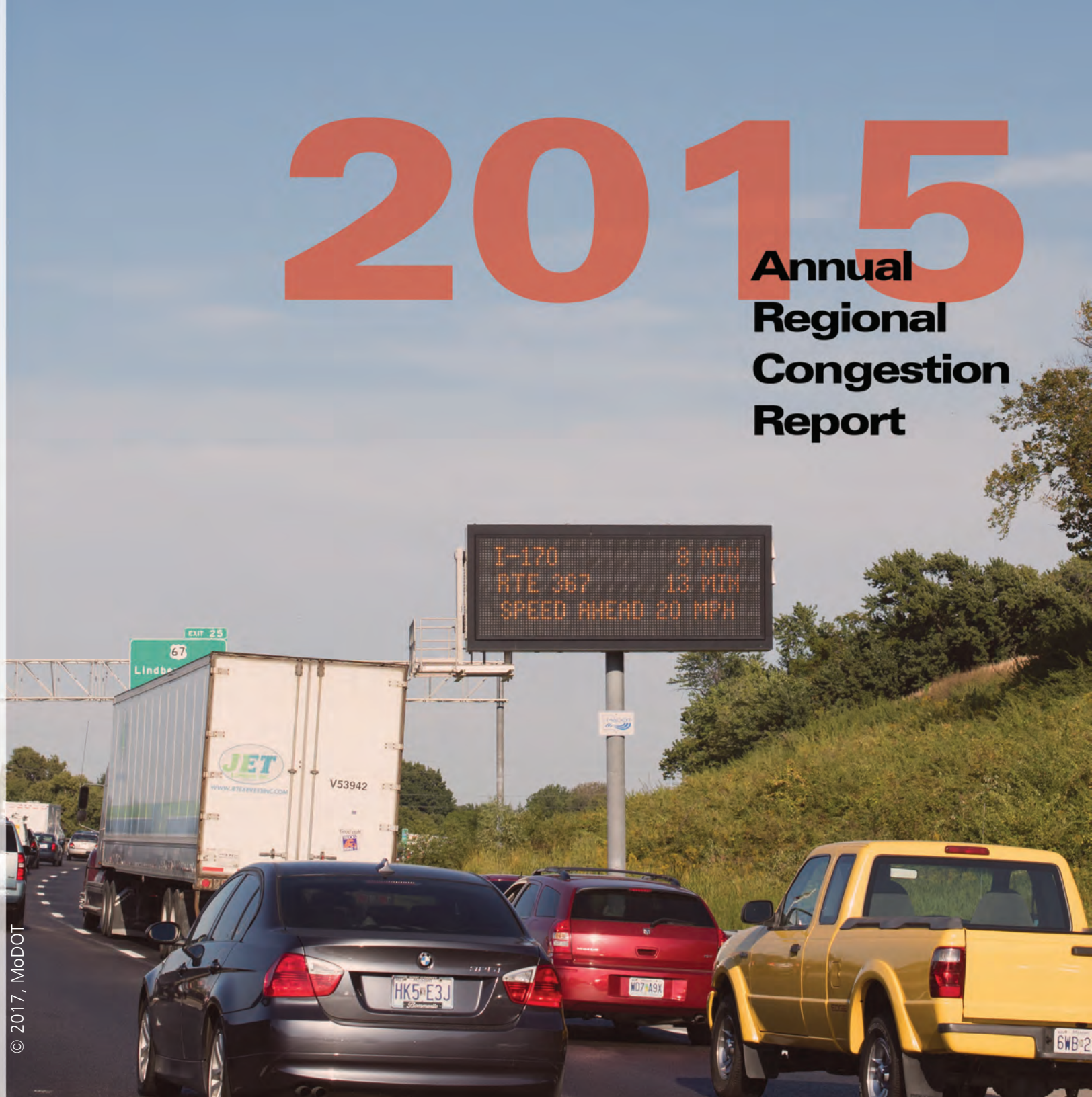
2015 Annual Regional Congestion Report



EAST-WEST GATEWAY
Council of Governments
Creating Solutions Across Jurisdictional Boundaries

St. Louis Metropolitan Area

May 2017

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2015 Annual Regional Congestion Report

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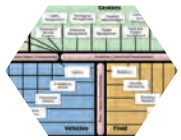
Contents



1

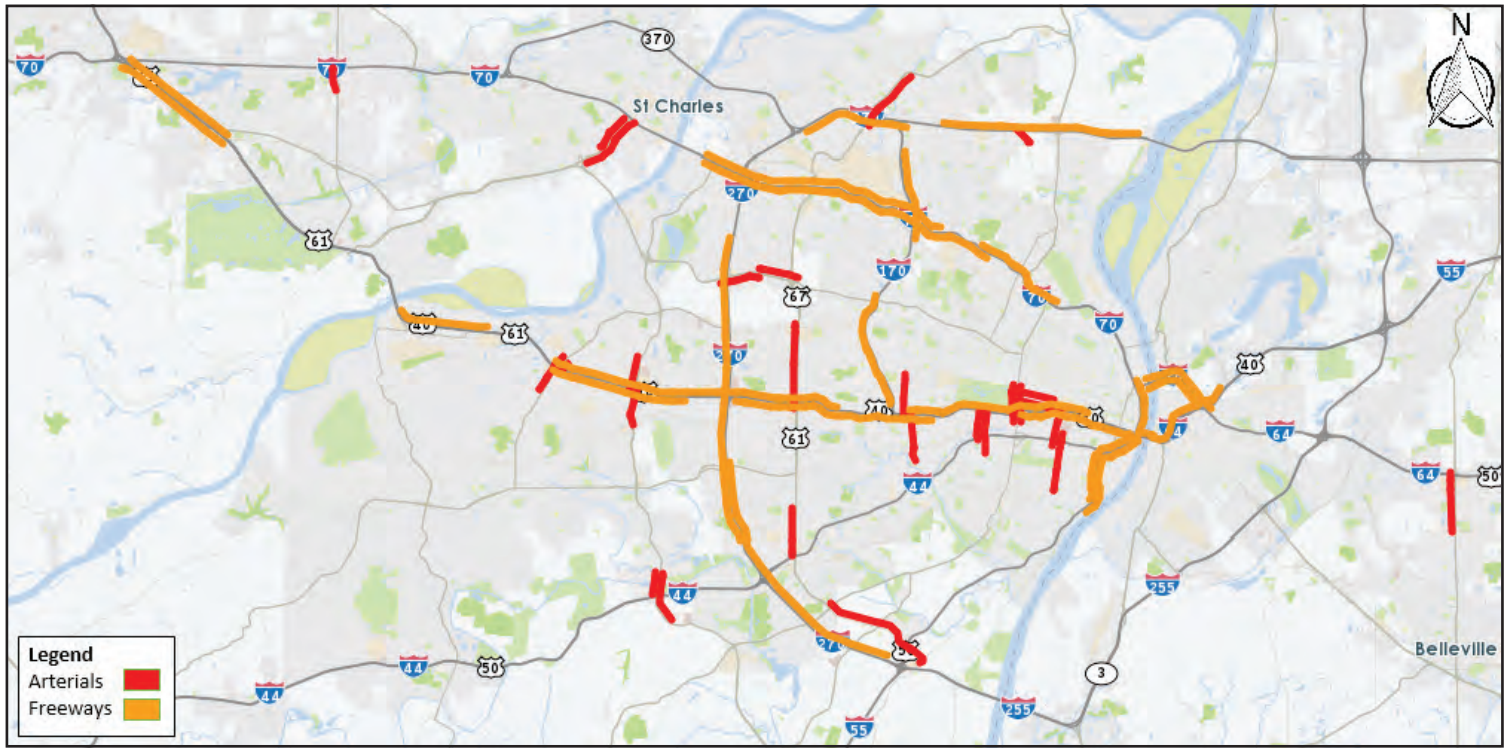
Introduction

The regional Congestion Management Process (CMP) is a systematic and regionally-accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assesses alternative operational and demand management strategies for congestion mitigation. A CMP is required by federal legislation in metropolitan areas with population exceeding 200,000, such as the St. Louis region.

The St. Louis Regional CMP was developed and implemented as an integral part of the metropolitan planning process, and was completed and approved by the East-West Gateway Council of Governments (EWG) Board in July 2013. The CMP includes a provision that "EWG will publish an annual report on regional congestion, mitigation efforts and evaluation results." This document constitutes the 2015 St. Louis Annual Regional Congestion Report.

The purpose of this report is to provide a snapshot of mobility and congestion in the St. Louis Metropolitan region in 2015. Figure 1 shows the regional CMP network of highways and arterials used for this report. Because this is the initial CMP report, the primary focus has been identifying data sources to assess and compare regional congestion and devising methods to analyze this data to identify the location, extent and severity of congestion. The report also includes mobility highlights from major regional transportation management and operations partners that provide descriptions of and, in some cases, results from congestion management projects and activities that took place in 2015.

Figure 1: Congested Locations on the Regional CMP Network



Source: Regional Integrated Transportation Information System (RITIS)

Data Sources

Two sources provided region-wide data used to evaluate congestion on the region's highway transportation system. They are the National Performance Management Research Data Set (NPMRDS) and the HERE data set.
The Federal Highway

Administration (FHWA) acquired the NPMRDS, which is a vehicle probe-based data set of average travel times, for its performance measurement requirements. This data set is made available to states and Metropolitan Planning Organizations (MPOs) to use for their performance management activities. It provides region-wide travel times on the National Highway System and enables EWG to compare congestion regionally using travel times from a common data source. The data are downloaded in raw form on a monthly basis.

HERE is a private vendor that provides mapping data and related services to individuals and companies. MoDOT has contracted with HERE for access to their data and the use of the Regional Integrated Transportation Information System (RITIS). RITIS is an automated data sharing, dissemination, and archiving system that includes many performance measures, dashboard, and visual analytics tools housed at the University of Maryland. MoDOT's contract provides the same access to Missouri MPOs, which gives EWG the ability to analyze the HERE data set for the entire eight-county region. The HERE data is a richer data set with more data sources and computation tools that smooth the data and provide a more accurate and real time data set.

Data Analysis

Regional congestion maps were developed using the NPMRDS. Because this data set is delivered as raw data, outlier data points were eliminated before creating the maps. Congestion is measured using the "travel speed index," which is defined as the ratio of the monthly average speed for weekdays between 6 and 9 a.m. for the morning peak (AM) period and 3 to 6 p.m. for evening peak (PM) period, to the free-flow speed. The free-flow speed is calculated as the 85th percentile of all the speeds during a particular month, which serves as a reasonable proxy for free-flow speed. Congestion thresholds for the freeway/Interstate maps and the NHS arterials are depicted as *severe, heavy, moderate* and *light,* with corresponding colors denoting the differences.

Each month has two sets of maps, with a set consisting of AM peak and PM peak maps. One set depicts congestion on regional freeways and a second set shows congestion on arterials. The congestion thresholds for the maps were developed in consultation with the St. Louis Regional Congestion Management and Operations Committee, which is led by EWG and consists of representatives of jurisdictions and organizations that manage and operate transportation systems in the region. The selected thresholds are identified on each map. The purpose of the congestion maps is to identify locations that experience the highest levels of congestion. The use of the NPMRDS travel-time data set and HERE data sets enable an examination of congestion using common data sets, which results in a valid comparison of congestion on the region's highways and roads. The accuracy of the data has been shown to vary based on the operating characteristics of different types of roadways.

Nevertheless, since the levels of congestion are evaluated using common sets of data, the result is a reasonable comparison of relative levels of congestion in the region.

EWG met with representatives of each individual regional stakeholder to get feedback on the congestion the NPMRDS maps showed in their respective jurisdiction. Using the maps, feedback from the stakeholders, and analysis tools in RITIS, a list of roadway segments was selected for further, more specific analysis.

Performance measure values were calculated for these locations based on HERE data using RITIS. Buffer time, Buffer Time Index, planning time, Planning Time Index, average speed, travel time, and Travel Time Index were calculated for each congested segment for the three hour peak period, (6-9 AM or 3-6 PM). In addition, congestion maps were developed based on HERE data that depict an entire year's worth of data in a single map. The results of the data analysis are displayed in the following tables and figures.

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2

Regional Congestion Maps

As part of the Annual CMP Report, regional congestion measurement maps were developed for the eight-county St. Louis region. The congestion maps utilize NPMRDS and HERE data for 2015.

NPMRDS Maps

The NPMRDS data set was used to compute regional congestion on a monthly basis. These maps depict levels of congestion using speed indices which were based on average travel times reported every five minutes (NPMRDS) for the region's freeways, Interstates, and National Highway System (NHS) designated principal arterials.

Hourly congestion for each peak period was averaged to arrive at the peak hour congestion.

The Speed Index is the ratio of average speed to 85th percentile speed. NPMRDS data was used to depict the regional speed index distribution. A typical set of the monthly congestion maps developed, based on this definition, is shown in Figures 2 through 5. The entire set is included in the appendix. These maps can also be accessed on the EWG website under *The Congestion Management Process* (CMP).

Figure 2: Sample AM Peak Congestion Map

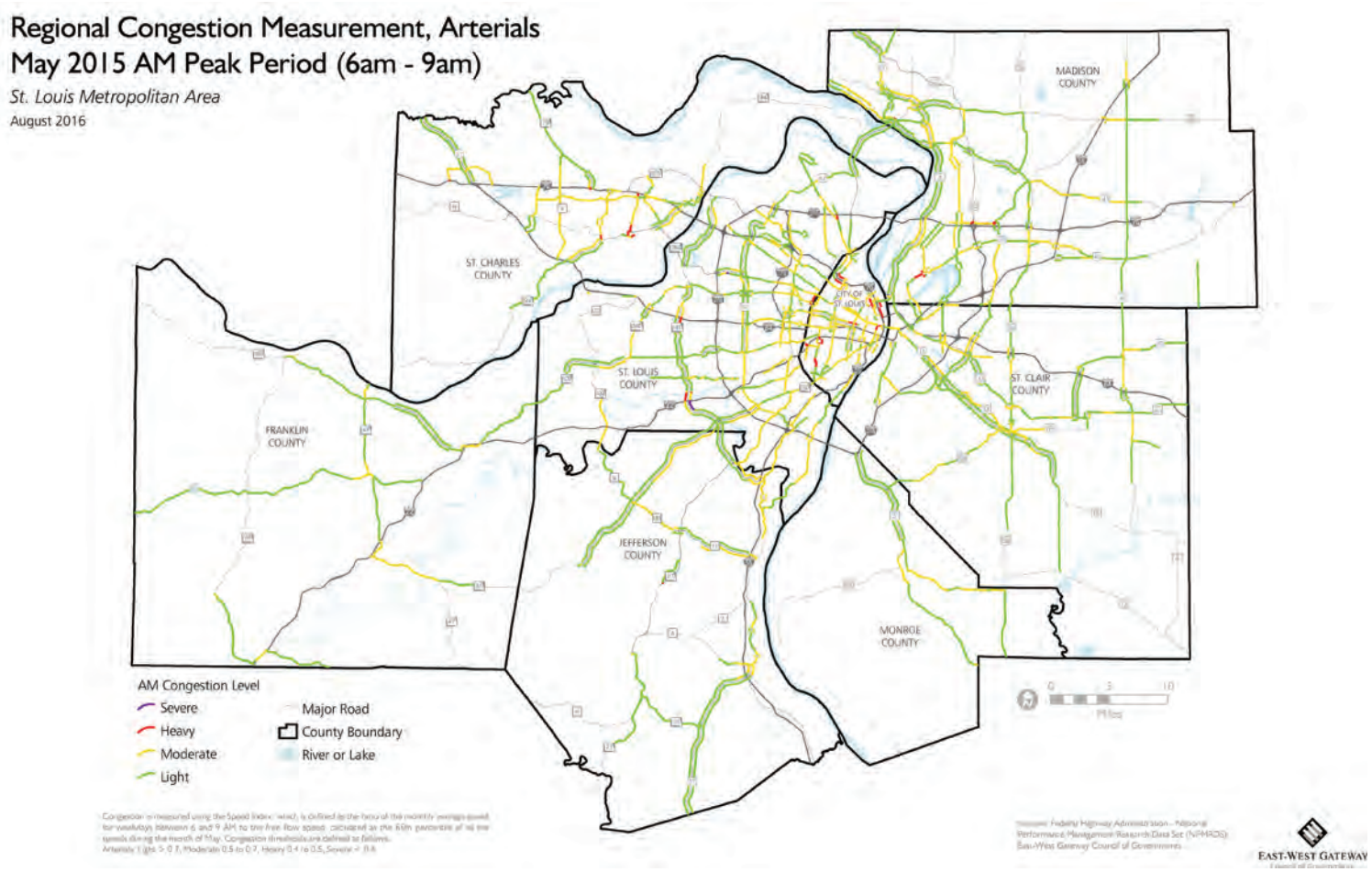


Figure 3: Sample PM Peak Congestion Map

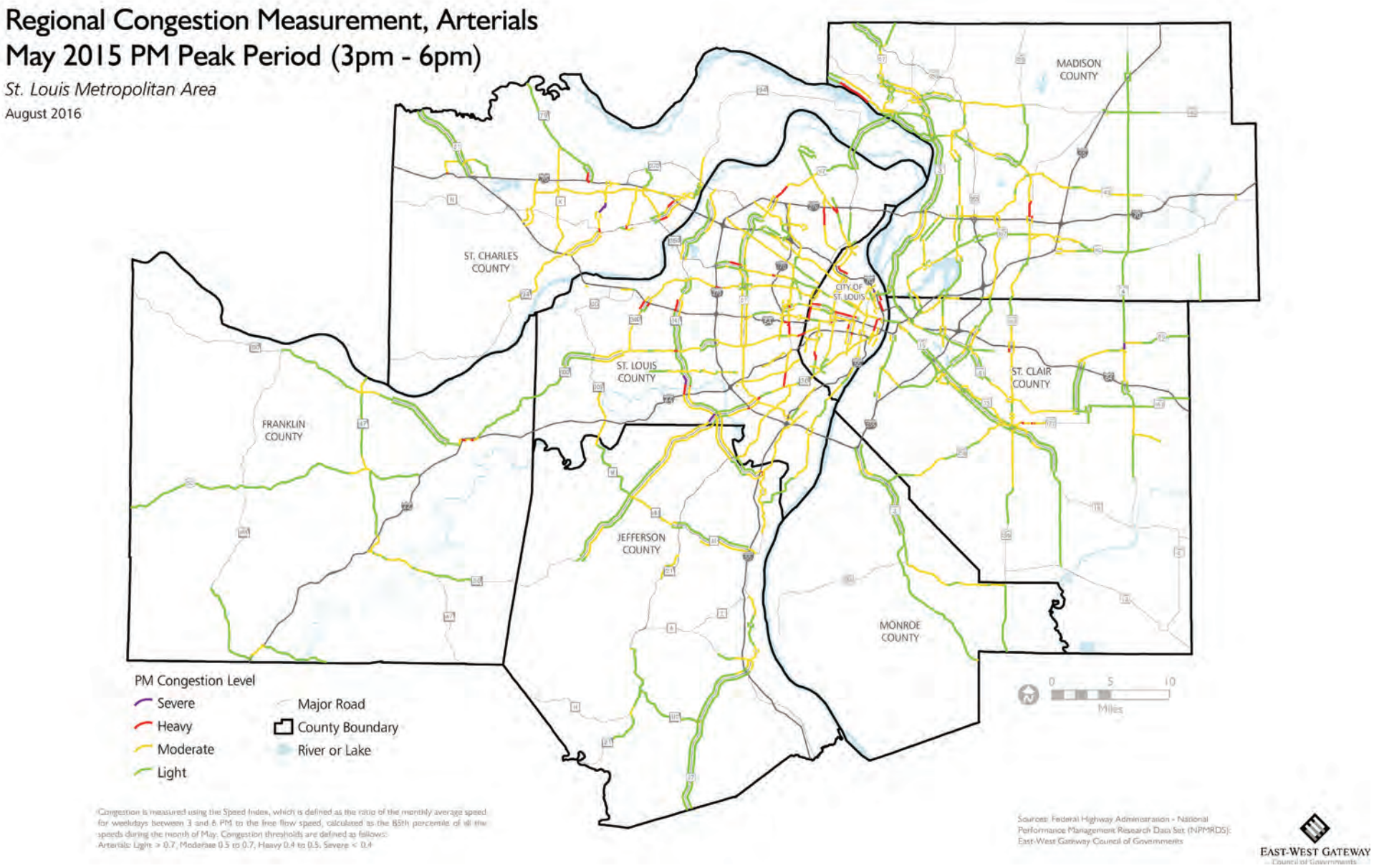


Figure 4: Sample AM Peak Congestion Map

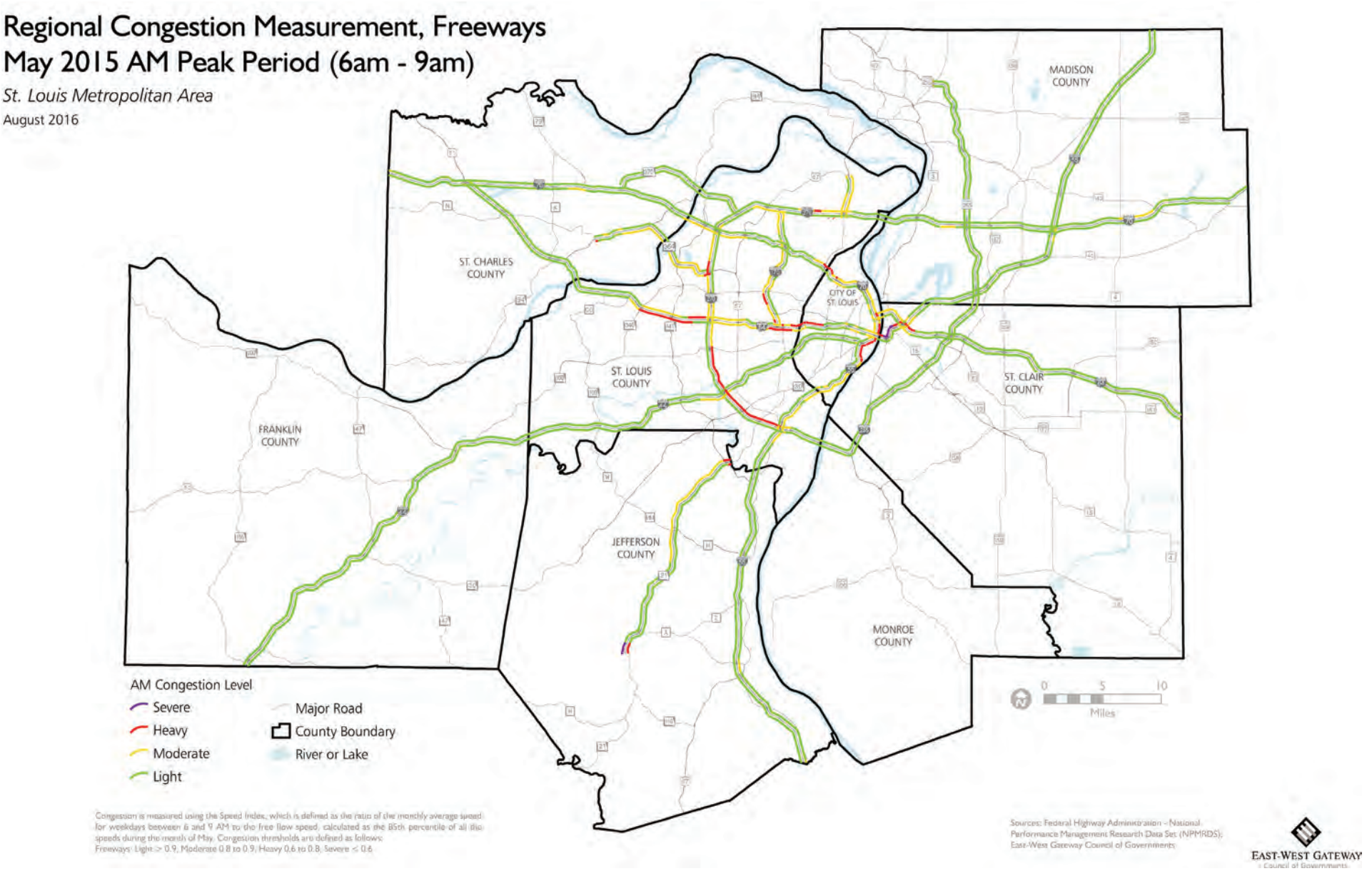
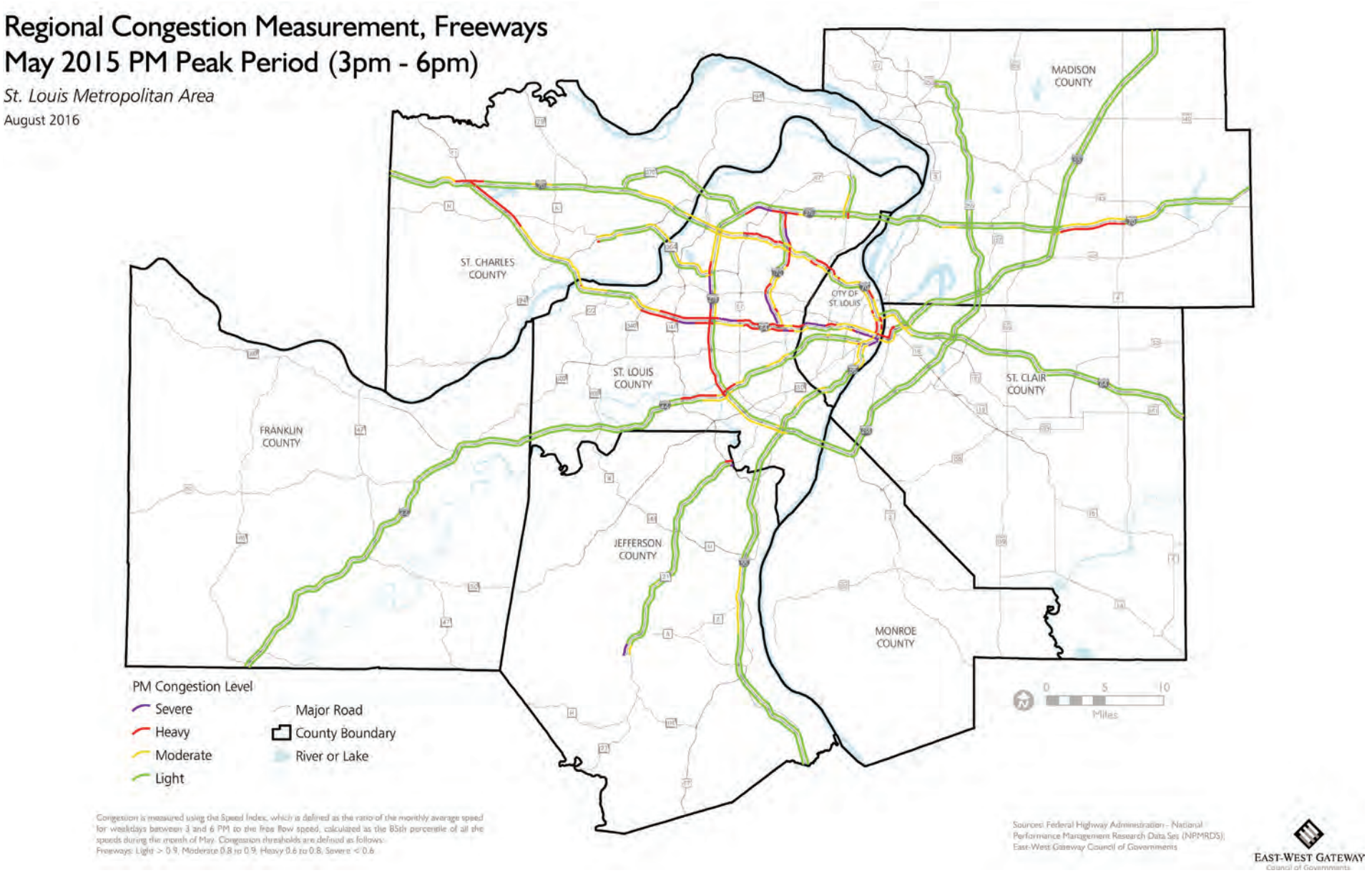


Figure 5: Sample PM Peak Congestion Map



HERE Data Maps

Using RITIS analysis tools and HERE data, congestion maps were developed based on a compilation of data over the entire year. They show congestion in one-hour time periods rather than the three-hour peaks depicted in NPMRDS maps. This illustrates how congestion varies over the three-hour peak periods as opposed to a three-hour average.

The arterial maps depict just the locations that were identified as those arterial locations experiencing recurring congestion. The arterial maps are shown from Figures 6 to 11. The freeway maps show congestion levels on the entire system throughout the peak periods (see Figures 12 to 17).

Figure 6: Spatial Distribution of Arterial Congestion, 6-7 AM (2015 Speed Index)

Figure 7: Spatial Distribution of Arterial Congestion, 7-8 AM (2015 Speed Index)

Figure 8: Spatial Distribution of Arterial Congestion, 8-9 AM (2015 Speed Index)

Figure 9: Spatial Distribution of Arterial Congestion, 3-4 PM (2015 Speed Index)

Figure 10: Spatial Distribution of Arterial Congestion, 4-5 PM (2015 Speed Index)

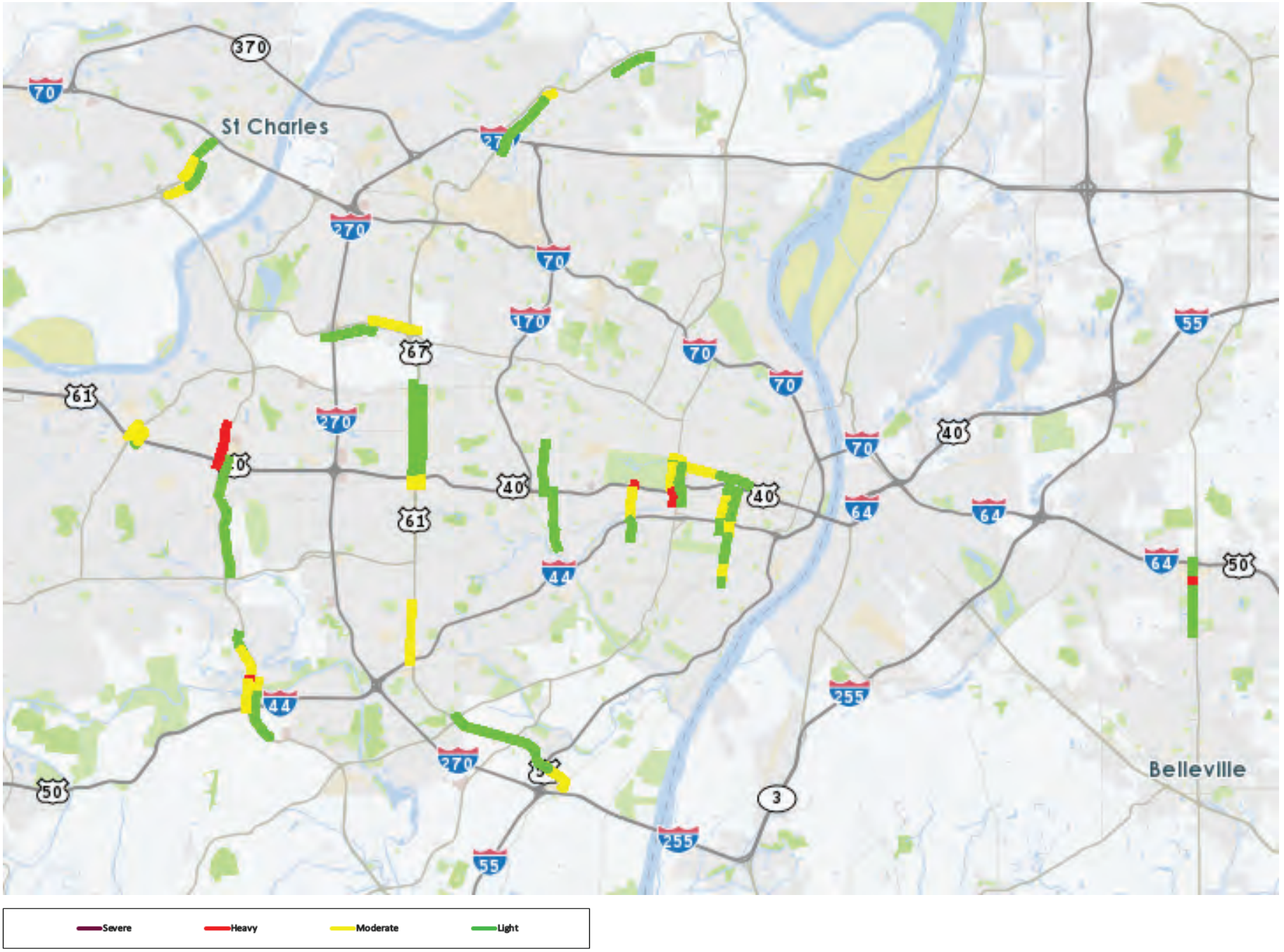


Figure 11: Spatial Distribution of Arterial Congestion, 5-6 PM (2015 Speed Index)

Figure 12: Spatial Distribution of Freeway Congestion, 6-7 AM (2015 Speed Index)

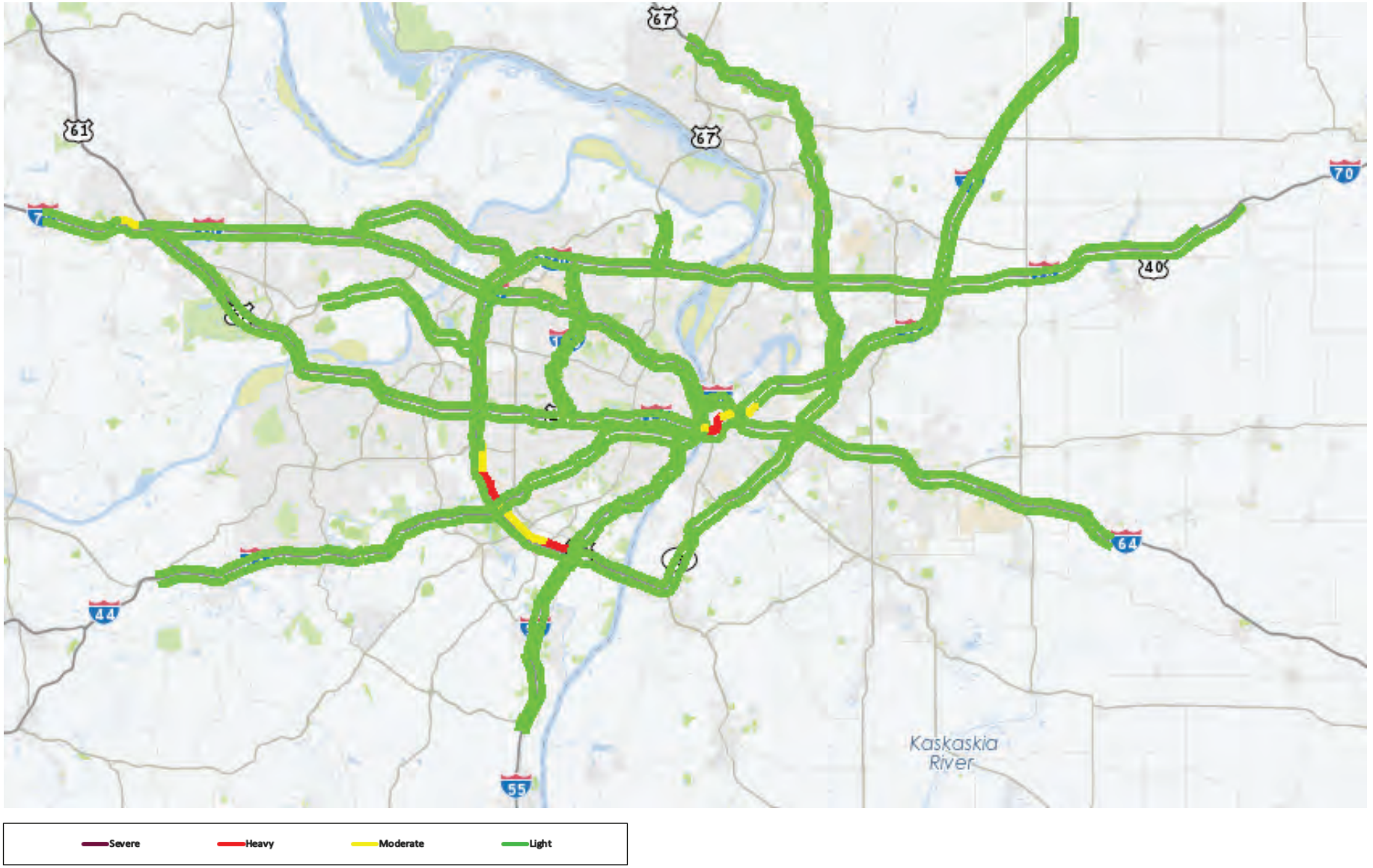


Figure 13: Spatial Distribution of Freeway Congestion, 7-8 AM (2015 Speed Index)

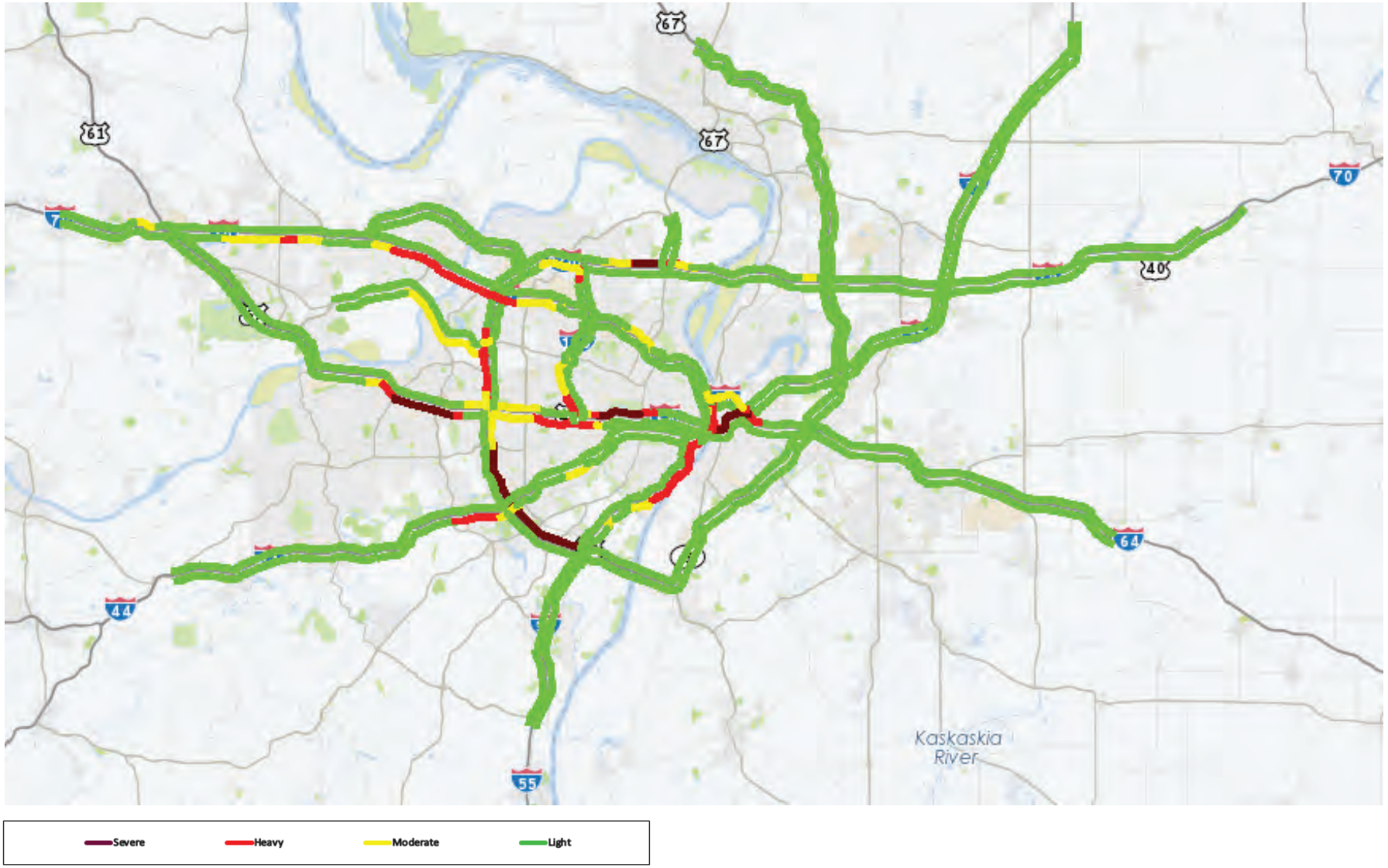
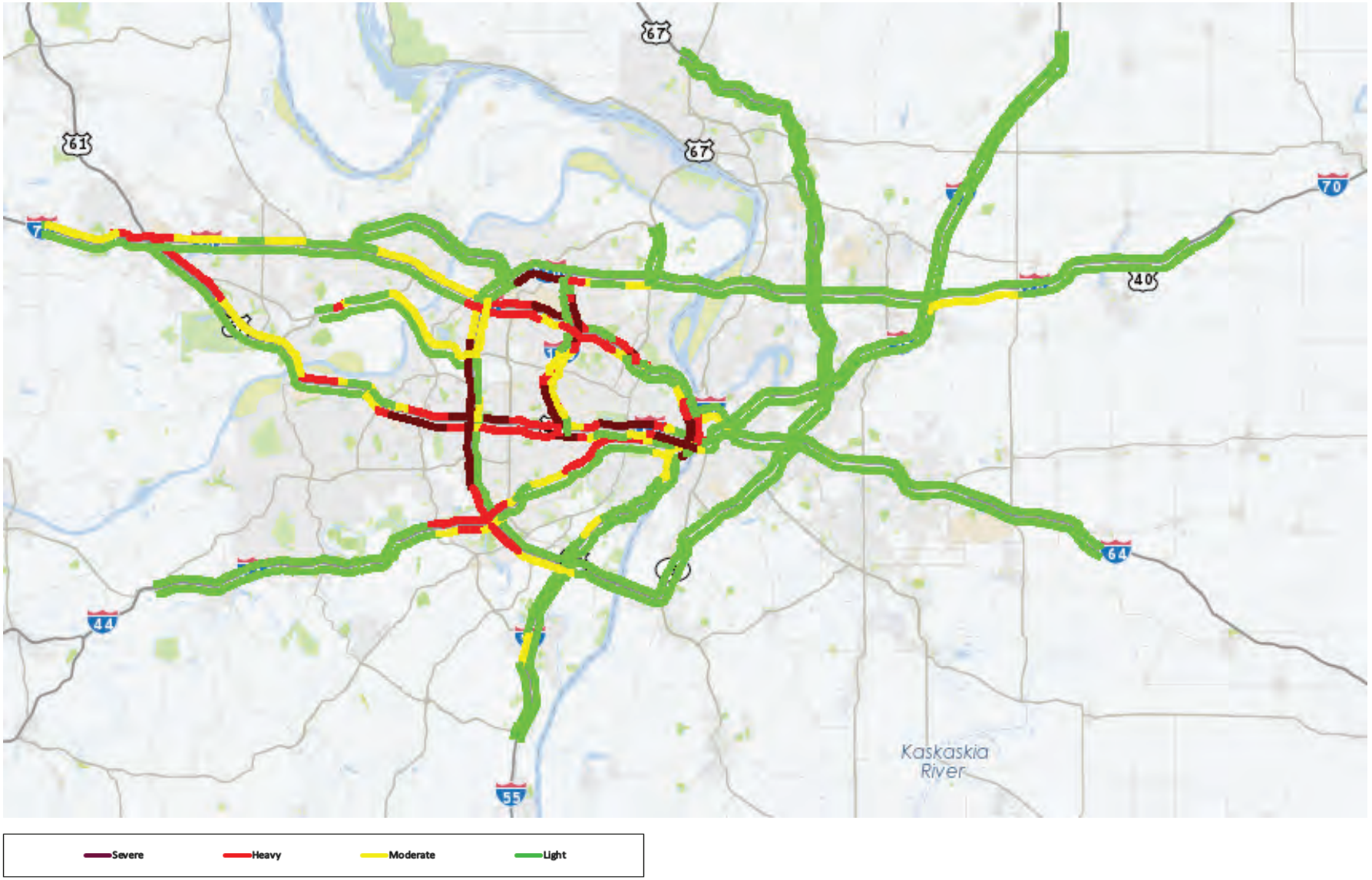


Figure 14: Spatial Distribution of Freeway Congestion, 8-9 AM (2015 Speed Index)

Figure 15: Spatial Distribution of Freeway Congestion, 3-4 PM (2015 Speed Index)

Figure 16: Spatial Distribution of Freeway Congestion, 4-5 PM (2015 Speed Index)

Figure 17: Spatial Distribution of Freeway Congestion, 5-6 PM (2015 Speed Index)



Ranking of Congested Roadways

Following the measurement of regional system performance, the next logical step was to identify regional congested locations. This was accomplished through ranking of segments. The road segment rankings are based on the average of Planning Time Index and travel time index. These performance measures are defined in Section 3. Tables 1 to 3 show the 2015 congested arterials and freeways. These represent the segments in the region identified as having consistently high levels of recurring congestion.

Table 1: Ranking of Congested Arterial

Rank	Route	Location Limits	State	Direction	Peak Time	TTI	PTI	Avg.	Miles
1	MO-141	Ladue to I-64	MO	SB	PM	2.04	3.17	2.61	1.23
2	MO-141	Hawkins to Vance	MO	NB	AM	1.74	3.40	2.57	1.77
3	340/CLARKSON RD	Chesterfield Pkwy N to Baxter Rd	MO	WB	PM	1.74	2.77	2.26	1.38
4	MO-141	Big Bend Rd to I-44	MO	SB	PM	1.52	2.64	2.08	2.34
5	MO-D	I-270 to Schuetz Rd	MO	EB	AM	1.54	2.60	2.07	1.41
6	KINGSHIGHWAY	Lindell to Rte 100	MO	SB	PM	1.72	2.39	2.06	1.28
7	HAMPTON AVE	I-44 to I-64	MO	SB	PM	1.70	2.39	2.05	1.02
8	MO-D	Schuetz Rd to Lindbergh Blvd	MO	WB	PM	1.70	2.35	2.03	1.33
9	MO-141	I-44 to Vance	MO	SB	AM	1.57	2.23	1.90	0.77
10	MO-141	Clayton To I-64	MO	NB	AM	1.28	2.41	1.85	1.49
11	LINDBERGH	I-44 to Big Bend Blvd	MO	SB	PM	1.66	1.99	1.83	1.69
12	FOREST PARK AVE	Vandeventer to Kingshighway	MO	WB	PM	1.66	2.00	1.83	1.32
13	FOREST PARK AVE	Vandeventer to Kingshighway	MO	WB	AM	1.64	2.00	1.82	1.32
14	MO-94	Pralle Ln to I-70	MO	WB	PM	1.44	1.95	1.70	1.34
15	MO-141	Ladue to I-64	MO	SB	AM	1.38	2.00	1.69	1.23
16	GRAND BLVD	Russell Blvd to I-64	MO	SB	PM	1.34	1.99	1.67	1.32
17	340/CLARKSON RD	I-64 to Chesterfield Pkwy N	MO	EB	PM	1.41	1.89	1.65	0.41
18	MO-AC	Old Halls Ferry to I-270	MO	NB	PM	1.44	1.80	1.62	0.69
19	GRAND BLVD	Rte 30 to Park Ave	MO	NB	PM	1.46	1.78	1.62	2.00
20	FOREST PARK AVE	Kingshighway to Vandeventer	MO	EB	PM	1.48	1.75	1.62	1.32
21	FOREST PARK AVE	Kingshighway to Vandeventer	MO	EB	AM	1.46	1.75	1.61	1.32
22	MO-94	MO-364 to Friedens Rd	MO	EB	PM	1.39	1.82	1.61	1.27
23	KINGSHIGHWAY	Rte 100 to Lindell	MO	NB	AM	1.34	1.83	1.59	1.28
24	MO-K	Mexico Rd to I-70	MO	SB	PM	1.41	1.72	1.57	0.72
25	MO-94	MO-364 to Friedens Rd	MO	EB	AM	1.25	1.87	1.56	1.27
26	MO-141	Vance to I-44	MO	NB	PM	1.24	1.87	1.56	0.74
27	LINDBERGH	Lemay Ferry to Rte 21	MO	NB	PM	1.40	1.60	1.50	2.28
28	HANLEY RD	N/O Forest Park Pkwy to Eager Rd	MO	SB	PM	1.30	1.69	1.50	1.38
29	IL-159	Frank Scott Parkwy to I-64	IL	SB	PM	1.36	1.61	1.49	2.05
30	LINDBERGH	I-270 to Patterson	MO	NB	PM	1.31	1.64	1.48	2.33
31	LINDBERGH	Clayton to Olive	MO	SB	PM	1.18	1.76	1.47	2.91
32	HANLEY RD	S/O 100 to I-64	MO	NB	PM	1.27	1.62	1.45	1.64
33	HANLEY RD	S/O 100 to I-64	MO	NB	AM	1.12	1.69	1.41	1.64
34	HAMPTON AVE	Watson to I-64	MO	NB	AM	1.08	1.69	1.39	1.55
35	LINDBERGH	Rte 21 to Rte 30	MO	NB	AM	1.14	1.50	1.32	1.81
36	MO-94	Pralle Ln to I-70	MO	EB	PM	1.16	1.46	1.31	2.18
		TOTAL MILES							**53**
		AM Miles							**36 (68%)**
		PM Miles							**17 (32%)**

Table 2: Ranking of Congested Freeways

Rank	Route	Location Limits	State	Direction	Peak Time	TTI	PTI	Avg.	Miles
1	I-270	McDonnell Blvd to I-170	MO	EB	PM	2.05	4.60	3.33	3.71
2	I-64	Kingshighway to Poplar St Bridge	MO	EB	PM	1.95	4.15	3.05	4.26
3	I-170	MO-D Page to Galleria Pky	MO	SB	PM	1.76	3.63	2.70	3.90
4	I-55/64	Poplar St Brg to MLK Bridg	MO	WB	AM	1.62	3.77	2.70	3.18
5	I-64	Market to Big Bend	MO	WB	PM	1.84	3.40	2.62	5.76
6	I-270	I-55 to Rte 100	MO	NB	AM	1.66	3.49	2.58	9.54
7	I-270	Dorsett Rd to Big Bend Rd	MO	SB	PM	1.64	3.40	2.52	11.00
8	I-64	Kingshighway to Hanley Rd	MO	WB	AM	1.57	3.39	2.48	3.97
9	I-64	Rte 340 to I-270	MO	EB	PM	1.55	3.05	2.30	5.73
10	I-64	Rte N to I-70	MO	WB	PM	1.38	3.16	2.27	4.22
11	I-64	Clayton to Rte 141	MO	WB	PM	1.50	2.79	2.15	7.44
12	I-64	Rte 340 to Mason Rd	MO	EB	AM	1.38	2.74	2.06	4.68
13	I-170	MO 70 (Exit 7) to Hanley Rd Exit 9	MO	NB	PM	1.46	2.59	2.03	3.11
14	I-64	Ballas to Big Bend	MO	EB	AM	1.30	2.57	1.94	6.92
15	I-70	Rte A to I-64	MO	WB	PM	1.32	2.54	1.93	3.96
16	I-64	Ballas to Big Bend	MO	EB	PM	1.32	2.47	1.90	6.92
17	I-70	Kingshighway to Lucas and Hunt	MO	WB	PM	1.29	2.31	1.80	3.35
18	I-64	Long Rd to Missouri River Bridge	MO	WB	PM	1.22	2.32	1.77	3.24
19	I-70	Earth City Expresssway to Natural Bridge	MO	EB	AM	1.23	2.24	1.74	4.79
20	I-70	Earth City Expressway to Lucas and Hunt	MO	EB	PM	1.19	2.22	1.71	10.00
21	I-55/44	Park Ave to I-70 (Tenth St)	MO	NB-WB	PM	1.23	2.16	1.69	2.71
22	I-70	Hanley to Earth City Expressway	MO	WB	PM	1.26	2.08	1.67	8.75
23	I-170	MO D Page Exit 4 to Galleria Pky	MO	SB	AM	1.22	2.07	1.65	3.90
24	I-270	MO-D Page Ave/Exit 16 to I-64	MO	SB	AM	1.17	1.92	1.55	4.70
25	I-70	Kingshighway to Lucas and Hunt	MO	WB	AM	1.13	1.95	1.54	3.35
26	I-270	Lilac to Washington-Elizabeth	MO	WB	AM	1.18	1.87	1.53	6.76
27	I-44	I-70 (Tenth) to I-64	MO	WB	AM	1.18	1.88	1.53	2.02
28	I-55	Potomac to I-64	MO	NB	AM	1.05	1.96	1.51	3.35
29	I-64	Lindbergh to Mason Rd	MO	WB	AM	1.13	1.73	1.43	4.93
30	I-70	Mississippi River (Stan Musial Br) to I-64	IL	NB	AM	1.07	1.77	1.42	2.24
31	I-55/70	E/O 203 to I-64	IL	SB	AM	1.09	1.74	1.42	1.16
32	I-55	Potomac to I-64	MO	NB	PM	1.09	1.67	1.38	3.35
33	I-55	Potomac to I-64	MO	SB	PM	1.13	1.61	1.37	3.09
34	I-70	Mississippi River (Stan Musial Br) to I-64	IL	SB	PM	1.06	1.58	1.32	2.25
		TOTAL MILES							**162**
		AM Miles							**65 (40%)**
		PM Miles							**97 (60%)**

Table 3: Percent of Congested Freeways by Peak Period

Route	AM		PM		TOTAL	
	Miles	% Congested	Miles	% Congested	Miles	% Congested
I-64	20.50	31%	37.57	39%	58.07	36%
I-70	9.49	14%	31.42	37%	40.91	25%
I-270	21.00	32%	14.71	15%	35.71	22%
I-55	3.35	5%	6.44	7%	9.79	6%
I-170	4.79	7%	3.9	4%	8.69	5%
I-55/64	3.18	5%	-	0%	3.18	2%
I-55/44	-	0%	2.71	3%	2.71	2%
I-44	2.02	3%	-	0%	2.02	1%
I-55/70	1.16	2%	-	0%	1.16	1%
TOTAL	**65.49**	**100%**	**96.75**	**100%**	**162.24**	**100%**

Extent of Congestion

The NPMRDS and HERE congestion maps alone provide little information on the extent of congestion in the region. Therefore, the following graphs attempt to close this gap by illustrating the percent of congested miles of the total CMP network, using HERE data. Figures 18 through 21 show percent of congested miles based on the roadway segments having consistently high levels of recurring congestion identified above.

Figure 18: Percent of Miles Congested by Direction (Arterials)

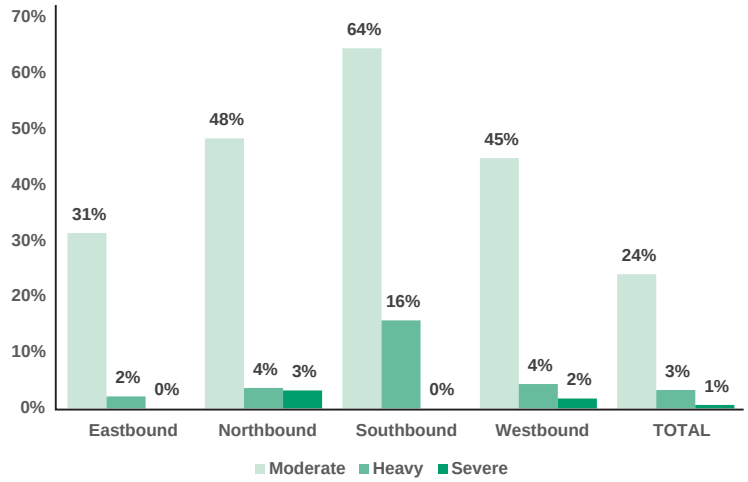


Figure 19: Percent of Miles Congested by Peak Time (Arterials)

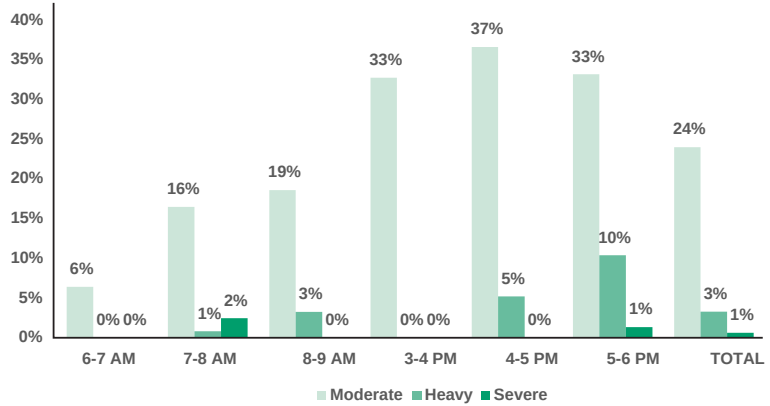


Figure 20: Percent of Miles Congested by Direction (Freeways)

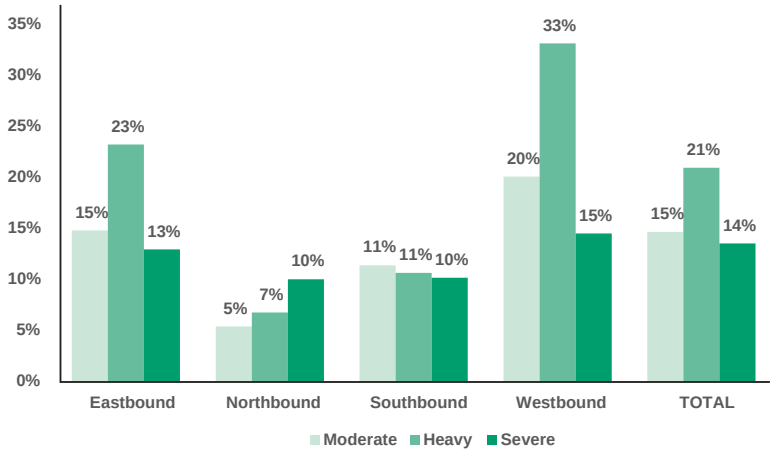
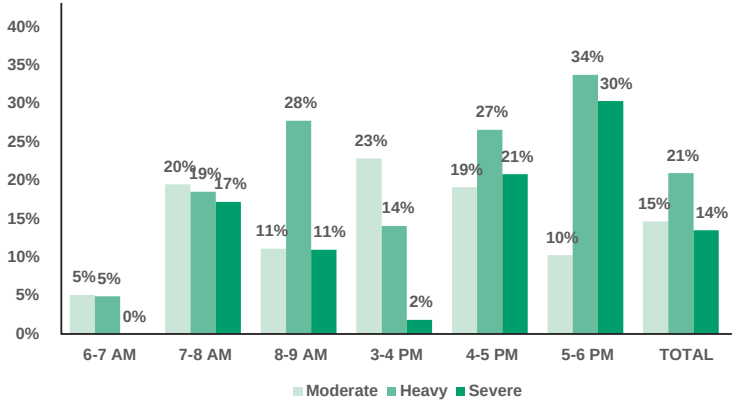


Figure 21: Percent of Miles Congested by Peak Time (Freeways)



3

Performance Measures

System performance measures are essential components of the CMP process. They are helpful in identifying existing conditions and locations of congestion, assessing progress toward achieving objectives, and communicating findings to stakeholders. The primary source of data for reporting regional congestion performance measures is RITIS's HERE data.

The HERE data reports congestion on corridors for seven indices: Buffer time (minutes), Buffer Index, planning time (minutes), Planning Time Index, speed (mph), travel time (minutes), and Travel Time Index. Five of these indices were used for analyzing congestion in the region. These are planning time (PT), Planning Time Index (PTI), speed, travel time (TT) and Travel Time Index (TTI).

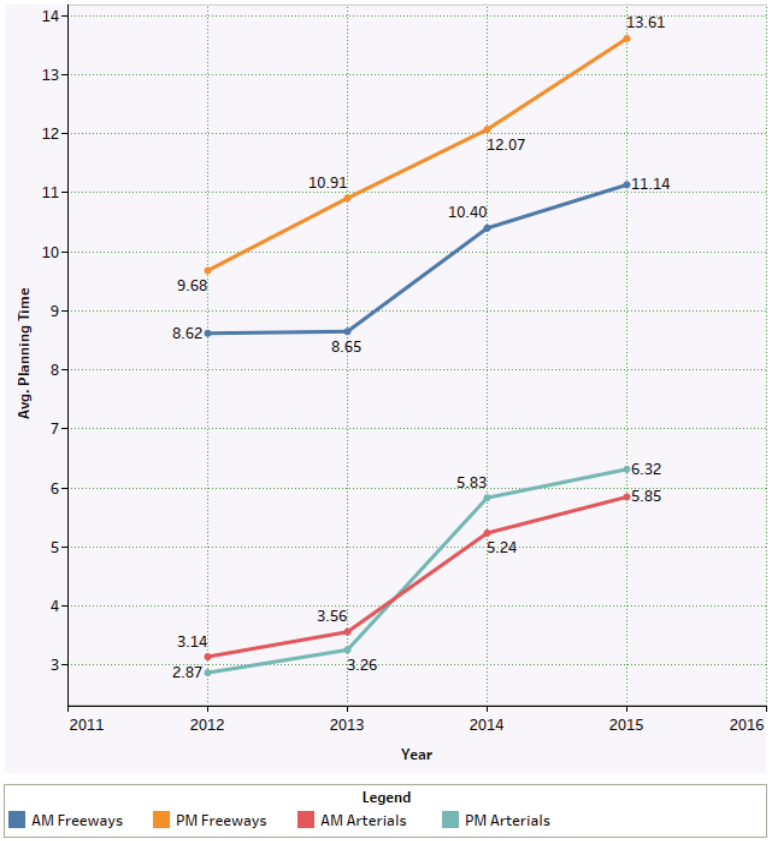
The following graphs are based on averages of all the roadway segments included in the lists of locations with congested conditions. They represent a performance trend analysis to understand changes in congestion across time. These graphs can be found at https://public.tableau.com/profile/zakari3012#!/vizhome/2015PerformanceMeasures_0503_Hidden/BufferTime

Planning Time

Planning Time (minutes) is the total time a traveler should plan for to ensure on-time arrival. Based on this snapshot of congested locations, regional planning times appear to have largely been increasing, albeit slowly, over the four years shown. Planning times have increased more rapidly for arterials than freeways over time. Also, evening peak congestion shows the greatest increase in planning time.

Average regional planning times are: 11 minutes for morning peak on freeways, 14 minutes for evening peak on freeways, six minutes for both peak periods on arterials. On average drivers in the region would have to plan according to these planning times to ensure on-time arrival most of the time. Figure 22 shows the regional planning times for 2015.

Figure 22: Planning Time Trends for Freeways and Arterials (AM Peak & PM Peak)



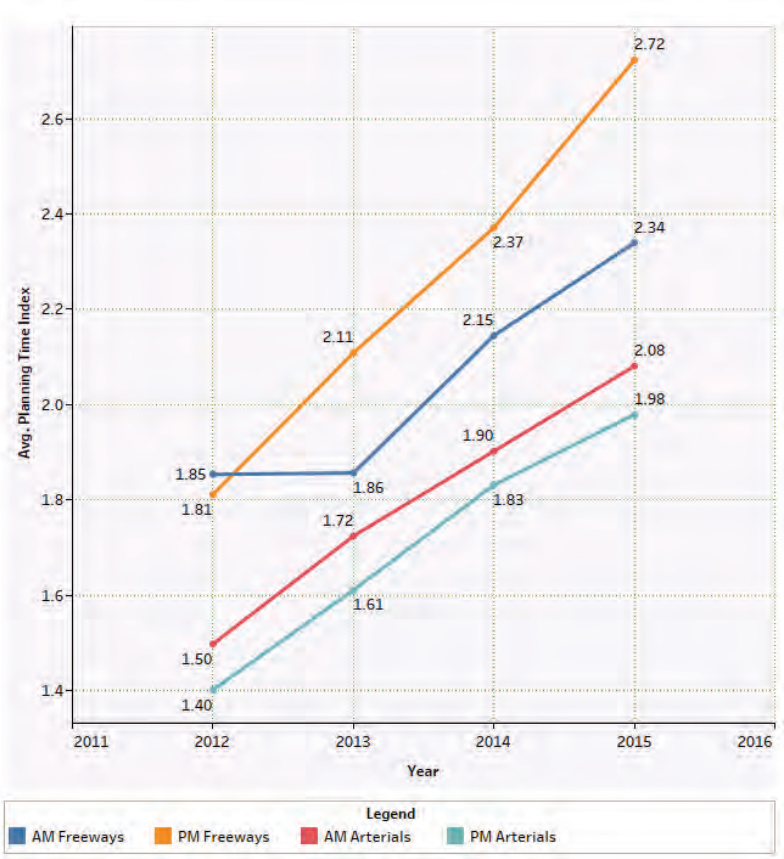
Planning Time Index

Figure 23 shows the Planning Time Index (PTI) for 2015. PTI is the ratio of 95th percentile travel time to free-flow travel time. A PTI of 1.20 for a 30-minute trip means that the total time that should be planned for the trip is 36 minutes (30 minutes x 1.20).

The regional PTI has seen sharp increases over time. For example, evening rush hours on freeways required much more than any other period. Between 2014 and 2015, PTI had increased by at least 8 percent, with the highest increase on evening rush-hour on freeways (15 percent).

The PTI for freeways was 2.3 for AM peak and 2.7 for PM peak. For arterials, the figure was 2.1 for AM peak and 2.0 for PM peak. Therefore, a 15-minute trip on freeways during morning rush-hour would require 35 minutes total travel time; a freeway trip during the evening peak would require 41 minutes; an arterial trip during the morning peak would require 31 minutes; an evening peak arterial trip would require 30 minutes. Higher total planning times are required on freeways during both peaks because they are more unreliable.

Figure 23: Planning Time Index Trends for Freeways and Arterials (AM Peak & PM Peak)

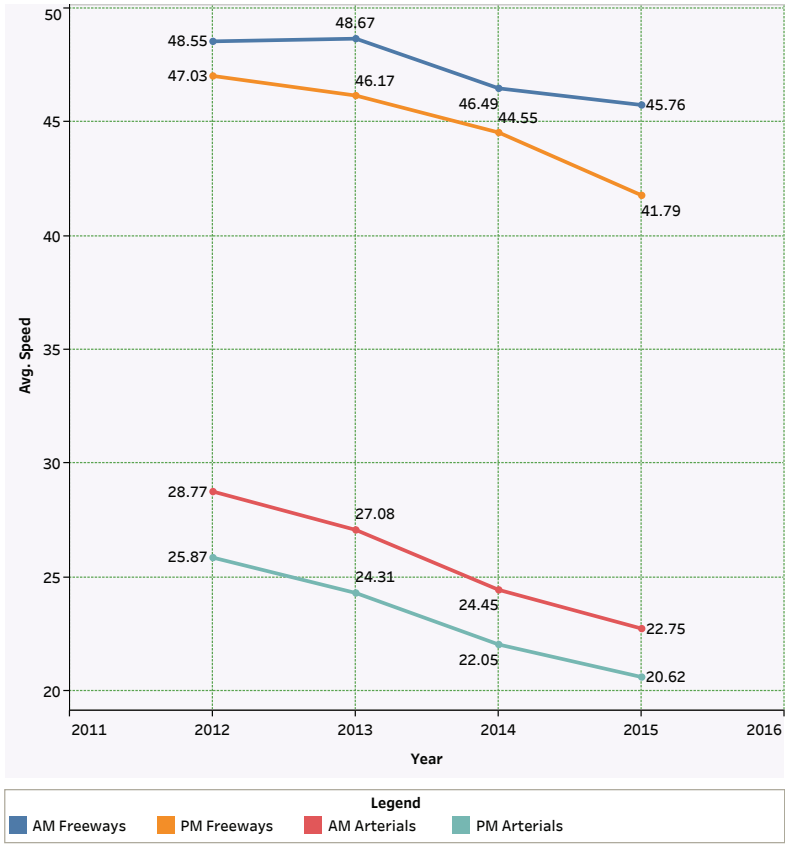


Average Speed

Figure 24 shows average network speeds for 2012 to 2015. Speed (mph) is the ratio of distance to average travel time. Regional speeds have been falling since 2013. As expected, freeway speeds are higher than arterial ones. However, arterial speeds have declined significantly.

Between 2014 and 2015, speeds have declined by about 1.6 percent in the morning peak on freeways, 6.2 percent in the evening peak on freeways, 7 percent in the morning peak on arterials, and 6.5 percent in the evening peak on arterials.

Figure 24: Speed Trends for Freeways and Arterials (AM Peak & PM Peak)



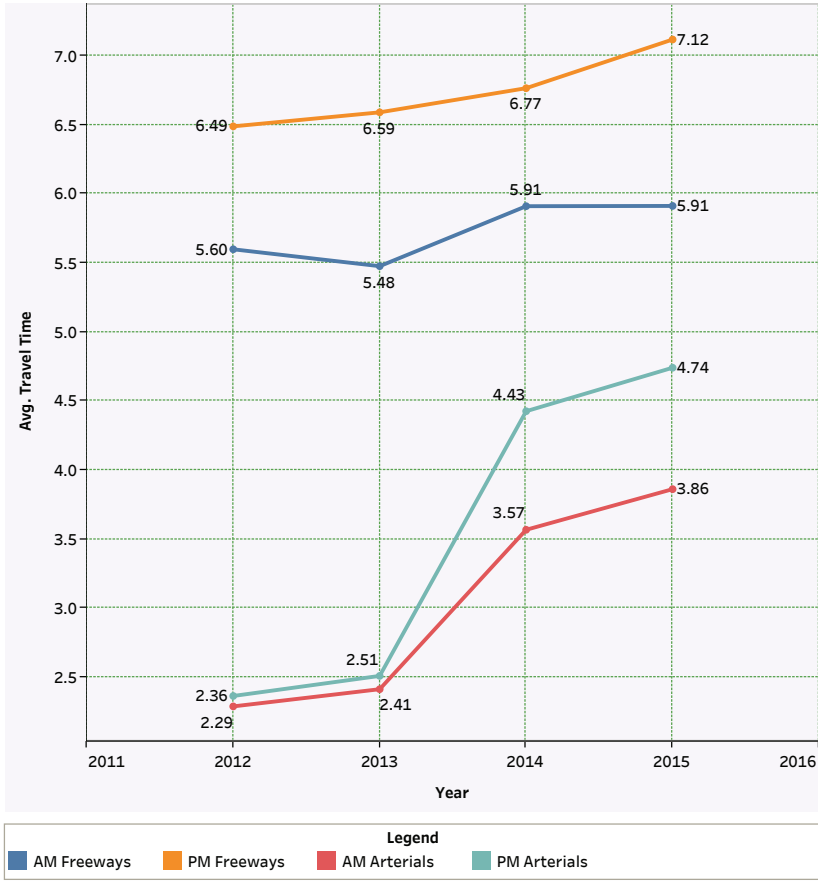
Average Travel Time

Travel time is the observed time it takes to travel from one end of a segment to the other.

Travel times have been appreciating slowly across the region, especially on the following segments. Between 2014 and 2015, TT increased by 5.2 percent on freeways (PM peak), increased by 8.1 percent on arterials (AM peak), and increased by 7 percent on arterials (PM peak).

The regional TT data shows 5.9 minutes for freeways (AM peak), 7.1 minutes for freeways (PM peak), 3.9 minutes for arterials (AM peak), and 4.7 minutes for arterials (PM peak). Figure 25 illustrates changes in regional travel times for all roadways.

Figure 25: Travel Time Trends for Freeways and Arterials (AM Peak & PM Peak)

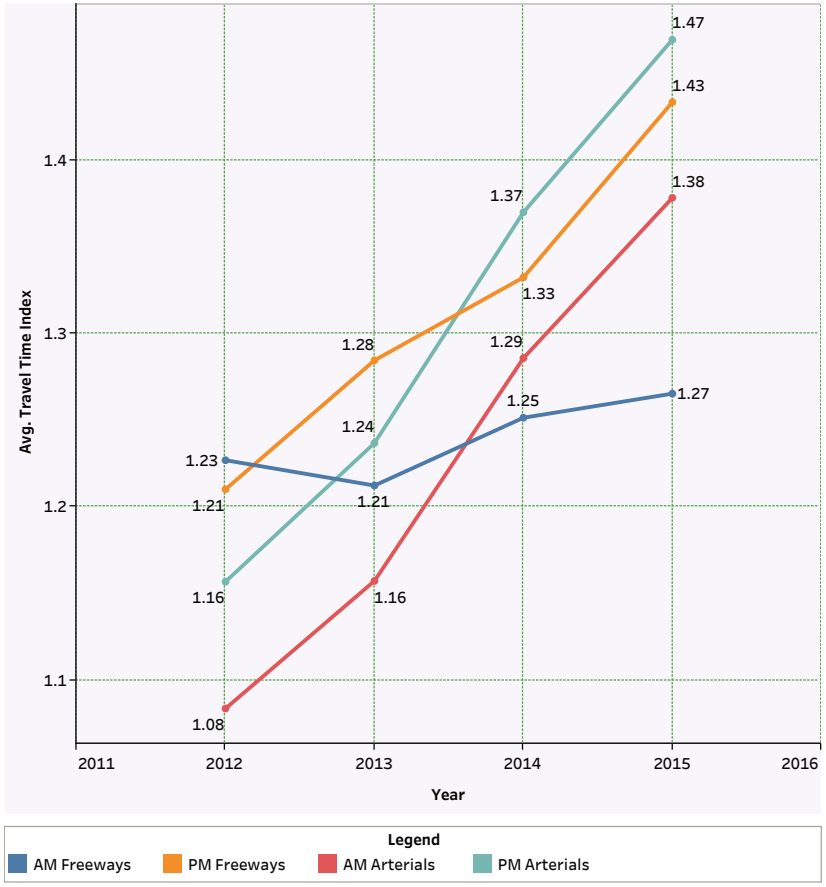


Travel Time Index

Travel Time Index (TTI) is the ratio of observed TT to free-flow travel time (distance divided by 85th percentile speeds). The TTI tells one how long a trip takes in congested periods compared with uncongested periods. A TTI of 1.20 means that a 20-minute off-peak trip will take 24 minutes during peak times (1.20 x 20) or 20 percent longer.

The regional TTI has been increasing at a slower rate. Regionally, TT burdens are higher during evening peaks than during morning peaks. During morning rush-hours, the TTI for arterial travel times (1.38) was slightly longer than freeways (1.27). A similar trend was observed in 2014. Figure 26 shows the TTI between 2012 and 2015.

Figure 26: Travel Time Index Trends for Freeways and Arterials (AM Peak & PM Peak)



4

Mobility Highlight Summaries

Missouri Department of Transportation (MoDOT)

The Missouri Department of Transportation's (MoDOT) mobility report is composed of four components: mobility projects, work zone crashes, incident management, and freeway/arterial management.

During 2015 MoDOT implemented three projects that had significant effects on mobility in the region. These are two signal coordination/timing projects (US 61/67 south from Big Bend Blvd to American Legion and MO 180 from Odgen Ave. to Pennridge Drive) and one lane addition (Route 364 and Missouri River Crossing). The US 61/67 south from Big Bend Blvd to American Legion signal timing/ coordination project was implemented in three sections—Big Bend Rd to I-255 WB Ramp/ Barracksview, Lindbergh Blvd to Telegraph Rd and Telegraph Rd to American Legion—while the Route 364 and Missouri River Crossing project had two sections —Rte. 364 EB and WB and Missouri River East-West Bridge.

Signal Coord./Timing: U.S. 61/67 South from Big Bend Blvd to American Legion

This project, located in Jefferson County, is comprised of three sections with a total of 52 signals. The peak hour signal coordination led to increased speeds and reduction in total travel times.

Overall, the coordination of 52 signal timings had significant effects on fuel consumption, vehicle operating cost and total emissions. For example, on an annual basis, reduction in fuel consumption was about 800,000 gallons and reduction of total emissions of over 500,000 pounds (see Table 4).

The limits of the three sections are: (1) Big Bend Road to I-255, (2) Lindbergh Blvd. to Telegraph Road, and (3) Telegraph Road to American Legion.

Each of these sections saw varying levels of stops and travel time reductions along with speed increases. Tables 5, 6, and 7 show the specific improvements for each section.

Table 4: Fuel Use, Cost, and Emissions from Signal Coordination: U.S. 61/67

Measure	Pre-Study	Post-Study	% Change
Annual Fuel Use (gal.)	15,622,665	14,827,065	-5.1%
Annual Operating Cost ($)	37,181,944	35,288,415	-5.1%
Total Emissions (VOC, CO & NO, lb/year)	5,256,713	4,731,226	-10.0%

Source: MoDOT SCAT Report

Table 5: Section 1 Congestion Effects

(Big Bend Rd. to I-255)

Effects	Direction	Measure	AM Peak	Midday Peak	PM Peak
Stops	NB	Before	11.2	12.6	10.4
		After	1.4	5.6	7.6
	SB	Before	7.6	7.8	10.2
		After	4.0	6.2	6.2
Speed (mph)	NB	Difference	+10.3	+5.1	+7.4
	SB	Difference	+1.3	+3.3	+4.2
Travel Time	NB	% Change	-33.1	-19.4	-16.4
	SB	% Change	-4.3	-11.9	-16.1

Table 6: Section 2 Congestion Effects

(Lindbergh Blvd. to Telegraph Rd.)

Effects	Direction	Measure	AM Peak	Midday Peak	PM Peak
Stops	NB	Before	5.6	5.8	6.8
		After	2.8	5.6	6.6
	SB	Before	6.4	4.4	7.0
		After	2.4	2.8	6.6
Speed (mph)	NB	Difference	+5.3	+0.8	+0.3
	SB	Difference	+4.3	+1.9	+3.0
Travel Time	NB	% Change	-14.5	-2.5	-1.0
	SB	% Change	-12.2	-5.1	-9.5

Table 7: Section 3 Congestion Effects

(Telegraph Rd. to American Legion)

Effects	Direction	Measure	AM Peak	Midday Peak	PM Peak
Stops	NB	Before	4.2	4.8	4.8
		After	3.6	1.8	3.6
	SB	Before	5.6	6.0	6.8
		After	2.6	3.0	3.4
Speed (mph)	NB	Difference	+3.4	+3.4	+4.4
	SB	Difference	+4.4	+5.1	+3.7
Travel Time	NB	% Change	-8.0	-7.6	-10.7
	SB	% Change	-10.4	-9.4	-9.4

Signal Coordination/ Timing: MO 180 from Odgen Ave. to Pennridge Drive

New coordinated signal timing was implemented in May 2015 for the 38 signals in the study area. Measurements of the net increase in travel speeds were used to determine that 229,530 gallons of fuel was saved each year by the improved coordination (see Table 8). This reduced fuel consumption resulted in an annual cost savings of approximately $583,006 (assuming an average fuel price of $2.54 per gallon).

Table 8: Fuel Use, Cost, and Emissions from Signal Coordination: MO 180

Measure	Pre-Study	Post-Study	% Change
Annual Fuel Use (gal.)	3,300,790	3,071,260	-7.0%
Annual Operating Cost ($)	8,384,007	7,801,000	-7.0%
Total Emissions (VOC, CO & NO, lb/year)	1,172,627	1,015,933	-13.4%

Source: MoDOT SCAT Report

Pollutant emissions would be decreased by 156,694 pounds per year between Pennridge Drive/Boenker Lane and Hanley Road. Tables 9 and 10 show the effect of signal coordination on congestion. For the first corridor (Pennridge Lane to Hanley Rd.), significant improvement was observed during the weekday midday and afternoon peak periods when traffic volumes are the highest. For these periods, delay was reduced between 28 percent and 53 percent, travel times reduced between 10 percent and 22 percent, and average speeds increased by 11 percent to 28 percent. For the morning peak period delay was reduced between 11 percent and 21 percent, travel times reduced between 3 percent and 7 percent, and average speeds increased by 4 percent to 8 percent.

For the Normandy Avenue to Ogden Avenue corridor, delay was reduced between 2 percent and 77 percent, travel times reduced between 1 percent and 16 percent, and average speeds increased by 3 percent to 20 percent. For all metrics, evening rush-hours had the largest effects, followed by morning peak and mid-day peak.

Table 9: Effects of Signal Coordination at Pennridge Lane to Hanley Rd.

		AM			MD			PM		
Measure	**Direction**	**Existing**	**Final**	**%**	**Existing**	**Final**	**%**	**Existing**	**Final**	**%**
Total Delay	EB	228.9	203.8	-11%	365	264	-28%	466	217.1	-53%
	WB	253.3	199.3	-21%	487.8	241.8	-50%	409.7	198.3	-52%
Stops	EB	5.4	4.2	-22%	8.1	4.6	-43%	10.0	3.1	-69%
	WB	5.5	4.1	-25%	10.8	4.5	-58%	9.2	5.1	-45%
Avg. Speed	EB	29.4	30.5	4%	25.5	28.4	11%	23.3	29.9	28%
	WB	28.6	30.8	8%	22.8	29.0	27%	24.4	30.5	25%
Travel Time	EB	903.1	871.5	-3%	1035	934.5	-10%	1140.2	886	-22%
	WB	925.7	861.3	-7%	1159	911.2	-21%	1081.8	867.8	-20%

Source: MoDOT SCAT Report

Table 10: Effects of Signal Coordination at Normandy Ave. to Ogden Ave.

		AM			MD			PM		
Measure	**Direction**	**Existing**	**Final**	**%**	**Existing**	**Final**	**%**	**Existing**	**Final**	**%**
Total Delay	EB	32.2	17.8	-45%	28.4	17.3	-39%	42.8	10	-77%
	WB	51.9	42.1	-19%	43.9	43.1	-2%	53.5	46.7	-13%
Stops	EB	0.7	0.3	-57%	0.3	0.3	0%	0.9	0	-100%
	WB	0.7	0.4	-43%	0.4	0.7	75%	0.6	0.8	33%
Avg. Speed	EB	33.4	36.1	8%	34	36.1	6%	31.7	38.1	20%
	WB	30.3	31.6	4%	31.3	31.4	0%	30	31	3%
Travel Time	EB	201.8	188.9	-6%	199.7	188.8	-5%	213	179.3	-16%
	WB	219	209.7	-4%	211.8	210.7	-1%	220.9	213.7	-3%

Source: MoDOT SCAT Report

Lane Addition: Route 364 and Missouri River Crossing

Section 1: Rte. 364 EB and WB

The new portion of Route 364, or "Page Avenue/Route 364 Phase 3", has been opened since late October 2014. The Phase 3 design-build project added a four lane divided freeway for nine miles from Route 94 at Mid Rivers Mall Drive in St. Peters to Interstate 64 in Lake Saint Louis. MoDOT, St. Charles County and local municipalities teamed together to allocate $118.2 million toward building Route 364/Page Phase 3. The $118.2 million was used for purchasing property, utility relocations, design and construction.

The highest recorded volumes on Rte. 364 Phase 2 or Phase 3 for July 2015 are east of Central School Rd., with a total combined volume in both directions of about 74,000 vehicles per day. The most heavily travelled section of Phase 3 was at Motherhead Rd., where the total volume in both directions was approximately 41,000 vehicles. In the Phase 3 section, traffic volume was highest in the eastern section and declined as the route progresses westward. In the eastbound Phase 2 section, traffic volume increased up to 45 percent between 2014 and 2015. Vehicular volumes in the westbound direction of the same section increased by 60 percent.

Section 2: Missouri River East-West Bridge

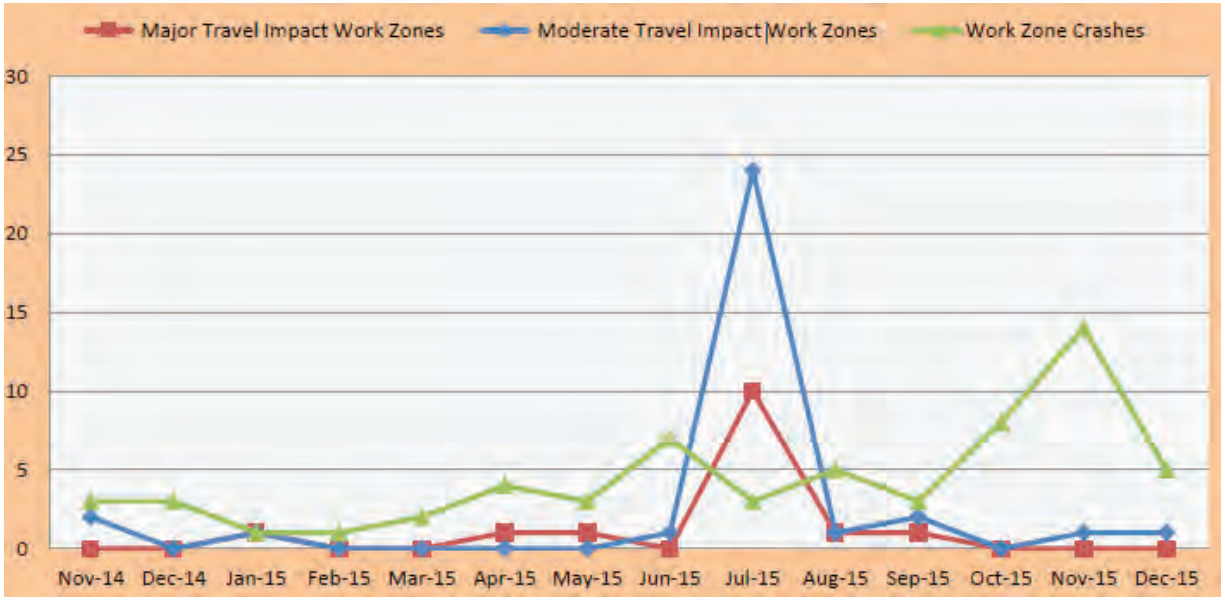
Traffic volume at river crossings increased from July 2014 to July 2015 at all locations and directions other than the Boone Bridge on I-64, which had ongoing construction during the time periods the analysis was conducted. Route 364 had a higher volume increase than any other crossing with approximately 12,000 additional vehicles per day in July 2015 when compared to July 2014. There were about 20,000 additional trips in July 2015 when compared to July 2014 on the four noted river crossings between St. Charles and St. Louis County. The Route 364 Bridge handled 59 percent of the total increase. It appears that the additional capacity may have induced additional trips, not just shifted existing trips to a new location.

Work Zone Management

Missouri DOT classifies work zones into three categories depending on road closure time: major, moderate and minor impacts. For the year under review, there were no minor road closures reported.

There was a fairly constant number of work zones across Missouri in 2015, except for July which recorded the highest number at about 25 work zones. Anecdotal evidence of work zone crashes shows uniformity in the year except for the last quarter. A careful study of Figure 27 indicates no apparent correlation between the number of travel impacts of work zones and crashes.

Fig 27: Work Zone History and Crashes



Source: MoDOT November/December 2015 Mobility Report

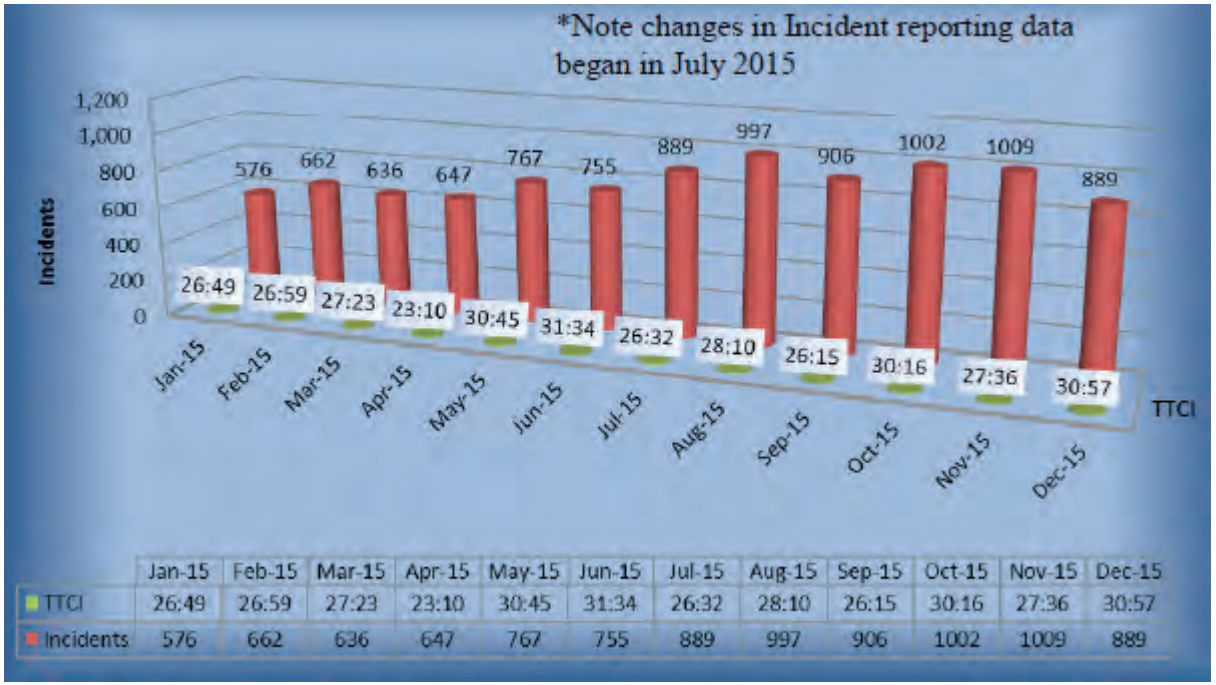
Incident Management

On average, there were 812 incidents per month in 2015, of which about 6 percent were caused by tractors or trailers. Generally, increases in the number of incidents were associated with increases in time to clear incidents (TTCI). However, there are subtle monthly variations from the general trend. While the number of incidents between January to June was less erratic, the second half of the year saw more variable incident reports.

Freeway and Arterial Management

MoDOT used the RITIS probe data to classify the speed index of each road segment according to pre-determined thresholds. The speed index thresholds used are: greater than 0.9 (high mobility), 0.8 to 0.9 (medium mobility) and less than 0.8 (low mobility). The arterial threshold was less than 1.25 (high mobility), between 1.25 and 1.75 (medium mobility), and a speed index in excess of 1.75 was labeled low mobility.

Figure 28: Number of Incidents and Time to Clear



	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15
TTCI	26:49	26:59	27:23	23:10	30:45	31:34	26:32	28:10	26:15	30:16	27:36	30:57
Incidents	576	662	636	647	767	755	889	997	906	1002	1009	889

Source: MoDOT November/December 2015 Mobility Report

The segments falling into each of these categories are shown in their bi-monthly mobility report accessible at http://www.modot.org/stlouis/links/traffictopics.htm. These maps show both morning and evening peak period congestion.

Generally, MoDOT's mobility analysis is difficult to compare with the annual regional mobility scans conducted by EWG because MoDOT performs mobility analysis on a monthly basis while EWG looks at mobility on a yearly basis.

City of St. Louis

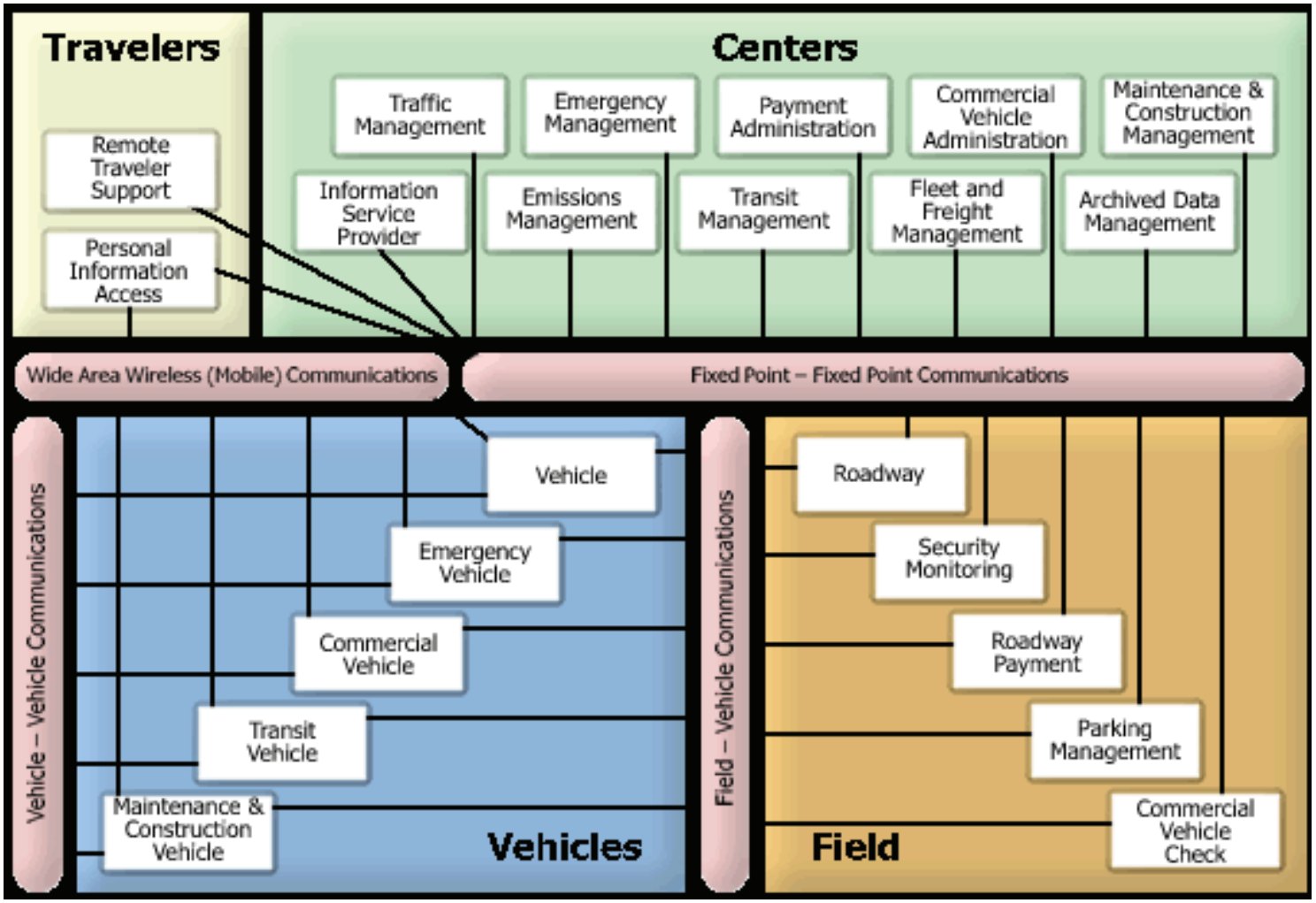
In 2015, the city of St. Louis completed Bike St. Louis Phase 3. The focus of this project was to make bicycling a safe, comfortable, and convenient transportation choice for St. Louis residents and visitors. In total, Bike St. Louis Phase 3 updated 42 miles of existing bikeways to meet current standards, upgraded 14 miles of existing bikeways to provide greater comfort and separation from motor vehicles, added 42 miles of new on-street bikeways, and installed the region's first parking protected bike lane on Chestnut Street in downtown St. Louis.

The city of St. Louis completed a number of Congestion Mitigation Air Quality (CMAQ) projects. First was a roadway improvement project at Skinker, Clayton and Oakland which provided full accessibility for pedestrians and cyclists into the southwest area of Forest Park across several arterials and an interstate ramp. Under CMAQ, bike lanes were added on Oakland Ave between Hampton and Skinker as well as a new sidewalk on the north side of Oakland while providing new traffic signal coordination for traffic signals in this area. The other CMAQ project was the Traffic Management Enhancement Phase II. This project included the installation of new advanced traffic management system (ATMS) software, Siemens TACTICS, to provide centralized control of the city's signalized intersections currently interconnected with fiber optic cable.

St. Charles County

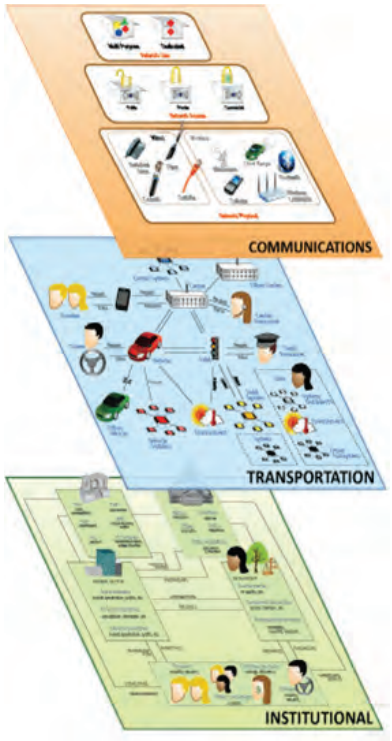
The opening of Page Avenue Phase III resulted in improvements to freeway traffic throughout the county by removing traffic from the congested routes of I-70 and I-64. However, this has led to changes to arterial mobility throughout the county where external-external traffic has become left-turn movements so as to access MO 364. The county's Gateway Green Light program has become a dynamic tool in addressing mobility and maintenance issues, and it allows the county to be more proactive in signal operations. Additionally, areas of greater impact have been identified with future projects planned to add lanes and improve traffic flows.

Another project benefitting freeway mobility was the construction of a roundabout at the ramp terminal of I-70 westbound at Route Z (Church Street). The addition of this roundabout has eliminated extended queue lengths on the off-ramp which would consistently impact I-70 in the PM peak hours. Additionally, the PM peak hour bottleneck along I-70 continues to move west and has reached the I-70 and I-64 interchange.



St. Louis Regional ITS Architecture Update

Fig 29: 3-Layer View of an ITS Architecture



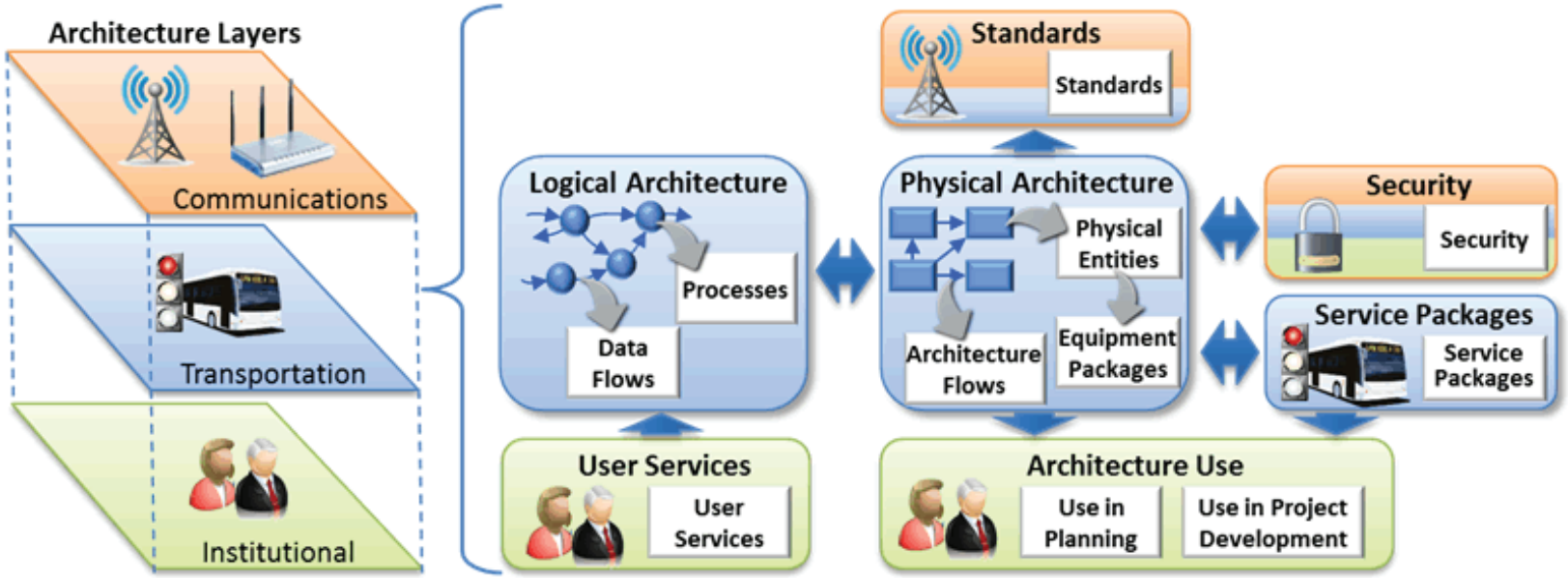
The East-West Gateway Council of Governments (EWG) updated the Intelligent Transportation System (ITS) Architecture for the St. Louis Metropolitan Region in 2015. The Architecture provides a framework for the planning and development of technology projects that improve the safety and efficiency of travel in the region. This framework complements EWG's Long Range Transportation Plan (LRTP) and CMP, and identifies a series of ITS projects that will further public mobility and safety through expanded collection and exchange of transportation network information, along with improved coordination between transportation agencies.

The Architecture development process was focused on both deriving an operational strategy that fits within the context of the regional transportation vision and identifying the framework by which it is implemented. The ITS architecture provides such a framework, in which multiple systems, subsystems, and stakeholders can work together to implement a regional transportation and mobility vision.

The ITS architecture framework (Figure 29) is based on the National ITS Architecture, and is comprised of two technical layers, a Transportation Layer and a Communication Layer, which must operate in the context of a third layer, called an Institutional Layer.

- The Communications Layer provides for the accurate and timely exchange of information between systems to support the transport solutions.
- The Transportation Layer is where the transportation solutions are defined in terms of the subsystems and interfaces and the underlying functionality and data definitions that are required for each transportation service. This layer is the heart of the ITS Architecture.
- The Institutional Layer includes the institutions, policies, funding mechanisms, and processes that are required for effective implementation, operation, and maintenance of an intelligent transport system. The Institutional Layer is shown as the base because solid institutional support and effective decisions are prerequisite to an effective ITS program. This is where the ITS objectives and requirements are established.

The St. Louis Regional ITS Architecture covers the EWG planning area boundaries encompassing four counties and the independent city of St. Louis within the state of Missouri and three counties in the state of Illinois. The region includes Interstate highways, U.S. and State numbered routes, city and county roads, MetroLink light rail services, Metro Transit and other area bus services, plus St. Louis Lambert International Airport along with railroad services. The Mississippi River serves as a principal navigable waterway, primarily for barge traffic traveling to or from St. Louis as well as beyond. The region also contains expanding bicycle and pedestrian facilities across the region, many of which follow major arterials and connect into transit services.



The regional ITS stakeholders defined for this ITS Architecture Update effort represented the full range of public entities in the St. Louis area. At the same time, much of the ITS deployment to date has been focused on work done or led by the following agencies:

- Missouri Department of Transportation (MoDOT), District 6
- St. Louis City, Department of Streets, Traffic Division
- St. Louis County, Department of Highways and Traffic
- St. Charles County, Transportation Department
- Illinois Department of Transportation (IDOT), District 8
- Metro Transit (Bi-State Development)

Various county and municipal representatives as well as police, fire and rescue staff, along with St. Louis Lambert Airport, were invited by EWG to participate in this process, and contributed greatly to the discussions resulting in both the Regional ITS Architecture and Strategic Deployment Plan. U.S. Department of Transportation representatives from the Federal Highway Administration (FHWA) also served as partners in this effort.

The Regional ITS Architecture was built on a strong infrastructure established by Missouri DOT and Illinois DOT, with key initiatives led by St. Louis and St. Charles counties, the city of St. Louis and Metro Transit. Key components of existing infrastructure included various components such as operations centers, traffic flow detection, closed-circuit television (CCTV) cameras, dynamic message signs (DMS), road weather information systems (RWIS), central computerized traffic signal control systems, and fiber optic communications, along with real-time information available via dedicated agency web sites.

The end products of the update are a Regional ITS Architecture and a Strategic Deployment Plan that defines the way forward in deploying ITS in the St. Louis region. Additional details on the ITS Architecture Update can be found at http://www.ewgateway.org/trans/ITS/ITS.htm.

6

Conclusion

Urban traffic congestion impacts economic and environmental dimensions of society, especially in fuel consumption, time, and economic activity. The CMP provides a unique opportunity to leverage data and inter-organizational coordination to mitigate the effects of congestion. The CMP is not only a structured process for analyzing regional congestion but a performance-based tool that draws on institutional strength of stakeholders that leads to an effective regional resource allocation and utilization.

The NPMRDS and HERE data were the primary source of data for the EWG CMP. Out of the 53 miles of arterial segments identified as congested, 68 percent were congested in the morning peak while 32 percent were congested in the evening peak. The top five congested arterial locations in 2015 are MO-141, Ladue to I-64 (SB PM); MO-141, Hawkins to Vance (NB AM); Rte. 340/Clarkson Rd, Chesterfield Pkwy N to Baxter Rd (WB PM); MO-141, Big Bend Rd to I-44 (SB PM); and MO-D, I-270 to Schuetz Rd (EB AM).

Of about 160 miles of congested freeway segments, 40 percent were congested in the morning peak while 60 percent were congested in the evening peak period. The distribution of congestion on freeways showed that 36 percent was on I-64, 28 percent on I-70, and 22 percent on I-270. The most congested five locations are: I-270, McDonnell Blvd to I-170 (EB PM); I-64, Kingshighway to Poplar St Bridge (EB PM); I-55/I-64, Poplar St Bridge to MLK Bridge(WB AM); I-170, MO-D/Page Ave. to Galleria Pky (SB PM); and I-64, Market to Big Bend (WB PM).

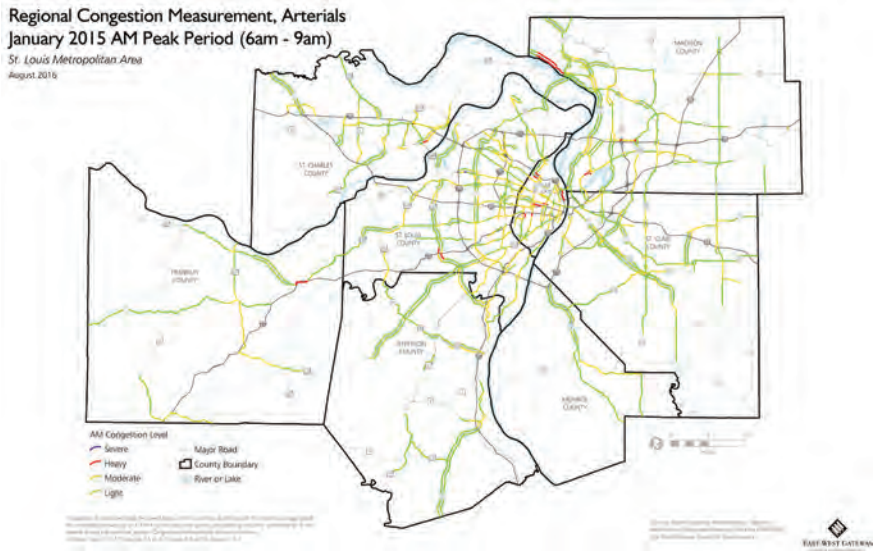
Both Regional the PTI and TTI have largely been increasing on all roadways at both peaks from 2012 to 2015. Freeway travel required more planned time than arterials due to higher levels of congestion. The TTI on arterials and freeways was higher in the PM peak than in the AM peak periods.

The continued coordination of congestion projects between EWG, MoDOT, IDOT, Bi-State Development, city of St. Louis, St. Louis County and St. Charles County is essential for future regional transportation system improvements.

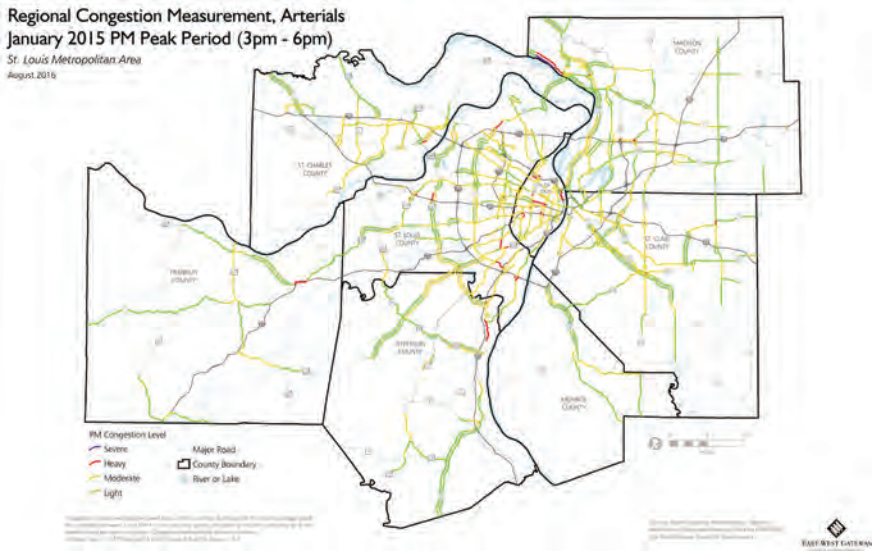
Appendix

Congestion Maps

CM 1: January
Congested Arterials AM click for pdf

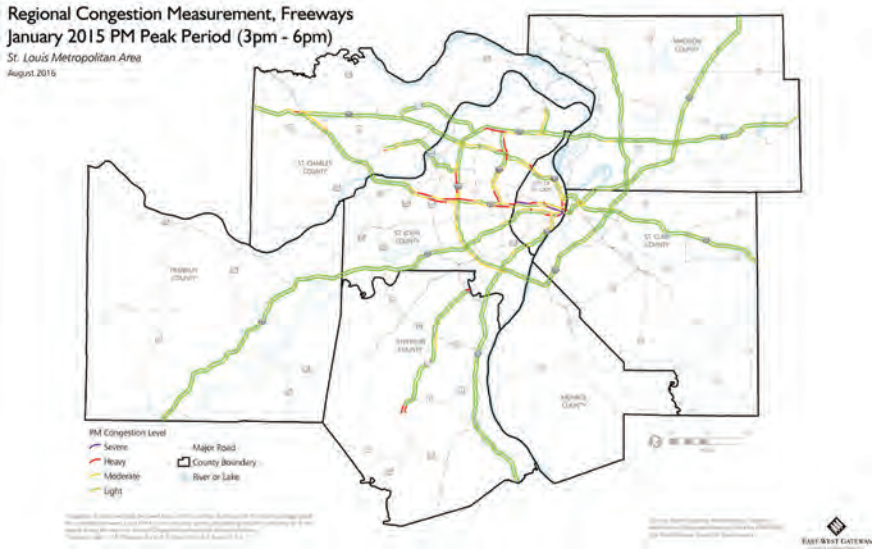


CM 1: January
Congested Arterials PM click for pdf

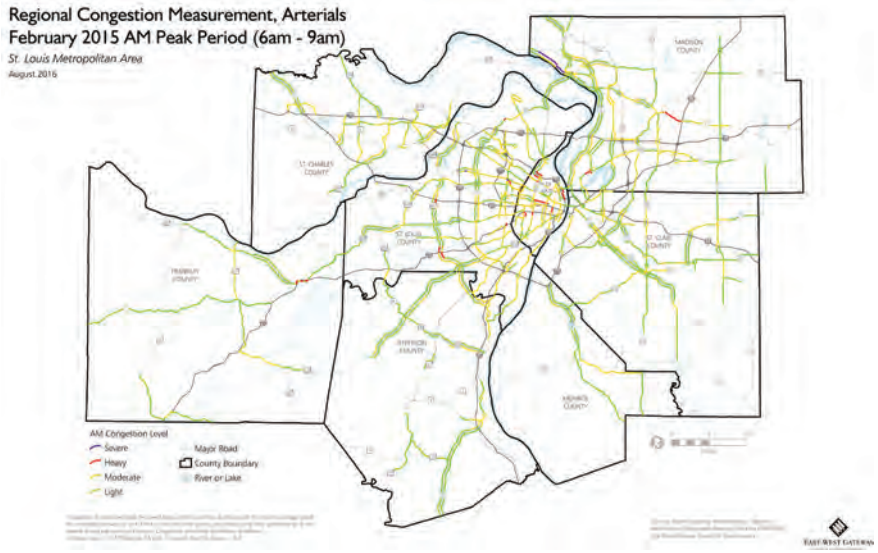


CM 1: January
Congested Freeways AM click for pdf

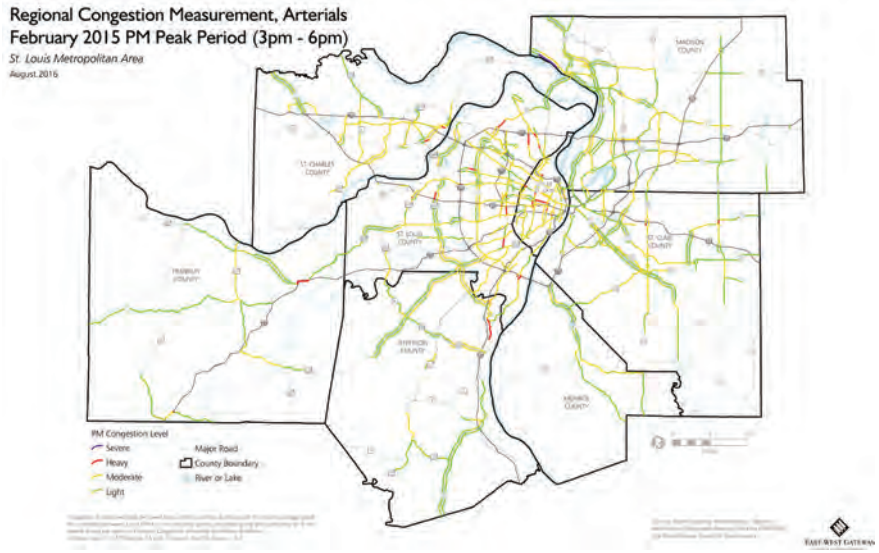
CM 1: January
Congested Freeways PM click for pdf



CM 2: February
Congested Arterials AM click for pdf



CM 2: February
Congested Arterials PM click for pdf



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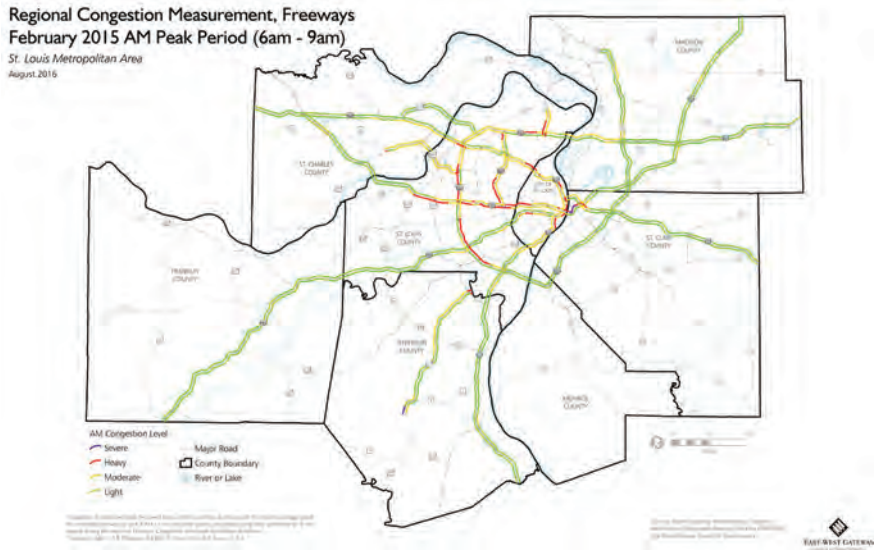

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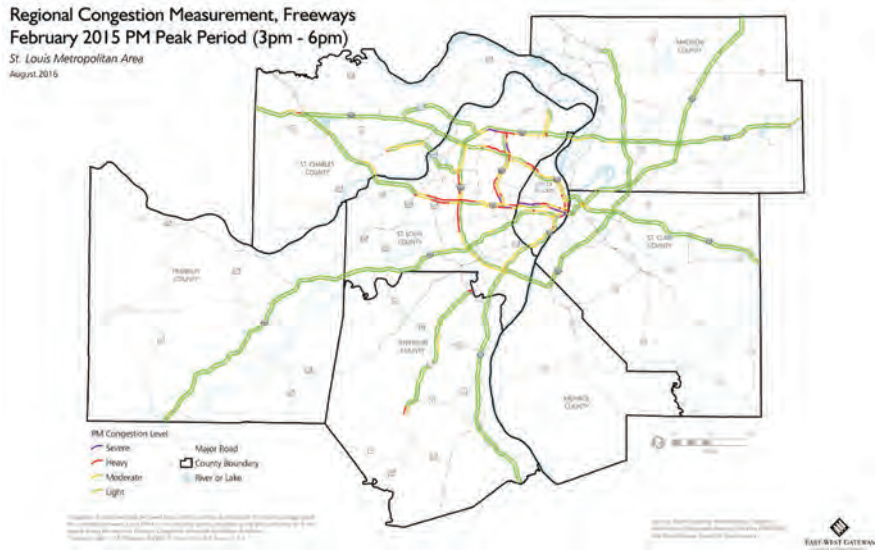

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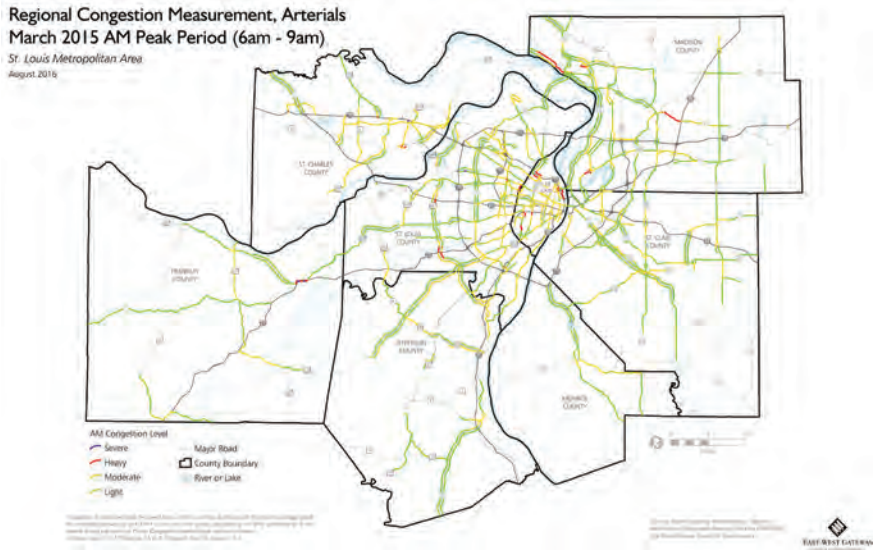

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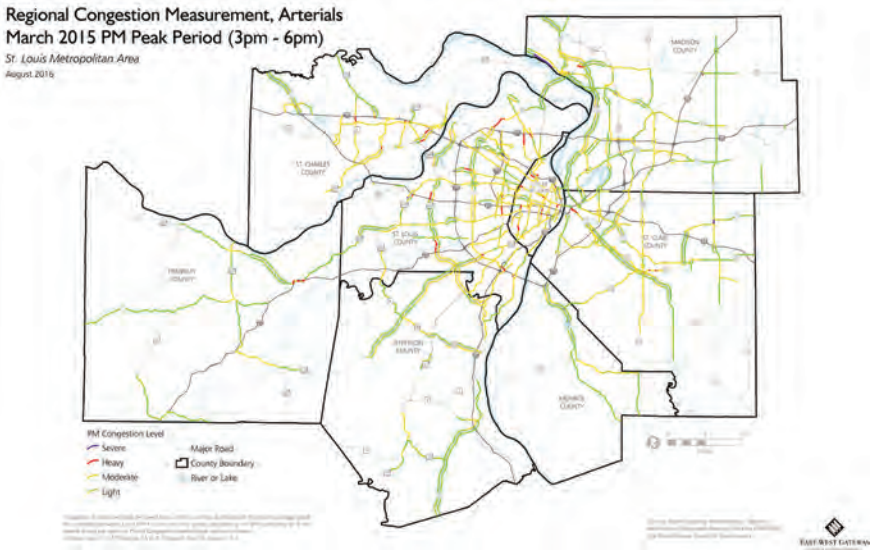

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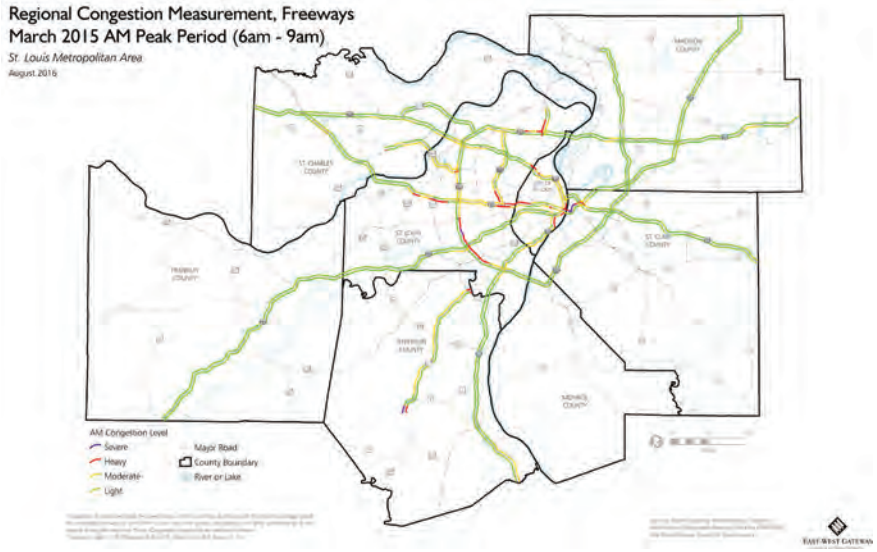

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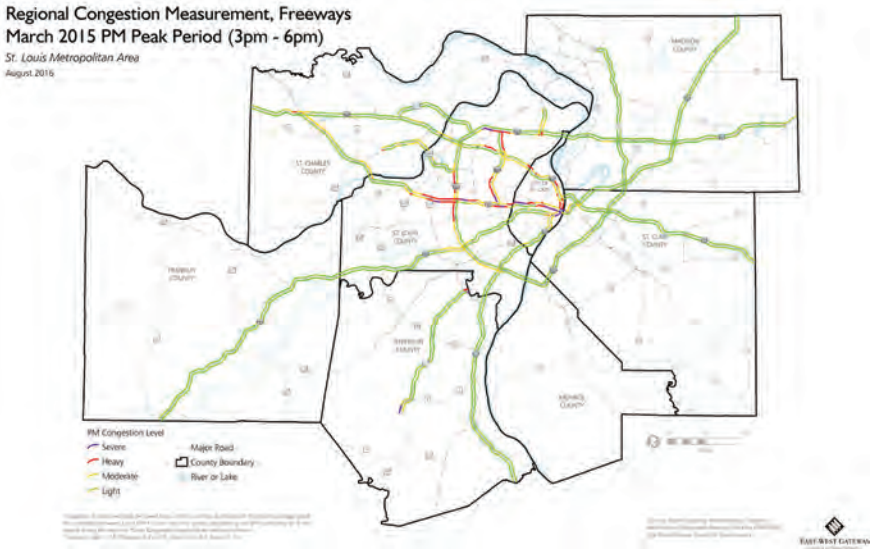

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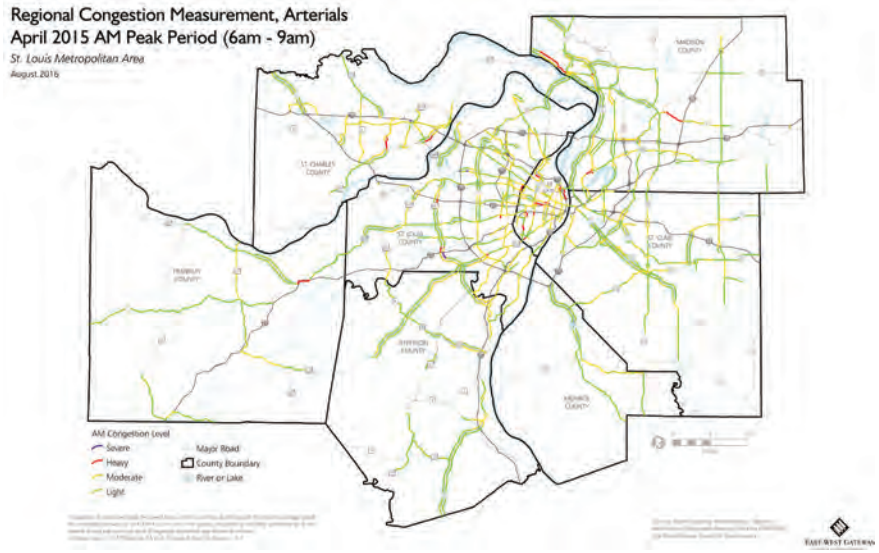

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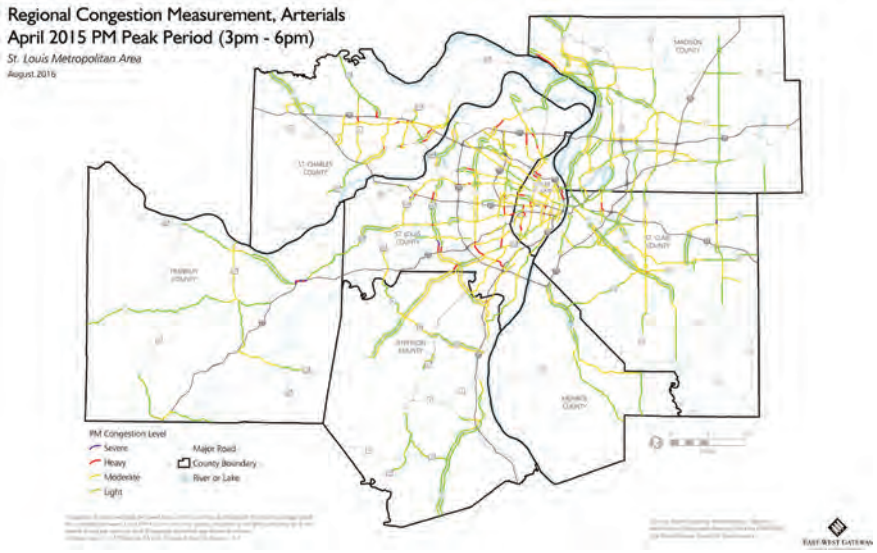

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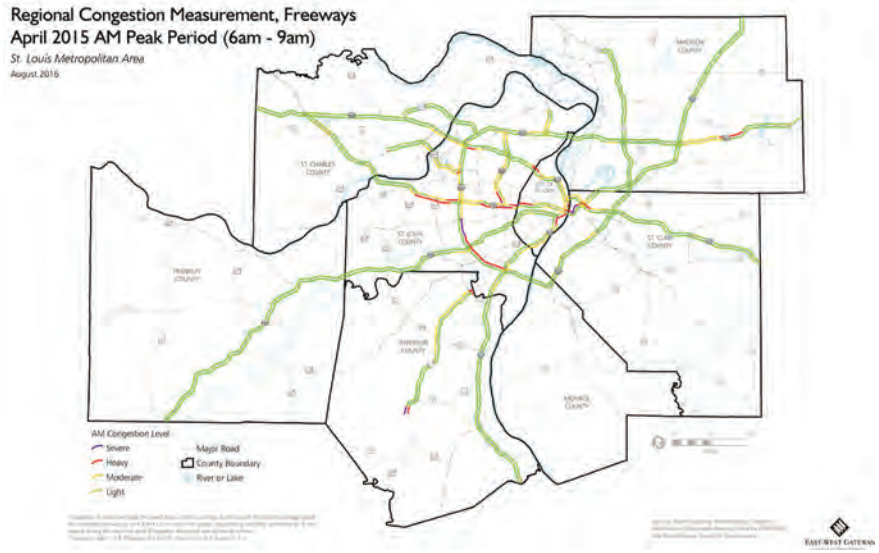

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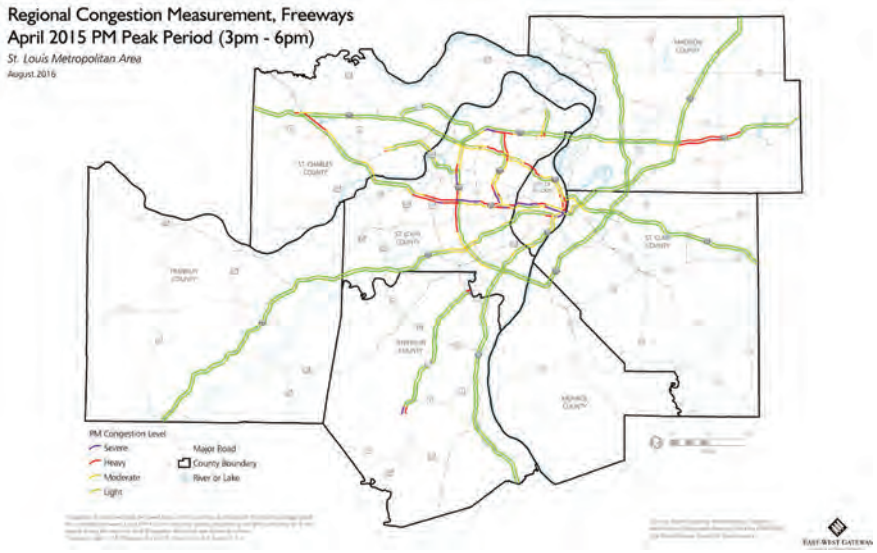

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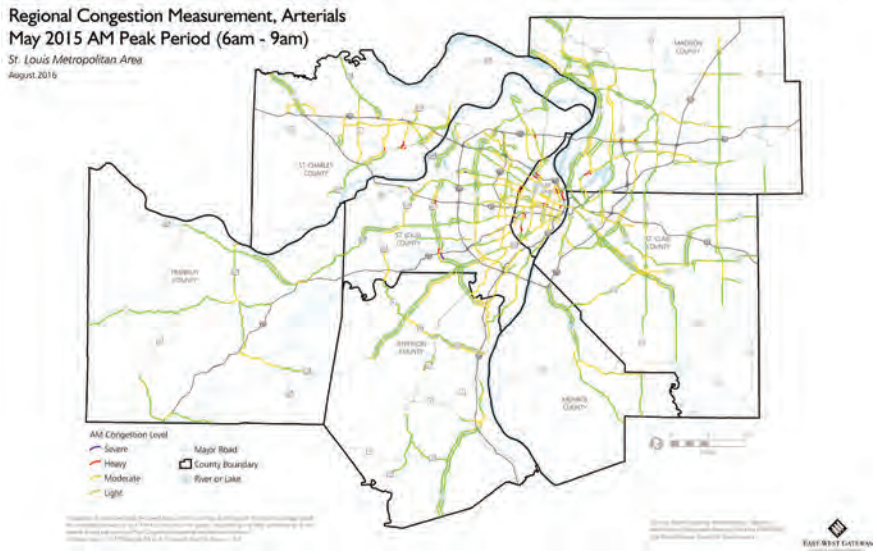

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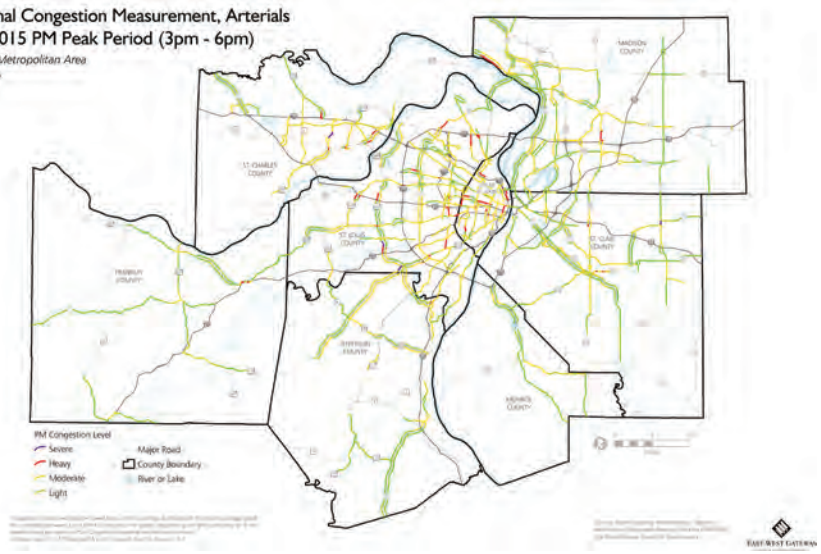

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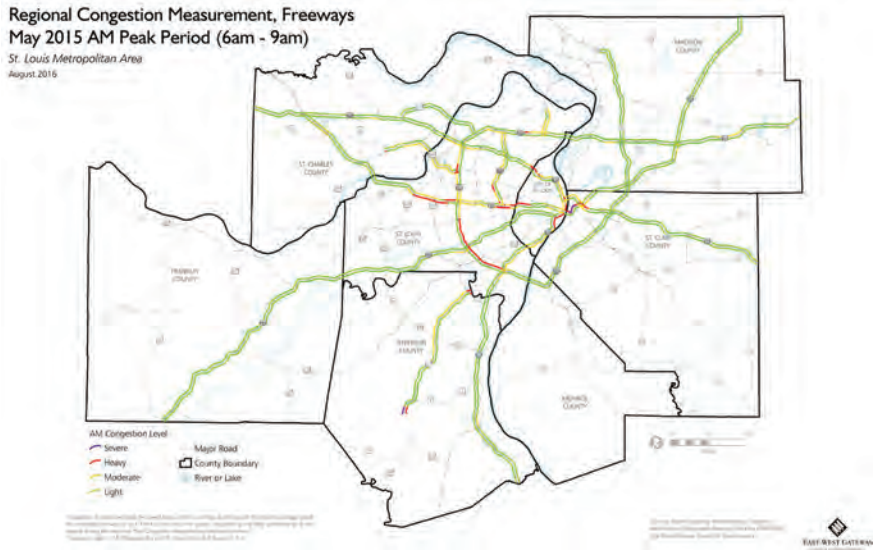

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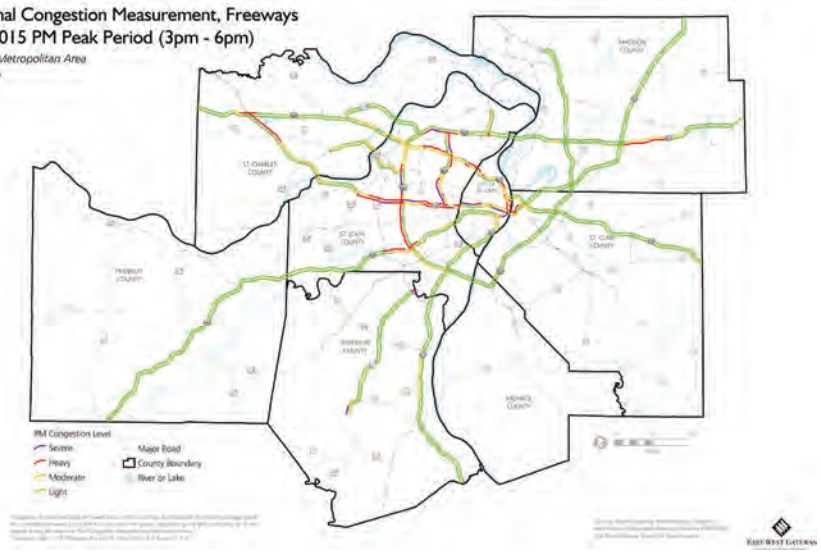

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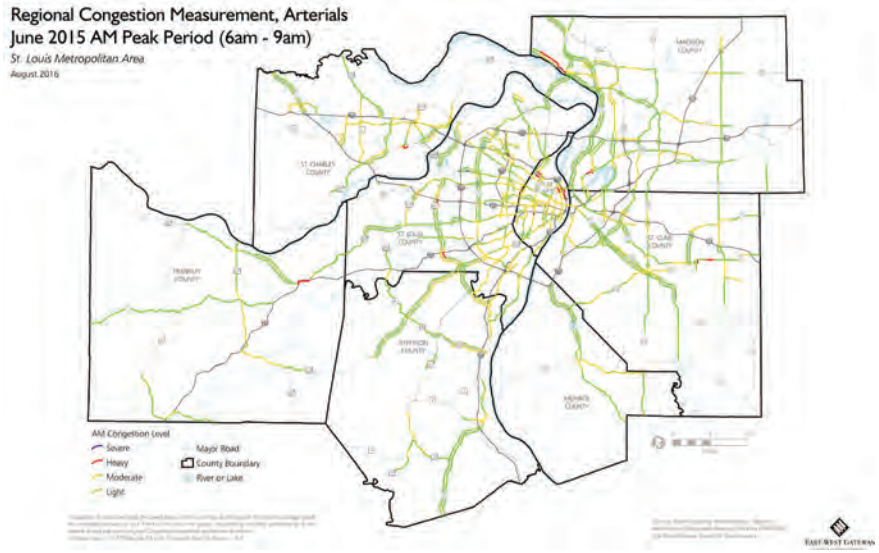

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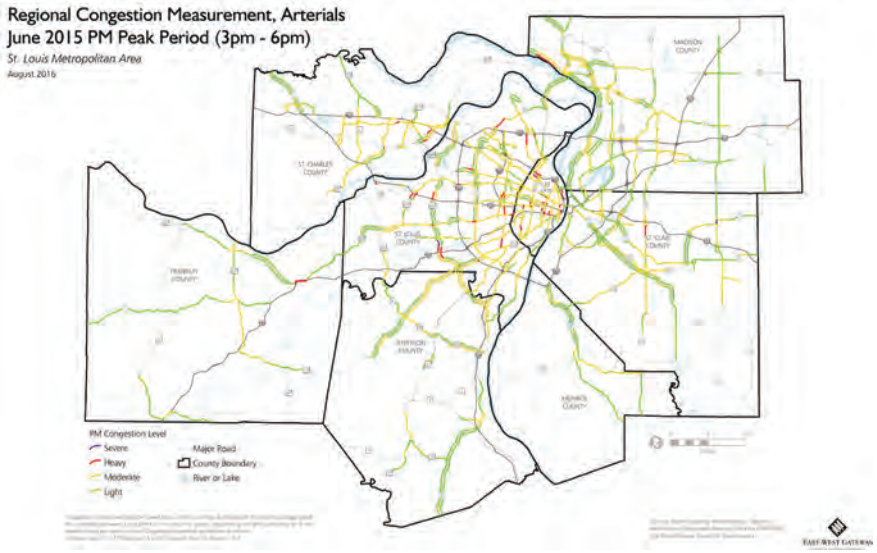

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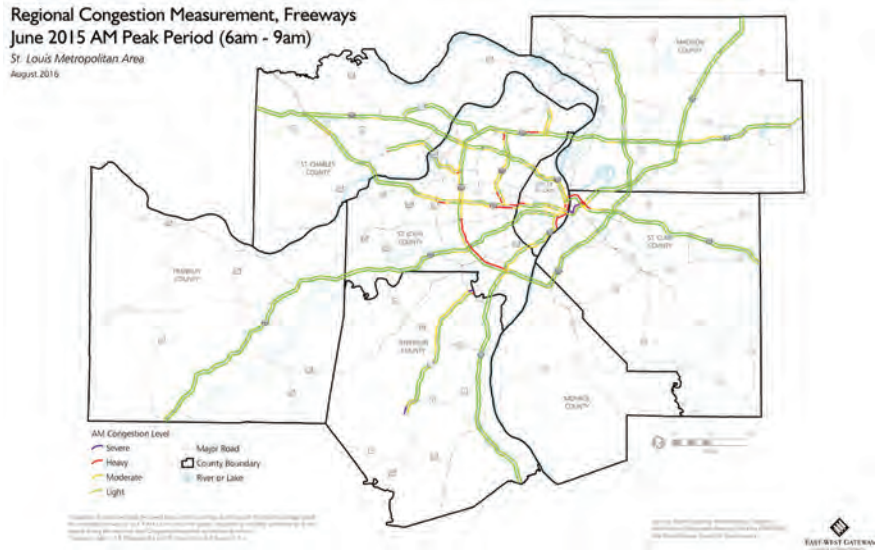

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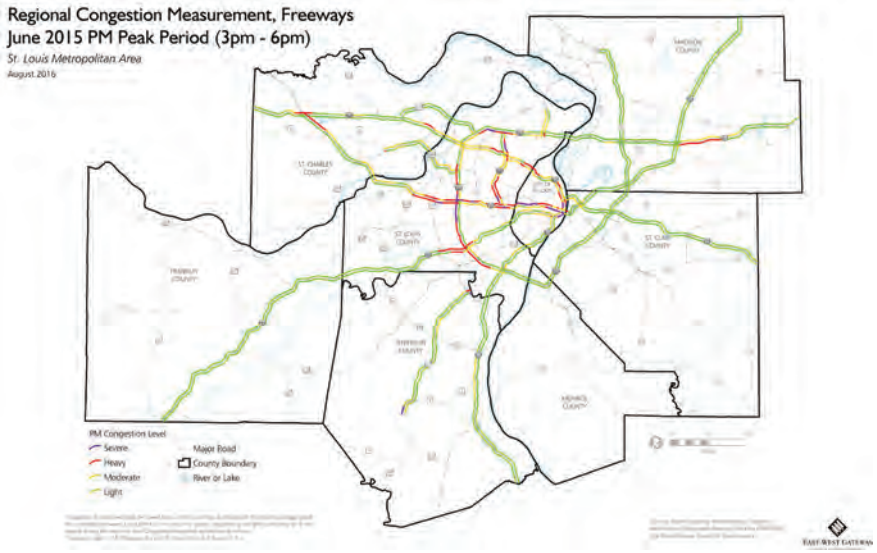

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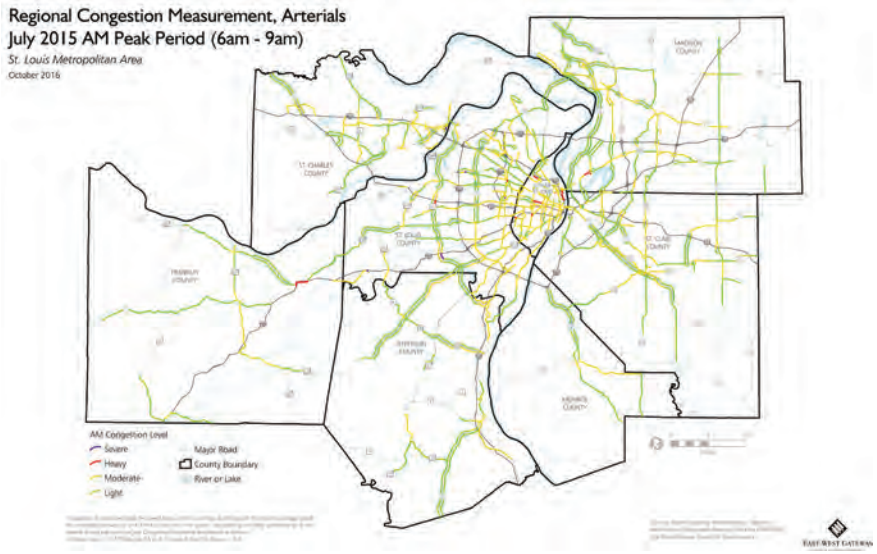

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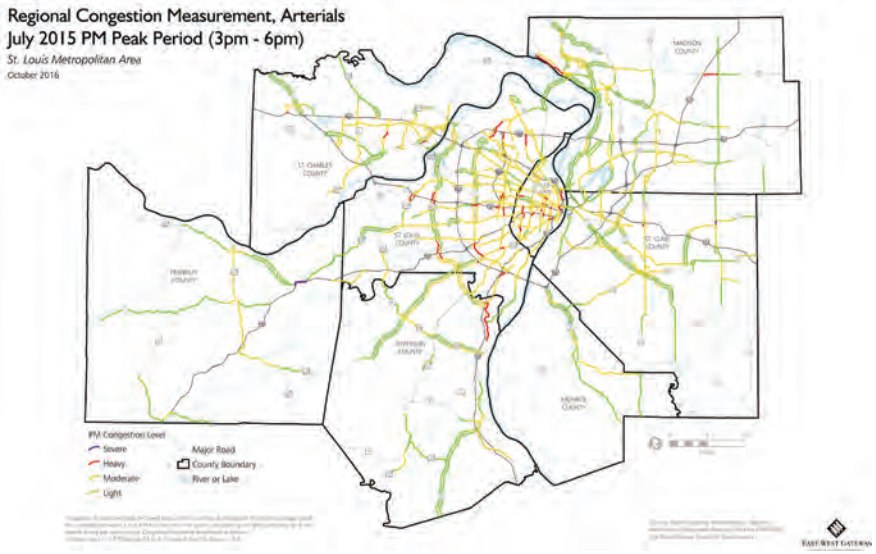

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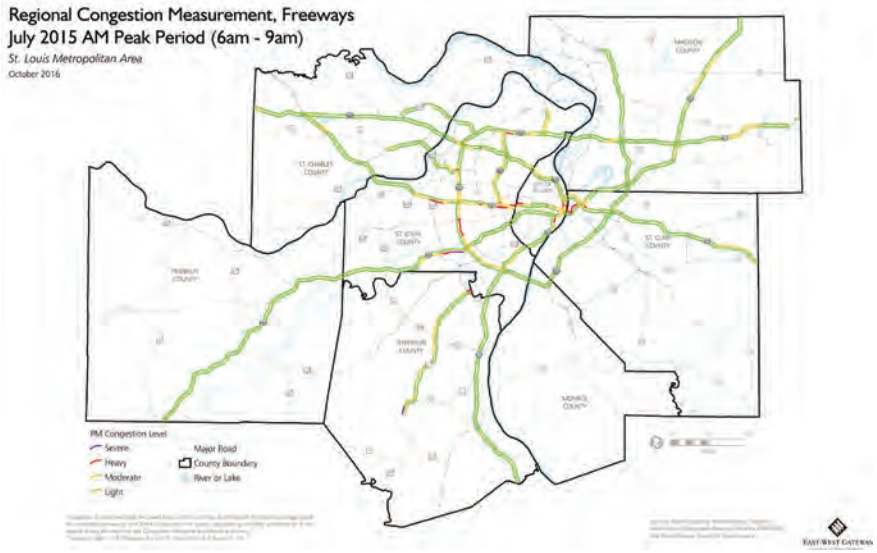

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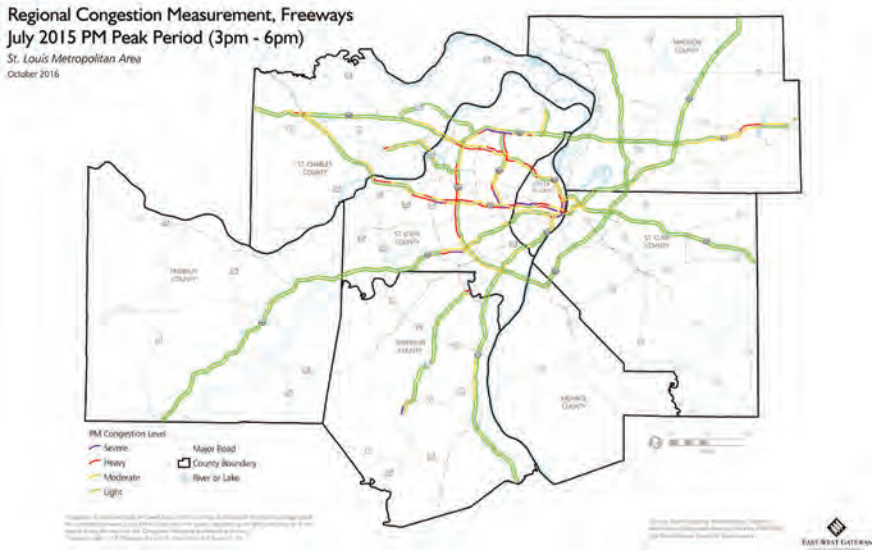

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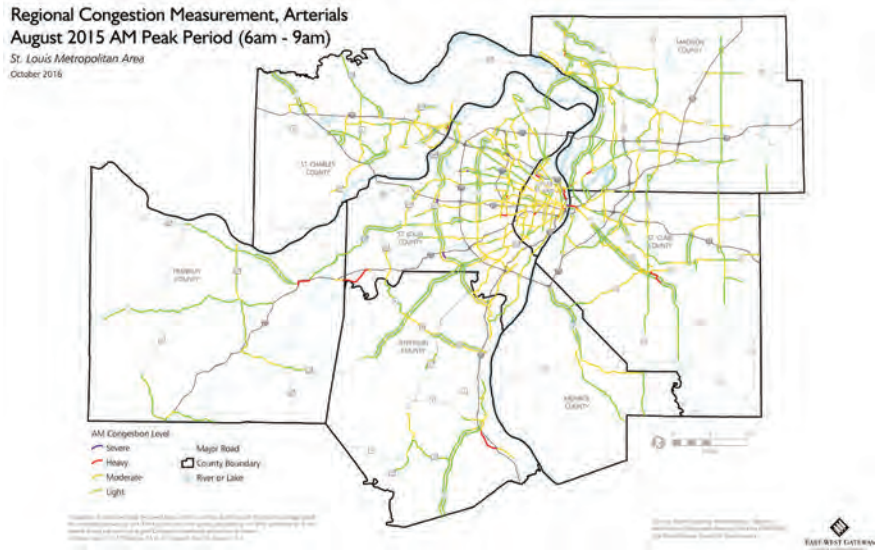

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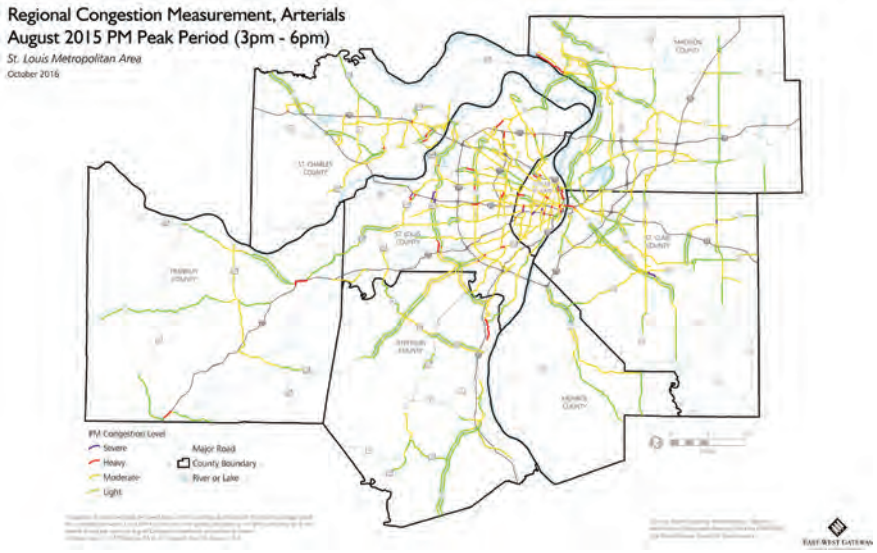

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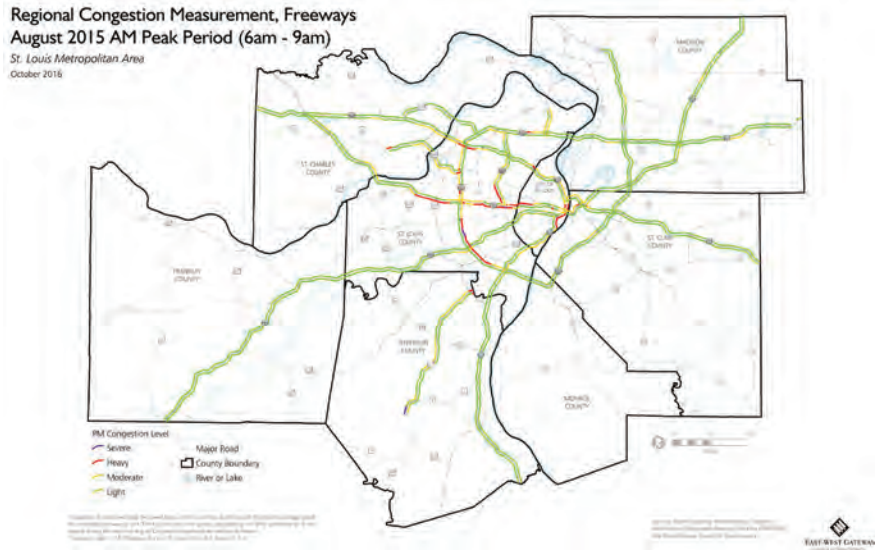

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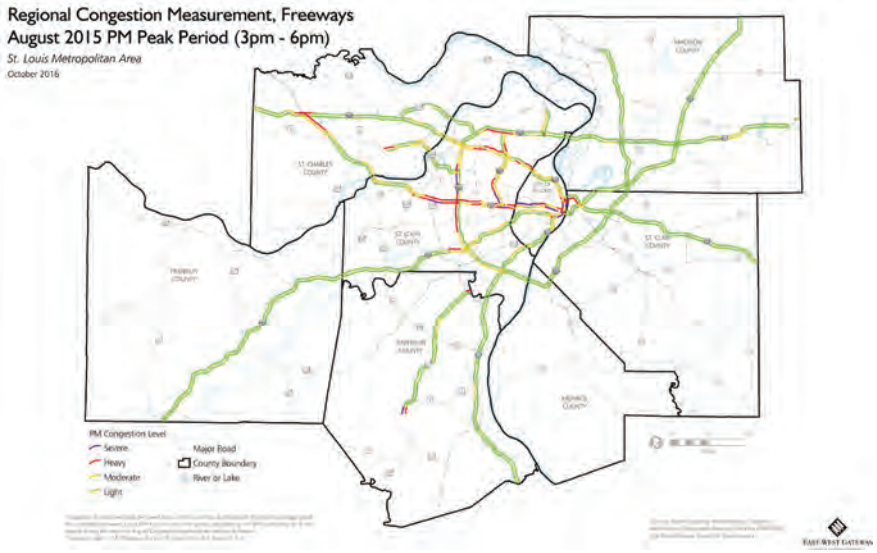

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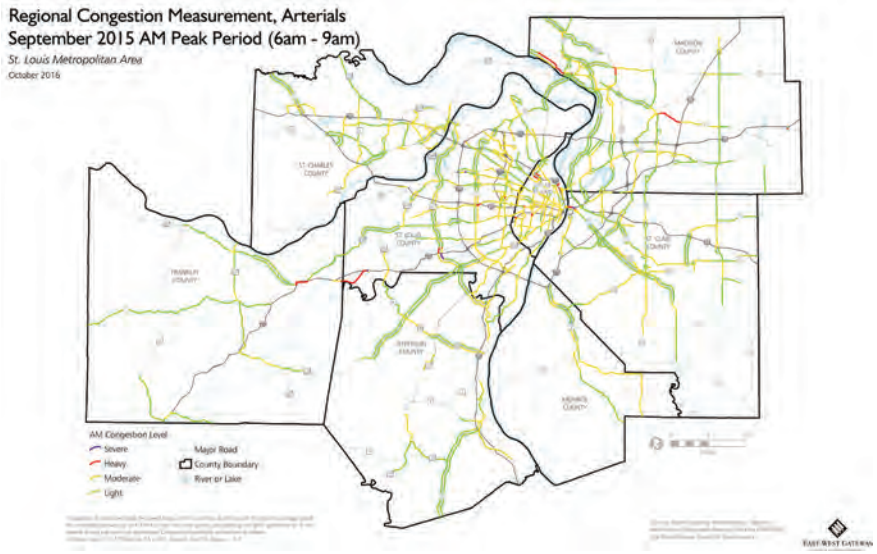

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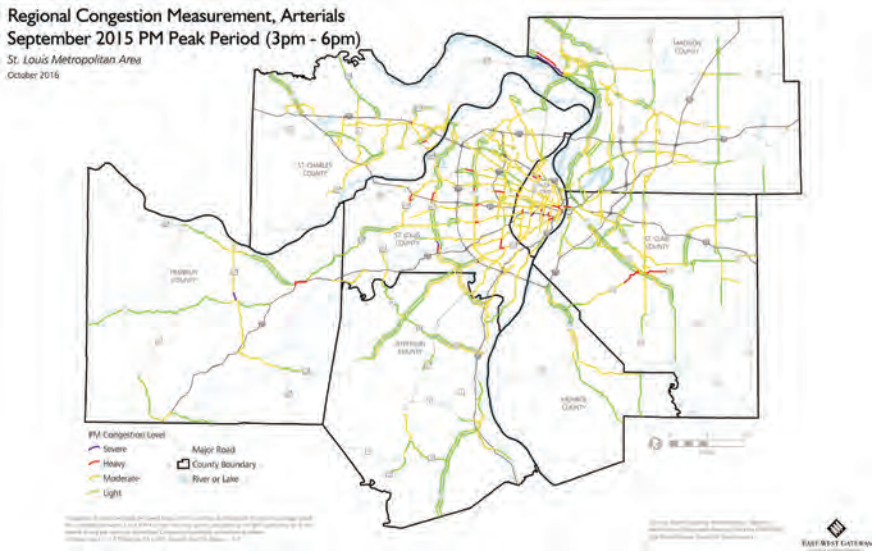

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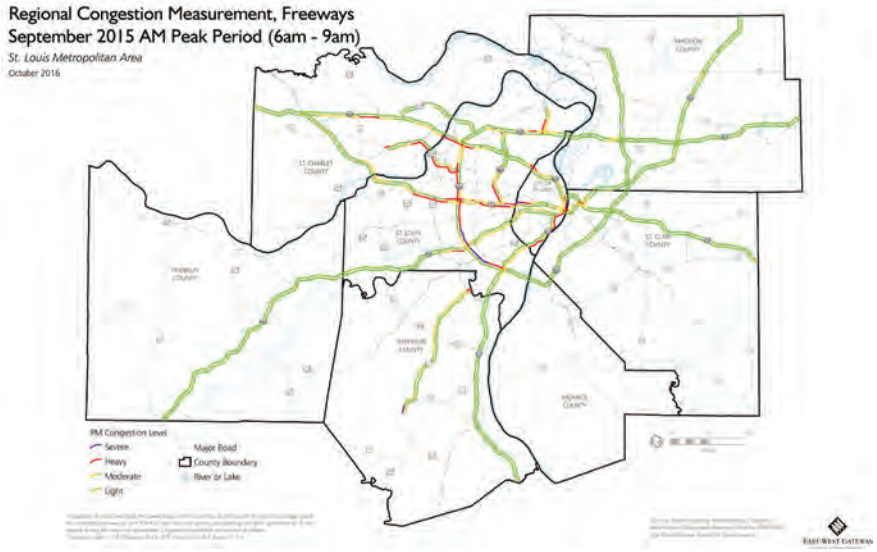

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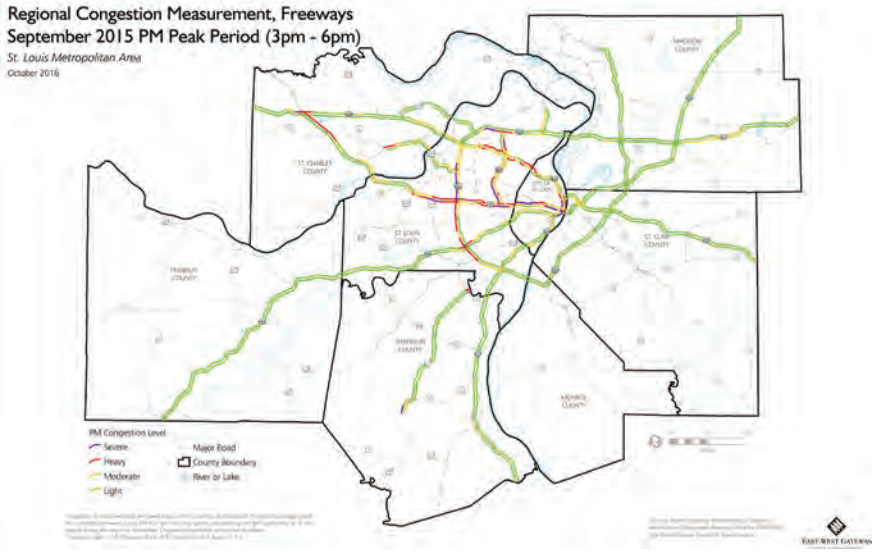

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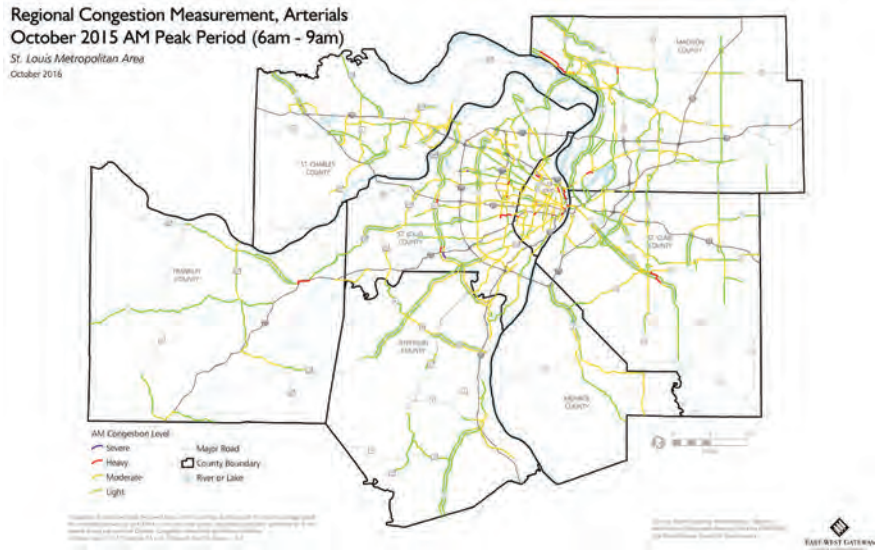

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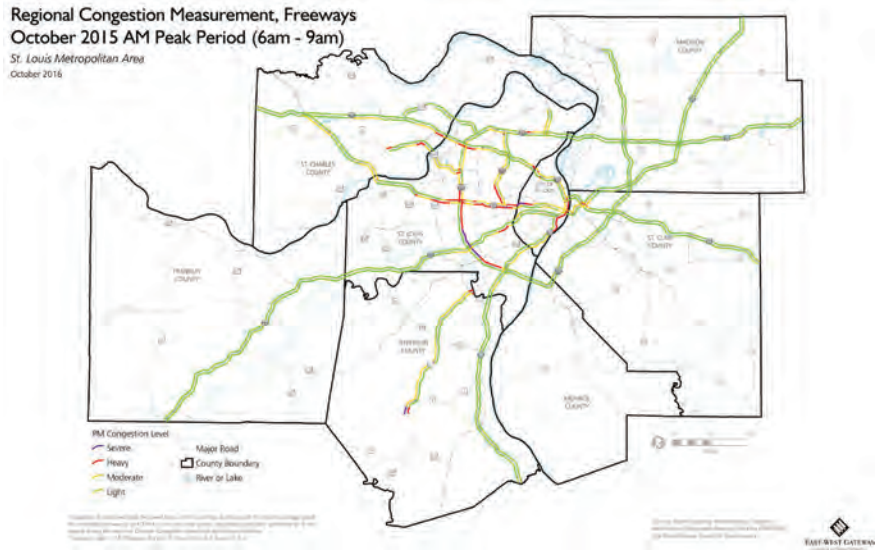

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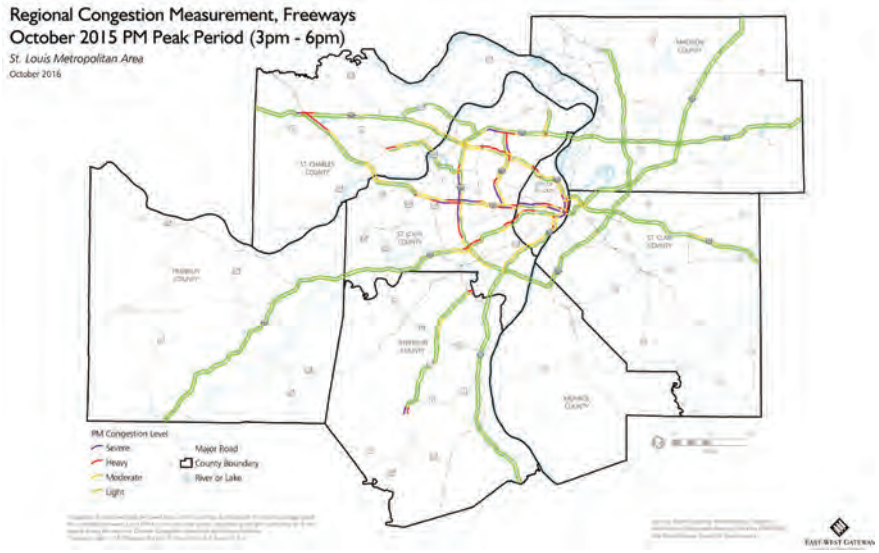

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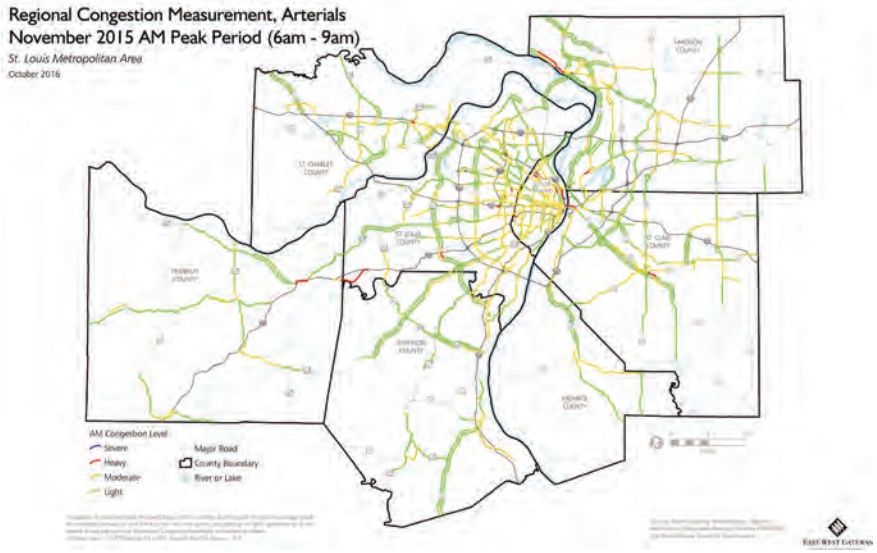

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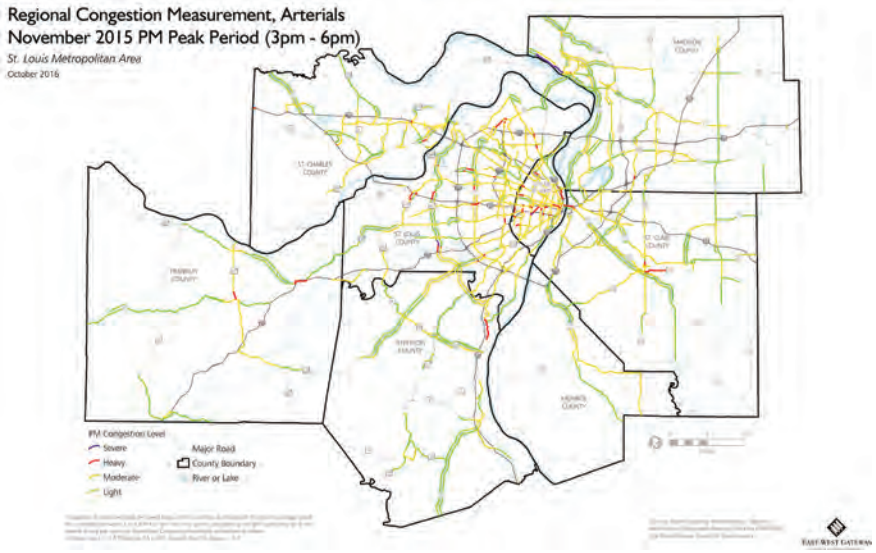

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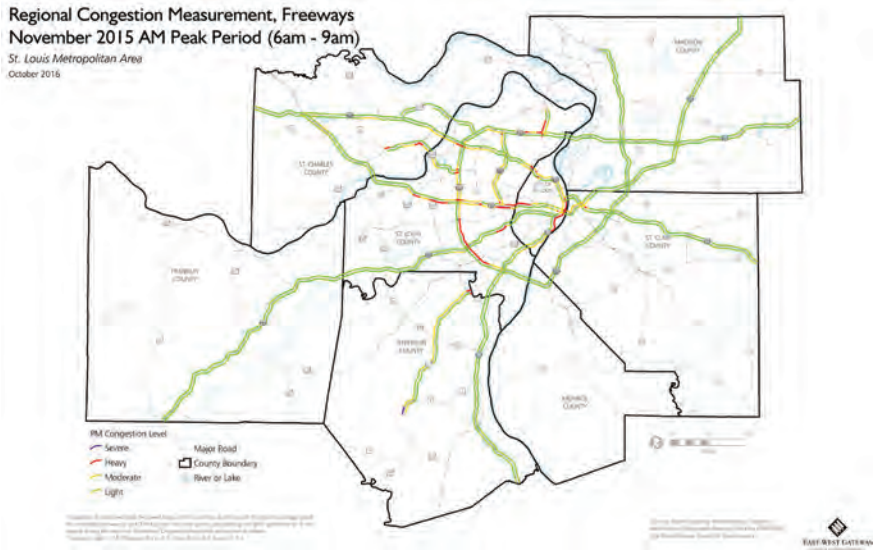

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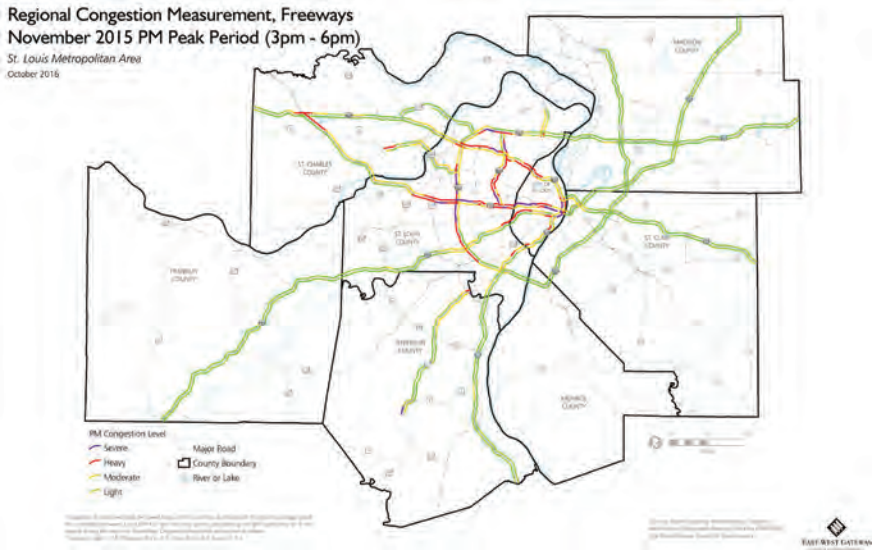

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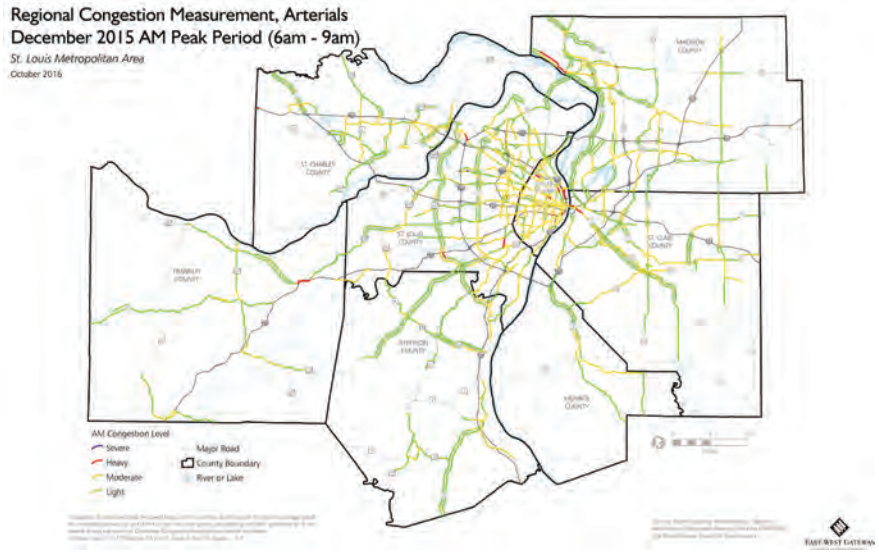

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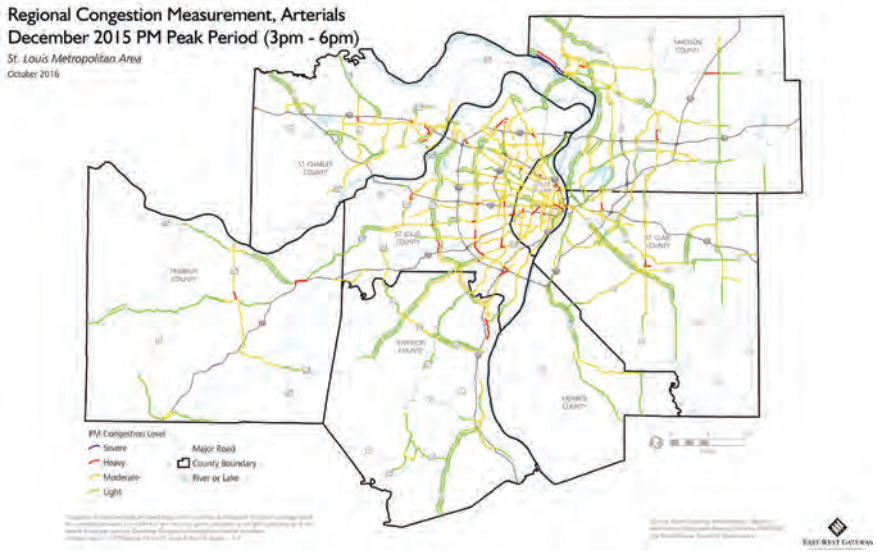

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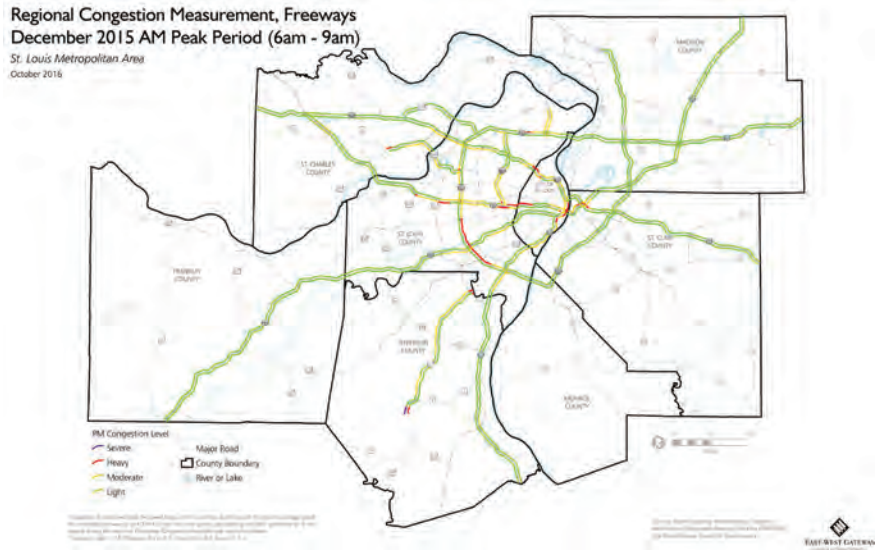

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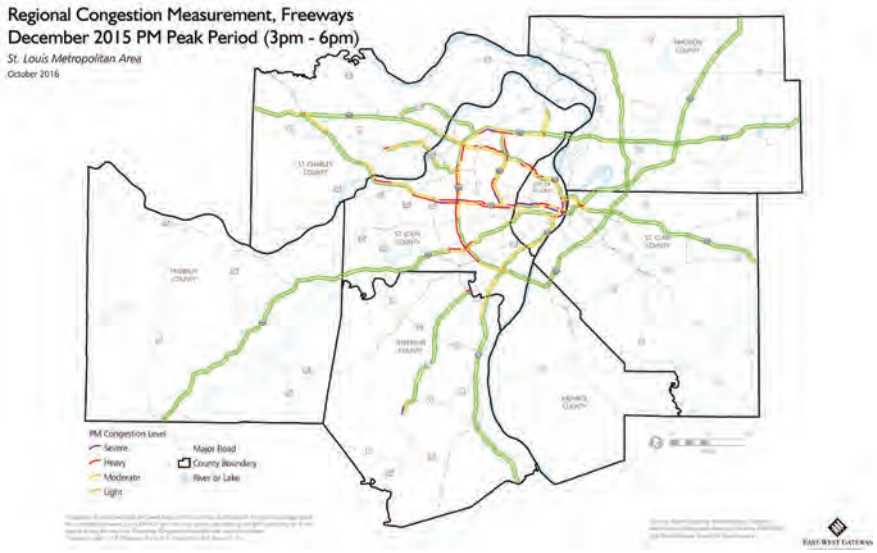

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