I-35 CORRIDOR

Johnson and Wyandotte Counties

Project # 35-106-KA-2597-01

Optimization Plan

May 2013

MARC
Mid-America Regional Council

Kansas
Department of Transportation

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Acknowledgements

The I-35 Corridor Optimization Study involved input from many team members from the Kansas Department of Transportation, Mid-America Regional Council, Federal Highway Administration, community leaders throughout the region, and HNTB Corporation and its study team members, Burns & McDonnell, CDMSmith and Texas Transportation Institute.

KDOT Staff

- Dave Schwartz
- Andy Jenkins
- Thomas Dow

MARC

- Ron Achelpohl

Federal Highway Administration

- John Knowles
- Karen Gilbertson

1-35 Advisory Group

- Ron Achelpohl, MARC
- Alice Amrein, Johnson County Transit
- Doug Brown, Overland Park
- Cindy Cash, Kansas Chamber of Commerce
- Emrick Cross, Unified Government WyCo/KCK
- Ron Freyermuth, City of Shawnee
- Brant Gaul, Citizen
- Tim Green, City of Lenexa
- Chris Gutierrez, SmartPort
- Bill Heatherman, Unified Government WyCo/KCK
- Heidi Holliday, Rosedale Development Association
- Mary Jager, City of Olathe
- Lee Ann Kell, MoDOT
- John Knowles, FHWA
- Captain Dek Kruger, Kanas Highway Patrol
- Amy Kynard, City of Gardner
- Phil Lammers, City of Merriam, Kansas
- Hye Jin Lee, City of Merriam, Kansas
- Laura McConwell, Mission, Kansas
- Tim McKee, Olathe EDC
- Lee Metcalfe, Johnson County Airport Commission
- T. Craig Morgan, Midcon Corridor, BNSF Railway
- Dean Palos, Planning, Johnson County
- Brian Pietig, Johnson County
- Ingrid Potts, MRI Global
- Rob Richardson, Unified Government WyCo/KCK
- Ted Rieck, Kansas City Regional Transit Alliance
- Tom Riederer, Southwest Johnson County EDC
- Martin Rivarola, City of Mission

- Patrick Robinson, Allen Group
- Terry Robinson, Robinson's Delivery Service
- Chuck Schlittler, Fairfax Industrial Association
- Blake Schreck, Lenexa Chamber of Commerce
- Deb Settle, Northeast Johnson County, Chamber of Commerce
- Jason Sims, KC Scout
- Shawn Strate, Johnson County Transit
- Bridgette Williams, Heavy Constructors Association of Greater Kansas City

Consultant Team

- HNTB Corporation
- Burns & McDonnell
- CDMSmith
- Texas Transportation Institute

Study Purpose

Interstate 35 in Kansas is the state's primary north/south corridor, moving thousands of people and millions of dollars in goods daily through the eastern part of the state. Due in large part to its connection through the heart of the Kansas City metropolitan area, I-35 is particularly congested in Johnson and Wyandotte counties. With new development occurring along the corridor and traffic expected to grow significantly, the Kansas Department of Transportation (KDOT) and the Mid-America Regional Council (MARC) are taking a hard look at how to keep this vital economic artery moving safely and efficiently.

The I-35 Corridor Optimization Study, also known as *I-35 Moving Forward*, studied innovative ways to address I-35's congestion issues. The strategies studied and recommended to address these transportation challenges were not all "traditional" from historical standards. A host of strategies to manage corridor congestion, reliability and safety were considered to maximize the capacity of the existing interstate corridor. The Optimization Plan recommends short, medium and long-term improvements for I-35 through 2040 and beyond. The study team included KDOT, MARC and an Advisory Group comprised of Federal Highway Administration (FHWA), city, county and private industry representatives.

Recognizing that I-35 is both a critical transportation corridor and congested, KDOT and MARC initiated a study known as "I-35 Moving Forward" to examine options to keep traffic moving safely and reliably today – and in the future.

Southbound traffic congestion on I-35 during the afternoon rush hour.

Optimization Plan

Interstate 35 is a vital link for interstate commerce that is subject to growing multi-modal transportation needs impacting its safety, capacity, design and operation. Recognizing this, KDOT and MARC have conducted a corridor optimization study known as "I-35 Moving Forward." The I-35 Corridor Optimization Study through Johnson and Wyandotte counties to examine options to keep traffic moving safely and reliably today – and in the future. **Figure 1** shows the location of the I-35 Corridor study area and its location within the greater Kansas City region.

Figure 1.

I-35 Regional Context

At the outset of the study, the Advisory Group was asked about their vision for I-35 in the future. The vision statement and guiding principles developed for the I-35 Corridor based on Advisory Group input is as follows:

Vision Statement

The vision for the I-35 Corridor is a sustainable, multi-modal transportation system that maximizes the safety and efficiency of existing and future conditions in order to achieve local and regional transportation and economic goals.

Guiding Principles

1. Move people and goods more efficiently.
2. Maximize the safety of the corridor.
3. Support economic growth in the region.

Study Process

The study was conducted in three phases. Each phase represented a critical step in the planning process to (1) identify the problem, (2) develop potential solutions, and (3) develop a plan for the corridor. The phases of the study are described below and shown in **Figure 2** (next page).

Phase 1 – Problem Definition. Phase 1 defined the corridor goals and needs by reviewing previous work in the corridor, examining current and projected travel characteristics and evaluating what would happen to traffic if no improvements were made.

Phase 2 – Strategy Development. Phase 2 developed and analyzed practical improvement strategies for improving recurring and non-recurring congestion

on I-35. Through technical analysis and discussions with the Advisory Group, the most feasible strategies for I-35 in Kansas were identified. National experts were brought in to discuss congestion management strategies that are being implemented elsewhere and how those strategies might work for I-35.

Phase 3 – Optimization Plan. Phase 3 developed a phased optimization plan that identified and prioritized practical improvement strategies, the conditions (or triggers) which indicate when it's time to implement those strategies and the period of time during which those strategies are likely to be effective. Since public education will be needed to support some of the strategies, a public information roll out plan was developed.

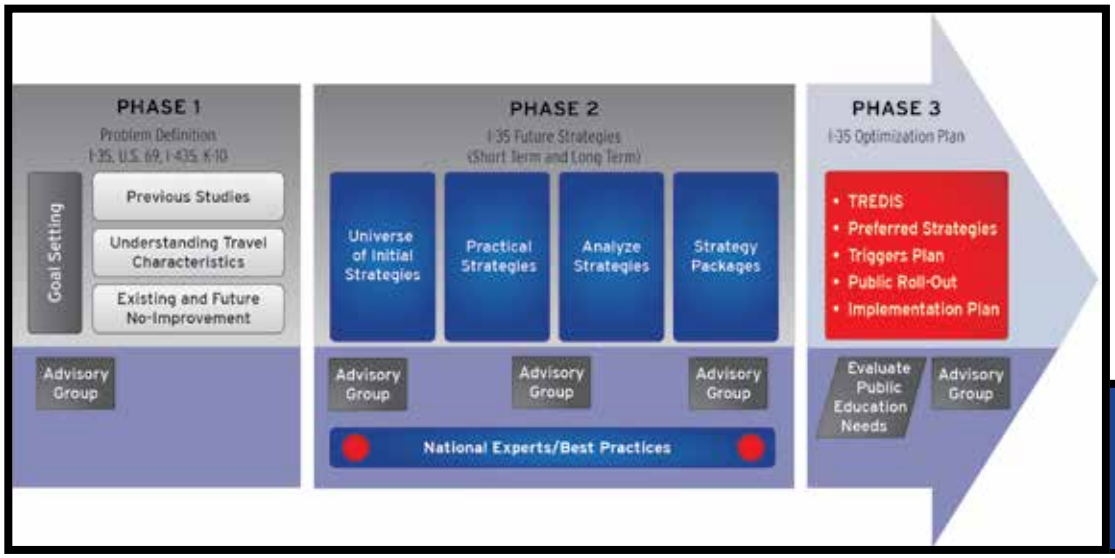


Figure 2.

Study Process

Problem Definition

Phase I of the project established the problem definition for the I-35 Corridor with existing and future no-action conditions. A summary of the *Phase I Technical Report* follows. Full copies are available upon request from KDOT.

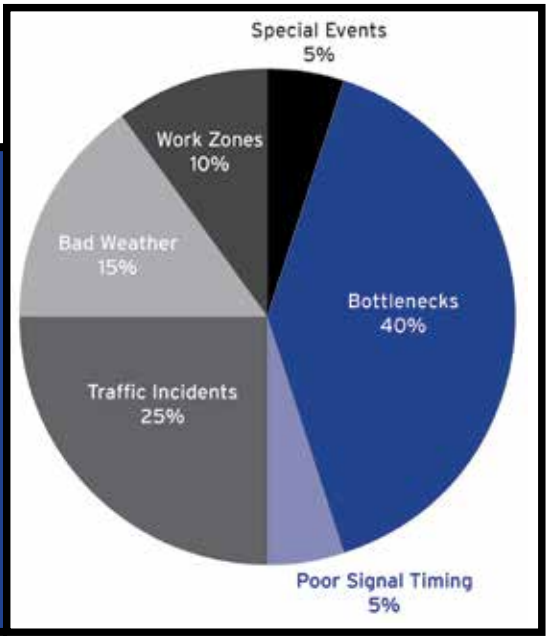
Existing Conditions

The I-35 Corridor is supported by a regional network of interstates, U.S. highways, state highways, major arterials and frontage roadways. It is a vital network for the mobility of people and commerce within and through the state of Kansas. However, the corridor is experiencing safety and congestion problems today that are anticipated to continue to worsen over the next 30 years. The key challenges and opportunities for the corridor identified within the study include.

- **Recurring Traffic Congestion** — Slow travel speeds are routinely seen during the peak hours north of 135th Street in both directions.
- **Non-Recurring Traffic Congestion** — Incident clearance times are longer in the I-35 Corridor than on other area freeways, including I-70 in Missouri, according to KC Scout data.

- **Safety** — The corridor north of 135th Street has higher crash rates than other statewide interstates in both directions.
- **Trucks** — The new BNSF Intermodal Facility and Logistics Park in Edgerton, Kansas is forecasted to generate between 7,000 and 10,000 trucks per day at full build-out (2025). This will affect travel patterns and characteristics along the I-35 Corridor.

Non-recurring traffic represents 55 percent and recurring traffic represents 45 percent of national interstate traffic delay, according to the FHWA.



- **Multi-Modal** — Bus on shoulder operation started in January 2012. Immediately, transit ridership increased 10.4 percent from the previous year. This provides real momentum to grow transit use and options along the corridor.
- **ITS** — The KC Scout intelligent transportation system (ITS) was expanded south to the Miami county line in 2012 to cover the entire 30 mile corridor. This provides an ITS foundation to expand upon in the future.
- **Design** — Less than desirable design features exist along the corridor, including horizontal curves, steep grades, insufficient ramp spacing and ramp lengths. These sub-standard areas are primarily present north of 95th Street to the Kansas-Missouri State Line.

Key transportation stakeholders were interviewed at the beginning of the project. Feedback received from the stakeholders indicated that:

- I-35 is vital … and a critical connection for commuters and an infrastructure backbone to attract businesses.
- … But it's not that bad, yet. A comparison was often made between I-35's "rush-minutes" and the hours of delay in Los Angeles or Washington, D.C. Strategies might be necessary or useful in 10-20 years, but we have it pretty good today.
- Look outside the mainline. Manage on- and off-ramps, improve interchanges and local street network and a lot of the congestion could be mitigated.
- HOV/HOT lanes could work – but don't take my lane.
- Funding options exist. I-35 is a KDOT facility but local communities might be open to the idea of raising funds to improve specific interchanges or sections. KDOT can generate support by demonstrating direct benefits to local areas.

During the last few decades KDOT and its city, county and regional planning partners have been planning, designing and implementing a number of general capacity widening, access, ITS and transit improvements along the I-35 Corridor. The following conclusions were drawn from the review of past work efforts along the corridor.

- Significant improvements have been completed in recent decades, but I-35 continues to remain a high growth and congested corridor.
- It is time to focus on the next 30-year planning horizon needs for I-35.
- Truck traffic is increasing and new freight development is a key factor.
- Corridor growth and travel patterns have shifted along corridor.
- Improvement strategies have become more "regionally" focused.
- Consideration of "optimization" strategies for I-35 are not new, just newly relevant.

Future No-Action Conditions

The Mid-America Regional Council's Long Range Transportation Plan (LRTP) for the Kansas City metropolitan area, *Transportation Outlook 2040*, was the basis for future traffic demand and travel characteristics within the study corridor. The study team for the I-35 Corridor Optimization Study looked at traffic conditions in 2020, 2040 and beyond.

Forecasted traffic is expected to increase 25 to 60 percent along the I-35 Corridor through 2040. The highest forecasted traffic volumes on I-35 are between U.S. 69 and I-635. When traffic is forecasted, an unconstrained assignment (no capacity limitations) indicates that there is more demand than capacity in parts of the corridor; especially north of U.S. 69 to the State Line. That means if additional capacity cannot be provided on I-35, the supporting transportation network will need to absorb the additional demand.

Considering existing conditions, a future No-Action scenario is expected to present the following challenges and opportunities for the corridor:

- **Traffic Demand —** Today, demand exceeds the capacity between U.S. 69 and I-635. Historical traffic trends and MARC's future traffic forecasts and land use plans were used to project future traffic trends for the corridor. These resources show that future traffic growth is forecasted to grow significantly along the corridor and the capacity issues experienced today will continue to worsen and spread along the corridor.
- **Recurring Traffic Congestion** — The I-35 Corridor has sustained congestion north of 135th with emerging congestion issues on the south side of the

corridor. Additionally, there is little excess capacity available on adjacent arterials to accommodate additional traffic growth.

- **Non-Recurring Traffic Congestion** — As traffic increases on I-35, traffic operations will continue to degrade, which is projected to increase safety incidents and their clearance times. This is anticipated to result in an increase in non-recurring congestion along the corridor.
- **Safety** — Annual crashes along I-35 are anticipated to increase by 380 crashes or 32 percent by 2040.
- **Trucks** — The BNSF Intermodal Facility and Logistics Park in Edgerton is forecasted to generate between 7,000 and 10,000 trucks per day at full build-out. This will have a significant impact on I-35 operations.
- **Multi-Modal** — Johnson County Transit plans to expand the existing I-35 Xpress (Bus on Shoulder) to operate from the Kansas/Missouri State Line to 135th Street.
- **ITS** — The KC Scout ITS system was expanded south to the Miami county line in 2012 to cover the entire 30-mile corridor. This will help provide a strong backbone to build additional ITS enhancements in the future.
- **Design** — Minimal design improvements are committed in the I-35 Corridor over the next 30-year planning horizon. Auxiliary lanes on I-35 between I-435 and 119th Street were completed in 2012. Phase 1 of the Johnson County Gateway project (I-35 / I-435 interchange improvements) and an improved interchange at I-35 and 95th Street are committed projects, scheduled to be constructed between 2014 and 2017. Major reconstruction/rehabilitation of the existing pavement and bridges along the corridor will be needed to maintain good operation conditions.

Figures that demonstrate the key existing and future, projected problems on I-35 follow. **Figure 3** (next page) shows the 2010 peak hour speeds along the corridor for northbound in the am and southbound in the P.M. peak hours. Significant speed reductions are shown north of 135th Street during the peak hours.

Figure 4 (next page) shows safety, congestion, design, trucks and transit for Existing and Future No-Action conditions. As illustrated most problems today and in the future are located from 135th Street to the northern limits of the study corridor.

According to KC Scout, on average an incident on I-70 in Missouri is cleared up in 32 minutes while an incident on I-35 in Kansas is cleared up in 48 minutes. KC Scout reports that much of this difference is attributed to the fact that the MoDOT Motorist Assist has twice as many staff resources as the Kansas Highway Patrol.

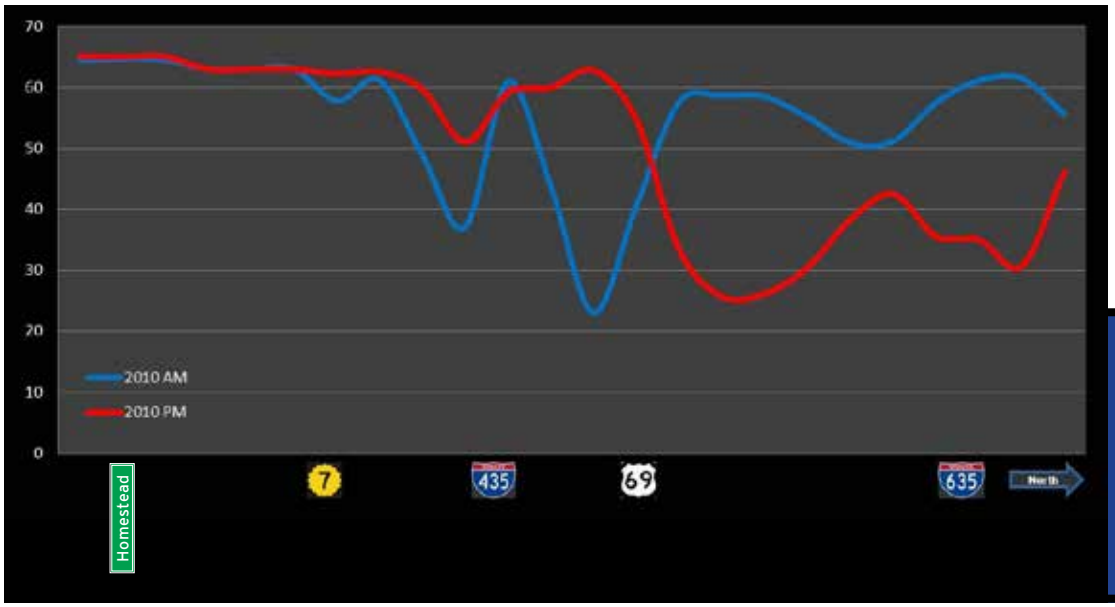


Figure 3.
2010 Average Peak Hour Speeds

A.M. - Northbound
P.M. - Southbound

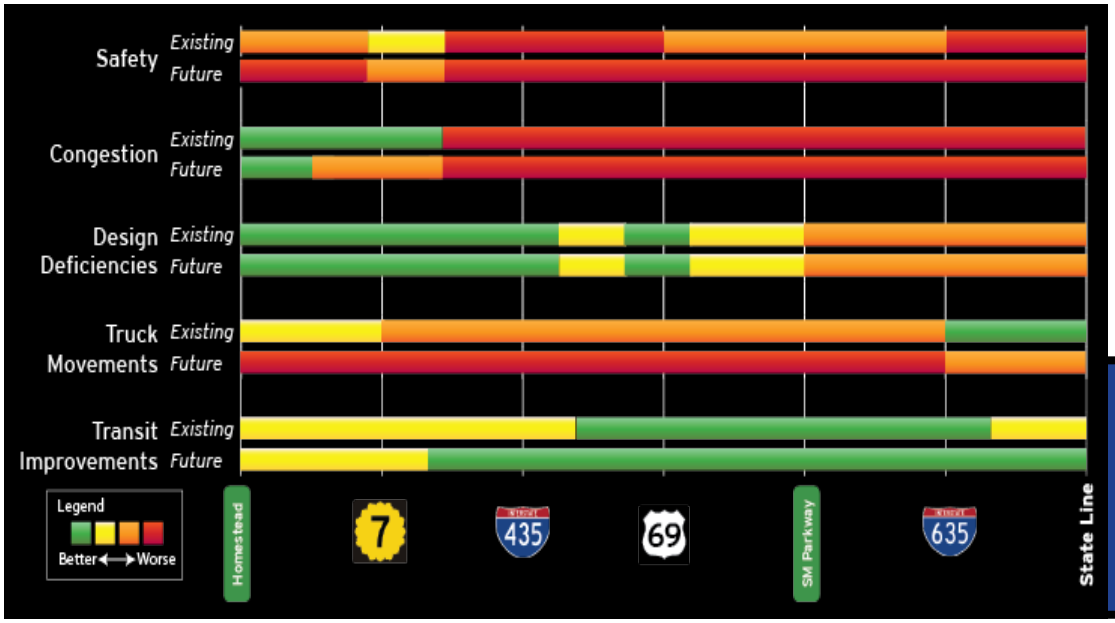


Figure 4.
Existing and Future 2040 No-Action Conditions

Strategy Development and Analysis

Phase 2 developed and analyzed improvement strategies for the I-35 Corridor. Below is a summary of the Phase 2 technical report approach and results. The complete *Phase 2 Strategy Development and Analysis Report* is available upon request from KDOT. The strategy development and analysis phase used a four step process as shown in **Figure 5**.

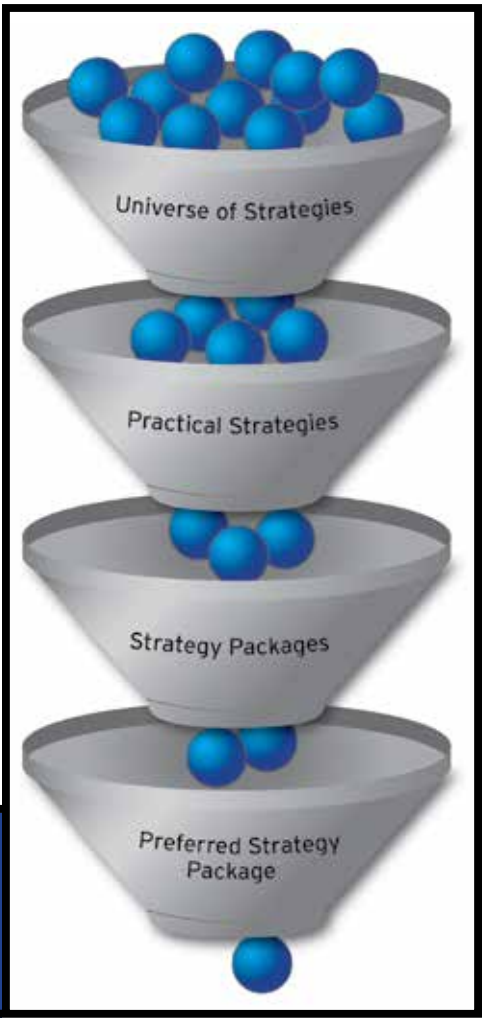


Figure 5.
I-35 Strategy Screening Process

Universe of Strategies - The universe of potential strategies were identified and ranged from:

1. MARC's Congestion Management Process "toolbox."
2. Strategies that have been proven successful historically over the long term to address corridor transportation needs;
3. Strategies that represent emerging, successful solutions - either internationally or nationally; and
4. Strategies that are still in their infancy today in research and development, but may prove to be successful corridor optimization strategies in the future.

Over 70 possible strategies were documented and shared with the Advisory Group.

Practical Strategies — Practical strategies were those that performed well when the study team used a qualitative screening process, based on a technical analysis and feedback from the Advisory Group. Seven practical strategies were identified to move forward for further quantitative analysis as standalone strategies to improve I-35.

Strategy Packages — Strategy packages were those practical strategies, combined together, that provided benefits based on location along the corridor and timing of needs. Three strategy packages were identified.

Preferred Strategy Package — The preferred strategy package was selected based on further quantitative analysis and its ability to best meet the I-35 Corridor vision and guiding principles established by the Advisory Group.

Practical Strategies

The study team first identified an initial list of potential strategies for possible application to the I-35 Corridor, designated as the Universe of Strategies. The documentation of the universe of strategies was compiled into a summary notebook and is available upon request as a separate document. Based on technical analysis and feedback from the Advisory Group, the strategies were screened down to the following practical strategies, as shown in **Table 1**. Each of the Tier 1 practical strategies are conceptually shown in **Figures 6 through 13**.

No.	Strategy
	Baseline for Comparison
1	No-Action
2	Add General Capacity
	Tier 1 Practical Strategies
3	Fix Key Bottlenecks
4	Managed Lanes (3 variations including shoulder running)
5	Transit
6	Intelligent Transportation Systems
	Tier 2 Practical Strategies
7	Off-System Improvements
8	Demand Management and Policy
9	Construction Management

Table 1. I-35 Practical Strategies Moving Forward

Baseline Strategies Moving Forward — Two strategies were used as a baseline for comparison to the Tier 1 Practical Strategies – a No-Action and general capacity widening. This was so that the study team could compare and assess the difference in benefits between a more traditional general purpose widening strategy, and innovative strategies like priced managed lanes, hard shoulder running, and active traffic management.

Tier 1 Practical Strategies Moving Forward — These strategies were recommended to advance to the practical strategies quantitative evaluation phase based on the qualitative analysis and feedback from the Advisory Group. The Managed Lanes Strategy was divided into three individual strategies to test a range of potential managed lane options:

1. Adding a new priced managed lane (also referred to as an express lane),
2. Developing a priced managed lane within existing right of way by reducing existing median, shoulder and lane widths, where necessary, and
3. Hard shoulder running.

Tier 2 Practical Strategies Moving Forward — These strategies were recommended to be advanced in principle as indirect strategies or policy decisions for regional transportation decision-making. These strategies were incorporated with Tier 1 strategy recommendations as appropriate in a regional context.

Figure 6.
Practical Strategy 1 - No Action

Figure 7.
Practical Strategy 2 - Add General Capacity

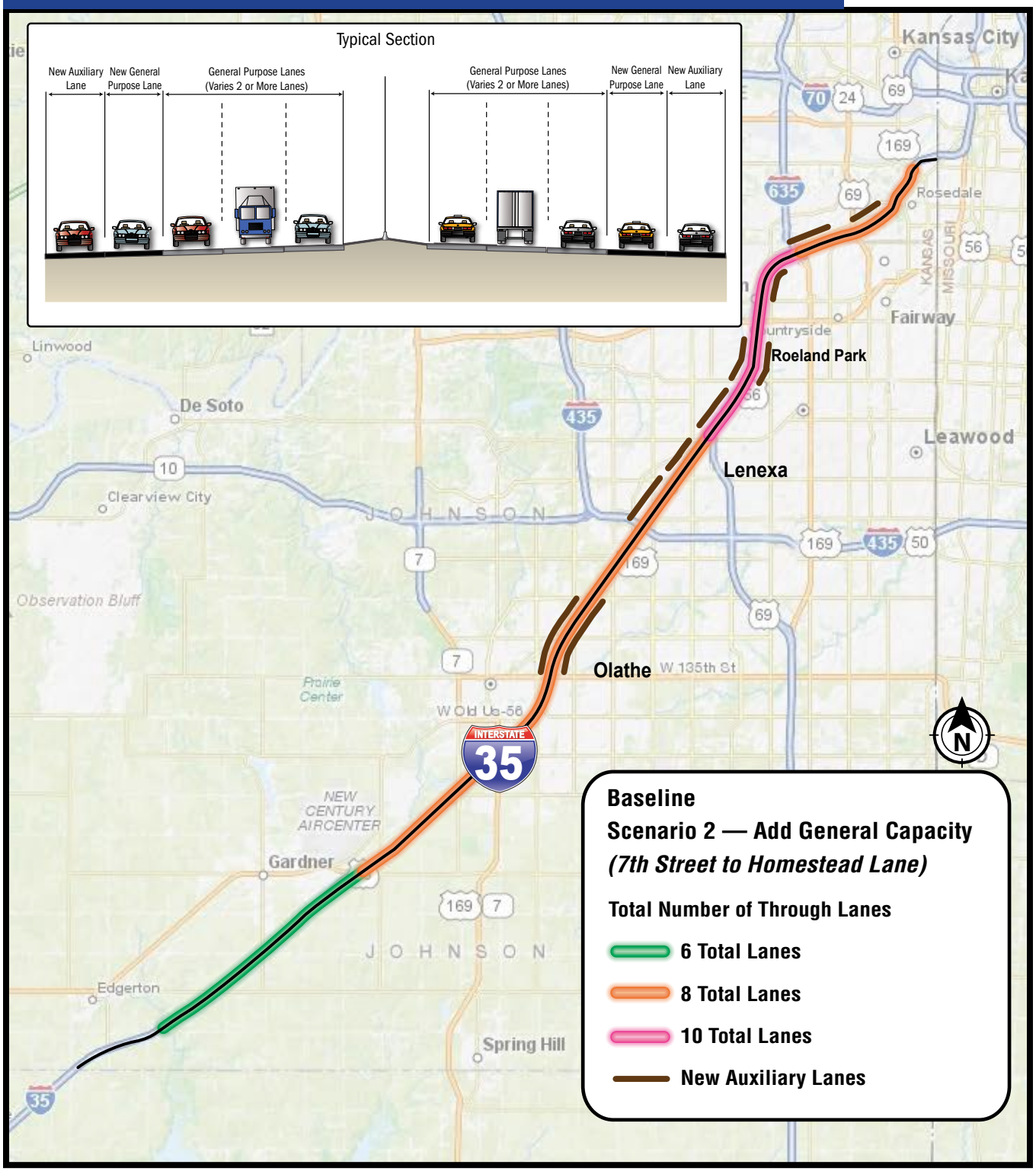


Figure 8.
Practical Strategy 3 - Fix Key Bottlenecks

Figure 9.
Practical Strategy 4A - New Managed Lanes

The Minneapolis, Minn. Managed Lane system.

Figure 10.
Practical Strategy 4B - Modified Managed Lanes

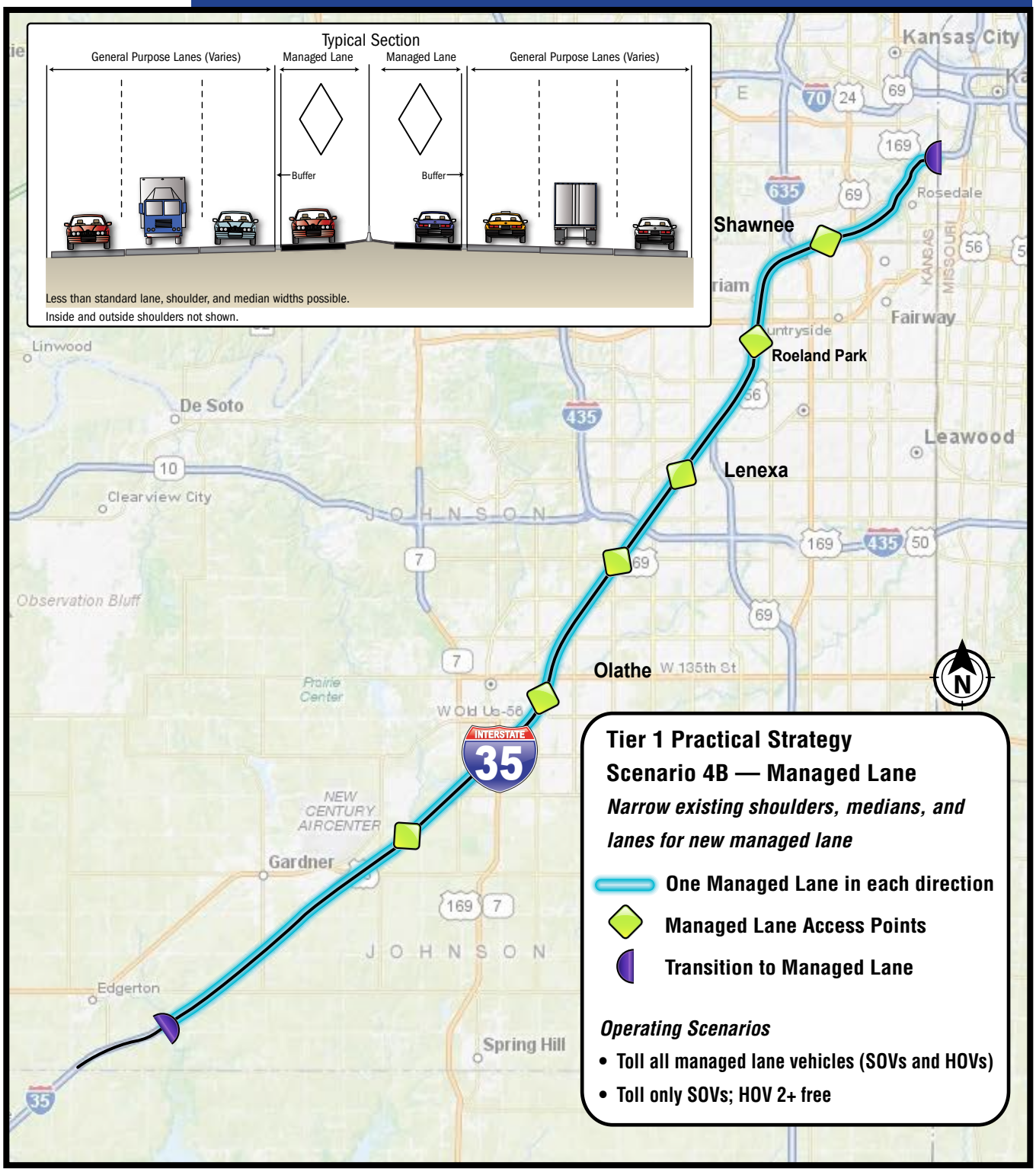


Figure 11.
Practical Strategy 4C - Shoulder Running Managed Lanes

Shoulder running on I-66 in Washington, D.C.

Shoulder running in the Netherlands

Figure 12.
Practical Strategy 5 - Transit

Bus on Shoulder in Minneapolis, Minn.

Figure 13.
Practical Strategy 6 - ITS

Ramp Metering

Motorist Assist

Technical analysis was performed for the two Baseline Strategies (No-Action and General Purpose Widening) and Tier 1 Practical Strategies. **Figure 14** shows the 2012 existing and 2040 future peak hour congestion levels for Existing, No-Action, General Capacity Widening, and each Practical Strategy under level of service (LOS) E and F operating conditions. LOS E operating conditions indicate the threshold where the travel lanes are operating at capacity and congested conditions exist. As shown, no single practical strategy reduces P.M. peak hour congestion below 30 percent congestion for the corridor or below existing P.M. congestion levels.

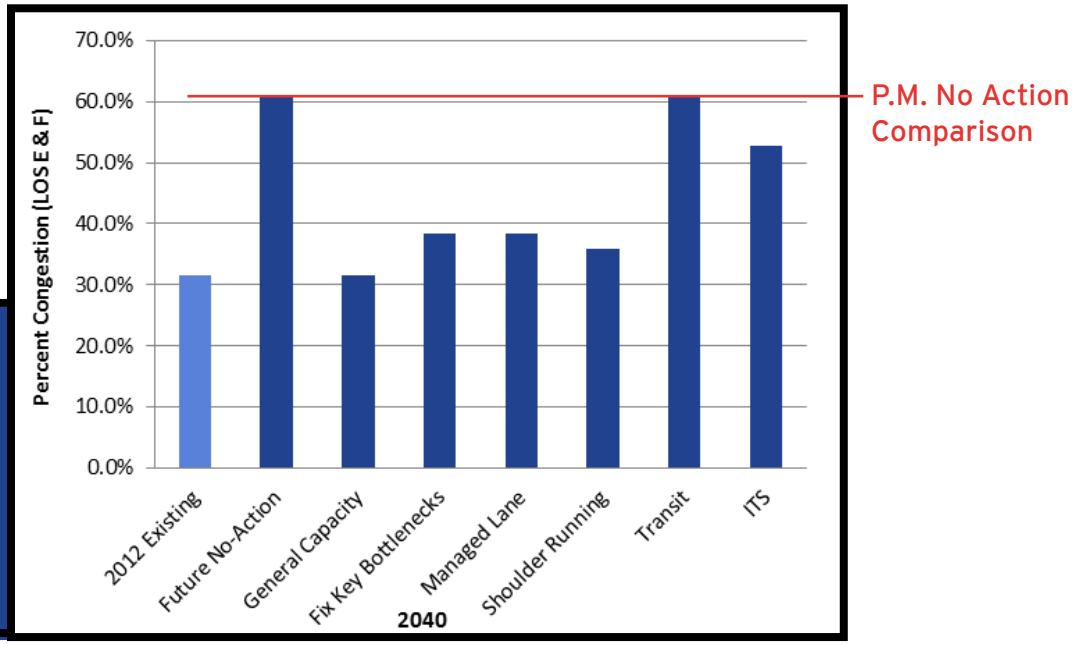


Figure 14. P.M. Peak Hour Congestion Levels on General Purpose Lanes - By Practical Strategy

Source: HCM 2010 mainline density analysis spreadsheet analysis.
Note: Shoulder running is open to all traffic in this scenario.
Analysis provides general purpose lane results.
Congestion is defined as LOS E and F operating conditions.

The following conclusions were determined from the technical analysis of the practical strategies.

- KDOT cannot build its way out of congestion in Sections 1,2 & 3
  - Managed Lanes provide at least one reliable travel lane in each direction at a good level of service
  - Shoulder Running addresses the peak congestion
- Congestion was best addressed with:
  - Corridor-wide: General purpose lanes, managed lanes, shoulder running and ITS
  - Localized areas: Fix bottlenecks and ITS
  - Non-recurring: ITS and managed lanes

- Arterials and frontage roads: Added local roadway capacity, intersection capacity and improved signal coordination will attract motorists from I-35 to the local roadways.

- Safety was best addressed with:
  - Corridor-wide: General purpose lanes, managed lanes, and ITS
  - Localized areas: Fix Bottlenecks, ITS
  - Non-recurring: ITS and managed lanes
- Alternative transportation, quality of life and livability were best addressed with:
  - Transit: Although there is no peak hour congestion benefit from transit (Figure 14), transit can provide an alternative choice for people.
  - Bicycle and pedestrian
  - Managed lanes
- Design deficiencies were best addressed with:
  - General purpose lanes, managed lanes and ITS
  - Expansion of right of way is limited without property impacts. Limited ROW is best addressed with shoulder running and practical design applications to add general purpose lanes or managed lanes

Strategy Packages

Based on conclusions from the practical strategy analysis, the following strategy package combinations were developed by the study team and shared with the Advisory Group.

Strategy Package 1 – Fix Key Bottlenecks

Strategy Package 1 focuses on fixing the key bottlenecks in the corridor while also including transit and ITS enhancements.

- Traditional design, operational and safety improvements to fix bottlenecks (auxiliary lanes, collector-distributor systems, interchange modifications).
- Transit enhancements (expanded bus-on-shoulder [BoS], new connecting Xpress routes, park-and-ride lots)
- ITS enhancements (active traffic management, including ramp metering; expanded travel information).

Strategy Package 2 – Address the Peak

Strategy Package 2 includes improvements identified in Strategy Package 1 and focuses on addressing the peak congestion periods by allowing hard shoulder running.

- Utilize existing shoulders during peak hours for some or all motorists to add capacity (inside or outside shoulder use).
- Transition to a more permanent, enhanced shoulder facility over time (geometric, pavement thickness and safety enhancements to shoulders).
- Incorporate complementary active traffic management technologies on shoulder (e.g., lane and merge control) for operational safety.

Strategy Package 3 – Manage for Sustainable Reliability

Strategy Package 3 includes improvements identified in Strategy Packages 1 and 2 and implements a priced managed lane, also referred to as an express lane, to provide a sustainable and reliable I-35 trip.

- Utilize existing shoulders during peak hours with user eligibility restrictions (permits/fees/toll, HOV 2+/HOV 3+, BoS) (inside or outside shoulder use) in the near term to add capacity.
- Incorporate complementary active traffic management technologies on shoulder (e.g., lane and merge control) for operational safety.
- Support change in traveler behaviors for later transition to priced managed lanes.
- Construct and transition restricted shoulder running to a permanent priced managed lane in the long term to add capacity.

Figure 15 shows how practical strategies were incorporated into the three strategy packages for further analysis as combination strategies.

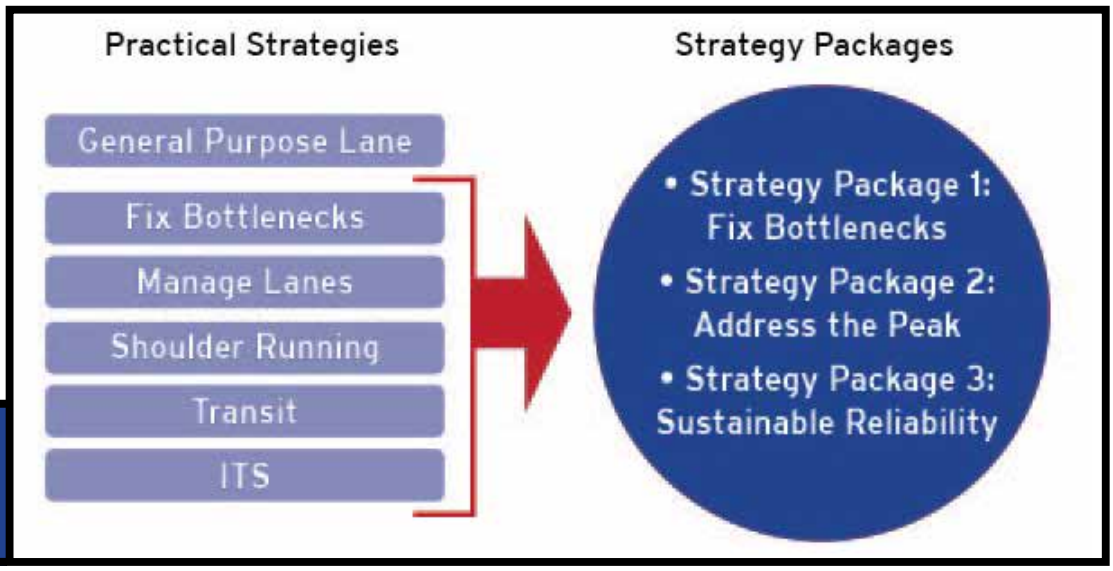


Figure 15.
Strategy Packages

After discussion of each of the strategy packages with the Advisory Group, the study team selected Strategy Packages 2 and 3 to analyze further in order to better understand and evaluate new and innovative strategies for the corridor, such as hard shoulder running and priced managed lanes. While Strategy Package 1 was not analyzed to the same level of detail, the key elements of Strategy Package 1 were incorporated into the analysis for Strategy Packages 2 and 3. This included fixing the key bottlenecks identified and expanding existing transit and ITS improvements along the corridor.

Figure 16 shows the traffic demand along the I-35 Corridor for Existing, Future No-Build and Future Build (Strategy Package 3) conditions.

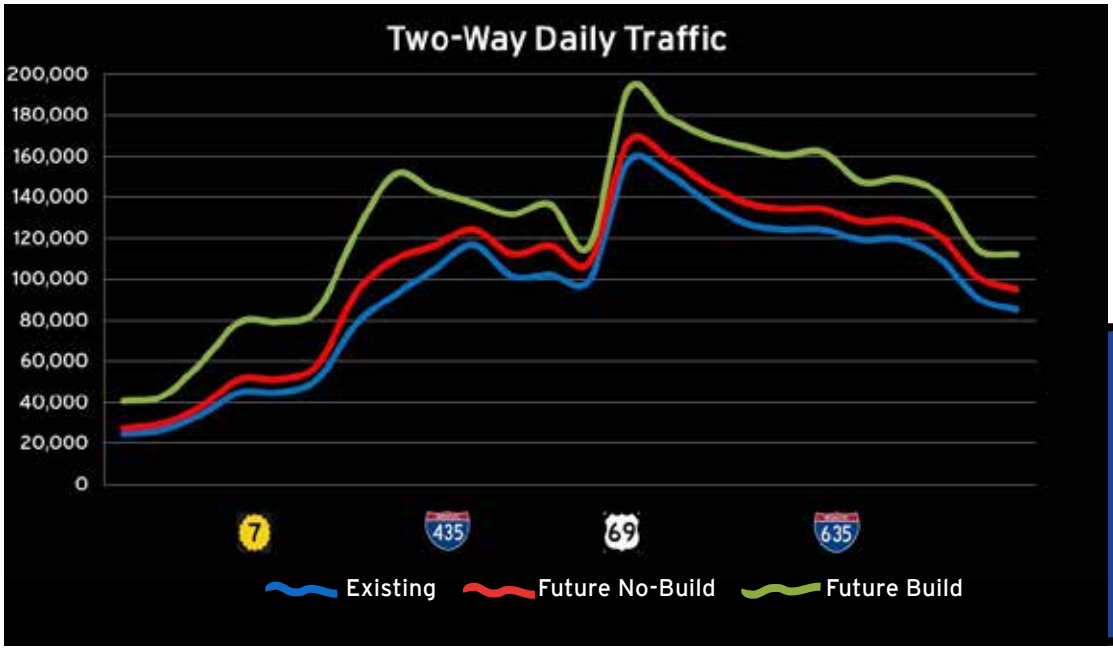


Figure 16. I-35 Traffic Existing, Future No-Build and Future Build

Note: Strategy Package 3 was used to represent future build conditions.

Figure 17 (next page) shows the P.M. peak hour travel times for Strategy Package 2 and 3. As shown in the graph, each strategy package reduced travel times from existing conditions. This demonstrates that packaging several diverse practical strategies together is projected to better address the safety and congestion needs of the corridor than selecting one, standalone strategy.

When practical strategies were analyzed as individual strategies the results indicated that heavy congestion and long travel times would still result in the future. Consequently, no single practical strategy was found to adequately address 2020 or 2040 congestion on I-35. However, when multiple strategies were combined together into strategy packages, congestion was addressed, resulting in travel times significantly lower than existing travel times.

Figure 17.
P.M. Peak Hour travel Times for General Purpose Lanes - By Strategy Package

Existing and Future 2040 Build

Source: HCM 2010 mainline density analysis VISSIM model

Policy Considerations

Each of the strategy packages offered trade-offs for the I-35 Corridor. In addition to the technical analysis, policy considerations were evaluated to better understand the key governance and policy changes that could be needed in order to implement new or non-traditional strategies along the corridor. A policy survey was sent out to 15 KDOT staff and one MARC staff member working on the project to get a better sense of how the planning partners envision moving forward with improvements to I-35 over the next 30 years. Thirteen responses were returned. The policy questions focused on the following areas. The complete survey results are available upon request.

1. **Improvement Type** — Fifty-four percent of respondents would like to have corridor-wide solutions and 46 percent would prefer a greater number of smaller, localized projects. None of the respondents indicated that they wanted one or two large isolated project, indicating the investment in the corridor should be spread throughout the corridor.
2. **Financial Level** — Sixty-two percent of respondents thought KDOT should spend about the same as historical funding on the I-35 Corridor.
3. **Investment Approach** – Ninety-two percent of respondents thought KDOT should continue traditional existing cost savings measures. Sixty-nine percent of respondents thought KDOT would consider tolls to provide new capacity. Fifty-four percent of respondents indicated that modified design standards

could be used to maximize dollars spent in the corridor. (More than one answer was possible.)

4. **Stakeholder Support** — Eighty-five percent of respondents thought KDOT and its stakeholders would support continuing existing strategies for I-35, such as fixing key bottlenecks and adding general capacity where needed. Sixty-nine percent of respondents thought KDOT and its stakeholders would support pricing to manage congestion. Fifty-four percent of respondents supported a complete streets/multi-modal approach to solving congestion in the corridor. (More than one answer was possible.)
5. **Multi-Modal Level** — Seventy-seven percent of respondents thought KDOT should be moderately aggressive to increase and enhancement multi-modal solutions.
6. **Shoulder Running** — Sixty-nine percent of respondents said they would support expansion of bus on shoulder to address congestion. Fifty-four percent of respondents said they would support restricted vehicles (e.g., transit, HOV, HOT) using the shoulders during peak periods and incidents. Only 23 percent felt that all traffic should use the shoulders to manage congestion and incidents during the peak periods.
7. **Managed Lanes** — One hundred percent of respondents said they understood that a primary purpose of managed lanes was to provide sustainable reliability to the I-35 Corridor. Sixty-nine percent of respondents said they understood that one of the key goals of managed lanes was to encourage greater use of transit and ridesharing.

The input from the policy considerations survey was used to help guide the decision-making process on the recommended preferred strategy for I-35.

Recommended Preferred Strategy

The recommended preferred strategy is based on a comprehensive analysis approach. The preferred strategy is based on:

- National and international best practices,
- Peer community interviews,
- Technical analysis, and
- Advisory group feedback.

The preferred strategy is intended to be flexible and adaptable to changing corridor conditions and evolving trends over time. It was also important the preferred strategy be constructible

Photo of hard shoulder running on I-66 in Virginia. Shoulder running is being utilized internationally in Great Britain, Amsterdam and the Netherlands, and nationally in Washington D.C., Seattle and Minneapolis to cost-effectively manage peak hour congestion needs.

considering the right of way constraints along the corridor, as well as financially feasible, since there are many competing priorities for the state's limited funding.

Exhibits 1, 2 and **3** (Page 26 - 28) show the recommended preferred strategy in a graphical format for the short-term (approximately 2013 to 2020), mid-term (approximately 2020 to 2040), and long-term (approximately beyond 2040), respectively. **Table 2** (Pages 29 -32) summarize the improvements recommended for the short-term, mid-term and long-term, respectively.

As KDOT considers I-35 improvements, looking at individual strategy components will be important. Each individual improvement should be evaluated in more detail in regards to their trade-offs. Benefits are both tangible and intangible.

Tangible benefits include measures such as travel time savings and accident reduction. Intangible benefits include measures such as customer perceived benefits and economic benefits. With limited funding, prioritization of corridor improvements could be determined in a manner similar to the Gateway Project and the I-70/K-7 interchange project by determining what initial phases provide the greatest immediate benefits for the cost.

Priced managed lanes are being used in many metropolitan areas today to manage congestion and provide a reliable commute. This photo shows priced managed lanes, known as Express Lanes in Minneapolis, Minn.

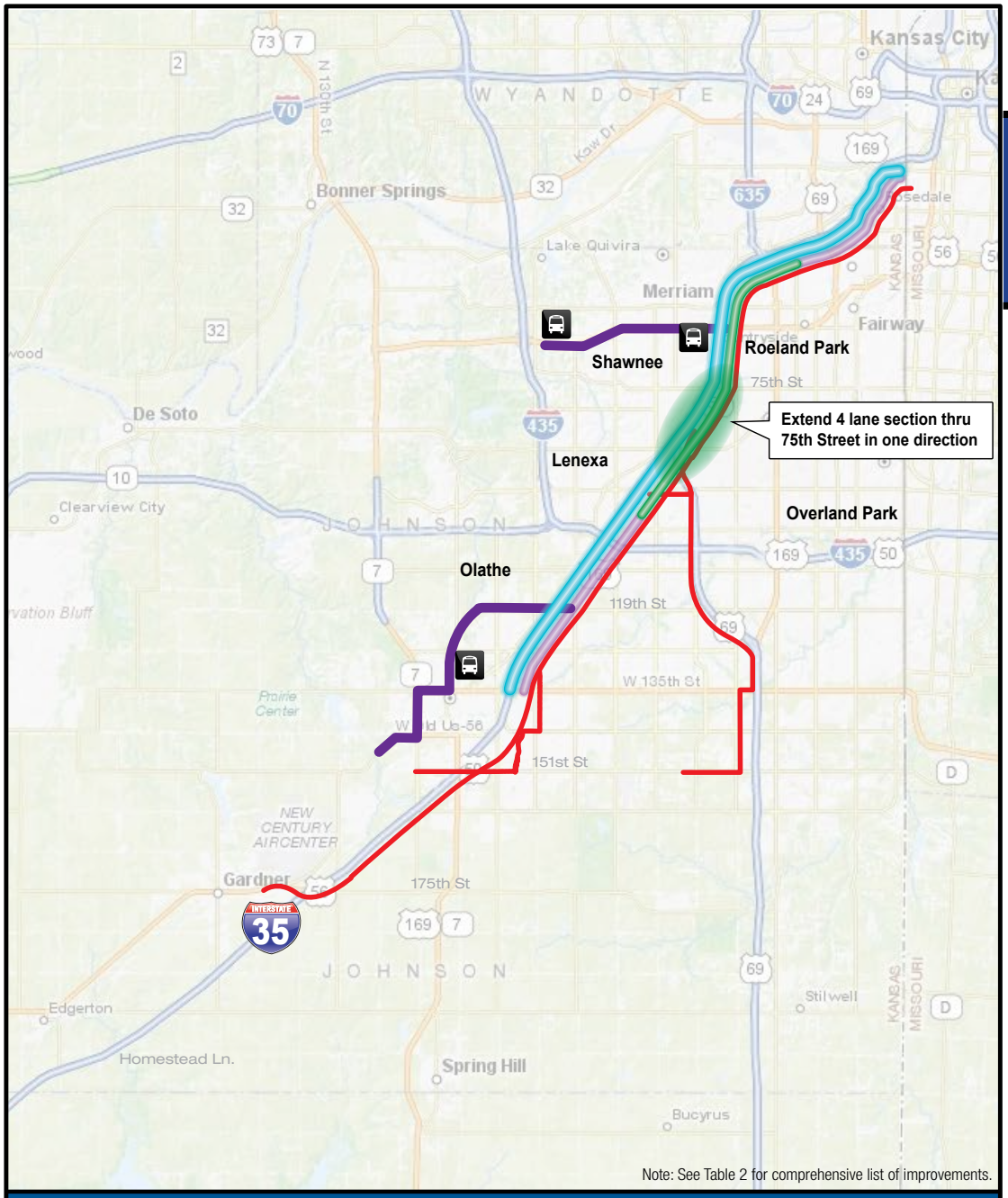
KDOT cannot implement the I-35 recommendations on their own. In order to achieve these improvement goals, a team approach will be necessary. The team starts with the Advisory Group. The Advisory Group was led by KDOT and MARC but included participation from:

- Wyandotte and Johnson Counties
- The Cities of Gardner, Kansas City, Kansas, Lenexa, Merriam, Mission, Olathe, Overland Park, and Shawnee
- Chambers of commerce and economic development agencies
- Private businesses
- The Federal Highway Administration
- Johnson County Transit
- Kansas Highway Patrol
- KC Scout
- Missouri Department of Transportation
- Interested Citizens

All of these groups will need to be at the table to implement the Plan's recommendations.

Exhibit 1.

Short-Term Improvements



Note: See Table 2 for comprehensive list of improvements.

Legend

Exhibit 1 – Short-Term Improvements (2013 – 2020)

Transit Improvement

- Existing Bus On Shoulder
- Expanded Bus on Shoulder
- Existing Xpress Routes with Service Enhancements
- New Xpress Routes
- New Park and Ride Lots

Corridor Improvement

- Enhanced ITS
- Ramp Metering
- Enhanced Traffic Incident Management
- Interchange Approach Arterial Dynamic Message Signs
- Transit Priority at Interchanges

Local Improvement

- Bottleneck Improvement

I-35 Moving Forward — I-35 Corridor Optimization Plan

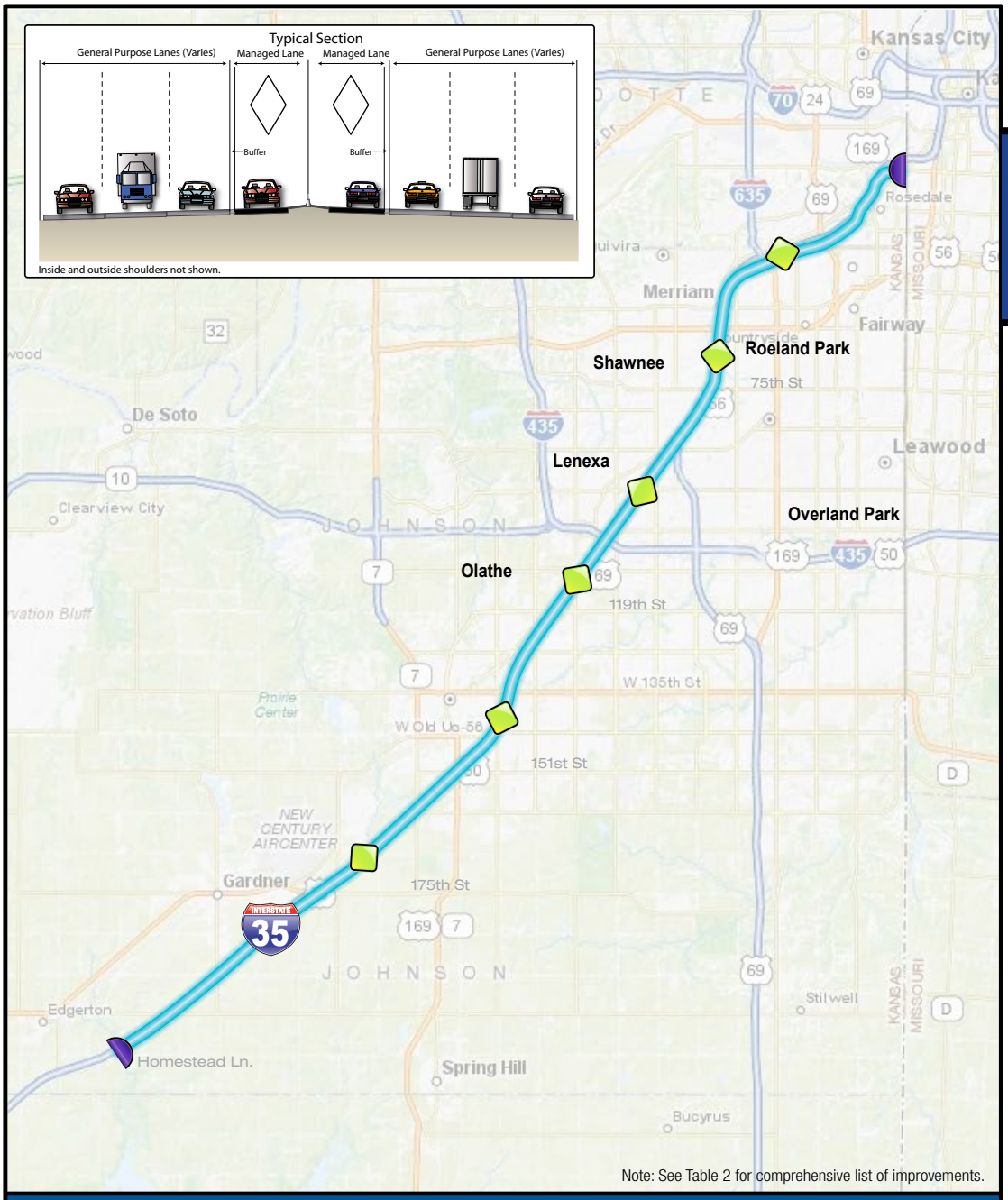
Optimization Plan

Exhibit 2.

Mid-Term Improvements

Exhibit 3.

Long-Term Improvements



Legend

Exhibit 3 – Long-Term Improvements (2040 and beyond)

Transit Improvement

Incorporate future transit improvements as identified by Johnson County Transit.

Corridor Improvement

Priced Managed Lanes

Managed Lane Access Points

Transition to Managed Lane

Incorporate future ITS technologies as identified.

Local Improvement

Incorporate spot improvements as identified in regional planning process.

I-35 Corridor Optimization Plan

Table 2. Recommended I-35 Improvements

(See Exhibits 1, 2 and 3 for a graphical representation of recommended improvements)

Strategy	Improvement	Time Frame*	Section 1 State Line to I-635			Section 2 I-635 to U.S. 69		
			Short	Mid	Long	Short	Mid	Long
ITS	Ramp metering with transit priority		✓	✓	✓	✓	✓	✓
	Facilitate and promote advanced traveler information		✓	✓	✓	✓	✓	✓
	Enhanced traffic incident management - Enhanced motor assist program - Multidiscipline responder training		✓	✓	✓	✓	✓	✓
	Arterial dynamic message sign		✓	✓	✓	✓	✓	✓
	Active Traffic Management (ATM) - Variable speed limits/queue warning - Lane control for general purpose lanes and shoulder			✓	✓		✓	✓
	Crash investigation sites			✓	✓		✓	✓
	Ramp metering to 175th Street							
	Support electronic toll collection				✓			✓
	Fiber backbone extension							
	Other future ITS/ATM technology improvements as identified through evolving trends				✓			✓
Multi-Modal	Bus on Shoulder expansion		✓	✓	✓	✓	✓	✓
	Supporting Bus on Shoulder system - U.S. 69 - I-435 west of I-35							
	Transit priority at interchanges		✓	✓	✓	✓	✓	✓
	Increase transit service levels		✓	✓	✓	✓	✓	✓
	Pedestrian/bicycle I-35 crossing where interchange movements are planned		✓	✓	✓	✓	✓	✓
	Add new Xpress Routes - Shawnee Route - West Olathe - K-10 to K-7 - Leawood Route					✓	✓	✓
	Park and Ride lots and improved pedestrian/bicycle access to the lots					✓	✓	✓
	Continue to evaluate based on new trends				✓			✓
Shoulder-Running (inside or outside lane)	Prepare shoulders for future should running in tandem with maintenance projects		✓	✓	✓	✓	✓	✓
	Restricted peak hour and incident use (e.g., a combination of transit/HOV/HOT)			✓	✓		✓	✓
	Crash investigation sites/refuge (see ITS above)			✓	✓		✓	✓
	Geometric and safety improvements to shoulders			✓	✓		✓	✓
	Combined with ATM (see ITS above)			✓	✓		✓	✓

* Short Term: 2013-2020
Mid Term: 2020-2040
Long Term: 2040+

Moving Forward

Table 2.

(continued)

Recommended I-35 Improvements

(See Exhibits 1, 2 and 3 for a graphical representation of recommended improvements)

Strategy	Improvement	Section 3 U.S. 69 to 135th Street			Section 4 135th Street to Miami County Line		
	Time Frame*	Short	Mid	Long	Short	Mid	Long
ITS	Ramp metering with transit priority	✓	✓	✓			
	Facilitate and promote advanced traveler information	✓	✓	✓	✓	✓	✓
	Enhanced traffic incident management - Enhanced motor assist program - Multidiscipline responder training	✓	✓	✓	✓	✓	✓
	Arterial dynamic message sign	✓	✓	✓		✓	✓
	Active Traffic Management (ATM) - Variable speed limits/queue warning - Lane control for general purpose lanes and shoulder		✓	✓		✓	✓
	Crash investigation sites		✓	✓		✓	✓
	Ramp metering to 175th Street					✓	✓
	Support electronic toll collection			✓			
	Fiber backbone extension						✓
	Other future ITS/ATM technology improvements as identified through evolving trends			✓			✓
Multi-Modal	Bus on Shoulder expansion	✓	✓	✓			
	Supporting Bus on Shoulder system - U.S. 69 - I-435 west of I-35		✓ ✓	✓ ✓			
	Transit priority at interchanges	✓	✓	✓			
	Increase transit service levels	✓	✓	✓	✓	✓	✓
	Pedestrian/bicycle I-35 crossing where interchange movements are planned	✓	✓	✓	✓	✓	✓
	Add new Xpress Routes - Shawnee Route - West Olathe - K-10 to K-7 - Leawood Route	✓	✓ ✓ ✓	✓ ✓ ✓			
	Park and Ride lots and improved pedestrian/bicycle access to the lots	✓	✓	✓			
	Continue to evaluate based on new trends			✓			✓
Shoulder-Running (inside or outside lane)	Prepare shoulders for future should running in tandem with maintenance projects	✓	✓	✓			
	Restricted peak hour and incident use (e.g., a combination of transit/HOV/HOT)		✓	✓		✓	✓
	Crash investigation sites/refuge (see ITS above)		✓	✓		✓	✓
	Geometric and safety improvements to shoulders		✓	✓		✓	✓
	Combined with ATM (see ITS above)		✓	✓		✓	✓

* Short Term: 2013-2020
Mid Term: 2020-2040
Long Term: 2040+

Table 2.

(continued)

Recommended I-35 Improvements

(See Exhibits 1, 2 and 3 for a graphical representation of recommended improvements)

Strategem	Improvements	Time Frame*	Section 1 State Line to I-635			Section 2 I-635 to U.S. 69		
			Short	Mid	Long	Short	Mid	Long
Frontage Road	Reclassification to allow for federal/state funding opportunities		✓	✓	✓	✓	✓	✓
	Signal and geometric improvements (local partnerships)			✓	✓		✓	✓
	Build frontage roads (local partnerships)							
	Improve arterial network							
Fix Bottlenecks	75th Street bottleneck in one direction					✓	✓	✓
	95th Street interchange (committed)							
	Gateway interchange improvements to I-35 (committed); coordination to allow for future improvements							
	Work to prevent new bottlenecks in developing area by managing access							
	Southwest Trafficway/Broadway/West Pennway system improvements (MoDOT)			✓	✓			
	Lamar Interchange upgrade			✓	✓			
	Key auxiliary lanes - SB Mission to 18th Street - NB and SB 67th Street to 75th Street - SB 95th Street to I-435			✓	✓		✓	✓
	Partial improvements to I-635 Interchange (may include managed bypass of I-635)						✓	✓
	75th Street bottleneck in the other direction						✓	✓
	SB connection to U.S. 69						✓	✓
	Extend 3rd lane in each direction to 175th Street							
Priced Managed Lane	Transition shoulder users to managed lane				✓			✓
	Add a priced managed/express lane in each direction				✓			✓
Merriam Lane upgrades (local partnerships)			✓	✓	✓			

* Short Term: 2013-2020
Mid Term: 2020-2040
Long Term: 2040+

Moving Forward

Table 2.

(continued)

Recommended I-35 Improvements

(See Exhibits 1, 2 and 3 for a graphical representation of recommended improvements)

Strategem	Improvements	Time Frame*	Section 3 U.S. 69 to 135th Street			Section 4 135th Street to Miami County Line		
			Short	Mid	Long	Short	Mid	Long
Frontage Road	Reclassification to allow for federal/state funding opportunities		✓	✓	✓			
	Signal and geometric improvements (local partnerships)			✓	✓			
	Build frontage roads (local partnerships)						✓	✓
	Improve arterial network						✓	✓
Fix Bottlenecks	75th Street bottleneck in one direction							
	95th Street interchange (committed)		✓	✓	✓			
	Gateway interchange improvements to I-35 (committed); coordination to allow for future improvements		✓	✓	✓			
	Work to prevent new bottlenecks in developing area by managing access					✓	✓	✓
	Southwest Trafficway/Broadway/West Pennway system improvements (MoDOT)							
	Lamar Interchange upgrade							
	Key auxiliary lanes - SB Mission to 18th Street - NB and SB 67th Street to 75th Street - SB 95th Street to I-435			✓	✓			
	Partial improvements to I-635 Interchange (may include managed bypass of I-635)							
	75th Street bottleneck in the other direction							
	SB connection to U.S. 69							
	Extend 3rd lane in each direction to 175th Street						✓	✓
Priced Managed Lane	Transition shoulder users to managed lane				✓			
	Add a priced managed/express lane in each direction				✓			✓
Merriam Lane upgrades (local partnerships)								

* Short Term: 2013-2020
Mid Term: 2020-2040
Long Term: 2040+

Table 3 and **4** (Pages 36 and 38) provide summary cost estimates of the recommended preferred strategy for I-35 in un-inflated 2012 dollars and inflated, future year dollars, respectively. It should be noted that there is currently no available funding in the current T-WORKS program available for I-35 improvements.

Cost estimates were developed at a planning level for this study. Cost estimates were based on the actual costs of other urban interstate projects let in the past 10 years in close proximity to the study area. The base costs (in 2012 dollars) were based on a ratio of various project costs relative to pavement cost. Additional costs (on a lump sum or percent of construction basis) were included for assumed right-of-way, bridge reconstruction/widening, frontage road reconstruction, channel relocations, utility relocation, tolling infrastructure, ITS equipment, transit improvements, design, construction engineering and operation/maintenance costs. Below is a summary of cost assumptions made for the project.

- Cost estimates are included for new infrastructure improvements only; reconstruction/rehabilitation costs for the existing I-35 pavement and bridges is not included in the estimate.
- Operations and maintenance cost estimates are included for new infrastructure improvements only; O&M and lifecycle replacement costs for existing I-35 pavement and bridges are not included in the estimate.
- Cost estimates are shown in existing 2012 dollars and inflated future-year dollars (2020, 2030 and 2040) for comparison purposes.
- Future, evolving transit and ITS/ATM technologies not yet identified within the preferred strategy (e.g. connected vehicles) are not included in the cost estimates.
- I-635 improvements include minor congestion and safety improvements only (estimated at $50 million for shoulder running/managed lane queue bypass and $50M for other focused improvements). A complete reconfiguration and reconstruction of the interchange is not included.
- Proposed MoDOT improvements to fix key bottlenecks (e.g., Southwest Trafficway/ Broadway/West Pennway bottleneck) are not included.
- Proposed frontage road improvements and improvements to arterial routes were not included in the cost estimates. These improvements were assumed to be implemented using local partnerships.
- The cost estimates include capital construction costs and right of way estimates.
- A contingency of 30 percent was applied to the cost estimates.

As KDOT and the study team move forward with future corridor planning, costs could be reduced through practical design applications or other cost saving measures. Some practical design elements could require federal approval for design exceptions, such as modifications to shoulder, median or lane widths.

Strategy Package 3	Capital Cost			
	Segment 1 I-635 to State Line	Segment 2 U.S. 69 to I-635	Segment 3 135th to U.S. 69	Segment 4 Miami County Line to 135th Street
	4.5 Miles	5.3 Miles	7.7 Miles	16.1 Miles
Short-Term (2013 - 2020) 2012 Dollars	**$2,853,000**	**$21,072,000**	**$5,911,000**	**$481,000**
ITS	$2,655,000	$2,505,000	$1,911,000	$222,000
Multi-Modal	$198,000	$2,943,000	$4,000,000	$259,000
Fix Key Bottlenecks	$-	$15,579,000	$-	$-
Mid-Term (2020 - 2040) 2012 Dollars	**$28,517,000**	**$190,441,000**	**$44,625,000**	**$40,350,000**
ITS	$6,105,000	$6,319,000	$11,005,000	$5,913,000
Multi-Modal	$2,108,000	$2,674,000	$9,000,000	$7,543,000
Fix Key Bottlenecks	$10,434,000	$167,517,000	$6,910,000	$26,894,000
Shoulder Running	$9,870,000	$13,931,000	$17,710,000	$-
Long-Term (2040 and Beyond) 2012 Dollars	**$99,470,000**	**$166,860,000**	**$149,861,000**	**$197,580,000**
ITS	$109,000	$112,000	$196,000	$2,124,000
Multi-Modal	$-	$1,338,000	$2,312,000	$-
Fix Key Bottlenecks	$-	$31,180,000	$-	$-
Managed Lanes	$99,361,000	$134,230,000	$147,353,000	$195,456,000

Table 3. Recommended I-35 Improvements Summary Costs 2012 Dollars

Table 3

(continued)

Recommended I-35 Improvements Summary Costs 2012 Dollars

Strategy Package 3	Capital Cost	O & M Cost	Total Cost
	Total Capital Costs (2012 Dollars)	Total Operations and Maintenance Costs (2012 Dollars)	Total Cost (2012 Dollars)
	33.6 Miles	33.6 Miles	33.6 Miles
Short-Term (2013 - 2020) 2012 Dollars	**$30,272,000**	**$38,865,000**	**$69,137,000**
ITS	$7,293,000	$15,780,000	$23,073,000
Multi-Modal	$7,400,000	$23,030,000	$30,430,000
Fix Key Bottlenecks	$15,579,000	$55,000	$15,634,000
Mid-Term (2020 - 2040) 2012 Dollars	**$303,933,000**	**$45,135,000**	**$349,068,000**
ITS	$29,342,000	$21,360,000	$50,702,000
Multi-Modal	$21,325,000	$23,030,000	$44,355,000
Fix Key Bottlenecks	$211,755,000	$745,000	$212,500,000
Shoulder Running	$41,511,000	$-	$41,511,000
Long-Term (2040 and Beyond) 2012 Dollars	**$613,771,000**	**$88,895,000**	**$702,666,000**
ITS	$2,541,000	$21,710,000	$24,251,000
Multi-Modal	$3,650,000	$23,030,000	$26,680,000
Fix Key Bottlenecks	$31,180,000	$795,000	$31,975,000
Managed Lanes	$576,400,000	$43,360,000	$619,760,000

Strategy Package 3	Capital Cost			
	Segment 1 I-635 to State Line	Segment 2 U.S. 69 to I-635	Segment 3 135th to U.S. 69	Segment 4 Miami County Line to 135th Street
	4.5 Miles	5.3 Miles	7.7 Miles	16.1 Miles
Short-Term (2013 - 2020) 2020 Dollars	**$3,942,000**	**$29,059,000**	**$8,169,000**	**$664,000**
ITS	$3,669,000	$3,462,000	$2,641,000	$307,000
Multi-Modal	$273,000	$4,067,000	$5,528,000	$357,000
Fix Key Bottlenecks	$-	$21,530,000	$-	$-
Mid-Term (2020 - 2040) 2030 Dollars	**$55,581,000**	**$371,170,000**	**$86,975,000**	**$78,642,000**
ITS	$11,899,000	$12,316,000	$21,449,000	$11,524,000
Multi-Modal	$4,109,000	$5,211,000	$17,541,000	$14,701,000
Fix Key Bottlenecks	$20,336,000	$326,491,000	$13,468,000	$52,417,000
Shoulder Running	$19,237,000	$27,152,000	$34,517,000	$-
Long-Term (2040 and Beyond) 2040 Dollars	**$273,443,000**	**$458,700,000**	**$411,967,000**	**$543,148,000**
ITS	$300,000	$308,000	$539,000	$5,839,000
Multi-Modal	$-	$3,679,000	$6,355,000	$-
Fix Key Bottlenecks	$-	$85,715,000	$-	$-
Managed Lanes	$273,143,000	$368,998,000	$405,073,000	$537,309,000

Table 4. Recommended I-35 Improvements Summary Costs Inflated 2020, 2030 and 2040 Dollars

Table 4.

(continued)

Recommended I-35 Improvements Summary Costs Inflated 2020, 2030 and 2040 Dollars

Strategy Package 3	Capital Cost	O & M Cost	Total Cost
	Total Capital Costs (Inflated)	Total Operations and Maintenance Costs (Inflated)	Total Cost (Inflated)
	33.6 Miles	33.6 Miles	33.6 Miles
Short-Term (2013 - 2020) 2020 Dollars	**$41,834,000**	**$43,776,000**	**$85,610,000**
ITS	$10,079,000	$17,768,000	$27,847,000
Multi-Modal	$10,225,000	$25,932,000	$36,157,000
Fix Key Bottlenecks	$21,530,000	$76,000	$21,606,000
Mid-Term (2020 - 2040) 2030 Dollars	**$592,368,000**	**$59,470,000**	**$615,838,000**
ITS	$57,188,000	$27,918,000	$85,106,000
Multi-Modal	$41,562,000	$30,100,000	$71,662,000
Fix Key Bottlenecks	$412,712,000	$1,452,000	$414,164,000
Shoulder Running	$80,906,000	$-	$80,906,000
Long-Term (2040 and Beyond) 2040 Dollars	**$1,687,258,000**	**$139,973,000**	**1,827,231,000**
ITS	$6,986,000	$32,934,000	$39,920,000
Multi-Modal	$10,034,000	$34,937,000	$44,971,000
Fix Key Bottlenecks	$85,715,000	$2,185,000	$87,900,000
Managed Lanes	$1,584,523,000	$69,917,000	$1,654,440,000

Five County Regional Transportation Study

In 2013, KDOT completed the Five-County Regional Transportation Study. The Study included transportation solutions in Johnson and Wyandotte Counties and the I-35 Corridor. The Five-County study identified key developments, traffic, other modes, corridor connections and suggested strategies along I-35. In fact, the study indicates that traffic volumes forecast on I-35 are among the highest for the Five-County region.

Figure 18 shows the Five-County Regional Transportation recommendation for the I-35 Corridor. The full report and details on the recommendations can be found on KDOT's website at www.ksdot.org.

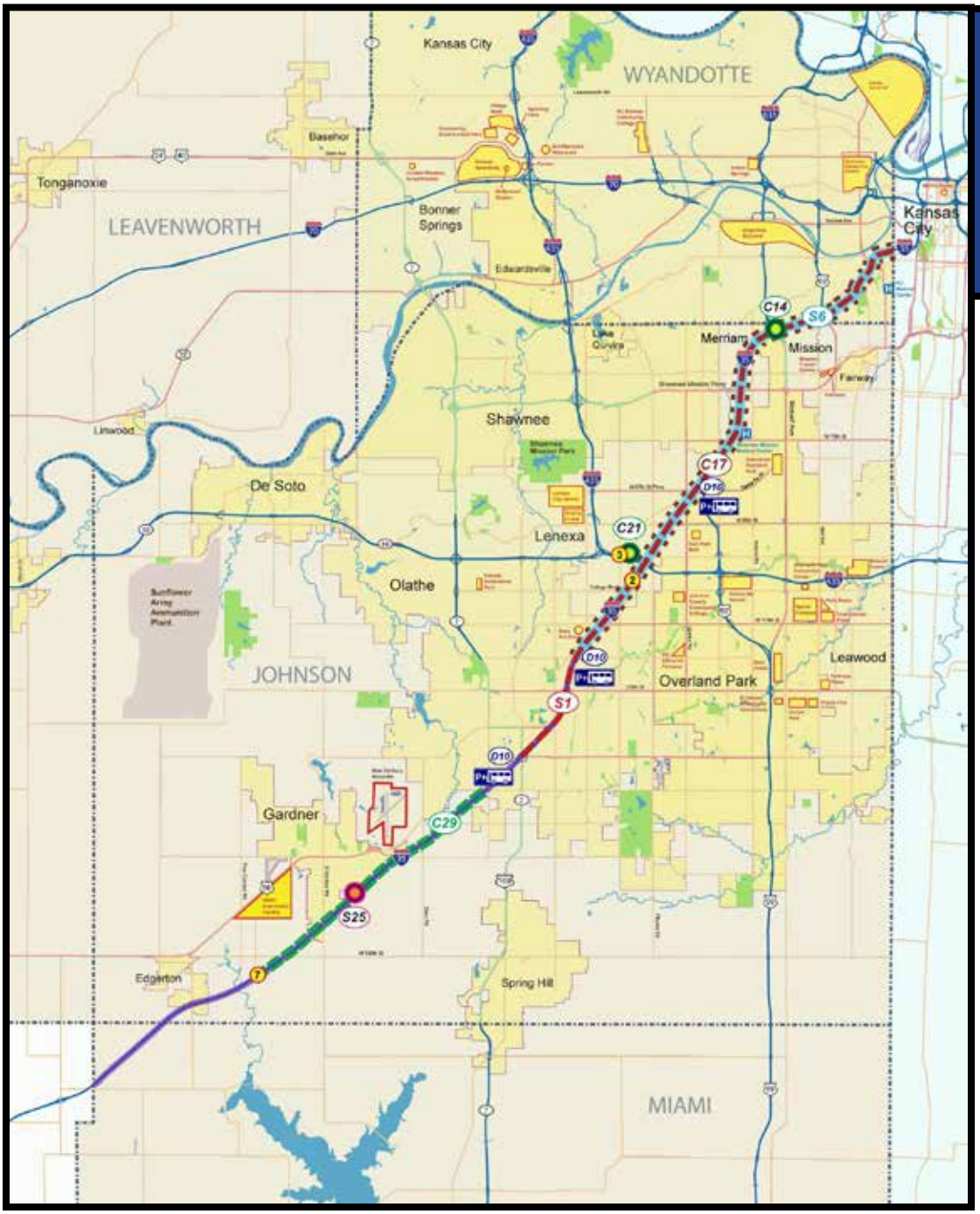


Figure 18. Five-County Regional Transportation Study

I-35 Corridor

The recommended strategies for the I-35 Corridor focus on system management, demand management, and increased capacity strategies. Many of the recommended strategies are consistent with the I-35 Corridor Optimization recommendations.

Other Improvements

A number of other improvements were deemed important to the overall success of the I-35 transportation corridor. These strategies are recommended in conjunction with those outlined above as indirect strategies or policy decisions for regional transportation decision-making.

- Off-System Improvements

  Off-system improvements are enhancements to the transportation system outside of the I-35 mainline. Improvements and upgrades to the arterial/frontage road system can be made through various mechanisms. Physical geometrics can be changed or capacity added to arterials, signal timing operations can be improved, and access management techniques can be applied.

- Demand Management and Policy Considerations

  Demand management strategies represent a variety of methods to move trips away from I-35 during the peak travel periods. These can be a function of making it easier to combine trips through ridesharing or transit use, or providing methods to eliminate or shift vehicle trips through tele-travel or alternative work schedules. Policy approaches, such as road pricing or long-term land use changes, can be considered demand reduction solutions at a regional level through Mid-America Regional Council.

- Construction Management

  When construction takes place to provide more lanes, new roadways, or improved geometrics, or during maintenance of the existing road system, the effort to improve mobility can itself cause congestion. Better techniques in managing construction and maintenance programs can make a difference for travelers.

I-35 Moving Forward

The I-35 Corridor Optimization Plan is intended to serve as a living document that can be reviewed and reevaluated at regular intervals by KDOT, MARC and their planning partners in order to monitor and respond to the evolving operations, conditions and trends of the corridor. Implementation of the preferred strategy is planned to occur in phases over the next 30 years, as corridor conditions warrant improvements. As a part of *I-35 Moving Forward*, five individual plans were developed by the study team, which focus on key future planning elements. These individual plans were developed to help guide KDOT, MARC and their planning partners moving forward beyond this study. The Moving Forward Plan is made up of the five individual plans below.

- Corridor Technical Plans
- Funding and Financing Plan
- Policy and Governance Plan
- Public Engagement Plan
- Corridor Monitoring Plan

The details of each of these plans are included in the Appendix to this report for further reference.

Conclusions

I-35 is a critical asset to the region. The transportation corridor plays a major role in the economic strength of the region. It is important to project the past and future investments made in the corridor. The *I-35 Corridor Optimization Plan* works toward protecting this valuable asset.

The I-35 Corridor Optimization Plan is a living document that can be reviewed and reevaluated at regular interviews by KDOT, MARC and their planning partners in order to monitor and respond to the evolving operations, conditions and trends of the corridor. The plan recommends short-term, mid-term and long-term improvements for I-35 through 2040 and beyond.

I-35 Corridor improvements are focused on balanced solutions of operating the corridor efficiently and safely, managing demand and providing multi-modal options for people. These balanced solutions are provided through improvements that include:

- **Intelligent transportation systems** (e.g. ramp metering, advanced traveler information, traffic incident management and arterial dynamic message signs)

- **Multi-modal** (bicycle and pedestrian improvements, transit improvements including Bus on Shoulder, park and ride lots and express transit routes)
- **Fixing key bottlenecks** (focused I-35 bottleneck improvements such as partial interchange and auxiliary lane improvements)
- **Shoulder running** (restricted peak hour and incident use to some combination of transit, HOV, HOT) in concert with crash investigation sites and active traffic management lane control
- **Managed lanes (**priced managed lane with supporting ITS and toll collection system)

The balanced solutions will meet the I-35 vision for a sustainable, multi-modal transportation system that maximizes the safety and efficiency of existing and future conditions in order to achieve local and regional transportation and economic goals. The balanced solutions will also address the I-35 guiding principles to:

1. Move people and goods more efficiently,
2. Maximize the safety of the corridor, and
3. Support economic growth in the region.

By achieving the I-35 vision and guiding principles, KDOT is "Moving I-35 Forward" toward managing for sustainable reliability.