Congestion Management Report 2023

Technical Appendix

MID-AMERICA REGIONAL COUNCIL

Contents

LIST OF ABBREVIATIONS

CATT	Center for Advanced Transportation Technology
CMN	Congestion Management Network
CMP	Congestion Management Process
LOTTR	Level of Travel Time Reliability
MARC	Mid-America Regional Council
NHS	National Highway System
PTI	Planning Time Index
TAMTI	Texas A&M Transportation Institute
TTI	Travel Time Index
TTTR	Truck Travel Time Reliability Index

Note: HERE and INRIX are names of traffic data firms and are not abbreviations.

INTRODUCTION

The 2023-2024 Congestion Management Report is part of the Mid-America Regional Council's (MARC) effort to fulfill its responsibilities related to its Congestion Management Process (CMP) Policy and the eight-step Congestion Management Process. The CMP is intended to provide information about the performance of the region's roadway network and provide select strategies to act on that information. This report fits the first part of the CMP's objectives — it displays congestion information to inform regional leaders and other stakeholders about the performance of the roadway network.

This report also supports economic vitality, one of the major policy framework goals of the Connected KC 2050, the region's Metropolitan Transportation Plan. Pinpointing where commuters and freight drivers might have the most difficulty reaching their destinations allows for more targeted and effective amelioration efforts.

This report portrays the analysis of data from 2022. For the purpose of awarding points to transportation project applications, projects that overlap with any segment showing as moderately or severely congested or unreliable on any data map in the report in either year of data will be considered as addressing congestion per the CMP Policy.

METHODOLOGY

Congestion Management Network

The Congestion Management Network (CMN) is the network of roadways in the Kansas City region that have been selected for congestion monitoring. There are three official criteria for a roadway's inclusion on the CMN, listed in step three of MARC's eight-step Congestion Management Process. Facilities considered to be part of the network include:

- All National Highway System (NHS) routes.
- All routes with average daily mid-block traffic volumes of 25,000 or more for segments of 2 miles or more in length.
- All routes with high levels of transit service.

MARC staff review traffic volumes using available historical data from cities and state departments of transportation (DOTs). In consultation with the Kansas City Area Transportation Authority, "high levels of transit service" is any route that has headways of 15 minutes or less under the upcoming RideKC Next service plan. Other informal criteria affected route selection, such as a route's listing as a future fast and frequent corridor in MARC's Smart Moves 3.0 plan. The MARC Highway Committee last approved changes to the CMN in 2021. Proposed changes to the CMN will be reviewed and approved in fall 2024/spring 2025 in parallel with updates to the Metropolitan Transportation Plan (MTP).

Data

The data listed below are used to generate performance measures, which supports step four of the eight-step Congestion Management Process.

HERE

Performance Measures:

- Travel Time Index (TTI)
- Planning Time Index (PTI)

MARC acquired traffic speed data generated by the traffic data firm HERE from two different sources. For the Missouri side of the Kansas City metro area, data was downloaded from the Probe Data Analytics Suite, run by the University of Maryland's CATT Lab. MARC's access to this data was sponsored by the Missouri Department of Transportation, but similar sponsorship was not available from the State of Kansas. MARC purchased HERE data for the Kansas side through a third-party reseller. Due to the difference in how the data was acquired, there will be differences in how it displays in the report.

HERE data is used to generate two performance measures and requires the calculation of the "reference travel time" and "average peak period travel time." The reference travel time is based on the reference speed of the segment. This reference speed has been calculated by MARC using the HERE probe data. This calculation removes data for the morning peak, mid-day, and afternoon peak periods for weekdays while retaining all data for weekends. This calculation differs from the HERE probe data as well as other sources that may use alternative calculations to determine their reference information which can cause relative differences between MARC data and other sources.

The reference travel time is calculated by finding the 15th percentile travel time of overnights and weekends. The average peak period travel time is calculated by averaging five-minute epochs of data in the peak periods (7 - 9 a.m., and 4 - 6 p.m.) on all Tuesdays, Wednesdays, and Thursdays of the specified year. The performance measures include:

- Travel time index (TTI) is used to measure recurring congestion, or congestion that a motorist can expect on an average day during peak hours as the result of a facility's capacity not meeting demand. It is calculated using the following formula:

  $$TTI = \frac{\text{average peak period travel time}}{\text{reference travel time}}$$

  If the TTI for a segment is 2.00, a motorist can expect that it will take twice as long to navigate that segment.

- Planning time index (PTI) is used to measure non-recurring congestion. This congestion is the result of temporary events such as inclement weather, construction, or vehicle collisions. It is calculated using the following formula:

  $$PTI = \frac{95th \text{ percentile travel time}}{\text{reference travel time}}$$

  If the PTI for a segment is 2.00, a motorist should plan on taking twice the normal travel time to ensure on-time arrival at the destination 95% of the time.

For these two measures, this report follows the distinctions and thresholds set by the 2019 report.

Routes on the CMN were classified as either a “highway” or a “major roadway.” “Highways” have a functional class of either “Interstate” or “freeway/expressway.” “Major roadways” have a functional class of “principal arterial” and below. This distinction was made to reflect the different expectations of service between these facilities when portraying the thresholds for TTI. For PTI, the thresholds remain the same between highways and major roadways.

TTI Congestion Thresholds:

Highways

≤1.24	Not Congested
1.25-1.49	Moderately Congested
≥1.50	Severely Congested

Major Roadways

≤1.49	Not Congested
1.50-1.99	Moderately Congested
≥2.00	Severely Congested

PTI Reliability Thresholds:

Highways & Major Roadways

≤1.99	Reliable
2.00-2.99	Moderate Unreliability
3.00	Severe Unreliability

Bottlenecks

The Probe Data Analytics Suite, run by the University of Maryland’s CATT Lab, tracks and ranks bottleneck locations in certain geographies using HERE probe data. At a high-level, per the Probe Data Analytics Suite, bottlenecks are locations on the roadway where conditions have fallen below a certain percent of the reference speed for an extended period of time. The temporal and geospatial extent of bottlenecks can be used to determine which locations are particularly troublesome for the traveling public.

The Bottleneck Tool includes four metrics to provide users with additional insight to bottlenecks impacting roadway systems. These metrics allow users to weigh the traditional impact metric (now referred to as the base impact) by other relevant factors, including:

- Base Impact — The sum of queue lengths over the duration of the bottleneck.
- Weighted Base Impact — The base impact weighted by different metrics as noted below:
    - Speed Differential — Base impact weighted by the difference between free-flow speed and observed speed. This metric should be used when you want to identify and rank bottlenecks from the individual vehicle perspective.
    - Congestion — Base impact weighted by the measured speed as a percentage of free-flow speed. Similar to the speed differential metric, the congestion metric should be used when you want to identify and rank bottlenecks from the individual vehicle perspective. NOTE: The term congestion is defined as "measured speed as a percent of the free-flow speed"

- Total Delay — Base impact weighted by the difference between free-flow travel time and observed travel time multiplied by the average daily volume (AADT), adjusted by a day-of-the-week factor. This metric should be used to rank and compare the estimated total delay from all vehicles within the bottleneck.

By default, the Bottleneck Tool sorts segments by base impact weighted by the total delay, and this is what MARC uses to identify bottlenecks within the region. MARC identified bottlenecks with a Total Delay value equal to or greater than 100 million. One limitation to using this tool is that HERE probe data is not available to the Probe Data Analytics Suite for the state of Kansas as it is for the state of Missouri. Identification of bottlenecks on the Kansas side of the Kansas City region will be an important part of future work.

INRIX

Performance measures:

- Level of Travel Time Reliability (LOTTR)
- Truck Travel Time Reliability (TTTR)

INRIX is a traffic data firm that supplies the data for the federally prescribed performance measures of level of travel time reliability and truck travel time reliability. This data is processed and supplied by the Probe Data Analytics Suite, a data platform supported by the University of Maryland's CATT Lab. MARC staff were able to download and map data calculated for these federal performance measures. The measures include:

- Level of travel time reliability (LOTTR) functions as a measure of reliability (non-recurring congestion), similarly to the PTI. However, LOTTR is calculated differently:

$$LOTTR = \frac{80th\ percentile\ travel\ time}{50th\ percentile\ travel\ time}$$

  The coverage of this data is limited mostly to the NHS as provided by the Probe Data Analytics Suite.

- Truck travel time reliability (TTTR) is another measure of non-recurring congestion, but intended to show the areas where trucks will encounter the most unreliability.

$$TTTR = \frac{95th\ percentile\ travel\ time}{50th\ percentile\ travel\ time}$$

  The coverage of this data was only calculated on the Interstate system as provided by the Probe Data Analytics Suite.

Reliability thresholds for both measures are as follows:

LOTTR & TTTR

≤1.24	Reliable
1.25-1.49	Moderately Unreliable
≥1.50	Severely Unreliable

Kansas City Scout

Performance measures:
- Average incident clearance time

MARC staff obtained data on the measure of average incident clearance time from Kansas City Scout, the bistate highway traffic management system. This is a measure of how much time elapses on average before all lanes of a roadway are cleared of the incident. It covers Scout's network in the eight counties of the MARC metropolitan planning area in 2022: Johnson, Leavenworth, Miami and Wyandotte in Kansas, and Cass, Clay, Jackson, and Platte in Missouri.

MARC staff calculated the measure of incident clearance time. KC Scout provided guidance for calculations of the measures, which are as follows:
- Field "lane blockage duration."
  - Incidents where only the shoulders of the road were closed were excluded.
- "Stalled vehicle" and "debris in the roadway" incidents were excluded when the average time to clear was zero. They were included when the average time to clear was above zero.
- "Roadwork" and "Special" incidents were excluded.
- Only facilities which were clearly named as Interstates, U.S. Routes, Highways, and Highway-to-Highway Ramps were included.

In addition, only incidents occurring within MARC region counties were included. For the remaining incidents, the arithmetic mean of the time to clear the lanes for each incident was calculated.

Annual Hours of Peak-Hour Excessive Delay per Capita

Comparing the Kansas City region to similar regions across the U.S. offers context. To examine the hours of delay per auto commuter in 2022 for the Kansas City metro and for peer metro areas, MARC utilized the RITIS NPMRDS Analytics Suite MAP-21 tool for Urbanized Area (UZA) geographies. The ten peer metro areas previously identified by KC Rising, and used for this analysis, include:
- Austin
- Charlotte
- Cincinnati
- Columbus
- Denver
- Indianapolis
- Minneapolis
- Nashville
- Portland
- Raleigh

Systemwide Statistics

MARC staff aggregated the HERE and INRIX data from the individual roadway segments into percentages of uncongested or reliable miles for each monitored network (CMN and Interstates, for trucks), according to its performance measures, for each year of the data. The methodology was to sum the miles of all segments on a network that fell below the threshold of moderately congested/unreliable and divide the total by the total number of miles on the network. The percentages for the NHS (percent of person-miles travelled on the Interstates/non-Interstate NHS that are reliable) were not calculated by MARC staff, as calculations were provided by the Probe Data Analytics Suite.

Historical Commuting Corridors

In the previous decade, MARC completed four studies that examined traffic data and congestion in the Kansas City metro area. These were published in 2012, 2013, 2019, and 2021. They featured data from the years 2010, 2012, 2017, and 2019-2020 respectively. Through these past studies, MARC can show changes in the levels of congestion for a few important commuting corridors in the region. These corridors include:

- **I-29 to US-169** from Kansas City International Airport to downtown Kansas City, Missouri.
- **I-35**, examined separately from Olathe (K-7) to downtown Kansas City, Missouri, and from Kearney (MO-92) to downtown Kansas City, Missouri.
- **I-70**, examined separately from K-7 to downtown Kansas City, Missouri, and from Oak Grove (MO-H) to downtown Kansas City, Missouri.
- **US-71 to I-49** from Harrisonville (MO-7/MO-2) to downtown Kansas City, Missouri.
- **US-69** from 167th St. to I-35.

The TTI was calculated at a corridor level for each peak period and portrayed in charts that grouped together commuting directions into and out of downtown Kansas City, Missouri. Some important notes on this data include:

- 2010 and 2012 data are from INRIX; 2017, 2019, and 2022 data are from HERE.
- The US-71/I-49 study corridor extended south to Belton in 2010 and 2012, and to Harrisonville in 2017 onward.
- The I-70 (Missouri) study corridor extended east to Blue Springs in 2010 and 2012, and to Oak Grove in 2017 onward.
- The US-69 (Kansas) study corridor extended south to 151st St. in 2010 and 2012, and to 167th St. in 2017 onward.