**PLAN**

Version 1.0

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<th>Release Date</th>
<th>Author(s)</th>
<th>Notes</th>
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ABBREVIATIONS

BoS – Bus on Shoulder
BNSF – Burlington Northern Santa-Fe (Railroad)
CCTV – Closed Circuit Television
DMS – Dynamic Message Sign
FHWA – Federal Highway Administration
HOV/HOT – High-Occupancy Vehicle (Lane) / High-Occupancy-Toll (Lane)
ICM – Integrated Corridor Management
KC Scout – Kansas City Scout
KCATA – Kansas City Area Transit Authority
KDOT – Kansas Department of Transportation
MPH – Miles-Per-Hour
MARc – Mid-America Regional Council
MoDOT – Missouri Department of Transportation
OGL – Operation Green Light
PTI – Planning Time Index
PTZ – Pan-Tilt-Zoom (Camera)
TMC – Transportation Management Center
TMC – Traffic Message Channel
TOC – Traffic Operations Center
TSM&O - Transportation System Management & Operations
The purpose of this document is to initiate Integrated Corridor Management (ICM) strategies for the I-35 Corridor through the Kansas City metro area.

ICM is the proactive, unified, multimodal management of transportation infrastructure assets and innovative strategies within a corridor. Simply put, ICM is the management of a corridor as a single system rather than the more traditional approach of managing individual transportation networks (e.g., freeways, arterials, transit). ICM requires taking coordinated actions to ensure networks operate at optimal performance (given the available capacity of each network) in order to maximize throughput across the corridor as a whole.¹

The vision of Integrated Corridor Management (ICM) is that transportation networks will realize significant improvements in the efficient movement of people and goods through institutional collaboration and aggressive, proactive integration of existing infrastructure along major corridors. Through an ICM approach, transportation professionals manage the corridor as a multimodal system and make operational decisions for the benefit of the corridor as a whole.¹

This document contains support for continued development of ICM for the I-35 Corridor from the City of Edgerton, Kansas at Sunflower Road to the Kansas/Missouri state line near Cambridge Circle, and in the future through the downtown Kansas City area. An assessment of the current system and projections for the state of the future system are combined based on existing reports. Use Cases for twelve operational conditions are documented which formed the basis for the User and Operational Needs. I-35 ICM Strategies that begin to fulfill the Operational Needs are identified, prioritized, and next steps are offered for action. This document lays the foundation for a complete Concept of Operations (ConOps), pending stakeholder agreement upon specific integration aspects. The I-35 ICM Plan is a “living document” that will be regularly reviewed and maintained by a designated group of stakeholders. Following the recommended next steps will enable the development of a complete Concept of Operations for integrated operations, decision making, and continued management.

The audience for this document are I-35 Corridor stakeholders and regional transportation professionals.

¹ FHWA Definition of ICM. http://www.its.dot.gov/icms/docs/its_worldcong/icm_pres.htm
INTENTION

This document and its appendices are intended to guide the continued development of ICM on I-35 in the Kansas City metro area.

The System Overview provides a snapshot of the transportation system as it was known at the time of planning for ICM. The ICM Strategies offered in this Plan are rooted in the current understanding of the system. This Plan includes partial User and Operational Needs for ICM in the region, based on the Use Case evaluated for this project. Additional Needs should be added, and all should be reviewed and updated regularly. Follow on documentation should include references to how the strategy or implementation fulfills the Operational Needs.

The activities in Table 1 provide a framework to follow in formalizing ICM strategies as the concept continues to develop in the Kansas City Metro area. The Stakeholders in the region desire to implement ICM strategies as possible. In doing so, there is a potential for misalignment or disconnected deployment activities. Prior to initiating an ICM strategy, the following activities should be considered and documented. It is critical that any ICM strategy is initiated within the regional framework to minimize the risk of misalignment or disconnect within the ICM context.

### Table 1 - ICM Process Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Result intended</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Overview</td>
<td>Understand system, available transportation resources, and current loading</td>
<td>Complete</td>
</tr>
<tr>
<td>Define Needs</td>
<td>Define why ICM is being done</td>
<td>Started</td>
</tr>
<tr>
<td>Concept of Operations</td>
<td>Define how ICM will operate</td>
<td>Started</td>
</tr>
<tr>
<td>System Architecture</td>
<td>Define what is part of ICM</td>
<td>Started</td>
</tr>
<tr>
<td>System Requirements</td>
<td>Define what parts will do</td>
<td></td>
</tr>
<tr>
<td>Subsystem Design Definition</td>
<td>Define how subsystems will be designed</td>
<td></td>
</tr>
<tr>
<td>System Analysis Modeling and Simulation</td>
<td>Predict and understand potential effects of ICM strategies</td>
<td></td>
</tr>
<tr>
<td>Interface Definition and Management</td>
<td>Document and manage interface points between subsystems</td>
<td></td>
</tr>
<tr>
<td>Implementation and Deployment</td>
<td>Integration Management</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oversee integration, provide consistent regional framework for integration of subsystems</td>
<td></td>
</tr>
</tbody>
</table>

| Verification                  | Verify that the subsystems do what they are supposed to do |
| Validation                    | Validate that the ICM system is providing efficient, safe management of the transportation system |

| Operations and Maintenance    | Operate ICM strategies and initiatives per MOUs and agreements. Refresh, update, and repair system elements on schedule |
| Evaluation                    | Evaluate performance of system, benchmark against expectations, adjust system parameters. |
| Disposal                      | Replace and dispose of subsystems on schedule |

As part of the analysis of strategies for implementation, the calculation of a benefit/cost (as appropriate) should to be used in comparison with other projects to assist with funding allocation and project prioritization.

**SCOPE**

**GEOGRAPHIC LIMITS**

The I-35 corridor segment considered in this document stretches for approximately 33 miles from Edgerton, Kansas to the Kansas/Missouri state line. Figure 1 shows the corridor highlighted in blue. The southern end of corridor starts at Exit 202, Sunflower Road, which serves the City of Edgerton. The corridor extends north to Exit 235, Cambridge Circle, which is only a few hundred feet south of the Kansas & Missouri state line. The highway has various cross-sections along the length of it including 4-lane sections, 6-lane sections, and an 8-lane section (excluding auxiliary lanes). This corridor segment includes 24 interchanges, three of which are major system interchanges.
AGENCIES INVOLVED

A range of regional stakeholders were invited to participate in the Stakeholder meetings. Participants included the organizations listed in Table 2.

Stakeholders included federal and state transportation departments, the regional planning organization, municipalities, emergency and first responders, transit providers, bike/pedestrian advocates, chambers of commerce, and transportation system operators. It is recommended that the next steps include freight organizations to represent this critical user of the transportation system.
Table 2 - Stakeholder Organizations

<table>
<thead>
<tr>
<th>Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bike-Walk KC</td>
</tr>
<tr>
<td>FHWA</td>
</tr>
<tr>
<td>City of Gardner, KS</td>
</tr>
<tr>
<td>Johnson County</td>
</tr>
<tr>
<td>Johnson County Commissioner</td>
</tr>
<tr>
<td>Johnson County EOC</td>
</tr>
<tr>
<td>Johnson County Public Works Department</td>
</tr>
<tr>
<td>Johnson County Transit</td>
</tr>
<tr>
<td>Kansas Highway Patrol</td>
</tr>
<tr>
<td>KC Scout</td>
</tr>
<tr>
<td>KCATA</td>
</tr>
<tr>
<td>KCMO - Traffic</td>
</tr>
<tr>
<td>KCMO EOC</td>
</tr>
</tbody>
</table>

REFERENCED RESOURCES

The following resources were referenced through the development of this Plan. Several of these resources were developed in support of this project.

The studies and projects reviewed by the project team include the following:

- I-35 Ramp Metering Installation Design – 2016
- Transportation Outlook 2040 – 2015
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- Operation Green Light Strategic Plan – 2013-2016
- 5-County Regional Study - 2013
- The Southwest Johnson County Area Plan - 2013
- I-35 Moving Forward Optimization Plan – 2013
- Johnson County Gateway Design – 2013
- Regional Transit Implementation Plan – 2011
- Johnson County Transit Strategic Plan Update – 2011

STAKEHOLDER ENGAGEMENT

Stakeholder engagement consisted of two group meetings (one at the beginning of the project and one towards completion) with feedback throughout the project development. Stakeholders contributed to the self-assessment of the Capability Maturity Model (CMM) regarding ICM readiness in the region. The CMM assessed the current state of ICM readiness in the region, and the stakeholders set goals for maturity progression for the next five years as a result of the first meeting. During the second meeting, the stakeholders validated prioritized ICM strategies identified as next steps towards I-35 ICM implementation along the corridor.

The CMM assessment, stakeholder meeting presentations and meeting minutes are available in project documentation on the MARC project site [currently http://www.marc.org/Transportation/Plans-Studies/Transportation-Plans-and-Studies/Special-studies-and-projects/I-35-Integrated-Corridor-Management-Planning].

SYSTEM OVERVIEW

The System Overview was prepared to document existing conditions within the limits of the I-35 corridor.

The System Overview is available in project documentation.

ADDITIONAL RESOURCES

SYSTEM BREAKDOWN STRUCTURE FOR THE I-35 CORRIDOR

A System Breakdown Structure was developed for the I-35 corridor in the Kansas City metro area. This structure should be the base for future System Architectures and is created to accommodate any subsystem architectures such as the Regional ITS Architecture. This top level breakdown provides visibility over the entire transportation system and identifies those elements that are within the control of transportation system managers and those that are outside system managers’ control. The System Breakdown Structure also provides a vocabulary for communicating system elements without
depending on specific technology or resource. System Breakdown Structures were developed for both the Current and Future system. Additional resources in the Future structure are shown in red to distinguish them as new from Current. These are projections, based on current technology and the potential speed of technology development. A partial image of the Current System Breakdown Structure is included in Figure 2 as a sample. The complete structure is included in Appendix B.

Figure 2 - Partial I-35 System Breakdown Structure

**PREDICTIVE MODELING TOOLS**

Predictive modeling tools for transportation networks have been tested across the world. Such tools support ICM in that transportation system managers can consider the travel demand predictions and take action in advance of predicted congestion to mitigate it. In the US, the ICM Demonstration sites of San Diego and Dallas implemented predictive modeling tools. Other similar tools were implemented in other locations including London UK, Madrid SP, Singapore, and Frankfurt GE.

Integrated Modeling for Road Condition Prediction (IMRCP) is an ongoing FHWA demonstration project, set in Kansas City, which makes operational predictions based on weather and traffic. This current demonstration project may lead the way for predictive analytics to be available for transportation
system managers. This particular tool will forecast congestion and travel conditions based on typical travel data combined with weather data. Eventually, these predictive tools may be reliable enough in the Kansas City metro area to become direct input to the decision support systems that will be developed as part of the ICM program. System actions could include implementing arterial diversion routes, enhancing transit service, or recommending alternate travel plans. For more information: https://ams.confex.com/ams/96Annual/webprogram/Paper286626.html.

**USE CASES**

To clearly scope the Concept of Operations, one Use Case was selected to be thoroughly analyzed. The Use Case presents a single user’s point of view from trip origin to destination, considering decision factors, resources available, and choices made. The selected Use Case was considered in three scenarios for four conditions for a total of twelve operational views. The scenarios are Current (2016), Future (2030), and ICM. Each of the scenarios was evaluated in four conditions: Typical Commute; Unplanned Incident; Planned Construction along I-35; and One Time Event that causes major predictable delays along I-35. Table 3 outlines the Use Case operational conditions. The single Use Case, evaluated in the various scenarios and conditions, provides a solid basis of comparison and evaluation of the transportation network from the user’s perspective. The insight gained during the Current and Future Use Case development resulted in the ICM strategies recommended and highlighted techniques that are most likely to have a positive benefit for users when implemented.

**Table 3 - Use Case Operational Conditions**

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current (2016)</strong></td>
<td>Typical Commute</td>
</tr>
<tr>
<td></td>
<td>Unplanned Incident</td>
</tr>
<tr>
<td></td>
<td>Planned Construction</td>
</tr>
<tr>
<td></td>
<td>One-Time Event</td>
</tr>
<tr>
<td><strong>Future (2030)</strong></td>
<td>Typical</td>
</tr>
<tr>
<td></td>
<td>Unplanned Incident</td>
</tr>
<tr>
<td></td>
<td>Planned Construction</td>
</tr>
<tr>
<td></td>
<td>One-Time Event</td>
</tr>
<tr>
<td><strong>ICM</strong></td>
<td>Typical</td>
</tr>
<tr>
<td></td>
<td>Unplanned Incident</td>
</tr>
<tr>
<td></td>
<td>Planned Construction</td>
</tr>
<tr>
<td></td>
<td>One-Time Event</td>
</tr>
</tbody>
</table>

The project team obtained input for the scenarios from existing models, plans, and documented resources of MARC, KDOT, KC Scout and Operation Green Light (OGL). The Current (2016) scenarios
were evaluated using real time mapping applications, information from RITIS², and team access to existing travel planning tools. Additional information was clarified via phone calls, as needed, to validate use of existing planning resources (such as the KU Medical Center’s internal Ride Share website). The Future (2030) scenarios were evaluated based on travel times predicted from the MARC regional travel demand model (R-TDM). MARC’s existing RTDM is not validated for microscopic or mesoscopic model level travel times; however, at the time of this version, MARC is in the process of updating their RTDM for travel times concurrently with this project (not available for use at this time). The differences (increase or decrease) in travel times for our user’s routes, between the model base and future travel times, was used to evaluate travel alternatives. The future conditions, available technology, and road condition assumptions were made by the project team based on development trends. The technology, tools, and implementation were discussed as resources so the prediction of our user’s behavior is not tied to specific technological solutions. For example, Google Maps is currently a popular mapping and traffic information tool. Google Maps is considered as a mobile “push-pull” mapping resource that will “push” travel information for known trips and is available for users to “pull” information on demand. Categorizing Google Maps as a mobile “push-pull” resource allows new mobile tools to be added to the resource and the user could choose any of the technologies in this resource. Future scenarios are more robust using the resource categories because they are not tied to a specific technology.

### TABLE OF USE CASES CONSIDERED

<table>
<thead>
<tr>
<th>Gender</th>
<th>Life Status</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male or Female</td>
<td>Single</td>
<td>18 – 24</td>
</tr>
<tr>
<td>Male or Female</td>
<td>Single w/kids</td>
<td>25 – 30</td>
</tr>
<tr>
<td>Male or Female</td>
<td>Married</td>
<td>30 – 35</td>
</tr>
<tr>
<td>Male or Female</td>
<td>Married w/kids</td>
<td>40 – 45</td>
</tr>
<tr>
<td>Male or Female</td>
<td>Widowed</td>
<td>50 – 55</td>
</tr>
</tbody>
</table>

Table 4 - Demographics Considered

---

² The Regional Integrated Transportation Information System (RITIS) is an automated data sharing, dissemination, and archiving system that includes many performance measure, dashboard, and visual analytics tools that help agencies to gain situational awareness, measure performance, and communicate information between agencies and to the public. 
http://www.cattlab.umd.edu/?portfolio=ritis
The demographic information is more detailed than typical transportation assessments. The information presented creates a vision of a person in the Kansas City metro area living their life. This supports the project team’s analysis by illuminating the factors that inform decisions the user may make related to transportation choices.

Mode is not included as part of the primary Use Case. The User’s decision on mode (private auto, transit, ride share, etc.) is based on the travel conditions, available options, and trip purpose.

Demographics considered are in Table 4.

Trip Purposes considered follow in Table 5.

**Table 5- Trip Purposes Considered**

<table>
<thead>
<tr>
<th>Purposes</th>
<th>![Image]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>![Image]</td>
</tr>
<tr>
<td>Home</td>
<td>![Image]</td>
</tr>
<tr>
<td>School</td>
<td>![Image]</td>
</tr>
<tr>
<td>Shopping/Use</td>
<td>![Image]</td>
</tr>
<tr>
<td>Recreation</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

Major origins and destinations were considered and the potential trip purpose for each was identified. Some areas were narrowed to a neighborhood or community in order to help visualize a real user associated with each trip. The trip origins, destinations and associated trip purposes follow in Table 6.

**Table 6 - Travel Patterns and Trip Purpose**

<table>
<thead>
<tr>
<th>Traveling From or To [Origin or Destination]</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downtown, Kansas City, MO</td>
<td>![Image]</td>
</tr>
<tr>
<td>Shawnee Mission Parkway, Shawnee, KS</td>
<td>![Image]</td>
</tr>
<tr>
<td>75th &amp; Antioch Area, Overland Park, KS</td>
<td>![Image]</td>
</tr>
<tr>
<td>95th &amp; Metcalf, Overland Park, KS</td>
<td>![Image]</td>
</tr>
<tr>
<td>103rd &amp; Quivira, Overland Park, KS</td>
<td>![Image]</td>
</tr>
<tr>
<td>127th &amp; N Mur-Len, Olathe, KS</td>
<td>![Image]</td>
</tr>
<tr>
<td>151st &amp; S. Pflumm, Olathe, KS</td>
<td>![Image]</td>
</tr>
<tr>
<td>K-7 and W. Santa Fe, Olathe, KS</td>
<td>![Image]</td>
</tr>
<tr>
<td>N Center &amp; E Main, Gardner, KS</td>
<td>![Image]</td>
</tr>
</tbody>
</table>
The Use Cases considered for evaluation were distilled from the demographics, trip purposes, and travel patterns listed above. Demographics were randomly combined to create logical uses for an associated origin, destination, and trip purpose. This list of potential Use Cases was vetted through the Stakeholders for preferences by publicly posting the potential Use Cases on the MARC ICM website. The table of Use Cases Considered follows in Table 7.

**Table 7 - Potential Use Cases Considered**

<table>
<thead>
<tr>
<th>Potential Use-Case</th>
<th>User Info</th>
<th>Traveling From</th>
<th>Traveling To</th>
<th>Purpose</th>
<th>Time of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Male 18 – 24 years Single</td>
<td>K-7 and W. Santa Fe, Olathe, KS (near Walmart south of Ernie Miller Nature Park)</td>
<td>Johnson County Community College</td>
<td>School</td>
<td>A.M. [non-peak]</td>
</tr>
<tr>
<td>B</td>
<td>Female 25 to 30 years Single</td>
<td>127th &amp; N Mur-Len, Olathe, KS (near Pioneer Trail Middle School)</td>
<td>KU Medical Center</td>
<td>Work</td>
<td>A.M. [peak]</td>
</tr>
<tr>
<td>C</td>
<td>Male 25 to 30 years Married</td>
<td>151st &amp; S. Pflumm, Olathe, KS (near Black Bob Park)</td>
<td>Downtown, Kansas City, MO</td>
<td>Work</td>
<td>A.M. [peak]</td>
</tr>
</tbody>
</table>
## PLAN

<table>
<thead>
<tr>
<th>ID</th>
<th>Gender</th>
<th>Age Range</th>
<th>Marital Status</th>
<th>Location</th>
<th>Mode</th>
<th>Time of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Male</td>
<td>30 – 35 years</td>
<td>Married w/kids</td>
<td>Downtown Kansas City, KS</td>
<td>Near Johnson County Community College</td>
<td>Home/Recreation</td>
</tr>
<tr>
<td>E</td>
<td>Female</td>
<td>40 – 45 years</td>
<td>Single w/kids</td>
<td>75th &amp; Antioch Area (near Shawnee Mission Medical Center)</td>
<td>BSNF Intermodal Facility, Edgerton, KS</td>
<td>Work</td>
</tr>
<tr>
<td>F</td>
<td>Male</td>
<td>50 – 55 years</td>
<td>Married</td>
<td>BSNF Intermodal Facility, Edgerton, KS</td>
<td>Armourdale Rail Yard, Kansas City, KS</td>
<td>Freight</td>
</tr>
<tr>
<td>G</td>
<td>Female</td>
<td>60 – 65 years</td>
<td>Widowed</td>
<td>127th &amp; N Mur-Len, Olathe, KS (near Pioneer Trail Middle School)</td>
<td>Shawnee Mission Parkway, Shawnee, KS</td>
<td>Pick up Grandchild from School</td>
</tr>
<tr>
<td>H</td>
<td>Male</td>
<td>70 – 75 years</td>
<td>Married</td>
<td>103rd &amp; Quivira, Overland Park, KS (neighborhoods south of Oak Park Mall)</td>
<td>KU Medical Center</td>
<td>Use</td>
</tr>
<tr>
<td>I</td>
<td>Female</td>
<td>80 – 85 years</td>
<td>Widowed</td>
<td>W Morgan &amp; Edgerton, Edgerton, KS</td>
<td>Shawnee Mission Parkway, Shawnee, KS</td>
<td>Recreation</td>
</tr>
</tbody>
</table>

### JUSTIFICATION OF USE CASE SELECTED FOR ANALYSIS

Stakeholders responded that Use Cases B and C were preferred because they represented a trip that covered much of the study corridor, and were representative of a large number of A.M. peak period trips. The Project Team evaluated the details of the two trips to compare them and verify that the final selection provided the most robust scenario.

The team considered the corridor length in detail. The longer corridor represented by Use Case C (151st St. & S. Pflumm to downtown KC, MO) presented more opportunities for transit use or diverting trips to arterials because of the increased distance traveled. However, the longer trip would be more complex for future modeling and would introduce many variables for an initial Use Case focused on ICM along the I-35 corridor. The shorter corridor of Use Case B (127th & N. Mur-Len to KU Medical Center) was evaluated as being more realistic and lent itself to a higher probability of ICM implementation as an initial effort. The destination of KU Medical Center was valuable because it is a logical hub and could be a potential partner in ICM strategies. The KCATA is planning a last-mile planning tool ([Ride KC Regional Transit Plan & Ride KC Workforce Connex](#)) that would have its initial implementation at KU Medical Center.
Center. Therefore, the origin and destination of Use Case B (127th & N. Mur-Len to KU Medical Center) was selected.

The team also considered the travel time of A.M. peak versus P.M. peak. The P.M. peak has higher travel volumes as reported in the regional planning studies and by RITIS data. However, there is a higher perceived value of getting to work on time to begin the workday. Travel reliability is more critical for commuters traveling to work, which happens mostly during A.M. travel times in the metro area. Off peak travel times are more reliable and have lower travel volumes. As a result, the off peak travel time period was not selected. The team determined that the higher criticality of the A.M. travel warranted preference for the first Use Case.

Trip B was ultimately selected because the trip from 127th and Mur-Len to KU Medical Center is entirely within the study area, the trip length is long enough to evaluate and short enough to implement, and travelers value a reliable travel time in the A.M. peak in the metro area.

Details about the user were developed to complete the user description as defined within the framework of the demographics, origin, destination and trip purpose selected. The Project Team identified Sarah, a 29-year old radiologist at KU Med, who likes country music, and is a Roasterie coffee fan. Sarah, iconized in Figure 3, lives in a townhouse that she owns at 127th and Black Bob with her young child. She plays volleyball on co-ed, evening league. On Tuesday morning, Sarah needs to be at KU Medical Center for an 8:45 A.M. patient appointment. She will depart from her townhouse near S. Black Bob Road and 127th Street so she can arrive 30 minutes prior to her appointment to turn on her radiology equipment. On the way to work, Sarah drops her child off at her parents’ house at West 61st Street (east of Antioch) in Merriam for day care.

Figure 3 – Sarah (User)
CURRENT USE CASES

Current use cases were evaluated using a “Sprint” technique wherein the Project Team focused on one trip, under specific conditions, used existing resources and knowledge in order to get Sarah to work on time. Each “Sprint” took one hour and focused on one of the operational conditions of typical, unplanned incident, planned construction, or major planned event. Sarah used the information available to her in 2016 and the Project Team made decisions about her trip as her representative. This process highlighted the information and transportation resources available today given her situation.

Each Use Case includes:
- A strip map of Sarah’s route that illustrates the time and location of her decisions that created her trip
- A decision tree that illustrates the decisions Sarah made before and during her trip and the sources of input for her decisions
- Sprint notes that capture the dialog and decisions of the project team while developing Sarah’s trip

The Current Use Cases and Sprint Notes are found in Appendix C.1.

FUTURE USE CASES

To understand potential future user needs, Sarah completed her trip for the same operational conditions as the Current scenarios. The differentiation was that Sarah made the trips in 2030, with the resources, technology, and support systems forecast to be reasonably available in the future. As with all future forecasts, it is impossible to predict what reality will be. So, the Future Use Case Sprints were conducted under a framework of moderate expectations grounded in the MARC Transportation Outlook 2040. Specific improvements to the I-35 corridor were based on the “financially constrained” projects
listed in Transportation Outlook 2040, on and around the I-35 corridor, that are planned between now and 2030 (Figure 4 and Table 8). These projects, and numerous locally sponsored arterial expansion projects on roads that interact with I-35, were incorporated into the existing MARC RTDM. The existing MARC model offered an option to evaluate future travel times without extensive travel demand modeling for this project.³

Future travel times and costs were forecast based on existing historical data. Travel times were based on the MARC RTDM. However, the model is not scaled for micro simulation of a single trip. Additionally, the model is based on a 2010 base year with forecast year of 2030. To get a representative trip time, the project team considered the difference in the travel time for segments of the model that created Sarah’s daily trip. Since the Current Sprints showed the 2016 actual travel times, the MARC model was used to identify the annual percent change in travel time predicted. The annual percent increase was then applied to the 2016 actual data. A complete description of the future travel time process followed is included in Appendix C.3 with the model output and subsequent calculations. Future travel costs were forecast based on historical increase in the Average Cost of Owning and Operating a Vehicle as reported by the Bureau of Transportation Statistics, US Department of Transportation. The 2015 latest reported year was used a base, and the future cost was escalated by 2%, which was validated as the historic escalation rate based on data from 1975 through 2015. Other transportation costs, such as transit passes and B-cycle fees were also escalated at 2% and adjusted up to the next whole number. A description of the future cost escalation are included in Appendix C.4.

³ Analysis Modeling Simulation is recommended in understanding Integrated Corridor Management techniques and is recommended to be conducted as follow-on in the regional process.
Figure 4 - Transportation Outlook 2040 Projects Map

Source: MARC (http://www.to2040.org/projectsmaphx)
### Table 8 – Financially Constrained Projects along the I-35 Corridor between 2016 and 2030

<table>
<thead>
<tr>
<th>City</th>
<th>Organization</th>
<th>Project</th>
<th>Location</th>
<th>Description</th>
<th>Planned Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Cities</td>
<td>KCATA</td>
<td>I-435 Express Bus</td>
<td>Between Johnson County and Kansas City, MO</td>
<td>New express bus service along the I-435 corridor from Johnson County to Kansas City, MO</td>
<td>2015 to 2020</td>
</tr>
<tr>
<td>Multiple Cities</td>
<td>KCATA</td>
<td>Regional Park and Ride Lot Development</td>
<td>Locations throughout the metropolitan area.</td>
<td>This project will plan, design, and construct new park and ride lots in the Kansas City metropolitan area.</td>
<td>2021 to 2030</td>
</tr>
<tr>
<td>Olathe</td>
<td>City of Olathe</td>
<td>135th Bridge widening</td>
<td>135th Street bridge over I-35.</td>
<td>Bridge widening and geometric modifications to serve increased traffic demand.</td>
<td>2021 to 2030</td>
</tr>
<tr>
<td>Multiple Cities</td>
<td>Johnson County Transit</td>
<td>Shawnee Mission Parkway transit service</td>
<td>Metcalf to K-7</td>
<td>Enhance transit service on Shawnee Mission Pkwy from Metcalf to K-7</td>
<td>2021 to 2030</td>
</tr>
<tr>
<td>Multiple Cities</td>
<td>Johnson County Transit</td>
<td>Metcalf/Shawnee Mission Parkway transit service</td>
<td>Johnson County, Kansas</td>
<td>The project will provide enhanced transit service and support development and the redevelopment of Metcalf Avenue</td>
<td>2021 to 2030</td>
</tr>
<tr>
<td>Lenexa</td>
<td>KDOT</td>
<td>I-35 Reconstruction</td>
<td>I-435 to 67th Street</td>
<td>Reconstruct, widen, and implement operations strategies along approximately 5 miles of I-35 in order to meet the corridors needs and future expected travel demand.</td>
<td>2021 to 2030</td>
</tr>
</tbody>
</table>

Source: MARC (Transportation Outlook 2040)

To capture the potential future resources available to Sarah, the System Breakdown Structure provides a framework for the types of tools that may be available. The high level descriptions of the systems
enabled the Project Team to reasonably forecast available tools without having to name a specific tool. For example, a resource of live traffic related applications (apps) included KC Scout, Waze, INRIX and other traffic applications for mobile devices. The team was able to proceed with the Use Case by referring to a live traffic app without getting caught up in which specific application may be prominent in 2030. There will be mobile live traffic apps in 2030, as there are today, so this future tool was agnostic in the Use Case. This process enabled the Project Team to make reasonable decisions based on the future resources available to Sarah.

Each Use Case includes:

- A strip map of Sarah’s route that illustrates the time and location of her decisions that created her trip
- A decision tree that illustrates the decisions Sarah made before and during her trip and the sources of input for her decisions
- Sprint notes that capture the dialog and decisions of the project team while developing Sarah’s trip

The Future Use Cases and Sprint Notes are found in Appendix C.2.

**USER AND OPERATIONAL NEEDS**

User Needs are the top level needs that the system shall fulfill to meet its intended purpose. The Operational Needs are derived from the User Needs and directly relate to the ICM activities that shall fulfill the User Needs.

User and Operational Needs were derived from the Current and Future Use Cases developed for this project. These needs are a result of the Use Case evaluated in its defined Scenarios and Conditions. While these needs are widely applicable to the I-35 corridor, there are other needs that may not be represented, such as freight movement. A clear next step for the development of ICM in the region would include additional analysis of Use Cases to complete the User and subsequent Operational Needs of the ICM system.

**USER NEEDS**

The following User Needs in Table 9 describe the expectations of the transportation system.

*Text in blue must be evaluated for inclusion in I-35 ICM concept. These items were either not specifically addressed in the project development process or vetted with the system owner.*
<table>
<thead>
<tr>
<th>ID #</th>
<th>Title</th>
<th>Rationale/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN1</td>
<td>Pre-departure information on travel options</td>
<td>Transportation system users often make travel decisions before beginning a trip. Therefore, the transportation system should provide real-time, accurate information upon which users can know and compare travel options to make informed decisions before beginning their trip.</td>
</tr>
<tr>
<td>UN2</td>
<td>Enroute information on incidents or delays</td>
<td>Travelers enroute can adjust their travel plans enroute if equipped with real-time, accurate system information. Therefore, the transportation system should provide real-time, accurate information upon which users can know and compare travel options to make informed decisions while enroute.</td>
</tr>
<tr>
<td>UN3</td>
<td>Accurate decision input</td>
<td>Travelers do not always trust the published travel information. Therefore, the transportation Corridor Managers should place a priority on providing timely, accurate information to the public for decision making.</td>
</tr>
<tr>
<td>UN4</td>
<td>Access to multimodal options</td>
<td>Multimodal transportation options are not always at the forefront of transportation system user’s mind. To enhance the knowledge and accessibility of multimodal options, the transportation Corridor Managers will work together across modal boundaries to provide a complete transportation service.</td>
</tr>
<tr>
<td>UN5</td>
<td>Reliable travel times – highway</td>
<td>Travel time reliability is an important factor for highway users. The transportation Corridor Managers will work together to actively manage highway system reliability by providing coordinated incident responses, proactive event management, and coordination with other system service managers.</td>
</tr>
<tr>
<td>UN6</td>
<td>Reliable travel times – arterial</td>
<td>Travel time reliability is an important factor for arterial users. The transportation Corridor Managers will work together to actively manage arterial system reliability by providing coordinated incident responses, proactive event management, and coordination with other system service managers.</td>
</tr>
<tr>
<td>UN7</td>
<td>Reliable travel times – transit</td>
<td>Travel time reliability is an important factor for transit users. The transportation Corridor Managers will work together to actively manage transit system reliability by providing coordinated incident responses, proactive event management, and coordination with other system service managers.</td>
</tr>
<tr>
<td>UN8</td>
<td>Knowledge and support of travel</td>
<td>Travel demand management options can be powerful, cost effective tools for travelers to avoid congested travel and support a resilient</td>
</tr>
</tbody>
</table>
OPERATIONAL NEEDS

The Operational Needs in Table 10 describe the expectations of the ICM system and regional processes.

Text in blue must be evaluated for inclusion in I-35 ICM concept. These items were either not specifically addressed in the project development process or vetted with the system owner.

Table 10 - Operational Needs

<table>
<thead>
<tr>
<th>ID #</th>
<th>ID #</th>
<th>Title</th>
<th>Description/Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON1</td>
<td>UN1</td>
<td>Publish Information to System Users</td>
<td>Information produced by the ICM System (ICMS) and its subsystems will be provided to system data users in a variety of data formats for travelers use to make decisions and take actions based on real-time information.</td>
</tr>
<tr>
<td>ON2</td>
<td>UN1</td>
<td>Publish Information to 3rd Party Providers</td>
<td>Information produced by ICMS and its subsystems will be provided to system data users (aka 3rd Party providers) in a variety of data formats for use to display information to travelers use to make decisions and take actions based on real-time information.</td>
</tr>
<tr>
<td>ON3</td>
<td>UN3</td>
<td>Collect and Process Data</td>
<td>Data is collected from a variety of existing and planned systems that support system reporting and synthesize decision input information. A central data processing manager should be identified (could be KC Scout or MARC). These data locations and process methods are documented in Interface Control Documents, which need to be developed for existing systems and new systems as they come on line. Algorithms are needed to clean and aggregate the data into corridor level reporting structures for the selected measures (e.g. volumes, occupancies, and speeds at multiple locations are converted to travel times).</td>
</tr>
</tbody>
</table>
Process Data includes conversion of host system data formats, if necessary, to standard XML schema for publishing information to share across the ICMS system.

<table>
<thead>
<tr>
<th>ON4</th>
<th>UN3</th>
<th>Access and Store Historical Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Provide the capability to create, populate, and access a historical database that includes existing independent data and future available data to create a variety of reports on corridor operations and performance. This database should contain real-time information on corridor performance as derived from data collected in the Collect and Process Data need. Accessing existing historical database of KC Scout is an important function of this Operational Need. Consistent export formats for data from these historical databases would simplify corridor-wide analysis. Ad hoc reporting based on this historical data allows the system users to create a variety of reports that characterize corridor operations and performance. These reports can then be stored in the historical database.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ON5</th>
<th>UN3</th>
<th>Predict Future Travel Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Provide the ability to use historical data fused with real-time data to predict the impact of travel conditions and incidents and predict the routing choices of system users. The predictions will then be used by Corridor Managers to adjust system operations as needed to respond to predictions. This system will be revisited annually to recalibrate prediction algorithms. This system will provide input to the decision support systems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ON6</th>
<th>UN3</th>
<th>Publish Information to Corridor Managers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Information produced by ICMS and its subsystems will display in a variety of data formats to agency decision makers for use to visualize corridor operations, make decisions, and take actions to implement the various decision components.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ON7</th>
<th>UN3</th>
<th>Coordinate Incident Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Corridor Managers and ICM stakeholders develop potential response plans to respond to incidents that occur in locations with historically documented high incident rates. Response plans are based on the prediction of likely diversion routes and define a coordinated response by Corridor Managers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ON8</th>
<th>UN4</th>
<th>Access to multimodal options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Provide tools for regional awareness of multimodal options, including last mile connections from transit. This would include the Transportation Hubs under development through the Ride KC effort, and third party transportation services such as ZipCars, Uber Share, and B-Cycle facilities. The goal of this need is broaden awareness of the suite of transportation options in the region, so travelers can have confidence that if they begin a trip outside of their personal vehicle they will be able to complete a round trip.</td>
</tr>
</tbody>
</table>
### ON9
#### UN5, UN6, UN7
**Coordinate Public Safety and Transportation Operations**
Provide public safety professionals access to the multi-dimensional data inherent in transportation management systems while seeking technical solutions to extracting useful incident information from public safety Computer Aided Dispatch systems. Useful incident information can be used by Corridor Managers to identify problem areas and ways the first responders can be better supported to quickly respond and clear incidents.

### ON10
#### UN5, UN6, UN7
**Interactively Conference with Corridor Agencies**
Corridor Managers will directly collaborate in real-time prior to, during, or after a major event in the Corridor. This will enable real-time decision making and consistent situational awareness as an event develops. A variety of voice, video and data formats will be supported for multi-site collaboration.

### ON11
#### UN5, UN6, UN7
**Implement Incident Responses**
The Response Plan allows ICMS and Corridor Managers to use a decision tool (Expert System or table-driven) that fuses real-time data and manually-entered data to determine if an incident response plan trigger has been met. Manually entered data can include that coming from the event site (e.g. KHP Traffic Officers talking to dispatchers using the KHP radio system). The response plan is then either manually or automatically generated based on the fused data input. Once a response plan is generated, the system operator can review the plan’s components and make changes deemed necessary before transmitting plan components to the affected systems. The status of affected systems is then returned to the ICMS operator and logged in the historical database.

### ON12
#### UN5, UN6, UN7
**Share Control of Devices**
Allow agencies to remotely control selected functions of field devices regardless of location or agency ownership. This will allow agencies to implement response plans and support system reliability. For this Operational Need to become real there must be interagency agreements to allow such sharing under carefully defined conditions.

### ON13
#### UN5
**Reliable travel times – highway**
Measure and control highway travel time reliability by reporting reliability measures, evaluating the system performance, and adjusting corridor operations plans to maximize system reliability.

### ON14
#### UN6
**Reliable travel times – arterial**
Measure and control arterial travel time reliability by reporting reliability measures, evaluating the system performance, and adjusting corridor operations plans to maximize system reliability.
GOAL FOR I-35 INTEGRATED CORRIDOR MANAGEMENT

Based on the User and Operational Needs defined above, the following goal and supporting actions were defined for I-35 ICM:

Goal:

- Actively manage the corridor to provide reliable travel times for users.

Actions:

- Coordinate jurisdictional and modal responses to recurrent and non-recurrent congestion.
- Actively broaden awareness of multimodal options and ways to reduce demand on our transportation system.

CONCEPTS FOR THE PROPOSED SYSTEM

This section provides initial strategies for ICM along the I-35 corridor. These strategies will continue the development of ICM in the corridor and will enable continued development of the Operational Concept. These strategies are not the final comprehensive list of strategies needed for complete implementation of ICM along the I-35 corridor, but they offer a path of active steps forward.

DERIVING ICM STRATEGIES

Comprehensive Integrated Corridor Management (ICM) is a major undertaking. As such, the transportation system managers along the I-35 Corridor have decided to prioritize next steps toward...
implementing ICM to facilitate incremental progression. Based on the Operational Needs defined above, a set of over fifty ICM strategies were developed. These strategies were evaluated, synthesized, and refined into eleven thematic groups. The eleven groups of strategies were presented to the corridor Stakeholders for prioritization.

SELECTING AND PRIORITIZING STRATEGIES

Priorities of 1, 2, and 3 were used to group the strategies. Priority 1 are strategies that can be implemented within three years. Priority 2 are strategies that can be implemented within three to five years. Priority 3 are strategies that can be implemented in five years or longer.

The Stakeholders considered the list of eleven shortlisted strategies and categorized them according to the Priority (1, 2 or 3). Stakeholders discussed each of the strategies, benefits and costs, application in other areas of the U.S., and applicability to the Kansas City region. Based on the discussion, each strategy Topic Area was prioritized. Each of the strategy Topic Areas has a driving integration element that is rooted in the U.S. DOT guidelines for ICM development: Institutional Integration, Technical Integration, and Operational Integration. The strategies are listed in Table 11 and described in detail in subsequent sections of this document. The strategies are presented by Priority and Topic Area.

RECOMMENDED ICM STRATEGIES FOR I-35

The complete list of potential ICM strategies identified for I-35 are shown in Appendix A. From this list, the final eleven recommended ICM strategies were selected (Table 11).
<table>
<thead>
<tr>
<th>Strategy #</th>
<th>Priority</th>
<th>Topic Area</th>
<th>Theme</th>
<th>ICM Initiatives and Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Institutional</td>
<td>Travel Demand Management</td>
<td><strong>Encourage Telecommuting, Delayed Commuting, and Flex Time for Employers and Workers using the I-35 Corridor:</strong> This strategy allows for employers and workers to choose telecommuting to reduce overall travel demand on I-35 and encourages alternative or creative work hours (delayed commuting and flex time) to allow for spreading demand across a greater time period. Peak hour congestion, incidents or weather related impacts would trigger the implementation of these plans with cooperation of the media and employers in the Kansas City region.</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Institutional</td>
<td>Travel Demand Management</td>
<td><strong>Media Support of Creative Commuting:</strong> Several ICM strategies will be more successful with the support of the media (radio, TV, print, web and social media). This strategy seeks to create a closer working relationship between the media and transportation professionals in Kansas City to encourage “creative commuting” when recommended by transportation professionals. Beyond traditional incident and congestion reports, the media can play a large role in encouraging alternate modes of transportation by noting arrival times based on mode, transit schedules, availability of parking, and mobility hub status updates. The media can also note when it is advantageous to vary your commute times and discourage travel when telecommuting is a better option due to incidents or poor road conditions.</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Institutional</td>
<td>TSM&amp;O Committee</td>
<td><strong>Create a TSM&amp;O Committee within MARC:</strong> Rebrand a current MARC Transportation Committee as the TSM&amp;O Committee to focus and revitalize the committee with a new mission to enhance the management and operations of the Kansas City transportation system. This will be achieved by supporting the use of new operational strategies, supporting infrastructure improvements to enhance operations, promoting multi-modalism, and encouraging the cooperation and coordination of activities amongst all agencies with transportation operations responsibilities in the metropolitan area. The Committee should meet regularly to discuss strategies and opportunities within the corridor.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Institutional</td>
<td>TSM&amp;O Committee</td>
<td><strong>Intensify Traffic Incident Management (TIM) Activities on the I-35 Corridor:</strong> Traffic incidents are the leading cause of poor reliability factors for the I-35 corridor. Although TIM techniques and response times have improved greatly in the Kansas City region over the past 15 years, these efforts need to constantly be maintained and enhanced when applicable. This strategy includes continued joint first responder and transportation agency training, addition of Motorist Assist Patrols, development of accident investigation sites, development of interstate and arterial diversion routes, and coordinated operations between KC Scout, OGL and cities when incidents take place on I-35.</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Technical Integration</td>
<td>Multi-Modal</td>
<td><strong>Develop Mobility Hubs along the I-35 Corridor:</strong> Mobility hubs act as the center of multi-modal activity, essentially the intersection of various modes and methods for mobility. They allow the user to make choices conveniently and have multiple options for reaching their destination and making last-mile connections for greater personal mobility. A mobility hub may have a combination of park-n-ride with a transit bus node, a streetcar stop, bike-share location, ride-sourcing via Uber/Lyft type services or taxi availability, Zipcar access, and carpooling or ride-sharing services. Amenities may include kiosks, Wi-Fi, EV charging stations, restrooms, cafes, etc. Mobility hubs will provide a convenient method for changing modes by the user.</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>Operational</td>
<td>Arterial Integration</td>
<td><strong>Enhancement of the Operation Green Light Program in Kansas City:</strong> This will include expansion of OGL to cover more arterial miles in the metro area, formalized arterial diversion route programs on both OGL routes and non-OGL routes, greater coordination between OGL and KC Scout, and, in the future, providing signal data to connected vehicles via roadside equipment or third party providers.</td>
</tr>
</tbody>
</table>
### ICM Initiatives and Strategies

<table>
<thead>
<tr>
<th>Strategy #</th>
<th>Priority</th>
<th>Topic Area</th>
<th>Theme</th>
<th>ICM Initiatives and Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2</td>
<td>Technical Integration</td>
<td>Multi-Modal</td>
<td><strong>All-Inclusive Transportation Dashboard:</strong> Through the use of one website/mobile app, trip information on all modes of travel is displayed to the user allowing them to make the best decision with regard to mode and expected travel times. This data would include real-time transit schedules, interstate travel times, incident data, car-sharing availability, ride-hailing service availability, streetcar arrival times, bike-share locations and availability, etc. The dashboard is potentially developed and funded through a private Transit Management Association and/or advertising and even includes incentivization in order to encourage multi-modalism.</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>Technical Integration</td>
<td>Transitional Technology</td>
<td><strong>Facilitate the Deployment of Connected Vehicles and Vehicle to Infrastructure Systems:</strong> The purpose of this initiative is to support and facilitate the systems, data and equipment that will enable Connected Vehicles to communicate with other vehicles and roadside units. As Connected Vehicles increase their market penetration these systems become a critical technology to allow for the sharing of transportation data such as road conditions, incidents, alternate routes, traveler information messages, modal data, and emergency data to the driver and the vehicle. We encourage deployment initiatives, whether public or private sector based, that will advance the state of this technology as well as make it socially equitable.</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>Technical Integration</td>
<td>Transitional Technology</td>
<td><strong>Prepare the I-35 Corridor for the Technology Shift to Autonomous Vehicles:</strong> Over the next 5 to 20 years, the autonomous vehicle will make up an ever increasing part of the vehicle fleet on the roadway. They will be able to utilize narrower lanes, closer headways, and create fewer incidents. Truck platooning will also transform how freight is moved and may necessitate designated lanes. The I-35 corridor will need to accommodate today’s vehicle technology level which may be at Autonomous Level 0 or 1 as well as fully autonomous vehicles at an Autonomy Level 4 or 5 for a lengthy transition period. Potential future-proofing measures include managed lane/dynamic lane systems that assigns lanes based on autonomy; creating special lanes for autonomous freight or transit vehicles; ensuring power and communications installations on new projects is standard; and ensuring new systems are equitable to all transportation users in the region.</td>
</tr>
<tr>
<td>10</td>
<td>3</td>
<td>Operational</td>
<td>Arterial Integration</td>
<td><strong>Expand the use of DMS on arterials adjacent to I-35:</strong> On key arterials that feed into I-35, install Dynamic Message Signs to provide information to users about traffic incidents, travel times and restrictions before they enter the I-35 corridor so they can make an informed decision about the route they choose. The use of DMS adjacent to the BNSF Intermodal Facility freeway entrances is also recommended to provide greater information to commercial vehicles on incidents and height and weight restrictions before they enter the I-35 corridor. Public Private Partnerships present an opportunity to fund this infrastructure by allowing advertising when not being used to convey traveler information.</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>Operational</td>
<td>Managed Lanes</td>
<td><strong>Implement Dynamic Lanes/Managed Lanes on I-35:</strong> Install multi-purpose traffic management gantries over I-35 that can provide for dynamic lane assignments, lane management, variable pricing, variable speed limits, traveler information, bus only lane assignments, etc. to control access and actively manage traffic on I-35.</td>
</tr>
</tbody>
</table>

**Priority Definitions:**
1 – Short Term (0-3 Years)
2 – Medium Term (3-5 Years)
3 – Long Term (5+ Years)*

* Some initiatives will be longer because they must be added to the funding program.
IMPLEMENTING RECOMMENDED ICM STRATEGIES

This section provides a description of the eleven prioritized, recommended strategies to move toward implementing ICM. Each strategy includes a description, roles and responsibilities of transportation system managers, and next steps to begin implementation of the strategy. Strategies are grouped by element of ICM Integration: Institutional, Technical, and Operational with priority.

Many of the strategies recommended as a result of studying the I-35 corridor are applicable to the broader Kansas City region. While the specific understanding of the system was gained by studying the I-35 corridor, many of the conditions that faced the user are not limited to I-35. Similarly, the recommendations for improving system reliability are also not limited to I-35. Therefore, the strategies listed below should be considered for application within the Kansas City metro area.

INSTITUTIONAL INTEGRATION

The recommendations that follow are rooted in institutional integration that is a base for accomplishing ICM along the I-35 corridor.

PRIORITY 1: CREATE A TSM&O COMMITTEE AT MARC

Satisfies Operational Need(s): ON9, ON10

STRATEGY DEFINITION

Rebrand a current MARC Transportation Committee as the TSM&O Committee to focus and revitalize the committee with a new mission to enhance the management and operations of the Kansas City transportation system. This will be achieved by supporting the use of new operational strategies, supporting infrastructure improvements to enhance operations, promoting multi-modalism, and encouraging the cooperation and coordination of activities amongst all agencies with transportation operations responsibilities in the metropolitan area. The Committee should meet regularly to discuss strategies and opportunities within the corridor.

ROLES AND RESPONSIBILITIES

<table>
<thead>
<tr>
<th>Agency/Entity</th>
<th>Roles and Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARC</td>
<td>TSM&amp;O and ICM Champion: Host TSM&amp;O Committee and coordinate activities, such as ICM planning and TIM activities</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represents KDOT priorities &amp; TSM&amp;O program</td>
</tr>
<tr>
<td>MoDOT</td>
<td>Represents MoDOT priorities &amp; TSM&amp;O program</td>
</tr>
<tr>
<td>KC Scout</td>
<td>Manages freeway operations for KDOT &amp; MoDOT in the Kansas City area</td>
</tr>
</tbody>
</table>
CONCEPT OF OPERATIONS

<table>
<thead>
<tr>
<th>OGL</th>
<th>Monitor arterial conditions and manage arterial traffic signal operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>KCATA</td>
<td>Represent and manage multi-modal operations in the Kansas City area</td>
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</table>

NEXT STEPS

To provide for the highest probability of success of a regional view of transportation system management, it is important that the TSM&O committee have a regional focus from its initiation. While the ICM recommendations were derived by analyzing the I-35 corridor, ICM and transportation system management and operations must be conducted with a regional perspective. Therefore, regional transportation system managers should be included in the TSM&O committee from its initiation.

Define authority of group – Define reporting structure; it is recommended that this committee does not report to the Total Transportation Policy Committee (TTPC), but can operate, prioritize, and allocate funds under its own autonomy. This will empower the committee in order to integrate operations and encourage shared responsibility among city, regional, and state jurisdictions with diverging priorities. Stakeholders engaged during the initial phase of the ICM Development should be invited to participate. This base group of stakeholders includes Missouri DOT representatives and Emergency Operations Center managers for Kansas City. Additional stakeholders to consider include, Kansas City Chief Innovation Office for Smart City development, First Responders, including the Kansas Highway Patrol, and KDOT’s Northeast Kansas Public Affairs Manager. During development of the group, KDOT and MoDOT should be aware that ICM oversight may become a state function to facilitate ICM consistency across the state. This regional framework may become an integral part of a statewide ICM framework.

Define funding sources and role in prioritizing funds – Define funding mechanisms for ICM initiatives in the region. Federal ICM funds have been sporadic in the past years. Funding in 2015 totaled $2.6 million, allocated to 13 cities for about $200,000 each with varying levels of local match. Projects focused on data integration for specific corridors to enable a unified system view and decision support systems. The FAST Act offers funding for multimodal operations for which some ICM recommendations for I-35 may qualify. In 2016, FHWA offered an Advanced Transportation and Congestion Management Technologies Deployment Initiative (ATCTMD) grant through which ICM projects could qualify for federal funding with 50% local match from the state DOT. The FHWA also has an Everyday Counts Initiative that offers funds available through Accelerating Innovation Deployment (AID) grants. In 2016, the Federal Transit Administration (FTA) granted $8 Million for a new program to demonstrate and evaluate innovative approaches to integrated “Mobility on Demand” (MOD) solutions within a public transportation framework. The on-going Mobility Hub program of the KCATA may qualify for additional funding through the FTA MOD grant. A local funding stream should be considered to demonstrate local
investment to improve competitiveness for federal grants. Additionally, having funds to allocate for ICM and related projects will enhance the effectiveness of and commitment to the TSM&O Committee hosted by MARC.

Review User and Operational needs defined in this Plan – the new MARC Committee should review the needs defined here holistically. Also, consider the tentative placeholder contents (in blue) included in some of the need definitions. These needs should be finalized and agreed upon by the stakeholders and system owners.

Define data available and needed in preparation for Multimodal Open Data Feed - Establish open data sharing regimes among regional stakeholders, including KC Scout, OGL, municipalities, and KCATA. Define how this data will be publicly available for third party providers. Before Decision Support Systems can be effective, the system managers must have a shared view of the system operations.

Prepare for Decision Support Systems – Outline framework and potential situations for decision support systems with triggers of when to implement specified ICM actions, such as arterial diversion, adding transit service, and broadcasting specific travel tips to media sources.

**Impacts during Implementation**

Minimal. May require additional meeting attendance for some stakeholders and utilization of MARC resources to staff the meetings and provide meeting space. The committee may have a greater impact after implementation by directing ICM and TSM&O activities and potentially prioritizing funding for these activities.

**System Safety**

Has the potential to improve system safety by facilitating implementation of ICM and TSM&O strategies along the I-35 corridor and further in the Kansas City area.

**System Security**

No effect

**Risks and Potential Mitigations**

There is a risk of over-taxing stakeholders through the addition of another committee meeting or commitment on their part. MARC is aware of this and is considering changing an existing committee to fulfill this new role and re-energize stakeholders.
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Training Needs of Operators and Participants

Committee participants may need additional understanding of ICM and support in learning about the implications of the level of coordination needed for ICM.

Disadvantages and System Constraints

None foreseen

Alternatives and Trade-Offs Considered

Alternatives considered included creating a new subcommittee within an existing committee that reports to the TTPC, creating a new committee that would report directly to the TTPC, or repurposing an existing committee to this new role. Consensus was to create a subcommittee to an existing committee or re-purpose an existing committee.

PRIORITY 1: INTENSIFY TRAFFIC INCIDENT MANAGEMENT (TIM) ACTIVITIES ON THE I-35 CORRIDOR

Satisfies Operational Need(s): ON7, ON9

STRATEGY DEFINITION

Traffic incidents are the leading cause of poor reliability factors for the I-35 corridor, as documented by the KC Scout 2015 Annual Report. Although TIM techniques and response times have improved greatly in the Kansas City region over the past 15 years, these efforts need to constantly be maintained and enhanced when applicable. This strategy includes continued joint first responder and transportation agency training, addition of Motorist Assist Patrols, development of accident investigation sites, development of interstate and arterial diversion routes, and coordinated operations between KC Scout, OGL, and cities when incidents take place on I-35.

ROLES AND RESPONSIBILITIES

<table>
<thead>
<tr>
<th>Agency/Entity</th>
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</tr>
</thead>
<tbody>
<tr>
<td>MARC</td>
<td>Leads revitalization of regional TIM Training under guidance of TSM&amp;O Committee</td>
</tr>
<tr>
<td>Kansas Highway Patrol</td>
<td>Responds to incidents, Manages the Motorist Assist Patrol in Kansas</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represents KDOT priorities &amp; provides TIM resources in Kansas</td>
</tr>
<tr>
<td>MoDOT</td>
<td>Represents MoDOT priorities &amp; provides TIM resources in Missouri, Manages the Motorist Assist Patrol in Missouri</td>
</tr>
</tbody>
</table>
KC Scout | Manages freeway operations for KDOT & MoDOT in the Kansas City area, directs TIM resources where needed, coordinates emergency response to incidents and motorist assist patrols in Kansas and Missouri

OGL | Monitor arterial conditions and manage arterial traffic signal operations

KCATA | Represent and manage multi-modal operations in the Kansas City area

**NEXT STEPS**

Refresh existing TIM training – MARC and other regional agencies, such as KC Scout, have a long standing history of TIM training. These efforts should be revisited, updated, and action taken to re-invigorate TIM training. A regularly scheduled program of TIM training would be beneficial to keep a close connection between transportation system managers and regional first responders.

Consider a ‘Hero Vehicle’ concept – Since stalled vehicles contribute to fifty-five percent of the regional incident types, a strong program to address stalled vehicles could have significant benefit to the highway system operation. The region could consider a ‘Hero Vehicle’ concept, which builds on KHP’s existing Motorist Assist and adds a Mechanic capability. Other areas of the country have engaged transit system mechanics to perform service as the ‘Hero Vehicle’ operator. The Hero Vehicle would perform temporary minor vehicle repair so the vehicle and operator could safely get off the highway and to a complete vehicle service. There are some legal and liability issues to address before initiating this service. However, the cost-benefit ratio is likely to be strongly beneficial given the high rate of stalled vehicles that contribute to the regional incident numbers.

Consider adding Accident Investigation Sites along major highways – Removing incidents from the highway quickly could facilitate recovery of system operations. It is possible that all available paved area may be used for through movement, especially as vehicle automation continues to increase. Constructing and reserving designated accident investigation sites could provide a safer location for First Responders to investigate an incident, and a place where incident participants can recover. In the near future, these sites can also be used as recovery stations for automated vehicles as the technology is evolving and may have higher risks while maturing.

**Impacts during Implementation**

Moderate. There is already a robust Traffic Incident Management program in Kansas City. This recommendation calls for additional Motorist Assist Patrols and training. TIM training will also be of

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ongoing benefit. The recommendation with the largest impact is likely to be the use of arterials for diversion routing. New procedures will need to be developed along with cooperative agreements between the states and the cities.

System Safety

Improved incident management has a great potential for impacting system safety by reducing clearance times and the potential for secondary incidents.

System Security

No effect

Risks and Potential Mitigations

There are budgetary risks associated with increasing motorist assist resources. Both states will need to consider the costs and benefits in their budgetary process. Obtaining agreements for city arterials to be utilized as diversion routes will create a risk of alienating some local agencies. MOUs will need to be developed along with operational procedures all agree to before implementing.

Training Needs of Operators and Participants

As this recommendation involves increased TIM training, the training needs of participants is paramount to its success. TIM training has long been practiced in Kansas City and continued funding and support of TIM training is seen as key to this strategy. Training will also be required for KC Scout and OGL operators to provide for a more collaborative approach to managing incidents and diversions.

Disadvantages and System Constraints

Finding suitable locations for accident investigation sites will be a challenge in already developed corridors within Kansas City. KC Scout and OGL are in the same building, but physically separated.

Alternatives and Trade-Offs Considered

Alternatives to coordinated diversion routing included non-advisory diversions, or letting traffic self-divert without guidance. This was considered a less desirable alternative to managing diversions proactively.

PRIORITY 1: ENCOURAGE TELECOMMUTING, DELAYED COMMUTING, AND FLEX TIME FOR EMPLOYERS AND WORKERS ON THE I-35 CORRIDOR
Satisfies Operational Need(s): ON13, ON14, ON15, ON16

**STRATEGY DEFINITION**

This strategy allows for employers and workers to choose telecommuting to reduce overall travel demand on I-35 and encourages alternative or creative work hours (delayed commuting and flex time) to allow for spreading demand across a greater time period. Peak hour congestion, incidents or weather related impacts would trigger the implementation of these plans with cooperation of the media and employers in the Kansas City region.

**ROLES AND RESPONSIBILITIES**

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</thead>
<tbody>
<tr>
<td>MARC</td>
<td>ICM/TSM&amp;O Champion, employer notifications</td>
</tr>
<tr>
<td>Employers</td>
<td>Encourage and facilitate telecommuting activities</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represents KDOT priorities &amp; TSM&amp;O program</td>
</tr>
<tr>
<td>MoDOT</td>
<td>Represents MoDOT priorities &amp; TSM&amp;O program</td>
</tr>
<tr>
<td>KC Scout</td>
<td>Manages freeway operations for KDOT &amp; MoDOT in the Kansas City area</td>
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**NEXT STEPS**

Work through new MARC TSM&O committee and other existing MARC committees to promote Travel Demand Management concepts. Remind ICM stakeholders and committee members to inform others of this tool.

**Impacts during Implementation**

Minimal impact on operating agencies. With employer and employee participation will come reduced demand on the I-35 corridor, but it will be gradual and dependent on day of week, weather, time of year, congestion levels and active incidents/events.

**System Safety**

It is expected that accidents and potential injuries caused by accidents will be reduced with lower overall vehicle miles traveled.

**System Security**

No effect
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Risks and Potential Mitigations

Risks include non-participation by major employers or resistance from employees to change daily habits. Incentive programs should be created to encourage telecommuting options amongst both employers and employees. Some regions have created alternative group work locations near residential centers. These centers have ranged from publicly funded sites to private enterprises who offer desks and other basic office features (wi-fi or internet, etc.) where people can work in an office environment away from the main work building.

Training Needs of Operators and Participants

Minimal training is required of participants other than implementation of home-based office environments.

Disadvantages and System Constraints

Potential loss of productivity of employees working in a home-based office environment is a disadvantage of telecommuting. Loss of human interaction in the conducting of business may lead to misinterpretation of directions. There may also be additional cost to employers to provide resources for a home-based work force, such as laptop computers, VPN, enhanced security, and other off-site expenses.

Alternatives and Trade-Offs Considered

Not applicable

PRIORITY 1: MEDIA SUPPORT OF CREATIVE COMMUTING

Satisfies Operational Need(s): ON16

STRATEGY DEFINITION

Several ICM strategies will be more successful with the support of the media (radio, TV, print, web and social media). This strategy seeks to create a closer working relationship between the media and transportation professionals in Kansas City to encourage "creative commuting" when recommended by transportation professionals. Beyond traditional incident and congestion reports, the media can play a large role in encouraging alternate modes of transportation by noting arrival times based on mode, transit schedules, availability of parking, and mobility hub status updates. The media can also note when it is advantageous to vary your commute times and discourage travel when telecommuting is a better option due to incidents or poor road conditions.
ROLES AND RESPONSIBILITIES

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>MARC</td>
<td>ICM/TSM&amp;O Champion, Coordinate responses based on decision support systems, Media notifications</td>
</tr>
<tr>
<td>Media</td>
<td>Broadcast of commuting alternatives and information</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represents KDOT priorities &amp; TSM&amp;O program, Media notifications</td>
</tr>
<tr>
<td>MoDOT</td>
<td>Represents MoDOT priorities &amp; TSM&amp;O program, Media notifications</td>
</tr>
<tr>
<td>KC Scout</td>
<td>Manages freeway operations for KDOT &amp; MoDOT in the Kansas City area, Media notifications</td>
</tr>
<tr>
<td>OGL</td>
<td>Monitor arterial conditions and manage arterial traffic signal operations</td>
</tr>
<tr>
<td>KCATA</td>
<td>Represent and manage multi-modal operations in the Kansas City area, Media notifications</td>
</tr>
</tbody>
</table>

NEXT STEPS

Initial connections should be made on behalf of the ICM concept with media outlets in the region. KC Scout and KDOT have strong existing communication ties with the media outlets. Messages such as TDM concepts, critical incident locations, high volume travel times and days, transit options and service changes can be shared based on existing operational knowledge. The foundations of communication with the media initiated now will support future communication that results from Decision Support Systems. Ultimately, if a route diversion or alternative is recommended by the Decision Support System, the media will play an important role in disseminating that information.

Impacts during Implementation

Moderate impact on operating agencies. A more collaborative culture between the media and operating agencies will be formed and it will require dedicated activities by operations personnel to be performed to inform and monitor the media.

System Safety

There should be a positive impact on system safety with reduced vehicle miles traveled and encouragement of telecommuting or the use of alternate modes of travel. Greater awareness of weather impacts to travel patterns will also reduce vehicle miles traveled.

System Security

No effect
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Risks and Potential Mitigations

If incorrect information is relayed by operating agencies or the media, consumers may lose trust in the information being provided. Proactive verification of information and monitoring of media reports will lead to greater accuracy as the program matures.

Training Needs of Operators and Participants

Operators and managers within the operating agencies responsible for communicating with the media will require training in the information needs and formats desired. Media representatives will need training on terms used by transportation agencies and how the information should be broadcast to consumers.

Disadvantages and System Constraints

Inconsistent information and details may be shared from various media sources and mediums depending on capabilities and time allotments.

Alternatives and Trade-Offs Considered

Operating agencies could be the data source and provide the medium by which consumers receive the data. They can provide radio broadcasts, live media reports from the TMC, social media feeds, etc. This was considered too specialized and better left to entities which perform these services on a constant basis.

TECHNICAL INTEGRATION

The recommendations that follow are rooted in technical integration that is a base for accomplishing ICM along the I-35 corridor.

PRIORITY 1: DEVELOP MOBILITY HUBS ALONG THE I-35 CORRIDOR

Satisfies Operational Need(s): ON8, ON10, ON16

STRATEGY DEFINITION

Mobility hubs will act as a center of multi-modal activity, essentially the intersection of various modes and methods for mobility. They will allow the user to make choices conveniently with multiple options for reaching their destination and making last-mile connections for greater personal mobility. A Mobility Hub may have a combination of park-n-ride with a transit bus node, a streetcar stop and bike-share locations, ride-hailing via Uber or taxi availability, ZipCar access, and carpooling or ride-share services.
Amenities may include kiosks, Wi-Fi, EV charging stations, restrooms, cafes, etc. Mobility Hubs can provide a convenient method of changing mobility modes by the user.

## ROLES AND RESPONSIBILITIES

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<td>MARC</td>
<td>ICM/TSM&amp;O Champion: Coordination host for ICM activities in the metro area</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represent KDOT priorities: State Roadways in the metro area</td>
</tr>
<tr>
<td>MoDOT</td>
<td>Represent MoDOT priorities: State Roadways in the metro area</td>
</tr>
<tr>
<td>KC Scout</td>
<td>Represent I-35 freeway conditions: Informational transportation hub for the KC metro area across political boundaries</td>
</tr>
<tr>
<td>OGL</td>
<td>Monitor arterial conditions: Arterial coordination across political boundaries</td>
</tr>
<tr>
<td>KCATA</td>
<td>Represent transit bus service: Major multi-modal transportation resource in the KC metro area</td>
</tr>
<tr>
<td>Regional Transit Coordinating Council (RTCC)</td>
<td>Represent “Smart Moves” includes multiple transportation and governmental agencies in the area concerned: Guides transit investment, including proposed Mobility Hubs in the years and decades ahead.</td>
</tr>
<tr>
<td>Chambers of Commerce</td>
<td>Represent employers and employment centers in the area: Communicate and support opportunities associated with hubs and express employers’ perspectives on services</td>
</tr>
</tbody>
</table>

## NEXT STEPS

Transit hubs are in development as part of RideKC Regional Transit Plan (an update of the Smart Moves Plan).

### Impacts during Implementation

It is expected that physical or geometric improvements needed during implementation will take place off-roadway and have no true effect on traffic or user-ship as these added locations did not exist initially. Computer software and hardware applications would fall into the same category.

### System Safety

With proper design of both roadway geometry and ITS architecture, system safety of both the physical roadway and electronic information/controls should not be effected.
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System Security

The method of data transfer to the Mobility Hub interface or to the traveling public interface is in development at this time. Sharing electronic information via any type of open system always poses a potential security threat by creating a situation where hackers could infiltrate any system from which data is being shared. Loss of this control would result in misinformation and informational confusion but not outright physical danger.

Risks and Potential Mitigations

Risks include misinterpretation of potential need and lack of use of the facility, precipitating the loss of funding that could have been used elsewhere.

Mitigations of possible misinterpretation of need include coordination with the transit authorities and potential services, including the planning of transit-related activities. Provide technical and policy recommendations to the oversight entities including MARC and all local stakeholder groups. Support of the Regional Transit Plan governance and any architectural changes needed to enhance the proposed regional transit services.

Training Needs of Operators and Participants

Training to include, knowledge, comprehension and understanding of operator policies procedures and job activities. Similar to those required by KC Scout, OGL, and KCATA.

Disadvantages and System Constraints

Areas that have a mix of land uses support a more frequent transit service and have more mobility options than others. Convenient transit service is usually concentrated in the core of regional areas. Jobs-transit disconnect is compounded by low density development patterns and limited funding sources. Environmental Justice Tracts Areas where there is a significant concentration of low-income and minority populations with service requirements lack the needed volume for frequent transit service. There are multiple transportation providers with multiple funding sources splitting funding into smaller bundles.

Alternatives and Trade-Offs Considered

Build out of roadway as a capacity expansion was an evaluated alternative but discarded due to cost and the inability to construct given the present land use constraints.

PRIORITY 2: PREPARE THE I-35 CORRIDOR FOR THE TECHNOLOGY SHIFT TO AUTONOMOUS VEHICLES
Satisfies Operational Need(s): ON2, ON3, ON4, ON10

**STRATEGY DEFINITION**

Over the next 5 to 20 years, the autonomous vehicle will make up an ever increasing part of the vehicle fleet on the roadway. They will be able to utilize narrower lanes, closer headways, and create fewer incidents. Truck platooning will also transform how freight is moved and may necessitate designated lanes. The I-35 corridor will need to accommodate the existing vehicle technology level, which may be at an Autonomous Level of 0 or 1, as well as accommodate fully autonomous vehicles operating at an autonomy level of 4 or 5. This ability to accommodate multiple autonomy levels may exist for a lengthy transitional time period.

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<td>ICM/TSM&amp;O Champion: Coordination host for ICM activities in the metro area.</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represent KDOT priorities: State Roadways in the metro area. Define capabilities of the road. Define licensing requirements and limits of liability for autonomous vehicles.</td>
</tr>
<tr>
<td>KC Scout</td>
<td>Represent I-35 freeway conditions: Informational transportation hub for the KC metro area across political boundaries. Provide data to third parties.</td>
</tr>
<tr>
<td>OGL</td>
<td>Monitor arterial conditions: Arterial coordination across political boundaries. Provide data to third parties.</td>
</tr>
<tr>
<td>Private Entities (such as private auto service providers and freight movement providers)</td>
<td>Expected to develop vehicle capabilities: Purchase data or acquire from data sources.</td>
</tr>
<tr>
<td>State Legislatures</td>
<td>Legal: Define what autonomy level is allowable by law and limits of state liability.</td>
</tr>
</tbody>
</table>

**NEXT STEPS**

Begin to consider legislative action necessary to prepare for autonomous vehicles on the road. Federal policy was released in September 2016 that provided a model state policy. In the *Federal Automated Vehicles Policy* States’ responsibilities include other aspects of motor vehicle regulations:

- Licensing (human) drivers and registering motor vehicles in their jurisdictions;
- Enacting and enforcing traffic laws and regulations;
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- Conducting safety inspections, where States choose to do so; and
- Regulating motor vehicle insurance and liability.

Impacts during Implementation

Unknown – system is expected to be phased in over time. Dependent on many sources including state of technology at the time, vehicle capability, available data and legal aspects. Allowable levels of control will have a great impact on the type of system or systems to be implemented.

The following are levels of autonomous vehicle control is provided by SAE (Society of automotive Engineers). The SAE definitions divide vehicles into levels based on “who does what, when.”

0. At SAE Level 0, the human driver does everything;
1. At SAE Level 1, an automated system on the vehicle can sometimes assist the human driver conduct some parts of the driving task.
2. At SAE Level 2, an automated system on the vehicle can actually conduct some parts of the driving task, while the human continues to monitor the driving environment and performs the rest of the driving task.
3. At SAE Level 3, an automated system can both actually conduct some parts of the driving task and monitor the driving environment in some instances, but the human driver must be ready to take back control when the automated system requests.
4. At SAE Level 4, an automated system can conduct the driving task and monitor the driving environment, and the human need not take back control, but the automated system can operate only in certain environments and under certain conditions.
5. At SAE Level 5, the automated system can perform all driving tasks, under all conditions that a human driver could perform them.

System Safety

Autonomous vehicles can provide improvements to vehicular safety and improvements in both highway capacity and traffic flow, lower fuel consumption and pollution, and fewer accidents. For autonomous vehicles to operate safely in everyday traffic, problems in perception, navigation, and control need to be resolved. The impacts and interactions with other components of the existing transportation system, as well as the future implementation details, remain uncertain at this time.

System Security

Security is a concern. Subversion of the system by malware, viruses and hackers must be considered. Both the functionality of the autonomous vehicle and its data sources must be protected. Sharing of electronic information via any type of system will always pose a potential security threat by creating a
situation where the system and its shared data sources could be compromised. Loss of this control would result in misinformation and possible failure of autonomous control.

**Risks and Potential Mitigations**

Initial costs to the system could be unaffordable. Licensing of vehicles and testing standards may lead to inconsistencies across state lines. Liability details are yet to be fully defined and security concerns are present. The impacts and interactions with existing components of the transportation system, as well as implementation details need to be fully analyzed. Mitigation of these concerns will come with time, experience, and analysis.

**Training Needs of Operators and Participants**

Training is yet to be defined and is depended on systems and technologies still advancing.

**Disadvantages and System Constraints**

The development of the complete autonomous vehicle and the necessary systems to operate it is a complex task and will require funding and understanding of a large variety of emerging technologies encompassing aspects that have not been applied to or used by roadway management systems to date. Besides the obvious advantages of increasing road safety and improving the quality and efficiency of moving people and goods around, the integration of intelligent features and autonomous functionalities in vehicles will lead to major economic benefits, including reduced fuel consumption, efficient use of the road network and reduced operational personnel.

**Alternatives and Trade-Offs Considered**

Build out of the roadway as a capacity expansion was an evaluated alternative but discarded due to cost and the inability to fully construct given the present surrounding land use constraints. No trade-off was considered as the move toward autonomous vehicles in some form is the direction of traffic management technology today.

**PRIORITY 2: FACILITATE THE DEPLOYMENT OF CONNECTED VEHICLES AND VEHICLE TO INFRASTRUCTURE SYSTEMS**

Satisfies Operational Need(s): ON2, ON3, ON4, ON10

**STRATEGY DEFINITION**

The purpose of this initiative is to support and facilitate the systems, data and equipment that will enable a Connected Vehicle to communicate with other vehicles and roadside units. As Connected Vehicles increase their market penetration, these systems become critical technology to allow for the
CONCEPT OF OPERATIONS

sharing of transportation data such as road conditions, incidents, alternative routes, traveler information messages, multi-modal data, and emergency data to both the driver and the vehicle. We encourage deployment initiatives, whether public or private sector based, that will advance the state of this technology as well as make it socially equitable.

ROLES AND RESPONSIBILITIES

<table>
<thead>
<tr>
<th>Agency/Entity</th>
<th>Roles and Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARC</td>
<td>ICM/TSM&amp;O Champion: Coordination host for ICM activities in the metro area</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represent KDOT priorities: State Roadways in the metro area. Define capabilities of the roadway infrastructure.</td>
</tr>
<tr>
<td>MoDOT</td>
<td>Represent MoDOT priorities: State Roadways in the metro area. Define capabilities of the roadway infrastructure.</td>
</tr>
<tr>
<td>KC Scout</td>
<td>Represent I-35 freeway conditions: Informational transportation hub for the KC metro area across political boundaries. Provide data as allowed to private entities.</td>
</tr>
<tr>
<td>OGL</td>
<td>Monitor arterial conditions: Arterial coordination across political boundaries. Provide data to Private entity.</td>
</tr>
<tr>
<td>Private Entities</td>
<td>Expected to develop connected vehicle capabilities: Purchase data or acquire from data sources as allowed.</td>
</tr>
<tr>
<td>State Legislatures</td>
<td>Legal: Define connectivity aspects allowable by law and limits of state liability.</td>
</tr>
</tbody>
</table>

NEXT STEPS

Continue to install, connect, and upgrade existing roadside units, prepare for a consistent open broadcast of data for vehicles and third party developers, seek opportunities for including fiber backbone and connecting existing transportation system networks to facilitate sharing of data.

Impacts during Implementation

Unknown – system is expected to be phased in over time. Dependent on many sources including state of technology at the time, vehicle capability, available data and legal aspects. Allowable and/or available types of data that can be shared such as V2V (vehicle to vehicle) and V2I (vehicle to infrastructure) will have a great impact on the type and capability of system or systems to be implemented. Will require modification of the existing transportation management software and hardware and may require the replacement of the existing transportation management software and hardware.
System Safety

This technology has the potential to radically improve the safety of everyday road travel. Connected vehicles can provide improvements to vehicular safety with fewer accidents. For connected vehicles to operate safely in everyday traffic clean data must be supplied by the outside source.

System Security

Security is a concern. Subversion of the system by malware, viruses, and hackers must be considered. Both the functionality of the connected vehicle and its data sources must be protected. Sharing of electronic information via any type of system will always pose a potential security threat by creating a situation where the system and its shared data sources could be compromised. Vulnerabilities have demonstrated the need for more advanced security measures. As the functions of the vehicle become more software controlled and less mechanically controlled, protection of the data required becomes essential to its safe operation. This becomes even more important if the vehicle shares this data with another vehicle.

Risks and Potential Mitigations

Initial costs to upgrade or modify the existing system could be costly. Licensing of vehicles and testing standards may lead to inconsistencies across state lines. Liability details are yet to be fully defined and security concerns are present. The impacts and interactions with existing components of the transportation system, as well as implementation details need to be fully analyzed. Mitigation of these concerns will come with time, experience and analysis.

Training Needs of Operators and Participants

Training is yet to be defined and is depended on systems and technologies still advancing.

Disadvantages and System Constraints

The development of the fully connected vehicle and the necessary systems needed to facilitate the safe and efficient operation of them, is a complex task. It will require funding sources and the implementation of a large variety of emerging technologies, encompassing some aspects that as of yet, have not been applied to or used by roadway management systems.

Alternatives and Trade-Offs Considered

No alternatives or trade-offs were considered as the move toward connected vehicle technology and control is the existing direction of traffic management.

PRIORITY 2: ALL-INCLUSIVE TRANSPORTATION DASHBOARD
CONCEPT OF OPERATIONS

Satisfies Operational Need(s): ON1, ON3, ON5, ON16

STRATEGY DEFINITION

Through the use of one website/mobile app, trip information on all modes of travel is displayed to the user allowing them to make the best decision with regard to mode and expected travel times. This data would include real-time transit schedules, interstate travel times, incident data, car-sharing availability, ride-hailing service availability, streetcar arrival times, bike-share locations and availability, etc. The dashboard is potentially developed and funded through a private Transit Management Association and/or advertising and even includes incentivization in order to encourage multi-modalism.

ROLES AND RESPONSIBILITIES

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<tr>
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</thead>
<tbody>
<tr>
<td>MARC</td>
<td>ICM/TSM&amp;O Champion: Coordination host for ICM activities in the metro area</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represent KDOT priorities: State Roadways in the metro area and available in house data.</td>
</tr>
<tr>
<td>MoDOT</td>
<td>Represent MoDOT priorities: State Roadways in the metro area and available in house data.</td>
</tr>
<tr>
<td>KC Scout</td>
<td>Represent I-35 freeway conditions: Informational transportation hub for the KC metro area across political boundaries. Responsible for the dissemination of data acquired.</td>
</tr>
<tr>
<td>OGL</td>
<td>Monitor arterial conditions: Arterial coordination across political boundaries. Responsible for the dissemination of data acquired.</td>
</tr>
<tr>
<td>Transportation Management Association</td>
<td>Show available transportation resources for specific locations: To be defined, possible employer funding or data availability.</td>
</tr>
</tbody>
</table>

NEXT STEPS

Consider a Transportation Management Association (TMA) as recommendation for major employment centers. TMAs are collaborative efforts by a major employer or employment center to offer transportation services for their employees with the goal of mitigating traffic congestion in the area. National examples are typically employer funded and provide employees resources focused on getting to or from a specific destination. A resource that has proven successful in other areas of the U.S. is a consolidated transportation information center that shows available transportation resources such as highway travel times (current and +30 minutes), transit routes (departure times and frequency), car share availability, weather (for walking/biking decisions). Examples of TMA information resources include: Transit Screen iGo Mosaic for a site in Washington, DC and a site at the Irvine Spectrum in Irvine, CA.
A demonstration project could be beneficial to evaluate the effectiveness of such an information resource tool in Kansas City. To select a prime location as the focal point of the dashboard, there are several aspects that may lead to higher use rate and achieved benefit of the dashboard. Topics to consider for potential success of a transit screen TMA-type display in a fixed location as a demonstration project:

- Availability/type of data from KCATA
- Availability/type of data from KC Scout
- Availability/type of data from OGL
- Location of TMA, including transit service
- New Transit Hub locations
- Density and diversity of potential user pool
- Proximity of third party rental/share equipment (ZipCar, Uber, B-Cycle)

**Impacts during Implementation**

As entities become interested in compiling existing traveler information, the following information sources can support Dashboard:

- Open feed data from KC Scout
- Data from OGL
- Ride KC Transit data – under development
- Data from Integrated Modeling for Road Condition Prediction (IMRCP) - operational predictions based on weather and traffic.
- Mobility hubs information

**System Safety**

Users are able to make better informed decisions regarding their trips and modes of travel with this single source of information conveniently available. Decisions that either keep the user from entering the transportation system (because of weather, incidents, other), lowering) or lower exposure to other vehicles through transit, carpooling/sharing or local trips via walking or biking, can have a positive impact on safety when aggregated over an extended period.

**System Security**

System security is always a concern. Subversion of the system by malware, viruses and hackers must be considered. Both the functionality of the dash-board and its possible data sources must be protected. Sharing of electronic information via any type of communication system will always pose a potential security threat by creating a situation where the system and its shared data sources could be compromised.
CONCEPT OF OPERATIONS

Risks and Potential Mitigations

System security risks are high for potential data breaches. Firewalls and network security can mitigate some of the risk.

Training Needs of Operators and Participants

Training is yet to be defined and is dependent on systems and technologies still advancing.

Disadvantages and System Constraints

The development of a fully functional all-inclusive Transportation Dashboard and the necessary data accumulation systems needed to provide accurate data in an understandable and meaningful way, is a complicated task. Traditionally non-transportation related entities would provide relevant and non-biased data, cooperation and the coordination of transportation data in a timely manner. This would require buy in by more than just the controlling transportation agencies maintaining the system. A Transportation Management Association is a means to providing the data needed. Association members would or could provide data concerning hours of work and available multi-modal sources in conjunction with the traditional transportation management resources.

Alternatives and Trade-Offs Considered

No alternatives or trade-offs were considered.

OPERATIONAL INTEGRATION

The recommendations that follow are rooted in Operational Integration that is a base for accomplishing ICM along the I-35 corridor.

PRIORITY 1: ENHANCE THE OPERATION GREEN LIGHT PROGRAM IN KANSAS CITY

Satisfies Operational Need(s): ON2, ON3, ON5, ON10, ON11, ON12, ON14

STRATEGY DEFINITION

This will include expansion of OGL to cover more arterial miles in the metro area, formalized arterial diversion route programs on both OGL routes and non-OGL routes, greater coordination between OGL and KC Scout, and, in the future, providing signal data to connected vehicles via roadside equipment or third party providers.

ROLES AND RESPONSIBILITIES
### I-35 INTEGRATED CORRIDOR MANAGEMENT

<table>
<thead>
<tr>
<th>Agency/Entity</th>
<th>Roles and Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARC</td>
<td>ICM/TSM&amp;O Champion, key contact with stakeholders</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Develop agency and elected official support for utilizing major arterials as I-35 diversion routes; Continue positive relationships with the media.</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represents KDOT priorities and support predictive modeling concept</td>
</tr>
<tr>
<td>MoDOT</td>
<td>Represents MoDOT priorities and support predictive modeling concept</td>
</tr>
<tr>
<td>KC Scout</td>
<td>Manages freeway operations for KDOT &amp; MoDOT in the Kansas City area; Support OGL’s implementation of their enhancements</td>
</tr>
<tr>
<td>OGL</td>
<td>Lead for identifying local diversion routes, performing predictive modeling, operations, maintenance and analysis of diverted incidents</td>
</tr>
<tr>
<td>KCATA</td>
<td>Represent and manage multi-modal operations in the Kansas City area; Provide multi-modal options available for potential diversion routes</td>
</tr>
</tbody>
</table>

### NEXT STEPS

Work with Stakeholders to identify natural diversion routes for I-35 utilizing major arterials adjacent to the corridor. The natural diversion routes can be identified through historical data of KC Scout and RITIS used together. KC Scout can identify specific incidents and RITIS data can be pulled for the incidents to find natural diversion routes that may emerge. With natural diversion routes identified, a decision support process can be developed to adjust signal timing along natural diversion routes in anticipation of diversion. This process should be revisited frequently to evaluate the effectiveness of the decision triggers and the signal adjustments. If the process and diversion routes are proven to be effective, consideration should be given to specifically broadcasting diversion routes.

Predictive modeling tools will rapidly become more robust. As these tools demonstrate their effectiveness, they should be tested and used as input to the decision support system. The predictive incident modeling along identified routes can support the development of incident timing plans in anticipations of diversion. Continued positive relationships with the media will be beneficial for broadcasting specific diversion routes.

### Impacts during Implementation

May need additional OGL staff or financial resources to perform and analyze predictive modeling for diversions along selected major arterial routes.

### System Safety

Reduce potential for secondary incidents along I-35 by providing diversion routes for drivers.
CONCEPT OF OPERATIONS

System Security

No effect

Risks and Potential Mitigations

Risk of having a lack of support from local agencies, elected officials or KDOT on the use of specific major arterials as potential diversion routes. Identify alternative diversion routes within the same vicinity of I-35 as potential mitigation.

Training Needs of Operators and Participants

Potential need for modeling software training and incident management training for stakeholder staff.

Disadvantages and System Constraints

Limited disadvantages performing predictive modeling and stakeholder relationship building. Because parallel routes are limited along the I-35 Corridor, take advantage of perpendicular major arterials followed by parallel arterials further from I-35.

Alternatives and Trade-Offs Considered

Do not enhance OGL’s capabilities and continue to react to I-35 incidents without pre-planned diversions along major arterial corridors.

PRIORITY 3: EXPAND THE USE OF DMS ON ARTERIALS ADJACENT TO I-35

Satisfies Operational Need(s): ON1, ON9, ON10

STRATEGY DEFINITION

On key arterials that feed into I-35, install Dynamic Message Signs (DMS) to provide information to users about traffic incidents, travel times and restrictions before they enter the I-35 corridor so they can make an informed decision about the route they choose. The use of DMS adjacent to the Burlington Northern Santa Fe (BNSF) intermodal facility freeway entrances is also recommended to provide greater information to commercial vehicles on incidents and height and weight restrictions before they enter the I-35 corridor. Public Private Partnerships present an opportunity to fund this infrastructure by allowing advertising when not being used to convey traveler information.

ROLES AND RESPONSIBILITIES

<table>
<thead>
<tr>
<th>Agency/Entity</th>
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</tr>
</thead>
</table>

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I-35 INTEGRATED CORRIDOR MANAGEMENT

<table>
<thead>
<tr>
<th>MARC</th>
<th>ICM/TSM&amp;O Champion, key contact with stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders</td>
<td>Develop agency and elected official support for funding arterial DMS adjacent to I-35</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represents KDOT priorities &amp; support arterial DMS adjacent to I-35</td>
</tr>
<tr>
<td>MoDOT</td>
<td>Represents MoDOT priorities support arterial DMS adjacent to I-35</td>
</tr>
<tr>
<td>KC Scout</td>
<td>Manages freeway operations for KDOT &amp; MoDOT in the Kansas City area; Coordinate with stakeholders to obtain access to DMS from KC Scout to post information as appropriate</td>
</tr>
<tr>
<td>OGL</td>
<td>Support potential use of OGL communications system for arterial DMS</td>
</tr>
<tr>
<td>KCATA</td>
<td>Represent and manage multi-modal operations in the Kansas City area; Provide multi-modal options available for potential diversion routes</td>
</tr>
</tbody>
</table>

NEXT STEPS

Work with Stakeholders to identify major arterials adjacent to the corridor that would be strategic for installing DMS. Identify local, state, and federal funding programs, as well as private public partnership opportunities, to consider submitting applications for implementation.

**Impacts during Implementation**

Minor impacts involved with design, communications, and installation of arterial DMS.

**System Safety**

Improve safety on I-35 by providing incident and travel time information to motorists on arterials approaching interchanges so they can decide to utilize an alternate route as appropriate.

**System Security**

Potential for “hackers” to post messages on arterial DMS.

**Risks and Potential Mitigations**

Local, State and Federal funding availability could be limited. Utilize Federal Funding Grant programs focused on ICM or ITS integration and deployment. Posting inaccurate information or problems with keeping the system in good working order could result drivers mistrust of the system.
CONCEPT OF OPERATIONS

Useful life of DMS may be limited. As technology and in-vehicle communications become more ubiquitous the need for DMS may dissolve. To mitigate this risk, continue to monitor the development of in-vehicle technology and its market penetration in the Kansas City metro area.

Training Needs of Operators and Participants

Potential need for modeling software training and maintenance of arterial DMS for stakeholder staff.

Disadvantages and System Constraints

May have issues with space for arterial DMS on approach to interchange with I-35 due to the presence of existing permanent signing, locations of access and other constraints.

Alternatives and Trade-Offs Considered

In-vehicle communications through Vehicle-to-Infrastructure technology will continue to evolve making DMS obsolete. New vehicles beginning in 2021 will contain this technology in the vehicle; however it will take years to enhance the vehicle fleet with this technology even with aftermarket systems.

PRIORITY 3: IMPLEMENT DYNAMIC LANES/MANAGED LANES ON I-35

Satisfies Operational Need(s): ON13

STRATEGY DEFINITION

Install multi-purpose traffic management gantries over I-35 that can provide for dynamic lane assignments, lane management, variable pricing, variable speed limits, traveler information, bus only lane assignments, hard shoulder running, etc. to control access and actively manage traffic on I-35.5

ROLES AND RESPONSIBILITIES

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<tbody>
<tr>
<td>MARC</td>
<td>ICM/TSM&amp;O Champion, key contact with stakeholders</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Develop agency and elected official support for Dynamic Lanes / Managed Lanes on I-35.</td>
</tr>
<tr>
<td>KDOT</td>
<td>Represents KDOT priorities &amp; owner /supporter of Dynamic Lanes / Managed Lanes on I-35</td>
</tr>
</tbody>
</table>

5 This is consistent with the recommendations provided in the “I-35 Moving Forward Plan” that was approved by MARC in July 2013.
**MoDOT**  
Represents MoDOT priorities & support Dynamic Lanes / Managed Lanes on I-35

**KC Scout**  
Manages freeway operations for KDOT & MoDOT in the Kansas City area;

**OGL**  
Monitor arterial conditions and manage arterial traffic signal operations

**KCATA**  
Represent and manage multi-modal operations in the Kansas City area; Coordinate multi-modal aspects of Dynamic Lanes / Managed Lanes on I-35.

---

**NEXT STEPS**

Identify local, state, and federal funding programs, as well as private public partnership opportunities, to consider submitting applications for dynamic lanes/managed lanes implementation. Begin design for the system and consider implementation in affordable stages. Communicate with stakeholders, and the general public, regarding the details of a dynamic lane/managed lane system on I-35 to build public support for a project.

**Impacts during Implementation**

Construction on I-35 will adversely impact traffic during the installation of infrastructure involved with the implementation of Dynamic Lanes / Managed Lanes. The traffic impacts will be directly correlated with the extent of the improvements if traffic lanes are closed for construction.

**System Safety**

Improved safety is anticipated by separating the managed lane from adjacent traffic and providing separate dedicated access treatments. Improved reliability along the corridor, which is a direct impact from Dynamic Lanes / Managed Lanes, will improve traffic safety as a result of reduced congestion and providing more information to the driver.

**System Security**

Potential for “hackers” to access any of the Dynamic Lane / Managed Lane technology such as variable speed limits, dynamic lane assignments, DMS or other connected items.

**Risks and Potential Mitigations**

Local, State and Federal funding availability. Utilize Federal Funding Grant programs focused on ICM or ITS integration and deployment. Displaying inaccurate information or problems with keeping the system in good working order could result drivers mistrust of the system.
CONCEPT OF OPERATIONS

Training Needs of Operators and Participants

Potential need for modeling software training and maintenance of Dynamic Lane / Managed Lane technology for stakeholder staff.

Disadvantages and System Constraints

Managed Lanes includes paying for the option to drive within the separated lane(s). Depending on the public’s view of and willingness to pay for this privilege, it may not be utilized as much as anticipated.

Alternatives and Trade-Offs Considered

In-vehicle communications through Vehicle-to-Infrastructure and Vehicle-to-Vehicle technology will continue to evolve making Dynamic Lanes / Managed Lanes obsolete. New vehicles beginning in 2021 will contain this technology in the vehicle; however, it will take years to enhance the vehicle fleet with this technology even with aftermarket systems.
APPENDIX A – ICM STRATEGIES CONSIDERED
# DRAFT I-35 ICM Potential Strategies

<table>
<thead>
<tr>
<th>Priority</th>
<th>Strategy Number</th>
<th>ICM Strategy</th>
<th>ICM Strategic Area</th>
<th>ICM Benefit</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 1</td>
<td>Provide SPaT data to drivers/vehicles</td>
<td>✓</td>
<td>Arterial Management</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>C 2</td>
<td>Arterial Signal Control from One TMC</td>
<td>✓ ✓ ✓</td>
<td>Arterial Management</td>
<td>✓ ✓ ✓</td>
<td>OGL currently Other TMCs (Olathe, OP, KC...) Consider making it virtual connection</td>
</tr>
<tr>
<td>3</td>
<td>Add More Arterials/Signals to OGL</td>
<td>✓</td>
<td>Arterial Management</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>4</td>
<td>Jointly Locate Operation Green Light TMC with KC Scout TMC in One Operations Theater</td>
<td>✓</td>
<td>Arterial Management</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>C 5</td>
<td>Arterial DMS</td>
<td>✓</td>
<td>Arterial Management</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>A 6</td>
<td>Formal Arterial Diversion Routing (approved by cities)</td>
<td>✓</td>
<td>Arterial Management</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>A 7</td>
<td>Arterial Signal Timing Plans Specific for Diversion Routing</td>
<td>✓</td>
<td>Arterial Management</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>8</td>
<td>All-Signal TMC (connects all cities to one TMC, an expanded version of OGL)</td>
<td>✓</td>
<td>Arterial Management</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>C 9</td>
<td>Truck Parking location and status app</td>
<td>✓</td>
<td>Freight</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>z 10</td>
<td>Freight Specific Traveler Information (closures, width/height/weight restrictions, parking)</td>
<td>✓</td>
<td>Freight</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>11</td>
<td>Freight Signal Priority (near ports or terminals)</td>
<td>✓</td>
<td>Freight</td>
<td>✓ ✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>B 12</td>
<td>Parking Management/Information System</td>
<td>✓ ✓ ✓</td>
<td>Operations</td>
<td>✓ ✓</td>
<td>✓</td>
</tr>
<tr>
<td>C 13</td>
<td>Ramp Metering/Adaptive Ramp Metering</td>
<td>✓ ✓ ✓</td>
<td>Operations</td>
<td>✓ ✓ ✓</td>
<td>Already implemented on I-35 6 locations Improves reliability and safety Emissions benefit</td>
</tr>
<tr>
<td>B 14</td>
<td>Managed Lanes/HOT Lanes</td>
<td>✓ ✓</td>
<td>Operations</td>
<td>✓ ✓ ✓</td>
<td>In adopted I-35 Moving Forward Need to add to MARC Long Range plan Add HOV/ make connected vehicle lane</td>
</tr>
<tr>
<td>15</td>
<td>Hard Shoulder Running</td>
<td>✓ ✓</td>
<td>Operations</td>
<td>✓ ✓</td>
<td>Left shoulder focus, right shoulder reserved for bus and merging</td>
</tr>
<tr>
<td>Priority</td>
<td>Strategy Number</td>
<td>ICM Strategy</td>
<td>ICM Strategic Area</td>
<td>ICM Benefit</td>
<td>Costs</td>
</tr>
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<tr>
<td>16</td>
<td></td>
<td>Contra-Flow Lanes</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>17</td>
<td>Variable Speed Limits</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>More Direct Scout and City TMC Connectivity with OP TMC, Olathe TMC, KCMD, 911, etc.</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>One TMC for all states, cities, counties, 911</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FYI</td>
<td>20</td>
<td>Modular Lanes Concept</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td>ID of key diversion routing and appropriate signing and infrastructure</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FYI</td>
<td>22</td>
<td>Road User Fee/VMT/Congestion Pricing</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FYI</td>
<td>23</td>
<td>Use of Predictive Analytics for Traffic Management</td>
<td>Operations</td>
<td></td>
<td></td>
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<tr>
<td>FYI</td>
<td>24</td>
<td>Junction Control/Junction Management</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>Active Traffic Management</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td>Automated Enforcement of Speeds</td>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td>PPP Advertising/DMS on Arterials</td>
<td>Other</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>28</td>
<td></td>
<td>Gamification of Transportation</td>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>29</td>
<td>Telecommuting (Vary with conditions, use media to convey message)</td>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>30</td>
<td>Alternative Work options - Delayed Commuting (Vary with conditions, use media to convey message), flex hours, telecommuting, compressed work weeks</td>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>31</td>
<td>Compressed work week or Flex Time</td>
<td>Other</td>
<td></td>
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<tr>
<td>A</td>
<td>32</td>
<td>Connected Vehicles (DMS type messaging displayed in-vehicle, alt. routes, real-time traffic, road conditions)</td>
<td>Other</td>
<td></td>
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<td></td>
<td>33</td>
<td>Autonomous Vehicles</td>
<td>Other</td>
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<tr>
<td>Priority</td>
<td>Strategy Number</td>
<td>ICM Strategy</td>
<td>Demand Management</td>
<td>Load Balancing/ Modal Shift</td>
<td>Event Response/ Operational Improvement</td>
</tr>
<tr>
<td>----------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------------------</td>
<td>-----------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>A 34</td>
<td></td>
<td>I-35 ICM Management/TSMO Committee at MARC</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>35</td>
<td></td>
<td>Ride Hailing Uber and Lyft</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>C 36</td>
<td></td>
<td>Ride Sharing (Uber, Lyft, etc.)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>B 37</td>
<td></td>
<td>Park-n-Ride Car Share (Car Pooling or Uber Hub)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>B 38</td>
<td></td>
<td>Additional Motorist Assist Patrol</td>
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<td>✓</td>
<td>✓</td>
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<tr>
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<td></td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>40</td>
<td></td>
<td>Accident investigation sites</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>C 41</td>
<td></td>
<td>Bus On Shoulder</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>A 42</td>
<td></td>
<td>Park-n-Ride Transit Mobility hubs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>43</td>
<td></td>
<td>Transit Signal Priority</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>C 44</td>
<td></td>
<td>Transit Express Routes</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>B 45</td>
<td></td>
<td>Provide Additional Transit Hubs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>B 46</td>
<td></td>
<td>Increase Transit Capacity</td>
<td>✓</td>
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<td>Transit Only Lanes on Arterials</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>C 48</td>
<td></td>
<td>Transit Queue Jumping</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>Priority</td>
<td>Strategy Number</td>
<td>ICM Strategy</td>
<td>ICM Strategic Area</td>
<td>ICM Category</td>
<td>System Reliability</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------</td>
<td>--------------</td>
<td>--------------------</td>
<td>--------------</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Demand Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Load Balancing/ Modal Shift</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Event Response/ Operational Improvement</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td>Capital Improvement</td>
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<td>49</td>
<td>Ramp Meter Bypass for Transit/HOV</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
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<tr>
<td>z</td>
<td>50</td>
<td>Incentives for Transit Use, Peak Period Transit Use</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>51</td>
<td>51</td>
<td>Mobility On Demand - Transit</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
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<tr>
<td>C</td>
<td>52</td>
<td>Private Sector Mapping/Dynamic Routing App</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td></td>
<td>53</td>
<td>Private Sector Mapping/Dynamic Routing In-Vehicle</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>C</td>
<td>54</td>
<td>Post Travel Times on DMS and Alert Media</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>A</td>
<td>55</td>
<td>Media Communications of ICM</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>56</td>
<td>56</td>
<td>1 App for all travel modes</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>57</td>
<td>57</td>
<td>Display Colored Travel Times (red, orange, green based on norm)</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>58</td>
<td>58</td>
<td>Transportation Management Association (TMA), group of employers who ban together and agree to consolidate. Could be like KU Med shuttle</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
<td>✓ ✓</td>
</tr>
</tbody>
</table>

= Short Term
= Long term
y being implemented
h stakeholders as concept
APPENDIX B – SYSTEM BREAKDOWN STRUCTURE
I-35 Integrated Corridor Management
System Breakdown Structure (Current 2016)

Transportation System

Infrastructure
- Highway
  - Ramp meters
  - Maintenance/construction
- Arterial
  - Traffic signals
  - Bike lanes
  - Sidewalks
  - Maintenance/construction
- Parking
  - Park and Ride
  - Paid
  - Free
- ITS
  - Cameras
  - Network
  - Software

Mobile
- Traffic Apps (pull - push)
  - KC Scout
  - Google
  - Inrix
  - Here
  - Waze
- Mapping Apps (pull)
  - Google
  - Apple
  - Yahoo
  - Mapquest
  - ... (more)
- Social Media
  - Twitter - KDOT
  - Facebook - KDOT, MARC, ...
  - On Twitter - general

Static
- Television
  - Network
  - Cable
- Dynamic Message Signs (DMS)
  - Highway
    - I-35 @ 132nd Street
    - I-35 @ 95th Street
  - Arterials
    - WB 135th St @ Metcalf
    - SB Metcalf @ 132nd

Computer/Internet
- Ride KC
- MARC RideShare site
- KUMC Carpool site
- KDOT Construction Info
- Yahoo
- Google

InVehicle
- On-Star
- ... (more)

Radio
- AM
- Satellite

Social Media
- Twitter - KDOT
- Facebook - KDOT, MARC, ...
- On Twitter - general

Software

Police
- Maintenance
- ... (more)

Alternative Work Options
- Telecommuting
- Work Hour adjustments

Operations Managers
- KC Scout
- OGL
- Roadway support (on-call)
- TSMO (process)
- TIM (process)
- Overland Park TMC
- Olathe TMC
- Police
- Maintenance

Private Auto
- Privately owned vehicle (POV)
- Carpool
- ... (more)

Shared Auto
- Uber/On Demand
- Lyft
- ZipCar
- ... (more)

Transit
- Bus
- Bus on Shoulder
- BRT
- Streetcar
- BRT
- Paratransit

Bike
- Shared bicycle
- Privately owned bicycle

Walk

Freight Movement
- ... (more)
I-35 Integrated Corridor Management
System Breakdown Structure (Future 2030)

**Transportation System**

- **Private Auto**
  - Privately owned vehicle (POV)
  - Carpool
  - Lyft
  - ZipCar
  - "Last mile" vehicles
- **Shared Auto**
  - Uber/On Demand
  - Lyft
  - ZipCar
  - "Last mile" vehicles
- **Transit**
  - Bus
  - Bus on Shoulder
  - BRT
  - Streetcar
  - Bridj
  - Paratransit
- **Bike**
  - Shared bicycle
  - Privately owned bicycle
- **Walk**

**Infrastructure**

- **Highway**
  - Ramp meters
  - Tolling (HOT Lanes)
  - Additional capacity - operational/widen
  - Maintenance/construction
- **Arterial**
  - Traffic signals
  - Bike lanes
  - Sidewalks
  - Maintenance/construction
- **Parking**
  - Park and Ride
  - Paid
  - Free
- **ITS**
  - Cameras
  - Network
  - Software
  - Ride KC - Last mile planning tools
  - On-dash alerts to incidents

**Software**

- **Police**
- **Maintenance**

**Operations Managers**

- **KC Scout**
- **OGL**
- **Roadway support (on-call)**
- **TSMO (process)**
- **TIM (process)**

**Other**

- **Alternative Work Options**
  - Telecommuting
  - Work Hour adjustments
- **Transportation Management Associations (TMA)**
  - Policies encouraging/requiring
    - Destination-based travel info
APPENDIX C – USE CASE SUPPORTING MATERIALS
Participants:
Ray Webb – MARC (OGL); Jim Hubbell - MARC
Jennifer Russell – Garver; David Church – WSP | Parsons Brinckerhoff

Jennifer summarized the goal for today and how it relates to our work this week.
Meeting today to discuss:
• Use Case options, stakeholder feedback and ultimately select the Use Case for moving forward
• Discuss the length of each corridor (longer vs. shorter)
• Discuss AM Peak vs. PM Peak vs. Off-Peak
• Give our traveler a name

We will be reviewing the following scenarios for the selected Use Case:

Trips / Journey – Scenarios (existing (2016), future no-build (2040), ICM)
Note: 2040 was the horizon year for the I-35 Moving Forward Study
• Planned trip
• Planned event (construction project)
• Unplanned event (crash resulting in lane(s) or road closure)

Ray and Jim talked about who else should be involved in these discussions (KDOT, KC Scout, other).
• Ray will talk with Mark Sommerhauser (KC Scout) about participation this week in the calls.
• Jim will talk with David Schwartz (KDOT) about participation this week in the calls.

Use Case Discussion
• Jim Hubbell said that Use Cases B and C were “floating to the top” based on stakeholder feedback (see Table 1 on page 2 for Potential Use Cases)
• Longer versus shorter corridor?
  o Longer Corridor (Use Case C) – 151st St. & S. Pflumm to downtown KC, MO
    ▪ More opportunities to use transit or divert to arterials
    ▪ More complex when it comes to future modeling efforts
  o Shorter Corridor (Use Case B) – 127th & N. Mur-Len to KU Medical Center
    ▪ More realistic and implementable
    ▪ Easier to model as a more condensed corridor
    ▪ Less opportunities to divert to arterials or utilize transit.
    ▪ KU Medical Center a very logical destination / potential partner for ICM
    ▪ Pilot transit project
• AM Peak vs. PM Peak vs. Off-Peak
  o PM Peak has higher volumes
  o AM Peak has a higher perceived value (more critical getting to work in the morning)
  o Off-Peak less of an issue
• Based on the items discussed above, the group chose Use-Case B
• User Description: Sarah, 29 years old, Radiologist at KU Med, likes country music, Roastery coffee fan. Lives alone in a townhouse that she owns. Plays volleyball on co-ed, evening league.
<table>
<thead>
<tr>
<th>Potential Use-Case</th>
<th>User Info</th>
<th>Traveling From</th>
<th>Traveling To</th>
<th>Purpose</th>
<th>Time of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Male</td>
<td>K-7 and W. Santa Fe, Olathe, KS (near Walmart south of Ernie Miller Nature Park)</td>
<td>Johnson County Community College</td>
<td>School</td>
<td>A.M. [non-peak]</td>
</tr>
<tr>
<td>B</td>
<td>Female</td>
<td>127th &amp; N Mur-Len, Olathe, KS (near Pioneer Trail Middle School)</td>
<td>KU Medical Center</td>
<td>Work</td>
<td>A.M. [peak]</td>
</tr>
<tr>
<td>C</td>
<td>Male</td>
<td>151st &amp; S. Pflumm, Olathe, KS (near Black Bob Park)</td>
<td>Downtown, Kansas City, MO</td>
<td>Work</td>
<td>A.M. [peak]</td>
</tr>
<tr>
<td>D</td>
<td>Male</td>
<td>Downtown Kansas City, KS</td>
<td>Near Johnson County Community College</td>
<td>Home/Recreation</td>
<td>P.M. [peak]</td>
</tr>
<tr>
<td>E</td>
<td>Female</td>
<td>75th &amp; Antioch Area (near Shawnee Mission Medical Center)</td>
<td>BSNF Intermodal Facility, Edgerton, KS</td>
<td>Work</td>
<td>A.M. [peak]</td>
</tr>
<tr>
<td>F</td>
<td>Male</td>
<td>BSNF Intermodal Facility, Edgerton, KS</td>
<td>Armourdale Rail Yard, Kansas City, KS</td>
<td>Freight</td>
<td>A.M. [non-peak]</td>
</tr>
<tr>
<td>G</td>
<td>Female</td>
<td>127th &amp; N Mur-Len, Olathe, KS (near Pioneer Trail Middle School)</td>
<td>Shawnee Mission Parkway, Shawnee, KS</td>
<td>Pick up Grandchild from School</td>
<td>P.M. [peak]</td>
</tr>
<tr>
<td>H</td>
<td>Male</td>
<td>103rd &amp; Quivira, Overland Park, KS (neighborhoods south of Oak Park Mall)</td>
<td>KU Medical Center</td>
<td>Use</td>
<td>P.M. [non-peak]</td>
</tr>
<tr>
<td>I</td>
<td>Female</td>
<td>W Morgan &amp; Edgerton, Edgerton, KS</td>
<td>Shawnee Mission Parkway, Shawnee, KS</td>
<td>Recreation</td>
<td>P.M. [non-peak]</td>
</tr>
</tbody>
</table>

Table 1: Potential Use Cases (A – I)
C.1 – CURRENT USE CASES AND SPRINT NOTES
I-35 ICM Use Case
Current – Typical
Total Travel Time: 45 mins.

Ref # Time Activity
15 8:15 AM Arrive at work
14 8:06 AM Walk from parking to work
13 8:06 AM Arrive KU Med Parking (red lot)
12 7:54 AM Exit I-35 at Southwest Blvd
11 7:54 AM Enter I-35 at Antioch
10 7:54 AM Decide to stay on route
9 7:47 AM Traffic is normal
8 7:47 AM Drop off child
7 7:47 AM Arrive at day care
6 7:47 AM Decide to stay on route
5 7:47 AM Exit Shawnee Msn Pkwy
4 7:47 AM Decide to stay on route
3 7:47 AM Check DMS at 95th Street
2 7:47 AM Enter I-35 at 119th Street
1 7:30 AM Leave home
Sarah decides her typical trip to work

**How do I get to work?**

- **Check Internet**
  - Bus to work:
    - Wait: 10–15 mins
    - Travel time: 75 mins
    - Cost: $3 day pass
    - Comfort: Low (2 bus changes)
    - Reliability: Medium

- **Check Google Maps**
  - Same info as Ride KC

- **Ride KC**
  - Bus to work:
    - Wait: 10–15 mins
    - Travel time: 75 mins
    - Cost: $3 day pass
    - Comfort: Low (2 bus changes)
    - Reliability: Medium

- **Car to work**
  - Wait: 0 mins
  - Travel time: 45 mins
  - Cost: $11.25
  - Comfort: Medium
  - Reliability: Medium

**Time:** When she gets her job

**Plan to take car to work**
- Leave at 7:30 am
- Arrive at 8:15 am

**Bus to work:**
- Same info as Ride KC

**Car to Work**
- Faster
- More comfortable

**Legend**
- **Begin/End**
- **Decision**
- **Action**
- **Info System**
- **Report**
- **Results**
Jennifer summarized the “user” info and explained the “Agile” process utilized for this week:

“Sarah is 29 years old, a Radiologist at KU Med Center, likes country music, and is a Roasterie coffee fan. Lives alone in a townhouse that she owns. Plays volleyball on co-ed, evening league.

On Tuesday morning, Sarah needs to get to work at KU Med Center for an 8:45am patient appointment. She will depart from her townhouse near S. Black Bob Road and 127th Street so she can arrive 30 minutes prior to her appointment to turn on her radiology equipment”.

Journey (AM Peak) – Scenarios (existing (2016), future no-build (2040), ICM)

Note: 2040 was the horizon year for the I-35 Moving Forward Study

• Planned trip (typical daily traffic)
• Unplanned incident
• Major planned construction
• One time major event

This morning we will focus on the Planned trip to work (typical daily traffic):

Current traffic (scenario)

• Jennifer described Sarah’s choices in the morning
• Jennifer summarized the Use Case template with the participants
• Questions?
  • Jim H. asked if once we pick a mode, if Sarah need to stick with that mode in all cases? Jennifer said that she does not and that she will pick the appropriate mode based on the best available information regarding her trip each morning.
• Mode Choices
  • Personal Vehicle – Google Maps shows that it would take between 30 minutes and 50 minutes based on historical data in the AM Peak, including a stop at the Roasterie for coffee, along this 19.7 mile trip (see Figure 1).
  • Transit (BRT) – according to the RideKC.org website (see Figure 2), transit may not be the most time effective mode option (1 hr, 15 minutes) with two bus changes get to work by 8:15 am
  • Bicycling – Google Maps shows that it would take approximately 1 hr, 37 minutes to bike the 17.5 mile trip which is longer than using transit.
  • Bike plus Transit – There may be a combination “Bike plus Transit” option that would shorten the trip.
  • Uber / Car Pool / Rideshare – Benefit that you can focus on other items (if not driving) during the trip, but essentially it takes the same amount of time as using a personal vehicle (https://www.ridesharekc.org/public/home.aspx)
KU Medical Center may post something regarding mode opportunities - http://www.kumc.edu/human-resources/employee-resources/alternative-work-schedules-and-transportation.html

- **Travel Information Resources**
  - KC Scout website / app / notification service – beta testing updated notification service (text, e-mail, push) website (http://kcscout.net/), application
  - INRX / Here Maps / other - Private applications (see Figure 3)
  - TV, radio, newspaper other media

- **Other Factors – Weather (good, wet, icy, snow, wind)**

- **Contacts at KU Med – Lideana Laboy (UG Traffic Engineer) has contacts; Jim will visit with Rideshare staff at MARC to identify other contacts**

- **Mode selection (personal vehicle)**
  - Parked in driveway
  - Journey – Is a process
    - 127th Street to 119th on-ramp via or Blackbob Road
    - ITS Resources on her route – DMS (first between I-435 & 95th Street)
    - Coffee at the Roastarie no SW Blvd? Yes, add in (added about 5 minutes to the trip)
    - Destination – park (pay for parking) / street parking limited, walk (how long of a walk)?
    - Completed her journey
  - Cost / Comfort Factor – Jennifer will add to the template
    - Cost
    - Comfort factor
      - Weather
      - Ability to work while she travels

Tomorrow morning we will be discussing an unplanned incident scenario.

DAC/JR
Figure 1: Personal vehicle trip from Blackbob Court Apartments to KU Medical Center (AM Peak) w/ Roasterie stop

Source: Google Maps
Figure 2: Transit trip from Blackbob Court Apartments to KU Medical Center (AM Peak) w/o Roasterie stop
Source: RideKC.org; Google Maps
Figure 3: INRX application w/planned trip from Blackbob Court Apartments to KU Medical Center (AM Peak) w/ Roasterie stop

*Source: INRX*

Cost of Vehicle ownership (2014 Baseline)

$0.58/mile


Parking Rates at KU Medical Center
How to obtain a parking permit: You may register as a new parker at the Parking Registration Portal. For additional information you may contact KUMC Parking Services, 2100 W. 36th Ave., Kansas City, KS 66160-7133. Operating hours are 7 a.m. to 4:30 p.m. Monday through Friday 913-588-6175.

Rates/fees for surface lots and garages.

<table>
<thead>
<tr>
<th>Permit Type</th>
<th>July 2016 Annual Cost</th>
<th>Effective July 1, 2017 Annual Cost</th>
<th>Annual Change</th>
<th>%</th>
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<tbody>
<tr>
<td>SURFACE LOTS</td>
<td></td>
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</tr>
<tr>
<td>ADA Permit Parking</td>
<td>$116</td>
<td>$122</td>
<td>$6</td>
<td>5.17%</td>
</tr>
<tr>
<td>Blue Lot</td>
<td>$378</td>
<td>$387</td>
<td>$9</td>
<td>2.33%</td>
</tr>
<tr>
<td>Chapel Lot</td>
<td>$630</td>
<td>$640</td>
<td>$10</td>
<td>1.61%</td>
</tr>
<tr>
<td>Red Lot</td>
<td>$242</td>
<td>$254</td>
<td>$12</td>
<td>5.00%</td>
</tr>
<tr>
<td>Yellow Lot</td>
<td>$110</td>
<td>$122</td>
<td>$12</td>
<td>5.17%</td>
</tr>
<tr>
<td>Yellow Student</td>
<td>$64</td>
<td>$68</td>
<td>$4</td>
<td>6.25%</td>
</tr>
<tr>
<td>Yellow Student - Night Only</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>NiA</td>
</tr>
</tbody>
</table>
I-35 ICM Use Case
Current – Incident
Total Travel Time: 47 mins.

Ref # | Time  | Activity
--- | --- | ---
16 | 8:17 AM | Arrive at work
15 | | Walk from parking to work
14 | 8:08 AM | Arrive KU Med Parking (red lot)
13 | | Take SMPW to Rainbow Blvd
12 | | Left onto Rainbow
11 | | Begin Route – Head south on Antioch to SMPW
10 | 7:54 AM | Decide to take alternative route – SMPW east toward Rainbow Blvd
9 | | Check map app – sees incident on I-35 north of Antioch
8 | 7:47 AM | See traffic back up at Antioch entrance to I-35
7 | | Drop off child
6 | 7:47 AM | Arrive at day care
5 | | Decide to stay on route
4 | | Exit Shawnee Msn Pkwy
3 | | Decide to stay on route
2 | | Check DMS at 95th Street
1 | 7:30 AM | Leave home
Sarah’s Decision Diagram
Current – Incident

Plan to take car to work.
Leave at 7:30 am
Arrive at 8:15 am

Time: When she gets her job

- Listen to Radio
  - Morning traffic report
    - Normal

- Check Television
  - Morning traffic report
    - Normal

Stay on plan
Leave at 7:30 am

View 95th St.
DMS

Stay on plan

View traffic back up at Antioch
entering I-35

Check mapping app

Accident on I-35 north of Antioch

Alternate route: SMPW east to Rainbow

Take alternate route

Arrive at work
8:17 am

Legend

- Begin/End
- Decision
- Action
- Info System
- Report
- Results

Exit at SMPW
Normal

Stay on plan

Drop off child @ daycare

View traffic back up at Antioch entering I-35

Check mapping app

Accident on I-35 north of Antioch

Alternate route: SMPW east to Rainbow

Take alternate route

Arrive at work
8:17 am

Time: Morning of trip
Participants:
Ray Webb – MARC (OGL); Jim Hubbell - MARC
Jennifer Russell – Garver; David Church – WSP | Parsons Brinckerhoff
David Schwartz – KDOT (Transportation Planning); Mark Sommerhauser– KC Scout (absent from call)

Note: A morning Incident initiated the closure of WB I-70 and traffic was being detoured to K-7 highway. Ray Webb and potentially Mark Sommerhauser were having to address this incident and the affect it was having on traffic during the call.

Jennifer Russell welcomed everyone to the call and introductions were made.

Jim Hubbell let the group know that he shared the selected Use Case with Ron Achelpohl, MARC’s Director of Transportation and Environment. Ron noted that a single-mother with before/after work childcare needs might be more relevant user for this project and would add some complexity to the trip along the I-35 corridor. Jim told Ron that he would share his thought with the Project Team.

Regarding Ron’s comments, Jennifer asked if we should add this to our Use Case at this time. Jim said that if wouldn’t disrupt the process, he would be in favor of adding feature to the Use Case. Jennifer and David Church agreed. David Schwartz agreed as well but would want to make sure that the day care location is relevant to the I-35 ICM. David S. stated that if we selected a family member day care near Shawnee Mission Parkway, then the best route seems to be the arterial system to KU Medical Center. The group discussed potential best route to take once you dropped the child off at the family day care. Jennifer suggested that the family day care could be located near West 61st Street, east of Antioch, which would result in a 15 minutes trip (based on a typical non-peak timeframe). The quickest route would then be to travel north on Antioch and access NB I-35 at Antioch to travel towards KU Medical Center.

Based on the discussion above, we’ve updated the Use Case as follows:

“Sarah is 29 years old, a Radiologist at KU Med Center, likes country music, and is a Roasterie coffee fan. She is a single mother of one child and lives in a townhouse that she owns. She plays volleyball on co-ed, evening league, as child care is available.

On Tuesday morning, Sarah needs to get to work at KU Med Center for an 8:45am patient appointment. She will depart from her townhouse near S. Black Bob Road and 127th Street, travel to her family day care (parents) on West 61st Street (east of Antioch), so she can arrive 30 minutes prior to her appointment to turn on her radiology equipment”.

This planned trip during the AM Peak, as shown in Figure 1, would typically take 28 minutes to 45 minutes with a suggestion to leave at approximately 7:30 am to arrive at 8:15 am. 
Figure 1: Personal vehicle trip from Blackbob Court Apartments to KU Medical Center (AM Peak) w/ stop at family day care east of W. 61th Street & Antioch Road  
*Source: Google Maps*

Today’s focus is an **unplanned incident** on I-35.

For her standard trip, let’s say she would follow the Google Maps recommendation (non-incident trip). Travel time remains the same which is the baseline.

An incident occurs (lane blocking) on I-35 north of the Antioch interchange. Do we want it before she leaves her home or after she drops off her child? Incident on I-35 at Antioch, during her trip after she drops off her child. She has to decide how to get to work without getting back on I-35. Sounds like a reasonable situation – Jim, David S. and Ray.

Jennifer talked about the architecture model that she drafted yesterday. Jim suggested that Sarah pull over and bring up her Waze phone app to see where it routes her around the incident. David S. – radio traffic could also provide information. Jim – a private app is probably the best way to route her in her personal vehicle. See Figure 2 for local route options from the family day care to KU Medical Center if taking NB I-35 is not an option. The preferred route would be to utilize Merriam Drive, to Merriam Lane to Southwest Blvd and then to Rainbow Blvd (16 – 22 minutes).
Figure 2: Personal vehicle trip with unplanned incident on NB I-35 just north of Antioch Road resulting in diverted trip to KU Medical Center

Source: Google Maps

Figure 3 and 4 show phone app screen shots of the local routes that are available to get to KU Med Center (12 – 14 minutes plus an additional 3 minutes of traffic congestion).

Figure 3: Mobile phone app showing diverted trip
Figure 4: Mobile phone app showing diverted trip

Discussion tomorrow will focus around Planned Major Construction along I-35.
I-35 ICM Use Case
Current – Planned Construction
Total Travel Time: 55 mins.

<table>
<thead>
<tr>
<th>Ref #</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>8:10 AM</td>
<td>Arrive at work</td>
</tr>
<tr>
<td>14</td>
<td>8:01 AM</td>
<td>Walk from parking to work</td>
</tr>
<tr>
<td>13</td>
<td>8:01 AM</td>
<td>Arrive KU Med Parking (red lot)</td>
</tr>
<tr>
<td>12</td>
<td>7:49 AM</td>
<td>Exit I-35 at Southwest Blvd</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Enter I-35 at Antioch</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Decide to stay on route</td>
</tr>
<tr>
<td>9</td>
<td>7:49 AM</td>
<td>Traffic is normal</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Drop off child</td>
</tr>
<tr>
<td>7</td>
<td>7:42 AM</td>
<td>Arrive at day care</td>
</tr>
<tr>
<td>6</td>
<td>7:15 AM</td>
<td>Turn north onto Antioch</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Exit Metcalf on right turn ramps onto SMPW west</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Exit I-435 at Metcalf, head north</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Exit I-35, enter I-35 East</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Enter I-35 at 119th Street</td>
</tr>
<tr>
<td>1</td>
<td>7:15 AM</td>
<td>Leave home</td>
</tr>
</tbody>
</table>
Time: Day before construction begins

**Construction on I-35 between 95th St. and 75th St.**

**How do I get to work?**

- **Check Internet – get around construction**
- **Google Maps**
- **Ride KC**

**Ride KC**
- Bus on Shoulder possible.
- Reliability Increases for transit

**Google Maps**
- Typical Route: I-35 north to SMPW east
- Alternate Route: I-35 north to I-435 east to Metcalf north to SMPW west

**Ride KC**
- Bus to work: Wait = 10 – 15 mins
  - Travel time = 75 mins
  - Cost = $3 day pass
  - Comfort = Low
  - (2 bus changes)
  - Reliability = Medium

**Alternate Route:**
- Car to work: Wait = 0 mins
  - Travel time = 55 mins
  - Cost = $13.86
  - Comfort = Medium
  - Reliability = Medium

**Car to work**
- Alt Route: Leave 15 mins early
- More comfortable
- Faster

**Typical Route:**
- Car to work: Wait = 0 mins
  - Travel time = 55 mins
  - Cost = $13.86
  - Comfort = Medium
  - Reliability = Low

**View Traffic on I-435**
- Construction started
- Stay on plan
  - Leave at 7:15 am
  - Arrive ~ 8:15 am
  - Arrive at work 8:10 am

**Time: Morning of trip**

- **Check Television**
- **Listen to Radio**
- **Morning traffic report**
- **Construction started**

**Normal**
- Stay on plan

Legend:
- Begin/End
- Decision
- Action
- Info System
- Results
Participants:
Ray Webb – MARC (OGL); Jim Hubbell - MARC
Jennifer Russell – Garver; David Church – WSP | Parsons Brinckerhoff
David Schwartz – KDOT (Transportation Planning) (absent from call); Mark Sommerhauser – KC Scout (absent from call)

Jennifer Russell welcomed everyone to the call and introductions were made.

Today we will focus on a Planned Major Construction event. We will assume that construction is occurring on NB and SB I-35, between 95th Street & 75th Street that will require a single-lane drop in both directions. It is anticipated that an additional 10 minutes will need to be added to Sarah’s trip in order for her to get to family day care and then to work by 8:15 am. Sarah is reminded by the television media of the construction on I-35 that morning, so she pulls out her mobile phone app to check for alternative routes. Figure 1 shows alternative routes for Sarah to consider that stay on the local roadway system (no highways) between her home and family day care. Figure 2 shows alternative routes for Sarah to consider that utilize other highway routes between her home and family day care.

Figure 1 – Alternative Routes from Blackbob Court Apartments (127th & Blackbob) to family day care near W 61st & Antioch Road (local roadways only)
Source: Google Maps
The group anticipated that Sarah would review the potential alternate routes and will probably take the shortest route utilizing other state highways (Figure 2). It is anticipated that the quickest alternate route would only add an additional 5 minutes to Sarah’s trip versus 10 minutes if she went through construction on I-35.

Jim asked if anyone currently has a system that would be able to identify a higher than expected volume of vehicles existing on to an exit ramp and then automatically adjust signal timings along the arterial to accommodate the influx of traffic. Ray and David C. both said that what Jim described is future Connected-Vehicle technology that we don’t anticipate in the foreseeable future.

Jim mentioned that arterial Dynamic Message Signs (DMS) are another way for drivers to obtain real-time information before or during their trip. Overland Park has deployed some arterial DMS on Metcalf Avenue.

Ray asked about in-vehicle guidance systems that some high-end vehicles are including in their new models. Jennifer and David thought that some in-vehicle guidance systems are able to access real-time data to assist with alternate routes identical to mobile phone applications providing today. This will continue to expand within the operating vehicle fleet.

Ray mentioned that there is no effective central location for municipalities to post information regarding local roadway construction projects. KDOT has the 511 road conditions website (http://511.ksdot.org/) but this only includes projects on the Kansas state highway system. David mentioned that the most accurate information is supplied by users through applications like WAZE, Google Maps or other user driven systems.
Note: For projects lasting three-consecutive days on an Interstate Highway System within a metro area, construction projects are required by the FWHA to have a Transportation Management Plan (TMP) approved by the Department of Transportation. The TMP includes three components: Temporary Traffic Control Plan (TTPC); Traffic Operations (TO) and Public Involvement (PI). The goal of the TMP is to plan ahead to minimize delay and improve safety for the driver during construction by utilizing a multitude of strategies.

Below is a link to KDOT’s document “Kansas Work Zone Safety and Mobility Processes and Procedures” which describes TMP requirements in Kansas (Figure 3):

https://www.ksdot.org/Assets/wwwksdotorg/PDF_Files/KANSAS%20WORK%20ZONE%20SAFETY%20AND%20MOBILITY%20POLICY%20MASTER.pdf

Discussion on Tuesday, August 9, 2016 will focus around One Time Planned Event affecting traffic along I-35.

Figure 3: Kansas WZSM Processes and Procedures (July 30, 2008)

Source: KDOT
I-35 ICM Use Case
Current – One Time Event
Total Travel Time: 83 mins.

Ref #  Time Activity
14  7:53 AM  Arrive at work
13  7:48 AM  Ride bike to work
12  7:29 AM  Ride bus 667 (to Rainbow)
7  6:45 AM  Arrive at day care
6  6:30 AM  Decide to stay on route
5  6:07 AM  Ride bike to bus stop
4  5:50 AM  Decide to stay on route
3  5:35 AM  Take bike on bus rack
2  5:30 AM  Wait for bus
1  5:00 AM  Exit SMPW

1  6:30 AM  Leave home
2  6:20 AM  Decide to stay on route
3  6:15 AM  Leave car at day care
4  6:10 AM  Drop off child
5  6:00 AM  Arrive at day care
6  5:45 AM  Decide to stay on route
7  5:30 AM  Ride bus 667 (to Rainbow)
8  5:15 AM  Take bike on bus rack
9  5:00 AM  Wait for bus
10  4:30 AM  Ride bike to bus stop
11  4:00 AM  Decide to stay on route
12  3:30 AM  Leave car at day care
13  3:00 AM  Drop off child
14  2:30 AM  Arrive at work

Planned Congestion
Shawnee Mission Pkwy
95th St
119th St
Antioch Rd
Nall Ave
Rainbow Blvd
Metcalf Ave

Total Travel Time: 83 mins.
Sarah’s Decision Diagram
Current – One Time Event

Big Event = Traffic will be bad

How do I get to work?

Check Internet – get to work on time

Google Maps

Ride KC

Reliability Increases for transit

Bus on Shoulder possible.

Bus to work:
Wait = 10 – 15 mins
Travel time = 75 mins
Cost = $3 day pass

Comfort = Low
(2 bus changes)
Reliability = Medium

RideShare Sites (MARC and KU Med)

My Car

Car to work:
Wait = 0 mins
Travel time = 70+ mins
Cost = $13.86 +
Comfort = Low
Reliability = Very Low

Same traffic as private car

Carpool

Check Television

Morning traffic report

Event reminder

Stay on plan

View 95th St. DMS

Travel times long

Stay on plan

Arrive at work 7:46 am

Trip 1:
Own Car to daycare
Child to daycare in car
Leave 60 min early

Two trips:
1. Home to daycare
2. Daycare to work

Trip 2:
Bike to Transit to Work
Alt Route & Mode
Reliable
Get exercise

Begin/End

Decision

Action

Info System

Report

Results

Legend

Time: Day before Event begins

Time: Morning of trip
Jennifer Russell welcomed everyone to the call and introductions were made.

Today we will focus on a one-time major planned event.

The group discussed the Kansas City Royals parade and celebration that occurred last fall after winning the World Series. David Schwartz talked about his experience traveling from home in Meriden, KS to the Royals ceremony at Liberty Memorial near Union Station. David utilized mobile GPS navigation tools and it was still difficult to get to the Liberty Memorial utilizing local roadways. He ended up parking at Westport and walking about two miles to Liberty Memorial.

Jim Hubbell sent a screen shot of Google Maps showing the congestion on both highways and local roadways at 10:00 am on Tuesday, November 3, 2015 the day of the Royals celebration (Figure 1). The group decided that this would be too large an event to discuss as part of this Use Case.

Figure 1: Map showing congestion as a result of the Royals celebration/parade (10:00 am, Tuesday, November 3, 2015)
Source: Google Maps
The group discussed that the one time major event needed to be large enough event that it causes travelers to evaluate transit and other modes for their trip.

David Schwartz noted that bus-on-shoulder can currently operate on I-35 up to the Johnson / Wyandotte County line.

The group decided on utilizing the following event. **Big 12 Tournament college basketball event at the Sprint Center in downtown Kansas City, MO with the first game at 10:00 am (KU vs Oklahoma).** A lot of fans will be traveling from across the region to attend. There has been a lot of press coverage about this event through local median. As a result, Sarah is planning her trip the day due to the forecast for heavy traffic on I-35 during the morning peak resulting in delays.

Sarah’s morning trip involves dropping off her child in the morning prior to work at her Parent’s home for family day care. She then need to travel to KU Medical Center and arrive by 8:15 am. Sarah knows from past years of the Big 12 Tournament that she needs to plan her trip very carefully in order to get to work on time.

Sarah utilizes the following resources to help plan her trip:

- Kansas City Regional Transit: [http://ridekc.org/](http://ridekc.org/)
- Kansas City Rideshare: [https://www.ridesharekc.org/public/home.aspx](https://www.ridesharekc.org/public/home.aspx)
- Google Maps: [https://www.google.com/maps](https://www.google.com/maps)
- KU Medical Center – Transportation Options: [http://www.kumc.edu/parking/transportation-options.html](http://www.kumc.edu/parking/transportation-options.html)

Information provided by Jim Hubbell from the Rideshare database include:

- 48 users with destinations in zip codes 66160 (KU Med), 66103 (Rosedale), and 64111 (Westport)
- 32 of these list KU Med as an employer
  - 31 users have a carpool profile listed
  - 9 have a bike trip profile listed
  - 10 have a transit profile listed

To break this information down further, users originating from communities in Johnson County, KS with **destinations zip code in** zip codes 66160 (KU Med), 66103 (Rosedale), and 64111 (Westport) include (Table 1):

<table>
<thead>
<tr>
<th>Origin City (Johnson County)</th>
<th>Carpool</th>
<th>Bike/Walk/Transit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overland Park</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Olathe</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Mission</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Roeland Park</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lenexa</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1: Origin cities (Johnson County) and modes with destination zip codes (66160, 66103 and 64111)

Based on the resources available to Sarah, she has decided the following routes/modes regarding her trip to work as a result of this one time major planned event:

- 6:30 am – 7:00 am (Figure 2): Leave her home at Blackbob Court Townhouses (127th & Blackbob) and take I-35 to her Parent’s home at 8308 West 61st Street (61st & Lamar) to drop off her child for family day care (14 to 18 minute trip)
- 7:00 am – 7:17 am (Figure 3): Ride her bike to the bus stop 63rd & Nall Avenue to catch the 667 (17 minute trip)
- 7:22 am – 7:41 am (Figure 4): Ride bus 667 from 63rd & Nall to Rainbow Blvd. near KU Medical Center (19 minute trip)
- 7:41 am to 7:46 am: Ride her bike from Rainbow Blvd. to KU Medical Center (5 minutes)

Figure 2: Personal vehicle on I-35 from Blackbob Court Townhouses to 8308 West 61st Street to drop off her child for family day care (14 to 18 minute trip) - Source: Google Maps

Figure 3: Ride bike from 8308 West 61st Street to the bus stop at 63rd & Nall Avenue to catch the 667 (17 minute trip) Source: Google Maps
Ray Webb stated that education is still needed regarding available resources that users can utilize to make the best decision about their daily trips. The group agreed.

Sarah has made it to work on time again. If this works for her, she may use this again as the need arises. Benefits of utilizing different modes of travel as a result of specific circumstances include:

- **Exercise** – Riding your bicycle in the morning is a good form of exercise
- **Stress Relief** – Riding your bicycle and taking a bus (no transfers) can relieve the stress involved in driving to work especially in congested conditions
- **Reduce Traffic** – Riding your bicycle and taking the bus helps reduce traffic during the AM Peak

Sarah arrived early to work today as a result of prior planning and good execution of utilizing different modes of travel during this one time major planned event.
C.2 – FUTURE USE CASES AND SPRINT NOTES
I-35 ICM Use Case
Future – Typical
Total Travel Time: 50 mins.

<table>
<thead>
<tr>
<th>Ref #</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>8:05 AM</td>
<td>Arrive at work</td>
</tr>
<tr>
<td>14</td>
<td>7:56 AM</td>
<td>Walk from parking to work</td>
</tr>
<tr>
<td>13</td>
<td>7:56 AM</td>
<td>Arrive KU Med Parking (red lot)</td>
</tr>
<tr>
<td>12</td>
<td>7:42 AM</td>
<td>Exit I-35 at Southwest Blvd</td>
</tr>
<tr>
<td>11</td>
<td>7:42 AM</td>
<td>Enter I-35 at Antioch</td>
</tr>
<tr>
<td>10</td>
<td>7:35 AM</td>
<td>Decide to stay on route</td>
</tr>
<tr>
<td>9</td>
<td>7:35 AM</td>
<td>Traffic is normal</td>
</tr>
<tr>
<td>8</td>
<td>7:35 AM</td>
<td>Drop off child</td>
</tr>
<tr>
<td>7</td>
<td>7:35 AM</td>
<td>Arrive at day care</td>
</tr>
<tr>
<td>6</td>
<td>7:35 AM</td>
<td>Decide to stay on route</td>
</tr>
<tr>
<td>5</td>
<td>7:30 AM</td>
<td>Exit Shawnee Mspkwy</td>
</tr>
<tr>
<td>4</td>
<td>7:30 AM</td>
<td>Decide to stay on route</td>
</tr>
<tr>
<td>3</td>
<td>7:30 AM</td>
<td>Check DMS at 95th Street</td>
</tr>
<tr>
<td>2</td>
<td>7:30 AM</td>
<td>Enter I-35 at 119th Street</td>
</tr>
<tr>
<td>1</td>
<td>7:15 AM</td>
<td>Leave home</td>
</tr>
</tbody>
</table>
Sarah decides her typical trip to work

- **Check Internet**: How do I get to work?
- **Check Mobile Device**: More comfortable for child
- **Check Mapping App**: Plan for travel time variance
- **Ride KC**: Bus to work: Wait = 10 – 15 mins, Travel time = 75 mins, Cost = $4 day pass. Comfort = Low (2 bus changes), Reliability = Med High.
- **Shared Option**: Bus on Shoulder, Reliability Increased, Interactive info station at destination.
- **Car to Work**:
  - Wait = 0 mins
  - Travel time = 50 mins
  - Cost = $14.93
  - Comfort = Medium
  - Reliability = Low
- **Transit to Work**: Same info as Ride KC.

**Plan for travel time variance**
- **Check Mapping App**: Morning traffic report - Normal
- **Check Television**: Traffic status - Normal
- **View In-vehicle message from 95th St. DMS**: Normal
- **Stay on plan**: Leave at 7:15 am

**Leave at 7:15 am**
- Arrive ~ 8:05 am

**Arrive at work 8:05 am**

**Legend**
- **Begin/End**: System
- **Decision**: Action
- **Info System**: Report
- **Results**: Find the best option for her trip to work.

**Future - Typical**

**Morning of trip**
- **Time**:
  - When she gets her job
  - Morning traffic report - Normal
I-35 ICM Project
Use Case Selection – Agile Process (Future 2030)
Monday, August 30, 2016
8:30 am to 9:30 am

Participants:
Ray Webb – MARC (OGL); Jim Hubbell - MARC
David Schwartz – KDOT (Transportation Planning); Mark Sommerhauser – KC Scout (absent from call)
Jennifer Russell – Garver; David Church – WSP | Parsons Brinckerhoff; Jay Aber – WSP l Parsons Brinckerhoff
Tom Evans – TREKK Design Group; Matt Volz - HDR

Jennifer Russell welcomed everyone to the call and introductions were made.

David Church asked if Jennifer could give a brief overview of “Sarah” who is the focus of our Use Case:

“Sarah is 29 years old, a Radiologist at KU Med Center, likes country music, and is a Roasterie coffee fan. She is a single mother of one child and lives in a townhouse that she owns. She plays volleyball on co-ed, evening league, as child care is available.

On Tuesday morning, Sarah needs to get to work at KU Med Center for an 8:45am patient appointment. She will depart from her townhouse near S. Black Bob Road and 127th Street, travel to her family day care (parents) on West 61st Street (east of Antioch), so she can arrive 30 minutes prior to her appointment to turn on her radiology equipment”.

Today’s call will focus on her typical trip with no interruptions (planned or unplanned).

David Church asked if Jim Hubbell could give a brief overview of the MARC Travel Demand Model (TDM). Jim said that the current model was used for the for the “Transportation Outlook 2040” long range planning effort which was adopted by the MARC Board of Directors in June 2015. The MARC TDM is currently going through a calibration and validation process, expanding zones within the MARC Region to over 2,000. This project is still ongoing and as a result we need to utilize the existing MARC TDM which has fewer zones and lacks other features.

David Church explained that the current MARC TDM has not been validated for travel time (being addressed through the current update) as explained by Eileen Yang, MARC’s Modeling expert. Jim Hubbell suggested that we obtain a base year (2010) MARC TDM run that we utilize as “existing” so that we have an equal comparison with the 2030 MARC TDM runs even though it has not been validated for travel times. **Action Item: David Church will make this request to Eileen Yang (MARC).**

Jim Hubbell confirmed that the 2030 MARC TDM includes “financially constrained” projects listed in Transportation Outlook 2040, on and around the I-35 corridor, that are planned between now and 2030 (see Figure 1 and Table 1). Jim said that the model handles these projects as having additional capacity as a result of each project Transportation Outlook 2040 also includes numerous locally sponsored arterial expansion projects on roads that interact with I-35. These could have the effect of funneling more trips onto I-35, especially during the peak periods.
Figure 1: Transportation Outlook 2040 Projects Map

Source: MARC (http://www.to2040.org/projectsmap.aspx)
Table 1: Financially Constrained Projects along the I-35 Corridor (on or near) Planned Between now and 2030

Source: MARC (Transportation Outlook 2040)

David Church submitted a MARC 2030 TDM run request to Eileen Yang, MARC’s Modeling expert, to provide travel times for our “future” conditions during the AM Peak including:

- Typical daily trip (for Sarah)
- Unplanned incident on I-35
- Planned construction on I-35
- One-time major event

- **12.25min**
- **8.31min**

Figure 2: MARC 2030 TDM Travel Times (Typical Daily Trip): Work to Family Day-Care (Left Map) & Family Day Care to KU Medical Center (Work)

Source: MARC
This travel time equates to approximately 21 minutes which is approximately 7 minutes less than the typical travel times provided on Google Maps in the current year. As previously discussed, a request will be made to Eileen Yang, MARC’s Modeling expert, to run travel times for each condition utilizing the base year 2010 MARC TDM for better comparison to future year travel times.

Jennifer Russell asked the Project Team if they would brainstorm the “information system” and “transportation system” that will be available to Sarah in 2030. Everyone agreed. Reminder that we are just “time shifting” Sarah (same age, same situation), just 14 years later (2030).

Information System (2030):

By 2030 “connected vehicles” will have evolved. Sarah’s personal vehicle will be tapped into more systems than they would be today. David Schwartz suggested that platooning of vehicles will start to become a reality within the next 14 years. Jennifer said that vehicle platooning is a part of the ITS system, but not something that we can control. Jay Aber suggested that driver information systems regarding traffic incidents should be improved. Tom Evans said that the DMS will be able to communicate with your vehicle before you can see it the message on the physical DMS. David Schwartz stated that a car that is new in 2030 will still have to interact with a lot of older vehicles in the fleet. Tom Evans and Matt Volz said that some high-end vehicles today are able to have software upgrades like Tesla, Cadillac, others. Matt Volz said that we will be more informed drivers. Today we have to actively go and find the data that we need to make a decision about transportation. In the future, this information will be pushed to your vehicle directly. There will be an improved last mile connection for public transportation (example: Ride KC - Bridj). There will need to be a cultural change. Many vehicles will be automated in 2030. A traveler will be able to request an automated vehicle that will take them where they want to go.

Jay Aber says that there will need to be a demographic shift. Some “Millennials” would like to live in inner-city urban areas; however you need good schools, safety, etc. A high percentage of Millennials may not have as many children as past generations or any at all. Teenagers today are not as interested in getting their driver’s license. “Cool kids” are those that ride transit, ride their bike and walk.

Matt Volz said that the meeting Ray Webb is having with Audi (car manufacturer) is about signal phasing and timing data. TTS is a company that is behind this, working with Audit and BMW. TTS obtains the data and then sells it to these car companies. Still trying to figure out the business model. With this data, the driver/vehicle will have more information about their trip. Using cellular network to transfer this data (real time). Tom Evans said that with this technology eventually vehicles won’t need traffic signals if they can regulate right-of-way through vehicle-to-vehicle and vehicle-to-infrastructure communication.

Transportation System:

Other modes available in 2030 – shared vehicles / uber / amount of personal vehicles will reduce dramatically. However, people love their cars. More capacity on our roadways could mean more vehicles will be using up that capacity. In 14 years (2030) we hope to have more of a shared economy; however with less expense fuels and not dramatic congestion, it will be hard to get people out of their cars and into other modes. Ray Webb suggested that we need to talk more about trends in technology and young people’s habits for driving. Jim Hubbell stated that there will be more options for travelers in 2030. Whether it will have a positive effect on operations is hard to say. The overall take-away was that there should be more shared economy options available to Sarah in 2030.
Jim Hubbell said that Transportation Outlook 2040 did not include planned expansion of bus routes along the I-35 corridor. However, the “Ride KC Regional Transit Plan & Ride KC Workforce Connex” project that Karen Clawson (MARC) is working on might come out with additional recommendations.

Jennifer Russell suggested that we plan Sarah’s trip based on this information. For the first portion of her trip (home to family day care) there is probably not much of a travel time difference from what we see today (leave at 7:15 am). At 7:45 am Sarah is ready for the second leg of her trip (family day care to work). For the second leg of her trip, let’s assume that it would take approximately 3 minutes longer than today (11.3 minutes in 2030). For the first leg of her trip, using her private auto is probably most reasonable option. For the second leg of her trip, what mode options does she have? About seven miles from family day care to work. David Schwartz suggested that in 2030, more Millennials will be using transit and there will be more transit options available. “Uber” concept for car-pooling (Jay Aber)? Jennifer Russell mentioned that there is a parking penalty at KU Medical Center (she has to pay for parking). David Schwartz suggested that KU Med would really need to raise parking costs, to encourage their employees to car pool, ride share, walk or bike to work. Jay Aber suggested that for these future conditions, using her personal vehicle for this standard trip is probably her most reasonable option. Jim Hubbell said that travel time increases along the I-35 corridor will be gradual and probably not significant enough for car sharing on this typical day. The group agreed.

Tom Evans said that when he was growing up, he rode the school bus every day and when there was a conflict, his parents took him to school. Are we thinking about this backwards? David Schwartz said that if Sarah didn’t have a stop in the middle (family day care), transit would be a more viable option. Jay Aber suggested that her work may look at subsidizing transit which would make her trip free.

The next “agile process” call on Friday, September 2, 2016 will focus on an unplanned incident on I-35.
### I-35 ICM Use Case

**Future – Incident**  
**Total Travel Time: 52 mins.**

<table>
<thead>
<tr>
<th>Ref #</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>8:07 AM</td>
<td><strong>Arrive at work</strong></td>
</tr>
<tr>
<td>16</td>
<td>7:58 AM</td>
<td>Walk from parking to work</td>
</tr>
<tr>
<td>15</td>
<td>7:58 AM</td>
<td>Arrive KU Med Parking (red lot)</td>
</tr>
<tr>
<td>14</td>
<td>7:58 AM</td>
<td>Exit I-35 to Southwest Blvd</td>
</tr>
<tr>
<td>13</td>
<td>8:00 AM</td>
<td>Take SMPW to Metcalf – Enter I-35 from Metcalf</td>
</tr>
<tr>
<td>12</td>
<td>7:32 AM</td>
<td>Begin route – Head south on Antioch to SMPW</td>
</tr>
<tr>
<td>11</td>
<td>7:42 AM</td>
<td>Decide to take alternate route shown</td>
</tr>
<tr>
<td>10</td>
<td>7:42 AM</td>
<td>Map app – shows reroute option of SMPW to Metcalf</td>
</tr>
<tr>
<td>9</td>
<td>7:42 AM</td>
<td>In-vehicle notification of incident on I-35 north of Antioch</td>
</tr>
<tr>
<td>8</td>
<td>7:35 AM</td>
<td>Drop off child</td>
</tr>
<tr>
<td>7</td>
<td>7:35 AM</td>
<td>Arrive at day care</td>
</tr>
<tr>
<td>6</td>
<td>7:35 AM</td>
<td>Decide to stay on route</td>
</tr>
<tr>
<td>5</td>
<td>7:35 AM</td>
<td>Exit Shawnee Msn Pkwy</td>
</tr>
<tr>
<td>4</td>
<td>7:35 AM</td>
<td>Decide to stay on route</td>
</tr>
<tr>
<td>3</td>
<td>7:35 AM</td>
<td>Check DMS at 95th Street</td>
</tr>
<tr>
<td>2</td>
<td>7:35 AM</td>
<td>Enter I-35 at 119th Street</td>
</tr>
<tr>
<td>1</td>
<td>7:15 AM</td>
<td><strong>Leave home</strong></td>
</tr>
</tbody>
</table>
Sarah’s Decision Diagram
Future – Incident

Time: When she gets her job

Plan to take car to work. Leave at 7:15 am Arrive ~ 8:05 am

- Check mapping app
- Traffic status: Normal
- Stay on plan Leave at 7:15 am
- View In-vehicle message from 95th St. DMS
- Normal
- Stay on plan

- Check Television
- Morning traffic report: Normal

Time: Morning of trip

- Exit at SMPW
- Normal
- Stay on plan
- Drop off child @ daycare
- View In-vehicle message
- Accident on I-35 north of Antioch
- Alternate route: Metcalf to I-35
- Take alternate route
- Arrive at work 8:07 am

Legend
- Begin/End
- Decision
- Action
- Info System
- Report
- Results
Jim Hubbell shared his trip to Indianapolis using the “Blueindy” electric car service from the Indianapolis International Airport to downtown Indianapolis and back. Overall a great experience! See website for more info: [https://www.blue-indy.com/](https://www.blue-indy.com/) (Follow-up question – would a similar service be viable between KCI to downtown Kansas City in lieu of transit service?)

Jennifer Russell welcomed everyone to the call and introductions were made.

Jennifer Russell distributed I-35 ICM “draft” System Architecture documents (current and future) to the group. She discussed the Information System (green) and the Transportation System (blue), with sub-category “Infrastructure”, and Other (telecommuting) for each (see Figure 1 and 2). There are some categories under Information Systems and Transportation Systems that we have influence/control over and others that we do not. We have control over the items above the dashed line and within each category. The items below the dashed line we do not have control over. This will help us decide where we can focus our efforts (items that we have control over). We can add, modify and delete items as needed over time into these categories. The goal is for this System Architecture to help with planning, implementing and measuring ICM in Kansas City for this project and in the future. Jennifer Russell reviewed the items shown in the Information System (green) and the Transportation System (blue). For the Future 2030 document, Jennifer has included changes between the current and the future systems (red). Jennifer Russell asked for feedback from the Project Team.

**Figure 1: “Draft” I-35 ICM System Architecture (Current 2016)**
Source: Project Team

Comments: Ray Webb asked Jim Hubbell if they should run this by Mark Hansen, Principal Planner, MARC? Jim Hubbell agreed and said that he would send this information to Mark Hansen for review and comment and copy Ray Webb on the submittal. David Schwartz asked if we should include the Kansas City Streetcar as an item in the Transit category.
even through there is no planned expansion into Johnson County, KS. Matt Volz suggested that we include the Kansas City Streetcar in the System Architecture (Future 2030). The Project Team though that it might be an attractive option for “Sarah” if we have planned expansion of the Kansas City Streetcar. Matt Volz also suggested that we include Bus Rapid Transit (BRT) as well as Bus-on-Shoulder in the System Architecture.

Figure 2: “Draft” I-35 ICM System Architecture (Future 2030)
Source: Project Team

If you have additional comments, please mark up these documents by hand or electronically, and send them to Jennifer Russell and David Church.

The focus of today’s call is an “unplanned incident” on I-35 north of the Antioch interchange.

Sarah is conducting the same path for her trip.

Sarah woke up expecting a normal day. She still needs to be to work by 8:15. She is leaving at 7:15 am in the Future Year 2030. She hops in the car and proceeds to family day care via I-35. After dropping off her child at family day care, Sarah finds out about an incident on I-35. She is reviewing the information available to her to decide which path to take to work as a result of the unplanned incident. Tom Evans – her touch screen in the car (in-vehicle system) should alert her of the incident and suggest alternate routes to KU Medical Center. She would then select the alternate route that she is most comfortable with. If she takes Shawnee Mission Parkway up to Rainbow Blvd., it would add approximately 2.4 minutes to her overall trip (see Figure 3). Jim Hubbell – the in-vehicle system may try to route her car in the least congested corridor between where she is and her destination. Jennifer Russell – for the sake of consistency, we probably have two reasonable options: 1) taking Shawnee Mission Parkway to Rainbow Blvd. adding about 2.4 minutes to her trip; 2) Take Metcalf Avenue, which is past the incident, and get back on northbound I-35. In 2030, there should be very specific information available about where the incident has occurred and the expected delay. Jennifer Russell – will there be enough people diverting through their in-vehicle systems to cause congestion on the alternate routes?
Matt Volz gave a local example. On a day this week I-35 was shut down to one lane in the southbound direction. This caused a five-mile backup of stopped vehicles. Matt was shocked that people were not paying attention to try to avoid this massive backup. Tom Evans noted that people do not like to detour away from their intended route. Matt Volz – they have to trust that KDOT and MoDOT are giving the traveler accurate information to avoid construction or congested areas. This was the first day of a closure down to one lane and the media and others did not know it was coming. David Schwartz’s perspective was that KDOT didn’t have a chance to get the word out to the local media in time before drivers left for work regarding the I-35 southbound lane closure.

Sarah needs to trust that taking an alternate route is a good option for her to get to her destination. The big question is how to do that. Sarah evaluates the two alternative routes and make the decision. She decides to take Metcalf Ave. up to I-35 and get back on the highway to travel to KU Med Center. A two to three minute time delay seems reasonable to avoid the incident. This alternative route will take Sarah 18 minutes instead of 16 minutes. She arrives at KU Medical Center at 7:58 am (parking) with a nine-minute walk to her office (8:07 am) which is arriving to work on time.

Observation (David Church / Matt Volz) – we enter our daily commute route in our phones every day in case there is an incident or planned construction. More and more drivers will do the same in the future.

The next meeting on Tuesday, September 6, 2016 (8:30 am to 9:30 am) will focus on “planned construction” on I-35.

Jennifer Russell wrapped things up for the group.
I-35 ICM Use Case
Future – Planned Construction
Total Travel Time: 60 mins.

<table>
<thead>
<tr>
<th>Ref #</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>8:15 AM</td>
<td>Arrive at work</td>
</tr>
<tr>
<td>14</td>
<td>8:06 AM</td>
<td>Walk from parking to work</td>
</tr>
<tr>
<td>13</td>
<td>7:52 AM</td>
<td>Arrive KU Med Parking (red lot)</td>
</tr>
<tr>
<td>12</td>
<td>7:52 AM</td>
<td>Exit I-35 at Southwest Blvd</td>
</tr>
<tr>
<td>11</td>
<td>7:45 AM</td>
<td>Enter I-35 at Antioch</td>
</tr>
<tr>
<td>10</td>
<td>7:45 AM</td>
<td>Decide to stay on route</td>
</tr>
<tr>
<td>9</td>
<td>7:45 AM</td>
<td>Traffic is normal</td>
</tr>
<tr>
<td>8</td>
<td>7:45 AM</td>
<td>Drop off child</td>
</tr>
<tr>
<td>7</td>
<td>7:30 AM</td>
<td>Arrive at day care</td>
</tr>
<tr>
<td>6</td>
<td>7:30 AM</td>
<td>Turn north onto Antioch</td>
</tr>
<tr>
<td>5</td>
<td>7:30 AM</td>
<td>Take SMPW, head east</td>
</tr>
<tr>
<td>4</td>
<td>7:30 AM</td>
<td>Exit I-435 at SMPW</td>
</tr>
<tr>
<td>3</td>
<td>7:30 AM</td>
<td>Exit I-35, enter I-35 East</td>
</tr>
<tr>
<td>2</td>
<td>7:30 AM</td>
<td>Enter I-35 at 119th Street</td>
</tr>
<tr>
<td>1</td>
<td>7:30 AM</td>
<td>Leave home</td>
</tr>
</tbody>
</table>
Time: Day before construction begins

**How do I get to work?**

1. **Check Internet**
   - **Ride KC**
     - **Bus on Shoulder**
       - **Wait**: 10 – 15 mins
       - **Travel time**: 75 mins
       - **Cost**: 54 day pass
       - **Comfort**: Low (2 bus changes)
       - **Reliability**: Med Low
     - **Still along construction route**
   - **Shared Auto Option**
     - **Shared Car to work**
       - **Wait**: 10 mins
       - **Travel time**: 50 mins
       - **Cost**: ~ 50% of $14.93
       - **Comfort**: Low (hard to move car seat for child)
       - **Reliability**: Med Low
     - **Still along construction route**

2. **Check Mobile Device**
   - **Mapping App**
     - **Bus on Shoulder**
       - **Wait**: 10 – 15 mins
       - **Travel time**: 75 mins
       - **Cost**: 54 day pass
       - **Comfort**: Low (2 bus changes)
       - **Reliability**: Med Low
     - **Still along construction route**
   - **Shared Auto Option**
     - **Shared Car to work**
       - **Wait**: 10 mins
       - **Travel time**: 50 mins
       - **Cost**: ~ 50% of $14.93
       - **Comfort**: Low (hard to move car seat for child)
       - **Reliability**: Med Low
     - **Still along construction route**

3. **Check Television**
   - **Morning traffic report**

**Typical Route:**
- I-35 north to SMPW west

**Alternate Route 1:**
- I-35 north to I-435 east to Metcalf north to SMPW west

**Alternate Route 2:**
- I-35 north to I-435 west to SMPW east

**Car to Work**
- **Wait**: 0 mins
- **Travel time**: 65 mins
- **Cost**: $14.93
- **Comfort**: Medium
- **Reliability**: Very Low

**Car to Work Alt Route 2**
- **More comfortable for child**
- **Wait**: 0 mins
- **Travel time**: 60 mins
- **Cost**: $18.39
- **Comfort**: Medium
- **Reliability**: Med Low

**Time: Morning of trip**

**Car to Work**
- **Wait**: 0 mins
- **Travel time**: 60 mins
- **Cost**: $18.39
- **Comfort**: Medium
- **Reliability**: Med Low

**Car to Work Alt Route 2**
- **More comfortable for child**
- **Wait**: 0 mins
- **Travel time**: 60 mins
- **Cost**: $18.39
- **Comfort**: Medium
- **Reliability**: Med Low

**Plan to take car to work. Leave at 7:15 am Arrive ~ 8:15 am**

**Legend**

- **Begin/End**
- **Decision**
- **Action**
- **Info System**
- **Report**
- **Result**

**Stay on plan**
- Leave at 7:15 am
- Arrive at work 8:15 am

**View In-vehicle message from I-435 95th St. DMS**

**Traffic status**
- Normal

**Check mapping app**
- **Traffic status**
  - Normal
- **Stay on plan**
  - Leave at 7:15 am
  - Arrive at work 8:15 am

**Sarah’s Decision Diagram**

**Future – Planned Construction**
I-35 ICM Project
Use Case Selection – Agile Process (Future 2030)
Tuesday, September 6, 2016
8:30 am to 9:30 am

Participants:
Ray Webb – MARC (OGL); Jim Hubbell - MARC
David Schwartz – KDOT (Transportation Planning); Mark Sommerhauser– KC Scout
Jennifer Russell – Garver; David Church – WSP | Parsons Brinckerhoff
Tom Evans – TREKK Design Group; Matt Volz – HDR (absent from call); Jay Aber – WSP l Parsons Brinckerhoff (absent from call);

Jennifer Russell welcomed everyone to the call and introductions were made.

The focus of today’s call is “planned construction” on I-35 between 95th Street and 75th Street interchanges.

Jennifer Russell asked the group to think of the System Architecture we have prepared.

Sarah is anticipating a “typical day” path for her trip.

Sarah woke up expecting a normal day. She still needs to be to work by 8:15. Sarah normally leaves home at 7:15 am in the Future Year 2030. We reviewed Sarah’s trip for a normal day in 2030.

- 7:15 am – 7:33 am: Leave her home at Blackbob Court Townhouses (127th & Blackbob) in her personal vehicle and take I-35 to her Parent’s home at 8308 West 61st Street (61st & Lamar) to drop off her child for family day care (12.25 minute trip per MARC 2030 model, estimated to be 18 minutes1)
- 7:40 am – 7:55 am: Leave family day care in her personal car and take I-35 north to Rainbow Blvd. and then to the parking facility at the KU Medical Center (8.3 minute trip per MARC 2030 model, estimated to be 15 minutes)
- 7:55 am – 8:04 am: Walk from the parking facility to her office (9 minute trip)
- 8:04 am: Arrive to work ahead of schedule

### Future - Typical

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Duration</th>
<th>Distance</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:15 AM</td>
<td>Begin</td>
<td>0 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:15 AM</td>
<td>Drive home to day care</td>
<td>18 mins</td>
<td>10.7 mi</td>
<td></td>
</tr>
<tr>
<td>7:33 AM</td>
<td>Drop off at day care</td>
<td>7 mins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7:40 AM</td>
<td>Depart from day care</td>
<td>15 mins</td>
<td>7.1 mi</td>
<td></td>
</tr>
<tr>
<td>7:55 AM</td>
<td>Park at KU</td>
<td>9 mins</td>
<td>$ 1.22</td>
<td></td>
</tr>
<tr>
<td>8:04 AM</td>
<td>Arrive</td>
<td>49</td>
<td>Total</td>
<td>$ 14.93</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cost</td>
<td>(2030 dollars)</td>
</tr>
</tbody>
</table>

However, that morning Sarah sees on television there is construction on I-35, closing the middle lane between the 95th Street interchange and the 75th Street interchange. Congestion during the AM Peak is expected. In 2030, how will we obtain travel information? Ray Webb said that information will be delivered to you without even thinking about it. Example: Recently Ray’s family was playing with the Amazon Echo where you can ask questions and obtain information.

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1 2030 travel times estimated based on travel time increase between 2010 and 2030. The increase was added to actual 2016 travel times used for project.

(2030 – 2012) + 2016 = 2030 Future Use Case
With today’s technology, you need to ask the Amazon Echo questions and obtain responses. In the future (2030), Sarah’s information system will know her daily route and information her ahead of time (the day before) of the planned construction on I-35 and suggest alternative routes. David Schwartz said that with current technology, Google knows his daily commute from Meriden to Topeka and will send him a “card” with predicted travel times based on planned construction or an unplanned incident. In the future, this type of information will be included with Sarah’s “internet of things” and she should know ahead of time that her normal trip will be disrupted. Sarah will continue to use her push device to continue to plan her trip. Jennifer Russell – the question for us to answer: Does Sarah leave earlier than 7:15 am (her normal time)? Jim Hubbell suggested that she would leave early based on this information.

Mark Sommerhauser said that there will probably be cost information provided to Sarah as well (parking, car maintenance, time, other). Mark said that cost information has been provided for other ICM corridors in the U.S., however many alternative mode providers are very selective about giving out this information because it is proprietary (example: late train times). Alternative modes are afraid of driving business away based on travel conditions or operations on a specific day / time. Jennifer Russell said that current costs in 2016 are $11.25 / day for a normal trip.

Based on the “planned construction” conditions, the following alternative routes have been identified including future year (2030) current MARC TDM travel time runs:

- **Alternative 1: I-435 East to Metcalf Ave. North (Figure 1):**
  - 7:15 am – 7:37 am: Travel from home to NB Black Bob Road and west via 119th Street to NB I-35; take I-35 north to east I-435; east on I-435 to Metcalf Ave.; take Metcalf Ave. north to Shawnee Mission Parkway and then west to family day care. (travel time is: 21.39 minutes)
  - 7:40 am – 7:49 am: Leave family day care and enter NB I-35 at Shawnee Mission Parkway and travel to work (KU Medical Center) parking structure via Rainbow Blvd. (travel time is: 8.31 minutes)
  - 7:49 am – 7:58 am: Leave parking structure and walk to office building (travel time is: 9 minutes)
  - Arrive to work ahead of schedule

- **Alternative 2: I-435 West to Shawnee Mission Parkway East (Figure 2):**
  - 7:15 am – 7:35 am: Travel from home to NB Black Bob Road and west via 119th Street to NB I-35; take I-35 north to west I-435; west on I-435 to Shawnee Mission Parkway; take Shawnee Mission Parkway east to family day care; (travel time is: 19.44 minutes)
  - 7:38 am – 7:47 am: Leave family day care and enter NB I-35 at Shawnee Mission Parkway and travel to work (KU Medical Center) parking structure via Rainbow Blvd. (travel time is: 8.31 minutes)
  - 7:47 am – 7:56 am: Leave parking structure and walk to office building (travel time is: 9 minutes)
  - Arrive to work ahead of schedule
Figure 1: MARC 2030 TDM Travel Times (Planned Construction – Alternative 1): Home to Family Day Care to Work (KU Medical Center)
*Source: Google Maps*

Figure 2: MARC 2030 TDM Travel Times (Planned Construction – Alternative 2): Home to Family Day Care to Work (KU Medical Center)
*Source: Google Maps*
If alternate routes are taken for the “planned construction” conditions, the user costs will increase from between $3.00 and $5.00 / day. Jennifer Russell said that it seems reasonable that Sarah will want to avoid the construction on I-35. Based on the information provided, Sarah chooses Alternate Route #2 which is shorter in length and subsequently has the lowest user costs.

David Schwartz said that this makes sense under “todays” paradigm for planning alternative routes if Sarah has more lead time. Do we expect a new paradigm in 14 years? Jennifer – maybe her morning routine changes after a few days based on her revised trip. David Schwartz said that a lot is determined based on if you know about this even a few days ahead of time. Sarah would build in more buffer time in the mornings if her alternate route dictated. Tom Evans said that after her first day, she would be planning things out based on her experience the first day, especially if it is long term construction. David Schwartz said that this would evolve into Sarah’s “new normal” conditions. In the future (2030) use case, Sarah will have the information to continue to adapt her route as needed. David Schwartz said that if Sarah has a bad experience on the Alternate 2 route, she can try Alternative 1 or other routes as appropriate.

Again, Sarah needs to trust that taking an alternate route is a good option for her to get to her destination.

The next meeting on Wednesday, September 7, 2016 (8:30 am to 9:30 am) will focus on a “one time major even” in the Kansas City Metro area.

Jennifer Russell wrapped things up for the group.
I-35 ICM Use Case
Future – One Time Event
Total Travel Time: 86 mins.
**Sarah’s Decision Diagram**

**Future – One Time Event**

**Big Event = Traffic will be bad**

1. **Check Internet – get to work on time**
   - **Ride KC**
     - Bus on Shoulder
     - Reliability Increases for transit
     - **Bus to work:**
       - Wait = 10 – 15 mins
       - Travel time = 75 mins
       - Cost = $4 day pass
       - Comfort = Low (2 bus changes)
       - Reliability = Med High

2. **Google Maps**
   - **Car to work:**
     - Wait = 0 mins
     - Travel time = 75+ mins
     - Cost = $14.93
     - Comfort = Medium
     - Reliability = Very Low

3. **RideShare Sites (MARC and KU Med)**
   - **Carpool**
     - Same traffic as private car

4. **My Car**
   - **Own car**
     - Shared car
     - **Car to daycare:**
       - Wait = 0 mins
       - Travel time = 20 mins
       - Cost = $8.24
       - Comfort = Medium
       - Reliability = Low

5. **Two trips: 1. Home to daycare 2. Daycare to work**
   - **Bike**
     - Casual ride from Turkey Creek toward KU Med
     - B-cycle station @ Ikea near daycare
     - **Bike from daycare to work:**
       - Wait = 0 mins
       - Travel time = 39 mins
       - Cost = $4.50
       - Comfort = Medium
       - Reliability = High
     - **Bike from daycare to work:**
       - Wait = 10 mins
       - Travel time = 20 mins
       - Cost = $4
       - Comfort = High
       - Reliability = Med High
       - Put bike on rack on bus

6. **Trip 2: Bike to Work**
   - B-cycle rental
   - Reliable
   - Get exercise

7. **Trip 1: Own Car to daycare**
   - Child to daycare in car
   - Leave 60 min early
   - **Own car**
     - Shared car
     - **Own car**
     - **Bus to daycare:**
       - Wait = 15 mins
       - Travel time = 70 mins
       - Cost = $3 day pass
       - Comfort = Low
       - Reliability = Medium
   - **Own car**
     - **One seat ride**
     - On arterials, avoids some congestion

**Legend**
- Begin/End
- Decision
- Action
- Info System
- Report
- Results

**Time: Day before Event begins**

**Time: Morning of trip**

- Plan to take car to daycare
  - Leave at 6:30 am
  - Arrive ~ 8:00 am
- Check Television
- Morning traffic report
- Event reminder
- Stay on plan
- View 95th St. DMS
- Travel times long
- Stay on plan
- Arrive at work 7:56 am
Participants:
Ray Webb – MARC (OGL); Jim Hubbell - MARC
David Schwartz – KDOT (Transportation Planning); Mark Sommerhauser – KC Scout (absent from call)
Jennifer Russell – Garver; David Church – WSP | Parsons Brinckerhoff
Tom Evans – TREKK Design Group; Matt Volz – HDR (absent from call); Jay Aber – WSP | Parsons Brinckerhoff

Jennifer Russell welcomed everyone to the call and introductions were made.

The focus of today’s call is “one time major event” affecting traffic on roadways throughout the KC Metro Area. Same conditions as the current year conditions. Big 12 Tournament college basketball event at the Sprint Center in downtown Kansas City, MO with the first game at 10:00 am (KU vs Oklahoma). A lot of fans will be traveling from across the region to attend. There has been a lot of press coverage about this event through local media.

Jennifer Russell asked everyone to think of the System Architecture we have prepared.

Sarah is conducting the same path for her trip.

Because of the local press coverage of this event, Sarah has known about this for about a week ahead of time. She has her child to drop-off at family day care before proceeding to work. She spends some time identifying alternate routes to family day care and then to work. In the current year (2016), Sarah was able to arrive 30 minutes early to work and had time for coffee. It is 2030, let’s think about the resources she has available:

- “More robust” vehicle sharing option
- Freight movement (platooning)
- Bike share (expanded)
- Last mile vehicles are more accessible throughout the area
- Access to the Ride KC last mile planning tool (interactive information station)
- Sarah is fit and likes to bike and walk when she can

Jim Hubbell suggested that she would obtain her information through the news media, newspaper or push service about this expected traffic congestion on I-35. Sarah may utilize technology similar to the Amazon “echo” from home or work to identify travel options. Jim Hubbell asked if we wanted to keep altering her work schedule as an option since she has such advance notice. She could push her work day to 9:30 am or 10:00 am and alter her scheduling of appointments.

Jennifer Russell suggested that we keep alternating work schedules as a great option for the ICM scenario. Jim Hubbell said that he agreed and thinks this can be a powerful tool for companies to utilize in the future.

Jennifer Russell asked if there was a good reason for Sarah to utilize a mode other than her private vehicle to get from family day care to work. In the current year (2016) conditions, Sarah’s trip included:

- 6:30 am – 7:00 am: Leave her home at Blackbob Court Townhouses (127th & Blackbob) and take I-35 to her Parent’s home at 6308 West 61st Street (61st & Antioch) to drop off her child for family day care (14 to 18 minute trip)
• 7:00 am – 7:17 am: Ride her bike to the bus stop 63rd & Nall Avenue to catch the 667 (17 minute trip)
• 7:22 am – 7:41 am: Ride bus 667 from 63rd & Nall to Rainbow Blvd. near KU Medical Center (19 minute trip)
• 7:41 am to 7:46 am: Ride her personal bike from Rainbow Blvd. to KU Medical Center (5 minutes)

Jim Hubbell suggested that she consider a bike share option. Instead of having to use her personal bike, there should be expanded bike share stations near family day care to the transit stop. Agreed. Sarah would walk from family day care to a future bike share station near IKEA. What if Sarah rode to work via the bike share in lieu of taking transit? Agreed. The bike ride from IKEA to work would be 6.5 miles and 39 minutes. David Schwartz said that they would need shower facilities at KU Med after the bike ride (currently available).

Therefore, for the future “one time major event” conditions:

• 6:30 am – 6:48 am (Figure 1): Leave her home at Blackbob Court Townhouses (127th & Blackbob) and take I-35 to her Parent’s home at 8308 West 61st Street (61st & Lamar) to drop off her child for family day care (12.25 minute trip per MARC 2030 model, estimated to be 18 minutes¹)
• 6:55 am to 7:10 am (Figure 2): Sarah walks from her family day care to the IKEA to access the bike share (15 minutes). It takes Sarah 5 minutes to rent her bike and begin her ride.
• 7:15 am – 7:54 am (Figure 3): Sarah checks out a bicycle from the bike share at IKEA and rides to work at KU Medical Center (39 minutes). She then utilizes the shower and locker accommodations.
• 7:54 am: arrives to her office are with plenty of time to shower and prepare for her 8:15 arrival

Our group thought that this was a reasonable route for Sarah today under these conditions. We are assuming that the bike share cost was $4.50 for the day. Bcycle currently rents bikes for $7 per day. With a two percent inflation, the daily rental cost would be about $9 per day by 2030, which would be $4.50 one-way. Note: David Schwartz said that he currently pays $25 a year for the bike share in Topeka and can get 90 minutes a day (three-speed bikes).

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<tr>
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<th>Activity</th>
<th>Time (mins)</th>
<th>Distance (mi)</th>
<th>Cost</th>
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<td>6:30 AM</td>
<td>Drive home to day care</td>
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<td></td>
<td>$4.50</td>
<td>bike rental (~$9/day)</td>
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<tr>
<td>7:54 AM</td>
<td>Arrive</td>
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<td>12.74</td>
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<th>Distance (mi)</th>
<th>Cost</th>
<th>Notes</th>
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<td>7:10 AM</td>
<td>Rent Bcycle</td>
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<tr>
<td>7:54 AM</td>
<td>Arrive</td>
<td>84</td>
<td>12.74</td>
<td>Cost</td>
<td></td>
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~ 30 mins early

Future - Planned One-time event

Take shower and prep for work

¹ 2030 travel times estimated based on travel time increase between 2010 and 2030. The increase was added to actual 2016 travel times used for project.
(2030 – 2012) + 2016 = 2030 Future Use Case
- 12.25min

Figure 1: MARC 2030 TDM Travel Time (One-Time Major Event): Home to Family Day-Care (12.25 minute drive)
Source: MARC

Figure 2: Estimated 2030 Travel Time (One-Time Major Event): Family Day-Care to IKEA for Bike Share (15 minute walk)
Source: Google Maps
On another note, David Church discussed data usage as part of current smart-phone use for navigation. He does not use his navigation during his daily commute from Topeka, KS to Lenexa, KS because of data usage unless he anticipates a delay in his trip due to construction or occasional incidents. David Schwartz reminded the group that we need to be conscious that many travelers don’t have smart phones or data plans to be able to use this technology. Jennifer Russell said that we need to consider how data is paid for in the future (monthly expense as part of each connected vehicle, other).

Jennifer Russell said that as we go through the ICM scenarios, let’s keep in mind not to design for the optimal user only without considerations for those that may not have this technology available. Jennifer explained the ICM conditions and said that our goal with ICM is how we can improve both “current” and “future” operations with ICM strategies.

The next meeting on Wednesday, September 22, 2016 (8:30 am to 9:30 am) will focus on “ICM” on I-35 during a typical trip for Sarah (home to family-day-care to work).

Jennifer Russell wrapped things up for the group.
C.3 – CALCULATIONS FOR FUTURE TRAVEL TIMES
### I-35 ICM Use Case Travel Time Analysis

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<th>2016 Travel Times (min)</th>
<th>2030 Travel Times (min)</th>
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<td>Home --&gt; Daycare Daycare --&gt; work Total Trip</td>
<td>Time (min) %</td>
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<td>Future - Incident</td>
<td>17 14 31</td>
<td>19.9 - 20.3 15.5 - 16 35.4 - 36.3</td>
<td>4.4 - 5.3 14.2% - 17.0%</td>
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<td>Future - One Time</td>
<td>17 n.a. 17</td>
<td>20 - 20.4 n.a. 20 - 20.4</td>
<td>3 - 3.4 17.4% - 19.8%</td>
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<tr>
<td>Future - Planned Construction</td>
<td>27 12 39</td>
<td>29.6 - 30 13.2 - 13.7 42.9 - 43.7</td>
<td>3.9 - 4.7 9.9% - 12.1%</td>
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<tr>
<td>Future - Typical</td>
<td>17 12 29</td>
<td>20 - 20.4 13.2 - 13.7 33.2 - 34.1</td>
<td>4.2 - 5.1 14.4% - 17.6%</td>
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</tbody>
</table>

Note: The difference between the low and high ends of the range is based on how arterial travel times are treated. The low end of the range assumes arterial travel times will increase based on an average number extracted from the regional model by MARC. The high end assumes that arterial travel times will increase similarly to a volume-weighted average of freeway travel times along the route.
### Detailed HDR Calcs

#### Home to Daycare

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<th>Segment</th>
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#### Home to Work

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C.4 – CALCULATIONS FOR TRIP COST
### Table 3-17: Average Cost of Owning and Operating an Automobile(a) (Assuming 15,000 Vehicle-Miles per Year)

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<td>51.7</td>
<td>56.2</td>
<td>52.2</td>
<td>52.2</td>
<td>54.1</td>
<td>54</td>
<td>56.6</td>
<td>58.5</td>
<td>59.6</td>
<td>60.8</td>
<td>59.2</td>
<td>58</td>
</tr>
<tr>
<td>Percent Change</td>
<td>4%</td>
<td>-2%</td>
<td>3%</td>
<td>9%</td>
<td>-7%</td>
<td>0%</td>
<td>4%</td>
<td>0%</td>
<td>5%</td>
<td>3%</td>
<td>2%</td>
<td>2%</td>
<td>-3%</td>
<td>-2%</td>
</tr>
</tbody>
</table>

**Average percent change (1990 - 2014)**

2%

OGL’s Mission Statement is: “Operation Green Light monitors and manages the existing transportation system through safe and efficient traffic signal operations to reduce travel time, fuel consumption and air pollution”. This includes over 700 intersections in more than 20 area cities in the Kansas City metro area on both sides of the state line. OGL is a key component of the Mid-America Regional Council (MARC) and works in close partnership with the Kansas Department of Transportation (KDOT), Missouri Department of Transportation (MoDOT) and the Federal Highway Administration. OGL helps synchronize traffic signals on major routes throughout the region, especially those that cross city limits. This helps reduce unnecessary delay, improve traffic flow, increases safety and reduce emissions that contribute to ozone pollution.

The current Concept of Operations for OGL focuses on the following areas:

- Signal Timing
- Initial Deployment of Timing Plans
- Providing Maintenance Timing Plans
- Incident Management
- Citizen’s Complaints
- Field Communication Design and Installation
- Controller Upgrades and Work Inside the Traffic Control Cabinet
- Technical Support for OGL Computer Network
- The Traffic Operations Center

After 10 years since its inception, OGL’s coordinated signal system is well established. It has recently shifted the primary focus from pure expansion to maintaining the system that has been established.

OGL is well positioned to enhance the operations focus in Kansas City into the following areas in support of ICM along the I-35 Corridor and future routes:

- Expansion of OGL to cover more arterial miles in the metro area Share expectations with I-35 ICM Corridor stakeholders through TSM&O Committee.
- Formalized arterial diversion route programs on both OGL routes and non-OGL routes
- Greater communication and communication between OGL and KC Scout

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6 The Kansas City Metro area has over 1200 signals “on-line” in total, including the 700+ OGL signals. These signals may contribute additional data to the regional knowledge base.
In the future, provide signal data to connected vehicles via roadside equipment or third party providers.
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