OPERATIONAL EFFICIENCY How is travel time impacted?	**Left-turn restrictions would be necessary in areas to maximize streetcar reliability**; preventing streetcar delays from left-turning cars. Center platforms cannot share bus stops or support a bus bridge.	**Streetcar could be delayed by illegally parked/ loading cars**; restrictions & buffer likely necessary in areas to minimize delays. More potential for reduced streetcar speeds due to cars turning right.
COST Does either alternative pose significant cost considerations for this section of the corridor?	Alternatives relatively equal; however center running may result in fewer stop platforms (**center platforms can be shared for travel in either direction**) potentially reducing costs.	Alternatives relatively equal in this respect.
CONSTRUCTABILITY Are there any significant characteristics that would impact construction?	None identified during this Project Development Phase.	None identified during this Project Development Phase.

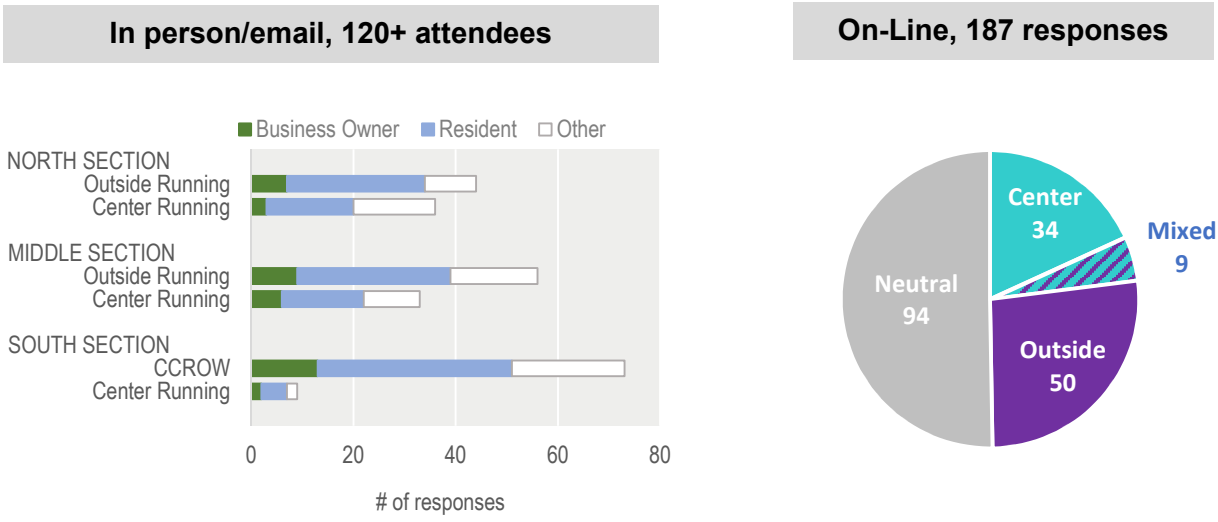
Table 3.2-5c: Public Meeting #1 Evaluation Matrix – South Section (Cleaver II Blvd to 51st Street)

CRITERIA RANKING: FAIR GOOD BETTER

CRITERIA	CENTER RUNNING in a Dedicated Lane	COUNTRY CLUB R.O.W. in a Dedicated Lane
ON-STREET PARKING/LOADING Is there a need for on-street parking and/or loading on one or both sides of the street?	N/A - No on-street parking/loading is currently available on this section of the extension.	N/A - No on-street parking/loading is currently available on this section of the extension.
THROUGH LANES How many auto through lanes are needed?	**Requires reconstruction within the Country Club Right-of-Way** (widening Brookside Boulevard) to maintain needed lanes. Both alternatives can provide two through lanes for auto traffic.	**No widening of Brookside Boulevard required.** Both alternatives can provide two through lanes for auto traffic.
DRIVEWAY ACCESS & INTERSECTION LEFT TURNS Is there a need to access businesses or driveways?	No driveways on this segment. Both alternatives can accommodate left turns at the intersections.	No driveways on this segment. Both alternatives can accommodate left turns at the intersections.
PEDESTRIAN NEEDS Does the alternative meet pedestrian needs?	**Center stop platforms may not provide adequate space for waiting passengers during busy events; may not be able to share bus stops.** The Trolley Track Trail would remain under both alternatives.	Streetcar stops are accessed via sidewalk/Trolley Track Trail. **Sidewalk platforms provide passenger convenience to nearby retail.** The Trolley Track Trail would remain under both alternatives.
UTILITIES Would existing utilities create conflicts with streetcar tracks in a given lane?	Based on preliminary inventory, neither alternative would have greater conflict with utilities. A detailed utility assessment will occur during Design.	Based on preliminary inventory, neither alternative would have greater conflict with utilities. A detailed utility assessment will occur during Design.
SYSTEM CONSIDERATIONS		
OPERATIONAL EFFICIENCY How is travel time impacted?	Since limited, on-street parking/loading & left turns are not a significant factor. Both alternatives will have to be carefully designed through the congested intersections along this segment.	**Building in the Country Club Right-of-Way provides additional opportunities for maintenance and temporary streetcar storage.**
COST Does either alternative pose significant cost considerations for this section of the corridor?	Additional costs would be required to widen Brookside Boulevard.	Potential cost savings by utilizing the existing Country Club Right-of-Way.
CONSTRUCTABILITY Are there any significant characteristics that would impact construction?	None identified during this Project Development Phase.	None identified during this Project Development Phase. Less reconstruction required (widening Brookside Boulevard)

Meeting Feedback: The majority of participating attendees expressed a preference for an outside-running streetcar option for all three sections of the extension (for the south section, outside-running would be in the Country Club Right-of-Way, CCROW). **Figure 3.2-7** summarizes the responses. As the figure shows, there was a clear preference among attendees to run in the CCROW on the southern section. In the middle section, outside running edged out center running. In the northern section, outside running appeared to be slightly preferred to center running, but the margin was thin. On-line, respondents tended to prefer the same lane position in all three sections, when they had a preference. Outside running was slightly more popular than center running in the on-line responses.

Figure 3.2-7: Public Meeting #1 - Lane Preference Expressions



Step 4: Concept Drawings

With the general feedback from the first public meeting in hand, the study team developed two scaled concept drawings (line on aerial) showing streetcar track centerlines, station-stop platforms, and potential associated re-striping of the corridor. The concepts retained the "Outside Running" and "Center Running" designations, although these distinctions did not hold at the south end (as discussed later). The team held several lengthy working meetings to develop these concepts, and worked through the specific issues on the corridor to develop conceptual alignments and station-stop locations that were reasonable – but by no means the final alignments. The concepts were developed to provide a basic comparison of tradeoffs and to ultimately form a basis for a concept-level cost estimate.

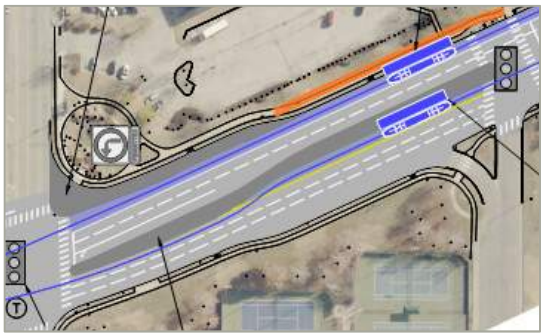
General Design Principles. The concepts were generally laid out using the design principles of the Kansas City Downtown Streetcar Design Criteria Manual (Starter Line). The alignments

assumed a design speed of 35 mph. Compared to the Downtown line, the design incorporated additional buffer between the streetcar and parked cars, as well as the curb, where appropriate. Far-side station-stops were assumed whenever possible.

A few additional specifics of the concepts follow:

- *Mixed vs. Exclusive:* Both concepts positioned the streetcar in dedicated lanes south of Emanuel Cleaver II Boulevard. The center-running option transitioned the southbound tracks into a dedicated lane just south of 45th Street.

Center-running



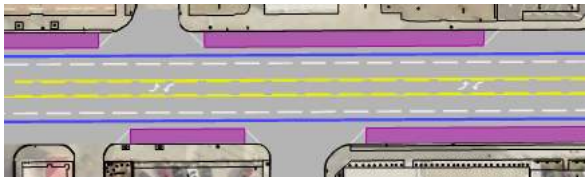
Outside-running
(southbound has transitioned to center)

Everywhere else except the locations described above, both concepts positioned the streetcar in mixed traffic. On the north end, this was a change from what was shown at the first public meeting. The study team had determined that a dedicated streetcar lane might not afford a high advantage on this segment, given that traffic volumes and conflicts are fairly low.

- *Medians and Turn Lanes:* The center-running concept included a raised median for most of the corridor's length, to minimize turning conflicts with the streetcar on this higher-speed (35-mph) portion of the streetcar line. Dedicated left-turn lanes were provided at and between intersections where possible to prevent turning vehicles from blocking the streetcar.

Center-running

In contrast, the outside-running concept featured almost no medians. Business access and intersection turns would be much like they are today – a center two-way left-turn lane in some locations, and a double-yellow line in some locations. At



Outside-running

some signalized intersections, left-turns would continue to be allowed from a shared through/left lane (although with time-of-day restrictions), because stopped left-turning vehicles would not block an outside-running streetcar.

- *Station-stop Effects on Turn Lanes:* With the center-running option, station-stop platforms would prevent left turns at several locations. Under the outside-running option, these left-turn movements would still be allowed, although often from shared through/left lanes.

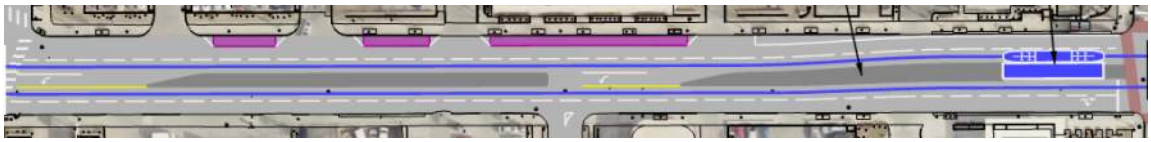
Center-running (43rd St)

Outside-running (43rd St)

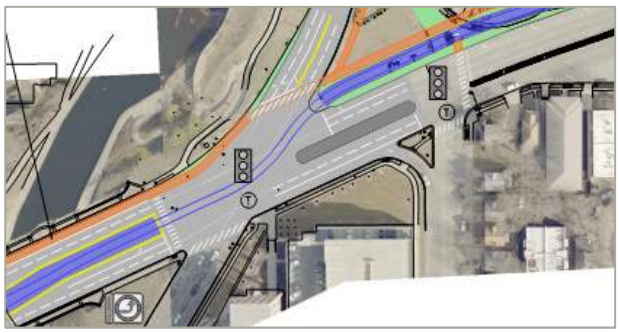
- *Parking:* Potential on-street parking areas were shown along the corridor in each concept, but they were clearly identified as "potential" with the knowledge that parking provisions would be refined as the selected concept moved forward in the planning and design process.

Outside-running

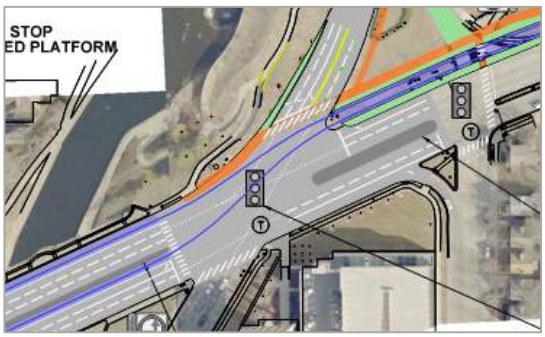
Center-running



- *Country Club Right-of-Way (CCROW):* Both concepts transitioned the streetcar to the CCROW south of Volker Boulevard. The public had strongly supported this option in the first public meeting, and the study team also noted the costs and difficulties associated with the streetcar remaining in the street in this area.



Center-running



Outside-running

- *New Sidewalk and Active Transportation Connections:* Both concepts showed construction of a sidewalk on the east side of Main Street between Pershing Boulevard and 27th Street. On the west side of the same segment, both concepts showed a potential area for bicycle and/or pedestrian improvements.

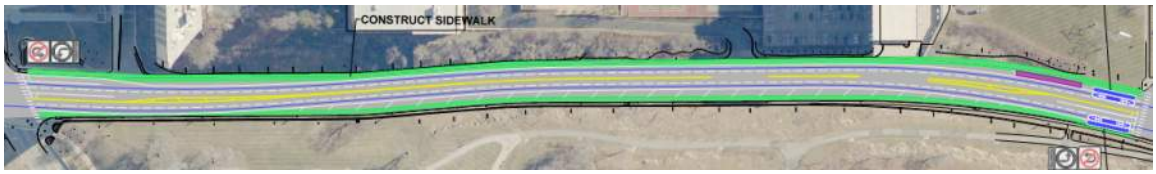


Figure 3.2-8 shows an overview of the concept drawings; **Figure 3.2-9** includes zoomed-in maps of each station-stop area.

Figure 3.2-8: Overview of Corridor Concepts

Outside Running

Center Running

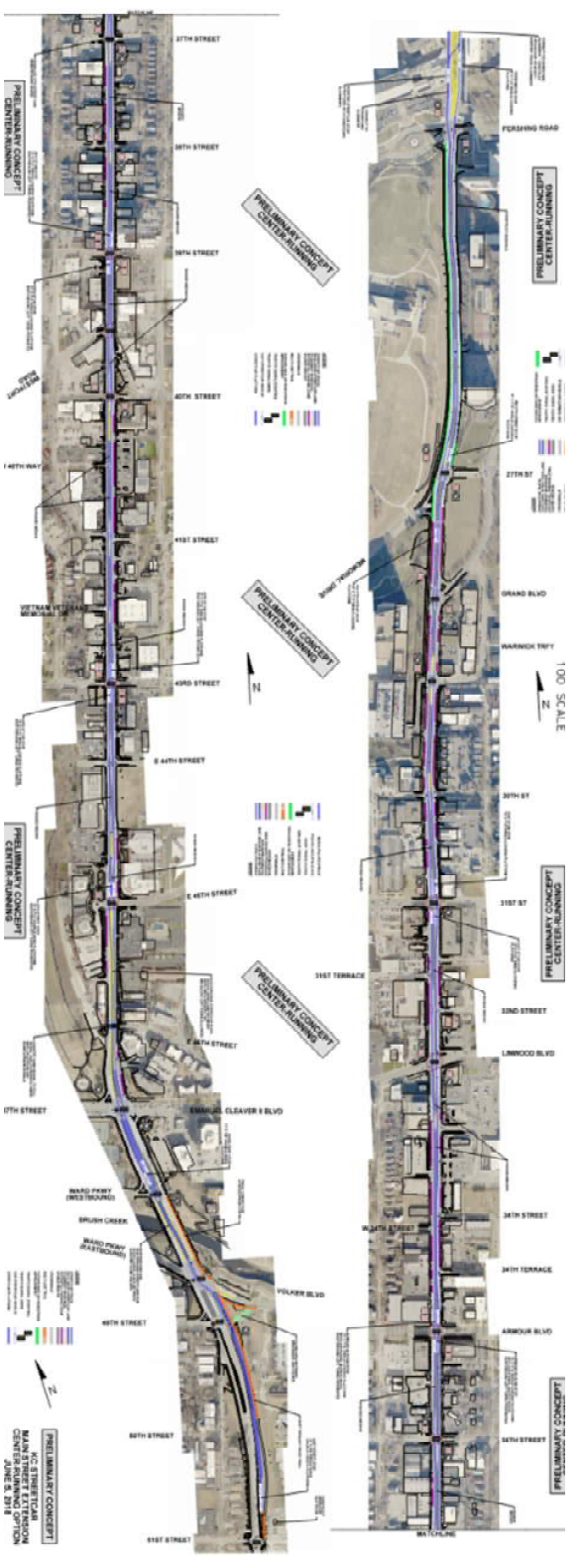
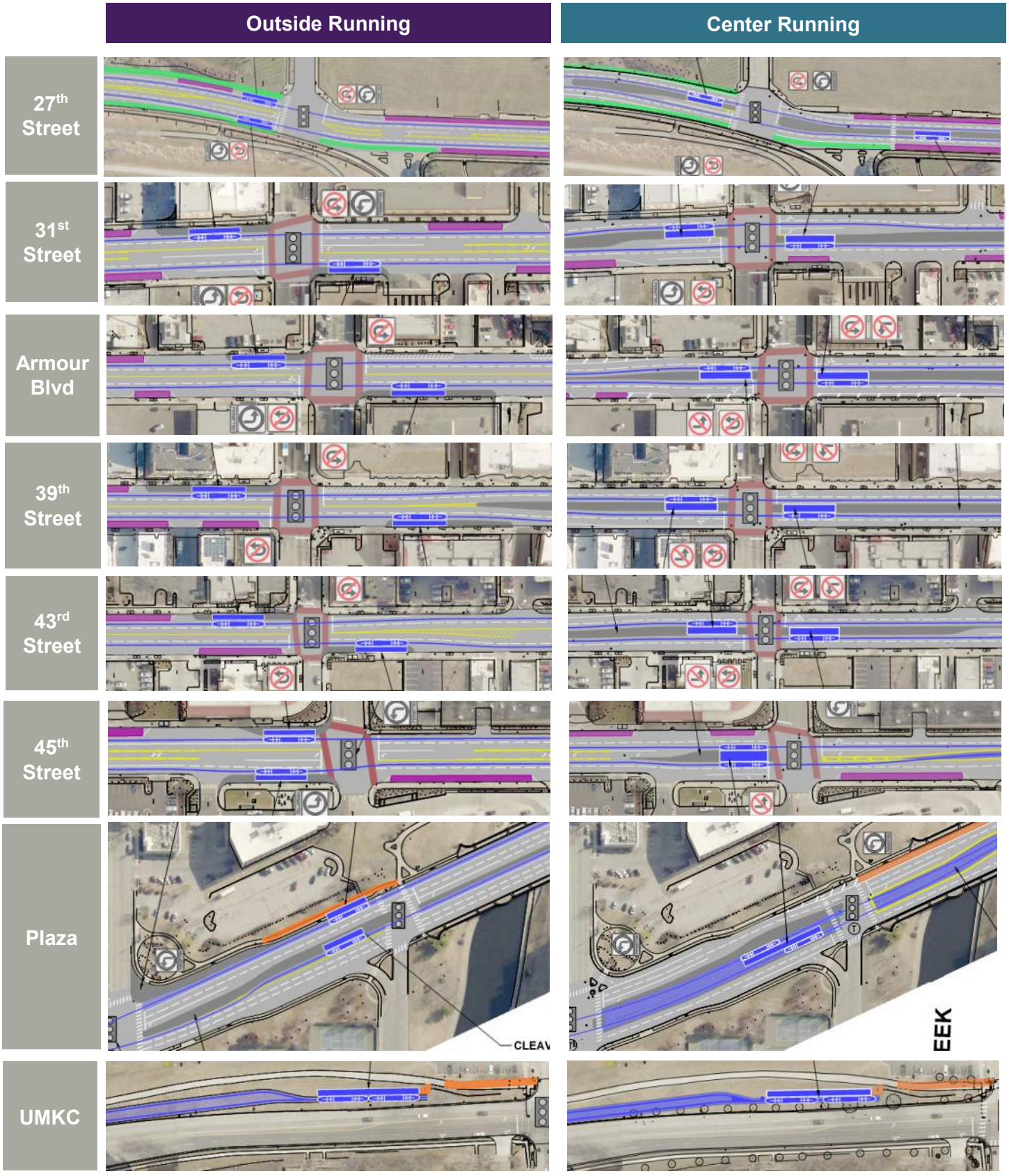


Figure 3.2-9: Corridor Concepts | Zoom-Ins of Station-Stop Areas



Step 5: Public Meeting #2

Roll-plot maps of the two concepts were unveiled at a public meeting on June 5, 2018. The study team also produced a refined matrix, shown in **Table 3.2-6**, comparing the two alternatives against key evaluation criteria and highlighting tradeoffs. The public meeting materials were also provided on-line until June 17, 2018.

The feedback focus of the second public meeting was to receive input on why participants preferred one of the two alternatives. A key focus of many participants was access to driveways and/or left-hand turns at key intersections. Study Team members gathered feedback via sticky-notes requesting participants describe "why" they prefer, placing their note on either the Outside- or Center-Running poster boards. The summaries below indicate that the public expressed a strong preference for outside-running operations.

75% **Outside Running Preference**

- Business operations (economic development, less disruptive to access/ left-hand turns)
- Safe and efficient access for riders
- Accessibility
- Consistency with current route

Better flow for both traffic and pedestrians, parking, and operations experience were also noted.

46 public meeting, 40 on-line

25% **Center Running Preference**

- Better for bicyclists
- Ability to dedicate lanes for streetcar, automobiles and bicyclists
- Organizing traffic

Safety, speed (faster running), and traffic calming were also noted.

16 public meeting, 14 on-line

Table 3.2-6: Public Meeting #2 Evaluation Matrix

GENERAL CHARACTERISTICS	CENTER RUNNING in Mixed Traffic	OUTSIDE RUNNING in Mixed Traffic
Where does the streetcar run?	In the inside, or center lanes of the street. Tracks are separated from parking lanes and sidewalks by one or more lanes of vehicle traffic.	In the outside lanes of the street, next to the curb or on-street parking space.
Where are the station stops?	Station stops, or platforms, are in the center of the street and accessed via signalized crosswalk.	Station stops are usually "bumped out" from the curb. Stops are adjacent to a single flow of traffic.
CRITERIA & TRADEOFFS		
HOW WILL IT AFFECT OTHER TRAFFIC?		
Turning On & Off Main Street	More restrictions on how cars can turn on and off Main Street. i.e., raised, concrete medians will be added and left turns will be restricted along much of the corridor.	Little restriction on traffic turning on to and off of Main Street. ★
Driveway Access	90-95% of the driveways on Main Street would be restricted by a median.	1-5% of the driveways restricted by a median. ★
Intersection Left-Turn Lanes	9 complete left-turn prohibitions.	No complete left-turn prohibitions; some time-of-day left-turn restrictions (similar to current conditions). ★
Bikes & Trails	Bicyclists typically travel at the curb, or outside lane. Center-running track separates the streetcar from bicycles. ★	Bicyclists would be encouraged to use alternative designated bike routes.
Bus Integration	Buses cannot share the station stop with streetcar because bus doors and the platforms are on opposite sides.	Streetcar stops can be designed to accommodate buses and bus bridging. ★
HOW IS ON-STREET PARKING IMPACTED?		
On-Street Parking / Loading	290-310 on-street parking spaces available.	350-375 on-street parking spaces available. ★
HOW DO THE PASSENGER EXPERIENCES DIFFER?		
Pedestrian Needs	Platforms are in the middle of the street (accessed via crosswalk), and platform capacity is limited.	Passengers can "spill" onto the adjacent sidewalks, creating overflow capacity. Passengers access the platform directly from the sidewalk. ★
HOW ARE STREETCAR OPERATIONS AFFECTED?		
Reliability	Turn restrictions permit the possibility of more efficient operations (e.g., no waiting behind a left-turning vehicle). Operating away from parked vehicles reduces potential for delay due to vehicles parked "over the line." ★	Vehicles parked over the white line will impact streetcar operations.
Travel Time / Efficiency	One-way travel time from Union Station to UMKC: 15-17 minutes. Potential to convert to dedicated lane in the future.	One-way travel time from Union Station to UMKC: 15-17 minutes.

Recommendations: Outside-Running

Based on the technical analyses, the public feedback, and further team discussion of the merits of each option, the study team has chosen to carry forward the outside-running alternative. The decision was not easy, as each option has both advantages and drawbacks. The primary factors that led to the selection of outside-running include the following:

- *Business Access – Autos:* An outside-running alignment would much better preserve left-turn vehicular access to/from businesses and properties along Main Street. In contrast, with the implementation of a median, a center-running alignment would dramatically curtail such access.
- *Turn Restrictions:* An outside-running alignment would allow intersection left-turn movements to be made much as they are today on Main Street, whereas a center-running alignment – with medians and center platforms – would have the potential to completely prohibit intersection left-turns at up to nine locations.
- *Bus Integration:* Station-stops on the outside of the street can be designed for shared-use with buses (as was done on the starter line). A center-running alignment would generally preclude such sharing because buses only have doors on their right sides.
- *Pedestrian Needs:* An outside-running alignment, with station-stops on the outside of the street, would have a much larger "reservoir" for storing pedestrians in "surge cases". Pedestrians could spill onto the existing sidewalks. Pedestrians would also have quicker, safer access to adjacent businesses (e.g., to grab a cup of coffee) while waiting. Finally, public meeting attendees generally expressed a greater sense of comfort with standing on the outside of the 35-mph roadway waiting for a streetcar than with standing in the middle.
- *On-Street Parking/Loading:* Preliminary concepts indicate that an outside-running alignment could allow for as much as 20 percent more on-street parking/loading capacity than a center-running alignment, due to the inclusion of a raised median in the center-running option. The raised median consumes width within some portions of the corridor where the outside-running alternative can operate without a width-consuming center turn lane.
- *Consistency:* Station-stops on the outside of the street are consistent with the existing system and with passenger expectations.

The two largest concerns with an outside–running alignment are operational reliability (potential for blockage by parked/stopped vehicles, frequent turns to/from driveways) and bicycle accommodations. The study team will work to mitigate these concerns through careful, iterative planning and design that continues to involve the community and integrates national best practices.

Future Refinement of South Segment

As the initial alignment concepts were developed, it became clear that the portion of the route south of 45th Street will need a great deal more conversation and refinement to arrive at the optimum design. Issues include the following:

- South of Emanuel Cleaver II Boulevard, the streetcar will transition to the Country Club Right-of-Way (CCROW), and while a potential location for that transition has been identified, more analysis and refinement is needed to determine the optimum location.
- Consideration is being given to a potential transit hub on the southeast corner of the intersection of Main Street / Cleaver II Boulevard, and the streetcar's lateral position in the street must be carefully coordinated with this hub.
- This stretch of Main Street / Brookside Boulevard is the most congested along the proposed extension, and is also more congested than the Downtown corridor. The interaction with the streetcar needs to be carefully thought through.
- A 270-foot-long section of Main Street in the vicinity 46th Street is the narrowest on the corridor (less than 55 feet wide), and appreciably constrains options.
- Several large office towers and hotels (as well as local businesses and institutions) have access needs between 45th Street and Emanuel Cleaver II Boulevard; these needs must be balanced against streetcar operational considerations.
- Main Street just north of Emanuel Cleaver II Boulevard has a significant grade (over 7 percent in some portions), complicating streetcar operations.
- One-way east-west streets (Volker Boulevard and Ward Parkway North) in the area tend to complicate and concentrate traffic circulation issues. They affect intersection operations as well as bus access to the potential transit hub, both of which ultimately affect streetcar operations.

As the project moves forward in planning and design, the study team will continue to scrutinize these technical issues, and work closely with the public and stakeholders, to pursue a concept that addresses the issues and extends the benefits of the Downtown starter line.

Chapter 3.3: Traffic and Parking Analysis

Traffic Analysis

The purpose of the planning-phase traffic analysis was to assist with the Best Lane Analysis by evaluating, at a planning level, the effects of the streetcar alternatives on traffic flow throughout the Main Street corridor. This was primarily accomplished by conducting intersection level of service (LOS) analysis using Highway Capacity Manual (HCM) methods as implemented in the Synchro software (version 10). The study team also built a VISSIM simulation model of the more complicated section of the corridor between Cleaver Boulevard and Volker Boulevard – a model that will continue to provide value as the project moves forward and alignment elements are evaluated at a more detailed level.

Existing Setting

The study corridor is largely urbanized, and primarily fronted by businesses. At the north end, as Main Street passes Penn Valley Park and Crown Center (including condominium towers), it has very few driveways and/or local access. The central portion of the corridor (Warwick Trafficway to 44th Street) is characterized by dense business driveways largely serving surface parking lots. Between 44th Street and Cleaver Boulevard, office towers and hotels tend to predominate. South of Cleaver Boulevard, there is no non-intersection access as the corridor crosses Brush Creek and connects to the west side of the University of Missouri – Kansas City (UMKC). The posted speed limit on the study portion of Main Street is 35 mph.

From Pershing Boulevard to Volker Boulevard, Main Street carries three lanes in each direction. For most of the corridor, the outside third lane allows parking during off-peak periods. During the a.m. peak period, the third lane northbound is restricted to the Main MAX transit service and turning vehicles only (no parking allowed). During the p.m. peak period, the third lane southbound experiences similar restrictions.

The portion of the corridor north of 34th Street is wide enough to provide a center two-way left-turn lane (TWLTL), and exclusive left-turn lanes are provided at every signalized intersection in this portion of the corridor. From 34th Street 44th Street, Main Street is narrower, and left-turn lanes are not provided at any signalized intersections – resulting in time-of-day left-turn prohibitions at all signalized intersections in this stretch. South of 44th Street, Main Street widens out again, and left-turn lanes (and occasional right-turn lanes) are provided at all signalized intersections.

The study team focused on 25 intersections along the 3.5-mile corridor. **Figure 3.3-1a/b** illustrates lane geometries and traffic control at each of these intersections.

Figure 3.3-1a: Existing Intersection Geometry and Traffic Control

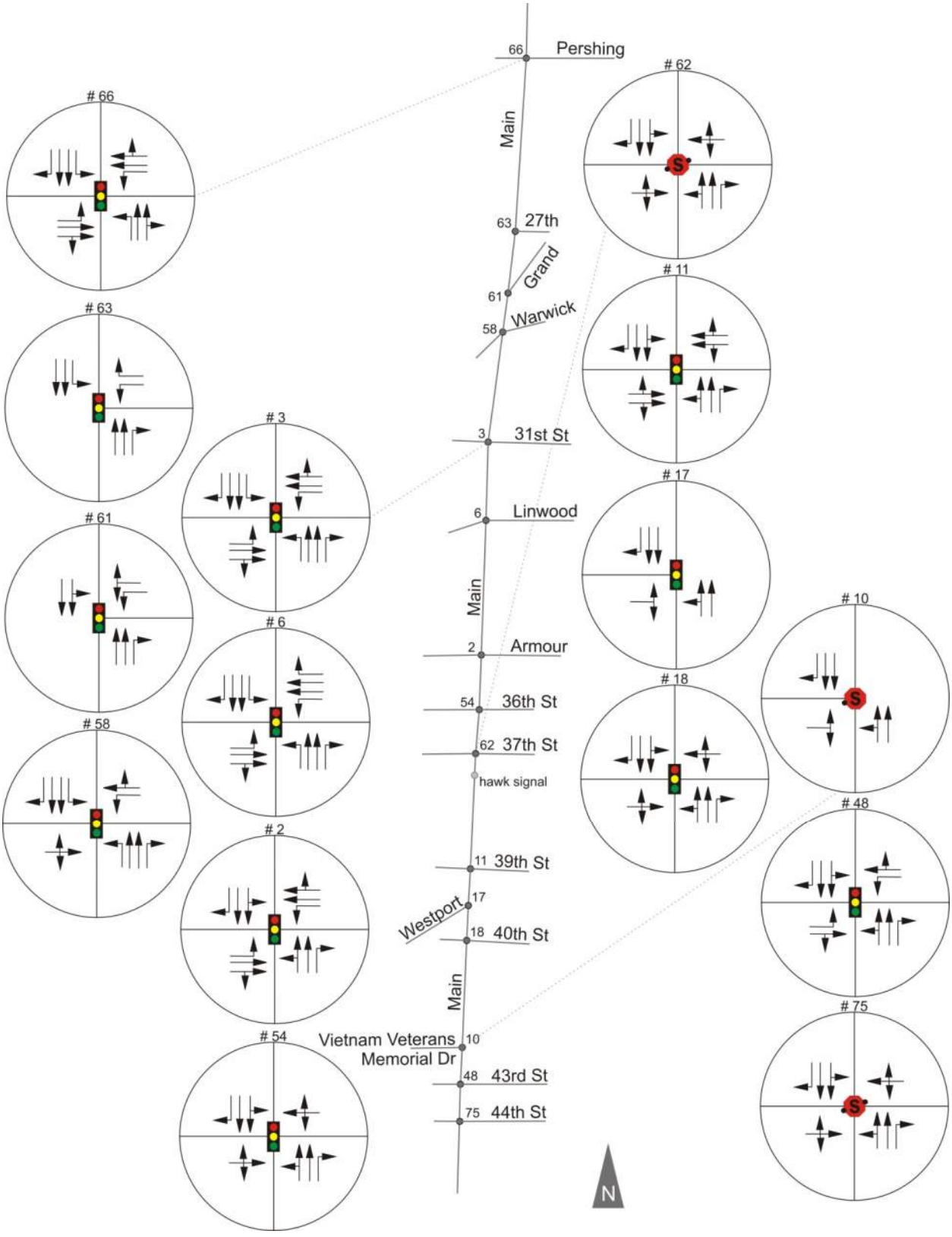
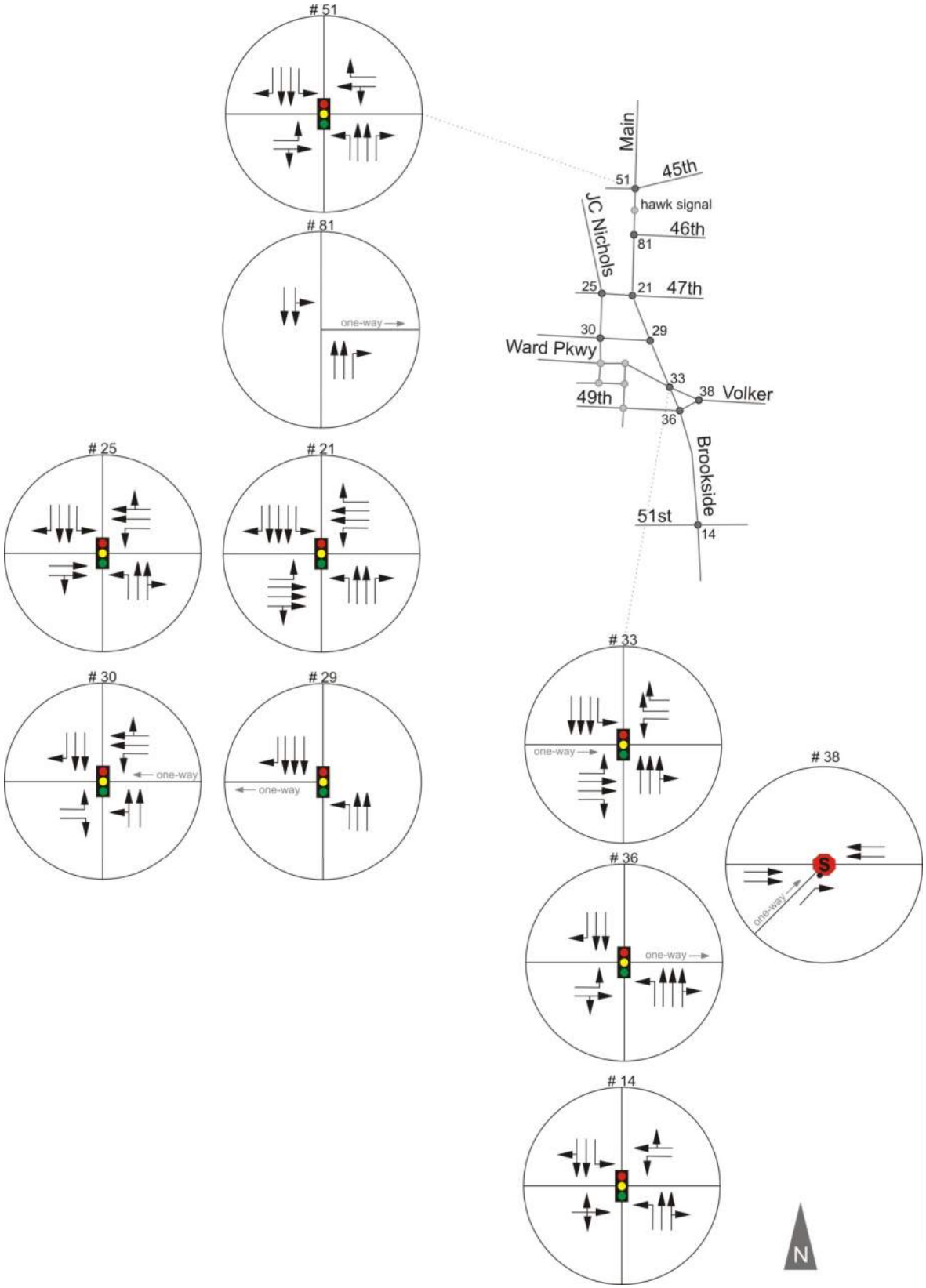


Figure 3.3-1b: Existing Intersection Geometry and Traffic Control, cont.



Existing Traffic Volumes

To support the traffic operations analysis (and other elements of the streetcar planning analysis), the study team conducted a.m. and p.m. peak-period turning-movement counts of the 25 study intersections in September of 2017. The data collected is representative of typical commuter peak periods while school is in session, which is commonly used as the basis for design of roadway infrastructure. This effort included vehicular counts, bicycle counts, and pedestrian counts. Vehicular counts are illustrated in **Figure 3.3-2a/b**.

Figure 3.3-2a: Existing Peak-Hour Turning Movement Counts

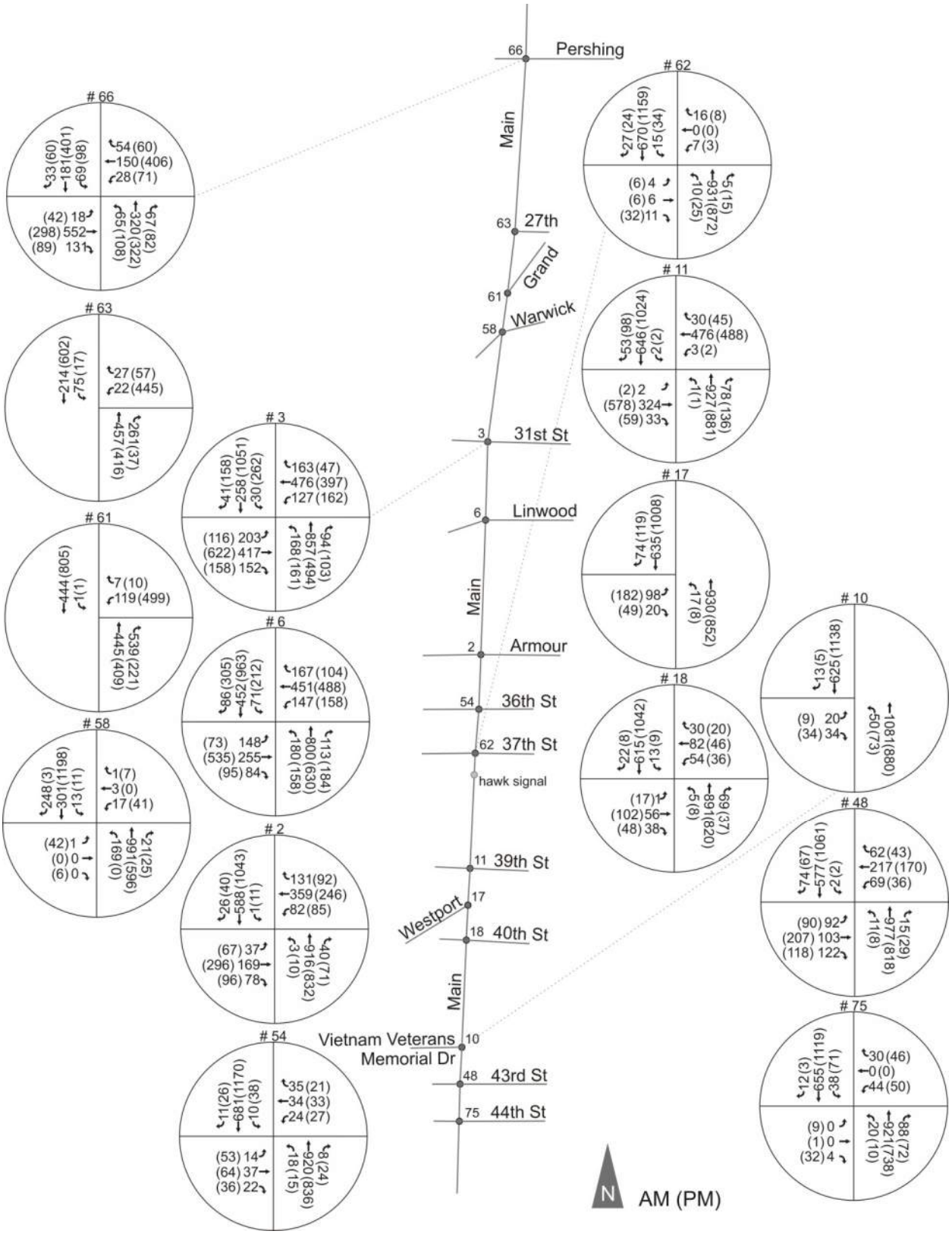
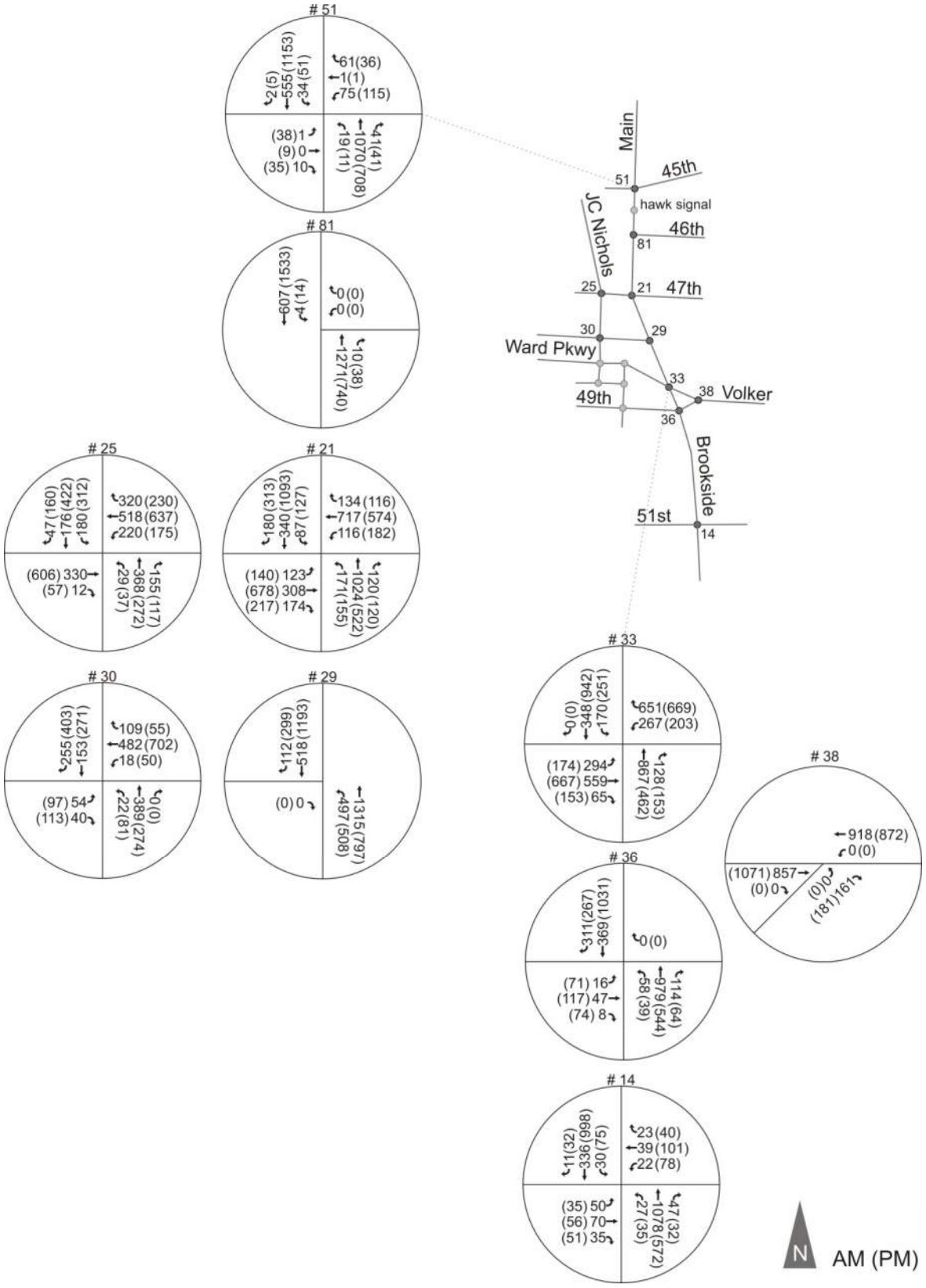


Figure 3.3-2b: Existing Peak-Hour Turning Movement Counts, cont.



Operational Analysis – Existing Conditions

A traffic operational analysis of the existing volumes, geometry, and traffic control was conducted using Synchro 10. The primary measures used for this analysis were delays and LOS. LOS is a measure that uses letter grades A through F to reflect the quality of travel and are based on the amount of predicted delays under prevailing conditions. LOS A represents very good operations with the shortest delays and LOS F represents poor operations with significant delays. Typically, in urban areas such as Kansas City, LOS E and F are considered to be unacceptable operating conditions, and LOS D and above are generally considered acceptable.

The Synchro results, using the HCM 6 analysis method, are shown in **Table 3-3.1**. As seen in the table, all of the currently signalized intersections operate at LOS D or better.

At unsignalized intersections, the LOS and delay for the worst movement is shown in the table. Three unsignalized intersections are shown to operate worse than LOS D:

- *Main Street / 37th Street (#62):* The eastbound approach to Main Street is shown to operate at LOS F during the p.m. peak hour. This is a low-volume approach (32 right turns, 6 through movements, and 6 left turns); and such conditions are not uncommon at unsignalized approaches. However, it should be noted that there is a pedestrian-activated beacon (HAWK signal) just south of the intersection, and the disposition of this signal, coupled with the addition of a signal at 37th Street is proposed – which would positively affect the LOS at Main Street / 37th Street – in the future streetcar scenarios (subsequently in this report).
- *Main Street / Veterans Memorial Parkway (#10):* The eastbound approach to Main Street is shown to operate at LOS E during both peak hours. This street is a "short cut" between Broadway Boulevard and Main Street, but there are alternatives available (most notably, 43rd Street) if delays are excessive. Traffic volumes would not warrant signalization.
- *Main Street / 44th Street (#75):* The westbound approach to Main Street is shown to operate at LOS F during both peak hours. Traffic to and from the QuikTrip, the adjacent office, and the Southmoreland Neighborhood all use this intersection to turn onto Main Street. Westbound peak-hour volumes are not high, but they are not insignificant either. Again, there are parallel signalized alternatives (43rd Street and 45th Street) that could be used to avoid this intersection if delays become excessive.

Table 3.3-1: Existing and Future No-Build Intersection Analysis Results

Intersection		Existing				Future No-Build			
		AM		PM		AM		PM	
		LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)
66	Main St & Pershing Rd	C	30.1	C	25.7	C	31.7	C	26.2
63**	Main St & 27th St	A	6.5	B	14.6	A	6.2	B	15.4
61**	Main St & Grand Blvd	A	6.1	B	10.4	A	7.0	B	10.3
58	Main St & Warwick Trfy	B	10.3	A	2.0	B	10.6	A	2.0
3	Main St & 31st St	D	46.5	D	53.0	C	32.7	D	43.1
6	Main St & Linwood Blvd	C	25.7	C	31.0	C	26.4	C	32.0
2	Main St & Armour Blvd	B	12.6	B	12.5	B	13.2	B	12.7
54	Main St & 36th St	A	5.8	A	5.8	A	5.9	A	6.0
62*	Main St & 37th St (EB)	D	34.1	F	77.0	E	39.0	F	113.2
11	Main St & 39th St	B	12.0	B	14.3	B	12.2	B	15.0
17**	Main St & Westport Rd	A	4.6	A	6.9	A	5.0	A	7.3
18**	Main St & 40th St	A	6.6	A	6.9	B	10.9	A	9.0
10*	Main St & Veterans Memorial Dr (EB)	E	38.1	E	45.8	F	51.2	F	62.2
48	Main St & 43rd St	A	9.3	B	15.8	B	11.1	B	17.0
75*	Main St & 44th St (WB)	F	154.9	F	468.2	F	233.1	F	765.7
51	Main St & 45th St	B	13.8	B	10.9	B	14.2	B	11.5
81*	Main St & 46th St	A	3.3	A	1.4	A	3.1	A	1.5
21	Main St & 47th St/Emanuel Cleaver II Blvd	D	48.2	D	52.5	E	56.7	E	56.7
25	JC Nichols Pkwy & 47th St	C	23.0	C	24.8	C	25.1	C	30.2
29	Brookside Blvd & Ward Pkwy	A	1.4	A	5.7	B	14.6	B	15.8
30**	Baltimore Ave & Ward Pkwy	B	19.6	C	21.0	B	19.4	C	22.7
33**	Brookside Blvd & Volker Blvd	D	46.6	D	39.3	D	46.2	C	34.6
38*	49th St & Volker Blvd (NEB)	B	14.8	C	18.8	C	15.5	C	20.4
36	Brookside Blvd & 49th St	A	5.7	A	9.2	A	4.2	A	9.5
14	Brookside Blvd & 51st St	B	19.2	C	20.0	C	20.2	C	20.8

* At unsignalized intersections, the delay and LOS for the worst movement is shown.
**Delays and LOS estimated using SimTraffic results.

Operational Analysis – Future No-Build Conditions

Table 3.3-1 also includes operational results for 2021 (to provide better consistency with the analysis of the streetcar opening year, which is anticipated to be 2023). To derive these results, existing counts were grown by a factor of 0.5 percent per year, in keeping with the general growth rates on Main Street and similar streets. As the table shows, most intersections currently operating at an acceptable LOS (D or better) are forecasted to continue to do so. Conditions at several intersections are worth noting in comparison to existing conditions:

- *Main Street / 37th Street (#62):* The eastbound approach is projected to degrade from LOS D to LOS E during the a.m. peak hour in the future year. The approach would continue to operate at LOS F during the p.m. peak hour, as it does today.
- *Main Street / Veterans Memorial Parkway (#10):* The eastbound approach is forecasted to degrade from LOS E to LOS F during both peak hours.
- *Main Street / 44th Street (#75):* The westbound approach is forecasted to continue to operate at LOS F during both peak hours.
- *Main Street / 47th Street / Cleaver Boulevard (#21):* The intersection is forecasted to degrade from LOS D to LOS E during both peak hours.

Operational Analysis – Future Streetcar Options

The study team used the operational models described above to analyze projected traffic operations along the corridor with the introduction of streetcar service. The team modified the models' lane geometry to reflect relevant changes associated with streetcar implementation (such as the addition or removal of turn lanes at certain intersections based on the concept layouts available at the time of analysis). Most of these changes can be seen in Chapter 3.2.

In order to emulate the effects of the streetcar in Synchro, the study team built two models for each streetcar scenario: a "streetcar present" model and a "streetcar not present" model:

- The "streetcar not present" model implemented the geometric changes described above, and assumed standard traffic signal phasing. This model reflected the times during the hour when no streetcar would be present and the intersection would operate as usual.
- The "streetcar present" model simulated the temporary lane closure resulting from a streetcar stopping in one of the mixed-traffic lanes, making that lane unavailable to vehicular traffic – by removing the lane. The model also accounted for extra delays caused by exclusive streetcar traffic signal phases where appropriate.

These models were run separately, and then the results combined in a weighted average based on the proportion of the hour during which each condition would be expected to occur. (Based on assumed peak-hour headways of 10 minutes, streetcars would be expected to affect 20 percent of signal cycles.)

Table 3.3-2 summarizes the results of the No-Build and Streetcar Options scenarios. The streetcar would not cause any intersection to operate at a poor LOS that is not already operating at a poor LOS. Three intersections are shown operating at LOS E or F under these scenarios:

- *Main Street / Veterans Memorial Parkway (#10):* The eastbound approach would continue to operate at LOS F under both streetcar scenarios. The center-running streetcar option would perform slightly better at this intersection (as per the concept current at the time of this analysis) because it would provide left-turn lanes on Main Street.

- *Main Street / 44th Street (#75):* The westbound approach would continue to operate at LOS F during both peak hours. Adding the streetcar to this intersection is projected to have no discernible impact on traffic operations.
- *Main Street / 47th Street / Cleaver Boulevard (#21):* This intersection would continue to operate at LOS E during both peak hours – with the exception of the a.m. peak hour under the outside-running option, which would improve slightly to LOS D. The outside-running option would not require a southbound transit-only phase, while the center-running option would, in order to allow the streetcar to transition to the exclusive lane south of the intersection. (Both options would require a northbound transit-only phase in order to allow the streetcar to transition out of the exclusive lane.) Other differences between the options are tied to signal timing.

Note that the intersection of Main Street and 37th Street (#62) shows a projected improvement to LOS A/B under both streetcar options, because the intersection is assumed to be signalized in replacement of the existing nearby HAWK signal.

In summary, the traffic operational analysis supporting this initial corridor planning analysis showed no major differences distinguishing center-running and outside-running, with minor exceptions at a few intersections. As the design concept is refined, so too will the traffic analysis.

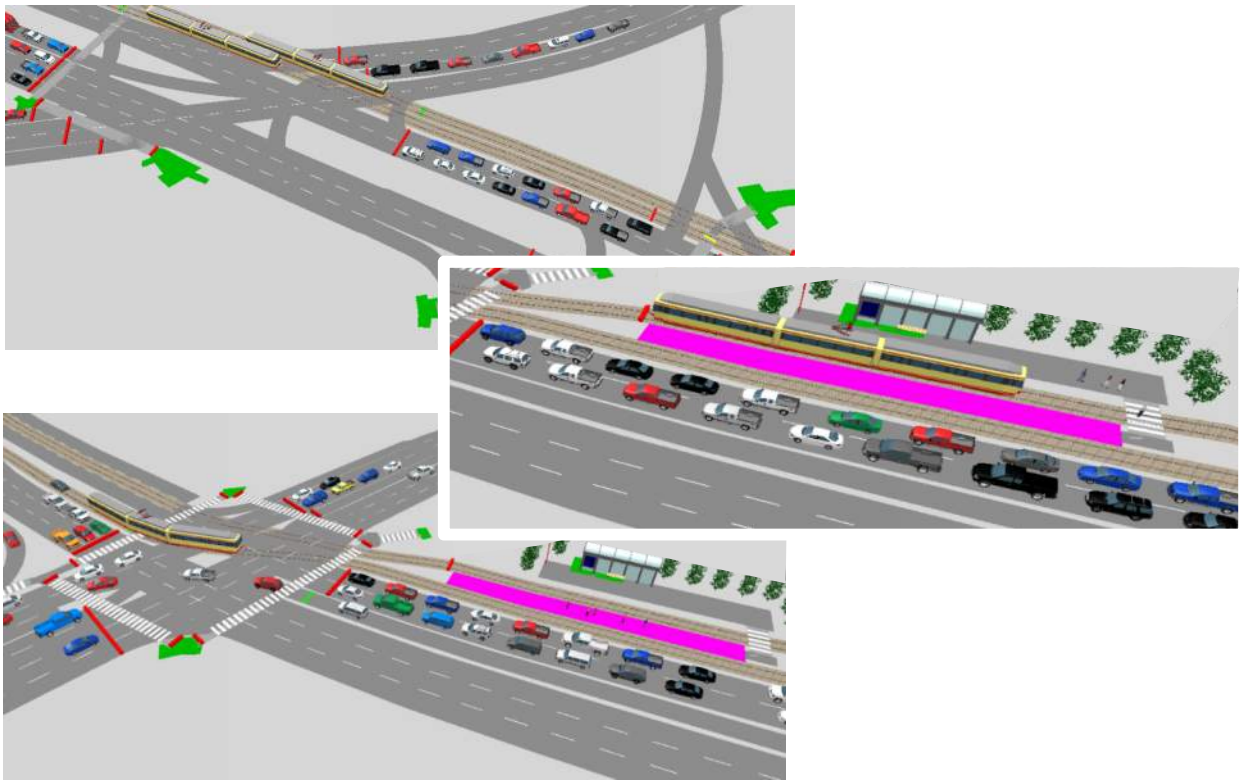
Table 3.3-2: Build Year Intersection Analysis Results with and without Streetcar

Intersection		Existing				No Build				W/ Streetcar - Center Alignment				W/ Streetcar - Outside Alignment			
		AM		PM		AM		PM		AM		PM		AM		PM	
		LOS	Delay (s/veh)	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
66	Main St & Pershing Rd	C	30.1	C	25.7	C	31.7	C	26.2	C	32.1	C	31.5	C	31.4	C	30.8
63**	Main St & 27th St	A	6.5	B	14.6	A	6.2	B	15.4	A	3.1	B	19.1	B	10.5	B	18.8
61**	Main St & Grand Blvd	A	6.1	B	10.4	A	7.0	B	10.3	B	11.0	D	53.2	A	8.7	B	12.9
58	Main St & Warwick Trfy	B	10.3	A	2.0	B	10.6	A	2.0	A	7.7	A	4.9	A	1.6	A	4.2
3	Main St & 31st St	D	46.5	D	53.0	C	32.7	D	43.1	D	40.4	D	48.8	C	33.6	D	47.5
6	Main St & Linwood Blvd	C	25.7	C	31.0	C	26.4	C	32.0	C	34.5	C	32.7	C	29.6	D	38.7
2	Main St & Armour Blvd	B	12.6	B	12.5	B	13.2	B	12.7	B	17.1	B	16.1	B	14.0	C	27.2
54	Main St & 36th St	A	5.8	A	5.8	A	5.9	A	6.0	B	11.1	A	5.1	A	4.5	A	5.8
62*	Main St & 37th St (EB)	D	34.1	F	77.0	E	39.0	F	113.2	B	11.0	B	10.3	A	8.5	B	12.7
11	Main St & 39th St	B	12.0	B	14.3	B	12.2	B	15.0	B	16.2	C	22.8	B	16.2	C	22.8
17**	Main St & Westport Rd	A	4.6	A	6.9	A	5.0	A	7.3	A	3.8	A	5.9	A	3.9	A	5.9
18**	Main St & 40th St	A	6.6	A	6.9	B	10.9	A	9.0	A	7.6	B	11.2	A	7.6	B	10.5
10*	Main St & Veterans Memorial Dr (EB)	E	38.1	E	45.8	F	51.2	F	62.2	F	53.8	F	91.9	F	90.5	F	200.2
48	Main St & 43rd St	A	9.3	B	15.8	B	11.1	B	17.0	B	17.7	C	23.3	B	17.7	C	26.1
75*	Main St & 44th St (WB)	F	154.9	F	468.2	F	233.1	F	765.7	F	304.2	F	900.5	F	304.2	F	900.5
51	Main St & 45th St	B	13.8	B	10.9	B	14.2	B	11.5	B	10.3	C	28.2	B	19.6	C	23.3
81*	Main St & 46th St	A	3.3	A	1.4	A	3.1	A	1.5	A	3.1	B	11.0	A	7.2	A	5.7
21	Main St & 47th St/Emanuel Cleaver II Blvd	D	48.2	D	52.5	E	56.7	E	56.7	E	60.9	E	66.4	D	51.5	E	63.8
25	JC Nichols Pkwy & 47th St	C	23.0	C	24.8	C	25.1	C	30.2	C	32.2	D	39.8	C	32.6	D	41.4
29	Brookside Blvd & Ward Pkwy	A	1.4	A	5.7	B	14.6	B	15.8	A	0.2	A	4.4	A	0.2	A	5.3
30**	Baltimore Ave & Ward Pkwy	B	19.6	C	21.0	B	19.4	C	22.7	B	16.1	B	17.4	C	21.0	C	24.3
33**	Brookside Blvd & Volker Blvd	D	46.6	D	39.3	D	46.2	C	34.6	D	54.3	C	33.1	D	54.1	D	40.6
38*	49th St & Volker Blvd (NEB)	B	14.8	C	18.8	C	15.5	C	20.4	-	--	-	--	-	--	-	--
36	Brookside Blvd & 49th St	A	5.7	A	9.2	A	4.2	A	9.5	A	4.7	B	10.3	A	4.7	A	7.2
14	Brookside Blvd & 51st St	B	19.2	C	20.0	C	20.2	C	20.8	C	26.6	C	25.1	C	26.6	C	25.1

* At unsignalized intersections, the delay and LOS for the worst movement is shown.
**Delays and LOS estimated using SimTraffic results.

Simulation

Due to the complexity and close spacing of the intersections at the southern end of the corridor, the project team used a more sophisticated tool to assist with analyzing traffic operations. The project team built a VISSIM simulation model for the group of intersections that includes the Main Street corridor from Emanuel Cleaver II Boulevard to 49th Street. This tool will be useful as the design is refined in this part of the corridor. (For the Best Lane Analysis, the Synchro model was used as the primary tool for consistency of comparison.) The images below show some ways in which the VISSIM model integrates the streetcar.



Parking Analysis

At the Best Lane stage, the study team examined parking from several angles:

- What is the existing on-street and off-street parking capacity along the corridor?
- What is the existing parking demand along the corridor?
- Are there areas where the on-street parking demand is high, and therefore streetcar designs should attempt to preserve it?
- What are the needed elements to consider in developing a comprehensive strategy that addresses parking (park-and-ride) associated with commuters using the streetcar?

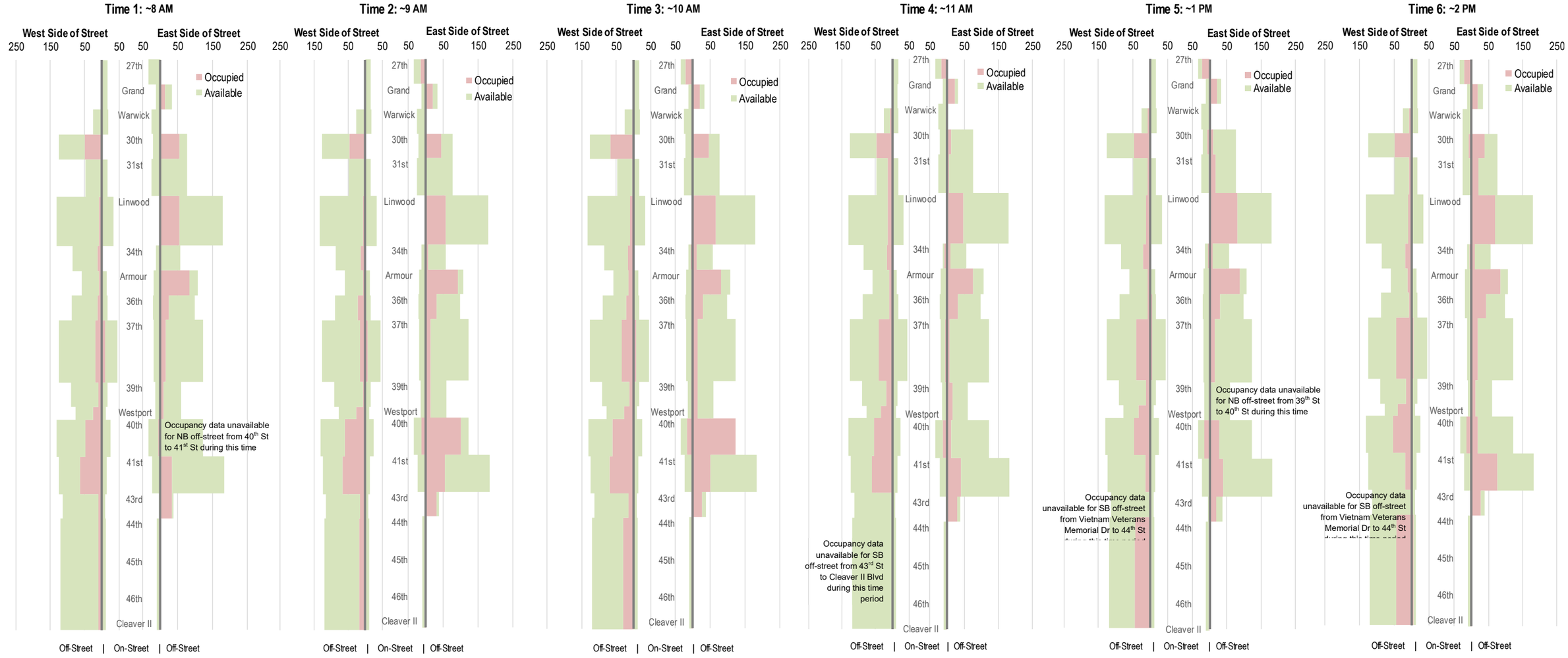
The first three items are addressed in the first part of this section – which is largely geared toward determining the need to retain on-street parking on segments throughout the corridor as future roadway cross-sections are considered. The fourth item is addressed in the second part of this section – which is largely geared toward the implications of the Main Street extension on commuter park-and-ride demand.

Corridor Parking Inventory and Usage

The study team evaluated on-street and surface off-street parking along the Main Street corridor and immediately adjacent along side streets (excluding private parking garages). The team used a 3D video camera mounted atop a vehicle to collect data at various periods over several days of a typical week. A total of six runs were made at various times on a typical weekday. The team reviewed and processed the video to determine the amount of occupied parking for each block, on each side of the street, during the time periods studied.

The data collection identified on-street and off-street capacity for approximately 4,700 vehicles along the corridor – approximately 3,100 in surface lots, 720 in adjacent garages, 550 on-street on Main Street, and 340 on-street nearby on adjacent side streets. Access to all the garages was not possible for counting occupancy. The graphs in **Figure 3-3.3** display the available vs. occupied parking along each block for each of the six time periods studied – for on-street parking directly on Main Street, and off-street surface lots immediately adjacent to Main Street. Parking occupancy along the corridor does not appear to fluctuate dramatically during different times of day in most parts of the corridor. Based on this evaluation, on-street parking is currently lightly used, except in three areas: near 27th Street (east side), near 34th Street (east side, especially near mid-day), and in the vicinity of 40th Street (east side). Although data was not collected north of Pershing Boulevard, on-street parking demand is known to be fairly high on the east side of Main Street in this location. In only one instance was on-street parking found to be occupied at capacity, for one block during one time run (on the east side of Main Street between 40th and 41st Streets). The remainder of the locations and time blocks had adequate and ample parking available – both on- and off-street.

Figure 3-3.3: Parking Inventory Results



It should be reiterated that one of the key purposes of the proposed project is to support economic development along the corridor, including support of the Main Street Overlay and Midtown/Plaza Area Plan. As denser uses are built along the corridor, surface parking capacity is likely to decrease, while overall parking demand is likely to increase – potentially increasing the demand for on-street parking that is above today's levels. Based on the foregoing analysis, the on-street parking system has reserve capacity and could handle significant increases. But careful planning and design will be needed with each development/redevelopment project to ensure that parking needs are met while simultaneously pursuing the goal of an integrated regional transit system and improved transit connections that would inherently reduce automobile-dependence in the corridor.

Elements of a Parking Strategy

On-street parking, and off-street parking associated with local businesses, are not intended to serve a weekday park-and-ride function. On-street parking is currently duration-restricted to encourage a flow of patrons to businesses, and off-street parking is generally exclusively meant for both patrons and employees of businesses.

The Downtown starter line experience showed that the park-and-ride component of streetcar is real. At the northern end of the line, no-charge parking in the River Market area resulted in a significant uptick in all-day parking throughout the district, as downtown workers parked in the district and used the streetcar to access their workplaces. At the southern end, Union Station has been a very popular place to park and ride the streetcar – much less for commute purposes, and more for downtown visitors. On weekdays, an estimated 9 percent of streetcar riders park and ride. The stops with the highest percent of streetcar riders who park (for any duration of time) and ride are North Loop (17 percent), Crossroads (14 percent), and Union Station (14 percent).

As the streetcar extends southward, there is the very real possibility that park-and-ride demand will emerge, especially at stations near the southern terminus. If free or comparatively cheap all-day parking is available at the southern end, it is possible that downtown workers commuting from locations further south (or even from areas in the wider southern metro area) will use it, parking for the day and using the streetcar to access their downtown workplaces.

Some of the key issues that need to be addressed in a more comprehensive parking strategy include:

- *Potential undesired usage of existing "free" parking.*

  A currently unanswered question is: to what extent will commuters try to use existing off-street no-charge parking spaces along the streetcar extension route for daily parking? As demonstrated in the previous section of this report, there is plenty of surface-lot capacity along the route, but there is also concern among businesses about this parking being overtaken by streetcar park-and-ride activities, reducing the number of spaces available for

customers. This potential exists at small and medium-sized surface lots throughout the corridor, but the greatest concerns are probably at or near the southern terminus:

- The **Country Club Plaza** offers hundreds of free parking spaces in structures scattered throughout its internal roadway network. Figure 3-3.4 is a publicly available map of the Plaza parking lots. All the Plaza garages/lots are potentially within a half-mile of the proposed Plaza streetcar station-stop; five of the nine are potentially within a quarter-mile. Information is not available regarding weekday utilization of the Plaza lots, but they can be quite crowded – especially during warmer weather and the winter holiday season. Plaza personnel have expressed concern about the potential for streetcar park-and-ride usage to negatively affect the ability for customers to find parking spaces. Although the Plaza stop is not the southern terminus, it is a major activity node near that terminus. Its obvious potential synergy with a streetcar has been noted for years – and is a driving force behind the desire to extend the streetcar south – but this very synergy is also the reason that parking is a concern.

Figure 3-3.4: Country Club Plaza Parking Areas

Source: https://brazilpdpiumkc.wordpress.com/tag/featured/. Accessed 11/8/2018

- The **UMKC** campus has a great deal of parking – most of it permit-based, some of it non-permit but metered. There is no "free" public parking on campus. Any free parking near campus (including parking associated with the new Brookside 51 development) is very attractive to students; so the struggle with parking intrusion in this area is already ongoing. UMKC's Cherry Street parking structure, located approximately 800-1,000 feet from the proposed 51st Street stop, may offer a potential location for transit park-and-ride opportunities. The capacity would probably be on the order of 50 parking stalls, and they would be metered, as they are today.

- The **Plaza Library**, less than 1,000 feet from the proposed Plaza stop, also offers free public parking for library patrons. Further into the **South Plaza** area, there are a number of surface lots that serve existing commercial developments, as well as on-street parking that serves the residential area. It is possible that some of these could be attractive to daily parkers.

- *Opportunities to create additional park-and-ride capacity along the corridor.*

  One way to combat unwanted streetcar-related parking "intrusion" in the corridor would be to introduce designated park-and-ride facilities at strategic locations. This could mean use of available public property, cooperative agreements with local businesses that have excess parking inventory, or creative shared-use parking (locations that have low parking demand during the day but higher parking demand in the evening). Some potential examples are discussed below.

  - KCATA and the City of Kansas City own right-of-way in the southeast quadrant of the intersection of Main Street and Cleaver Boulevard. While this area is being contemplated as a potential transit interface location, it could also provide a limited number of park-and-ride spaces. It is almost immediately adjacent to the proposed Plaza stop.

  - The private underground parking structure near 4717 and 4740 Grand Avenue (near Grand Street Café), just east of the above-described location, may have some excess capacity that could be leased for park-and-ride uses. This site is fairly close to the proposed Plaza stop (within 300 feet).

  - The Home Depot / Costco site in the southwest quadrant of the Main Street / Linwood Boulevard intersection features two very large surface parking lots. During weekday work hours, one or more of these lots may have excess capacity and could be considered for a park-and-ride implementation. The western lot is approximately 1,500 feet from the proposed 31st Street stop and approximately 1,300 feet from the proposed Armour Boulevard stop.

  - As previously mentioned, UMKC's Cherry Street garage may present an opportunity for perhaps up to 50 metered parking spaces, approximately 800-1,000 feet from the proposed southern terminus (51st Street) stop.

  - The large parking garage in the northwest quadrant of Main Street / 31st Street appears to have spaces for lease, and is within 300 feet of the proposed 31st Street stop.

These are some of the more prominent options within the corridor. There may be other, perhaps smaller, opportunities with other developments – especially those with complementary uses (where parking demand peaks outside of working hours). Even this short list begins to indicate that there is significant opportunity for targeted park-and-ride strategies in key, prominent locations along the corridor. Any designated parking areas would need to be highly visible (strong wayfinding), well-mapped, and well-communicated, so that their use is maximized.

Park-and-ride locations outside the streetcar corridor should also not be forgotten. There are existing no-charge park-and-rides at the Wornall Road / Gregory Boulevard intersection (2.5 miles south of the southern terminus) and at the Wornall Road / 75th Street intersection (3.5 miles south), currently serving Main MAX. The ability of these lots to extend the reach of the streetcar, by providing access to the proposed Brookside-Waldo connector, is worth incorporating into an overall parking strategy.

- *Enforcement strategies to effectively manage parking outcomes.*

  - As with the downtown streetcar, enforcement, clear delineation, and effective signing would be needed to keep the tracks cleared of parked or loading vehicles. In addition, parking time limits (also well-enforced) would be needed to ensure reasonable turnover to support adjacent businesses and discourage on-street spaces from being used for all-day park-and-ride purposes.

  - Parking fees should be examined as part of the parking strategy. As previously mentioned, a park-and-ride implementation at UMKC's Cherry Street garage would involve meters as it currently does today. Union Station is an existing example of another paid lot that is also used by streetcar riders. This exact model may or may not be replicable in other parts of the corridor, but the concept and supporting technologies should be explored.

  - One notable on-street loading issue occurs at St. Paul's Episcopal Day School. The northbound curb lane on Main Street is heavily utilized during the afternoon school dismissal for student pick-up, winding around the block on 41st Street and Walnut Street. The design of the streetcar alignment must coordinate with this activity, and signing/enforcement needs to make clear that the curb is not for parking during these times, so that loading cars do not have to queue around a parked vehicle and block the streetcar tracks.

- *Recognition of short-term (hourly, not daily – non-commute) parking's value to streetcar.*

  - Non-commuting visitors to downtown can park on Main Street and use the streetcar for their visits – generally 3 hours of parking are allowed during weekday work hours, and no time restrictions are in place for weeknights and weekends. Since such "visitor" trips are prevalent on the streetcar, on-street parking capacity can be used

more effectively by encouraging such visitors to use available on-street parking for their weekend, weeknight and short weekday streetcar trips.

- *Longer-term strategies as the corridor evolves.*

  - As mentioned previously, streetcar-induced development and redevelopment is expected to increase land-use density along the corridor. Strategies and policies that consider appropriate parking provisions when sites develop/redevelop – potentially including provisions for dedicated park-and-ride areas for larger projects – could help better disperse the parking "load" throughout the corridor. Parking policy must balance the objectives of reducing dependence on automobile usage, avoiding parking intrusion into residential neighborhoods, supporting the customer access that represents the lifeblood of many local businesses, and providing streetcar access for those who travel to/from the corridor by automobile.

- *More detailed analysis of parking demand and patterns*

  - The recently developed corridor ridership forecasting model, coupled with the recent survey of streetcar and Main MAX riders, can be mined to yield additional information and more accurate predictions of the magnitude and location of parking demand associated with the Main Street streetcar extension. As the project moves further into Project Development and conceptual design, the project team will examine these sources to further refine an overall parking strategy.

Chapter 3.4: Vehicle Maintenance Facility Analysis

Existing Facility Expansion

Figure 3.4-1 Existing Vehicle Maintenance Facility (VMF)

The existing Kansas City Streetcar Vehicle Maintenance Facility (VMF) is situated near Third and Holmes Streets (**Figure 3.4-1)**. It was completed in 2015 concurrently with the construction of the Starter Line. It presently houses four streetcar vehicles in three interior bays and on exterior yard trackage. Without modifications, the existing trackage can accommodate up to 6 vehicles without fouling (occupying/ blocking) the non-revenue facility lead. A conceptual layout (for feasibility purposes) demonstrating the physical feasibility to add a maintenance bay, storage tracks and a drive-through wash-bay to the existing site was evaluated. This assumes an eventual fleet size of up to 15 vehicles.

Several assumptions were made when considering ways to store these additional vehicles. First, all vehicle storage should be contiguous to the existing facility and within the secured perimeter (expanding the perimeter if necessary). Second, the non-revenue lead must remain clear for arrivals and departures of in-service vehicles and to allow for intra-facility switching. Third, operators should be able to hostle (move) vehicles within the facility without having to leave the secured perimeter. Stored streetcars were assumed to have a 10-foot gap between vehicles to allow for circulation of facility staff. Proposed track centers were typically set at 15 feet.

A number of potential track configurations were evaluated. The first, and most basic, is to extend the current non-revenue lead east as a fourth yard track running parallel to and north of the existing VMF, shown in **Figure 3.4-2**. The proposed track is shown in blue and existing tracks are shown in black. Streetcar vehicles are shown in gold. Adding this track would create storage space for four additional vehicles. The eastern driveway to the VMF would have to be relocated or kept in place with the understanding that vehicles may foul it (touch the tracks) at times.

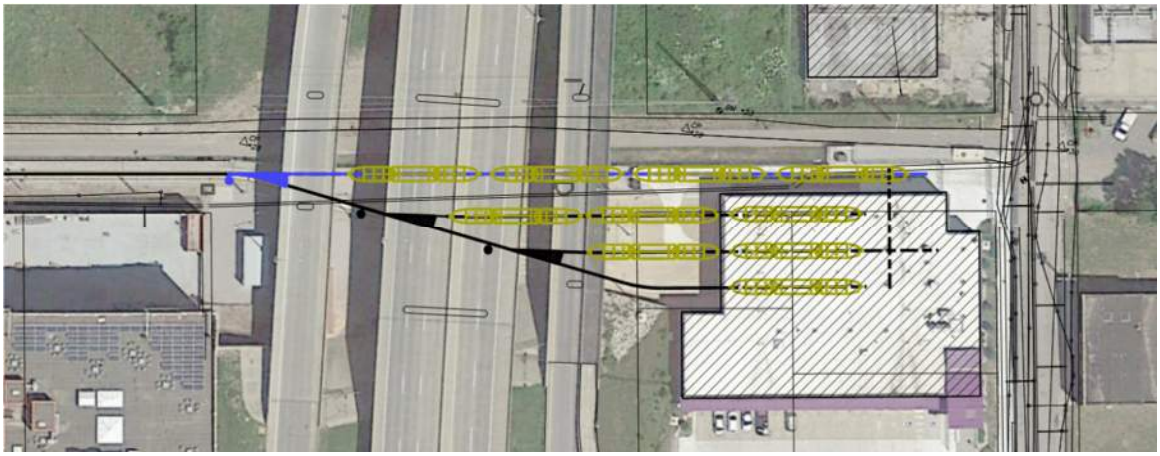


Figure 3.4-2 ***Existing VMF with Addition of Track 4***

The next option examined was the addition of a siding track along the north side of the existing non-revenue lead, as depicted by the purple trackage in **Figure 3.4-3**. This would occupy the space currently used as a trail within the Second Street right-of-way corridor. This track would be single-ended, with an optional right-hand crossover located west of the existing yard ladder to allow for switching of vehicles between the VMF and the western half of the siding. Total vehicle capacity on this track would be six with the crossover or seven without. There is an existing steam line running parallel to this alignment that veers south under the Heart of America Bridge, truncating the length of track that can be built without relocating or hardening the steam line.

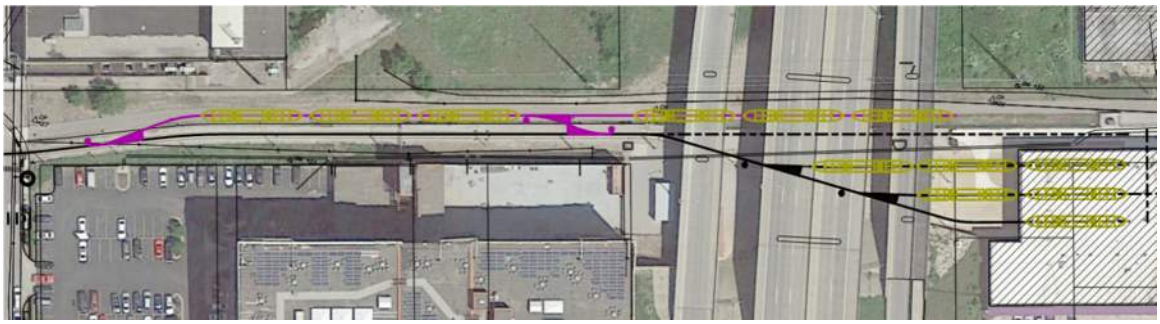


Figure 3.4-3 ***Existing VMF with Addition of Siding Track (Crossover Shown)***

Combining these two options (**Figure 3.4-4**), along with the currently available space on the existing VMF trackage provides accommodations for up to 16 vehicles (with crossover) or 17 vehicles (without crossover) while keeping the non-revenue lead clear for switching and arrival/departure moves.

Another option considered, but not shown here, would be to add a siding track along the south side of the non-revenue lead. This would require the relocation of the existing overhead catenary system (OCS) serving that track. If the crossover shown in **Figure 3.4-4** is installed, the turnout for this track would fall west of that point on the non-revenue lead and allow only

enough clear space for two vehicles. As such, this option was removed from further consideration due to these drawbacks.

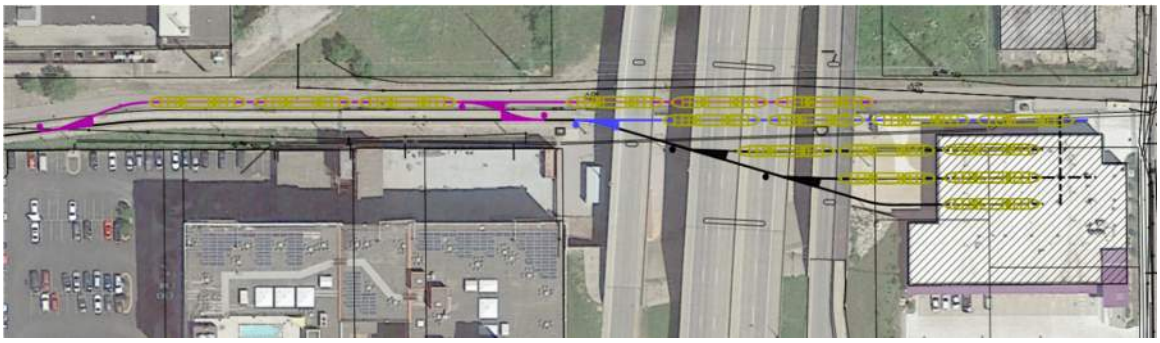


Figure 3.4-4 ***Existing VMF with Addition of Track 4 and Siding Track***

To increase operational flexibility, a condition where the steam line conflict has been mitigated, allowing for an eastern extension of both Track 4 and the siding track was considered (see **Figure 3.4-5**). This would allow for an additional two vehicles to be stored on the Siding Track. Furthermore, this opens the potential for a tail track to be extended across Holmes Street to create more operational flexibility within the VMF. However, this would require modifications to the profile of Holmes Street, as the working elevation of the VMF and yard is several feet above the top of pavement at this point (See **Figure 3.4-6**). At least one driveway would be impacted by this profile change. Streetcars crossing Holmes Street would also require flaggers or a signal to protect the movements.

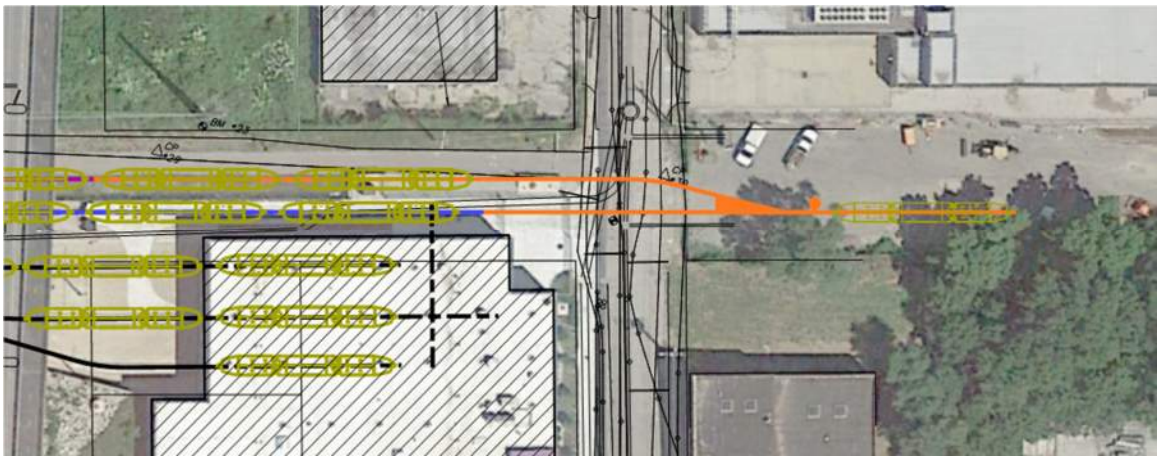


Figure 3.4-5 ***Existing VMF with Addition of Tail Track***

Figure 3.4-6 View of Grade Difference at Holmes

The portion of the tail track east of Holmes could potentially be extended to serve as a storage track if additional property was acquired by the KCSA and the site were secured with fencing and other security measures.

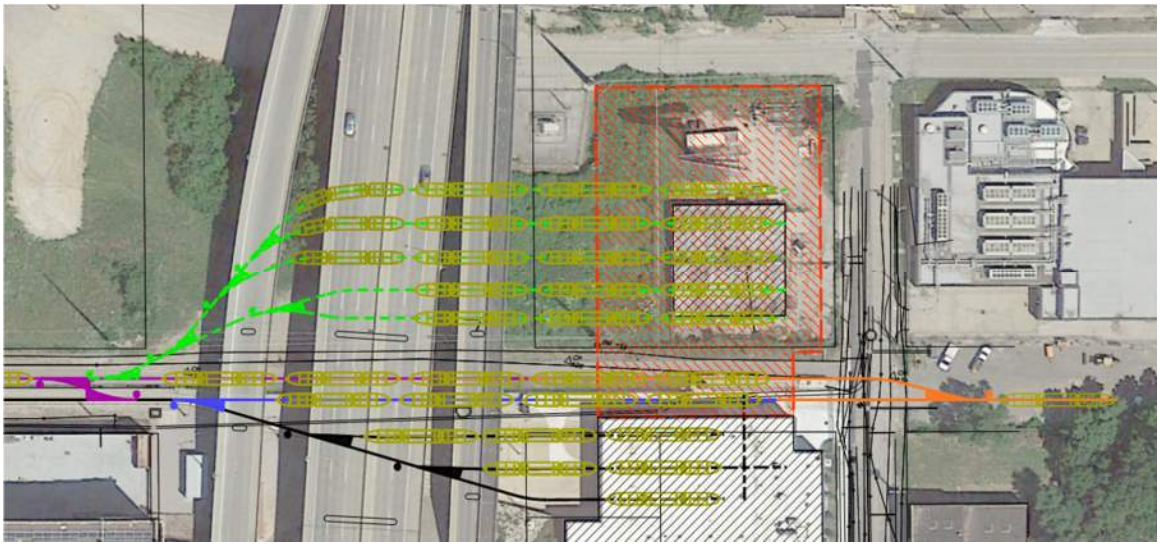


Figure 3.4-7 Future North Expansion

Looking farther into the future, a potential layout of additional yard tracks and a new building to the north of the existing VMF was also examined (see **Figure 3.4-7**). This expansion could conceptually fit up to 18 vehicles and a new or expanded building of approximately the same footprint as the existing VMF, on the order of 30,000 square feet. Considerations would have to

be made for grade (the elevation of First Street, at north, is approximately 20 feet lower than the VMF) and the bridge overhead (both vertically and horizontally) for the pier columns. The steam line would also have to be addressed in this scenario.

Another expansion option at the VMF site exists to the south, between the current parking lot and Third Street (**Figure 3.4-8**). Presently, this area is partially occupied by a storm water BMP but is mostly under-utilized. The total building footprint available here is on the order of 20,000 square feet, and could increase an additional 5,000 square feet if facility parking were relocated. It is important to note that this potential expansion area would not be suitable for any vehicle-related activities, but would be for office, administration, and staff accommodation. There is a possibility for revenue generation, should the KCSA consider partnering with a developer to construct a multi-story mixed-use structure on this site.

Figure 3.4-8 Potential South Expansion

In conclusion, the VMF site offers a range of potential expansion options in terms of vehicle storage, vehicle maintenance, operations, and staff accommodation. Most, if not all, of these expansions can be phased to suit the needs of the KCSA. In the near-term, storage for the additional vehicles in the streetcar fleet can be accomplished with reasonable effort, as depicted in Figure 3.4-4.

KC Streetcar Vehicle Maintenance Facility Main Street Evaluation

As part of the study for the Main Street Extension, the project team reviewed possible sites for vehicle storage and servicing along the Main Street corridor for suitability of accommodating the identified VMF program requirements. This secondary facility would be used for storage and light maintenance to supplement the existing VMF. The following criteria were used when identifying and evaluating sites:

- Proximity of site to proposed alignment – minimize length of non-revenue track
- Ownership of site – KCATA or other public entity preferred
- Size of site – ability to accommodate a 2-bay building and store at least six vehicles
- Suitability of site grades – minimize grading and avoid retaining walls

Due to the proximity of the existing VMF, only sites south of 39th Street were considered, and potential site were examined at a high level only. Several potential areas were dismissed due to excessive impacts on surrounding infrastructure, infeasible topography, distance from the proposed alignment, or potential for a higher and better use for the land. The following general locations were identified (see **Figure 3.4-9**):

- Near 44th & Main
- Near Cleaver II & Main
- Near UMKC

However, as noted previously, the existing VMF site offers a range of potential expansion options that could accommodate vehicle storage, vehicle maintenance, operations, and staff accommodation, in the near-term and long-term. Therefore, it was determined that an additional maintenance facility is not necessary.

Figure 3.4-9 Potential Vehicle Storage/Servicing Locations (reviewed but not warranted)

Chapter 3.5: Power Systems

Background

The proposed streetcar extension is intended to function with the Starter Line as a single system, and as such will run the same type of vehicles on an Overhead Contact System (OCS), the same as the current Starter Line. The *Kansas City Downtown Streetcar Design Criteria Manual* outlines and describes the Traction Power Supply & Distribution system in detail and is considered the basis for the same on the extension.

Potential Substation Locations

The current Starter Line alignment, running 2.2 miles from Union Station to River Market, features four substations. One under the Main Street Viaduct at Union Station; one at Main & Truman, south of Interstate 670; one under the Main Street overpass over Interstate 70; and one at the site of the Vehicle Maintenance Facility.

Figure 3.5-1 ***Starter Line Substation***

For the purposes of this effort, a prototypical traction power substation (TPSS) layout was assumed. This was based on the Starter Line TPSS located at Main & Truman. The approximate footprint of this site is 70 feet by 35 feet. Potential sites for new TPSSs had to have a footprint of at least this size. Preference was given to sites owned by a public entity such as the City of Kansas City (KCMO) and the Kansas City Area Transportation Authority (KCATA). Spacing of approximately one-half to one mile per stations is desirable. To provide a number of options, up to five sites per mile were sought.

The neighborhoods surrounding the proposed expansion are some of the densest in Kansas City. Publicly-owned parcels are not common, and many public parcels are well-used parks. Surface parking abounds, but much of it is either actively used or part of a larger site that represents a redevelopment opportunity. These potential redevelopment sites were not considered for substations so as to not impact future development. Laterally, the search for sites was restricted to areas within 1,000 feet of Main Street.

Pershing Road to Grand Blvd

Penn Valley Park spans the length of this stretch on the west side; on the east side are all properties owned by Hallmark consisting of either current Crown Center development or parcels earmarked for future development of a similar scale. Moving south of Crown Center, land use on the east side of Main Street includes the Union Hill neighborhood and historic Union Hill cemetery. South of Penn Valley Park on the west side of Main Street is the Federal Reserve Bank of Kansas City. Potential TPSS locations exist within this segment in the area of Grand Boulevard/Warwick Trafficway. Location of a TPSS within this vicinity would be feasible.

31st Street to 43rd Street

Generally, the portion of the corridor from 31st Street to 43rd Street is a mix of mixed-use development, residential, or auto-oriented commercial sites. The former two do not allow for many candidate sites, and the latter were considered to be potential redevelopment parcels. Stepping away from Main Street going either east or west takes one into dense blocks of high-value single-family homes and small apartment buildings. Vacant lots exist in this area as well. Candidate sites, primarily privately-owned, were identified at several locations within this segment. Several other privately-owned site locations are also possible within this segment. Location of one or more TPSSs within this stretch appears to be feasible.

43rd Street to 51st Street

From 43rd Street to 51st Street there are multiple candidate sites. This coincides with the north end of the Country Club Right-of-Way (CCROW, owned by KCATA) and the existence of more public land than to the north. Location of one or more TPSS within this stretch appears to be feasible.

Chapter 4: Operational Planning & Estimated Annual Operating Costs

Existing Transit Service

Streetcar Service

The existing 2.2-mile Downtown Streetcar line operates in a north-south direction and extends from River Market to historic Union Station and provides service to Central Business District/Convention District, Power & Light District and Crown Center offering access to businesses, restaurants, galleries and residential areas. There are 16 stops located every two blocks.

The KC Downtown Streetcar line operates with ten- to twelve-minute headways, seven days a week. Hours of operation are listed below.

- Monday-Thursday: 6AM - Midnight
- Friday: 6AM - 2AM
- Saturday: 7AM - 2AM
- Sunday: 7AM - 11PM

The KC Streetcar line was designed to complement local bus service and provide a more robust transit system. The Main Street extension alignment would help to create a north-south transit spine that would connect with local and regional bus service. With its 10 minute service frequency and station spacing, the streetcar would afford an expedited trip between major regional activity centers that would also entice usage along those bus routes that connect with streetcar stations.

Bus Service

KCATA currently provides local, regional, and Bus Rapid Transit (BRT) bus service in the corridor. The primary transit service along the corridor is provided by Main MAX (Metro Area Express), a BRT service that carries approximately 4,000 weekday passenger trips within the corridor. Main MAX started operations in 2005 and was expected to be a precursor to future rail in the same corridor. Main MAX runs seven days a week from 4:00am-1:00am (later on Friday and Saturday evenings), with 10-minute headways all day during weekdays, and 15- to 30-minute headways most other times. Local bus routes provide east-west connections throughout the Main Street corridor; and regional bus connections to Kansas suburbs, eastern Jackson County communities, and the Northland occur at Union Station and at 27th Street / Main Street. Additional Kansas and local bus connections occur at 47th Street / Main Street. A streetcar extension would serve as the regional transit spine and interface with all these bus routes.

Future Transit Service

The existing streetcar operating characteristics were used to develop the proposed Streetcar Main Street Extension operating characteristics as both the existing and proposed alignments would operate as one continuous route.

To match the existing operating characteristics, the same service assumptions were used, with the addition of hours in the early morning to account for the current Main MAX service which starts earlier than streetcar service and would be replaced by the proposed Streetcar Main Street Extension service. The service schedule assumptions for typical weekday service are summarized below. Friday to Sunday service would be adjusted in the Early AM and Night time periods to accommodate projected ridership. See **Table 4-1** for service schedule assumptions.

Table 4-1 Service Schedule Assumptions

Day of Week	Start Time	End Time	Hours per Day
Monday through Thursday	4:00 AM	12:00 AM	20
Friday	4:00 AM	2:00 AM	22
Saturday	5:00 AM	2:00 AM	21
Sunday	5:30 AM	11:00 PM	17.5

Along with these service schedule assumptions, an average speed of 15.6 miles per hour was determined for the seven-mile (round trip) trip distance, along with an 8-minute layover, resulting in a total cycle time (existing downtown service plus the extension) of approximately one hour. See **Table 4-2** for a summary of project operating characteristics.

Table 4-2 Project Operating Characteristics

Operating Characteristics	Mon - Thurs	Fri	Sat	Sun
Average Speed	8-15 miles per hour for 7 miles per trip			
Layover	8 minutes			
Headway	10-12 minutes (30 early a.m.)		12-15 minutes (20 early a.m.)	12-18 minutes (30 early a.m.)
Round Trip Cycle Time	58-63 minutes			
Required Vehicles	7*			
Days per Week	4	1	1	1
Hours per Day	20	22	21	17.5
Annual Hours (52 weeks)	26,000	7,228	5,720	4,108

**The capital cost accounts for 6 new vehicles, bringing the fleet to a total of 12 (8 peak, 4 spare). The system is expected to experience at least 25 "surge" days per year, during which 8 vehicles will be needed to serve demand and meet operating requirements; and the high spare ratio is based on KCSA's operating experience. The operating budget contingency accounts for the extra revenue-hours.*

A more detailed operating plan is included in Table 4-4.

Operations and Maintenance Costs

Main Street Extension Operating Plan

The streetcar system (Starter Line plus Man Street Extension) would operate over 17.5 hours a day, seven days a week, for 365 days a year. As noted, the service schedule is set to align with existing transit operations (bus and Max services) and the schedule of operation is reported in Table 4-1.

As shown in the **Table 4-4**, the service schedule and operating assumptions would result in 43,056 annual revenue hours. The Financial Plan assumes this level of service will be maintained through 2039.

Incremental Cost Increase Estimate

Historic Starter Line streetcar operating expenses were used to develop Main Street Extension operating expenses. Specifically, 2023 Starter Line costs were projected and a percentage markup was applied to estimate the total operating cost with the new extension. Though the extension would run over twice as many operating hours than the existing route, the operating cost would only be about twice as much because of economies of scale. Beyond 2023, the Financial Plan assumes operating cost will increase approximately 2.5 percent per year. See **Table 4-3** for incremental cost assumptions.

Table 4-3. Incremental Cost Assumptions

EXPENSE	Starter Line	Main Street Extension Incremental	Total
GENERAL MANAGEMENT AND ADMIN	$1,312,780	$651,782	$1,964,562
Professional Services	$127,001	$50,800	$177,801
Marketing and Communications	$141,426	$56,570	$197,996
Insurance	$426,587	$365,670	$792,257
Administrative	$91,156	$36,463	$127,619
Payroll Expense	$442,064	$176,826	$618,889
Management/ Admin Contingency	$80,767	-$30,767	$50,000
Operations and Maintenance	$4,167,875	$4,880,445	$9,048,320
O&M Contract	$3,266,032	$4,377,717	$7,643,749
Utilities	$219,493	$219,493	$438,986
Supplemental Safety and Security	$302,652	$302,652	$605,303
Operations Support (KCATA)	$137,304	$102,978	$240,281
Operations Contingency	$215,378	-$95,378	$120,000
Capital Program	$269,223	$269,223	$538,445
Total Expense	**$5,746,098**	**$5,805,229**	**$11,551,327**

Ridership Forecast

Based on the results of the FTA Simplified Trips-on-Project Software (STOPS) ridership model, the streetcar system (Starter Line plus Main Street Extension) is projected to have 11,644 daily riders. Based on an annualization factor of 312 days, this results in an estimated 3.6 million annual riders. (See Travel Forecast Report for additional details). As noted earlier, KCSA does not charge a fare on the streetcar. As such, the Financial Plan assumes no fare revenue for the streetcar system through 2039.

Table 4-4 Kansas City Streetcar Operating Plan

Kansas City Streecar Main Street Extension + Starter Line 10/2/2018
Operating Plan

DRAFT

Distance, mi (round trip)																														
Downtown	3.8																													
Extension	7																													
Operating cost /hr	$186																													
Vehicle Spare Ratio (non-surge days)	25%																													
	Monday - Thursday							**Friday**							**Saturday**							**Sunday**							
	Early AM	AM	MD	PM	Early Eve	Eve	Night	Early AM	AM	MD	PM	Early Eve	Eve	Night	Early AM	AM	MD	PM	Early Eve	Eve	Night	Early AM	AM	MD	PM	Early Eve	Eve	Night	
Start Time	4:00 AM	5:00 AM	9:00 AM	3:00 PM	6:00 PM	8:00 PM	10:00 PM	4:00 AM	5:00 AM	9:00 AM	3:00 PM	6:00 PM	8:00 PM	12:00 AM	5:00 AM	6:00 AM	9:00 AM	3:00 PM	6:00 PM	8:00 PM	12:00 AM	6:00 AM	7:00 AM	9:00 AM	3:00 PM	6:00 PM	8:00 PM	10:00 PM	
End Time	5:00 AM	9:00 AM	3:00 PM	6:00 PM	8:00 PM	10:00 PM	12:00 AM	5:00 AM	9:00 AM	3:00 PM	6:00 PM	8:00 PM	12:00 AM	2:00 AM	6:00 AM	9:00 AM	3:00 PM	6:00 PM	8:00 PM	12:00 AM	2:00 AM	7:00 AM	9:00 AM	3:00 PM	6:00 PM	8:00 PM	10:00 PM	11:00 PM	
Days per week	4	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Headway, min	30	10	10	10	10	10	12	30	10	10	10	10	10	10	20	12	12	12	12	12	15	30	12	12	12	12	18	18	
Hours per day	1	4	6	3	2	2	2	1	4	6	3	2	4	2	1	3	6	3	2	4	2	1	2	6	3	2	2	1	
Average Speed, mph																														
Downtown	10	10	8	8	8	10	10	10	10	8	8	8	10	10	10	8	8	10	10	10	10	10	10	10	10	10	10	10		
Extension	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6		
Layover, min	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8		
TOTALS																														
Cycle Time (Travel + Layover), min	57.7	57.7	63.4	63.4	63.4	57.7	57.7	57.7	57.7	63.4	63.4	63.4	57.7	57.7	57.7	63.4	63.4	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7	57.7		
Required # vehs, raw	1.92	5.77	6.34	6.34	6.34	5.77	4.81	1.92	5.77	6.34	6.34	6.34	5.77	5.77	2.89	5.29	5.29	4.81	4.81	4.81	3.85	1.92	4.81	4.81	4.81	4.81	3.21	3.21		
Required # vehs, rounded	2	6	7	7	7	6	5	2	6	7	7	7	6	6	3	6	6	5	5	5	4	2	5	5	5	5	4	4		
Annual Hours	416	4,992	8,736	4,368	2,912	2,496	2,080	104	1,248	2,184	1,092	728	1,248	624	156	936	1,872	780	520	1,040	416	104	520	1,560	780	520	416	208		
Annual Cost	$77,376	$928,512	$1,624,896	$812,448	$541,632	$464,256	$386,880	$19,344	$232,128	$406,224	$203,112	$135,408	$232,128	$116,064	$29,016	$174,096	$348,192	$145,080	$96,720	$193,440	$77,376	$19,344	$96,720	$290,160	$145,080	$96,720	$77,376	$38,688		
Spare Vehicles	1	2	2	2	2	2	2	1	2	2	2	2	2	2	1	2	2	2	2	2	1	1	2	2	2	2	1	1		
Total Vehicles	3	8	9	9	9	8	7	3	8	9	9	9	8	8	4	8	8	7	7	7	5	3	7	7	7	7	5	5		
Total Annual Hours	43,056																													
Total Annual Op Cost	$8,008,416																													
% Layover (~15-18%)	14%	14%	13%	13%	13%	14%	14%	14%	14%	13%	13%	13%	14%	14%	14%	13%	13%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%		
Special Day Ops (First Friday, etc.) - Not incorporated in cost																														
Headway								30	10	12	9	9	9	10	20	12	9	9	12	12	12	30	15	9	9	9	9	9		
Required # vehs, rounded								2	6	6	8	8	7	6	3	6	8	7	5	5	7	2	4	7	7	7	7	7		
Peak Vehicle Requirement	8																													

Chapter 5: Ridership Analysis

Ridership Forecasts

As part of the Main Street Extension Study, ridership forecasts were developed for three scenarios identified by the Kansas City Streetcar Authority (KCSA). Forecasts were developed using the Federal Transit Administration (FTA) Simplified Trips-on-Project (STOPS) model for an existing year (2017), opening year (2023), 2027, and 2037. This technical memorandum summarizes the results of the forecast scenario modeled utilizing the FTA STOPS model.

STOPS is a stand-alone ridership model specifically created by FTA for evaluating new transit networks and is similar to a conventional four-step model that evaluates zone-to-zone travel markets based on socio-economic characteristics and the existing transit network. STOPS produces base year average weekday ridership forecasts for mobility and cost effectiveness measures and quantifies the projected change in daily automobile person miles travelled (PMT) resulting from implementation of the proposed project. STOPS has been calibrated and validated using actual ridership experience on fixed-guideway transit including bus rapid transit (BRT), light rail (LRT), commuter rail and streetcar systems across the country.

Inputs

The following section documents the inputs used in the model to develop the forecasts. The inputs include Mid-America Regional Council (MARC) socio-economic and highway skim data, existing transit system data from the KCATA, and transit survey data.

MARC Data

The current regionally-adopted adopted socio-economic data was obtained from MARC, the region's Metropolitan Planning Organization (MPO). The base year in the MARC data is 2015 and the future year is 2040. To develop the data for the existing year ridership forecast (2017) and future year ridership forecasts, including 2023 (opening year), 2027, and 2037, the population and employment data was interpolated between 2015 and 2040 to develop the inputs.

The highway travel time and distance skims were also obtained from MARC from the regional travel demand model. The 2015 and 2040 data was input into the STOPS model.

KCATA Data

The existing transit system data was obtained from the KCATA. The existing transit network general transit feed specification (GTFS) was input into the model to develop the existing transit network. The GTFS data for the realignment of Main Street MAX to Grand Avenue was also obtained for use in the no build and build scenarios. Average daily ridership by stop by route was obtained for the current transit network including Johnson County Transit routes and the existing Streetcar route.

On-Board Survey

ETC Institute completed an in-person survey on-board the Main Street MAX and KC Streetcar vehicles in August through October 2017. The primary purpose of the survey was to better understand travel patterns, trip purpose, access modes, and general demographics of transit

passengers in the Main Street corridor to assist with ridership forecasting and potential bus route modifications.

The survey field work consisted of two major elements:

- On-to-Off (O2O) survey to identify boarding and alighting paths, and
- Origin-Destination (OD) survey that includes a detailed interview of passengers on the two routes.

ETC collected 572 validated weekday responses from Main Street MAX riders and 642 validated responses from KC Streetcar riders. ETC surpassed the goal of 7.5 percent of weekday ridership surveyed. The OD survey was weighted and expanded to represent the total ridership population on both routes using existing automated passenger counter (APC) data and the O2O survey. A detailed description of the survey design, sampling procedures, methodology, and data analysis is included in a longer report, *2017 KC Streetcar and Main Street MAX On-Board Survey Methodology Report*.

The Main Street MAX and Streetcar Survey was combined with the 2005 MARC System Wide On-Board Survey to develop the transit trip tables for use in the model. The MARC survey was re-weighted using 2017 KCATA APC counts by route. The survey contained records for Route 56 which pre-dated Main Street MAX. The records that corresponded with Route 56 were removed from the survey and replaced with the Main Street MAX survey records from the 2017 survey. Because the Streetcar is a new service, the survey records for the streetcar were added to the 2005 survey. The survey records were converted into a transit trip table that was then used in the model.

Model Scenarios and Assumptions

The following sections documents the scenarios and assumptions that were used in the development of the forecasts. Three scenarios were developed including Existing, No Build, and Build models.

Existing

The existing transit system for each scenario is the system that was in place in June of 2017. The KCATA system underwent significant modifications in July and September of 2017. As a result, KCATA did not have accurate ridership data for some routes to calibrate the model. Therefore, the existing scenario was based on the system that was in place prior July 2017 – the system KCATA had reliable ridership data for.

No Build

The No Build scenario used the transit network was in place after September of 2017. This includes the re-alignment of Main Street MAX to Grand Avenue, which was implemented by the KCATA in October 2017. The No Build scenario was run with and without Prospect MAX. In the scenario with Prospect MAX, Prospect Local was also included.

Build

The Build scenario that was modeled as part of the study includes the extension of the Streetcar and the supporting modifications that were recommended in the *Transit System Integration and Modifications Report.* The following bus network modifications were coded into the model.

- **Main Street MAX:** The existing Main Street MAX route was removed, as it will be replaced with the extension of the Streetcar. A new route, Route 603, was created that will operate from 47th Street / Main Street to 75th Street / Wornall Road (the southern portion of the existing Main Street MAX route that will remain), connecting to the streetcar at the Country Club Plaza. Route 603 was coded to operate at 10-minute peak headways and 20-minute off peak headways.
- **Route 35 35th Street:** The headways were improved on Route 35 from 30-minute to 15-minute peak and midday service. Evening headways were also improved from the existing 60-minute headways to 30-minute headways. Route 35 becomes Route 635 in the model.
- **Route 39 39th Street:** Midday service on Route 39 was improved from 20-minute to 15-minute headways. Route 39 becomes Route 639 in the model.
- **Route 47 Broadway:** The existing Route 47 will be removed and replaced with two separate routes that meet at the Country Club Plaza. The eastern portion of Route 47 that operates from Blue Ridge Crossing to the Plaza becomes Route 647 in the model. The new Route 647 will operate with 20-minute peak headways and 30-minute off peak headways. The portion of Route 47 that operates from the Plaza to Downtown becomes Route 640 in the model. The new Route 640 will operate with 30-minute peak and midday headways and 60-minute early morning and evening headways.
- **Route 55 Universities-Crossroads:** The headways were improved on Route 55 from 60-minute all-day service to 30-minute all-day service. Route 55 becomes Route 655 in the model.
- **Streetcar:** The Project extension was coded into the GTFS extending the Streetcar route south from Union Station (existing south terminus) to 51st Street / Brookside Boulevard (future south terminus). The Streetcar is modeled to operate at 10-minute headways from 5:00am to 10:00pm (30-minute headways from 4:00am to 5:00am and 12-minute headways from 10:00pm to 12:00am). The extension of the Streetcar adds approximately 13.5 minutes in each direction to the existing travel time of the streetcar route. The existing Streetcar route, Route 601, becomes Route 602 in the build model.

The following stations were coded into the build model as part of the Streetcar Extension:

- Union Station northbound
- 27th Street and Main Street northbound and southbound
- 31st Street and Main Street northbound and southbound
- Armour Boulevard and Main Street northbound and southbound
- 39th Street and Main Street northbound and southbound

- 43rd Street and Main Street northbound and southbound
- 45th Street and Main Street northbound and southbound
- 47th Street/Cleaver Boulevard and Main Street northbound and southbound
- 51st Street and Brookside Boulevard combined northbound and southbound

The Build scenario also included Prospect MAX which is currently under construction.

Ridership forecasts were developed in support of the Main Street Extension Project New Starts application utilizing the guidelines of the Federal Transit Administrations Capital Investment Grant Program. In accordance with the guidelines and direction from the Federal Transit Administration, the forecasts utilized the No Build scenario that did not include Prospect MAX.

Model Assumptions

The streetcar extension in each scenario was assumed to have 10-minute headways for the entire service span. The service span was assumed to be 4:00am to 12:30am. The running times for the southern extension were developed by HDR and are shown in **Table 5-1** below.

Table 5-1: Streetcar South Extension Running time

	Streetcar	
	NB	SB
AM Peak	13.5	13.0
PM Peak	13.5	13.5

The existing park and rides in the system were assumed in the model. To assist with calibration Union Station was added as a park and ride. For the build scenarios one park and ride was added at 47th Street and Main Street.

As part of the existing scenario calibration a time penalty was added to all bus stops in the system to replicate a fare. To determine the time penalty of a fare the assumption of ten dollars equals 60 minutes was used. Using the KCATA's average fare of $0.65 a time penalty of 1.95 minutes was used. The 1.95 was added to the streetcar extension stops south of Union Station as part of modeling the fare scenario.

Results

The following table summarizes the ridership estimates based on the STOPS model for the current year (2017) and forecast years (2023, 2027, and 2037).

Table 5-2: Build Alternative 2017 Results

Route	2017 Actual	2017 Existing Stops	Difference	2017 Build Stops	Change
Main Street MAX	4,537	4,531	-6		
KC Streetcar	4,849	4,850	1	11,760	
Waldo Brookside Connector				1,140	
Corridor Total	9,386	9,381		12,900	38%
System	52,914	53,585	671	61,170	14%

The Build alternative is forecasted to produce a 38% increase in corridor ridership. The corridor ridership increases by 3,500 over the existing Main Street MAX and Streetcar. The system ridership increases by 14%. The results were compared to the existing Main Street MAX ridership by stop in the corridor, the results of this comparison are shown in **Table 5-3** below.

Table 5-3: 2017 Existing MAX Boardings Compared to 2017 Build Alternative Model Results

Station	MAX Boardings	Build Alt 1 Boardings
ON BROOKSIDE BTW 51ST TER AND 51ST ST NB	48	460
ON JC NICHOLS PKWY BTW WARD PKWY AND 47TH NB	406	517
ON MAIN BETWEEN 45TH AND 44TH NB	41	248
ON MAIN AT 43RD NB	162	145
ON MAIN AT 39TH NB	427	473
ON MAIN AT ARMOUR NB	183	335
ON MAIN AT LINWOOD NB	93	-
ON MAIN AT 31ST NB	130	422
ON MAIN AT 29TH NB	9	-
ON MAIN AT 27TH NB	-	301
ON GRAND ACROSS FROM CROWN CENTER NB	59	-
ON MAIN AT UNION STATION NB	67	660
ON MAIN AT UNION STATION SB	77	488
ON GRAND AT PERSHING CROWN CTR	280	-
ON MAIN AT 27TH SB	-	285
ON MAIN AT 29TH SB	12	-
ON MAIN AT 31ST SB	164	330

ON MAIN AT LINWOOD SB	76	-
ON MAIN AT ARMOUR SB	138	396
ON MAIN AT 39TH SB	223	466
ON MAIN AT 43RD SB	44	104
ON MAIN AT 45TH SB	5	184
ON JC NICHOLS PKWY AT 47TH	223	551
ON BROOKSIDE AT 51ST SB	16	-

Ridership is projected to increase at all stations except for the 43rd NB station. This is likely due to the model over assigning trips to 45th Street due to the proximity of the two stops. The existing Crown Center ridership is split being the Union Station stops and the 27th Street stops.

Table 5-4: Future Streetcar Ridership Forecasts – 2017 to 2037 Build

Year	Forecast	% Change
2017	11,760	
2023	12,890	9.6%
2027	13,330	3.4%
2037	14,230	6.8%

Table 5-4 shows the future year ridership forecasts for the Build alternative and the percent change between each forecast year. The growth in ridership between 2017 and 2037 for each scenario is between 21%.

Conclusion

The streetcar ridership forecasts illustrate the benefits that the project will provide in the corridor. The streetcar Build alternative provides an increase in ridership of 25%. The increase in system ridership of 14% shows that the streetcar will provide an overall benefit to the system through improved connections. The increases in ridership are reasonable and would be expected with this level of transit investment.

Chapter 6: Capital Cost Estimate

Capital Cost Methodology

The capital cost estimate is based on quantities taken from the Preliminary Concept Outside-Running design CADD files and reflects the following activities, which are described in this section: establish project segmentation, identify project elements and measure quantities; develop a cost library; and prepare cost estimate.

ESTABLISH PROJECT SEGMENTATION

The overall project was divided into nine distinct segments to provide flexibility in reporting costs. These segments are tied generally to geographic locations that make up the Project and most construction costs and associated non-construction costs can be summarized by these geographical segments:

Zone 1: Downtown Alignment to 27th Street;
Zone 2: 27th Street to 31st Street;
Zone 3: 31st Street to Armour Boulevard;
Zone 4: Armour Boulevard to 39th Street;
Zone 5: 39th Street to 43rd Street;
Zone 6: 43rd Street to 45th Street;
Zone 7: 45th Street to Ward Parkway;
Zone 8: Ward Parkway to 51st Street; and
Zone 9: Vehicle Maintenance Facility Location.

IDENTIFY PROJECT ELEMENTS AND MEASURE QUANTITIES

Preliminary bid items were identified through the process of quantity takeoffs using the Preliminary Concept Outside-Running design files. The items were comprehensive enough to adequately define the aspects of project construction while reflecting the level of design development and quantities that could be readily measured.

DEVELOP COST LIBRARY

The cost library is a compilation of all construction and non-construction items contained within the cost estimate, with the items presented in calendar year Q3 2018 dollars. The items are characterized by unit price, lump sum cost, and allowance.

- **Unit Costs:** Unit costs represent basic construction elements such as roadway excavation, import borrow, curb and gutter, etc. that are typically bid by a contractor on a given project. Unit pricing prices for these items are developed primarily through a production-based methodology in the same format as a bidding contractor self-performing the work. Developed unit pricing is considered to be a direct cost – including all activities and materials associated with completing the actual work, but excluding all indirect supervision, mobilization, overhead and profit.

- **Lump Sum Costs:** Lump sum costs are included in the estimate to provide for negotiated and budgeted fees for administrative and project management activities. For example, the program cost estimate is carrying many assumed costs for engineering, program management or other services as lump sum costs.

- **Allowances and Percentage-Based Costs:** Allowances and percentage-based costs are intended to capture elements known to be a part of this type of project, but not known and/or

defined at the time the estimate was prepared (for example, mobilization, traffic control, contractor indirect costs, etc.). These costs are based on historical sources or prevailing experience. As the design progresses and these elements are defined, these costs will be converted to other cost types.

PREPARE COST ESTIMATE

The project costs described above were transferred over to a spreadsheet workbook that was developed for the capital cost estimate. In general, individual tables were created to hold specific information such as the cost library, segmentation, quantity takeoff, work categorization, Standard Cost Category (SCC) coding, schedule association, etc. These tables are compiled in the Base Cost Estimate worksheet via lookup or other formulaic methodology. This approach provides consistency for elements that are distributed in a variety of locations throughout the estimate. In addition, it provides a single database from which various summaries can be easily generated to provide response to a wide variety of potential information requests. This data is then input into the main FTA worksheet.

ESTIMATE EXCLUSIONS

- Market Adjustment Factor. The Market Adjustment Factor is above and beyond the typical contractor mark-ups and current but normal escalation factors. It covers the potential influence of an abnormal bidding environment such as a lack of competition among contractors (contractors being busy or selectively bidding jobs), competition for construction personnel that requires contractors to pay wage premiums to retain key workers and management staff, and abnormal increases or decrease in fuel and material costs.
- Hazardous or contaminated material abatement and/or removal.
- 3rd party utilities, impacts, relocation and/or any delays that could be caused by them.
- Cost reductions based on 3rd party funding or grants.
- Unforeseen conditions due to additional borings or geotechnical information.
- Special environmental considerations and mitigation.
- All other costs not specifically called out in this report or in the estimate.

ASSUMPTIONS

Finally, the following major assumptions were made when developing the cost estimate:

- Escalation for overtime and expedited schedule have not been applied.
- The costs included in the estimate are in 2018 dollars.
- Total contingency is set at 32.23 percent. Although current FTA guidance would indicate a contingency of 30 percent at this level of planning and design, the higher value was selected in anticipation of potential P65 risk-assessment requirements. Division between allocated and unallocated contingency is described in Section 2.2.
- The cost estimate includes escalation of base year costs to YOE based on preliminary project construction schedules provided by the design team. In general, construction costs

for various cost components such as guideway or paving are assigned to the construction year in which they are assumed to be constructed. Each component is linked to a scheduled activity and escalated to year of construction for that particular element, and combined with other elements to provide the YOE cost. A simplified process is necessary within the SCC Workbooks, however, as this flexibility is not a part of the methodology. Therefore, a 3.5 percent annual escalation rate is assumed for this cost estimate, and within the SCC Workbooks

- Unit costs as shown in the cost library reflect total construction costs including overhead and profit.
- This cost estimate currently reflects a design-bid-build delivery method with a sufficient number of bidders to provide a competitive bidding environment.
- Imported construction materials such as fill and concrete are available in sufficient quantities from local suppliers, and that waste material can be disposed of within a reasonable haul distance from the project location.

Capital Cost Estimate by FTA Standard Cost Category

Based on the previously described methodology, the current implementation schedule summarized previously, and annual escalation for construction costs, the detailed cost estimate for Main Street Extension Project is shown in **Table 6-1**. As shown in the table, the total capital cost of the Project, is $279.6 million (2018$) or $316.6 million (YOE$).

Table 6-1. Streetcar Project Capital Cost Estimate
(2018 $ and YOE $, in million)

FTA Standard Cost Category	2018	2019	2020	2021	2022	2023	Total
10—Guideways and Track Elements	$0.0	$0.0	$3.3	$19.8	$9.9	$0.0	$33.0
20—Stations, Stops, Terminals, Intermodal	$0.0	$0.0	$1.0	$4.0	$4.0	$0.0	$9.1
30—Support Facilities: Yards, Shops, Admin. Buildings.	$0.0	$0.0	$0.0	$3.9	$11.6	$0.0	$15.4
40—Sitework and Special Conditions	$0.0	$0.0	$18.2	$6.2	$13.8	$0.0	$38.1
50—Systems	$0.0	$0.0	$21.0	$39.8	$0.0	$0.0	$60.8
60—ROW, Land, Existing Improvements	$0.0	$0.0	$0.2	$0.4	$0.4	$0.0	$0.9
70—Vehicles	$0.0	$0.0	$0.0	$0.0	$53.1	$0.0	$53.1
80—Professional Services	$2.8	$11.2	$10.1	$10.0	$12.1	$1.9	$48.1
90—Unallocated Contingency	$0.3	$1.0	$4.6	$7.0	$7.9	$0.2	$21.0
100—Finance Costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Total (2018 $)	**$3.1**	**$12.3**	**$58.4**	**$91.0**	**$112.8**	**$2.0**	**$279.6**
Escalation Rates	**1.02**	**1.05**	**1.09**	**1.13**	**1.17**	**1.21**	
Total (YOE $)	**$3.1**	**$12.9**	**$63.7**	**$102.7**	**$131.7**	**$2.5**	**$316.6**

Totals may not sum due to rounding.

CONTINGENCIES

As described in the Capital Cost Methodology summary, the capital cost estimate includes a total contingency of $69.8 million (2018 $) for both allocated and unallocated contingencies. This is equivalent to 32.23 percent of the base year dollars for all categories (cost categories 10 through 80) and 44.5 percent of the construction categories (cost categories 10 through 50). As mentioned previously, the 32.23 percent was chosen in anticipation of P65 risk-assessment requirements.

- **Allocated Contingencies**: **Table** summarizes the allocated contingencies included by SCC category to address the level of design, scope, and quantity definition at this phase of the Project. The amount of allocated contingency depends on the complexity of any particular item as well as the stage of engineering completion. As shown in the table, at this point of the Project Development process, the allocated contingencies for all cost categories and the total level of allocated contingency included in the capital cost estimate is 22.23 percent of total base year costs (2018 $). As part of FTA's risk assessment process, which will occur later in the project development process, individual contingencies will be evaluated and appropriate allocations based on the determined level of risk.

- **Unallocated Contingency:** The unallocated contingency was included to address bid risk and construction risk in addition to the aforementioned allocated contingencies. Unallocated contingency is intended to address "unknown unknowns," to cover unanticipated events, including political events, labor strife, weather, differing site conditions, commodity pricing fluctuations, unfavorable market conditions, bid risk, etc. A 10.0 percent unallocated contingency was applied to the total base year dollars (2018 $) for cost categories 10 through 80.

Table 6-2. Allocated Contingency Assumptions

	SCC Category and Description	Allocated Contingency Percentage
10 GUIDEWAY & TRACK ELEMENTS (route miles)		**20%**
10.10	Track: Embedded	20%
10.12	Track: Special (switches, turnouts)	20%
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)		**20%**
20.01	At-grade station, stop, shelter, mall, terminal, platform	20%
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS		**30%**
30.02	Light Maintenance Facility	30%
30.05	Yard and Yard Track	30%
40 SITEWORK & SPECIAL CONDITIONS		**27%**
40.01	Demolition, Clearing, Earthwork	35%
40.02	Site Utilities, Utility Relocation	50%
40.06	Pedestrian / bike access and accommodation, landscaping	26%
40.07	Automobile, bus, van accessways including roads, parking lots	25%
40.08	Temporary Facilities and other indirect costs during construction	18%
50 SYSTEMS		**20%**
50.01	Train control and signals	20%
50.02	Traffic signals and crossing protection	20%
50.03	Traction power supply: substations	20%
50.04	Traction power distribution: catenary and third rail	20%
50.05	Communications	20%
50.06	Fare collection system and equipment	20%
Construction Subtotal (10 - 50)		**23%**
60 ROW, LAND, EXISTING IMPROVEMENTS		**N/A**
70 VEHICLES (number)		**40%**
70.01	Light Rail	40%
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)		**10%**
80.01	Project Development	10%
80.02	Engineering	10%
80.03	Project Management for Design and Construction	10%
80.04	Construction Administration & Management	10%
80.05	Professional Liability and other Non-Construction Insurance	0%
80.06	Legal; Permits; Review Fees by other agencies, cities, etc.	10%
80.07	Surveys, Testing, Investigation, Inspection	10%
80.08	Start up	10%
Subtotal (10 - 80)		**23%**

Professional Services

Costs for professional services include elements such as project management, engineering, construction administration, insurance, inspections, fees/permits, and start-up costs (covering project initiation work such as training, site access, and protection work performed by agency staff and outside contractors). In some instances, these have been represented as a percentage of the construction cost, and in other cases as an assessment of commitments in place at the time and any anticipated adjustments. **Table 6-3** summarizes the percentages assumed in each subcategory in relation to the base year construction estimate (cost categories 10 through 50).

Table 6-3. Professional Services Percentage Assumptions

FTA Category No.	Description	Percent of Construction Costs
80.01	Project Development	4.0%
80.03	Project Management	8.0%
80.04	Construction Administration	8.6%
80.05	Professional Liability Insurance	10.4%
80.06	Legal/Permits	0.0%
80.07	Surveys, Testing, Inspection	1.0%
80.08	Start-Up	0.8%

MAIN WORKSHEET-BUILD ALTERNATIVE

(Rev.19, June, 2017)

Kansas City SC

Kansas City Streetcar

Today's Date 11/6/18

Yr of Base Year $ 2018

Yr of Revenue Ops 2023

	Quantity	Base Year Dollars w/o Contingency (X000)	Base Year Dollars Allocated Contingency (X000)	Base Year Dollars TOTAL (X000)	Base Year Dollars Unit Cost (X000)	Base Year Dollars Percentage of Construction Cost	Base Year Dollars Percentage of Total Project Cost	YOE Dollars Total (X000)
10 GUIDEWAY & TRACK ELEMENTS (route miles)	**3.50**	27,509	5,502	**33,011**	**$9,432**	**21%**	**12%**	**37,831**
10.01 Guideway: At-grade exclusive right-of-way	0.10			0	$0			0
10.02 Guideway: At-grade semi-exclusive (allows cross-traffic)				0				0
10.03 Guideway: At-grade in mixed traffic	3.40			0	$0			0
10.04 Guideway: Aerial structure				0				0
10.05 Guideway: Built-up fill				0				0
10.06 Guideway: Underground cut & cover				0				0
10.07 Guideway: Underground tunnel				0				0
10.08 Guideway: Retained cut or fill				0				0
10.09 Track: Direct fixation				0				0
10.10 Track: Embedded		25,427	5,085	30,513				34,968
10.11 Track: Ballasted				0				0
10.12 Track: Special (switches, turnouts)		2,082	416	2,498				2,863
10.13 Track: Vibration and noise dampening				0				0
20 STATIONS, STOPS, TERMINALS, INTERMODAL (number)	**16**	7,177	1,435	**8,613**	**$538**	**6%**	**3%**	**9,936**
20.01 At-grade station, stop, shelter, mall, terminal, platform	16	7,177	1,435	8,613	$538			9,936
20.02 Aerial station, stop, shelter, mall, terminal, platform				0				0
20.03 Underground station, stop, shelter, mall, terminal, platform				0				0
20.04 Other stations, landings, terminals: Intermodal, ferry, trolley, etc.				0				0
20.05 Joint development				0				0
20.06 Automobile parking multi-story structure				0				0
20.07 Elevators, escalators				0				0
30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	3.50	11,868	2,967	**14,835**	**$4,239**	**10%**	**5%**	**17,175**
30.01 Administration Building: Office, sales, storage, revenue counting				0				0
30.02 Light Maintenance Facility		9,807	2,452	12,259				14,192
30.03 Heavy Maintenance Facility				0				0
30.04 Storage or Maintenance of Way Building				0				0
30.05 Yard and Yard Track		2,061	515	2,577				2,983
40 SITEWORK & SPECIAL CONDITIONS	3.50	29,932	7,947	**37,879**	**$10,823**	**25%**	**14%**	**42,165**
40.01 Demolition, Clearing, Earthwork		2,745	969	3,714				4,135
40.02 Site Utilities, Utility Relocation		5,692	2,846	8,538				9,504
40.03 Haz. mat'l, contam'd soil removal/mitigation, ground water treatments				0				0
40.04 Environmental mitigation, e.g. wetlands, historic/archeologic, parks				0				0
40.05 Site structures including retaining walls, sound walls				0				0
40.06 Pedestrian / bike access and accommodation, landscaping		2,106	558	2,664				2,965
40.07 Automobile, bus, van accessways including roads, parking lots		3,315	836	4,151				4,620
40.08 Temporary Facilities and other indirect costs during construction		16,074	2,738	18,812				20,941
50 SYSTEMS	3.50	50,672	8,747	**59,419**	**$16,977**	**39%**	**21%**	**69,007**
50.01 Train control and signals		516	88	604				701
50.02 Traffic signals and crossing protection		4,424	885	5,309				6,165
50.03 Traction power supply: substations		16,472	2,800	19,273				22,383
50.04 Traction power distribution: catenary and third rail		17,758	3,019	20,777				24,130
50.05 Communications		10,325	1,755	12,080				14,029
50.06 Fare collection system and equipment		1,059	180	1,239				1,439
50.07 Central Control		118	20	138				160
Construction Subtotal (10 - 50)	3.50	127,158	26,598	**153,756**	**$43,930**	**100%**	**56%**	**176,114**
60 ROW, LAND, EXISTING IMPROVEMENTS	3.50	520	364	**884**	**$253**		**0%**	**1,004**
60.01 Purchase or lease of real estate		520	364	884				1,004
60.02 Relocation of existing households and businesses				0				0
70 VEHICLES (number)	**6**	37,950	15,180	**53,130**	**$8,855**		**19%**	**62,035**
70.01 Light Rail		34,500	13,800	48,300				56,395
70.02 Heavy Rail				0				0
70.03 Commuter Rail				0				0
70.04 Bus				0				0
70.05 Other				0				0
70.06 Non-revenue vehicles				0				0
70.07 Spare parts	6	3,450	1,380	4,830	$805			5,640
80 PROFESSIONAL SERVICES (applies to Cats. 10-50)	3.50	43,601	4,360	**47,961**	**$13,703**	**31%**	**17%**	**53,502**
80.01 Project Development		5,086	509	5,595				6,241
80.02 Engineering		10,173	1,017	11,190				12,483
80.03 Project Management for Design and Construction		10,994	1,099	12,093				13,490
80.04 Construction Administration & Management		13,216	1,322	14,537				16,217
80.05 Professional Liability and other Non-Construction Insurance				0				0
80.06 Legal; Permits; Review Fees by other agencies, cities, etc.		1,272	127	1,399				1,560
80.07 Surveys, Testing, Investigation, Inspection		954	95	1,049				1,170
80.08 Start up		1,907	191	2,098				2,340
Subtotal (10 - 80)	3.50	209,229	46,503	**255,731**	**$73,066**		**92%**	**292,655**
90 UNALLOCATED CONTINGENCY				**20,923**			**8%**	**23,923**
Subtotal (10 - 90)	3.50			**276,654**	**$79,044**		**100%**	**316,578**
100 FINANCE CHARGES				**0**			**0%**	**0**
Total Project Cost (10 - 100)	3.50			**276,654**	**$79,044**		**100%**	**316,578**
Allocated Contingency as % of Base Yr Dollars w/o Contingency				22.23%				
Unallocated Contingency as % of Base Yr Dollars w/o Contingency				10.00%				
Total Contingency as % of Base Yr Dollars w/o Contingency				32.23%				
Unallocated Contingency as % of Subtotal (10 - 80)				8.18%				
YOE Construction Cost per Mile (X000)								$50,318
YOE Total Project Cost per Mile Not Including Vehicles (X000)								$72,727
YOE Total Project Cost per Mile (X000)								$90,451

Chapter 7: Regional Transit Coordination Integration Strategy

The investment in an extension along Main Street south to the Country Club Plaza and UMKC will be the largest transit investment Kansas City has undertaken. A purpose and need for transit integration was developed at the beginning of the study to define the purpose of the project and develop objectives. Objectives of transit system integration and modifications include the following.

- **Streetcar as the spine.** The Streetcar will provide more direct service with greater capacity between the UMKC and Plaza activity centers and downtown compared with Main Street MAX. The Streetcar has also shown the ability to attract choice riders and visitors, an important consideration in the Main Street Corridor.
- **Reduce operating cost.** Main Street MAX has an annual operating cost of nearly $5 million. The Streetcar's operating cost would be covered by revenues from the TDD, allowing KCATA to reallocate the annual investment in MAX to other services to improve overall transit service.
- **Establish network connections.** Main MAX is an integral part of the transit network with over 60 percent of passengers transferring from other connecting routes. The Streetcar must address this connectivity and enhance the function of the Streetcar as the spine. This may include reconfiguring other services to connect with the Streetcar line.
- **Enhance service in the corridor.** The Main Street corridor is one of the most important in the metropolitan area with activity centers such as Crown Center, the Country Club Plaza and UMKC. The corridor also has the highest residential densities in Kansas City and a transit favorable mix of commercial land uses. Beyond UMKC, the Brookside and Waldo neighborhoods have relatively high population densities and a strong orientation to downtown for work and other trips. The Streetcar investment is an opportunity to significantly increase transit market share in this corridor.
- **Create permanent facilities.** Transit facilities can elevate the visibility of transit services and provide a more attractive environment for accessing transit services. Stations at transfer locations will be designed to facilitate transferring passengers. Terminal facilities at the Plaza and UMKC stations are especially important because they need to accommodate transit vehicles from other routes and make transferring between bus routes and the streetcar easy. The terminus stations and other key Streetcar stations may also be candidates for mobility hubs.

The KC Streetcar service must be completely integrated with existing and planned bus services. The Main Street Extension requires substantial modifications to the existing bus transit network, including the elimination of Main Street MAX (Main MAX). This report summarizes the conclusions and recommendations regarding bus transit modifications.

Main MAX Conclusions

- **Main MAX should be discontinued as the Streetcar will provide adequate capacity, operate at similar service levels, and obtain faster running times.** The Streetcar will provide more than adequate capacity in the Main Street corridor (even if ridership in the corridor doubles) and will operate at equivalent service levels to Main MAX. The operating cost savings from discontinuing Main MAX are substantial as Main MAX has an annual operating cost of $4.9 million in allocated cost and $3.2 million in incremental

cost. Thus, discontinuing MAX service along the Streetcar route and along Grand in downtown is recommended.

- **A direct express route in the peak periods is not warranted.** There are more existing riders making a one-seat trip in the reverse peak direction and as many midday riders as peak riders. Travel time can remain similar, if not improved, with a timed transfer between a new bus Waldo-Brookside connector and the KC Streetcar.
- **A new Waldo-Brookside connector route should be created to cover the portion of Main MAX between the Plaza and Waldo areas.** This portion of the route accounts for a significant portion of existing Main MAX ridership (approximately 15 percent).

Northern Conclusions

3rd & Grand Connections and the Riverfront Streetcar Extension

- Currently routes 10, 55, 85 and 103 layover at this location, in addition to Main MAX. Routes 77 and 201 also serve the location.
- No changes to this service plan are recommended at this time. A planned TOD at this location may require altering the service plan in the future.

Grand Avenue

- Main MAX operates on Grand Avenue but will be replaced with the Streetcar that will not directly serve Crown Center or the Grand Avenue corridor downtown affecting riders destined specifically for locations east of Grand Avenue in downtown. The most significant group of existing riders affected are those going to or from the Government District. They will have a slightly longer walk, but will continue to be well served by transit with frequent connections along the transit emphasis corridor (TEC) on 11th and 12th streets in downtown.

Crown Center and Hospital Hill Connectivity

- The Streetcar will not directly serve Crown Center or Hospital Hill; thus, a shuttle may improve connectivity among the Union Station, Crown Center, and Hospital Hill areas. Several shuttle alignments were considered that connect to the Union Station and 27th Street Streetcar stations, but are not recommended at this time.

Union Station

- Several routes will connect to the Streetcar at Union Station including local routes 23, 27, 51, and 237, and express commuter routes 403, 404, 435, 519, 550, 563, 569, 570, 571, and 595. Additional space for layovers or extended dwell times is not needed.

Route 23 23rd Street

- No recommended changes to route alignment or service level.

Route 27 27th Street

- No recommended changes to route alignment or service level.

Bus Interface at 27th Street

- Several routes turn around at either 27th Street or Grand and Main Street. This includes 77 Casino Cruiser, 201 North Oak, 229 Boardwalk-KCI, 236 East Gladstone, and 237 West Gladstone. Express routes include 404 Metcalf-Downtown, 435 JOCO Downtown

Midday, 519 Olathe Express, 563 Shawnee Express, 569 South OP Express, and 595 Gardner-OP Express. Existing routes 201 North Oak and 77 Casino Cruiser currently layover at this location. The planned facility should also allow space for an additional layover for future Independence MAX, currently in the initial planning stage.

- The site design of the 27th Street KC Streetcar station needs to accommodate bus turns, layovers, and facilitate transfers. The facility will require four off-street bus bays and pedestrian amenities. (See **Figure 7-1** for existing bus routing in the vicinity of 27th Street.)

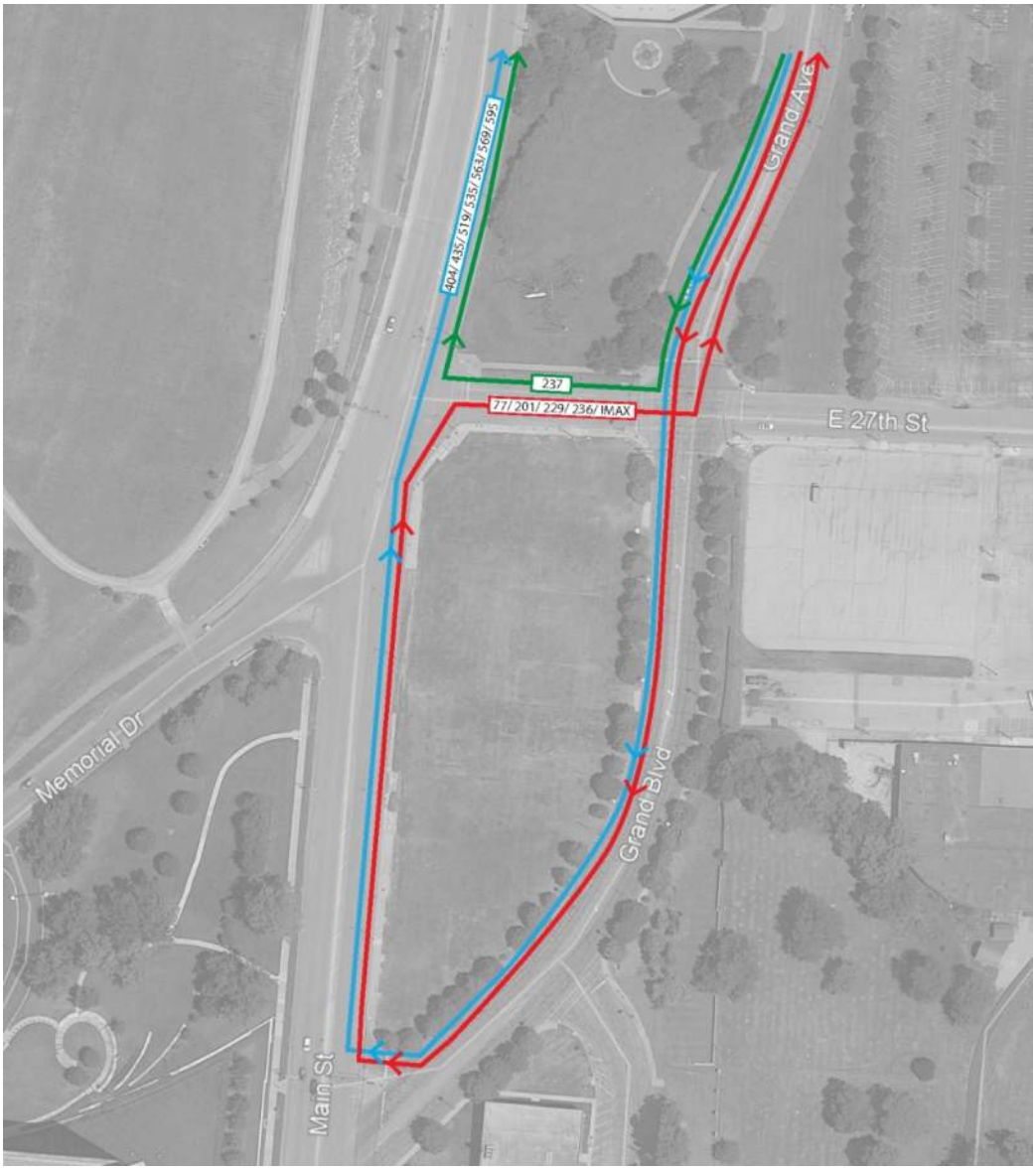


Figure 7-1: Bus Routing at 27th Street

Route 85 Paseo

- Route 85 Paseo currently operates on Gillham Road and Pershing Road to Grand Boulevard through Crown Center. Once construction on 27th Street has concluded, Route 85 could be re-routed to McGee Trafficway and 27th Street to Grand Boulevard through the Crown Center shops. This allows for direct access to the heart of Crown Center and facilitates a nearby transfer to the Streetcar. This change will have no significant effect on cost.

Midtown Conclusions

31st Street and Linwood Boulevard Area

- There are operational benefits to the Streetcar system by limiting the number of stops. A single stop at 31st Street has been recommended (rather than stops at both 31st Street and Linwood Boulevard) based on transit regional connectivity, bus integration objectives, existing ridership, pedestrian demand, economic development potential, and locally expressed desire.
- Route 31 ridership supports 15-minute service and the existing service level should remain (with 30-minute headways in the evening) with the extension of the Streetcar.

Route 35 35th Street

- Route 35 35th Street currently operates on Main Street between Armour Boulevard and Westport Road. It is recommended that Route 35 operate continue this alignment.
- Route 35 currently operates 30-minute headways for the majority of the day (one-hour frequency in the evening). Ridership supports increased frequency; it is recommended to increase peak and midday frequency to 15-minute headways and operate 30-minute frequency in the early morning and evening periods. The existing annual incremental operating cost of Route 35 is just over $700,000 and the estimated incremental operating cost with increased frequency is almost $1,270,000; an increase of $565,000 annually.

Route 39 39th Street

- No changes are recommended for the routing of the 39th Street route.
- The intersection of 39th Street and Main Street is a high transfer location today and will continue to be an important node on the Streetcar line. The Streetcar station(s) at 39th Street may require additional platform capacity and special attention to pedestrian crossings.
- Route 39 ridership supports frequent service; midday headways should be increased from 20-minute to 15-minute headways. Thirty-minute service should remain in the evenings.

Connectivity in the 43rd Street and 45th Street Area

- Saint Luke's Hospital and associated medical facilities is the largest employment site in the area and an important destination. The area is difficult to serve with east-west fixed route transit due to topography and barriers in the street grid; the area has no existing cross-town routes (the closest being Route 39 to the north and Route 47 to the south). An enhanced pedestrian connection to Saint Luke's should be considered. This area may be a prime location for an innovative service delivery model and should be considered by the Planning and Innovative Service Delivery Departments of KCATA.

North/South Corridors West of Main Street

- Route 47 Broadway is an east-west route east of the Plaza, but Route 47 is a north-south route between the Plaza and downtown. It is recommended to break Route 47 at the Plaza and replace the north-south portion of the route with a new Route 40 covering the north-south portion of the route. Breaking the long route will help make the service more reliable.
- Route 55 Universities-Crossroads also originates southeast of the Plaza and operates to 3rd and Grand via Southwest Trafficway. It is recommended to maintain the existing routing on Route 55 and increase service to 30-minutes.
- Route 51 Ward Parkway also operates on Southwest Boulevard north of the Plaza. No changes are recommended to Route 51.

Southern Conclusions

Serving the Country Club Plaza

- The Plaza streetcar stop will be located south of the intersection of 47th Street and Main Street/Brookside Boulevard and may not effectively serve the greater Plaza area and West Plaza neighborhoods.
- There are three options to provide transit connections to the Plaza: 1) rely on existing routes (35, 55, and 401), 2) route the proposed Waldo/Brookside connector along 47th Street into the Plaza, or 3) operate a Plaza shuttle that connects to the Plaza Streetcar station. These options will be evaluated further in the next planning phase of the KC Streetcar extension.
- Routes extending south and east from the Plaza should connect to the Streetcar station with convenient transfers at an off-street facility designed for bus/Streetcar interface.
- The bus connection to the Waldo Brookside area should be a premium service to offset the required transfer to the Streetcar. This includes making the route as direct as possible. To ensure efficient bus operations, a two-way Ward Parkway may be necessary between Baltimore Avenue and Brookside Boulevard. Several routing options and concepts were evaluated as part of this work.

Waldo-Brookside Connector

- The connector should provide direct access to the Streetcar station via Brookside Boulevard over Brush Creek rather than via Main Street between 51st Street and Brush Creek.
- The connector should match Streetcar frequency and include a timed transfer to the Streetcar that is convenient and minimizes walk distances with a high level of passenger amenities.

51st Street and Brookside

- The Streetcar will connect to the UMKC campus shuttle and Waldo-Brookside connector at the 51st Street transit center. The center may require off-street bus staging for UMKC campus buses and one on-street bus bay or zone. This station is a secondary transfer location and a platform designed for shared use with buses may be required.

Route 57 Wornall

- It is recommended that Route 57 remain as is with a transfer in Waldo to the Waldo-Brookside Connector. There is currently a transfer between Route 57 and Main MAX at 75th and Wornall.
- It is recommended to not interline the Waldo-Brookside connector with Route 57 due to the potentially long length of the route, reliability problems, and difference service frequency.

Route 47 Broadway

- It is recommended to break existing Route 47 and replace the northern portion of the route with a new Route 40 Broadway. Breaking Route 47 will improve service reliability and allow for increased frequency on the eastern portion of the route, better serving east neighborhoods and providing enhanced connections to the Streetcar.
- It is recommended to terminate Route 47 just south of the Plaza. After serving the Plaza in the inbound direction, the route can cover the portion of Main Street south of Brush Creek that is currently served by Main Street MAX.

Route 55 Universities - Crossroads

- Route 55 serves eastside neighborhoods along 55th Street and 51st Street as far east as Cleveland Avenue. Service should be improved to 30 minutes in keeping with the objective to improve connectivity between eastside neighborhoods and the Streetcar. This service improvement will also enhance east-west service through the university area and improve service on Southwest Trafficway.

Route 401 Metcalf-Plaza

- Route 401 Metcalf-Plaza serves Johnson County and terminates at Johnson County Community College. Route 401 is one of the highest performing Johnson County routes. Existing service levels (weekday service at one-hour headways and 30-minute peak headways) should be maintained with the extension of the streetcar.

Cost Estimates

Weekday Service Options and Cost Estimates

Costs were developed for a variety of service changes in addition to those shown below. This table represents the recommended changes related to the extension of the KC Streetcar. If all recommended service adjustments are implemented, KCATA's costs would increase by roughly $411,000 annually.

#	Route	Existing	Proposed	Difference	Δ Buses (PM)	Explanation
MMAX	Main Street MAX	$2,524,000	$0	-$2,524,000	-8	Eliminate Main Street MAX
WBC	Waldo-Brookside Connector (new)	$0	$794,000	$794,000	+4	Add new connector between Plaza and Waldo areas with 10-min peak and 20-min off-peak headways
23	23rd Street	----------				*No Change*
27	27th Street	----------				*No Change*
31	31st Street	----------				*No Change*
35	35th Street	$704,000	$1,269,000	$565,000	+3	Change from majority 30-min all day service to 15-min peaks and midday; 30 min early morning and evening
39	39th Street	$1,250,000	$1,367,000	$117,000	0	Change from 20-min midday headway to 15-min midday headway (maintain 30-min evening headway)
47	Broadway (existing)	$1,203,000	$0	-$1,203,000	-5	Eliminate existing route
47	East Hills (new)	$0	$1,547,000	$1,547,000	+3	New route from Blue Ridge Crossing to 51st St & Brookside (routed through the Plaza) with 30-min all day service and 20-min peak service
40	Broadway (new)	$0	$425,000	$425,000	+2	New route between Downtown and Plaza following previous #47 alignment; 30-min peak/midday service and 60-min early am and evening
55	Universities Crossroads	$466,000	$1,156,000	$690,000	+2	Change headway from 60 to 30 minutes (all day) & extend service span
57	Wornall	----------				*No Change*
85	Paseo	$0	$0	$0	0	Re-route to Grand between McGee Trafficway and Pershing
200s	Northland Rts	----------				*No Change*
400s	Johnson County Rts	----------				*No Change*
500s	Express Rts	----------				*No Change*
	Total			**$411,000**	**-8 MAX Buses +4 Waldo-Brookside Connector vehicles* +5 Regular vehicles**	

Note: Costs shown are based on annual incremental costs unless otherwise noted. Incremental costs are those that vary directly with the level of service. Incremental costs are regarded as a better estimate of the effect on the operating budget.
* Waldo-Brookside Connector route could deploy uniquely branding vehicles. If uniquely branded vehicles are not pursued, then there would be an increase of nine regular vehicles during the PM Peak time period (highest demand period).

Weekend Service Options and Cost Estimates

If all recommended weekend service adjustments are implemented, KCATA would incur an additional cost of approximately $80,000 annually.

Route / Option	*Existing*	*Proposed*	*Difference*	*Δ Buses (Midday)*	*Explanation*
Main Street MAX (Saturday)	$338,000	$0	-$338,000	-5	Eliminate Main Street MAX
Main Street MAX (Sunday)	$225,000	$0	-$225,000	-4	Eliminate Main Street MAX
Waldo-Brookside Connector (Saturday)	$0	$117,000	$117,000	+2	Add new connector with 20-min headways
Waldo-Brookside Connector (Sunday)	$0	$99,000	$99,000	+2	Add new connector with 30-min headways
35th Street (Saturday)	$87,000	$123,000	$36,000	+1	Headway from 45 to 30 minutes in morning, midday, and evening peak periods
Existing Broadway (Saturday)	$163,000	$0	-$163,000	-2	Eliminate existing Broadway route
Existing Broadway (Sunday)	$135,000	$0	-$135,000	-2	Eliminate existing Broadway route
East Hills (Saturday)	$0	$191,000	$191,600	+3	Blue Ridge Crossing to 51st St & Brookside (through Plaza) 30-min all day; 60-min early and evenings
East Hills (Sunday)	$0	$159,000	$159,000	+3	Blue Ridge Crossing to 51st St & Brookside (through Plaza) 30-min all day
Broadway (Saturday)	$0	$86,000	$86,000	+2	Downtown to Plaza; maintain existing headways and alignment
Broadway (Sunday)	$0	$48,000	$48,000	+1	Downtown to Plaza; maintain existing headways and alignment
Universities-Crossroads (Saturday)	$0	$109,000	$109,000	+2	Replace 47 north of Plaza service (60-minute headway)
Universities-Crossroads (Sunday)	$0	$96,000	$96,000	+2	Add service to replace 47 north of Plaza
Total			**$80,000**		

Note: Costs shown are based on annual incremental costs unless otherwise noted. Incremental costs are those that vary directly with the level of service. Incremental costs are regarded as a better estimate of the effect on the operating budget.

Chapter 8: Public Engagement and Communications

The objective of the public and stakeholder engagement in this phase of the project was to provide the public with balanced and objective information to assist them in understanding the trade-offs involved with the various options so that the public could provide meaningful feedback on the alternatives considered. The public input gathered through this process helped inform the Project Management Team's selection of the station stop locations and lane placement. The Project Team engaged stakeholders and the public to obtain information through the following methods:

Working Group Meetings

Ten stakeholders along the extension route were invited to share their organizations' perspectives and participate with the project team by serving on the Main Street Extension Working Group. The group came together 4-5 times throughout the project development phase (November 2017 - June 2018) and helped the project team identify potential issues and explore solutions in a collaborative environment alongside the KCSA, KCATA, and consultant team.

One-on-One/Small Group Interviews

One-on-one meetings took place with key stakeholders along the alignment. The team gathered the stakeholder's general feedback and asked questions specific to their interests (location along the alignment, operations, etc.). One-on-one meetings were held with:

- American Century Investments
- Capitol Federal
- Children's Center for Visually Impaired
- Colonial Shops (Owned by UMKC Trustees)
- Community Christian Church
- Copaken Brooks - property manager of Colonial Shops
- Country Club Plaza/The Taubman Company
- Crown Center
- KC Art Institute
- KC Library - Plaza Branch
- Kemper Museum
- Mac Properties
- MainCor
- Nelson-Atkins Museum of Art
- St. Paul's Episcopal Church
- St. Paul's Episcopal Church / Day School
- TDD Board
- The Whole Person
- UMKC
- Union Hill Development Company
- VanTrust

Small Group Presentations

Team members attended already scheduled meetings of community groups representing project stakeholders to increase awareness and gather feedback.

Open House #1

On Tuesday, April 3, 2018, the KC Streetcar Main Street Extension project held its first Open House at the Community Christian Church (4601 Main St. in Centennial Hall) from 4:30-6:30 p.m. More than 120 were in attendance; 14 attendees identified as business owners along the extension, 57 indicated they were residents along the extension (the remainder identified as "other").

Participants were invited to take a self-guided tour through 18 informational boards that highlighted:

- The project's purpose and need (connect, thrive, develop)
- The goal of the current project phase and project lifecycle
- The data-driven project process informed by public input
- Transit connections and modifications
- Proposed stop locations (and the high-level results of the criteria evaluation)
- Which lane(s) of the road should the streetcar run (inside vs. outside running)?

Images of participants at the April 3 Open House at Community Christian Church (located along the extension).

The public-input focus of the first Open House event was to receive feedback on:

1. Proposed stop locations & transit connections
2. Preference on a center vs. outside running streetcar for the three varying sections of the extension corridor (north, middle, south)

Project team members were stationed beside each board/section to prompt feedback and TDD Board Members were on-hand to answer questions. In general, participants were excited for the Main Street Extension. Some participants expressed an urgency and a "Let's build it already!"

sentiment. Several residents and business owners had key questions for the TDD Board, including the election process and the way the assessment area was drawn.

Only a few participants indicated they were bus riders; however, the riders who did discuss the proposed transfers and connections with project team members were satisfied with the project team's recommendations. The attendees who reported living south of 51st Street and are usual Main MAX riders seemed satisfied and excited about a high-frequency connector in place of the current Main MAX.

Proposed Stop Locations – Public Input Received

Of the 49 participants who provided comments on proposed stop locations, 19 expressed support for the recommendations as presented. Of the 29 proposed changes, 23 were specific to stop locations (vs. other items such as parking or route variations), seven of which could be considered/addressed in design when finalizing actual locations (vs. intersections) and/or mid-block stops.

The top three public-preferred stops were:

- 31st Street (5 comments)
- 49th Street/Plaza Library (5 comments)
- Westport Rd (4 comments)

Best-Lane Preference – Public Input Received

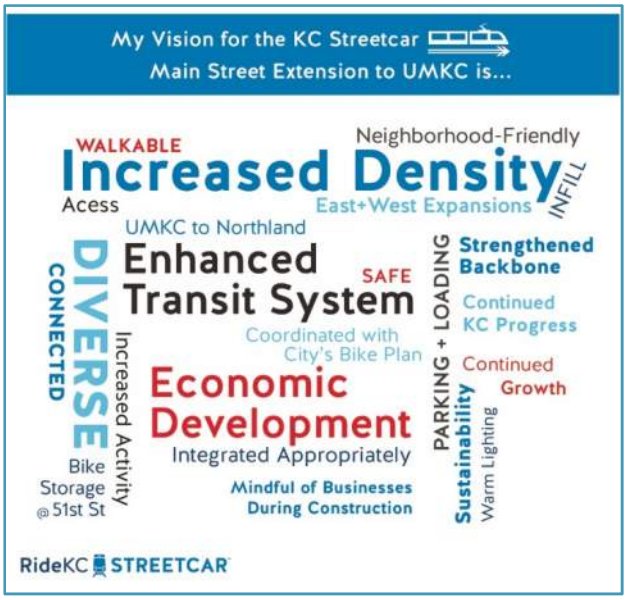
The majority of participating attendees preferred an outside-running streetcar option for all three sections of the extension (for the south section outside-running is in the Country Club Right-of-Way). The full results of the Best-Lane Alternatives exercise are below:

Alternative	Business Owner	Resident	Other	Total
North Section – Outside Running	7	27	10	44
North Section – Center Running	3	17	16	36
Middle Section – Outside Running	9	30	17	56
Middle Section – Center Running	6	16	11	33
South Section – CCROW	13	38	22	73
South Section – Center Running	2	5	2	9

**Feedback received via KCSA email during the event has been incorporated into the participant feedback above.*

"My Vision for Main Street Extension" Board – Public Input Received

The adjacent "word cloud" is the result of participant responses to the prompt, "My Vision for the KC Streetcar Main Street Extension to UMKC is…" The size of the words reflects the frequency of use.



Online Survey following Open House #1

Following the Open House on Tuesday, April 3, the project informational boards were posted online and invitations to provide feedback on stop locations and pros/cons of inside vs. outside running lanes were distributed via social media, email and the KC Streetcar Authority's website. The online survey was open for two weeks – closing on Friday, April 20.

A total of 187 unique participants took part in the survey. Below is the breakdown of how respondents indicated their relationship to the KC Streetcar Extension:

- 69% residents in the TDD
- 5% were business owners
- 24% remainder indicated they were employees, RideKC users, residents in surrounding areas/parts of the city

Online Survey Stop Feedback

The majority of respondents who provided feedback on proposed stop locations strongly encouraged an additional stop at 30th or 31st Street; many respondents specifically indicated/referred to this addition as a "Union Hill" stop. This additional stop are was referenced 133 times; additional details include:

- 82 respondents indicated 30th St. and/or 31st – many specifically referencing Union Hill or (few references of Longfellow)
- 40 respondents specified only 31st Street as an additional stop location
- 11 respondents indicated a preference of 31st ***over*** Linwood
- 36 respondents were in support of the stops as presented/recommended; 3 of these specifically indicated a support for a Linwood stop
- 5 respondents recommended stop consolidation of 43rd/45th Street stops
- Additional Plaza Library was referenced twice

Several respondents did not provide applicable comments; single comments received included a preference that all stops be located mid-block (away from intersection traffic) and that stops be available every two blocks (similar to Downtown starter line).

Online Survey Best-Lane Preference

The majority of respondents who indicated a preference in center vs. outside running lanes preferred an outside running streetcar. This was true for all sections of the extension; only nine (5%) of responders indicated varying or "mixed" responses to inside vs. outside running for specific segments.

- Neutral – 50% or 94 responses
- Center Running – 18% or 34 responses
- Outside Running – 27% or 50 responses
- Mixed – Inside/Outside for various sections of extension – 5% or 9 responses
    - North Section – 2 preferences for Center; 2 preferences for Outside
    - Middle Section – 4 preferences for Center; 2 for Outside
    - South Section – majority preference was for CCROW

Notably, for respondents who preferred Outside running, safety was one of the most frequently referenced reasons.

Email Feedback Received via KC Streetcar Authority

In addition to online survey feedback, 21 email comments were received via info@kcstreetcar.org. Of these email comments, 16 requested a stop at 31st Street (75%). Three responses preferred a center-running streetcar alignment; one response was concerned center-running would prevent needed left-hand turns along the extension. Additionally, one response preferred outside running and two recommended/requested stop names (*Unicorn Theater Stop/39th Street* and *Westport/39th Street*).

Letters of Support

Letters of Support were received on behalf of organizations, neighborhoods and businesses along the extension. Below is a list of letters received to-date:

- Ability KC Board of Directors in support of a Union Hill stop – specifically north of the 31st & Main St. intersection
- BMO Financial Group (on behalf of Ability KC via current chair of facilities committee) in support of an addition of a 31st Street stop
- Children's Mercy Hospitals & Clinics in support of a 31st Street stop
- Fairfield Inn by Marriott in support of a stop north of 31st Street
- JE Dunn Construction Company in support of a 31st Street stop
- Kansas City KPS (KCPT) in support of a 31st Street stop

- One Park place Homeowners Association in support for the addition of a 31st Street stop
- Shops at Union Hill in support for the addition of a 31st Street stop
- South Plaza Neighborhood Association, Inc. supporting the use of the Trolley Track Trail Right of Way
- Union Hill Properties in support for the addition of a stop north of 31st Street
- Co-signed on behalf of Union Hill Homes & the Union Hill Neighborhood requesting the addition of a 31st Street stop
- Co-signed on behalf of Nelson-Atkins Museum of Art, Kemper Museum of Contemporary Art, and the Kansas City Art Institute expressing support for the extension and re-enforcing a 45th Street stop – proposing a unique visual identity that would distinguish it as a gateway to the "Art Walk" initiative connecting the institutions

Petition for 31st Street Stop

A "Save Our Stop" petition was initiated by the Union Hill neighborhood with support from the nearby neighborhoods/residents. The petition requested the *addition* of a 31st Street stop. The petition included 370 signatures when it was delivered by hand to the KC Streetcar Authority on April 20, 2018.

Open House #2

On Tuesday, June 5, 2018, the project team hosted its second and final Open House at St Paul's Episcopal Church (11 E 40th St.) 4:30-6:30 p.m. A total of 96 participants signed in; 10 attendees identified as business owners along the extension, 30 indicated they were residents along the extension (the remainder identified as "other").

Similar to the first Open House, participants reviewed informational boards, each accompanied by project team members, which highlighted the following:

- The project's purpose and need (connect, thrive, develop)
- The goal of the current project phase & project lifecycle
- The data-driven project process informed by public input
- Transit connections and modifications – updated to provide more detailed regional connections
- Stop locations – updated to reflect additional data and public feedback received
- Best-Lane Matrix – including characteristics for inside vs. outside running, criteria and tradeoffs


Images of participants at the June 5 second Open House at St. Paul's Episcopal Church (located along the extension).

The public-feedback focus of the second Open House was to receive input on ***why*** participants preferred a center vs. outside running streetcar for the entire length of the extension. Two roll-plot maps were on display – allowing participants to see the anticipated tradeoffs for each option. A key focus of many participants was access to driveways and/or left-hand turns at key intersections. Team members gathered feedback received via sticky-notes requesting participants describe "why" they prefer, placing their note on either the Outside- or Center-Running poster boards. Below are additional details from the comments received.

Outside Running Preference	Center Running Preference
46 participants	16 participants
20% referenced business operations (economic development, less disruptive to access/left-hand turns)	38% referenced being better for bicyclists
16% reference safety in some way (crowded platforms)	31% referenced an ability to dedicate lanes for streetcar, automobiles and bicyclists
Accessibility & Consistency were both referenced 13%	Safety, speed (faster running), and traffic calming were also noted
Better flow for both traffic and pedestrians, parking, and operations experience were also noted	

Online Survey following Open House #2

Following the second Open House on Tuesday, June 5, invitations to provide feedback on stop locations and pros/cons of inside vs. outside running lanes were distributed via social media, email and the KC Streetcar Authority's website. The online survey was open for two weeks – closing on Sunday, June 17.

A total of 54 participants took part in the survey. Below is the breakdown of how respondents indicated their relationship to the KC Streetcar Extension:

- 32% of respondents *work* in the TDD (Transportation Development District)
- 28% of respondents *live* in the TDD
- 9% of respondents *own property* in the TDD

- 31% "other" indicated living near the TDD, considering moving into the TDD or are frequent users/advocates of the KC Streetcar

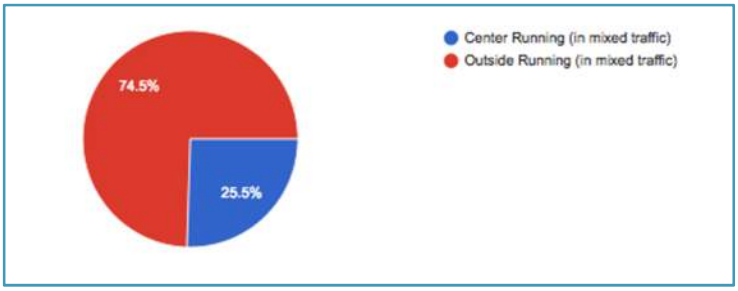
Online Survey Stops Feedback

Many participants responded positively to the updated presented stops, praising them as 'logical' and 'well-spaced'. Few respondents expressed their preference for a previous version of the stop locations.

- 25 respondents approved of the current stop locations with no further comment
- Three respondents proposed moving the stop at 39th Street to Westport Road
- Four respondents appreciated the addition of a stop at 31st Street; however, three suggested moving the stop location back to Linwood Blvd.
- Several respondents commented on how the stops should be designed (i.e. more shelter from the elements, informational signage, etc.)

Online Survey Best-Lane Preference

The majority of respondents who indicated a preference in center vs. outside running lanes preferred an outside running streetcar. This is consistent with previous community meetings/surveys.



- **75% of respondents opted for <u>outside running (in mixed traffic)</u>**
  - The primary reason provided for outside running was safe and efficient access for riders
  - Few people added that outside running was more consistent with the current route, and thus, the logical choice

- **25% of respondents opted for <u>center running (in mixed traffic)</u>**
  - The primary reason for a center running lane was organizing traffic (8 respondents). Respondents were concerned about:
    - Left turning vehicles
    - Parked vehicles ("over the white line") blocking traffic
    - Crossing the street
  - A secondary reason for a center running lane was cycling (1 respondent)