CONGESTION MANAGEMENT PROCESS

TECH MEMO 3

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November 5, 2025

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This report is the product of a project (study) financed in part by the Federal Transit Administration and the Federal Highway Administration of the U.S. Department of Transportation.

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TECH MEMO 3

1. Introduction

The Congestion Management Process (CMP) is a federally required planning framework for Transportation Management Areas (TMAs) that ensures congestion is addressed through data-driven, performance-based, and multimodal strategies. For the Association of Central Oklahoma Governments (ACOG), the CMP plays a critical role in identifying congestion issues, evaluating potential solutions, and integrating strategies into the region's Metropolitan Transportation Plan (MTP) and Transportation Improvement Program (TIP). Technical Memorandum 3 builds upon earlier tasks by advancing the discussion of multimodal performance measures, outlining congestion management needs, and preparing for the development of strategies in subsequent phases.

This document recognizes congestion in Central Oklahoma cannot be addressed solely through roadway capacity expansion. Instead, it highlights the importance of multimodal performance metrics that assess how well the overall transportation system—across driving, transit, walking, bicycling, and freight—meets regional mobility, accessibility, and sustainability goals. By aligning with federal guidance and national best practices, the CMP provides ACOG and its partners with the tools to prioritize investments, track progress over time, and deliver transportation solutions that balance efficiency, equity, and livability.

2. Multimodal Performance Measures

Modern urban regions, such as Oklahoma City, face challenges in managing congestion as travel demand grows and infrastructure ages. Addressing congestion is no longer just a matter of expanding roadways for vehicles; it requires a holistic, multimodal approach. Multimodal performance measures are at the heart of an effective CMP. They provide a quantitative and qualitative framework for assessing how well the entire transportation system serves its users and meets regional mobility goals. By integrating these measures, agencies can better identify problems, allocate resources, evaluate strategies, and track progress toward a more efficient, equitable, and sustainable transportation future.

Defining Multimodal Performance Measures

Performance measures are metrics used to evaluate how well a transportation system is functioning. A multimodal approach recognizes congestion affects and is affected by more than just automobiles - public transit, bicycles, pedestrians, freight vehicles, and other modes must be considered to gain a complete picture of mobility.

A robust set of multimodal performance measures typically includes:

- **Travel Time and Reliability:** Average and peak hour travel times, on-time performance, and variability for all modes.
    - Level of Service (LOS): Quality of service rankings for roadways, transit, sidewalks, and bike lanes.
    - Volume-to-Capacity Ratios: The ratio of observed demand versus infrastructure capacity for each mode.
- **Person Throughput:** The number of people (not just vehicles) moving through a corridor per unit of time.
- **Accessibility:** The ease with which people can reach desired destinations by various modes.
- **Mode Share:** The percentage of travelers using each mode (auto, transit, bike, walk, etc.).
- **Safety Metrics:** Crash rates, severity, and risk exposure for all users.
- **Environmental Impact**: Emissions, energy use, and noise generated by each mode.
- **Equity and Inclusion:** The system's ability to serve disadvantaged and mobility-limited populations.
- **Customer Satisfaction:** Perceptions and attitudes of users toward the available modes.

CMP Goals, Objectives, and Performance Measures

The proposed objectives and performance measures for the ACOG CMP are presented below in **Table 2.1.** The proposed objectives are shown in relation to the ACOG Long Range Transportation Plan (LRTP), *Encompass 2045,* seven goal areas. The table reflects the Goal Area from the LRTP, the CMP Objective, and the performance measures to support the objective. One goal is consistency between the two plans.

Performance measures are presented in two categories. These categories represent the prioritization of the performance measures based on their perceived effectiveness in measuring the impact of CMP strategies and the availability of data to support measurement.

- Tier 1 Performance Measures are readily available and recommended for short-term implementation.
- Tier 2 Performance Measures may not be readily available and are recommended for phasing in overtime, due to limitations of currently available data and existing processing constraints.

Table 2.1 – LRTP Encompass 2045 Goals and CMP Goals and Performance Measures

Goal area	CMP Objective	Performance measures
Connectivity	• Provide efficient connections within and between modes and facilities • Facilitate the movement of people and goods, improve connectivity between regions and activity centers, and increase travel mode choices • Implement a Complete Streets policy for the region and encourage member communities to adopt a Complete Streets policy • Support and expand an interconnected bus and commuter rail transportation system in the region	**Tier 1** - Pedestrian Composite Index - Bicycle Composite Index **Tier 2** - BNA score[1] - Miles of area operating under a Local Complete Streets policy - Network Completeness Analysis - Route Directness Analysis (from transit routes) - Network Quality Analysis (intensive)
Economic Strength	• Invest in improvements that enhance the efficiency of the existing transportation system • Improve accessibility to regional employment centers • Invest in transportation that supports tourism, commerce, and economic activity • Increase efficiency of goods movement by truck, rail, water, air, and pipeline	**Tier 1** - Congestion intensity (Travel time index) - Reliability (buffer index) - Mode share for all trips - Person or vehicle hours of delay - Truck Travel Time Index - User cost (as a function of delay) **Tier 2** - Vehicle Miles Traveled (VMT) per capita. - Person Miles Traveled (PMT)
Equity & Options	• Provide equitable transportation services and improvements that support a multimodal system • Expand and maintain a safe, secure, and accessible public transportation system • Expand and maintain accessible and connected pedestrian and bicycle facilities • Avoid, minimize, or mitigate negative human health and environmental effects on Environmental Justice populations	**Tier 1** - Total miles of sidewalk and bicycle paths/lanes. - Percent of population and jobs located within ¼-mile of transit. **Tier 2** - Miles of sidewalk and bicycle paths/lanes added within ¼-mile of transit stop
Healthy Communities	• Improve, enhance, and expand the ability for residents to walk, bike, or use public transportation • Encourage use of alternative energy and cleaner-burning fuels to improve the region's air quality • Reduce the potential negative impacts transportation projects have on the environment and human health • Better connected land use and transportation decision-making	**Tier 1** - Transit ridership per revenue vehicle hour - Mode share for commuter trips. - Annual air quality index reading for the region

[1] https://bna.peopleforbikes.org/#/places/6d756a31-5d42-4c12-949e-63f0ef22f443/
https://bna.peopleforbikes.org/#/places/b510b8a4-ecc6-4310-9221-cf054e5df2b6/
https://bna.peopleforbikes.org/#/places/057acaf1-def3-44f1-9050-df3cddc3c198/

Performance	• Invest in Intelligent Transportation Systems (ITS) and other improvements that enhance the efficiency of the existing transportation system • Improve the resiliency and reliability of the existing transportation system • Increase roadway capacity for vehicles, bicycles, pedestrians, and transit where needed • Sustainably fund transportation projects while continuing to leverage additional resources	**Tier 1** - Lane miles severely congested. - Travel time ratio (morning/afternoon peak vs. midday travel times). - Lane-miles covered by ITS services and devices including cameras, Dynamic Message Signs, Service Patrols and advanced signal coordination **Tier 2** - Person or vehicle hours of nonrecurring delay - Duration of congestion
Safety & Security	• Improve design, construction, and maintenance of infrastructure to reduce the number and severity of crashes, injuries, and fatalities of all users • Increase awareness of the public on safety issues and skills • Collaborate with area communities and stakeholders on transportation system safety and security strategies • Improve situational awareness, understanding, and collaboration in the area of cybersecurity across the region	**Tier 1** - Number of crashes by severity for vehicle crashes, vehicle-bicycle crashes, and vehicle-pedestrian crashes - Fatality and serious injury crash rate per 100M VMT **Tier 2** - Response and/or incident clearance time
System Preservation	• Invest in projects that preserve and enhance the existing transportation infrastructure • Encourage policies and procedures that preserve traffic operations and safety • Explore new or improved transportation technologies • Decrease unnecessary bridge and roadway wear and tear	**Tier 1** - Percent of roadways above PCI 70 - Number of bridges in poor quality or worse **Tier 2** - Percent of sidewalks above PCI 90 - Percent of trails above PCI 90 - Percent of signals that have had timing reviewed in the past 3 years - Truck Route adherence

Design & Collect Data for Multimodal Performance Measures

Data to support the CMP can be derived from multiple sources. Understanding the type and availability of data collected is essential in analyzing the CMP network, as the data will be used to accurately and efficiently calculate the system's performance. For the 2050 CMP, some sources provide data that could be used more often in analysis than other sources.

The project team has reviewed applicable data sources and coverage and recommends the following data be used to support the CMP. Data sources for specific measures are shown in **Table 2.2** below.

Table 2.2 – CMP Data Sources and Measure Alignment

Data	Data Source	Description	Applicable Measures
Streetlight	Streetlight™	-vehicle-probe speed data -Travel-time data -Truck congestion data	-Free Flow Factor -speed -Average Daily Traffic
ACOG Travel Model Outputs	ACOG	-Congestion Speed -Volume -Capacity -Vehicle Miles Traveled (VMT)	-Level of Service -User Cost -Vehicle Hours of Delay (VHD) -Reliability (Buffer Index) -Average Trip Distance
Crash Data	ODOT, FARS	-Crash severity -Crash frequency -Collision type -Bicycle/Pedestrian involvement	-Serves as base information for multiple measures
Roadway Shapefiles	ODOT	-Roadway alignments -Traffic Counts -Functional classification	-Serves as base information for multiple measures
Demographic Shapefiles	US Census	-Population -Employment	-Percent of population and jobs located within ¼ mile of transit
Transit Data	EMBARK, CityLink	-Monthly ridership counts -Ridership per revenue hour	-Transit ridership per revenue hour -Miles of sidewalk and bicycle paths/lanes added within ¼-mile of transit stop
Annual Air Quality Ratings	ACOG	-Ozone levels -Status of meeting NAAQS	-Annual Air Quality Index
Mode Split	US Census	-Traveler mode split	-Mode share for commuter trips
Bicycle/Pedestrian Network	ACOG	-Pedestrian Composite Index -Bicycle Composite Index -Sidewalk location/condition -Bicycle path/lane location/condition	-PCI + BCI -Total miles of sidewalk and bicycle lane/path -Miles of sidewalk and bicycle paths/lanes added within ¼-mile of transit stop
ITS Network	ACOG/ ODOT	-Location/type of ITS Devices -Location for future deployments	-Total miles of network covered by ITS Devices

Details of the seven goal areas from the LRTP, Encompass 2045, are listed below. Information includes Tier 1 and Tier 2 measures and resources.

1. CONNECTIVITY

The CMP proposes Tier 1 and Tier 2 performance measures to determine if the ACOG region is meeting its goals for Connectivity and at what level. Figure 1 and 2 show the PCI and BCI for the ACOG region.

Tier 1 Performance Measures

1. Pedestrian Composite Index (PCI)
    a. Index used to determine the priority of building more walkable facilities. The Pedestrian Composite Index is a number between 0 and 1, representing the necessity of sidewalks by considering locations of pedestrian generators and pedestrian deterrents.
2. Bicycle Composite Index (BCI)
    - Index used to determine the priority of building more biking facilities. Similar to PCI, Bicycle Composite Index is a number between 0 and 1, representing the necessity of sidewalks by considering locations of generators and deterrents.

Tier 2 Performance Measures

1. Miles of area operating under a Local Complete Streets policy
    a. Inventory of area recently adopted or codified a policy to encourage, support or require complete streets (streets accommodating multiple modes) to be developed during reconstruction or new construction.
2. Network Completeness Analysis
    - A comparison of existing bike and pedestrian facilities and planned facilities.

Figure 1: Pedestrian Composite Index (PCI)

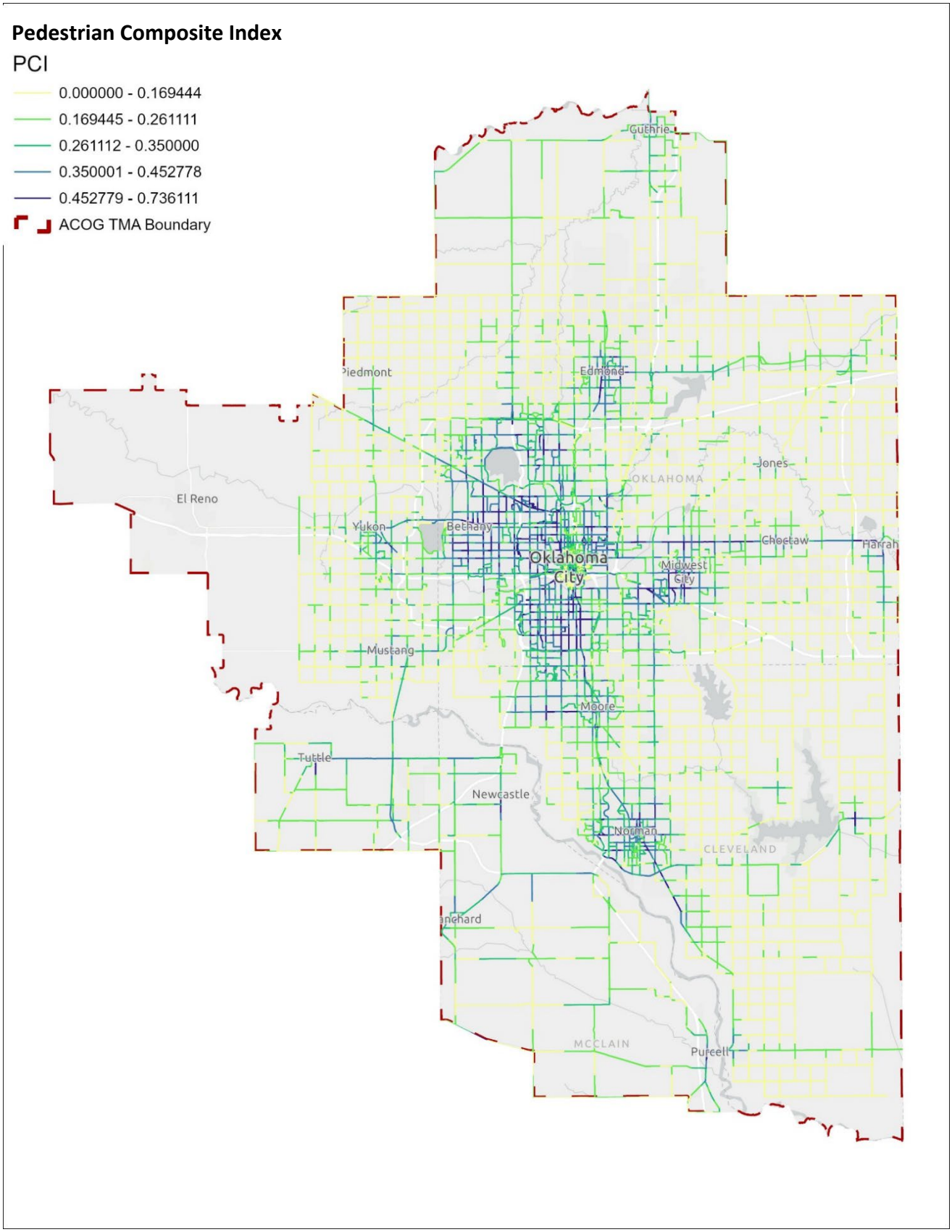
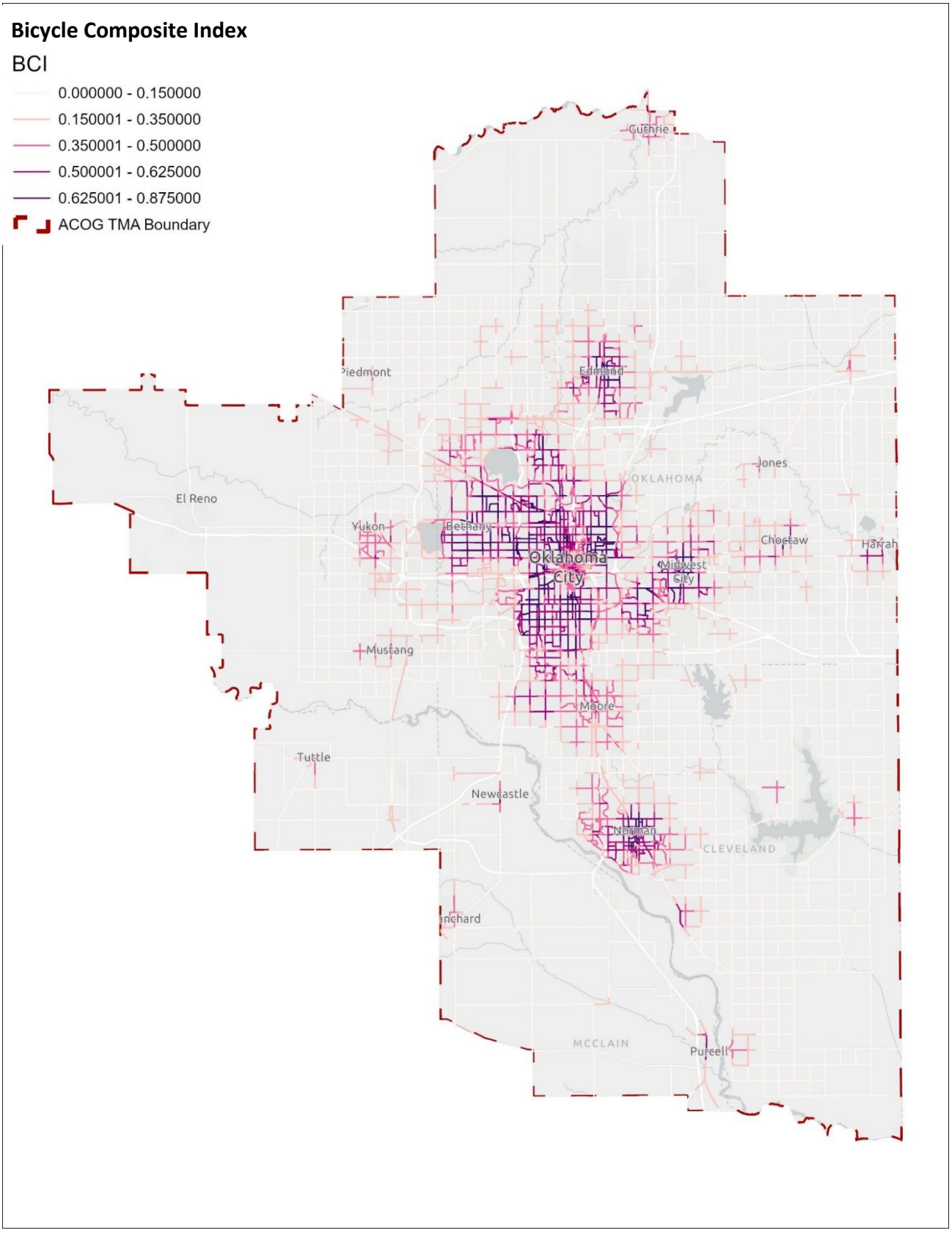


Figure 2: Bicycle Composite Index (BCI)



2. ECONOMIC STRENGTH

The CMP proposes Tier 1 and Tier 2 performance measures for ACOG to determine the level of meeting the Economic Strength goals. **Table 2.3** shows the methodology for calculating performance for Tier 1 Performance Measures.

Tier 1 Performance Measures

- Congestion intensity (Free Flow Factor)
  - The congestion intensity measure uses free flow factor to determine the severity of congestion. When the free flow factor is closer to 1, there is little congestion on the corridor, however when the free flow factor is lower, the congestion level is more severe.
- Reliability (buffer index)
  - The buffer index represents the extra time most travelers add to their average travel time when planning trips to ensure on-time arrival at their destination. The buffer index is calculated as the difference between the 95th percentile travel time (near worst case) and the average travel time, divided by the average travel time.
- Mode Share for Commuter Trips
  - The mode share is a common outcome measure used to determine the effectiveness of efforts to reduce the dependence on automobiles. Mode share can be identified by using the US Census Means of Transportation to Work data.
- Person or Vehicle Hours of Delay
  - The delay measurements are based on the 2010 travel model output which is assumed to be able to represent the 2015 traffic condition. The person hours of delay can be calculated by multiplying the local vehicle occupancy rate of 1.2 persons per vehicle by the vehicle hours of delay.
- Truck Free Flow Factor
  - Truck Free Flow Factor is ratio of the average trip speed for a day to the maximum average trip speed in any hour during the entire data period.
- User Cost (as a function of delay)
  - The user cost of delay is the value of time multiplied by the hours of delay. The United States Department of Transportation (USDOT) utilizes an Hourly Value of Travel Time Savings for general travel time, for all purposes, as $21.10 based on the 2025 Benefit Cost Guidance (Update 2, May 2025).

Tier 2 Performance Measures

- Vehicle Miles Traveled (VMT) per Capita
  - VMT per capita is the total number of miles traveled by motor vehicles in the ACOG region divided by the population of the region.
- Person Miles Traveled (PMT)
  - PMT is a calculation of miles traveled in the ACOG region by mode by occupancy. For example, a person using a single occupancy vehicle, driving alone, traveling 5 miles would yield 5 person-miles traveled. A transit vehicle traveling 1 mile, carrying 40 passengers would yield 40 person-miles traveled.

Table 2.3 – Tier 1 Performance Measurements for Economic Strength Goal

Goal Area/ Performance Measure	Calculation Method		2016 Results	Current Results	Data Source
Congestion Intensity	(Peak travel time/free-flow travel time)		Varies by Route	Varies by Route	Streetlight
Reliability (Buffer Index)	95Th percentile travel time for CMP Focus Network		Varies by Route	Varies by Route	FHWA NPMRDS
Person or Vehicle Hours of Delay	((VMT/Congestion Speed) – (VMT/free-flow speed)) x 1.2 persons/vehicles	Interstate & Freeway	120,865	*TBD*	Streetlight
		Turnpike	15,024	*TBD*	
		Principal Arterial	68,428	*TBD*	
		Total	204,317	*TBD*	
Truck Free Flow Factor	Truck FFF Percentages across all Streetlight Segments (weekday Average)		N/A	Under 0.55: 15.9% 0.55-0.7: 23.7% 0.7-0.85: 50.5% Over 0.85: 9.8%	Streetlight
	Truck FFF Percentages across CMP Focus Network (weekday Average)		Weighted Average TTI for Truck Routes: 1.05	Under 0.55: 13.5% 0.55-0.7: 24.5% 0.7-0.85: 49.3% Over 0.85: 12.8%	
	Max Congestion among all the monitored segments		Max TTI for Truck Routes: 2.89	Min FFF for CMP Focus segment 0.09	
User Cost (as a function of delay)	Vehicle hours of delay x value of time ($21.10 Dollar/Hours)	Vehicle Delay Cost	$3,573,841	*TBD*	Streetlight
	Person Hours of Delay x Value of Time ($20.99 Dollar/Hours)	Person Delay Cost	$4,288,610	*TBD*	

3. EQUITY & OPTIONS

To adequately measure efforts made towards the Equity and Options Goal, the CMP proposes the following Tier 1 and Tier 2 performance measures.

Tier 1 Performance Measures

- Total Miles of Sidewalk and Bicycle Paths/Lanes
  - Inventory data on the total mileage of pedestrian and bicycle infrastructure for the ACOG MPO TMA.
- Percent of population and jobs located within ¼-mile of transit.
  - GIS overlay of existing transit services routes into the population and employment files that can be obtained from the US Census Bureau.

Tier 2 Performance Measures

- Miles of Sidewalk and Bicycle Paths/Lanes Added Within ¼-mile of Transit Stop
  - Measure to evaluate the expansion of the bicycle and pedestrian network's connectivity to transit services.

Table 2.4 – Tier 1 Performance Measurements for Equity and Options Goal

Goal Area/Performance Measure	Calculation Method		2016 Results	Current Results	Data Source
Miles of Sidewalks and Bicycle Routes	GIS Tabulation	Miles of Sidewalks	3,512.5	*Awaiting Data*	ACOG Generated Shapefile
		Miles of Bicycle Routes	415	699.2	
Percent of population and jobs located within ¼-mile of all transit.	GIS Buffer	Population Percentage	49.2%	24.6%	2022 Census on the Map, ACOG Generated Shapefile
		Employment Percentage	72.5%	53.9%	
Percent of population and jobs located within ¼-mile of 30-min headway transit.	GIS Buffer	Population Percentage	N/A	17.2%	2022 Census on the Map, ACOG Generated Shapefile
		Employment Percentage	N/A	41.0%	

4. HEALTHY COMMUNITIES

The CMP proposes Tier 1 performance measures to indicate the level the ACOG region is meeting its goals for Healthy Communities.

Tier 1 Performance Measures

- Transit Ridership per Revenue Vehicle Hour
    - Transit ridership can indicate a shift in the active transportation characteristics of a region. An increase in ridership per revenue hour may indicate a more active population.
- Mode Share for Commuter Trips
    - Mode split for journeys to work or school (when tracked over time) can be used to evaluate the tendency of the population to utilize more active transportation modes.
- Annual Air Quality Index (AQI)
    - The AQI provides information relating to the level of pollution in the air that can negatively impact sensitive populations. Reducing SOV trips can also increase the quality of air. The Oklahoma Department of Environmental Quality (DEQ) provides daily forecasts and updates for pollutants and particulate matter in the air. Currently, the ACOG MPO TMA region is not in a non-attainment zone for all National Ambient Air Quality Standards (NAAQS).

Table 2.5 – Tier 1 Performance Measurements for Healthy Communities Goal

Goal Area/Performance Measure	Calculation Method		2016 Results	Current Results	Data Source
Transit Ridership per Revenue Vehicle Hour	Transit Ridership/Revenue Hours	Citylink	15.9	5.6	Transit Agencies[2]
		EMBARK (COTPA)	16.9	11.2	
		EMBARK NORMAN	19.3	11.3*	
Mode Share for Commuter Trips	Research/ Look-Up	Car, Truck, Van -Drive Alone	82.20%**	76.70%	2023 ACS 5-year Estimates Means of Transportation to Work
		Car, Truck, Van -2+	10.93%**	10.42%	
		Transit, Railroad	0.50%**	0.59%	
		Bicycle	0.28%**	-	
		Walked	1.54%**	-	
		Taxi, Motorcycle, Others	1.13%**	-	
		Work at Home	3.42%**	8.37%	
Annual Air Quality Index Reading for the Region	Research/ Look-Up	Ozone	39.1	37	Oklahoma DEQ[3]
		Fine Particulates (PM 2.5)	35.8	45	
		Oxides of Nitrogen (NO_x)	27.8	12	
		Oxides of Sulfur (SO_x)	1.0	-	
		Carbon Monoxide (CO)	4.3	9	
		Coarse Particulates (PM 10)	17.0	12	

* This transit agency now contracts with EMBARK for day-to-day operations.

** These figures were pulled from the 2010 Census Journey to Work

[2] NTD Transit Agency Profiles | FTA

[3] Air Quality Index Daily Values Report | US EPA

5. PERFORMANCE

Regional goals for system performance focus on enhancing both the efficiency and reliability of the transportation network. To assess congestion levels within the CMP network, both model-based assignments and actual travel time data are used. While model assignments offer insights into overall network operation and areas of congestion, the four-step travel model relies on numerous assumptions and may not provide a detailed analysis. Therefore, it is essential to evaluate network performance using real-world travel data, which reflects more accurate traffic conditions.

This CMP proposes Tier 1 and Tier 2 performance measures for the region.

Tier 1 Performance Measures

- Travel Time Ratio (morning/afternoon peak vs. free flow travel speeds)
    - The ratio of travel speed during congestion to the highest average speeds during the day.
- Lane Miles Severely Congested
    - Severe congestion is defined as a segment with a Free Flow Factor under 0.7, which equates to a 1.4 TTI. This information is derived from the Streetlight segment level data.
- Lane-Miles Covered by ITS Services and Devices Including Cameras, Dynamic Message Signs, Service Patrols and Advanced Signal Coordination
    - Inventory of the existing ITS devices or services that have been deployed in the ACOG MPO TMA.

Tier 2 Performance Measures

- Person or Vehicle Hours of Nonrecurring Delay
- Duration of Congestion
    - This is a measure of how long the congestion exists on the roadway. The Congestion Management Problem and Needs analysis Methodology 1 (Corridor Average Congestion) is one fashion of calculating this performance measure.

Table 2.6 – Tier 1 Performance Measurements for Performance Goal

Goal Area/Performance Measure	Calculation Method		2016 Results*[4]	Current Results	Data Source
Lane Miles Severely Congested	The percentage of segments in the CMP network with a FFF of 0.7 or lower.	Interstate & Freeway (%)	AM: 226.32 (24%) PM: 80.87 (9%)	7-8am: 12.9% 5-6pm: 34.4%	Streetlight
		Turnpike (%)	AM: 9.46 (4%) PM: 0.43 (0.2%)	N/A	
		Principal Arterial (%)	AM: 39.39 (3%) PM: 23.61 (2%)	7-8am: 7.1% 5-6pm: 25.1%	
		Total (%)	AM: 275.17 (11%) PM: 104.91 (4%)	7-8am: 8.2% 5-6pm: 26.7%	
Free Flow Factor (morning/ afternoon peak vs, free flow travel speeds)	Congestion speed/free flow speed	5pm Segment Average FFF	-	*All CMP Network: 0.8326 CMP Focus Corridors: 0.7696:*	Streetlight
	Weighted Average = Segment FFF x Segment Length / Total Length	Weighted Average for CMP Network	1.09*	*Varies*	
	Max FFF = Worst FFF among all the monitored segments	Max FFF for CMP Network	2.89*	*Max FFF CMP Network: 0.127 Focus Corridors: 0.261*	
Lane Miles Covered by ITS Services and Devices Including Cameras, Dynamic Message Signs, Service Patrols and Advanced Signal Coordination	GIS Measurements	Cameras	249	174**	ACOG/ ODOT
		DMS	23	23**	
		Speed Stations	60	60**	
		Total Devices	332	257**	
		Total Mileage Covered by ITS Devices	162	122**	

* These figures are represented in Time Travel Index (TTI).

** These numbers are based on ODOT facilities only.

[4] 2016 Congestion based on TTI

6. SAFETY & SECURITY

The CMP Proposes Tier 1 and Tier 2 performance measures to identify the level the ACOG region is meeting its Safety and Security goals. Data for evaluating the Safety and Security of the ACOG CMP network is readily available from ODOT's crash data and statistics website.[5]

Tier 1 Performance Measures

- Number of Crashes by Severity for Vehicle Crashes, Vehicle-Bicycle Crashes, and Vehicle-Pedestrian Crashes
    - Crash information by severity can be found through the Oklahoma DOT's data and statistics website. Information relating to fatalities can be found through the FARS system if not readily available from ODOT.
- Fatality and Serious Injury Crash Rate per 100M VMT
    - Fatality and serious injury rates can be calculated for specific segments of the CMP network based upon the information collected from ODOT and FARS.

Tier 2 Performance Measure

- Response and/or Incident Clearance Time
    - The length of time that it takes for first police, fire, and/or tow operators to respond to an incident or the duration of an incident from the time the incident begins to the time in which normal conditions are restored to the system.

Table 2.7 – Tier 1 Performance Measurements for Safety & Security Goal

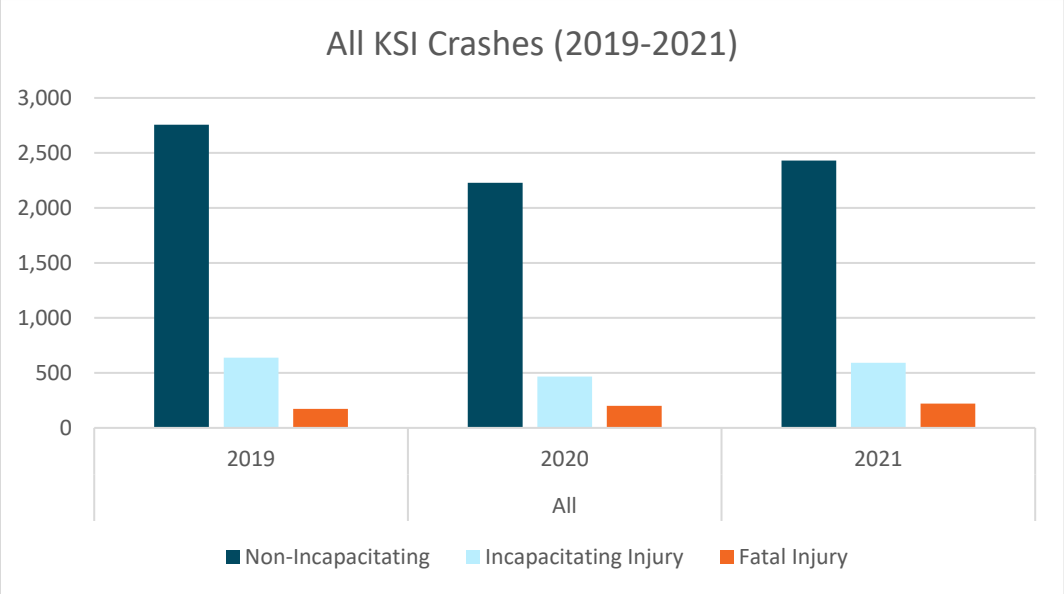
Goal Area/Performance Measure	Calculation Method	2016 Results	Current Results	Data Source
Number of Crashes by Severity for Vehicle Crashes, Vehicle-Bicycle Crashes, and Vehicle-Pedestrian Crashes	ODOT Data	Varies	Table 2.8	ODOT Crash Data Website, FARS
Fatality and Serious Injury Crash Rate per 1M VMT	Formula Based for Segments or Intersections	Location specific Intersection formula: Rate = (#of Fatal and Serious Injury Crashes x 1,000,000)/(ADT x 365) Segment formula: Rate = (# of Fatal and Serious Injury Crashes x 1,000,000)/(Length of segment in miles x ADT x 365)		ODOT Crash Data Website, FARS

[5] https://oklahoma.gov/highwaysafety/data/current-crash-data.html

Table 2.8 summarizes the number of non-incapacitating, incapacitating, and fatal injury crashes by severity in the ACOG MPO TMA from 2019 to 2021. The severity levels follow the traditional "KABCO" scale developed by the National Safety Council (NSC) including the fatal injury (K), incapacitating injury (A), non-incapacitating (B), while not including the possible injury (C) and property damage only (O).

Table 2.8 – Number of Crashes in the ACOG MPO TMA by Severity Level (2019-2021)

Collision Type	Recent Years	Non-Incapacitating	Incapacitating Injury	Fatal Injury	Total Crashes	Past Years	Total Crashes
All	2019	2,756	638	173	3,567	2012	3,623
	2020	2,228	467	201	2,896	2013	3,520
	2021	2,431	592	221	3,244	2014	3,336
Pedestrian	2019	105	66	29	200	2012	179
	2020	72	63	38	173	2013	151
	2021	102	73	40	215	2014	135
Bicycle	2019	67	24	6	97	2012	125
	2020	43	14	4	61	2013	74
	2021	40	13	5	58	2014	135



7. SYSTEM PRESERVATION

System Preservation is a critical component of this congestion management process, focusing on maintaining and improving the existing infrastructure to ensure its safety, reliability, and longevity. Together, the following measures provide a comprehensive view of the system's current state, guiding effective maintenance and investment strategies to support long-term preservation goals.

Tier 1 Performance Measures

- Percent of Roadways Above PCI 70 (currently only have ODOT data)
  - The amount of roadways with a Pavement Condition Index score of 70 or above. These roadways are in poor condition or worse.
- Number of Bridges with Poor Sufficiency Rating
  - The number of bridges in the region with sufficiency ratings below 50 and between 50-81. These cut off points correspond to the ACOG STBG project scoring, and based on data available from ODOT's Open Data GIS database.

Tier 2 Performance Measures

- Percent of Sidewalks Above PCI 70
  - Percentage of sidewalks in disrepair or poor conditions. Presences of heaved or significant vertical displacement between panels.
- Percent of Trails Above PCI 70
  - Percentage of trails in disrepair or poor conditions. Presences of heaved or significant vertical displacement between panels.
- Percent of updated signal timings.
  - Percentage of intersection Signals that Have Had Timing Reviewed in the Past 3 Years.
- Truck Route Adherence
  - Percentage of thru truck traffic that does not utilize/follow identified truck routes.

Table 2.9 – Tier 1 Performance Measurements for System Preservation Goal

Goal Area/Performance Measure	Calculation Method	Current Results	Data Source
Percent of Roadways Above PCI 70	GIS Tabulation	*Awaiting Data*	-
Number of Bridges with Poor Sufficiency Rating	Below 50	On System: 131 Off System: 516	ODOT GIS[6]
	50-81	On System: 326 Off System: 584	

[6] https://okdot.maps.arcgis.com/apps/webappviewer/index.html?id=6555de44b6314ab2a71bb0620e52ea78

3. Implementing Multimodal Performance Measures

Implementing multimodal performance measures is essential for advancing a data-driven and equitable approach to congestion management in the ACOG region. Regular analysis and accessible reporting, such as dashboards and infographics, empower decision-makers and the public to track progress, identify trends, and prioritize investments that enhance mobility, accessibility, and sustainability across the region.

Data Collection and Management

Robust multimodal performance measurement relies on high-quality data. Agencies should invest in automated counters, sensor networks, mobile data, and integrated data management platforms. GIS mapping enables spatial analysis of congestion, accessibility, and equity.

Analysis and Reporting

Performance measures should be analyzed regularly and reported in accessible formats. Dashboards, maps, and infographics help decision-makers and the public understand congestion issues and progress. Comparative analysis between corridors and time periods is valuable for trend identification.

Integration with Strategy Development

Multimodal performance data informs CMP strategy selection. Agencies can prioritize projects to improve throughput, accessibility, safety, and environmental outcomes across all modes. Scenario modeling and performance forecasting support decision-making.

Continuous Improvement

The CMP should be a living process, with performance measures guiding strategy updates and investments. Agencies must review measures periodically, adapt to emerging technologies (such as micro-mobility and autonomous vehicles), and respond to shifting travel patterns.

Continuous improvement is at the heart of effective multimodal performance measurement. As travel patterns shift and new technologies emerge, agencies must periodically review and adapt their performance measures to ensure relevance and accuracy. By integrating these measures into strategy development and investment decisions, the Congestion Management Process remains a dynamic tool—guiding the region toward more efficient, equitable, and resilient transportation solutions that respond to evolving community needs.

4. Challenges and Considerations

While multimodal performance measurement offers significant benefits, its implementation is not without challenges. Key considerations agencies must address, include the need for robust interagency coordination, resource constraints, meaningful community engagement, and the integration of technological advancements. Successful multimodal measurements depend on clear data-sharing protocols, common performance definitions, and a commitment to reflecting community values in both priorities and outcomes.

Interagency Coordination

Multimodal performance measurement requires collaboration across transportation, planning, transit, and public works agencies. Clear data sharing protocols and common performance definitions are key.

Resource Constraints

Comprehensive data collection and analysis can be resource-intensive. Agencies may need to phase in measures, prioritize high-impact corridors, and leverage technology for efficiency.

Community Engagement

Performance measures should reflect community values and goals. Agencies must engage residents, businesses, and advocacy groups in defining priorities and evaluating outcomes.

Technological Advancements

Emerging technologies—such as connected vehicles, real-time transit information, and crowdsourced reporting—offer new opportunities to enhance multimodal performance measurement.

Navigating these challenges requires flexibility, collaboration, and innovation. Agencies must strategically phase in new measures, leverage technology to maximize efficiency, and foster ongoing dialogue with stakeholders to ensure that performance metrics remain aligned with regional goals. By proactively addressing resource limitations and embracing emerging tools, the region can build a more responsive and inclusive congestion management framework—one that supports continuous progress toward safer, healthier, and more connected communities.

5. Congestion Management Problems & Needs

Chapter 5 presents the analysis of congestion problems and needs of the CMP Focus Corridors. The analysis utilizes streetlight segment level data and aggregates the congestion metrics up to corridor levels. Three methodologies show a range of potential congestion characteristics for different corridors.

1. Corridor Average Congestion
2. Corridor Peak Hour Congestion
3. Peak Hour Weighted Congestion

Based on the analysis, the 5pm-6pm hour was the highest peak congestion time throughout the region, particularly on roadways with regional significance. The CMP Focus Corridors were categorized in two buckets, Freeways (F) and Arterials (A). This categorization will play a role in approaches to solutions and helps better define the types of congestion experienced on different roadways.

Methodologies

METHODOLOGY 1 - CORRIDOR AVERAGE CONGESTION

This methodology focuses on congestion on the corridor across an average weekday, giving value to minor congestion seen on non-peak hours.

1. Average Severity of Congestion:
    a. For each corridor, the average of Congestion (1 - Free Flow Factor) across all hourly columns is calculated.
        i. This reflects how severe the congestion is, with higher values indicating more severe congestion.
2. Worst Severity of Congestion:
    a. For each corridor, the average of (1 - congestion value) across all hourly columns is calculated.
        i. This reflects how severe the congestion is, with higher values indicating more severe congestion.
3. Longevity of Congestion:
    a. For each corridor, the number of hours where Free Flow Factor is < 0.85 (Congestion > 0.15) is counted.
        i. This indicates how long the corridor experiences significant congestion.
4. Normalization:
    a. The two severity and one longevity scores is normalized to a 0-1 scale using MinMaxScaler for comparability.
5. Composite Rank:
    a. The final rank is the average of the 3 normalized severity and longevity scores.
        i. Higher composite rank values indicate corridors with more severe and prolonged congestion.

Corridor Average Impact Results

This graph shows the distribution of average corridor congestion on each corridor across each hour of the day.
The darker red indicates higher congestion. Free Flow Factors greater than 0.85 are not shown on this graphic.
The graph highlights 5-6pm is the heaviest congestion hour for most corridors, and it is the hour with the most congested corridors.

Figure 3: Methodology 1 - Corridor Average Results

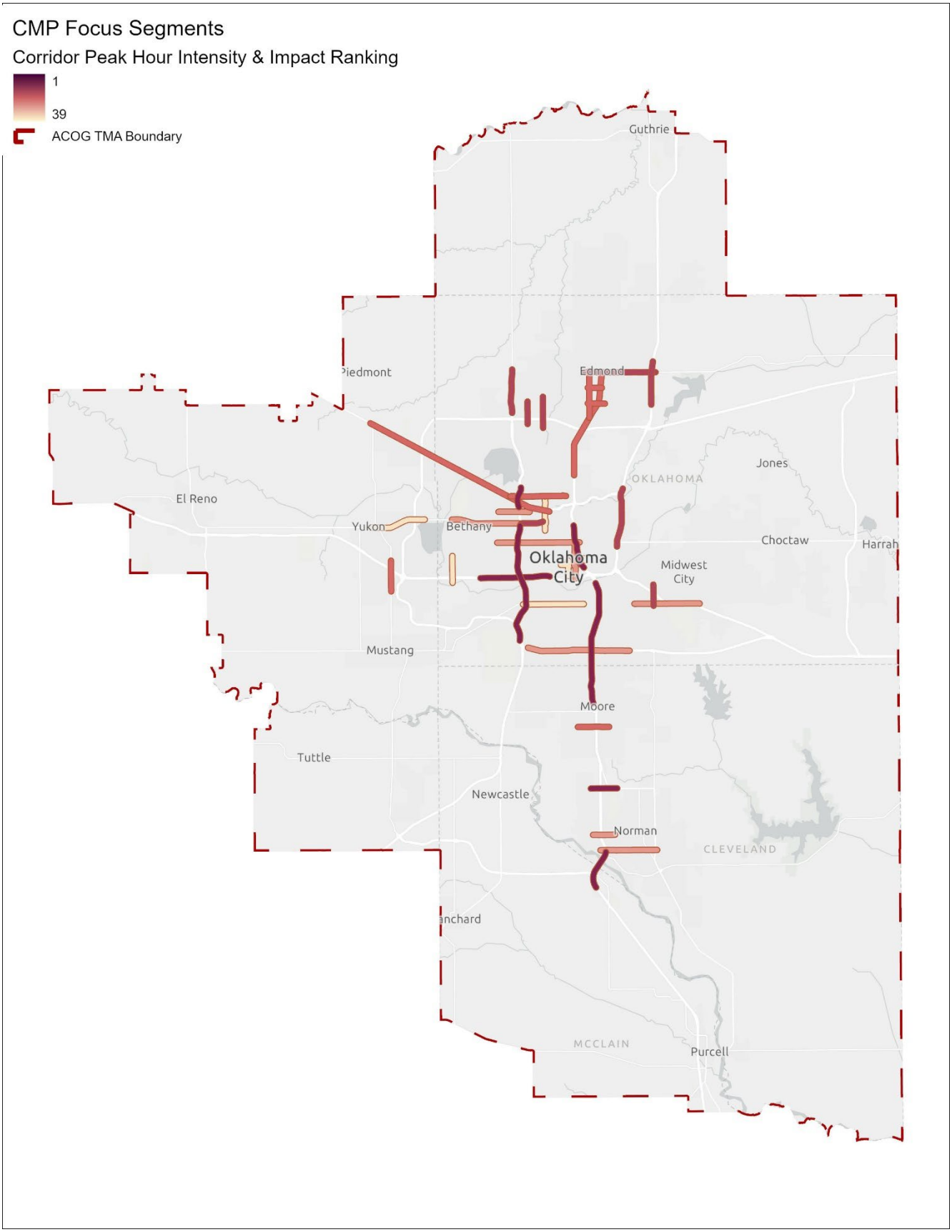
Corridor ID	Corridor Name	Corridor Type	Ranking	12am-1am	1am-2am	2am-3am	3am-4am	4am-5am	5am-6am	6am-7am	7am-8am	8am-9am	9am-10am	10am-11am	11am-noon	noon-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	6pm-7pm	7pm-8pm	8pm-9pm	9pm-10pm	10pm-11pm	11pm-12am
32	NW 4th/Harrison Ave	A	1							0.83	0.75	0.74	0.76	0.75	0.74	0.73	0.74	0.74	0.72	0.67	0.68	0.77	0.78	0.79	0.80	0.81	
19	Oklahoma City Blvd	A	2	0.64							0.84	0.84	0.83	0.83	0.81	0.78	0.78	0.80	0.79	0.77	0.73	0.72	0.77	0.79	0.72	0.77	
31	Walker Ave	A	3	0.83						0.84	0.74	0.77	0.77	0.75	0.75	0.74	0.71	0.73	0.76	0.75	0.74	0.75	0.76	0.81	0.80	0.77	
41	Sooner Rd	A	4								0.81	0.80	0.80	0.79	0.75	0.73	0.75	0.75	0.73	0.69	0.68	0.74	0.78	0.81	0.84		
5	Tecumseh Rd	A	5							0.83	0.74	0.73	0.76	0.76	0.74	0.73	0.75	0.73	0.71	0.71	0.70	0.76	0.81	0.83			
10	NW 50th St	A	6								0.81	0.79	0.80	0.79	0.78	0.77	0.78	0.77	0.74	0.74	0.73	0.77	0.80	0.82	0.84		
12	15th Street	A	7								0.79	0.77	0.80	0.80	0.78	0.75	0.77	0.77	0.74	0.73	0.70	0.80	0.84				
14	SW 29th St	A	8								0.82	0.80	0.82	0.83	0.81	0.81	0.81	0.80	0.77	0.73	0.74	0.77	0.80	0.83			
6	SE 29th St	A	9								0.84	0.83	0.83	0.82	0.78	0.76	0.78	0.78	0.75	0.75	0.75	0.78	0.81	0.84			
25	N May Ave	A	10									0.84			0.79	0.76	0.79	0.80	0.79	0.76	0.71	0.77	0.81				
22	W Main St	A	11									0.82	0.83	0.80	0.78	0.76	0.77	0.77	0.75	0.76	0.75	0.79	0.82	0.83			
28	N Portland Ave	A	12								0.77	0.78	0.82	0.83	0.83	0.83	0.83	0.82	0.79	0.76	0.72	0.80					
27	Shields Blvd	A	13	0.84								0.83	0.84	0.84	0.83	0.81	0.82	0.84	0.84	0.79	0.78	0.81	0.84	0.84	0.84		
30	NW 23rd St	A	14								0.84	0.80			0.82	0.79	0.80	0.80	0.75	0.76	0.76	0.79	0.82	0.83			
33	S Kelly Ave	A	15								0.84	0.81	0.83	0.82	0.80	0.79	0.80	0.80	0.79	0.77	0.74	0.82					
4	Pennsylvania	A	16											0.84	0.82	0.79	0.80	0.81	0.80	0.78	0.76	0.78	0.81	0.82			
24	NW 63rd	A	17								0.84	0.84			0.80	0.79	0.80	0.81	0.81	0.78	0.75	0.83					
38	SW 19th St	A	18										0.84	0.84	0.82	0.79	0.81	0.82	0.80	0.77	0.76	0.79	0.83	0.84			
26	W 33rd St	A	19									0.84	0.84	0.84	0.79	0.75	0.78	0.79	0.78	0.77	0.75	0.82					
23	NE 10th St	A	20										0.84	0.83	0.82	0.81	0.82	0.82	0.81	0.75	0.76						
18	E 2nd St	A	21									0.84			0.83	0.81	0.82	0.81	0.78	0.79	0.76	0.81	0.84				
40	I-35 - OKC to Moore	F	22								0.81	0.80							0.81	0.68	0.65						
9	I-44	F	23								0.80	0.81							0.81	0.71	0.65						
20	Lindsey St	A	24															0.84	0.82	0.81	0.80	0.82	0.84	0.83			
34	NW Expressway	A	25												0.84	0.83	0.84	0.84	0.83	0.82	0.79	0.83	0.84				
39	E Main/Hwy 66	A	26								0.83					0.84	0.84	0.83	0.82	0.82	0.80	0.83					
11	S Mustang Rd	A	27								0.81	0.84							0.84	0.81	0.78	0.83					
7	I-235	F	28																0.84	0.70	0.69						
2	I-40	F	29																	0.75	0.71						
35	Pennsylvania Ave - Central	A	30																0.83	0.82	0.81	0.84					
15	NW 39th	A	31									0.84							0.84	0.84	0.82						
8	S Council Rd	A	32																0.84	0.82	0.81						
36	I-35 Central	F	33																	0.81	0.77						
1	Hwy 77/Broadway Ext	A	34																		0.83						
17	I-44 - SH74 Thru Youngs Blvd	F	35																	0.84	0.78						
37	I-240	F	36																								
3	74/Lake Hefner Pkwy	A	37																		0.79						
21	I-35 South	F	38																		0.79						
16	I-35 North	F	39																		0.80						

METHODOLOGY 2 - CORRIDOR PEAK HOUR CONGESTION

This analysis focuses on the entire corridor average values in the peak hour. The average Free Flow Factors and corridor volumes are utilized, without accounting for the length of the corridor.

1. Severity of Congestion:
    a. For each corridor, the congestion is calculated (1- Free Flow Factor).
        i. This reflects how severe the congestion is, with higher values indicating more severe congestion.
2. Intensity/Impact of Congestion:
    a. For each corridor, multiply the Severity by the Average Daily Traffic experienced in that corridor.
        i. This indicates how impactful the Severity of congestion is for the full corridor.

Figure 4: Methodology 2 – Results Peak Hour Congestion



METHODOLOGY 3 - PEAK HOUR WEIGHTED CONGESTION

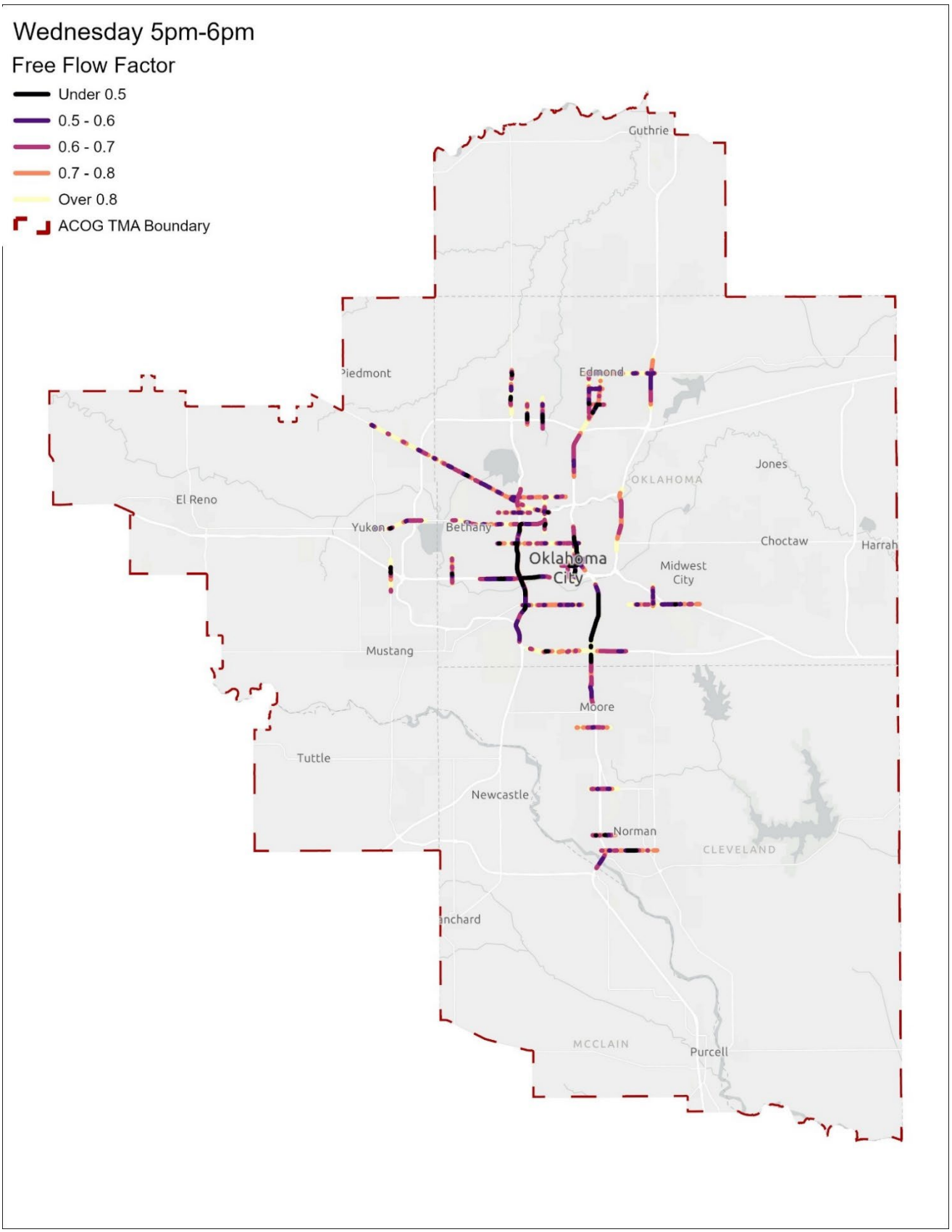
Methodology 3 analysis leverages the higher fidelity and variability of segments reported from streetlight which make up a CMP Focus Corridor. This more intensive analysis accounts for the differences in congestion metrics, volumes, and segment lengths before summing to the corridor level.

1. Severity of Congestion:
    a. For each segment, the congestion is calculated (1 - Free Flow Factor).
        i. This reflects how severe the congestion is, with higher values indicating more severe congestion.
2. Portion of the Corridor
    a. Determine what percentage each segment represents for the entire corridor
        i. The total length of the corridor is calculated as the summation of the segment lengths.
3. Impact of Congestion:
    a. For each segment, multiply the Congestion Severity by the Average Daily Traffic experienced by that segment.
        i. This indicates how many people are experiencing the Severity of congestion in the segment.
4. Segment Level Weighted Congestion Impact
    a. For each corridor, sum the Congestion Impact across all segments in that corridor.
        i. This indicates how impactful the Severity of congestion is for the full corridor.

Figure 5: Methodology 3 - Segment Level Peak Hour Intensity and Impact Ranking

Corridor ID	Corridor Name	Type	Ranking	5pm Average Daily Segment Traffic	Congestion Severity	Segment level volume weighted congestion
2	I-44	F	1	4,165	0.348	1400.7
8	I-235	F	2	4,335	0.307	1287.8
7	I-35 - OKC to Moore	F	3	3,884	0.350	1241.3
1	I-40	F	4	3,857	0.290	1190.6
3	74/Lake Hefner Pkwy	F	5	4,128	0.205	879.3
16	I-35 Central	F	6	2,466	0.229	559.6
21	I-35 South	F	7	2,694	0.211	541.0
41	Tecumseh Rd	A	8	2,005	0.300	541.0
17	I-35 North	F	9	2,861	0.198	540.2
15	Hwy 77/Broadway Ext	A	10	2,137	0.173	534.1
37	I-44 - SH74 Thru Youngs Blvd	F	11	2,484	0.222	516.9
5	Sooner Rd	A	12	1,611	0.318	499.0
30	N May Ave	A	13	1,760	0.291	449.8
28	N Portland Ave	F	14	1,725	0.278	433.2
23	E 2nd St	A	15	1,826	0.244	418.2
24	S Kelly Ave	A	16	1,501	0.262	407.0
26	W 33rd St	A	17	1,612	0.254	398.4
25	15th Street	A	18	1,338	0.299	387.9
33	SW 19th St	A	19	1,638	0.237	385.8
38	NW 63rd	A	20	1,572	0.253	383.4
9	NW Expressway	A	21	1,811	0.211	378.5
27	Pennsylvania	A	22	1,864	0.241	342.7
34	S Mustang Rd	A	23	1,777	0.219	341.3
36	I-240	F	24	1,873	0.153	334.3
22	W Main St	A	25	1,214	0.253	301.8
10	NW 50th St	A	26	1,151	0.274	262.3
6	SE 29th St	A	27	1,128	0.254	259.5
4	NW 23rd St	A	28	1,087	0.242	256.8
40	Lindsey St	A	29	1,217	0.200	253.9
13	Shields Blvd	A	30	1,123	0.224	239.5
35	S Council Rd	A	31	1,268	0.188	237.0
11	NW 39th	A	32	1,325	0.180	214.2
20	E Main/Hwy 66	A	33	1,068	0.205	197.8
14	SW 29th St	A	34	773	0.257	193.8
18	NE 10th St	A	35	581	0.244	178.9
32	NW 4th/Harrison Ave	A	36	520	0.322	176.8
39	Pennsylvania Ave - Central	A	37	942	0.191	174.1
19	Walker Ave	A	38	569	0.265	151.4
31	Oklahoma City Blvd	A	39	555	0.267	120.0

Figure 6: Methodology 3 - Segment Level Peak Hour Intensity Map



Summary Analysis

Olsson recommends Methodology 1 and Methodology 3 for congestion analysis because each provides unique and complementary insights into corridor performance. Methodology 1, Corridor Average Congestion Ranking, evaluates the severity and longevity of congestion across all hours of a typical weekday. By averaging congestion metrics over time, this approach captures not only peak-hour bottlenecks but also persistent, lower-level congestion that can impact overall mobility. It normalizes severity and duration scores, allowing for a composite ranking that highlights corridors with both acute and chronic congestion issues. This broader perspective is valuable for identifying corridors that may not have the worst peak-hour congestion but still experience significant delays throughout the day.

Methodology 3, Peak Hour Weighted Congestion, offers a more granular and intensive analysis by leveraging segment-level data. It accounts for differences in congestion, traffic volumes, and segment lengths, then aggregates these impacts to the corridor level. This method is particularly effective at pinpointing where most people are affected by severe congestion during the highest demand periods. By weighting congestion by both severity and the number of travelers affected, it provides a robust measure of the true impact on users, ensuring that high-volume segments receive appropriate attention in planning and investment decisions.

Together, these methodologies provide a comprehensive understanding of congestion patterns. Methodology 1 ensures that persistent, off-peak congestion is not overlooked, while Methodology 3 focuses resources on the most critical peak-hour problems. This dual approach supports more effective prioritization of strategies and investments, helping agencies address both daily operational challenges and acute congestion hotspots for a more efficient and equitable transportation system. **Figure 7** summarizes the three methodologies.

Figure 7: Final CMP Focus Corridor Rankings

Corridor ID	Corridor Name	Type	Methodology 1 Corridor Average Impact	Methodology 2 Corridor Peak Hour Congestion	Methodology 3 Weighted Peak Hour Congestion
2	I-44	F	23	1	1
8	I-235	F	28	3	2
7	I-35 - OKC to Moore	F	22	2	3
1	I-40	F	29	4	4
3	74/Lake Hefner Pkwy	F	37	5	5
16	I-35 North	F	39	9	6
21	I-35 South	F	38	7	7
41	Tecumseh Rd	A	5	6	8
17	I-35 Central	F	33	8	9
15	Hwy 77/Broadway Ext	A	34	23	10
37	I-44 - SH74 Thru Youngs Blvd	F	35	10	11
5	Sooner Rd	A	4	12	12
30	N May Ave	A	10	11	13
28	N Portland Ave	F	12	13	14
23	E 2nd St	A	21	15	15
24	S Kelly Ave	A	15	19	16
26	W 33rd St	A	19	16	17
25	15th Street	A	7	17	18
33	SW 19th St	A	18	21	19
38	NW 63rd	A	17	18	20
9	NW Expressway	A	25	22	21
27	Pennsylvania	A	16	14	22
34	S Mustang Rd	A	27	20	23
36	I-240	F	36	26	24
22	W Main St	A	11	25	25
10	NW 50th St	A	6	24	26
6	SE 29th St	A	9	27	27
4	NW 23rd St	A	14	28	28
40	Lindsey St	A	24	30	29
12	Shields Blvd	A	13	29	30
35	S Council Rd	A	32	32	31
11	NW 39th	A	31	31	32
20	E Main/Hwy 66	A	26	33	33
14	SW 29th St	A	8	34	34
18	NE 10th St	A	20	39	35
32	NW 4th/Harrison Ave	A	1	36	36
39	Pennsylvania Ave - Central	A	30	35	37
19	Walker Ave	A	3	37	38
31	Oklahoma City Blvd	A	2	38	39

6. Next Steps

The next steps for the CMP include the creation of CMP strategies, toolbox, and matrix. This will include strategies for the two priority methodologies discussed within this report. Technical Memorandum 4 will be the next deliverable.