

APPENDIX C TIER 1 SCREENING



JACKSON COUNTY
COMMUTER CORRIDORS
ALTERNATIVES ANALYSIS

TIER ONE SCREENING REPORT

January 2012



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1 INTRODUCTION

PROJECT BACKGROUND

The Mid-America Regional Council (MARC), Jackson County, the City of Kansas City, Missouri, and the Kansas City Area Transportation Authority (KCATA) initiated the Jackson County Commuter Corridors Alternatives Analysis (JCCC AA) to identify transit improvements within the study area originating in the regional core area (downtown Kansas City / Crown Center) and extending to suburban areas in the eastern and southeastern part of the metropolitan area. The study area, as shown in Figure 1, encompasses all of Jackson County, the northern portion of Cass County, the northwest portion of Johnson County, and the western portion of LaFayette County. The physical boundaries are the Kansas state line on the west, the Missouri River on the north, Missouri Highway 131 on the east, and Missouri Highway 58 on the south.

The intent of the study is to reach decisions on a Locally Preferred Alternative (LPA), defined in terms of transit mode and general alignment, to meet the project goals. The goals include:

- expand available transit options,
- improve transit speeds and schedule reliability,
- increase the mode share and competitiveness of transit for commuting and other trip-making purposes, and
- support regional goals for development, redevelopment, and sustainability.

These goals and the problems to be addressed within the study area are more fully presented in the JCCC AA *Purpose and Need Report* (Draft: November 2011), which also identifies the major travel markets that could benefit from improved transit service.

PURPOSE AND STRUCTURE OF THE TIER 1 SCREENING REPORT

The Tier 1 Screening Report defines an initial set of mode and alignment alternatives considered in the JCCC AA, documents the Pre-Screening and Tier 1 Screening of these alternatives, and identifies the alternatives that will be advanced for more detailed study in Tier 2 Screening. The methodology employed for the screening results is documented in the *Evaluation Methodology Report* (November 2011) and is consistent with FTA guidance for the evaluation of alternatives provided in FTA's *Procedures and Technical Methods for Transit Project Planning*.

The Tier 1 Screening Report is divided into the following sections:

- Definition of Initial Alternatives
- Tier 1 Screening Criteria and Results
- Summary of Alternatives Advanced to Tier 2 Screening.

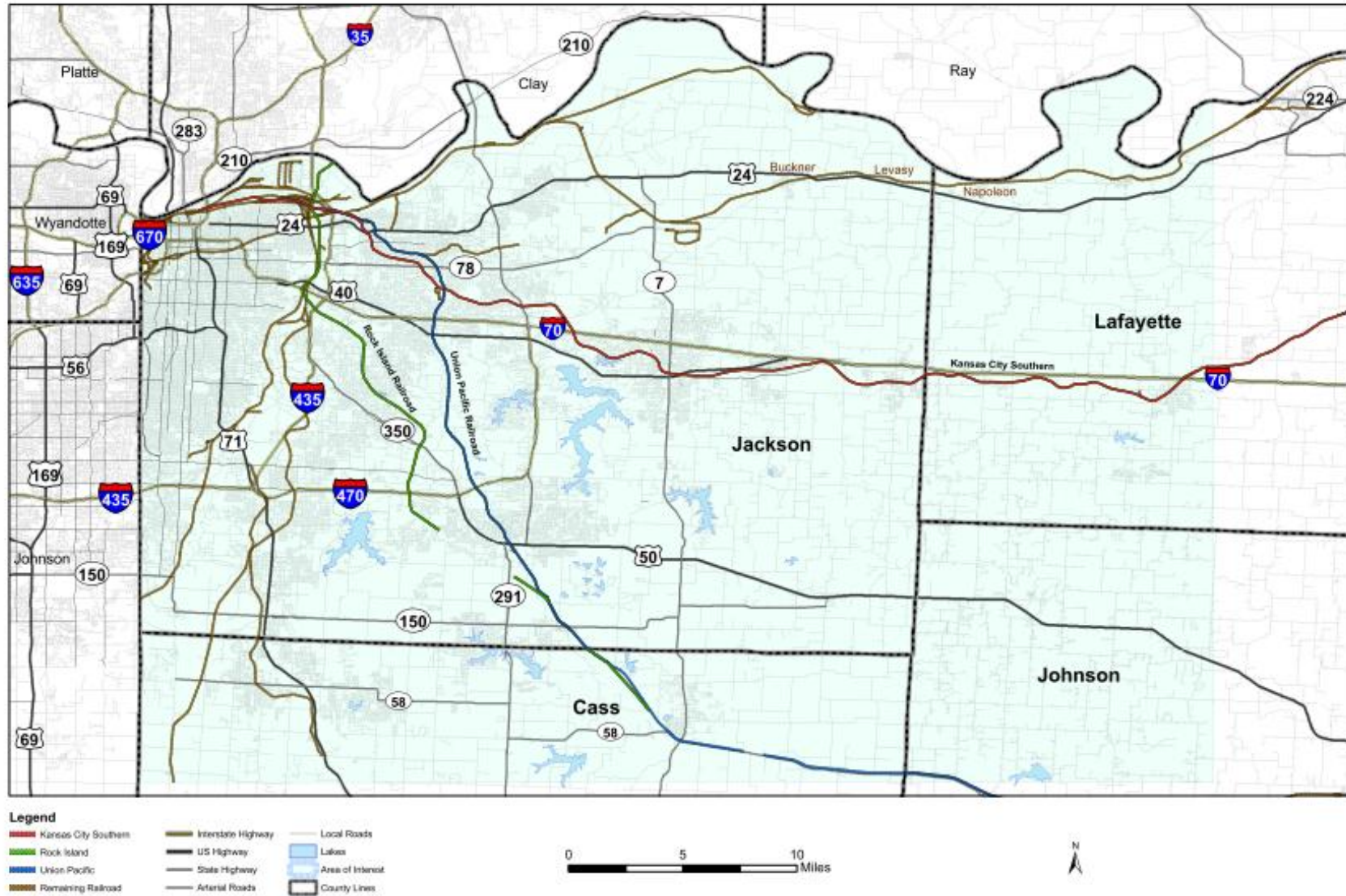


Figure 1 JCCC AA Study Area

2 DEFINITION OF INITIAL ALTERNATIVES

This section summarizes the development of alternatives and describes the alternatives evaluated in the Tier 1 Screening. The alternatives include a No Build Alternative, a relatively low cost Transportation System Management (TSM) Alternative, and a list of more capital intensive mode and alignment alternatives that could be combined into discrete Build Alternatives for more advanced study in Tier 2.

DEVELOPMENT OF ALTERNATIVES – PRE-SCREENING

The consultant team conducted the Pre-Screening of alternatives to narrow the infinite universe of alternatives to a long list of alternatives for the Tier 1 Screening that meets the following criteria:

- Have not been eliminated in previous studies/discussions for reasons that are still considered valid.
- Could address the project goals.
- Do not present an obvious fatal flaw considering the market to be served or the environment within which they would operate.

As discussed in the *Evaluation Methodology Report* (November 2011), given that the study area encompasses two separate travel corridors, that several potential alignments exist within each corridor, and that there are multiple transit technologies that could be used, the evaluation and decision-making process is complex. A technology that performs well in one corridor, for example, may not perform well in the other. Therefore, the study team divided the JCCC AA study area into three segments to evaluate alignment and technology alternatives. The three segments are:

- Common Segment - Between the regional core and the I-435/I-70 interchange area
- East Segment - Generally from the I-435/I-70 interchange area east and parallel to I-70
- Southeast Segment - Generally from the I-70/I-435 interchange area southeast toward Lee's Summit

The Pre-Screening considered modes and alignment separately and then assessed the various combinations of remaining mode and alignment alternatives within each segment. The evaluation was based on previous planning studies, feedback received in early project meetings with the Project Partnership Team (PPT), and initial project team observations. The results of each step of the screening are presented below.

Modal Alternatives Pre-Screening Results

The potential universe of modes that might conceivably be implemented in the study area include Express Bus, Bus Rapid Transit (BRT), Light Rail Transit (LRT), Streetcar, Diesel Multiple Units (DMUs), Electric Multiple Units (EMUs), Push-Pull Locomotive, heavy rail, people movers, and Maglev. Streetcar, Push-Pull Locomotives, heavy rail, and people movers were eliminated because the technologies would not be appropriate for the study area due to the length of the study corridor. For Push-Pull locomotives in particular the longer acceleration and deceleration times would not be conducive to a service on the study corridors with semi-frequent stops. In addition, considering the travel markets to be served, EMU, Maglev, and heavy rail were eliminated because they were deemed cost-prohibitive. Maglev in

particular would not address the Purpose and Need set for the AA and is still largely an unproven technology for implementation.

The following modal alternatives were advanced to the Tier 1 Screening (detailed descriptions are provided in Section 2.1.1):

- Express Bus - A bus vehicle that is 40 feet in length, diesel-powered, and features higher comfort seating than standard local buses.
- BRT: An enhanced bus system that may include such elements as a dedicated busway, high frequency, all day service, off-board fare payment, a unique branded identity, distinctive stations or stops, and Intelligent Transportation Systems (ITS) elements such as signal prioritization.
- DMUs: A medium capacity, non-locomotive hauled, diesel powered rail vehicle that can run in an active freight environment, if FRA-compliant.
- Enhanced Streetcar: The Enhanced Streetcar was developed to address the varying operating environments of downtown Kansas City and the suburban areas to the east as well as for future connectivity to the proposed downtown circulator.

Alignment Alternatives Pre-Screening Results

Only one alignment alternative considered in the Pre-Screening was eliminated from further consideration in the pre-screening -- the Trench alignment in the Common Segment. The alignment follows the Kansas City Terminal Railway (KCT) rail corridor from approximately Interstate 435 near Independence Avenue on the east, through the center of the Kansas City central business district (CBD), terminating at Union Station. This alternative was eliminated from further consideration because it was deemed fatally flawed due to restrictions on capacity. The KCT or "trench" line is near capacity with over 100 trains daily, including eight Amtrak trains arriving or departing Union Station. The project team determined that there are no feasible technology options for the trench without costly infrastructure upgrades (new elevated tracks), schedule guarantees, and/or operating agreements. The railroad owners have indicated through informal discussion with project team members that they would not permit passenger rail service operations in the Trench.

The following alignment alternatives were advanced to the Tier 1 Screening:

<u>Common Segment</u>	<u>East Segment</u>	<u>Southeast Segment</u>
Knoche Yard	Kansas City Southern	Rock Island Railroad Corridor
Truman Road	US 40	M-50/Rock Island
Trench Embankment	I-70	M-350/I-435/I-70
Linwood/31st		
I-70		

Mode and Alignment Combination Alternatives Pre-Screening Results

The alignment and modal options that were not eliminated in the separate alignment and mode pre-screening were combined to create distinct alignment and mode alternatives in each segment for the Tier 1 Screening. All mode and alignment alternative combinations were screened at a high level for

fatal flaws. Alternatives receiving a “pass” did not present any obvious fatal flaws and alternatives that received a “fail” rating presented a fatal flaw in terms of cost or technical feasibility.

The following alternative combinations received a fail rating:

- Common Segment
 - Knoche Yard combined with Express Bus, BRT, and Enhanced Streetcar
 - Trench Embankment combined with Express Bus, BRT, and Enhanced Streetcar
 - KCS combined with Express Bus, BRT, and Enhanced Streetcar
 - Linwood/31st combined with DMU
 - I-70 combined with BRT, Enhanced Streetcar, and DMU
- East Segment
 - I-70 combined with BRT, Enhanced Streetcar, and DMU
 - US 40 combined with DMU
- Southeast Segment
 - M-50/Rock Island combined with DMU
 - M-350/I-435 combined with DMU

In the Common Segment, the Knoche Yard, Trench Embankment, and KCS combination alternatives were eliminated because all three alignments are active freight rail rights-of-way that would only be compatible with DMU. Linwood/31st with DMU was eliminated from consideration because Linwood Road and 31st Street have limited right-of-way. Both roadways currently vary from one to two lanes of traffic in each direction and stakeholders have indicated that it would be challenging to lose a lane of capacity to accommodate the fully dedicated guideway that would be required for DMU. In addition, expanding the right-of-way would require costly property acquisitions. The DMU technology would thus be largely incompatible with the setting. The scale of the DMU vehicle and potential traffic impacts due to the guideway largely would not fit the character or the standards of the historic boulevard in its current setting.

The fixed-guideway alternatives (BRT, Enhanced Streetcar, and DMU) combined with I-70 Enhanced Streetcar in the Common and East Segments were eliminated from further consideration due largely to right-of-way constraints. Construction of a fixed-guideway along I-70 would require removal of lane capacity. As indicated in the *Purpose and Need Report* (November 2011), I-70 is among the most congested roadways in the study area during peak periods. Reducing available capacity would exacerbate traffic conditions and be unacceptable to local decision-makers. In addition, the *I-70 First Tier EIS* performed by Missouri DOT (MoDOT) in 2008 determined that rail (LRT and Commuter Rail Transit) is largely not appropriate within the I-70 right-of-way due to the capacity constraints.

DMUs combined with US 40 in the East Segment and M-50/Rock Island and MS 350 in the Southeast Segment were also eliminated as stakeholders have indicated that the property acquisitions and loss in automobile capacity required to accommodate the DMU guideway would be unacceptable.

Ratings assigned to all of the combination alternatives are summarized in the following table. Alternatives that received a “pass” rating were advanced to the Tier 1 Screening.

Table 1: Mode and Alignment Combination Alternatives Pre-Screening Ratings

	Express Bus*	BRT	Enhanced Streetcar	DMU
Common Segment				
Knoche Yard	Fail	Fail	Fail	Pass
Truman Road	Pass	Pass	Pass	Pass
Trench Embankment	Fail	Fail	Fail	Pass
Linwood	Pass	Pass	Pass	Fail
I-70	Pass	Fail	Fail	Fail
East Segment				
Kansas City Southern (KCS) Railroad	Fail	Fail	Fail	Pass
US 40	Pass	Pass	Pass	Fail
I-70	Pass	Fail	Fail	Fail
Southeast Segment				
Rock Island Railroad	Pass	Pass	Pass	Pass
M-50/Rock Island	Pass	Pass	Pass	Fail
M-350/I-435	Pass	Pass	Pass	Fail

*Express Bus is included as the mode for the TSM Alternative. Express Bus along alignments that passed the Pre-Screening but are not part of the TSM Alternative will not be evaluated in the Tier 1 Screening.

NO BUILD ALTERNATIVE

The No Build Alternative is required for inclusion in the AA by the FTA and serves several purposes. It helps define the problem to be solved, identifies the consequences of “doing nothing,” establishes a baseline for evaluating the benefits and costs of other alternatives, and is a start for meeting National Environmental Policy Act (NEPA) evaluation requirements. It includes all highway and transit projects identified in the fiscally constrained MARC 2040 LRTP, as documented in the *Purpose and Need Report* (November 2011). It also will assume recommendations for KCATA that stem from the *Comprehensive Service Analysis Key Corridor Network* (ongoing).

The No Build Alternative is automatically carried through the Tier 1 Screening. The alternative will be defined in greater detail at the Tier 2 Screening level.

TSM ALTERNATIVE

The TSM Alternative is also required for inclusion in the AA. The alternative includes relatively low cost transit service improvements and represents the best that can be done to improve transit service short of a major capital investment in a fixed-guideway. While considered to be a real alternative that could be chosen, the TSM alternative can also serve as a baseline for assessing the added benefits and costs of the more capital intensive alternatives. It can also serve as the first phase of a major investment or, in the event funding is not found for the ultimate LPA, as a fallback alternative. The TSM Alternative includes all of the projects identified in the No Build Alternative as well as additional improvements to the bus system.

The TSM Alternative will include Express Bus on existing highways (I-70 in the East and Common Segment and M-350 in the Southeast Segment), possibly operating on the shoulder, and other improvements such as park-and-ride lots. The TSM is automatically carried through the Tier 1 Screening and will be defined in greater detail for the Tier 2 Screening. The Express Bus option is included in the Tier 1 Screening for comparison purposes only.

FIXED GUIDEWAY ALTERNATIVES

The Tier 1 Screening focuses on developing discrete, full corridor alternatives for detailed study in the Tier 2 Screening. The alternatives under consideration include the higher cost mode and alignment combination alternatives that passed the Pre-Screening. For clarity in documentation, the modes and alignment alternatives under consideration are described separately.

2.1.1 MODE ALTERNATIVES

Below is a brief description of the major characteristics of the modes under consideration in Tier 1. Technologies are summarized in the following table. Express Bus is included in the description for comparison purposes.

Table 2: Typical Transit Technology Comparison

Typical Characteristics	Express Bus	Bus Rapid Transit	Enhanced Streetcar	DMU
Service Type	Regional, interurban	Regional, urban	Regional, urban	Regional, interurban
Vehicles	Standard	Standard, articulated	Articulated single or multiple unit	Single multiple unit
Vehicles per Set	1	1	1-4	1-4
Seated Capacity per Vehicle	40	Standard: 40 Articulated: 65	32-90	65-100
Guideway	Mixed traffic	Exclusive right-of-way (busway or transitway), dedicated travel lane in-street, mixed traffic	Fixed-guideway in exclusive right-of-way, dedicated travel lane in-street, mixed traffic	Fixed-guideway in exclusive right-of-way or dedicated travel lane in-street (with complete separation from automobile)
Propulsion (Power Supply)	Diesel or alternative fuel	Diesel or alternative fuel	Electric with overhead catenary wire	Diesel
Suspension	Rubber tire on pavement	Rubber tire on pavement	Steel wheel on steel rail	Steel wheel on steel rail
Stop/Station Spacing	2-10 miles	1/2 to 2 miles	1/4 to 2 miles	2-10 miles
Operating Speed	20-65 mph	20-65 mph	8-55 mph	30-80 mph
Route Length	2-40 miles	2-40 miles	2-20 miles	20-100 miles
Maximum Grade	10%-13%	10%-13%	7%-9%	5%
Capital Cost per Mile	< \$1 million	\$16-\$40 million	\$12-\$80 million	\$25-\$80 million

Express Bus

Buses are the most flexible form of transit and normally operate in mixed traffic but may travel in exclusive exclusive rights-of-way. Express bus vehicles proposed as part of the JCCC AA would be consistent with the

the current vehicles in operation by KCATA. Vehicles are 40 feet in length, diesel powered, and feature higher



comfort seating than standard local buses.

Figure 2 presents an example of a KCATA express bus.



Figure 2: Over the Road Coach used for Express Bus Services (Source: Metro Magazine)

Bus Rapid Transit

BRT is an enhanced bus system that blends the flexibility and relatively lower capital cost of buses with the efficiency of rail. Similar to rail, BRT systems can operate in an exclusive right-of-way (busway) that is access controlled. Busways can be at-grade, with pavement markings or physical barriers separating the busway from general traffic, or fully grade separated. Like conventional buses, however, BRT can also operate in mixed-traffic. Further, vehicles can smoothly transition between the various busway configurations and mixed-traffic operations. Typical operating speeds for BRT vary from 20 to 65 miles per hour and route lengths are typically between two (2) and 40 miles. Maximum grades for BRT systems are 10 to 13 percent.

Key characteristics of BRT systems may include high frequency, all day service, off-board fare payment, a unique branded identity, and the incorporation of Intelligent Transportation Systems (ITS) elements including automatic vehicle locations, priority or pre-emption at signalized intersections, and real-time

passenger information systems both on-board vehicles and at stations. BRT systems also feature distinctive stops or stations that offer passenger protection, information, and fare collection equipment. Designs can vary from simple bus shelters to full station buildings. In most systems, a combination of low-floor buses and station platforms can be utilized to speed passenger boarding and alighting. Stops are generally spaced one-quarter to two (2) miles apart and can be located curbside, in the median, or a combination of both. BRT vehicles typically feature unique branding, large windows, enhanced wheelchair loading, and internal layouts that maximize passenger comfort and circulation. KCATA currently operates the Metro Area Express (MAX) BRT service along the Main Street corridor in Kansas City.

The capital cost of new BRT systems can range between \$16 million and \$40 million per mile, although exact costs vary depending on environmental constraints, number of stations at and above grade, land/right-of-way costs, topography, and other site specific considerations. The KCATA MAX BRT was approximately \$5 million per mile because it did not include all of the elements of a traditional BRT service. Typical operating costs average \$85 to \$100 per hour per bus.

A key advantage of BRT is its operating flexibility. Other benefits include improved operating speeds and reliability due to elimination of various types of delay as well as moderate to high vehicle capacities at a lower cost than rail. Compared with Express Bus, BRT can yield higher capital costs and have somewhat less flexible routing, depending on the degree of fixed-guideway within the system.

For the purposes of the Tier 1 Screening, unless otherwise noted, it is assumed that BRT would operate within a busway so as to differentiate BRT from Express Bus.



Figure 3: KCATA MAX Bus (Source: KCATA)

Enhanced Streetcar

As rail technology progresses, the line between LRT and Streetcar vehicles is becoming increasingly blurred. For the purpose of this study, there is an interest in finding a vehicle that is flexible so that it can run in mixed traffic and connect into downtown, yet also has enough power and capacity to serve longer distances, provide needed acceleration and speed between proposed stations, and accommodate more passengers.

The Enhanced Streetcar envisioned for the JCCC AA would generally have the operating characteristics of LRT but would utilize a Streetcar vehicle compatible with the proposed downtown circulator, if Streetcar is selected as the LPA. Streetcar vehicles are typically electrically powered, run at-grade mode, and feature medium capacity vehicles. In addition to serving the short-distance, urban core trips typical of Streetcar service, the vehicles are also suitable for serving medium-distance trips in suburbs and between the CBD and other major activity centers that is more typical of LRT. The vehicle can also operate in an exclusive right-of-way to maximize its travel time savings and reliability or in mixed-traffic where exclusive right-of-way is unavailable.



Figure 4: Possible Vehicle for LRT/Streetcar Hybrid (Source: Jackson County, Missouri)

Diesel Multiple Units

Diesel Multiple Units (DMUs) are medium capacity, non-locomotive hauled, diesel-powered rail vehicles. These vehicles can either be FRA-compliant, meaning that the vehicle is compliant with FRA 49 CFR 238 Tier 1 heavy-weight vehicle structural strength requirements, or Non FRA-compliant. A non FRA-compliant vehicle can only operate in an active heavy railroad setting if there is temporal separation, which means the non FRA-compliant vehicle is not operating during the same time span as the heavy rail vehicles.

DMU's generally operate in an exclusive right-of-way outside of a street setting. In order for the vehicle to operate in a street environment, there must be various safety measures, including quad gates at existing signalized intersections and limitations to cross street traffic and pedestrian movements. DMUs can operate at speeds between 55 and 90 miles per hour in an exclusive guideway. DMUs are generally used for service between suburbs and urban centers for the purpose of reaching activity centers and employment destinations.

Designed to primarily meet the needs of regional commuters in the AM and PM peak travel times, DMU service also tends to offer lower frequencies than Enhanced Streetcar. The distance of a typical DMU corridor is also longer than that of Enhanced Streetcar, ranging from 20 to 80 miles. DMUs are upwards of 125 feet long and weigh in excess of 160,000 lbs. Capital costs range from \$25 to \$80 million per mile, depending on whether or not additional track is needed and the operating environment. Where

new right-of-way must be created, the cost can be considerably more. Typical operating costs average \$230 per hour per train, which may be one rail car or several linked rail cars.

A key advantage of the DMU is its ability to operate in an active freight rail environment. Other benefits include improved operating speeds and reliability due to elimination of various types of delay as well as moderate to high vehicle capacities as compared to that of Enhanced Streetcar.



Figure 5: DMU Vehicle (Source: Denton County Transit)

2.1.2 ALIGNMENT ALTERNATIVES

The following is a brief description of the alignments under consideration. Figure 6 shows all of the alignments under consideration in the three segments and is followed by alignment descriptions. Additional maps follow the alignment descriptions and show further detail of the Common Segment in Figure 7, East Segment in Figure 8, and Southeast Segment in Figure 9.

(Page holder for Full Map)

Common Segment

The Common Segment is the portion of the study area where the alignments of the Southeast and East corridors operate in one alignment. The easternmost portion of this segment is generally close to the Truman Sports Complex. The westernmost portion of the segment is in Downtown Kansas City, Missouri. The alignment options identified for this corridor are described in the following paragraphs.

Knoche Yard – Knoche Yard is part of a rail corridor owned and operated by the Kansas City Southern Railroad (KCS) and is located northeast of the Kansas City CBD. The alignment through the Knoche Yard is currently single-tracked. The alignment is fully contained within the KCS rail corridor, extending west from approximately I-435 and Front Street and through the Knoche Yard. The alignment then continues west, terminating near the River Market. Adding DMU service to this right-of-way would likely require additional track and flyover structures. It is the longest of the alignment alternatives, at 15.9 miles.

Truman Road – The Truman Road alignment includes portions of in-street and new greenfield rights-of-way. The alignment begins near the Truman Sports Complex and travels northwest through the Blue Valley to Van Brunt Park and portions of the East 23rd Street neighborhood to Truman Road near Lister Street. Once on Truman Road, the new alignment continues west to the edge of downtown. An additional option is for the Truman Road alignment to turn southwest at Cherry Street toward a terminus near Union Station.

Trench Embankment - The Trench Embankment alignment includes a portion of the Truman Road alignment from the Sports Complex to near the 23rd Street neighborhood. The Trench Embankment is on KCT property, where space is available for a new single track rail line within the current spans of the numerous bridges. While not crossing existing tracks, it is within 25 feet of the KCT rail lines, and therefore is an active freight environment. Because of this, the only vehicle that can be used in this corridor is DMU. Once in the Trench Embankment, the new alignment continues west to a downtown terminus point, near Union Station.

Linwood /31st - The Linwood/31st alignment begins near the Truman Sports Complex and one or both alignments continue northwest along Stadium Drive. This new alignment continues west along Linwood Boulevard where it then travels to a downtown terminus via US 71 or a north-south city street connector (such as Main Street). Linwood Blvd is part of Kansas City's historic boulevard system and is managed by the City of Kansas City, MO's Parks Department.

I-70 – The I-70 alignment begins on I-70 at I-435 and continues west within the highway right-of-way to a downtown terminus.

East Segment

The East Segment of the corridor serves an area that is adjacent to I-70 which includes Kansas City, Missouri, Independence, Blue Springs, Oak Grove, and Grain Valley. The alignment options for this segment are described in the following paragraphs.

Kansas City Southern – The KCS alignment follows the KCS Gateway Subdivision rail corridor beginning at Oak Grove in the east and traveling west to Independence. At this point, the alignment would continue traveling west via new track on one of two alignments: 1) starting west of Noland Road in Independence to travel to the Truman Sports Complex or 2) starting west of Sterling, along 23rd Street until it connects up with the Common Line.

US 40 – The US 40 alignment follows US 40, an east-west route that parallels I-70 to the south. This route is managed by MoDOT and the local municipalities. The alignment travels west on US 40 and departs the US 40 right-of-way at Noland Road. From this point it would travel on E. 47th Street, continuing to Raytown Road, and onto the Truman Sports Complex at the beginning of the Common Line.

I-70 – The I-70 alignment follows I-70, an east-west route, and continues within the highway right-of-way to Blue Ridge Cutoff, the beginning of the Common Segment.

Southeast Segment

The Southeast Segment of the corridor serves cities along an alignment similar to the Rock Island Railroad, which includes Kansas City, Missouri, Raytown, Lee’s Summit, Greenwood and Pleasant Hill. The alignment options for this segment are described in the following paragraphs.

Rock Island Railroad – The Rock Island Railroad alignment follows the out-of-service Rock Island Railroad, currently owned by the Union Pacific Railroad. The Rock Island line was placed out-of-service in 1982. The Rock Island Rail alignment extends westward to the Truman Sports Complex, where it meets the Common Line. This alignment would allow for “rails with trails,” as this is the proposed alignment for the extension of the Katy Trail.

M-50/Rock Island – The Highway-50-Rock Island alignment runs within the rail corridor and along existing streets. The street-running portion of the alignment starts in the east at the intersection of Missouri Highways 50 and 7. The alignment travels west along M-50 until it transitions into the Rock Island Railroad alignment at Noland Road. It then travels along the Rock Island Rail alignment to the Truman Sports Complex, where it meets the Common Line.

M-350/I-435/I-70 - The M-350/I-435 alignment is street-running, starting in the east at the intersection of Missouri Highways 58 and 7. It travels west along M-58, then north along M-291, and continues west along M-50 until it transitions into M-350. The alignment continues northwest and turns north on I-435. It then connects to I-70 at the beginning of the Common Segment.

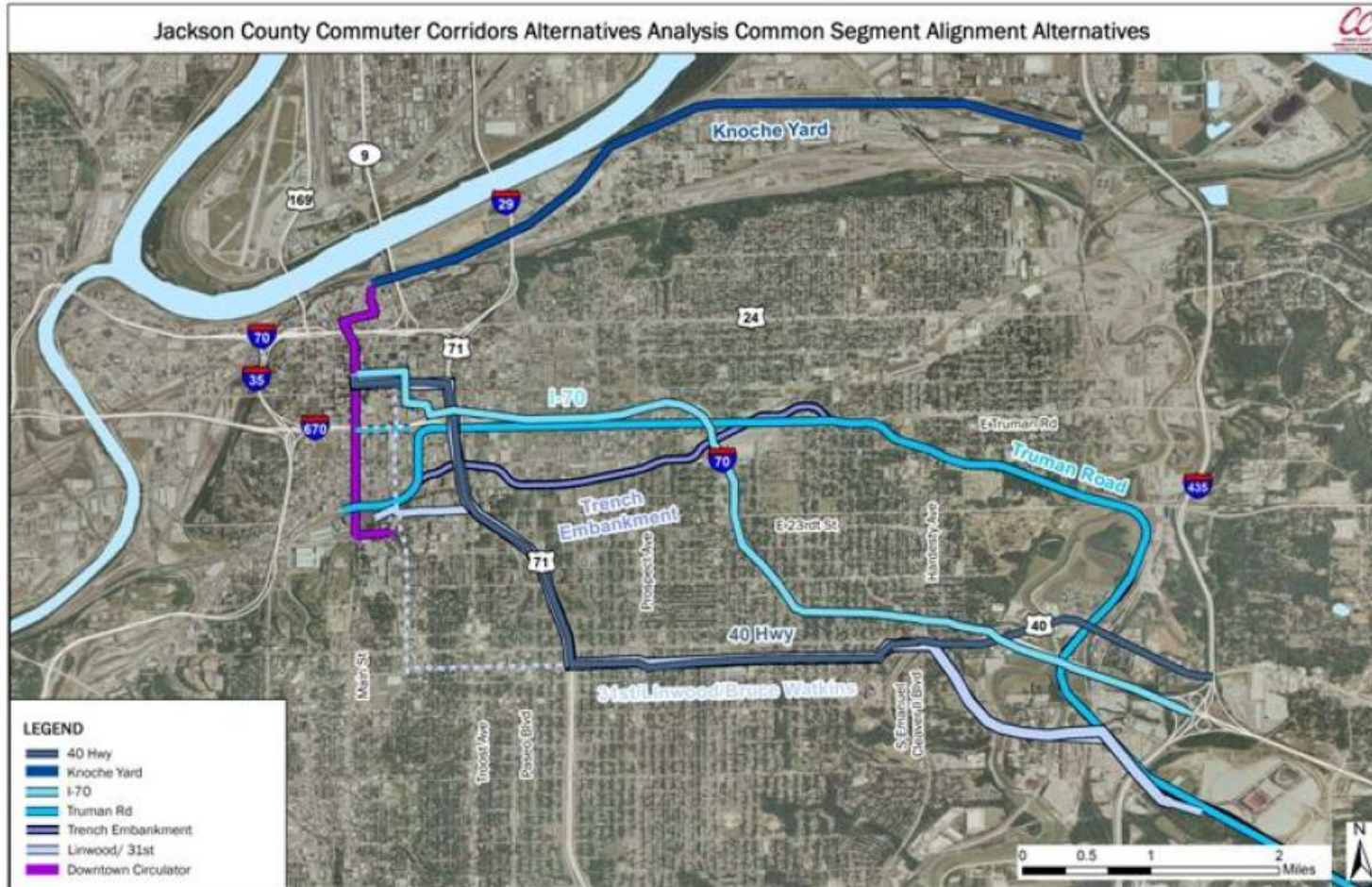


Figure 6: JCCCAA Common Segment Tier 1 Alignment Alternatives

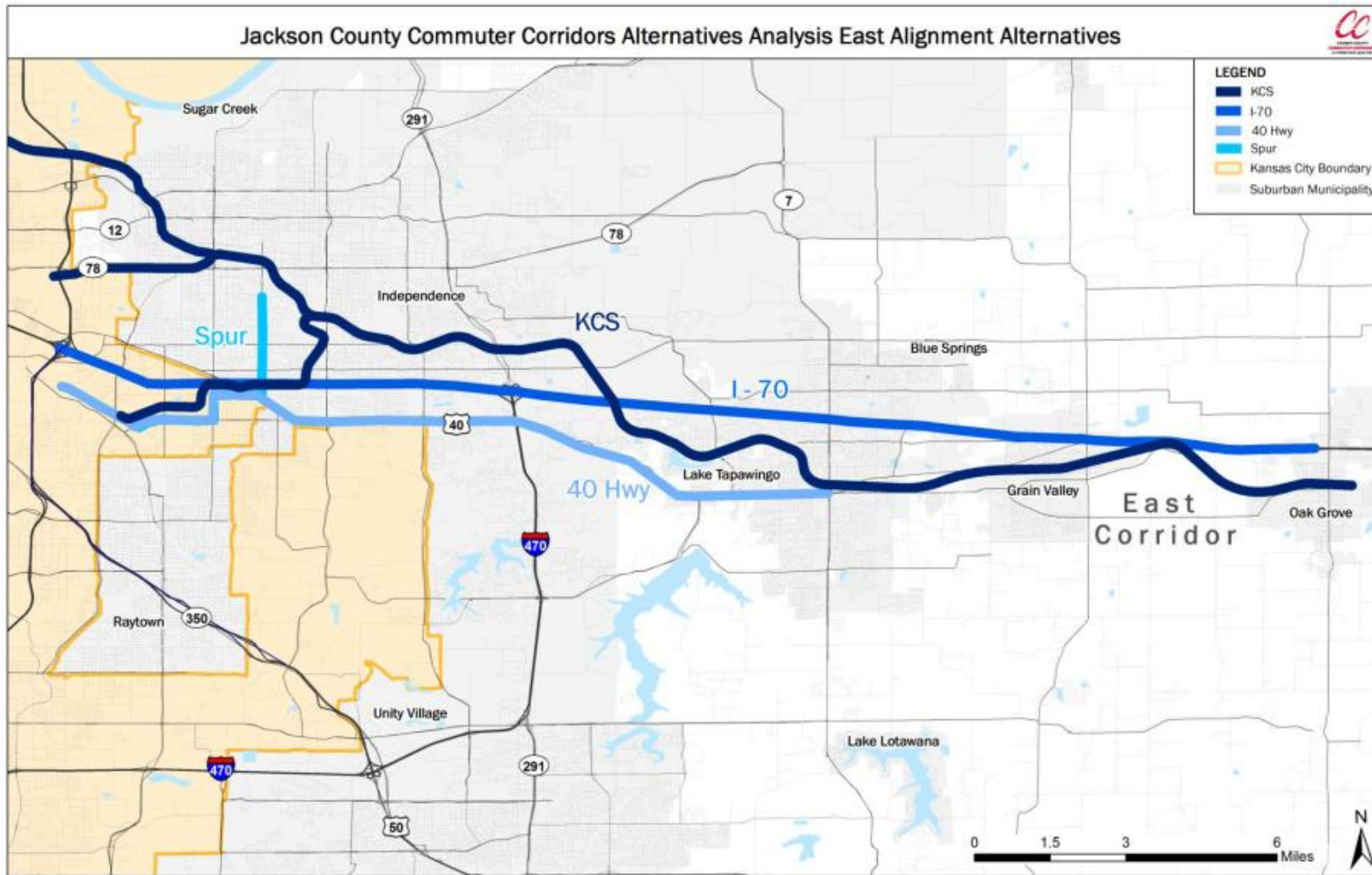


Figure 7: JCCCA East Alignment Alternative

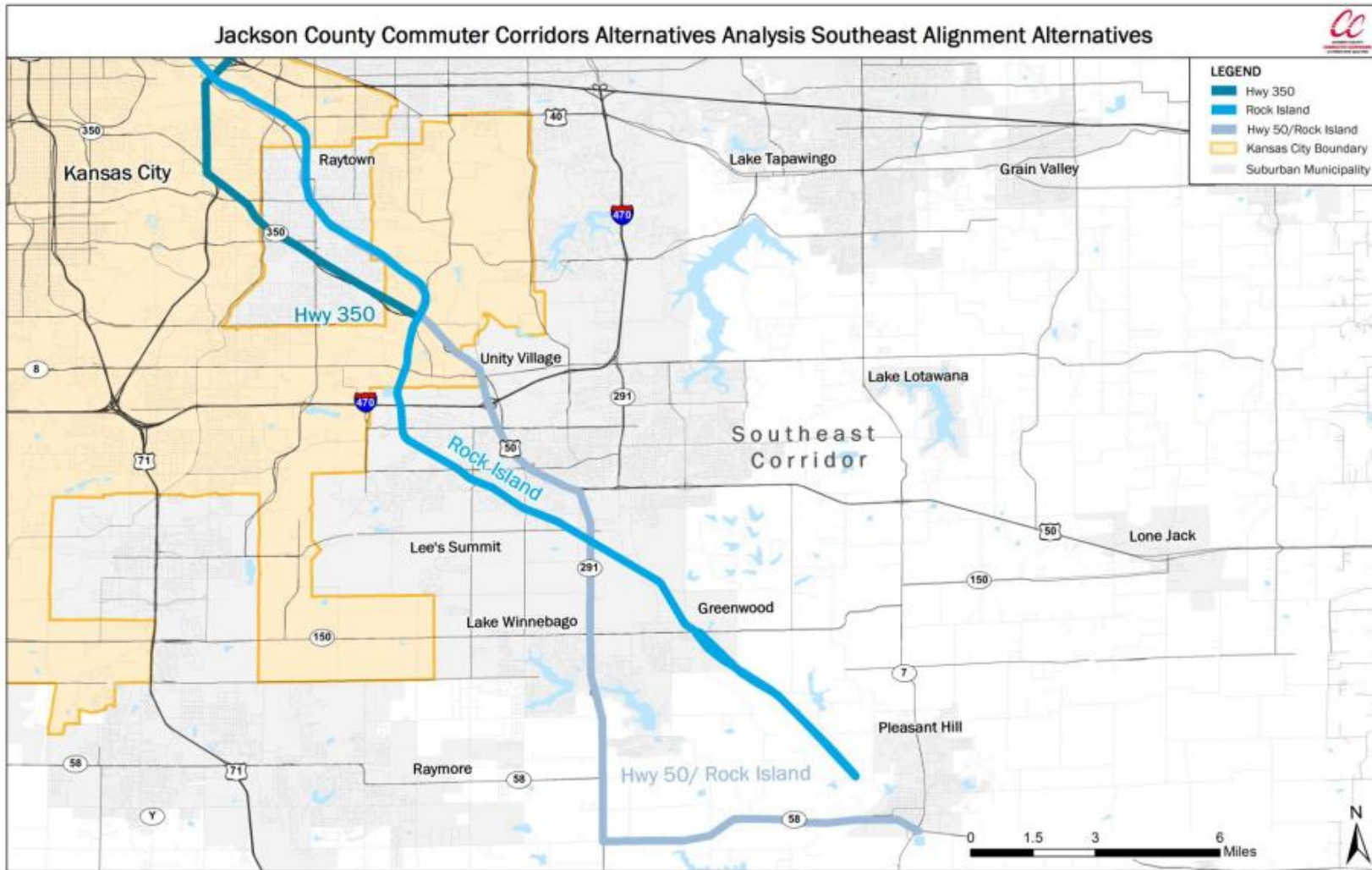


Figure 8: JCCCAA Southeast Tier 1 Alignment Alternatives

3 TIER 1 SCREENING CRITERIA AND RESULTS

This section describes the process and results of the alternatives considered in the Tier 1 Screening.

METHODOLOGY

As noted earlier in this report, the methodology for the Tier 1 Screening is documented in the *Evaluation Methodology Report* (November 2011). The Tier 1 Screening is conducted by corridor segment (Common Segment, East Segment, and Southeast Segment). The performance of the Express Bus along I-70 in the Common and East Segments and MO 350 in the Southeast Segment is included for comparison purposes only.

3.1.1 SCREENING CRITERIA

The following criteria were applied to all of the Tier 1 alternatives. The criteria are presented according to the FTA perspectives of Effectiveness, Cost-Effectiveness, Feasibility, Impacts, and Equity.

Effectiveness Measures

Effectiveness directly measures the extent to which the alternative combinations address the project's goals and objectives.

	Goals	Objectives	Tier 1 Screening Measures	Methodology
Transportation & Mobility	Develop a transit alternative that is competitive with the automobile and can attract new riders	Improve transit travel times and speeds within study area Attract new transit riders	Directness of route	Length of alignment segment in miles
			Average transit travel speed	Length of alignment in miles and assumed transit vehicle speeds
		Increase accessibility to transit	Population & employment concentrations within ¼ mile of alignment	Census data and alignments
		Provide transit capacity to meet current and future travel demand	Ability of alternative to meet expected demand	Qualitative assessment of technologies
	Improve transit service reliability within the study area	Improve on-time performance	Length of alignment within fixed guideway	Length in miles of fixed guideway
Land Use and Economic Development	Develop a transit service that supports regional economic development and land use and transportation objectives.	Provide transit service that can support desired land use growth patterns. Provide convenient and accessible transit service to existing and planned activity centers.	Number of targeted activity centers served Number of redevelopment sites served	Location of activity centers vs. alignments Length of alignment segment in miles
		Provide transit service that is compatible with Smart Moves and KCATA CSA Key Corridor Network	Compatibility with Smart Moves Compatibility with KCATA CSA Key Corridor Network	Qualitative assessment

	Goals	Objectives	Tier 1 Screening Measures	Methodology
Sustainability	Develop a transit service that supports regional sustainability goals	Reduce air pollutant emissions, fuel consumption, and VMT / VHT and delay	Sustainability benefits of modal alternatives	Qualitative assessment of difference in sustainability benefits of modal alternatives

Cost-Effectiveness Measures

Cost-effectiveness assesses the extent to which the costs of the alternatives, both capital and operating, are commensurate with their anticipated benefits.

Evaluation Criteria	Tier 1 Screening Measures	Methodology
Capital & O&M Costs	Assessment of capital and O&M costs	Qualitative assessment – high, medium, low
Transit Productivity	NA	NA
Cost Effectiveness	Assessment of cost effectiveness	Qualitative assessment – high, medium, low

Feasibility Measures

Feasibility assesses the financial and technical feasibility of the alternatives. Financial measures assess the extent to which funding for the construction and operation of each alternative is considered to be readily available. Technical feasibility assesses potential engineering challenges or restrictions that could limit the viability of an alternative.

Evaluation Criteria	Tier 1 Screening Measures	Methodology
Technical Feasibility	Assessment of technical feasibility	Subjective assessment of constructability, willingness of the railroads to share right-of-way, etc.
Financial Feasibility	Assessment of financial feasibility	Comparison of order-of-magnitude capital cost estimate with estimated funds available for local match

Impact Measures

Impacts assess the extent to which the alternatives could present potential environmental and traffic issues that could be fatal flaws or otherwise influence the selection of a preferred alternative.

Evaluation Criteria	Tier 1 Screening Measures	Methodology
Environmental Impacts	Qualitative assessment of fatal flaws Sections 4(f) and 106 impacts	Overlay alignments on environmental features
Traffic impacts	Qualitative assessment of fatal flaws	Qualitative assessment of traffic impacts such as grade crossings, lanes removed, safety etc

Equity Measures

Equity assesses the extent to which an alternative’s costs and benefits are distributed fairly across different population groups.

Evaluation Criteria	Tier 1 Screening Measures	Methodology
Impacts on minority and low-income groups	Transit-dependent populations concentrations within 1/4 mile of alignments Concentrations of service sector jobs within 1/4 mile of alignments Environmental Justice Impacts	Census and Employment data Qualitative assessment of potential environmental justice issues

TIER 1 SCREENING RESULTS – COMMON SEGMENT

Figure 10 summarizes the ratings for each alternative combination. The results of the Tier 1 Screening for the Common Segment are summarized by evaluation perspective (Effectiveness, Cost-Effectiveness, Feasibility, Impacts, and Equity) following the matrix.

Tier 1 Summary Matrix

Key: ● - Best; ◐ - Good; ○ - Less Good

Alignment Technology/Mode	Common Line								
	Knoche Yard	Truman Road			Trench Embankment	Linwood/31st		I-70	
	DMU	DMU	BRT	LRT/SC	DMU	BRT	LRT/SC	Express Bus	
Effectiveness (Purpose and Need)	Directness of Route	○	◐	◐	◐	●	◐	◐	●
	Average Transit Travel Speed	○	◐	◐	◐	●	◐	◐	○
	Population & Employment Concentrations within 1/4 Mile of	○	◐	◐	◐	○	◐	◐	○
	Ability of Alternative to Meet Expected Demand	●	●	●	●	●	●	●	●
	Number of Targeted Activity Center	○	◐	◐	◐	○	◐	◐	○
	Sustainability benefits of modal alternatives	◐	◐	◐	◐	◐	◐	◐	◐
	Number of Redevelopment Sites Served	◐	◐	◐	◐	◐	◐	◐	◐
Relation to other Planning	Compatibility with Smart Moves	●	●	●	●	●	●	●	●
	Compatibility with KCATA Comprehensive Service Analysis	○	●	●	●	●	●	●	○
Cost Effectiveness	Capital Costs	○	○	●	◐	◐	●	◐	●
	Operations & Maintenance Costs	◐	◐	●	◐	◐	◐	◐	●
	Cost Effectiveness	○	○	●	◐	◐	◐	◐	●
Feasibility	Technical Feasibility / Constructability	◐	◐	●	◐	◐	●	◐	●
	Affordability	○	◐	●	◐	◐	●	◐	●
Impacts	Subjective Assessment of Environmental Fatal Flaws	●	○	●	◐	○	●	◐	●
	Parkland and Historical Impacts	●	○	●	◐	○	●	◐	●
	Traffic Impacts	●	○	◐	◐	●	◐	◐	●
Equity	Transit Dependent Populations within 1/4 mile of Alignment	○	◐	◐	◐	◐	●	●	○
	Environmental Justice Impacts	●	○	●	◐	○	●	◐	●
	Concentrations of Service Sector Jobs within 1/4 mile of	○	◐	◐	◐	○	◐	◐	○
Tier 1 Recommendations		X	X	X	X	X	X	X	X

Figure 9: Tier 1 Summary Matrix - Common Segment

EFFECTIVENESS

BRT and Enhanced Streetcar along the Truman Road or Linwood/31st alignments received the most favorable ratings across the Effectiveness criteria, indicating that they are relatively the best suited to meet the project's goals and objectives. DMUs operating in Knoche Yard generally rated lowest of the alternatives, indicating that it could not meet the project's goals and objectives as well as the other alternatives screened. The Effectiveness screening results are summarized in the three broad goal categories of Transportation and Mobility, Land Use and Economic Development, and Sustainability.

Transportation and Mobility

The performance of the mode and alignment alternatives for each of the Transportation and Mobility criteria varied, but, in general, with the exception of the DMU in Knoche Yard alternative, all of the alternatives screened could provide a relatively competitive transit service that could attract new riders and offer improved service reliability. Alternatives with the highest ratings across the criteria, and thus the greatest potential for meeting Transportation and Mobility goals and objectives, were BRT, DMU, and Enhanced Streetcar along Truman Road and DMU in the Trench Embankment. DMU in Knoche Yard consistently underperformed all of the remaining alternatives for Transportation and Mobility and thus would not be well-suited for addressing the Transportation and Mobility goals and objectives. A discussion of the ratings for each Transportation and Mobility criterion begins below.

Improves Travel Time Alignments that are the most direct and can allow for the highest transit operating speeds are likely to offer the most improved transit travel times within the Common Segment. For the purposes of the Tier 1 screening, it is assumed that the average travel speed of all of the mode alternatives would equal the maximum speeds allowable on the alignment in which it operates.

While both the Trench Embankment and Truman Road are the most direct alignments (Trench Embankment and Truman Road are both 7.0 miles compared with 15.9 miles for Knoche Yard and 9 miles for Linwood), the Trench Embankment would likely have the shortest travel times because the portion of the alignment within the rail corridor can accommodate average operating speeds of roughly 40 miles per hour. This is consistent with speeds allowed on the adjacent freight tracks. Average speeds along Truman Road and Linwood/31st could not exceed the posted speed limits of 25 to 35 miles per hour. Knoche Yard would result in the least competitive travel time, as DMUs in this alignment would likely not exceed 10 miles per hour, unless dedicated tracks and/or trackage rights could be obtained. The slow speeds would largely be due to the high activity level of freight traffic. The alignment crosses various freight rail junctions, including four (4) other Class I rail crossings.

Improves Transit Capacity All of the mode and alignment alternatives under consideration would improve transit capacity over existing transit service and could, given the appropriate operating plans for the modes, meet existing and future demand. However, the offered capacity of DMU along the Trench Embankment or Knoche Yard may not be as competitive as BRT, DMU, or Enhanced Streetcar along Truman Road or Linwood/31st Street. The Trench Embankment and Knoche Yard would largely be single track operations, limiting the number of trains that could operate on the

line. For Knoche Yard, the alignment also would potentially conflict with the CP/DME, UPRR, BNSF, KCS and ICE railroads at locations such as Rock Creek Junction, Southwest (Airline) Junction, the Sheffield Flyover, and the entrance to Union Pacific's Neff Yard.

Improves On-Time Performance Schedule adherence for all of the mode and alignment alternatives under consideration depends largely on the levels of automobile or freight congestion on the alignments. Alternatives that operate completely within a dedicated, fixed guideway are most likely to be operated on-time. Truman Road is not currently congested and there is space to create a dedicated right-of-way for BRT, Enhanced Streetcar, and DMUs. DMU along the Trench Embankment could operate in a dedicated guideway, but the single track operations could reduce schedule reliability. DMU in Knoche Yard may offer the least reliable service as it would share rail tracks with heavy freight traffic, offering little improvement over existing transit service. Although BRT or LRT/Street along Linwood/31st could not accommodate a dedicated guideway, neither Linwood Boulevard nor 31st Street is congested and transit vehicles could flow largely unimpeded.

Increases Accessibility to Transit Alternatives that could have stations locations within a short distance of high population and employment concentrations would most enhance transit accessibility. The Truman Road and Linwood/31st alignments have substantial population and employment concentrations within ¼ mile. Linwood/31st, in particular, has the highest employment within ¼ mile of all of the alternatives under consideration. Knoche Yard would provide the least opportunity for increasing accessibility to transit, as there are few viable stop locations between Truman Sports Complex and the Rivermarket area. Transit service through Knoche Yard would fail to serve sizeable population and employment concentrations in Kansas City, including some of the highest concentration of transit-dependent groups in the study area. The Trench Embankment, while slightly more viable than the Knoche Yard, has limited potential to improve accessibility because the Trench to the north of the alignment provides lesser opportunity for pedestrian access.

Land Use and Economic Development

Alternatives that demonstrated the best potential for supporting Land Use and Economic Development goals were BRT and Enhanced Streetcar along Truman Road or Linwood/31st, indicating that they are well suited for meeting regional economic development and land use and transportation objectives. DMUs in Knoche Yard or the Trench Embankment showed the least promise for meeting Land Use and Economic Development goals and objectives. A discussion of the ratings for each Land Use and Economic Development criterion begins below.

Support Desired Land Use Growth Patterns/ Provide Convenient and Accessible Access to Activity Centers The evaluation of these criteria at the Tier 1 Screening level is largely dependent on the number of activity centers within a reasonable distance of the alignments. Both Truman Road and Linwood/31st alignments could provide convenient and direct access to existing and planned activity centers. Truman Road offers the potential for serving the southern edge of downtown with a possible connection (depending on mode) into downtown or to Union Station. Linwood/31st offers the potential for direct access to the Truman Sports Complex and VA Hospital. This alignment would

provide connections to the Troost and Prospect KCATA routes, which are two of the highest ridership routes in the KCATA system. Both the Truman Road and Linwood/31st alternatives traverse sections of Kansas City that are ripe for redevelopment. A fixed-guideway investment in the Truman Road corridor could support redevelopment efforts that build upon the Paseo reconstruction and development of the historic 18th and Vine District. Linwood/31st Street is primarily residential with few commercial centers that would be ripe for redevelopment.

Both the Knoche Yard and the Trench Embankment alignments have low potential for supporting regional land use and economic objectives and improving connectivity between existing and emerging activity centers and redevelopment sites. Industrial areas adjacent to Knoche Yard have some transit-oriented development (TOD) potential, particularly the terminus at Rivermarket. However, Rivermarket and other areas adjacent to Knoche Yard are largely inaccessible, decreasing the viability of TOD at these sites. Similar to the Truman Road alignment, the Trench Embankment can build upon the Paseo reconstruction and development in the historic 18th and Vine neighborhoods. Once the alignment enters the KCT right-of-way, the TOD opportunities decrease greatly. Ultimately it has potential to capture ridership and contribute to economic development, largely on one side of the alignment as the Trench presents a substantial perceived and/or real barrier.

When looking specifically at the potential for BRT, DMUs, and Enhanced Streetcar to connect activity centers, the flexibility of BRT surpasses the other alternatives. BRT offers the possibility to serve not only activity centers within ¼ mile of the Truman Road and 31st/Linwood alignments, but can also offer one-seat rides to jobs in the CBD and destinations beyond the fixed-guideway terminus near Union Station, such as Crown Center, by tying into the street system. Enhanced Streetcar, while not as flexible as BRT, could be designed for compatibility with the proposed downtown circulator if Streetcar or LRT are advanced as the preferred technology. This would extend improved access to jobs in the CBD and increase the potential destinations accessible by a one-seat ride, including Pershing Road, Grand Blvd, Hospital Hill, and Crown Center. The proposed terminus at Union Station limits for the DMU along the Trench Embankment or Knoche Yard would require a transfer to MAX or other transit services, limiting connectivity with a key employment center and potentially reducing the attractiveness of the service.

At this level of screening, it is assumed that all of the modes under consideration could help to stimulate economic development at any of key redevelopment sites located along the alignment alternatives.

Relation to Other Planning

Realizing land use and economic development objectives will require an efficient and comprehensive supporting transportation network. Two local plans that articulate a comprehensive vision for transit are Smart Moves (2008) and the KCATA CSA Key Corridor Network Plan (2011 draft). The Truman Road and Linwood/31st alignments are the most compatible with Smart Moves and the KCATA CSA Key Corridor Network recommendations. The Trench Embankment alignment is also compatible with both plans as it

provides access through Kansas City, Missouri to the CBD. The Knoche Yard alignment, while compatible with Smart Moves, received a lower rating because it offers little potential for more direct pedestrian connections to the proposed Downtown Circulator. The backside of the existing KCS park-and-ride at 2nd and Oak Streets is one proposed terminus of the Downtown Circulator, but making the connection from the Knoche Yard alignment would be a challenge for pedestrians and may require a bridge over the main railroad. The Knoche Yard alignment is also largely incompatible with the CSA Key Corridor Network because the alignment could not accommodate any stops between Truman Sports Center and a downtown Kansas City terminal station, limiting connectivity with the overall KCATA network.

When considering the compatibility of BRT, Enhanced Streetcar, and DMUs operating on specific alignments, Enhanced Streetcar alternative along Truman Road or Linwood/31st Street supports the emerging concept of the Downtown Circulator. As noted previously, if LRT or Streetcar are selected as the LPA for the Downtown Circulator, the Enhanced Streetcar could share the tracks and a maintenance and/or overnight storage facility with the proposed service. BRT along Truman Road alternative is consistent with the Smart Moves Plan, which recommends BRT on Truman Road. BRT operating along Linwood/31st Street offers the possibility of coordinating BRT service with local bus service in one of the KCATA's systems highest ridership corridors. Two concepts proposed by stakeholders include (1) overlaying BRT on local bus service on Linwood Road or 31st Street and (2) creating complementary transit corridors on Linwood and 31st with pedestrian connections between the two (BRT on Linwood and local bus on 31st). While stakeholders have indicated DMU as the technology assumed for the Regional Rail service in the Smart Moves commuter corridors, DMUs would largely be incompatible with Knoche Yard due largely to the aforementioned limitations of the alignments. DMUs along Truman Road or the Trench Embankment could be compatible with the Smart Moves Plan and KCATA recommendations but would not support the land use and economic developments as well as LRT because the technology does not offer flexibility to extend beyond a Union Station or Rivermarket terminus.

COST EFFECTIVENESS

BRT and Enhanced Streetcar on the Truman Road and Linwood /31st alignments received the highest ratings for the Cost Effectiveness criteria, indicating that these options could provide the desired benefits for the project at the lowest cost. The DMU alternatives were rated the lowest of all of the alternatives under consideration. A discussion of the ratings assigned for the Capital and O&M Costs and Cost Effectiveness criteria are below.

Capital and O&M Costs While all of the fixed guideway alternatives were rated similarly for operations and maintenance costs, capital costs differentiated these alternatives from the DMU alternatives along Truman Road, the Trench Embankment, and Knoche Yards. DMUs operating on Truman Road, Trench Embankment, and Knoche Yard are estimated to be among the most costly at this level of screening due largely to property acquisitions and bridges and structures.

High costs for DMU's relative to BRT and Enhanced Streetcar are largely due to the following:

- *Added safety and access control requirements for the DMUs guideway above and beyond BRT and Enhanced Streetcar:* Unlike BRT and the Enhanced Streetcar, DMUs must operate in a fixed guideway completely separate from vehicular traffic. Vehicular, pedestrian, and bicycle crossings can only occur at signalized at-grade or grade-separated intersections / crossings. Major capital improvements to meet these requirements for DMUs on Truman Road include upgrading/ reconstructing 20 to 25 existing intersections and five to 10 structures, including four rail bridges and a tunnel under Hardesty Street. Many of these improvements would also be required for the street running portion of DMUs along the Trench Embankment. Additionally, the difference in vehicle size between DMUs and either BRT or Streetcar would reduce the size and cost of the stations along the corridor.
- *Higher cost of constructing new alignment and acquiring property for DMU alternatives:* Like BRT and the Enhanced Streetcar, DMUs along Truman Road or the Trench Embankment would require construction of a new guideway and stations. The Trench Embankment/DMU and Truman Road/DMU alternatives would also require the construction of new tracks through or adjacent to Van Brunt Park and through the East 23rd Street neighborhood and Blue Valley areas, resulting in costly property acquisitions. Construction of this new alignment with associated structures is also likely to be costly. Because of the smaller turning radius and greater flexibility of a BRT or Enhanced Streetcar vehicle, it is possible that BRT and Enhanced Streetcar along Truman Road would be able to maneuver through existing neighborhoods and streets easier, thereby potentially avoiding many of these acquisitions.
- *Accommodating DMU operations in active freight corridors:* Similar to the Enhanced Streetcar, the DMU alternatives within the Trench Embankment, and potentially Knoche Yard, would include construction of new tracks. However, the DMU alternatives would also require costly operating agreements with the private railroad companies to gain trackage rights, operating guarantees and liability indemnification agreements, construction of bridges and other structures at railroad crossings, and relocation or adjustment of infrastructure assets to accommodate passenger rail operations. Knoche Yard in particular would require multiple major bridge structures to span junctions / fly-overs and relocation or adjustment of infrastructure assets, potentially including KCMO water lines and bridge crossings at Hwy 9, US 71/I-35, Chouteau Trafficway, and I-435.

Cost Effectiveness The BRT and Enhanced Streetcar alternatives would likely realize the stated benefits for the project at a substantially lower capital cost than the DMU alternatives. Although the lower costs come at the potential expense of some of the desired benefits for the project, as discussed under the Effectiveness perspective, all of the mode and alignment alternatives could still meet the goals and objective defined for the project. Therefore, for the Tier 1 Screening, BRT and Enhanced Streetcar along Truman Road or Linwood/31st are rated the most cost effective.

FEASIBILITY

Alternatives rated most favorably under feasibility demonstrated fewer technical barriers to construction, low potential for regulatory barriers, and less potential for capital costs that exceed the estimated capacity of the project sponsor(s) to afford the system through a local funding mechanism. BRT and Enhanced Streetcar along Linwood/31st or Truman Road received the highest ratings for feasibility and DMUs on Truman Road, the Trench Embankment, and Knoche Yard received the lowest ratings. A discussion of the ratings for each criterion is below.

Technical Feasibility BRT or Enhanced Streetcar on Linwood/31st or Truman Road are likely to be the most technically feasible alternatives. At this high level of screening BRT and Enhanced Streetcar receive similar ratings, although Enhanced Streetcar would likely be more complex than BRT as it requires construction of tracks and installation of an overhead catenary system. However, relative to the DMUs on Truman Road, Trench Embankment, or Knoche Yard, the BRT and Enhanced Streetcar alternatives present far fewer potential constructability issues.

For Truman Road, when compared against street-running DMUs, the BRT and Enhanced Streetcar alternatives demonstrated greater ability to operate within a street-running environment with fewer issues. The lower rating for DMUs reflects the scale of the vehicle, the need to operate in an exclusive more robust guideway, and the need for various safety measures such as gated crossings and pedestrian protection. Additionally, DMUs on Truman Road (and thus the eastern portion of the Trench Embankment) were penalized due to the need for a new right-of-way through residential neighborhoods, stream valleys, and parks, as compared to BRT and Enhanced Streetcar, both of which could stay largely within roadway rights of way. Ultimately, the DMU alternatives are likely to pose substantial technical, procedural, and community acceptance challenges that would be less severe with BRT and Enhanced Streetcar options.

The Knoche Yard alignment may be more compatible with a DMU technology as it does not require new alignment in areas that may be sensitive to large and heavy vehicles. However, although DMUs in Knoche Yard would preclude many of the issues inherent in accommodating DMUs in a street running environment, this alternative was also rated among the lowest for technical feasibility because of potential capacity conflicts with existing freight operations as well as the need to secure operating agreements and trackage rights from private railroad companies at potentially high costs. Additionally, double tracking Knoche Yard for DMUs could be a challenge as the KCS constructed a yard departure and receiving track in the place where the proposed single track passenger route was envisioned in previous studies. The addition of this infrastructure has limited the amount of available right-of-way for track through Knoche Yard. Similar to Knoche Yard, the western portion of the Trench Embankment alignment would also need to secure operating agreements and trackage rights from private railroad companies, further lowering the rating of the alternative for Technical Feasibility.

Financial Feasibility As part of this study, local funding streams are being analyzed for their ability to finance this project. However, the costs of the LPA should be minimized to keep within the final amount of funding that could be dedicated to the project. As discussed under the Capital and O&M

cost criteria, operations and maintenance costs are not a key differentiator at this Tier 1 level of screening, therefore, for financial feasibility, alternatives that are likely to yield the lowest capital costs are assigned higher ratings for financial feasibility. BRT and Enhanced Streetcar on the Truman Road or Linwood /31st alignments received the highest ratings for financial feasibility and the DMU Alternatives received the lowest.

IMPACTS

Mode and alignment alternatives rated highest for impacts would likely have the least impacts to the human and natural environment, including specific impacts associated with parklands, historic resources, and traffic. Environmental justice concerns, while related to Impacts, are evaluated under the Equity perspective. DMUs in Knoche Yard were generally rated most favorably for impacts as this alternative would operate in a previously disturbed rail environment, thereby minimizing new impacts. DMUs on Truman Road or the Trench Embankment received the lowest ratings, indicating that these alternatives would result in the most significant impacts. A discussion of the ratings for each Equity criterion begins below.

Environmental Impacts As noted previously, DMUs along Knoche Yard alternative, while presenting significant technical feasibility challenges associated with its location in a congested rail yard, would likely yield the least amount of impacts as it does not negatively impact any population subgroups, interfere with parks or historic areas, is located in a previously environmentally-disturbed location, and would have limited interactions with vehicle or pedestrian traffic.

BRT and Enhanced Streetcar along Truman Road and Linwood/31st BRT were the next highest rated alternatives. Both would likely have fewer impacts than DMUs on the Truman Road alignment due to the additional safety and access requirements for DMU and the associated environmental, parkland, and social impacts. In addition, the segment of the Truman Road alignment between the Truman Sports Complex and the east-west alignment on Truman Road requires traversing or running adjacent to Van Brunt Park, stream valleys, and an established neighborhood, which would require the acquisition of existing homes and could have negative noise and vibration impacts to residences and other sensitive receptors adjacent to the alignment. As noted in other sections of the document, DMUs on the eastern end of the Trench Embankment would experience many of the impacts noted for DMUs on Truman Road, including the parkland, stream, and neighborhood impacts.

Because BRT and Enhanced Streetcar have the flexibility to travel on the existing street network and do not require the safety and access requirements of DMUs, environmental and traffic impacts would be comparatively minimal.

Traffic Impacts DMUs on Truman Road and along Trench Embankment would have substantial traffic impacts, as required safety features, such as quad gates at existing signalized sections and restricting through vehicle traffic to signalized intersections, would limit existing north-south traffic crossing Truman Road and provide limited accessibility to pedestrians and businesses. DMUs in Knoche Yard would have virtually no impacts to automobile traffic, but would impact existing freight rail operations.

As under environmental impacts, because BRT and Enhanced Streetcar have the flexibility to travel on the existing street network and do not require the safety and access requirements of DMUs, traffic impacts for BRT and Enhanced Streetcar along the Truman Road and Linwood/31st alignments would be comparatively minimal.

EQUITY

BRT and Enhanced Streetcar on Linwood/31st were rated most favorably of all the alternatives for equity, indicating that these options would likely present the fairest distribution of costs and benefits among different population groups. DMUs in Knoche Yard received the lowest ratings. A discussion of the ratings for each Equity criterion begins below.

Population and Employment Concentrations & Service Sector Jobs Adjacent to Corridor The neighborhoods adjacent to the Linwood/31st alignment are home to the highest concentration of transit-dependent and minority populations in the Common Segment. Linwood/31st provides direct access to several service sector jobs. BRT and Enhanced Streetcar could provide higher capacity and higher quality transit services to persons living and working adjacent to the Linwood/31st Street alignment with the least amount of negative costs to these groups. The Truman Road and Trench Embankment alignments also presented substantial concentrations of transit-dependent and minority populations and a high number of service sector jobs adjacent to these alignments.

The Knoche Yard and Trench Embankment alternatives have limited accessibility to service sector jobs. The Knoche Yard in particular was found to be the least equitable as the alternative would not directly serve many of the transit-dependent or minority populations between the Truman Sports Complex and downtown Kansas City because it has no intermediate stations and is largely isolated and inaccessible.

Environmental Justice BRT and Enhanced Streetcar on Truman Road could provide an equitable transit alternative. The anticipated impacts of DMUs on the Truman Road and Trench Embankment alignments in the East 23rd Street neighborhood would likely present environmental justice issues as the area is home to a high concentration of minority and low-income populations and the extent of the potential negative impacts on these persons would be substantially greater than impacts to population groups in other portions of the study corridors.

RECOMMENDATIONS FOR THE COMMON SEGMENT

Alternatives Eliminated in the Common Segment

Based on the evaluation results for the Common Segment, it is recommended that the following alternatives be dropped from further consideration:

- DMUs along Knoche Yard alignment
- DMUs along Trench Embankment alignment

Reasons for eliminating the alternatives are:

- Effectiveness: Alternatives would not meet the project's goals and objectives as well as other alternatives screened.
- Cost Effectiveness: Alternatives present highest costs for fewest benefits.
- Feasibility: Alternatives would require potentially cost prohibitive operating agreements with operating railroads and capacity conflicts with other freight rail (Knoche Yard only) and are largely incompatible with street running environment (street running portion of Trench Embankment only).
- Enhanced StreetcarEquity: Knoche Yard would not serve high transit-dependent and minority concentrations.

Alternatives Advanced in the Common Segment

It is recommended that the following alternatives be advanced:

- BRT along Truman Road alignment
- LRT / Streetcar Hybrid along Truman Road alignment
- DMUs along Truman Road alignment
- BRT along Linwood /31st alignment
- LRT / Streetcar Hybrid along Linwood /31st alignment

Reasons for advancing BRT and LRT / Streetcar Hybrid along Truman Road alignment and BRT and Enhanced Streetcar along Linwood /31st alignment are:

- Effectiveness: Alternatives are best suited to meet project's goals and objectives.
- Cost Effectiveness: Ability of alternatives to operate in existing right of way could achieve stated benefits for the project at a substantially lower cost than DMU alternatives.
- Feasibility: Alternatives presented fewest constructability issues, regulatory barriers, and are among the most affordable. Alternatives have greater potential to operate within a street-running environment with fewer issues than DMUs.
- Equity: Alternatives present fairest distribution of costs and benefits among different population groups.

DMUs along Truman Road alignment is advanced because it demonstrated strong performance under the Effectiveness criteria. The alternative has potential to meet project goals and objectives. Truman Road has room to accommodate a DMU guideway and provides access to a high concentration of population and employment. Alternative could support redevelopment efforts in the Truman Road corridor.

TIER 1 SCREENING RESULTS – EAST SEGMENT

Figure 11 summarizes the ratings for each alternative. The results of the Tier 1 Screening for the East Segment are summarized by evaluation perspective (Effectiveness, Cost-Effectiveness, Feasibility, Impacts, and Equity) following the matrix.

Tier 1 Summary Matrix

Key: ● - Best; ◐ - Good; ○ - Less Good

Alignment Technology/Mode		East Line			
		KCS	40 Hwy		I-70
		DMU	BRT	LRT/SC	Express Bus
Effectiveness (Purpose and Need)	Directness of Route	●	○	○	◐
	Average Transit Travel Speed	●	○	○	○
	Population & Employment Concentrations within 1/4 Mile of	◐	◐	◐	○
	Ability of Alternative to Meet Expected Demand	●	●	●	●
	Number of Targeted Activity Center	◐	◐	◐	○
	Sustainability benefits of modal alternatives	◐	◐	◐	◐
	Number of Redevelopment Sites Served	◐	◐	◐	◐
Relation to Other Planning	Compatibility with Smart Moves	●	●	●	●
	Compatibility with KCATA Comprehensive Service Analysis	◐	◐	◐	◐
Cost Effectiveness	Capital Costs	◐	◐	○	●
	Operations & Maintenance Costs	◐	◐	◐	◐
	Cost Effectiveness	◐	◐	○	●
Feasibility	Technical Feasibility / Constructability	◐	◐	○	◐
	Affordability	◐	●	◐	◐
Impacts	Subjective Assessment of Environmental Fatal Flaws	○	◐	○	●
	Parkland and Historical Impacts	○	◐	◐	●
	Traffic Impacts	◐	○	○	●
Equity	Transit Dependent Populations within 1/4 mile of Alignment	◐	◐	◐	◐
	Environmental Justice Impacts	○	◐	◐	●
	Concentrations of Service Sector Jobs within 1/4 mile of	◐	●	●	○
Tier 1 Recommendations		X	X	X	X

Figure 10: Tier 1 Summary Matrix East Corridor

EFFECTIVENESS

DMUs operating along the KCS alignment generally performed better under the Effectiveness criteria than the BRT and Enhanced Streetcar alternatives on US 40, indicating that the alternative is better suited for meeting the goals and objectives defined for the AA. Factors contributing to this rating are summarized in the three broad categories of Transportation and Mobility, Land Use and Economic Development, and Sustainability.

Transportation and Mobility

The Tier 1 Screening indicates that DMU along the KCS alignment presents the best option for meeting the Transportation and Mobility project goals and objectives, indicating that it is better suited to providing time competitive transit service that can improve transit travel times and speeds, attract new transit riders, and increase accessibility and reliability of transit than BRT or Enhanced Streetcar on US 40. A discussion of the ratings for each Transportation and Mobility criteria begins below.

Improves Travel Time Alignments that are the most direct and can allow for the highest transit operating speeds are likely to offer the most improved transit travel times within the East Segment. For the purposes of the Tier 1 screening, it is assumed that the average travel speed of all of the mode alternatives would equal the maximum speeds allowable on the alignment in which it operates. Between the KCS and US 40 alignments, the KCS line would likely provide the most competitive improvement in travel times as it is shorter in length and could maintain consistent average operating speeds of up to 50 miles per hour. Both BRT and Enhanced Streetcar on US 40 would provide average speeds of up to 35 miles per hour.

Improves Transit Capacity DMU on the KCS line and BRT or Enhanced Streetcar on US 40 could improve transit capacity over existing transit service and could, given the appropriate operating plan for the modes, meet existing and future demand.

Improves On-Time Performance Schedule adherence for all of the mode and alignment alternatives under consideration depends largely on the levels of automobile or freight congestion on the alignments. Alternatives that operate completely within a separate dedicated, fixed guideway are most likely to be operating on-time. DMU in the KCS alignment is likely to better improve on-time performance as the service would run on a fixed guideway for the entire alignment. Although the alignment would share tracks with freight traffic, the level of activity is light and the DMUs could be scheduled to largely avoid conflicts that would lead to schedule delays. In addition, portions of the alignment could be constructed to run on dedicated tracks. Due to space constraints on US 40, it would be challenging to develop a fixed guideway without limiting capacity or acquiring additional right-of-way at great costs and impacts. In a street-running environment, BRT or Enhanced Streetcar service along US 40 would not be as reliable as DMU on the KCS alignment.

Increases Accessibility to Transit Alternatives that could have station locations within a short distance of high population and employment concentrations would most enhance transit accessibility. The KCS alignment has higher population and employment concentrations within $\frac{1}{4}$

mile of the alignment than the US 40 alignment, indicating that the KCS alignment may provide a slightly greater improvement to transit accessibility in the East segment.

Land Use and Economic Development

DMUs along the KCS alignment received a more favorable rating for land use and economic development criteria, indicating that it is better suited for meeting regional economic development and land use and transportation objectives than BRT or Enhanced Streetcar along US 40. DMUs in Knoche Yard or the Trench Embankment showed the least promise for meeting Land Use and Economic Development goals and objectives. Below is a discussion of the ratings for each Land Use and Economic Development criterion.

Support Desired Land Use Growth Patterns/ Provide Convenient and Accessible Access to Activity Centers The evaluation of these criteria at the Tier 1 Screening level are largely dependent on the number of activity centers within a reasonable distance of the alignments. Both the KCS and US 40 alignments provide convenient and accessible access to existing and planned activity centers. Both alignments could serve numerous interim locations on the corridor, depending on station locations. The KCS alignment could serve downtown Blue Springs and Independence. The DMU alignment that serves Truman Sports Complex will also serve major shopping destinations south of I-70 just east of the Truman Sports Complex. The US 40 alignment also serves the major shopping destinations south of I-70 and the Truman Sports Complex, but does not directly serve downtown Blue Springs and Independence.

Relation to Other Planning

All three alternatives—DMUs on KCS, BRT on US 40, and Enhanced Streetcar on US 40—would be compatible with Smart Moves. Portions of the alignments within the KCATA service would not conflict with KCATA's CSA Key Corridor Network Plan.

Sustainability

At this level of screening, all of the alternatives under consideration could generally support regional sustainability goals.

COST-EFFECTIVENESS

BRT and Enhanced Streetcar on US 40 received the highest ratings for the Cost Effectiveness criteria, indicating that these options could provide the desired benefits for the project at a lower cost than DMU service along the KCS alignment. A discussion of the ratings assigned for the Capital and O&M Costs and Cost Effectiveness criteria are below.

Capital and O&M Costs While all of the fixed guideway alternatives were rated similarly for operations and maintenance costs, capital costs are a differentiator between the BRT and Enhanced Streetcar on US 40 alternatives and the DMU on KCS alternative. While Enhanced Streetcar may be more costly to implement on US 40 due to the costs of constructing tracks and electrification, at the

Tier 1 Screening level, the alternatives are rated the same as they are similar relative to the cost of DMU on the KCS line.

In general, the higher anticipated cost of the DMUs on KCS alternative is largely due to property acquisitions, construction of bridges and structures, and intersections/railroad crossings. Improvements required along the existing KCS rail to accommodate DMUs include new continuous welded rail (CWR), signal system upgrades, positive train control, some structure upgrades, and other miscellaneous track improvements. Use of the KCS line would require potentially costly operating agreements with private railroad companies to gain trackage rights and operating guarantees and liability indemnification agreements. In addition, two new track segments outside of the rail corridor are under consideration that would further increase capital costs. Option 1 starts west of Noland Road in Independence to travel to the Truman Sports Complex. This option will have right-of-way acquisitions, require a grade separated crossing over I-70 at Blue Ridge Crossing and US 40, and would also include the cost elements under the next option. The second option starts west of Sterling, running along 23rd Street until it connects with an alignment in the Common Segment. This 23rd Street option will remove a lane of traffic from a 5-lane roadway and require a bridge over I-435, Manchester Trafficway, and railroads.

BRT and Enhanced Streetcar alternatives on US 40 may require numerous property acquisitions which could increase costs, although likely not to the same extent as the costs associated with DMUs on the KCS alignment. The flexibility in operations for BRT and Enhanced Streetcar would minimize elements such as property acquisitions, bridges/structures, and intersections and railroad crossings that would escalate costs.

Cost Effectiveness DMU on the KCS line would achieve project benefits at a substantially higher capital cost than those of the BRT and Enhanced Streetcar alternatives on US 40. However, these lower costs come at the potential expense of some of the desired benefits for the project. In particular, measures to minimize capital expenses for the BRT and Enhanced Streetcar alternative on US 40 would increase travel time and reduce schedule reliability, thereby decreasing the attractiveness of the service to new riders. Ultimately, service could be slower and likely offer fewer travel time benefits, particularly for commuters headed to the regional core. However, as discussed under the Effectiveness perspective, all of the mode and alignment alternatives could to some extent provide desired project benefits. Therefore, for the Tier 1 Screening, the BRT and Enhanced Streetcar alternatives on US 40 are rated as more cost-effective as it could provide improvements to Transportation and Mobility, Land Use and Economic Development, and Sustainability at a potentially substantially lower cost than DMUs on the KCS alignment.

FEASIBILITY

Alternatives rated most favorably under feasibility presented few substantial constructability issues and regulatory and other types of barriers and had capital costs that could potentially be funded within the estimated financing capacity of the project sponsor(s). All three alternatives were assigned the same ratings for feasibility. Both alternatives, while generally technically and financially feasible, both

demonstrate potential issues that influenced the rating of “good” rather than “best.” A discussion of the ratings for each criterion is below.

Technical Feasibility DMUs on the KCS line is technically feasible as the alignment has fairly light freight traffic, with between 4 to 6 freight trains daily. The rail corridor has the availability to accommodate DMUs on existing track, but also has sufficient right-of-way to construct new tracks. However, the need to negotiate operating agreements with private railroad companies to gain trackage rights and operating guarantees and liability indemnification agreements could severely limit the technical feasibility of the alternative, reducing its overall rating depending upon how costly those agreements are. Although US 40 is technically feasible for BRT and Enhanced Streetcar operations, the potential for a full fixed-guideway is limited. Service would likely have to operate within a congested roadway, severely limiting the viability of the alternative. The potential difficulty of constructing a fixed guideway in the existing right-of-way without affecting capacity reduces its overall rating.

Financial Feasibility As part of this study, local funding streams are being analyzed for their ability to finance this project. However, the costs of the LPA should be minimized to keep within the final amount of funding that could be dedicated to the project. As discussed under the Capital and O&M cost criteria, operations and maintenance costs are not a key differentiator at the Tier 1 level of screening, therefore, for financial feasibility, alternatives that are likely to yield the lowest capital costs are assigned higher ratings for financial feasibility. BRT and Enhanced Streetcar on the US 40 alignment received a higher rating for financial feasibility.

IMPACTS

Mode and alignment alternatives rated highest for impacts would likely have the least impacts to the human and natural environments, including specific impacts associated with parklands, historic resources, and traffic. Environmental justice concerns, while related to Impacts, are evaluated under the Equity perspective. DMUs in the KCS alignment was generally rated most favorably for impacts as this alternative would largely operate in a previously disturbed rail environment.

Environmental Impacts As noted previously, DMUs in the KCS alignment would likely yield the least amount of impacts as it does not negatively impact any population subgroups, interfere with parks or historic areas, is located in a previously environmentally-disturbed location, and would have limited interactions with vehicle or pedestrian traffic. The KCS alternative operates for much of the segment in existing railroad right-of-way, which is a previously disturbed environment and in a transportation use. The portion of the alignment that exits the KCS to ultimately connect with an alignment in the Common Segment requires cutting through an established residential neighborhood, which would require the acquisition of existing homes and could have negative noise and vibration impacts. At the western terminus near 23rd and Sterling Avenue approximately 40 single family homes and light commercial properties are anticipated to be impacted.

BRT and Enhanced Streetcar along US 40 could have substantial property impacts to accommodate fixed guideway service.

Traffic Impacts DMUs on the KCS alignment would likely have minimal traffic impacts as it would operate largely in the rail corridor. The grade crossings along the alignments would have active warning devices and traffic could experience some delay due to the service. Once the alternative is in a street environment, the DMUs would have substantial traffic impacts, as the required safety features would limit north-south traffic crossing the road and provide limited accessibility to pedestrians. In addition, particularly if the 23rd Street option were to be selected for connection to the Common Segment, it will require possible impacts to traffic on that facility.

BRT or Enhanced Streetcar service along the US 40 alignment may require removal of lane capacity, which could significantly impact traffic operations.

EQUITY

BRT and Enhanced Streetcar on US 40 were rated most favorably of all the alternatives for equity, indicating that these options would likely present the fairest distribution of costs and benefits among different population groups. A discussion of the ratings for each criterion is below.

Population and Employment Concentrations & Service Sector Jobs Adjacent to Corridor DMUs along the KCS alignment was rated favorably for these criteria as the alignment runs adjacent to neighborhoods that have a concentration of transit-dependent populations. The US 40 corridor also has transit dependent populations adjacent to the corridor but does not provide direct access to some of the neighborhoods and service sector employment in Independence served by the KCS alignment.

Environmental Justice DMUs along the KCS alignment and BRT and Enhanced Streetcar on US 40 could provide an equitable transit alternative. However, the anticipated impacts of DMUs on the western portion of the alignment near 23rd Street and Sterling could present environmental justice issues as the area is home to a high concentration of minority and low-income populations and the extent of the potential negative impacts on these persons would be greater than impacts to population groups in other portions of the study corridors.

RECOMMENDATIONS FOR THE EAST SEGMENT

Based on the evaluation results for the East Segment, it is recommended that all of the capital intensive alternatives be advanced for more detailed study in the Tier 2 evaluation. Thus, the alternatives to be recommended would include:

- BRT along US 40 alignment
- LRT / Streetcar Hybrid along US 40 alignment
- DMUs along KCS alignment

Although DMUs along the KCS alignment performed well under Effectiveness, Impacts and Equity, its relatively weaker performance under Cost-Effectiveness and Feasibility warrants studying the viability of BRT and Enhanced Streetcar at a Tier 2 Screening level.

TIER 1 SCREENING RESULTS – SOUTHEAST SEGMENT

Figure 12 summarizes the ratings for each alternative combination. The results of the Tier 1 Screening for the Southeast Segment are summarized by evaluation perspective (Effectiveness, Cost-Effectiveness, Feasibility, Impacts, and Equity) following the matrix.

Tier 1 Summary Matrix

Key: ● - Best; ◐ - Good; ○ - Less Good

Alignment Technology/Mode		Southeast								
		Rock Island			M-350/Rock Island		M-350/I-435/I-70			
		DMU	BRT	LRT/SC	BRT	LRT/SC	Express Bus	BRT	LRT/SC	
Effectiveness (Purpose and Need)	Directness of Route	●	●	●	◐	◐	○	○	○	
	Average Transit Travel Speed	●	●	●	○	○	◐	○	○	
	Population & Employment Concentrations within 1/4 Mile of	◐	◐	◐	◐	◐	◐	◐	◐	
	Ability of Alternative to Meet Expected Demand	●	●	●	●	●	●	●	●	
	Number of Targeted Activity Center	◐	◐	◐	◐	◐	○	○	○	
	Sustainability benefits of modal alternatives	◐	◐	◐	◐	◐	◐	◐	◐	
Number of Redevelopment Sites Served		◐	◐	◐	◐	◐	◐	◐	◐	
Relation to Other Planning	Compatibility with Smart Moves	●	●	●	●	●	●	●	●	
	Compatibility with KCATA Comprehensive Service Analysis	◐	◐	◐	◐	◐	◐	◐	◐	
Cost Effectiveness	Capital Costs	○	◐	◐	◐	◐	●	◐	◐	
	Operations & Maintenance Costs	◐	◐	◐	◐	◐	◐	◐	◐	
	Cost Effectiveness	○	●	◐	●	◐	●	◐	◐	
Feasibility	Technical Feasibility / Constructability	●	●	●	◐	◐	◐	○	○	
	Affordability	◐	◐	◐	◐	○	●	◐	○	
Impacts	Subjective Assessment of Environmental Fatal Flaws	●	●	●	◐	◐	●	○	○	
	Parkland and Historical Impacts	●	●	●	●	●	●	◐	◐	
	Traffic Impacts	●	●	●	○	○	◐	○	○	
Equity	Transit Dependent Populations within 1/4 mile of Alignment	◐	◐	◐	◐	◐	◐	◐	◐	
	Environmental Justice Impacts	◐	◐	◐	◐	◐	◐	◐	◐	
	Concentrations of Service Sector Jobs within 1/4 mile of	◐	◐	◐	◐	◐	◐	◐	◐	
Tier 1 Recommendations		X	X	X			X			

Figure 11: Tier 1 Summary Matrix Southeast Corridor

EFFECTIVENESS

The Rock Island Railroad alignment received the highest ratings for the Effectiveness criteria, indicating that it is best suited for meeting the Purpose and Need defined for the JCCC AA. Factors contributing to this rating are summarized in the three broad categories of Transportation and Mobility, Land Use and Economic Development, and Sustainability.

Transportation and Mobility

The Tier 1 Screening indicates that the Rock Island alignment presents the best option for meeting the Transportation and Mobility project goals and objectives, indicating that it is best suited to providing time competitive transit service that can improve transit travel times and speeds, attract new transit riders, and increase accessibility and reliability of transit. A discussion of the ratings for each Transportation and Mobility criteria begins below.

Improves Travel Time Alignments that are the most direct and can allow for the highest transit operating speeds are likely to offer the most improved transit travel times within the Southeast Segment. For the purposes of the Tier 1 screening, it is assumed that the average travel speed of all of the mode alternatives would equal the maximum speeds allowable on the alignment in which it operates. The Rock Island alignment is likely to provide the most competitive travel times as it covers the shortest distance and could maintain the highest average operating speeds of the alignments under consideration. The Rock Island rail corridor is currently out-of-service; therefore, fixed guideway transit service in the rail corridor could maintain the highest average operating speeds that can be achieved given grade crossings, stop spacing, and any speed constraints on the operating mode. The M-50/Rock Island alignment would have similar travel time advantages for the portion that is within the Rock Island rail corridor. However the travel time for the entire alignment would not be as competitive as the portion running along M-50, which would be limited to operating at a maximum average operating speed of 55 miles per hour the posted speed limits for M-50. The least competitive option for improving travel times would be along the M-350/I-435 alignment. A slightly longer route than the other two alignment alternatives, the average operating speed would likely not exceed the posted speed limit of 35 to 40 miles per hour along M-350. Transit service could reach speeds of up to 70 miles per hour along I-435, but this would be a relatively small portion of the alignment. Additionally, M-350 may not have sufficient right-of-way width to accommodate a fixed guideway and operating in mixed traffic to minimize costs may result in even slower operating times, as M-350 is congested and has several closely spaced signalized intersections.

Improves Transit Capacity All of the mode and alignment alternatives under consideration would improve transit capacity over existing transit service and could, given the appropriate operating plan for the modes, meet existing and future demand.

Improves On-Time Performance Schedule adherence for all of the mode and alignment alternatives under consideration depends largely on the levels of automobile or freight congestion on the

alignments. Alternatives that operate completely within a dedicated, fixed guideway are most likely to operate on-time. The Rock Island alignment is most likely to improve on-time performance in the Southeast Segment as BRT, Enhanced Streetcar, and DMUs operating in the rail corridor would operate in fully dedicated right-of-way. Fixed guideway service along the M-50/Rock Island and M-350/I-435 alignments could also improve on-time performance if operated in a fully dedicated guideway.

Increases Accessibility to Transit Alternatives that could have stations locations within a short distance of high population and employment concentrations would greatly enhance transit accessibility. All of the alignment alternatives run adjacent to substantial population and employment concentrations. Areas adjacent to the Rock Island rail corridor are forecast to experience tremendous growth through 2035; thus the Rock Island and the M-50/Rock Island alignments will increase accessibility for a greater share of residents and jobs within ¼ mile of the alignment and are assigned a higher rating.

Land Use and Economic Development

Alternatives that demonstrated the best potential for supporting Land Use and Economic Development goals were BRT and Enhanced Streetcar along the M-50/Rock Island alignment, indicating that they are well suited for meeting regional economic development and land use and transportation objectives. DMUs in Knoche Yard or the Trench Embankment showed the least promise for meeting Land Use and Economic Development goals and objectives. A discussion of the ratings for each Land Use and Economic Development criterion begins below.

Support Desired Land Use Growth Patterns/ Provide Convenient and Accessible Access to Activity Centers The evaluation of these criteria at the Tier 1 Screening level is largely dependent on the number of activity centers within a reasonable distance of the alignments. All of the alignments under consideration could provide convenient and accessible access to existing and planned activity centers along the Southeast Segment. Key locations to be served in the Southeast Segment include Downtown Lee's Summit, Summit Fair (a major shopping destination located at M-350 and I-470 in Lee's Summit), and Downtown Raytown. In addition, serving commuters that work in downtown Kansas City and intermediate locations is also an important consideration for the Southeast Segment. The M-50/Rock Island alignment alternative provides the best access to existing and planned activity centers, running within ¼ mile of all of the targeted activity centers and various residential areas. The M-350 alternative would provide access to Downtown Lee's Summit and Summit Fair as well as commercial destinations between East 83rd Street and East 63rd Street on M-350. This alternative is also located in close proximity to residential areas. The Rock Island alignment provides the least access to the targeted activity centers, providing direct access only to Downtown Raytown. However, it still is assigned a rating of "good" score because population forecasts indicate that it will be within a short distance of several concentrations of residents, particularly on the west side of Lee's Summit.

Relation to Other Planning

All of the alternatives are generally consistent with Smart Moves and the sections of the alignment within the KCATA service area would not conflict with the KCATA CSA.

Sustainability

At this level of screening, all of the alternatives under consideration could support regional sustainability goals.

COST-EFFECTIVENESS

BRT and Enhanced Streetcar on US 40 received the highest ratings for the Cost Effectiveness criteria, indicating that these options could provide the desired benefits for the project at the lowest cost. A discussion of the ratings assigned for the Capital and O&M Costs and Cost Effectiveness criteria are below.

Capital and O&M Costs While all of the fixed guideway alternatives were rated similarly for operations and maintenance costs, capital costs differentiated the alternatives under consideration. The capital costs associated with utilizing the Rock Island rail corridor are largely undetermined as it depends on the cost of acquiring right-of-way and the extent to which existing infrastructure, including tracks, would have to be upgraded and new infrastructure added. At a high level, the condition of bridges and rail are such that they can be reused for passenger rail with only minor upgrades.

BRT and Enhanced Streetcar service along the Rock Island Corridor may require fewer new bridges/structures and upgrades to intersections and railroad crossings as the access and safety requirements are not as stringent for these modes. However, an additional cost for Enhanced Streetcar that would impact cost is the installation of an overhead catenary system.

BRT and Enhanced Streetcar alternatives on M-50/Rock Island and M-350 would require numerous property acquisitions which could substantially increase costs to accommodate a fixed guideway alternative. Although the flexibility in operations for BRT and Enhanced Streetcar could minimize the more costly elements such as property acquisitions, bridges/structures, and intersections and railroad crossings, the level of congestion along these roadways makes it unlikely that mixed traffic operations could be a competitive alternative for the entire length of the alignment.

Given the degree of uncertainty surrounding the viability of the alignments for fixed guideway service, at the Tier 1 Screening, all of the fixed guideway alternatives are assigned the second highest rating of "good."

Cost Effectiveness The Rock Island line could represent a cost effective option for fixed guideway service but that is largely dependent on the costs of acquiring the right-of-way and upgrading or developing existing infrastructure or building new components. However, the right-of-way does offer an opportunity for relatively fast transit service with few conflicts that would detract from speed, indicating that fixed guideway service along the alignment could surpass the other alignments in terms of travel time and other benefits. The M-350 and M-50/Rock Island alternatives could be extremely costly to operate in an exclusive guideway due to largely to the property

acquisition costs. However, if operated in mixed traffic conditions, the M-350 and M-50/Rock Island alternatives would be cheaper but at the expense of degrading the quality of service, particularly for M-350. This roadway is heavily congested; thus, mixed traffic service would be slower, have regular delays, and would be likely to offer fewer travel time benefits, particularly for commuters headed to the regional core.

As discussed under the Effectiveness perspective, all of the mode and alignment alternatives could to some extent provide desired project benefits and, given the uncertainty related to cost, at the Tier 1 Screening level it is assumed that they could provide it within a similar cost range. However, the Effectiveness screening determined that the Rock Island alignment would be most effective at addressing the project goals and objectives. In addition, as noted previously, it does offer the best opportunity for improving travel times. Therefore, for the Tier 1 Screening, all three fixed guideway alternatives along the Rock Island alignment—BRT, Enhanced Streetcar, and DMUs—are rated the most cost effective.

FEASIBILITY

Alternatives rated most favorably under feasibility presented few substantial constructability issues and regulatory and other types of barriers and had capital costs that could potentially be funded within the estimated financing capacity of Jackson County. The fixed guideway alternatives along the Rock Island alignment—BRT, Enhanced Streetcar, and DMUs—are rated the best for feasibility due to absence of major obstacles to constructability in the Rock Island corridor at the Tier 1 level of screening. Remaining alternatives were assigned slightly lower ratings. A discussion of the ratings for each criterion is below.

Technical Feasibility In the evaluation of technical feasibility, the Rock Island alignment is largely feasible for BRT, Enhanced Streetcar, and DMUs. At a high level, the corridor is readily transformed back to a transportation use and does not present any major impediments. Union Pacific Railroad, the owner of the rail right-of-way, is willing to enter into a purchase agreement for the corridor. At a high level, the condition of bridges and rail are such that they can be reused for passenger rail with only minor upgrades.

The M-350 and M-50/Rock Island alternatives, although technically feasible for BRT and Enhanced Streetcar operations, the potential for a full fixed-guideway is limited on M-350 and M-50. Without a fixed guideway, transit would likely have to operate within heavy congestion, severely limiting the viability of the alternatives. The potential challenges of constructing a fixed guideway reduces its overall rating.

Financial Feasibility As part of this study, local funding streams are being analyzed for their ability to finance this project. However, the costs of the LPA should be minimized to keep within the final amount of funding that could be dedicated to the project. As discussed under the Capital and O&M cost criteria, operations and maintenance costs are not a key differentiator at the Tier 1 level of screening, therefore, for financial feasibility, alternatives that are likely to yield the lowest capital costs are assigned higher ratings for financial feasibility. Because of all of the alternatives were rated similarly for capital costs, they receive the same rating for financial feasibility.

IMPACTS

Mode and alignment alternatives rated highest for impacts would likely have the least impacts to the human and natural environment, including specific impacts associated with parklands, historic resources, and traffic. Environmental justice concerns, while related to Impacts, are evaluated under the Equity perspective. BRT, Enhanced Streetcar, and DMUs within the Rock Island alignment are generally rated most favorably for impacts as this alternative would largely operate in a previously environmentally-disturbed location that was previously a transportation use.

Environmental Impacts As noted previously, BRT, Enhanced Streetcar, and DMUs in the Rock Island alignment would likely yield the least amount of impacts as they would not negatively impact any population subgroups, interfere with parks or historic areas, is located in a previously environmentally-disturbed location, and would have limited interactions with vehicle or pedestrian traffic. The Rock Island corridor is existing railroad right-of-way, which is already environmental disturbed and in transportation use. However, the out-of-service rail corridor does run adjacent to numerous residential areas, so impacts related to noise and acoustics would need to be evaluated.

BRT and Enhanced Streetcar along M-350 and M-50/Rock Island could have substantial environmental impacts if a fixed guideway service is implemented. In addition to property acquisitions, depending on the siting of the fixed guideway, there could be impacts to Palmer Park on the east side of I-435, Trace County Park on Mo-350, and Summit Park in Lee's Summit. These impacts could be avoided if the fixed-guideway is sited on the west. Additionally, many of the most severe impacts could be minimized by providing some mixed traffic operations, albeit at the cost of service quality.

Traffic Impacts BRT, Enhanced Streetcar, and DMUs on the Rock Island alignment would likely have minimal traffic impacts as they would operate largely in the rail corridor. The grade crossings along the alignments would have active warning devices and traffic could experience some delay due to the service. BRT or Enhanced Streetcar service along the M-50 and M-350 alignments would have minimal traffic impacts if operated in mixed traffic. However, fixed guideway operations may require removal of lane capacity, which could significantly impact heavily congested traffic operations.

EQUITY

When analyzing the alternatives for equity, all of the alternatives rated similarly, indicating that all of them could likely present a fair distribution of costs and benefits among different population groups. A discussion of the ratings for each criterion is below.

Population and Employment Concentrations & Service Sector Jobs Adjacent to Corridor All of the alternatives serve neighborhoods that have high transit dependent populations and directly access service-sector job locations. All received the same rating for these criteria.

Environmental Justice No environmental justice issues are anticipated for any of the alternatives under consideration.

RECOMMENDATIONS FOR THE SOUTHEAST SEGMENT

Alternatives Eliminated in the Southeast Segment

Based on the evaluation results for the Southeast Segment, it is recommended that the following alternatives be dropped from further consideration:

- BRT along M-350 alignment
- Enhanced Streetcar along M-350 alignment
- BRT along M-50/Rock Island alignment
- Enhanced Streetcar along Rock Island/M-50 alignment

Reasons for dropping BRT and Enhanced Streetcar along M-350 alignment and BRT and Enhanced Streetcar along Rock Island/M-50 alignment from further consideration are:

- Effectiveness: Alternatives are significantly less competitive than the fixed guideway alternatives in terms of travel times, schedule reliability, and population and employment concentrations within ¼ mile of the alignment.
- Feasibility: The alternatives present substantial challenges to constructing a fixed guideway reduces viability of the alternatives.

Alternatives Advanced in the Southeast Segment

It is also recommended that the following alternatives be advanced:

- BRT along Rock Island alignment
- Enhanced Streetcar along Rock Island alignment
- DMUs along Rock Island alignment

Reasons for advancing BRT, Enhanced Streetcar, and DMUs along Rock Island alignment are:

Effectiveness: The M-350/I-435 Alternatives are significantly less competitive than the fixed guideway alternatives in terms of travel times, schedule reliability, and population and employment concentrations within ¼ mile of the alignment.

Cost Effectiveness: Rock Island alternatives would yield many of the desired project benefits and more detailed information is needed to determine if it would be a cost-effective option.

Feasibility: Rock Island alternatives present no major impediments to constructability at the Tier 1 level of screening.

Impacts: Rock Island alternatives present fewest environmental impacts due to operations in a previously environmentally-disturbed location that was previously a transportation use.

SUMMARY OF TIER 1 SCREENING RESULTS FOR ALL THREE SEGMENTS

This section summarizes the key differentiators that led to recommendations to eliminate or advance the alternatives evaluated in the Tier 1 Screening.

RECOMMENDATIONS FOR THE COMMON SEGMENT

Alternatives Eliminated

DMUs along Knoche Yard alignment and DMUs along Trench Embankment alignment are recommended for elimination due to poor performance under the Effectiveness, Cost Effectiveness, Feasibility, and Equity perspectives:

Effectiveness: Alternatives would not meet the project's goals and objectives as well as other alternatives screened.

Cost Effectiveness: Alternatives would yield few of the desired benefits for the project, such as travel time improvements, new transit riders, and economic development, and at a substantially higher cost than other non-DMU alternatives due largely to added safety and access control requirements for DMU guideways, higher cost of constructing new alignment and acquiring property for DMU alternatives, and capital investments needed to accommodate DMU operations in active freight corridors.

Feasibility: Alternatives would require potentially cost prohibitive operating agreements with operating railroads and capacity conflicts with other freight rail (Knoche Yard only) and are largely incompatible with street running environment (street running portion of Trench Embankment only).

Equity: Knoche Yard would not serve high transit-dependent and minority concentrations because it could not accommodate intermediate stations and is largely isolated and inaccessible.

Alternatives Advanced

BRT and LRT / Streetcar Hybrid along Truman Road alignment and BRT and Enhanced Streetcar along Linwood /31st alignment are recommended to advance because they demonstrated the strongest performance under Effectiveness, Cost Effectiveness, Feasibility, and Equity:

Effectiveness: Alternatives are best suited to meet project's goals and objectives.

Cost Effectiveness: Ability of alternatives to operate in existing right of way could achieve stated benefits for the project at a substantially lower cost than DMU alternatives.

Feasibility: Alternatives presented fewest constructability issues, regulatory barriers, and are among the most affordable.

Equity: Alternatives present fairest distribution of costs and benefits among different population groups.

DMUs along Truman Road alignment are recommended to advance because the alternative demonstrated strong performance under the Effectiveness criteria:

Effectiveness: Alternative has potential to meet project goals and objectives, particularly as related to land use and economic development.

RECOMMENDATIONS FOR THE EAST SEGMENT

Alternatives Advanced

All of the alternatives evaluated for the East Segment—BRT along US 40 alignment, LRT / Streetcar Hybrid along US 40 alignment, and DMUs along KCS alignment—are recommended to advance. Although DMUs along the KCS alignment performed well under Effectiveness, Impacts, and Equity, the relatively weaker performance under Cost-Effectiveness and Feasibility warrants studying the viability of BRT and Enhanced Streetcar at a Tier 2 Screening level:

Effectiveness: The DMUs along KCS alignment are best suited to meet the Effectiveness criteria. It largely outperformed other alternatives under Transportation and Mobility as it would operate in a dedicated guideway, sharing tracks with light freight traffic.

Cost Effectiveness: Although DMUs along the KCS alignment were best suited to meet project goals and objectives, BRT and Enhanced Streetcar alternatives along US 40 could meet project goals and objectives at a substantially lower cost.

Feasibility: All alternatives present technical and/or financial feasibility issues that warrant further study in Tier 2. For DMU in the KCS alignment, the cost of operating agreements with private railroad companies will largely determine the viability of the alternative from a technical and financial perspective.

Impacts: DMUs in the KCS alignment could present the least amount of environmental impacts, but potential environmental and traffic impacts to the east of the Truman Sports Complex require more detailed study.

Equity: BRT and Enhanced Streetcar on US 40 present the fairest distribution of costs and benefits among different population groups.

RECOMMENDATIONS FOR THE SOUTHEAST SEGMENT

Alternatives Eliminated

BRT and Enhanced Streetcar along M-350 alignment and BRT and Enhanced Streetcar along Rock Island/M-50 alignment are recommended for elimination because:

Effectiveness: Alternatives would not meet Transportation and Mobility goals. Alternatives are significantly less competitive than the fixed guideway alternatives in terms of travel times, schedule reliability, and population and employment concentrations within ¼ mile of the alignment.

Feasibility: Challenges of constructing a fixed guideway reduces viability of the alternatives. The M-350 and M-50/Rock Island alternatives, although technically feasible for BRT and Enhanced Streetcar operations, the potential for a full fixed-guideway is limited on M-350 and M-50. Without a fixed guideway, transit would likely have to operate within heavy congestion, severely limiting the viability of the alternatives.

Alternatives Advanced

BRT, Enhanced Streetcar, and DMUs along Rock Island alignment are recommended for advancement because these alternatives outperformed other options in the Southeast Segment in Effectiveness, Cost Effectiveness, Feasibility, and Impacts:

Effectiveness: Alternatives are best suited for meeting the Transportation and Mobility goals and could provide some support for regional economic development and land use objectives. The M-350/I-435 Alternatives are significantly less competitive than the fixed guideway alternatives in terms of travel times, schedule reliability, and population and employment concentrations within ¼ mile of the alignment.

Cost Effectiveness: Rock Island alternatives would yield many of the desired project benefits and more detailed information is needed to determine if it would be a cost-effective option.

Feasibility: Rock Island alternatives present no major impediments to constructability at the Tier 1 level of screening.

Impacts: Rock Island alternatives present the fewest environmental impacts due to operations in a previously environmentally-disturbed location that was previously a transportation use.

4 FULL CORRIDOR ALTERNATIVES TO BE ADVANCED TO TIER 2

The following are the full corridor alternatives that are recommended to be advanced to Tier 2.

Alternatives Recommended for Tier 2 Screening	
No Build	"No Action"—Alternative includes all highway and transit projects identified in the fiscally constrained MARC 2040 LRTP and recommendations from the KCATA CSA.
TSM	Relatively low cost improvements that represent best that can be done to improve transit service short of a major capital investment. Alternative includes Express Bus on existing highways (I-70 in the East and Common Segment and M-350/I-435 in the Southeast Segment), possibly operating on the shoulder, and other improvements such as park-and-ride lots.
Full Regional Rail	Alternative includes DMUs (FRA Compliant) via Truman Road or the Trench Embankment to Union Station on Common Segment, KCS rail corridor in East Segment, and Rock Island rail corridor in Southeast Segment.
Regional Rail & Enhanced Streetcar	Alternative combines DMUs and Enhanced Streetcar modes. DMU along KCS rail corridor in East Segment connecting to Multimodal Transfer Center at Truman Sports Complex. Streetcar/LRT Hybrid on Rock Island Line connecting to Truman Sports, serving as the common line into downtown via either Linwood or Truman. Once in downtown, the Enhanced Streetcar could use the Downtown Circulator tracks.
Enhanced Streetcar & BRT	Alternative combines Enhanced Streetcar and BRT modes. BRT or Enhanced Streetcar along US-40 in the East Corridor. Streetcar/LRT Hybrid on Rock Island Line connecting to Truman Sports, serving as the common line into downtown via either Linwood or Truman. Once in downtown, the Enhanced Streetcar could use the Downtown Circulator tracks.

