US 169/I-70 North Loop
Planning & Environmental Linkages Study

BEYOND THE LOOP

Alternative Evaluation and Screening Methodology Report

September 2017 – Through Level 1 Analysis

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List of Acronyms and Abbreviations

ADA	Americans with Disabilities Act
AM	Morning
APE	Area of potential effect
AST	Aboveground storage tank
ASTM	American Society for Testing and Materials
BGPA	Bald and Golden Eagle Protection Act
BMcD	Burns & McDonnell
BMPs	Best Management Practices
C-D	Collector-Distributor
CWA	Clean Water Act
dBA	A-weighted decibels
EDR	Environmental Data Resources, Inc.
EA	Environmental assessment
EIS	Environmental impact statement
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
GDAP	Greater Downtown Area Plan
GIS	Geographic information system
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
I-29	Interstate 29
I-35	Interstate 35
I-70	Interstate 70
Hg	Hg Consult, Inc.
KCATA	Kansas City Area Transportation Authority
KC EDC	Kansas City Economic Development Council
KCK	Kansas City, Kansas
KCMO	Kansas City, Missouri
KDOT	Kansas Department of Transportation
L_{eq}	Equivalent sound level
LOS	Level of service
LUST	Leaking underground storage tank
MARC	Mid America Regional Council
MBTA	Migratory Bird Treaty Act
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MoDOT	Missouri Department of Transportation
MP	Milepost
Mph	Miles per hour
MPO	Metropolitan Planning Organization

NAC	Noise abatement criteria
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
PEL	Planning and Environmental Linkages
PM	Evening
RCBC	Reinforced concrete box culvert
ROW	Right-of-way
TAZ	Transportation analysis zone
TNM	Traffic noise model
TOD	Transit-oriented development
UG	Unified Government of Wyandotte County/Kansas City, KS
US-169	US Highway 169
USACE	US Army Corps of Engineers
USCG	US Coast Guard
USDOT	US Department of Transportation
USGS	US Geological Survey
USFWS	US Department of Interior Fish and Wildlife Service
UST	Underground storage tank
VMS	Variable message sign
Vpd	Vehicles per day
Vph	Vehicles per hour
WOUS	Waters of the United States

1. Introduction

The Mid America Regional Council (MARC), in cooperation with the Federal Highway Administration (FHWA); Missouri Department of Transportation (MoDOT); City of Kansas City, Missouri (KCMO); Kansas Department of Transportation (KDOT); and the Unified Government of Kansas City, Kansas and Wyandotte County, KS (UG) is conducting a Planning and Environmental Linkage (PEL) study for an area that includes US-169/I-70/I-35/29/I-670 in Jackson and Clay Counties, Missouri and Wyandotte County, Kansas.

MARC, with its partners, is conducting the US 169/I-70 North Loop PEL Study to assess the existing conditions, identify anticipated problem areas, and develop and evaluate transportation improvements to reduce congestion, enhance connectivity, and improve the safety of US-169 and I-70 within the Study Area. MARC is preparing this PEL study in accordance with Federal Highway Administration (FHWA) guidance for improving and streamlining the environmental process for transportation projects by conducting planning activities before the start of the NEPA process.

The US 169/I-70 North Loop PEL Alternative Evaluation and Screening Methodology (ASM), as described in this document, provides a tiered, decision-making framework to determine if each of the proposed alternatives meets the established purpose and need, and then to recommend alternatives for further analysis based on an evaluation of how well each alternative addresses measures associated with the needs and goals of the project. The decisions and recommendations made in the PEL Study will be well documented so that they may be used in future NEPA analysis.

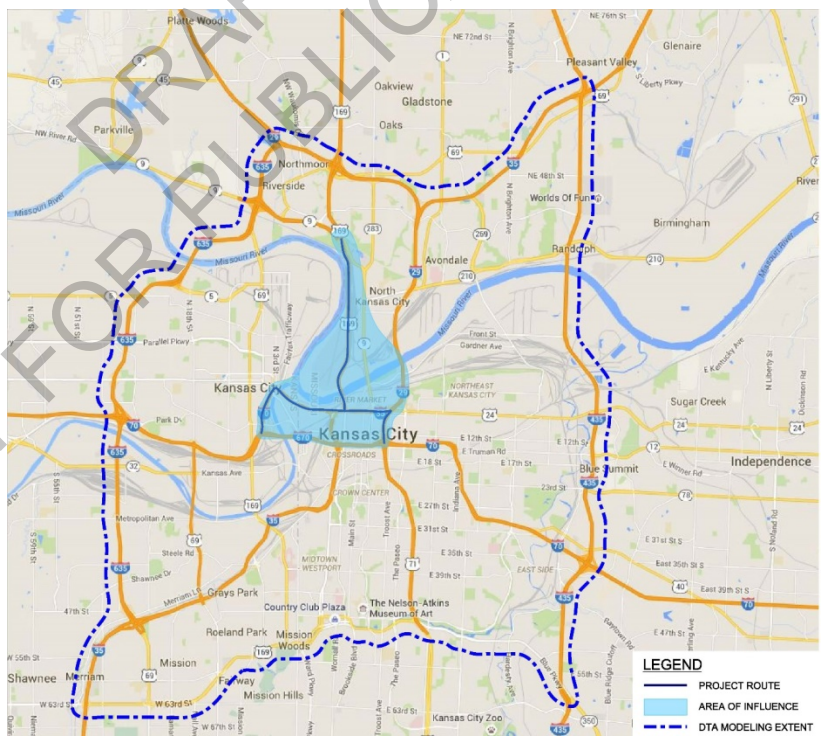
The purpose for the project and the established goals are shown in Table 1 below. The first three goals - Improve Physical Conditions, Optimize System Performance, and Improve Safety and Security – also serve as the project needs. By definition, these needs must be resolved by the selected alternative strategy/strategies. In addition, the Alternative and Screening Methodology Report considers the feasibility of proposed alternatives by looking at projected improvement costs and ability of a given option to be phased in over time.

Table 1: Purpose and Need

Purpose: The study purpose is to seek the most effective approach to improve the transportation facilities in the Study Area, including the development of alternative strategies, which, when implemented, will meet the identified current and future needs while balancing the interests of the various stakeholders.	
Need	**Description**
Improve Physical Conditions	Ensure that existing and new transportation assets in the Study Area better serve the region and are maintained in a state of good repair.
Optimize System Performance	Manage the operations of the existing transportation facilities to achieve reliable and efficient performance.
Improve Safety and Security	Identify reasonable improvements to ensure the safety and security of the affected area.
Goals	**Description**
Improve Transportation Choices	Provide viable, accessible, multi-modal transportation options.
Improve Economic Vitality and Placemaking	Improve transportation and land-use linkages in the Study Area
Improve Sustainability	Protect and enhance the region's natural, cultural, and social resources. Explore ways to mitigate the adverse impacts of the existing system and proposed alternatives.
General Feasibility	Consider the feasibility of delivering the proposed improvements within reasonable financial and schedule constraints.

The first step in the alternative screening process is the development of the *Universe of Alternatives (Universe)*, which includes all possible solutions to the transportation problems in the US 169/I-70 North Loop Study Area **(Figure 1)**.

Figure 1: Map of Area



The Universe will include alternatives which address needs in the following four geographic areas (Figure 2):

- I-70 North Loop
- Downtown Airport
- West Bottoms
- Buck O'Neil Bridge

The alternatives for each of these areas will be evaluated separately, which will lead to a group of alternatives being recommended for further study in each of the four geographic regions.

Figure 2: Geographic Regions (TO BE ADDED)

2. Concept Screening Framework

Each of the alternatives, including the No-Build alternative, will be evaluated using the methodology described in this document. The No-Build concept represents the baseline condition in the study area as if no improvements are implemented other than normal operations and maintenance, which also includes those projects programmed in the fiscally constrained MARC Metropolitan Transportation Plan (MTP) or Transportation Improvement Program (TIP).

The effectiveness of each concept, in terms of meeting the needs of the study area, will be measured against a wide range of criteria defined by the Purpose and Need and the Study Goals. The successful concepts at each level will be advanced to the next screening level for further evaluation, while the unsuccessful concepts will be eliminated from further consideration. Decisions made during the screening process will be thoroughly documented so that they may be relied upon during future studies. Alternatives developed subsequent to a specific level of screening will be subject to the measures of the previous screenings to demonstrate their value for continued evaluation. At the time of the completion of this Report, Level 1A screening had been completed, Level 1B screening was underway and Level 2 screening is proposed.

The three screening levels that comprise the CSM include:

- Level 1A, Fatal Flaw Screening - The Study Team developed the Universe with input received from stakeholders. Fatal flaw criteria were then utilized to evaluate and screen the Universe against the Purpose and Need. The study team, along with representatives from the Mid America Regional Council (MARC) and its partners, convened to review each alternative against each of the defined study needs (Physical Conditions, System Performance, and Safety and Security) in order to gain consensus on the effectiveness of each alternative in meeting each of the three needs. Those alternatives that substantially addressed each need were advanced to Level 1B, while those that did not were eliminated from further consideration. A list of the Universe considered during Level 1A analysis is listed in the Appendix in Table 3. The list is constantly updated with subsequent evaluations and additions of new proposed strategies.

- Level 1B, the Refinement Process - In Level 1B analysis, alternatives advancing from Level 1A are being evaluated. The level of alternative development is sufficient to allow for the qualitative evaluation against the study goals, as shown in the Appendix in Table 5 through Table 8 (pages A-6 to A-9). Level 1B scoring consists of a mostly qualitative analysis, with the study team using quantitative data when available. At this level, the alternatives are summarized and compared to one another relative to their ability to meet study needs and goals. Input from MARC, its partners and the public are being considered during this level of evaluation.

  Based on these analyses, alternatives that best meet the established study goals will be advanced to Level 2 as Reasonable Alternatives.

- Level 2, Detailed Evaluation – In Level 2, the Reasonable Alternatives will be designed to a level of detail as to define the number of lanes, the entrance and exit points for roadway access, and to further clarify any ROW needs. Additionally, predictive traffic volume data will be available to quantitatively predict the specific traffic demand, delay and travel time associated with each alternative. More detailed cost estimates for each alternative will also be developed at this stage. The level of alternative development will be sufficient to allow for the quantitative evaluation against the study goals, as shown in the Appendix in Table 9 through Table 12 (pages A-10 to A-

13). The measures for the Study Goals may be prioritized and weighted during Level 2 screening in order to emphasize the critical needs of the project. The Level 2 screening process will identify the alternative that best address the transportation needs in each geographic area while minimizing the negative impacts.

3. Alternative Evaluation Criteria and Measures

Alternative evaluation criteria and measures for the US 169/I-70 North Loop PEL Study are based on both the Purpose and Need and the Study Goals. The following sections provide detailed definitions of each of the evaluation criteria and measures.

3.1 Level 1A

Level 1 screening consisted of a qualitative assessment of the ability of each alternative to meet the Purpose and Need and goals of the project. Each alternative must meet the first three goals, which also serve as the needs for the project, see **Table 4** in Appendix.

Need - Improve Physical Conditions – Alternatives must ensure that existing and new transportation assets in the Study Area better serve the region and are maintained in a state of good repair.

Need - Optimize System Performance - Manage the operations of the existing transportation facilities to achieve reliable and efficient performance.

Need - Improve Safety & Security – Alternatives must ensure the safety and security of the affected area.

Goal - Improve Transportation Choices – Alternatives must provide viable, accessible, multi-modal transportation options.

Goal - Improve Economic Vitality and Placemaking – Alternatives must improve transportation and land-use linkages in the Study Area.

Goal - Improve Sustainability –Alternatives must protect and enhance the region's natural, cultural, and social resources. The study team must explore ways to mitigate the adverse impacts of the existing system and proposed alternatives.

3.2 Level 1B

Level 1B is an analysis against measures associated with the study goals. The alternatives have been divided into four geographic areas (North Loop, Downtown Airport, West bottoms, and Buck O'Neil Bridge). Specific measures can vary from geographic area to area depending on the specific opportunities and needs within that area.

Need – Improve Physical Conditions

Measures - Number of Existing Bridges Being Replaced; Area of Existing Pavement Being Replaced; Number of Existing Substandard Geometric Features Replaced (Red/Yellow)

Three different measures are being used to evaluate the ability of each alternative to meet the need of "Improve Physical Condition." This need, as developed from the project Purpose and Need, is meant to consider the physical condition of the existing roadway and bridge infrastructure within the project study area. The first way this is evaluated is in terms of the amount of existing, in-service infrastructure that will

be replaced with any given alternative. It is measured both relative to the area of pavement and number of bridges to be replaced. Given the high importance of the Broadway Bridge's available service life to the overall project purpose, bridges to be replaced within the "Bridge" geography was provided in terms of area and not just count. There is a high level of variance in these values and as compared to the no-build alternative.

The other measure quantified the ability of each alternative to improve the number of existing sub-standard geometric features within a given geography. Geometric features focused on the highway and ramp infrastructure and measured the shoulder width curve radii, and number of available ramp lanes. GIS maps of the existing geometric features were developed and color coded red, yellow and green based on the compliance or deviation from existing design standards. The proposed alternative improvements were overlaid on the GIS data and the number of deficient yellow colored and red colored features were counted and added to the evaluation matrix, see **Figure 3** in the Appendix.

Need – Optimize System Performance

Measures - Total Delay, Travel Time, Average Peak Hour Travel Speed, Travel Distance, Ramp LOS

Several different measures are being used in the evaluation matrix to evaluate system performance as it relates to traffic operations. These measures were developed with reference to the MARC Congestion Management Toolbox. Level 1B analysis focused on strategies related to access management, active transportation, highways, and transit. Some areas, including regulatory, land use, parking and TDM strategies were considered beyond the scope of this phase of the study. While the specific strategies are not called out, the various improvement alternatives all consider some toolbox recommendations in addition to the underlying concepts for congestion improvement. In addition, several of the analytical methods recommended in the toolbox, including use of a regional travel model, localized analysis, simulation model and HCM software are utilized during the Level 1B and subsequent Level 2 analyses.

This need addresses how each of the improvement alternatives will successfully improve the flow of traffic improving level of service (LOS) and travel speed while lowering delay and shortening travel time and distance. One major caveat is that the time the Level 1B screening was performed the traffic assignment models were not sufficiently developed in order to provide analysis of the future year conditions. For this reason, all of the traffic evaluations in Level 1B are qualitative or based on existing year traffic or both.

Where applicable the LOS was determined for each on-ramp and off-ramp based on a Highway Capacity Manual (HCM) analysis, an example is shown in **Table 2** below.

Table 2: Example Level of Service (LOS) Ranking

LOS	Intersections		Freeways	
	Control Daily Per Vehicle (sec/veh)		Density (vpmpl or pcpmpl)	
	Signalized Intersections	Unsignalized Intersections	Basic	Merge/Diverge
A	≤ 10	0-10	0-11	0-10
B	> 10-20	> 10-15	> 11-18	> 10-20
C	>20-35	> 15-25	> 18-26	> 20-28
D	>35-55	> 25-35	> 26-35	> 28-35
E	>55-80	> 35-50	> 35-45	> 35
F	>80	> 50	> 45	Demand exceeds capacity

1 Vehicles per Mile per Lane or Passenger Cars per Mile per Lane

In many cases the individual LOSs for the weave areas are likely modeled to perform better than the actual conditions because the HCM does not provide models for weaving areas as short as the ones that exist in the no-build condition. For these locations, the minimal allowable weave length was used. The individual ramp LOSs were then aggregated to provide an overall LOS for each improvement alternative using best engineering judgement.

Average peak hour travel speed was evaluated for only the primary through highway routes. System wide measures including total travel, total travel distance and total peak hour delay were all evaluated qualitatively based on best engineering judgement. These measures are meant to demonstrate how well the overall system would operate in any given improvement scenario. A four-tiered rating from best to worst was provided for these measures. Individually travel times were also estimated to specific critical traffic generators within each geographic region.

Need – Improve Safety and Security

Measures – Bike/Ped facility improvement capacity, Emergency Vehicle Travel Time, Conflict Points

Safety and security of transportation system users is of the utmost importance, and is the major driver of the creation of this project need. Three specific measures we developed for this Level 1B evaluation to address a range of potential system users. One such measure looks at the safety and security of non-motorized users within the corridor by looking at each alternatives ability to improve existing bike/ped facilities in a manner consistent with the local prevailing guidance, including the Kansas City Bicycle Plan. This measure provides a qualitative assessment of the volume of existing sidewalks and bike routes within a given geographic region that fall within the footprint of a given improvement alternative. As a planning level analysis, the measure only looks at the capacity of the project to improve existing facilities and was not able to commit to a specific LOS improvement at any given location. This measure focuses on improvement of existing bike/ped facilities. Other measures in the goal section look at expansion of bike/ped facilities.

To evaluate safety for motor vehicles within the study corridor some of the geographic regions have specifically identified existing crash hot spots where specific intersection improvements have been targeted to improve safety. At these locations, the number of conflict points were determined for each intersection improvement alternative. Conflict points are a widely accepted surrogate measure for intersection safety. Intersections with fewer conflict points are correlated with less crash exposure for drivers and therefore typically have a better safety performance.

Emergency response time to a crash has been shown to have an impact on the severity of the crash. An alternative that reduces emergency response times within the corridor promotes better crash severity outcomes and provides better overall safety for all transportation system users. Similar to the other traffic operations measures, for the Level 1B evaluation engineering judgement was used to provide a qualitative assessment of the travel time for area emergency response dispatch centers to nodes within the study area.

Goal – Improve Transportation Choice

Measures – Potential for future bike/ped expansion and bus/streetcar integration, bike/ped connectivity (bridge only)

Three measures are being used for the evaluation of each alternatives ability to improve transportation mode choice within the study corridor. These measures were directed at the projects ability to improve

the two choice transportation modes which are sensitive to the availability of appropriate built infrastructure, bicycle and transit.

Addition of bike/ped accommodations to the Buck O' Neil bridge represents a major bike/ped linkage and could have large impact on mode choice and multi-modal connectivity within the study array. For this reason, the width of proposed bike/ped facility on the bridge is considered as part of the sustainability goal with the assumption that additional available width will be more inviting and comfortable for a wider array of users.

Both measures were evaluated qualitatively based on the ability of each alternative to expand of infrastructure within the corridor to meet growing local demand. This differs from similar measures in other categories that evaluate the ability of each alternative to improve existing facilities. The Kansas City Bike plan was utilized to evaluate future planned bike corridors that fall within the study area. Existing and future potential bus routes throughout the corridor were overlaid on the improvement alternatives. A qualitative assessment was then made regarding how future sidewalk and bus shelter improvements could be accommodated with each improvement alternative. As the resolution of the options for the

Goal – Improve Economic Vitality and Placemaking

Measures – Potential to make space available for development, average truck travel time, visual character and aesthetics

The goal of improving of economic vitality and placemaking is a complex and diverse goal and therefore several different measures are being used which cover a wide array of topics. The lone quantitative measure for this goal in the Level 1B analysis was looking at potential space made available for development as either commercial or recreational improvements. Especially for the north loop area, this measure is incredibly important as it captures how much of the existing right-of-way could be repurposed by shrinking or altogether removing the highway footprint. This measure, provided in acres, was also carried through the other geographies, even though it is less impactful since the various options vary less in the amount of existing right-of-way that could be repurposed with any given alternative.

Several different qualitative measures were used within this measure. The first, visual character and aesthetics is certainly an important element for consideration though it can be difficult to evaluate. To provide ratings based on a four-tiered rating each alternatives ability to provide roadside beautification in keeping with complete street concepts was considered. For the bridge area, special consideration was given to the ability of each bridge alignment to provide aesthetic enhancements. This is directly related to the proximity of the bridge to the airport which has strict elevation controls. For the north loop area, consideration was given to recreational areas that could be created with a reduced highway footprint.

To assess economic vitality ease of access to area freight hubs was considered. For the Level 1B analysis this was provided qualitatively as an assessment of off-peak congestion and ease of direct access. The specific generators within the study corridor are stated in the evaluation matrix and were linked to appropriate freeway entry points into the study corridor.

Goal – Improve Sustainability

Measures – Right-of-way impacts (including EJ/LEP population displacements), impact to cultural and natural resources

Sustainability is an important goal in the purpose and need of this project and is considered in the Level 1B evaluation matrix relative to many of the cultural and environmental resources that is specifically evaluated in all stages of the NEPA process. To develop the sustainability measures numerous resources

were referenced including the MARC Natural Resource Inventory, which identifies conservation and restoration priorities throughout the region. The first measure looks at the proposed right-of-way footprint that would be needed for all the alternatives being considered. This measure, provided as an area, is only a cursory look at the footprint, based on the plan displays, and does not consider existing property lines, total takes, or other easements necessary for utility or related roadway improvements. This measures looks at both the overall right-of-way footprint and considers what, if any, existing properties have EJ/LEP populations within the study area.

The cultural resource measures examined how many National Register of Historic Places (NRHP) sites or districts and recorded archaeological sites fell within the boundaries of each alternative. The measures provide a quantitative assessment of the number of cultural resource sites potentially impacted and are based upon research conducted by the project team of over a dozen different sources of cultural resource information.

The environmental measures examined how many acres of wetlands, linear feet of floodplain, number of recorded hazardous material sites and parks fell within the boundaries of each alternative. The measures provide a quantitative assessment for each of these features. Acres of wetlands were calculated using National Wetland Inventory mapping data from the U.S. Fish and Wildlife Service (USFWS). Linear feet of floodplain were calculated using floodplain mapping data from the Federal Emergency Management Agency (FEMA). The number of recorded hazardous material sites was identified from a report supplied by Environmental Data Resources (EDR), Inc., a private vendor that searches over 100 federal, tribal, state and local hazardous materials databases. The number of parks were identified from online data obtained from the City of Kanas City, Missouri's Parks Department and the National Park Service's listing of sites receiving Land and Water Conservation Funds.

Goal – Feasibility

Measures – Cost and opportunity for phased implementation

To understand the feasibility of implementing each alternative in the future, a rough order of magnitude cost is provided for each alternative. These are high level planning cost estimates are based on the volume and complexity of infrastructure to be improved with each alternative. Additionally, for the airport option consideration was given for the ability to phase the improvements in over time.

3.3 Level 2

Level 2 is a mostly quantitative analysis against measures associated with the study goals. Similar to the Level 1B analysis, the alternatives have been divided into four geographic areas (North Loop, Downtown Airport, West bottoms, and Buck O'Neil Bridge). Specific measures can vary from geographic area to area depending on the specific opportunities and needs within that area. The Level 2 analysis will also introduce weighting of measures within each broader need and goal. The weighting allows for the quantitative consideration of overlapping measures with a need or goal. For example, within the optimize system performance need there are multiple measures of peak traffic time depending on the specific origin and destination. Since these measures consider variations on similar operational elements of the project, they are each provided a lower weight. In comparison, system-wide total travel distance is one of the only such measures of impact to vehicles for route optimization so it received a higher individual weight for that measure.

Need – Improve Physical Conditions

Measures – Area of Existing Bridges Being Replaced; Area of Existing Pavement Being Replaced; Number of Existing Substandard Geometric Features Replaced (Red/Yellow)

The measures for this need will be relatively unchanged from the Level 1B screening because the measures were already strongly supported by quantitative analysis. With Level 2 screening it is anticipated to be able to improve the resolution of the pavement area measurements and upgrade bridge measurement to include bridge area for all alternatives. Additional sub-standard geometric features may be as be added including locations with insufficient weave distance or storage length. Weighting of the individual geometric features may be necessary as they are all currently weighted evenly and not given precedent based on volume or relative impact to safety.

Need – Optimize System Performance

Measures - Total Delay, Travel Time, Average Peak Hour Travel Speed, Travel Distance, Ramp LOS

The same measures utilized for Level 1B screening will carry forward to the Level 2 screening. However, a great deal of precision and quantification will be performed to measure system optimization. Once accurate traffic assignment data are available and Vissim models are created, exact predictions of speed, delay, and travel time will be able to be provided. In the Level 2 analysis specific external traffic generators will be specified to tie to the internal generators identified within each geography. This will be a tremendous benefit to those alternatives that propose substantial changes to the roadway network since the impact of modification of those facilities to travelers throughout the study area will be able to be quantified and compared. Additional strategies and analysis methods from the MARC Congestion Management Toolbox will also be considered during the Level 2 analysis. With additional clarity in proposed reuse of existing right-of-way related to different options, the ability to incorporate land use and parking strategies will be more readily available in the Level 2 analysis as the strategies are refined to a higher level of detail.

Need – Improve Safety and Security

Measures – Bike/Ped facility improvement capacity, Emergency Vehicle Travel Time, System Redundancy, Quantitative Safety Analysis

In the Level 2 evaluation the same measures of bike/ped safety and security will be maintained though future analyses will have greater precision on the specific volume and location of existing facilities that can be upgraded. To address driver safety, quantitative safety models will be developed which have the capacity to measure changes to the number of predicted crashes, broken down by severity level. Since crash prediction models are not currently available for systems as complex as are being considered here, analyses will focus on systemic measures and those facilities that either currently or are forecasted to have the highest rates of crashes.

Level 2 evaluation will also bring significant improvements to the measures of security that are available. First, more quantitative evaluations will be developed for the emergency vehicle travel time. As with the other traffic operations measures, this will be measured from specific emergency vehicle deployment nodes to specific locations within the study area. The Vissim models will also allow the ability to more accurately consider system redundancy and measure the impact of lane closures to system performance.

Goal – Improve Transportation Choice

Measures – Potential for future bike/ped expansion and bus/streetcar integration, bike/ped connectivity (bridge only)

The same high-level measures for this goal are anticipated for the Level 2 evaluation. In this study area bicycle, pedestrian, bus and streetcar present the vast majority of transportation choice options by

volume and predictability. With the Level 2 analysis a high degree of quantification will be added including better accounting for any improved connectivity brought through infrastructure improvements, especially new bridge crossings. Input from local stakeholders regarding existing barriers to mode choice will play an important role in developing measures that accurately account for predicted future improvement.

Goal – Improve Economic Vitality and Placemaking

Measures – Potential to make space available for development, average truck travel time, visual character and aesthetics

For the Level 2 analysis improved traffic volume and routing information will be available so that off-peak travel times can be quantified for each different alternative. Additional critical economic links may also be added and more clearly defined in the Level 2 analysis based on stakeholder feedback. Another area that stakeholder input will play a large role in the Level 2 evaluation is relative to the proposed future uses of the area that could be made available with some of the North Loop improvement options. With input from project stakeholders, including ULI, specific understanding of community goals for the potential repurposed right-of-way should be available for the Level 2 evaluation. This will better inform the quantitative and qualitative measures related to this goal and potentially allow for the creation of new measures which can further quantify the proposed benefit from this resource.

Goal – Improve Sustainability

Measures – Right-of-way impacts (including EJ/LEP population displacements), impact to cultural and natural resources

Level 2 analysis will carry forward these same measures which consist of the environmental resources most typically linked to transportation projects. Additional environmental or cultural resources may surface during further study and community outreach. One such issue that is being considered for inclusion is the lack of measures in the Level 1B matrix that address environmental benefits that could be brought by the project. Air quality is an example of an environmental impact, linked to congestion, that could help to inform an understanding of the net impact that each alternative will have on the environment.

Goal – Feasibility

Measures – Cost and opportunity for phased implementation

Successive iterations of study, including the Level 2 analysis will allow for greater refinement and accuracy of the cost estimates and opportunity for phasing.

4. Matrices

The matrices for Level 1A, Level 1B, and Level 2 analyses shown in the Appendix in **Table 4** through **Table 12.**

Appendix

Figure 3: Sample Geometrics Features Asessment

Figure 2.7 -Outside Ramp Shoulder Widths

Figure 2.8 - Inside Ramp Shoulder Widths

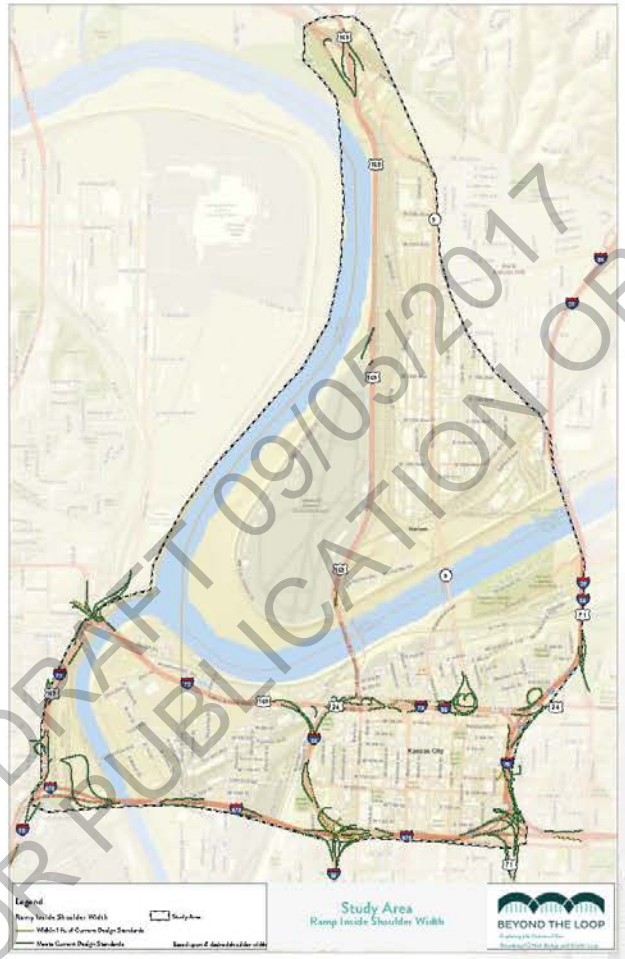


Figure 2.9 - Ramp Radii

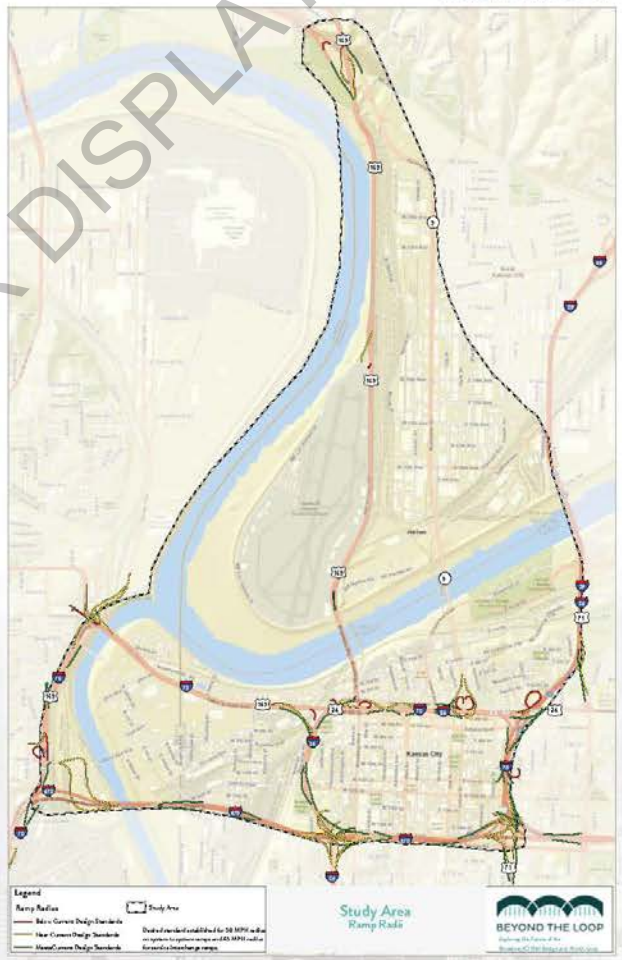


Table 3: Refined Stategies List

Initial Conceptual Build Strategies

August 9, 2017

BEYOND THE LOOP

New Buck O'Neil Bridge	Exhibit	Description	Comments	Status
Rehabilitate the Existing O'Neil Bridge (No-Build Condition)	A1	Rehabilitation of the existing bridge as currently programmed would consist of a $50 million project and would restore the structure to satisfactory physical condition, and would extend the expected life of the bridge an additional 35 years	This is considered the No-Build condition as it constitutes the future condition of the bridge absent the construction of a replacement structure. Connections with Broadway and I-35 could be improved under this strategy by a total reconstruction of the existing interchange with a high capacity type interchange such as a single point urban or possible diverging diamond.	Active
Western Alignment	A2	Approxmate 28 degree skew to river. Most direct connection to I-35.	Indirect access to Broadway requires series of tandem turns at grade. US 169 connects directly with flyover ramps to I-35 with local access provided at a service interchange connecting with 4th and 5th Street and the existing Broadway interchange at I-70.	Active
Central Alignment	A3	Approxmate 20 degree skew to river. South abutment approximately half-way between the existing bridge at Broadway and I-35 at the west side of the loopSplit Interchange to provide Direct Connection to I-35 and existing Broadway I-70 Interchange.	Northbound I-35 to US 169 left or right split. Final Alignment to be determined to balance grades and impacts to properties on west side of Broadway. The concept for connections to I-35 and the CBD entails a bifurcation of the alignment into separate flyover ramps to I-35 and local service ramps towards the existing Broadway interchange at 5th Street.	Active
Eastern Alignment	A4	Approximate 10 degree skew to river. Location just upstream of existing bridge. Requires reconfiguration of existing Broadway interchange	Complexity of construction adjacent to the existing bridge. Would require extensive structures to provide direct connection to I-35.	Active
New Bridge with Rehabilitiation and Re-purposed O'Neil Bridge	A5	Construction of a new bridge at either the previously described A1 or A2 alternative locations, combined with the rehabilitation of the existing bridge.	Under this concept, the new bridge would carry the west loop traffic, and the existing bridge would be configured to carry downtown and I-70 traffic, and a dedicated bike/pedestrian facility.	Screened Out
Combination New Bridge with New Railroad Bridge	A6	Construction of a structure that combines a new highway bridge with a replacement of the existing Hannibal Bridge that carries the BNSF railway.	Maximizes efficiency of the freight rail movements by increasing track speeds currently controlled by tight horizontal curvature at both approaches to the existing bridge. Addresses long term potential for expanding transit service to the north although any extension of fixed rail transit is currently planned along Route 9 and the Heart of America Bridge.	Screened Out

North Loop	Exhibit	Description	Comments	Status
Re-Use I-70 Mainline and Consolidation of Ramps and Access Points	B1	Replicates the design concept that was developed in 2005 to support the original I-29/I-35 corridor EIS.	In addition to the consolidation of ramp and access points, the freeway-to-freeway interchange connections with Route 9 (Heart of America bridge) are removed and replaced with the reconnection of Independence Avenue and at-grade intersections at Grand and Charlotte and at-grade intersections.	Active
New Collector Distributor (CD) System	B2	Removes short sections of auxiliary lanes from the existing I-70 mainline and constructs a new CD System within the I-70 right-of-way to consolidate and distribute access into the River Market and CBD		Screened Out
Compressed Footprint Strategies			Enhanced lid opportunities and development expansion potential	
Compressed Footprint South Option	B3-6a	Compressed I-70 Along South Side of Corridor with Access at Independence Ave. Roundabout and Oak Trafficway	Two-Way Independence Avenue, 6th Street Closed, All development opportunities in River Market and Along MO-9 Corridor, No added Opportunities to connect River Market and Downtown, Access to WB I-70 and SB I-35 from Independence Ave removed, At-Grade Intersections between River Market and Columbus Park,	Active
Compressed Footprint North Option	B3-6b	Compressed I-70 Along North Side of Corridor with Access at Broadway and Oak Trafficway	Independence Avenue Closed and Consolidated with 6th Street. Development Opportunities split between downtown and MO-9 Corridor, Development Opportunities to connect Downtown with River Market with Lid over I-70 between Wyandotte and Grand, MO-9 Direct Connections removed, At-Grade Intersections between River Market and Columbus Park	Active
Compressed Footprint on Existing Mainline Location	B3-7	Compressed I-70 Along Centerline of existing I-70	Splits development opportunity areas on both sides of the compressed fooprint. Independence Avenue treatment on north side and 6th Street on south side can be combination of either the north or south compressed footprint options (B3-1 or B3-3)	Active
Reconfiguration of the Downtown Loop to One-Way Directional	B4	Reconfigures the entire loop system to carry traffic one-way in the counter clockwise direction.	All current ramp movements from the clockwise direction would be eliminated.	Screened Out
Reconfiguration of the Downtown Loop to One-Way Directional with CD System	B5	Mimics Strategy B4 and includes a CD system in the opposing direction to mitigate the major missing directional connections on the east and west legs of the loop.		Screened Out
Reconfiguration of the Downtown Loop to Partial One-Way Directional	B6	Reconfigures the downtown loop to partial one-way counter clockwise circulating interstate system.	Northbound I-35 is carried on the east side of the loop and southbound I-35 is carried on the west side of the loop. I-70 (north loop) and I-670 (south loop) are maintained as two-way interstates.	Screened Out
Redesignate and Reclassify North Loop			required to fully assess secondary impacts and traffic mitigation needs	
Independence Ave Parkway	B7-1	Independence Avenue converted to Parkway and connected across Oak Trafficway, 6th Street two-way between Broadway and Charlotte.	Downtown and River Market connections improved some between 6th Street and Independence Avenue, Split Diamond Interchange with I-35 between 7th Street and Independence Avenue, Grade Separated Oak Trafficway between River Market and Columbus Park, Additional development potential at Independence Ave and I-35 NW corner with cul-de-sac	Active
6th Street to Independence Avenue Connection	B7-2	I-670 connection to Downtown via 6th Street with connection to Independence Avenue with Grade Separation at Oak Trafficway	Downtown and River Market connections improved between 6th Street and Independence Avenue, Modified Diamond Interchange at Independence Avenue and I-35, Grade Separated Oak Trafficway between River Market and Columbus Park, Traffic Calming effect with Independence Avenue cut off within River Market and through traffic using 6th Street	Screened Out

Initial Conceptual Build Strategies

August 9, 2017

BEYOND THE LOOP

Harlem / Wheeler Airport Acesss	Exhibit	Description	Comments	Status
Interchange Improvements				
Half Diamond Interchange with Existing Harlem Road Access	C1	A half diamond interchange, with the exit and entrance ramps on the right-hand side.	Harlem Road Eastbound and Westbound traffic remain in the existing location and condition (separated with individual railroad under crossings) and connect to Richards Road, which is relocated slightly west. Re uses the existing bridges under the BNSF tracks into Harlem.	Active
Half Diamond Interchange with Direct Connection to Northbound Richards Road	C2	Similar to strategy C1 except US-169 NB exit ramps connects to Richards Road		Screened Out
Half Diamond Interchange with Relocated Harlem Railroad Crossing and Improved Direct Connection to Northbound Richards Road	C3	Similar to strategy C1 except the Harlem Road railroad crossing is relocated	The complex intersection in Strategy W2 is replaced with traditional intersection due to the removed Harlem Road connection.	Screened Out
Half Diamond Interchange with Split Lou Holland Undercrossing	C4	Similar to strategy C1 except Northbound Lou Holland drive splits near the levee retaining wall and provided direct connection to Northbound US-169 and Richards Road via a weaving movement.		Active
Half Diamond Interchange with New Single Harlem Road Railroad Crossing	C5	A half diamond interchange, with the exit and entrance ramps on the right-hand side. Harlem Eastbound and Westbound traffic is brought together for a Single railroad undercrossing.		Active
Button-Hook Interchange with Relocated Harlem Railroad Crossing	C6	A half diamond interchange with button-hook style ramps, along with the exit and entrance ramps on the right-hand side. The Harlem Road railroad undercrossing is relocated either to the north or south		Screened Out
Auxiliary Improvements			These improvement alternatives provide independent utility to the above altnernative scenarios	
Right In Right Out 1	RIRO 1	Improve existing RIRO by providing additional length to existing accel/decel lanes	Provides SB US-169 connectivity into the Airport near VML. 2nd SB US-169 movement provided further north.	Active
Right In Right Out 2	RIRO 2	Improve existing RIRO by providing separated accel/decel lanes	Provides dedicated accel/decel lane similar to an interchange ramp. 2nd SB US-169 movement provided further north.	Active
Northern Access Connection to US-169	N. Intchg	SB on and off ramp connections and NB On ramp Connections	This configuration provides additional movements into and out of the airport in order to provide at least 2 entrance and exit locations into the airport.	Active

West Bottoms	Exhibit	Description	Comments	Status
Roadway network changes to mitigate possible closure of Woodswether viaduct and connection to Broadway				
Half Diamond Interchange at Wymoing Street	D1	Provides partial interchange access into and out of the West Bottoms from I-70. Reduces impacts to the existing Kansas City Missouri Waste Water Treatment Facility.	Partial interchange access will create difficulties in obtaining an approved access modification to the interstate. Steep profile grades for both the onramp and offramp from I-70. This will could result in operational and safety concerns. Impacts the proposed expansion of the Kansas City Missouri waste water treatmen facility in the north-east quadrant of I-70 and Wyoming Street.	Screened Out
Half Tight Diamond Interchange option on the Kansas Side at Ohio Street	D1a	Eliminate impact to the Kansas City Missouri waste water treatment facility. Provides additional weaving space between I-35 directional ramps.	Partial interchange access. This will be a significant concern in obtaining an approved access modification to the interstate. Steep grades from I-70 to Ohio Street. Impacts several businesses and parking areas on both sides including a large area of truck and trailer parking for UPS.	Screened Out
Full Diamond Interchange at Wyoming Street	D2	Provides all traffic movements between I-70 and Wyoming Street.	Inadequate weave, merge, acceleration, and deceleration distance for the I-35 directional ramps on the east side and the future Phase 2 of the LCV. Wyoming Street Traffic to WB I-70 would require 3 lane changes to access the future WB I-70 in Phase 2 of the LCV project. Impacts both the existing and proposed expansion area of the Kansas City Missouri waste water treatment facility	Screened Out
Folded Diamond Interchange at Wyoming Street	D3	Eliminates impacts to the existing Kansas City Missouri waste water treatment facility in the NW quadrant of I-70 and Wyoming Street. Provides all movements to and from I-70 at Wyoming Street. Provides additional separation distance from future Phase 2 construction of the LCV.	Folded diamond on the northside of I-70 impacts entire property for the proposed location for the expansion of the Kansas City Missouri waste water treatment facility. Requires acquisition of Geo. E. Fern Co. building and large dual sided Lamar outdoor advertising billboard. Tight loop ramps on steep grades to and from I-70 will create operational and safety issues. The proximity of WB I-70 offramp to Woodswether Road would create a difficult turning movement for trucks wanting to go EB on Woodswether Road.	Screened Out
Partial Folded Diamond Interchange at Wyoming Street	D4	Eliminates impacts to the existing Kansas City Missouri waste water treatment facility in the NW quadrant of I-70 and Wyoming Street. Eliminates tight radius (20 mph) loop ramp for EB I-70.	Inadequate weave, merge, acceleration, and deceleration distance for the I-35 directional ramps on the east side and the future Phase 2 of the LCV. Only 430' of weaving distance between EB I-70 onramp and SB I-35 directional ramp. EB I-70 onramp traffic will have to shift two (2) lanes to continue EB on I-70. Wyoming Street traffic to WB I-70 would require 3 lane changes to access the future WB I-70 in Phase 2 of the LCV project.	Screened Out
Madison Ave to Sante Fe St	D5	New connection between Woodswether and Forrester	Added Roadway to construct and maintain between Madison and 8th Street, Multiple intersections for trucks to navigate, Need to review intersection improvements to facilitate traffic diverted from Woodwether Road (added turn lanes, improved turn radius, signals, etc)	Screened Out
Mulberry St to Forrester Rd	D6	Utilize existing Mulberry St between Woodswether and Forrester	Uses existing street network, Multiple intersection turning movements for trucks to navigate, Need to review intersection improvements to facilitate traffic diverted from Woodswether Road (added turn lanes, improved turn radius, signals, etc)	Active
Wyoming St to Forrester Rd	D7	Utilize existing Wyoming St between Woodswether and Forrester	Uses existing street network, Fewest intersection turning movements for trucks to navigate, Need to review intersection improvements to facilitate traffic diverted from Woodswether Road (added turn lanes, improved turn radius, signals, etc), longest route to replace Woodswether Road connection	Active

Table 4: Level 1A Matrix - Initial Screening

NORTH LOOP PLANNING AND ENVIRONMENTAL LINKAGES STUDY

Initial Screening of Partial List of Build Strategies

Study Management Team Meeting - May 16, 2017

SMT COLLECTIVE SCORING - MAY 16, 2017

BEYOND THE LOOP

Conceptual Build Strategies	Exhibit	Description	Comments	Improve Physical Conditions	Optimize System Performance	Improve Safety & Security	Improve Transp. Choices	Improve Economic Vitality and Placemaking	Improve Environn Sustainability	AVE. SCORE	SCREENED
O'Neil Bridge Strategies											
Rehabilitation		Use In Place	Coordinated w/5th / 6th Interchange Imp & other local interchange improvements	3	0	0	0	0	0	0.5	
New Bridge											
Location Alternative 1	A1	Largest Skew Angle to Nav Channel	Can combine with alternate local access scenarios. Left split probably requires I-35 designation to south loop	5	0	2	3	0	0	1.7	
Location Alternative 2	A2	Lesser Skew Angle to Nav Channel	Alternate sub-alignments on south side. Can combine with alternate local access scenarios. Left split probably requires I-35 designation to south loop	5	4	3	3	-2	-2	1.8	
Location Alternative 3	A3	Existing Skew Angle to Nav Channel as Existing	Connects with existing Broadway interchange at 5th and 6th OR Alternative Interchange Strategies depending on traffic	5	4	3	3	0	0	2.5	
New Bridge and Repurpose		Existing Bridge used for local access	Highly Improbable - additional bridge in system and ownership	3	5	4	4	-2	-5	1.5	X
Highway Strategies (Med Impact - Med Range)											
Interchange Improvements											
5th/6th Street	C1	SPUI, DDI, etc.	Independent or in conjunction with other medium and high impact strategies	2	2	2	2	3	2	2.2	
Route 9/Independence Avenue	C2	At-grade intersection at Independence. Removes system to system connectoin	Links Columbus Park with River Market. Independent or in conjunction with other medium and high impact strategies	4	0	2	3	5	2	2.7	
Highway Strategies (High Impact - Long Range)											
I-70 Mainline Reconfiguration											
North Loop Access Modifications	B1	I-29 / I-35 EIS North Loop Alternative B. Uses existing mainline with elimination and consolidation of access ramps.	Some traffic relief but does not provide any additional development potential in comparison with other strategies	2	2	0	0	2	0	1.0	X
Mainline Collector Distributor	B2	At mainline elevation-separated auxiliary lane	Through traffic relief only but CD requires upstream decision points, and additional pavement to be constructed and maintained. No additional development opportunities.	2	2	3	0	-5	-3	-0.2	X
Compressed Footprint Mainline (North or South)	B3	Tight adjacent frontage roads. Shorter bridges	Enhanced lid opportunities and development expansion potential	5	3	3	3	4	3	3.5	
Loop System Reconfiguration											
Total One Way Circulation	B4, B5	Counter Clockwise Circulation	With or without SB CD on east leg for connection to SB 71 and EB I-70 & NB CD on west leg for access to 12th Street, O'Neil Bridge, and north side of CBD	0	-1	-1	0	0	-1	-0.5	X
Partial One-way Circulation	B6	Two-Way on north and south legs	Maintains continuity on I-670 and I-70, splits I-35	0	0	0	0	0	0	0.0	X
Redesignate and Reclassify North Loop	B7	Includes Arterial Couplet - 6th and Independence	diversion of north leg I-70 traffic is a concern. Detailed traffic modeling reuired to fully assess secondary impacts and traffic mitigation needs.	3	0	2	3	5	3	2.7	

Table 5: Level 1B Matrix - North Loop

	I-70 PEL North Loop Strategy Evaluation Matrix										
				Measures	Units	No-Build	Alternative B1	Alternative B3-6A	Alternative B3-6B	Alternative B3-7	Alternative B7-1
NEEDS	IMPROVE PHYSICAL CONDITIONS	INFRASTRUCTURE	POTENTIAL TO IMPROVE USEFUL LIFE OF FACILITY	Number of Existing Bridges Being Replaced	Area	0	7	10	10	10	11
				Area of Existing Pavement Being Replaced	Area	0 Ac	28.8 Ac	40.4 Ac	40.4 Ac	40.4 Ac	39.8 Ac
		GEOMETRY	POTENTIAL TO IMPROVE SUB-STANDARD GEOMETRY	Number of Existing Substandard Geometric Features Replaced (Red)	Count	0	46	71	71	71	63
				Number of Existing Substandard Geometric Features Replaced (Yellow)	Count	0	18	27	27	27	27
	OPTIMIZE SYSTEM PERFORMANCE	REGIONAL CONNECTIONS	NORTHLAND	Will Alternative Improve Travel Time	1-4 (Best to Worst)	4	2	3	3	3	4
			WYANDOTTE CO. AND KC, KANSAS	Will Alternative Improve Travel Time	1-4 (Best to Worst)	4	3	2	2	2	4
			SOUTHERN KC and JOHNSON CO.	Will Alternative Improve Travel Time	1-4 (Best to Worst)	4	3	2	2	2	4
		DOWNTOWN LOOP	MAINLINE TRAFFIC SPEED	Average Peak Hour Travel Speed	1-4 (Best to Worst)	4	3	2	2	2	4
			EXIT AND ENTRANCE RAMP PERFORMANCE	LOS (HCM)	1-4 (Best to Worst)	4	2	3	3	3	4
		SYSTEM-WIDE	TRAFFIC CONGESTION	Total Peak Hour Delay	1-4 (Best to Worst)	4	2	3	3	3	4
			TOTAL TRAVEL	Total Daily Travel Time	1-4 (Best to Worst)	4	2	3	3	3	4
				Total Daily Travel Distance	1-4 (Best to Worst)	3	3	2	2	2	4
	IMPROVE SAFETY AND SECURITY	VEHICULAR TRAFFIC	NUMBER OF CONFLICT POINTS	Ramp Density	Ramps per Mile	19	13	3	3	8	2
		BIKE/ PEDESTRIAN	BICYCLE/PEDESTRIAN SAFETY	Potential to Allow for Improve existing Bike/Ped Facilities	1-4 (Best to Worst)	4	4	2	2	2	1
		IMPROVE EMERGENCY RESPONSE TIMES		Will Alternative Improve Emergency Vehicle Travel Time?	1-4 (Best to Worst)	3	2	2	2	2	4
GOALS	IMPROVE TRANSPORTATION CHOICES	CONTRIBUTE TO/COMPLEMENT BIKE KC PLAN		Potential for Bike/Ped Network Expansion	1-4 (Best to Worst)	4	4	2	2	2	1
		ACCOMMODATE EXISTING AND FUTURE TRANSIT		Potential for Bus/Streetcar Integration	1-4 (Best to Worst)	4	4	2	2	3	1
	IMPROVE ECONOMIC VITALITY AND PLACEMAKING	REVITALIZATION AREAS		Potential to Make Space Available for Commercial/Recreational Development	Area	0 Ac	8.0 Ac	14.9 Ac	11.3 Ac	13.0 Ac	29.0 Ac
		ENHANCE REGIONAL FREIGHT HUBS	PORT OF KC	Average Truck Travel Time	1-4 (Best to Worst)	4	3	2	2	2	4
			RAIL YARDS	Average Truck Travel Time	1-4 (Best to Worst)	4	3	2	2	2	4
			DOWNTOWN AIRPORT	Average Truck Travel Time	1-4 (Best to Worst)	4	3	2	2	2	3
		PROMOTE QUALITY PLACES		Visual Character and Aesthetics	1-4 (Best to Worst)	4	4	2	2	2	1
	IMPROVE SUSTAINABILITY	MAINTAIN/ IMPROVE MULTI-MODAL CONNECTIONS		Potential to meet regional Bike Plan	1-4 (Best to Worst)	4	4	2	2	2	1
		COMMUNITY IMPACTS	ROW IMPACTS	Residential	Area	0	0	0	0	0	0
				Commercial	Area	0	0	0	0	0	0
			EJ/LEP POPULATIONS DISPLACED	Residential	Area	0	0	0	0	0	0
				Commercial	Area	0	0	0	0	0	0
		PROTECT CULTURAL/NATURAL RESOURCES	CULTURAL RESOURCES	NRHP Sites Impacted	Count	0	0	0	0	0	0
				NRHP Districts Impacted	Count	0	0	0	0	0	0
				Documented Archeology Sites	Count	0	0	0	0	0	0
				Hazmat Sites Impacted	Count	0	0	0	0	0	0
			NATURAL RESOURCES	Parks Impacted	Count	0	6	3	3	3	3
				Wetlands Impacted	Area (Acres)	0	0	0	0	0	0
				Floodplains Impacted	Linear Feet Crossed	0	0	0	0	0	0
	FEASIBILITY	TOTAL COST		Planning Level Construction Cost Estimate (Bridge)	Dollars	$4,500,000	$22,200,000.00	$22,500,000	$22,500,000	$20,500,000	$0
				Planning Level Construction Cost Estimate (Roadway)	Dollars	$2,200,000	$31,000,000.00	$46,300,000	$46,500,000	$34,700,000	$16,560,000
										Roadway cost w/o SPUI	
										$30,500	

Table 6: Level 1B Matrix – Downtown Airport

	Downtown Airport Strategy Evaluation Matrix								
				Measures	Units	No-Build	Alternative C1	Alternative C4	Alternative C5
NEEDS	IMPROVE PHYSICAL CONDITIONS	INFRASTRUCTURE	POTENTIAL TO IMPROVE USEFUL LIFE OF FACILITIES	Area of Existing Bridges Being Replaced	Area	0	80,000 SF	80,000 SF	82,000 SF
				Area of Existing Pavement Being Replaced	Area	0	110,000 SF	115,000 SF	120,000 SF
		GEOMETRY	POTENTIAL TO IMPROVE SUB-STANDARD GEOMETRY	Number of Existing Substandard Geometric Features Replaced (Red)	Count	0	8	8	8
				Number of Existing Substandard Geometric Features Replaced (Yellow)	Count	0	2	2	2
	OPTIMIZE SYSTEM PERFORMANCE	LOCAL ACCESS	AIRPORT	Total Delay at Airport Entrances	Hours	Worse	Better	Better	Better
			HARLEM	Travel Time from US 169 into Harlem	Red, Yellow, Green	Neutral	Better	Better	Better
		US 169	US 169 TRAVEL SPEED	Average Peak Hour Travel Speed	Red, Yellow, Green	Worse	Better	Better	Better
			EXIT AND ENTRANCE RAMP PERFORMANCE	LOS (HCM)	LOS	Worse	Better	Better	Better
	IMPROVE SAFETY AND SECURITY	VEHICULAR	Total Number of Conflict Points		Count	25	20	12	17
		BICYCLE/ PEDESTRIAN	BICYCLE/PEDESTRIAN SAFETY	Does Alternative Allow for Improve existing Bike/Ped Facilities	Qualitative	6' Path	10' Path	10' Path	10' Path
		IMPROVE EMERGENCY RESPONSE TIMES		Will Alternative Improve Emergency Vehicle Travel Time?	Qualitative	Worse	Better	Better	Better
GOALS	IMPROVE TRANSPORTATION CHOICES	CONTRIBUTE TO/COMPLEMENT BIKE KC PLAN		Potential for Bike/Ped Network Expansion	Qualitative	No	Yes	Yes	Yes
		ACCOMMODATE EXISTING AND FUTURE TRANSIT		Potential for Bus/Streetcar Integration	Qualitative	No	Better	Better	Better
	IMPROVE ECONOMIC VITALITY AND PLACEMAKING	REVITALIZATION AREAS		Potential to Make Space Available for Commercial/Recreational Development	Area	0	0	0	0
		ENHANCE REGIONAL FREIGHT HUBS	PORT OF KC	Average Truck Travel Time	Red, Yellow, Green	Neutral	Neutral	Neutral	Neutral
			RAIL YARDS	Average Truck Travel Time	Red, Yellow, Green	Neutral	Neutral	Neutral	Neutral
			DOWNTOWN AIRPORT	Average Truck Travel Time	Red, Yellow, Green	Neutral	Neutral	Neutral	Neutral
		PROMOTE QUALITY PLACES		Visual Character and Aesthetics	Qualitative	No	Yes	Yes	Yes
	IMPROVE SUSTAINABILITY	MAINTAIN/ IMPROVE MULTI-MODAL CONNECTIONS		Potential to meet regional Bike Plan	Qualitative	No	Yes	Yes	Yes
		COMMUNITY IMPACTS	ROW IMPACTS	Residential	Area	0	0	0	0
				Commercial	Area	0	0	0	0
			EJ/LEP POPULATIONS DISPLACED	Residential	Area	0	0	0	0
				Commercial	Area	0	0	0	0
		PROTECT CULTURAL/NATURAL RESOURCES	CULTURAL RESOURCES	NRHP Sites Impacted	Count	0	0	0	0
				NRHP Districts Impacted	Count	0	0	0	0
				Documented Archeology Sites	Count	0	0	0	0
				Hazmat Sites Impacted	Count	0	0	0	0
			NATURAL RESOURCES	Parks Impacted	Count	0	0	0	0
				Wetlands Impacted	Area (Acres)	0	0	0	0
				Floodplains Impacted	Linear Feet Crossed	0	0	0	0
	FEASIBILITY	TOTAL COST		Planning Level Construction Cost Estimate	Dollar Range	$8-10M	$25-30M	$25-30M	$35-40M

Table 7: Level 1B Matrix - West Bottoms

	West Bottoms Strategy Evaluation Matrix							
				Measures	Units	No-Build	Alternative D6	Alternative D7
NEEDS	IMPROVE PHYSICAL CONDITIONS	INFRASTRUCTURE	POTENTIAL TO IMPROVE USEFUL LIFE OF FACILITIES	Number of Existing Bridges Being Replaced	Area	0	0	0
				Area of Existing Pavement Being Rehabilitated	Area	0	122899 SF	154489 SF
		GEOMETRY	POTENTIAL TO IMPROVE SUB-STANDARD GEOMETRY	Number of Existing Substandard Geometric Features Replaced (Red)	Count	0	0	0
				Number of Existing Substandard Geometric Features Replaced (Yellow)	Count	0	0	0
	OPTIMIZE SYSTEM	LOCAL ACCESS	I-70 TO LOCATION X	Average Peak Hour Commute Travel Time	Red, Yellow, Green	Neutral	Neutral	Neutral
	IMPROVE SAFETY AND SECURITY	VEHICULAR TRAFFIC	WILL ALTERNATIVE IMPROVE TOTAL NUMBER OF CONFLICT POINTS		Qualitative	No	Better	Best
		BIKE/ PEDESTRIAN	BICYCLE/PEDESTRIAN SAFETY	Does Alternative Allow Improvements to existing Bike/Ped Facilities	Qualitative	No	Potential	Potential
		IMPROVE EMERGENCY RESPONSE TIMES		Will Alternative Improve Emergency Vehicle Travel Time?	Qualitative	Neutral	Neutral	Neutral
GOALS	IMPROVE TRANSPORTATION CHOICES	CONTRIBUTE TO/COMPLEMENT BIKE KC PLAN		Potential for Bike/Ped Network Expansion	Qualitative	Yes	Yes	Yes
		ACCOMMODATE EXISTING AND FUTURE TRANSIT		Potential for Bus/Streetcar Integration	Qualitative	Yes	Yes	Yes
	IMPROVE ECONOMIC VITALITY AND PLACEMAKING	REVITALIZATION AREAS		Potential to Make Space Available for Commercial/Recreational Development	Area	No	No	No
		ENHANCE REGIONAL FREIGHT HUBS	West Bottoms	Average Truck Travel Time	Red, Yellow, Green	Neutral	Neutral	Neutral
		PROMOTE QUALITY PLACES		Visual Character and Aesthetics	Qualitative	Bad	Neutral	Neutral
	IMPROVE SUSTAINABILITY	COMMUNITY IMPACTS	ROW IMPACTS	Residential	Area	0	0	0
				Commercial	Area	0	0	0
			EJ/LEP POPULATIONS DISPLACED	Residential	Area	0	0	0
				Commercial	Area	0	0	0
		PROTECT CULTURAL/NATURAL RESOURCES	CULTURAL RESOURCES	NRHP Sites Impacted	Count	0	2	2
				NRHP Districts Impacted	Count	0	1	1
				Documented Archeology Sites	Count	0	0	0
				Hazmat Sites Impacted	Count	0	3	3
			NATURAL RESOURCES	Parks Impacted	Count	0	0	0
				Wetlands Impacted	Area (Acres)	0	5.2	5.2
				Floodplains Impacted	Linear Feet Crossed	0	5100	7600
	FEASIBILITY	TOTAL COST		Planning Level Construction Cost Estimate (Bridge)	Dollars	0	0	0
				Planning Level Construction Cost Estimate (Roadway)	Dollars	$0	$664,000	$534,400

Table 8: Level 1B Matrix – Buck O'Neil Bridge

	River Bridge + Connections to North Loop Evaluation Matrix								
				Measures	Units	Alternative A1 / No Build	Alternative A2	Alternative A3	Alternative A4
NEEDS	IMPROVE PHYSICAL CONDITIONS	INFRASTRUCTURE	POTENTIAL TO IMPROVE USEFUL LIFE OF FACILITY	Service Life of River Bridge	Years	35	100	100	100
				Area of Existing Bridges Being Replaced	Area	0	175,000 SF	220,000 SF	195,000 SF
				Area of Existing Pavement Being Replaced	Area	0	180,000 SF	30,000 SF	120,000 SF
		GEOMETRY	POTENTIAL TO IMPROVE SUB-STANDARD GEOMETRY	Number of Existing Substandard Geometric Features Replaced (Red)	Count	0	12	17	11
				Number of Existing Substandard Geometric Features Replaced (Yellow)	Count	0	0	1	1
	OPTIMIZE SYSTEM PERFORMANCE	US 169	MAINLINE TRAFFIC SPEED	Average Peak Hour Travel Speed	1-4 (Best to Worst)	4	1	2	3
		INTERSECTION PERFORMANCE	US 169/INDEPENDENCE AVE (Broadway / 5th Ave)	LOS (HCM)	1-4 (Best to Worst)	4	2	1	3
		TRAFFIC CONGESTION		Total Peak Hour Delay	Hours	4	1	2	3
		PEAK PERIOD TRAVEL TIME	FREEWAY	Airport to 12th Street Interchange	1-4 (Best to Worst)	4	1	2	3
			LOCAL	Airport to 6th Street Intersection	1-4 (Best to Worst)	4	2	1	3
	IMPROVE SAFETY AND SECURITY	VEHICULAR TRAFFIC	CONFLICT POINTS AT BRIDGE TERMINALS		Qualitative	30	12	34	24
		BIKE/ PEDESTRIAN	BICYCLE/PEDESTRIAN SAFETY	Does Alternative Allow for Improve existing Bike/Ped Facilities	Qualitative	6' Path	10' Path	10' Path	10' Path
		IMPROVE EMERGENCY RESPONSE TIMES		Travel Time for Emergency Responders to Airport	Qualitative	Bad	Good	Good	Bad
GOALS	IMPROVE TRANSPORTATION CHOICES	CONTRIBUTE TO/COMPLEMENT BIKE KC PLAN		Potential for Bike/Ped Network Expansion	1-4 (Best to Worst)	4	2	2	1
		ACCOMMODATE EXISTING AND FUTURE TRANSIT		Potential for Bus/Streetcar Integration	1-4 (Best to Worst)	4	1	2	2
		BIKE/ PEDESTRIAN RIVER CROSSING		Width of bike/ped accomodation on bridge	Width (feet)	6	10	10	10
	IMPROVE ECONOMIC VITALITY AND PLACEMAKING	REVITALIZATION AREAS		Potential to Make Space Available for Commercial/Recreational Development	Area	0	0	0	0
		ENHANCE REGIONAL FREIGHT HUBS	RAIL YARDS	Average Truck Travel Time	1-4 (Best to Worst)	4	1	2	3
			DOWNTOWN AIRPORT	Average Truck Travel Time	1-4 (Best to Worst)	4	1	2	3
		PROMOTE QUALITY PLACES		Visual Character and Aesthetics	1-4 (Best to Worst)	4	2	2	2
	IMPROVE SUSTAINABILITY	COMMUNITY IMPACTS	ROW IMPACTS	Residential	Area	0	0	0	0
				Commercial	Area	0	60,000 SF	80,000 SF	10,000 SF
			EJ/LEP POPULATIONS DISPLACED	Residential	Area	0	0.37 Ac	0	0
				Commercial	Area	0	0	0	0
		PROTECT CULTURAL/NATURAL RESOURCES	CULTURAL RESOURCES	NRHP Sites Impacted	Count	0	0	0	0
				NRHP Districts Impacted	Count	0	0	0	0
				Documented Archeology Sites	Count	0	0	0	0
				Hazmat Sites Impacted	Count	0	1	1	1
			NATURAL RESOURCES	Parks Impacted	Count	0	0	0	0
				Wetlands Impacted	Area (Acres)	0	3.5	3.5	2.9
				Floodplains Impacted	Linear Feet Crossed	0	2200	2200	2100
	FEASIBILITY	TOTAL COST		Planning Level Construction Cost Estimate	Dollar Range	$50-60M	$160-190M	$160-190M	$120-150M
		OPPORTUNITY FOR PHASED IMPLEMENTATION			Qualitative	No	Yes	Yes	No

Table 9: Level 2 Matrix - North Loop

				Insert Legend Color Codes for Groups		I-70 North Loop Strategies				
						Baseline (Existing)	Future No-Build	Alternative 2	Alternative 3	Alternative 4
				Measures	Units					
NEEDS	IMPROVE PHYSICAL CONDITIONS	INFRASTRUCTURE	NUMBER OF BRIDGES WITH SUFFICIENCY RATING <=50		Count					
			MILES OF ROAD IN POOR CONDITION IMPROVED		Miles					
		GEOMETRY	POTENTIAL TO IMPROVE SUB-STANDARD GEOMETRY		Qualitative					
	OPTIMIZE SYSTEM PERFORMANCE	REGIONAL CONNECTIONS	NORTHLAND	Average Peak Commute Travel Time	Minutes					
			WYANDOTTE CO. AND KC, KANSAS	Average Peak Commute Travel Time	Minutes					
			SOUTHERN KC and JOHNSON CO.	Average Peak Commute Travel Time	Minutes					
		DOWNTOWN LOOP	MAINLINE TRAFFIC SPEED	Average Peak Period Travel Speed	MPH					
			EXIT AND ENTRANCE RAMP PERFORMANCE	LOS	LOS					
			LANE CONTINUITY	Lane Transitions Meeting AASHTO Standards	Count					
		SYSTEM-WIDE	TRAFFIC CONGESTION	Total Peak Period Delay	Hours					
			TOTAL TRAVEL	Total Daily Travel Time	VHT					
				Total Daily Travel Distance	VMT					
	IMPROVE SAFETY AND SECURITY	VEHICULAR TRAFFIC	INTERCHANGE RAMP DENSITY		Count/Mile					
			TOTAL NUMBER OF CONFLICT POINTS (Ramp Gores and Ramp Terminals)		Count					
		BICYCLIST SAFETY	BICYCLE FACILITIES		Miles					
		IMPROVED PEDESTRIAN SAFETY	PEDESTRIAN FACILITIES		Qualitative					
		IMPROVE EMERGENCY RESPONSE TIMES		Peak Period Travel Time from 12th St./Hickory St. to Truman Medical Center	Minutes					
				Peak Period Travel Time from Harlem to Truman Medical Center	Minutes					
GOALS	IMPROVE TRANSPORTATION CHOICES	CONTRIBUTE TO/COMPLEMENT BIKE KC PLAN/KC WALKABILITY PLAN		Potential for Bike/Ped Network Connections	Qualitative					
		ACCOMMODATE EXISTING AND FUTURE TRANSIT		Potential for Bus/Streetcar Integration	Qualitative					
	IMPROVE ECONOMIC VITALITY AND PLACEMAKING	REVITALIZATION AREAS		Potential to Make Space Available for Development	Acres					
		PROMOTE QUALITY PLACES		Visual Character and Aesthetics	Qualitative					
	IMPROVE SUSTAINABILITY	INTEGRATE NEW TECHNOLOGIES		Allow for future autonomous vehicles	Qualitative					
		COMMUNITY IMPACTS	ROW IMPACTS	Potential Residential Impacts	Acres					
				Potential Commercial Impacts	Acres					
			EJ/LEP POPULATION IMPACTS	Potential Residential Impacts	Total Count					
				Potential Commercial Impacts	Total Count					
		PROTECT HISTORICAL RESOURCES	CULTURAL RESOURCES	Potential Archeological Sites Impacted	Count					
				Potential NRHP Sites Impacted	Count					
			NATURAL RESOURCES	Potential Parks Impacted	Acres					
				Potential Surface Water	Acres					
	COST	PLANNING LEVEL COST ESTIMATE			Dollars					

Table 10: Level 2 Matrix – Downtown Airport

				Insert Legend Color Codes for Groups			Downtown Airport Strategies			
						Baseline (Existing)	Future No-Build	Alternative 1	Alternative 2	Alternative 3
				Measures	Units					
NEEDS	IMPROVE PHYSICAL CONDITIONS	INFRASTRUCTURE	NUMBER OF BRIDGES WITH SUFFICIENCY RATING <=50		Count					
			MILES OF ROAD IN POOR CONDITION IMPROVED		Miles					
		GEOMETRY	POTENTIAL TO IMPROVE SUB-STANDARD GEOMETRY		Qualitative					
	OPTIMIZE SYSTEM PERFORMANCE	LOCAL ACCESS	AIRPORT	Total Delay at Airport Entrances	Minutes					
			HARLEM	Travel Time from US 169 into Harlem	Minutes					
		US 169	US 169 TRAVEL SPEED	Average Peak Period Travel Speed	MPH					
			EXIT AND ENTRANCE RAMP PERFORMANCE	LOS	LOS					
	IMPROVE SAFETY AND SECURITY	VEHICULAR	INTERCHANGE RAMP DENSITY		Count/Mile					
			TOTAL NUMBER OF CONFLICT POINTS (Ramp Gores and Ramp Terminals)		Count					
		BICYCLIST SAFETY	BICYCLE FACILITIES		Miles					
		IMPROVED PEDESTRIAN SAFETY	PEDESTRIAN FACILITIES		Qualitative					
		IMPROVE EMERGENCY RESPONSE TIMES		Peak Period Travel Time from Harlem to Truman Medical Center	Minutes					
GOALS	IMPROVE TRANSPORTATION CHOICES	CONTRIBUTE TO/COMPLEMENT BIKE KC PLAN/KC WALKABILITY PLAN		Potential for Bike/Ped Network Connections	Qualitative					
		ACCOMMODATE EXISTING AND FUTURE TRANSIT		Potential for Bus/Streetcar Integration	Qualitative					
	IMPROVE ECONOMIC VITALITY AND PLACEMAKING	REVITALIZATION AREAS		Potential to Make Space Available for Development	Acres					
		PROMOTE QUALITY PLACES		Visual Character and Aesthetics	Qualitative					
	IMPROVE SUSTAINABILITY	INTEGRATE NEW TECHNOLOGIES		Allow for future autonomous vehicles	Qualitative					
		COMMUNITY IMPACTS	ROW IMPACTS	Potential Residential Impacts	Acres					
				Potential Commercial Impacts	Acres					
			EJ/LEP POPULATIONS DISPLACED	Potential Residential Impacts	Total Count					
				Potential Commercial Impacts	Total Count					
		PROTECT HISTORICAL RESOURCES	CULTURAL RESOURCES	Potential Archeological Sites Impacted	Count					
				Potential NRHP Sites Impacted	Count					
			NATURAL RESOURCES	Potential Parks Impacted	Acres					
				Potential Surface Water	Acres					
	COST	PLANNING LEVEL COST ESTIMATE			Dollars					

Table 11: Level 2 Matrix – West Bottoms

				Insert Legend Color Codes for Groups		West Bottoms Strategies				
						Baseline (Existing)	Future No-Build	Alternative 1	Alternative 2	Alternative 3
				Measures	Units					
NEEDS	IMPROVE PHYSICAL CONDITIONS	INFRASTRUCTURE	NUMBER OF BRIDGES WITH SUFFICIENCY RATING <=50		Count					
			MILES OF ROAD IN POOR CONDITION IMPROVED		Miles					
		GEOMETRY	POTENTIAL TO IMPROVE SUB-STANDARD GEOMETRY		Qualitative					
	OPTIMIZE SYSTEM PERFORMANCE	LOCAL ACCESS	I-70 TO LOCATION X	Average Peak Commute Travel Time	Minutes					
			12th STREEET EXIT AND ENTRANCE RAMP PERFORMANCE	LOS	LOS					
	IMPROVE SAFETY AND SECURITY	VEHICULAR TRAFFIC	TOTAL NUMBER OF CONFLICT POINTS (Ramp Gores and Ramp Terminals)		Count					
		BICYCLIST SAFETY	BICYCLE FACILITIES		Miles					
		IMPROVED PEDESTRIAN SAFETY	PEDESTRIAN FACILITIES		Qualitative					
		IMPROVE EMERGENCY RESPONSE TIMES		Peak Period Travel Time from 12th St./Hickory St. to Truman Medical Center	Minutes					
				Peak Period Travel Time from I-70 /Wyoming Street to Truman Medical	Minutes					
GOALS	IMPROVE TRANSPORTATION CHOICES	CONTRIBUTE TO/COMPLEMENT BIKE KC PLAN/KC WALKABILITY PLAN		Potential for Bike/Ped Network Connections	Qualitative					
		ACCOMMODATE EXISTING AND FUTURE TRANSIT		Potential for Bus/Streetcar Integration	Qualitative					
	IMPROVE ECONOMIC VITALITY AND PLACEMAKING	REVITALIZATION AREAS		Potential to Make Space Available for Development	Acres					
		PROMOTE QUALITY PLACES		Visual Character and Aesthetics	Qualitative					
	IMPROVE SUSTAINABILITY	INTEGRATE NEW TECHNOLOGIES		Allow for future autonomous vehicles	Qualitative					
		COMMUNITY IMPACTS	ROW IMPACTS	Potential Residential Impacts	Acres					
				Potential Commercial Impacts	Acres					
			EJ/LEP POPULATION IMPACTS	Potential Residential Impacts	Total Count					
				Potential Commercial Impacts	Total Count					
		PROTECT HISTORICAL RESOURCES	CULTURAL RESOURCES	Potential Archeological Sites Impacted	Count					
				Potential NRHP Sites Impacted	Count					
			NATURAL RESOURCES	Potential Parks Impacted	Acres					
				Potential Surface Water	Acres					
	COST	PLANNING LEVEL COST ESTIMATE			Dollars					

Table 12: Level 2 Matrix – Buck O'Neil Bridge

				Insert Legend Color Codes for Groups		Buck O'Neil Bridge Strategies				
						Baseline (Existing)	No-Build	Alternative 1	Alternative 2	Alternative 3
				Measures	Units					
		OPPORTUNITY FOR PHASED CONSTRUCTION			Qualitative					
NEEDS	IMPROVE PHYSICAL CONDITIONS	INFRASTRUCTURE	NUMBER OF BRIDGES WITH SUFFICIENCY RATING <=50		Count					
			MILES OF ROAD IN POOR CONDITION IMPROVED		Miles					
		GEOMETRY	POTENTIAL TO IMPROVE SUB-STANDARD GEOMETRY		Qualitative					
	OPTIMIZE SYSTEM PERFORMANCE	US 169	MAINLINE TRAFFIC SPEED	Average Peak Period Travel Speed	MPH					
		INTERSECTION PERFORMANCE	US 169/INDEPENDENCE AVE.	LOS	LOS					
		LANE CONTINUITY		Lane Transitions not Meeting AASHTO Standards	Count					
		TRAFFIC CONGESTION		Total Peak Period Delay	Hours					
		PEAK PERIOD TRAVEL TIME	FREEWAY	Downtown Airport to 12th Street Interchange	Minutes					
			LOCAL	Downtown Airport to 6th Street Intersection	Minutes					
	IMPROVE SAFETY AND SECURITY	VEHICULAR TRAFFIC	TOTAL NUMBER OF CONFLICT POINTS (Ramp Gores and Ramp Terminals)		Count					
		BICYCLIST SAFETY	BICYCLE FACILITIES		Miles					
		IMPROVED PEDESTRIAN SAFETY	PEDESTRIAN FACILITIES		Qualitative					
		IMPROVE EMERGENCY RESPONSE TIMES		Peak Period Travel Time from Downtown Airport to Truman Medical Center	Minutes					
				Peak Period Travel Time from Harlem to Truman Medical Center	Minutes					
GOALS	IMPROVE TRANSPORTATION CHOICES	CONTRIBUTE TO/COMPLEMENT BIKE KC PLAN/KC WALKABILITY PLAN		Potential for Bike/Ped Network Connections	Qualitative					
		ACCOMMODATE EXISTING AND FUTURE TRANSIT		Potential for Bus/Streetcar Integration	Qualitative					
	IMPROVE ECONOMIC VITALITY AND PLACEMAKING	REVITALIZATION AREAS		Potential to Make Space Available for Development	Acres					
		PROMOTE QUALITY PLACES		Visual Character and Aesthetics	Qualitative					
	IMPROVE SUSTAINABILITY	INTEGRATE NEW TECHNOLOGIES		Allow for future autonomous vehicles	Qualitative					
		COMMUNITY IMPACTS	ROW IMPACTS	Potential Residential Impacts	Acres					
				Potential Commercial Impacts	Acres					
			EJ/LEP POPULATION IMPACTS	Potential Residential Impacts	Total Count					
				Potential Commercial Impacts	Total Count					
		PROTECT HISTORICAL RESOURCES	CULTURAL RESOURCES	Potential Archeological Sites Impacted	Count					
				Potential NRHP Sites Impacted	Count					
			NATURAL RESOURCES	Potential Parks Impacted	Acres					
				Potential Surface Water	Acres					
	COST	PLANNING LEVEL COST ESTIMATE			Dollars					

Measure – Exit and Entrance Ramp Performance – This will be a quantitative measure of the LOS provided at I-70 Interchange intersections as a result the implementation of each alternative, based on Highway Capacity Manual (HCM) analysis.