OZARKS TRANSPORTATION ORGANIZATION

A METROPOLITAN PLANNING ORGANIZATION

# Congestion Management Process

## Congestion Monitoring and Strategy Evaluation

Board of Directors Adoption: April 20, 2017

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# Report Highlights

This reports offers an updated looked at congestion in the OTO area. Data on current congestion was collected and recent system improvements, either capacity or operations related, were added to a list of completed projects. Changes in congestion and implemented projects were compared to determine if regional investments were having a positive impact on congestion.

The following are highlights found during the Congestion Monitoring Process.

### Volume-to-Capacity Ratio

- 102 out of 180 road segments maintained acceptable Volume-to-Capacity ratios.
- The number of segments with acceptable Volume-to-Capacity ratios is 20 lower than in 2012.
- No noticeable improvements in historically problem areas, such as US 160, between Springfield and Nixa, and National, north of James River Freeway.

### Accident Frequency

- 176 of the 218 signalized intersections have an acceptable frequency of accidents
- 10% of CMP mileage have accidents frequencies above the MPO average for a given road type
- The percentage of roads and intersections with above-average accident frequencies is similar to 2012.

### Average Travel Speeds

- The average delay increased from 8.77 to 10.6 mph below posted speed limits since 2012.
- Eastbound travel has experienced growing delay. For the first time, two of the three slowest commutes are eastbound travel.
- The method used to calculate delay in 2016 represents a significant change from previous years

### Intersection Level-of-Service

- 94% of intersections are providing acceptable Levels of Service in 2016
- More intersections experienced declines in service than experienced improvements
- Five of the eight intersections declining to LOS F are associated with the US 160 corridor between Springfield and Nixa

### The following are considered Congested Facilities

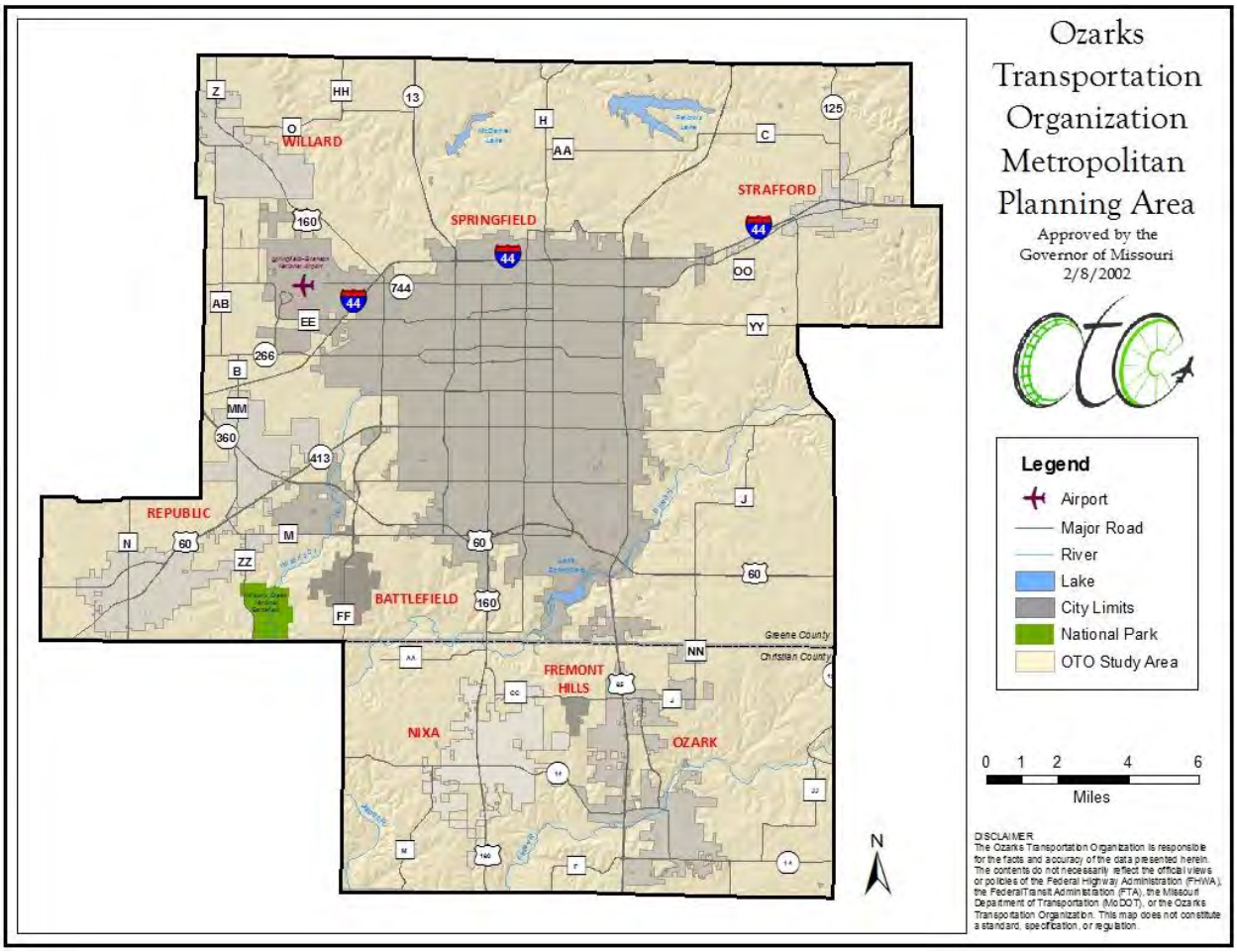
| **Battlefield Road** | |
|---|---|
| Campbell to Battlefield Mall | At Kansas Expressway |
| **Chestnut Expressway** | |
| Sherman Avenue to Boonville Avenue | |
| **Glenstone Avenue** | |
| I-44 to Division Street | Chestnut Expressway to Seminole |
| At EB I-44 Ramps | At Chestnut Expressway |
| At Sunshine | |

*Continued following page*

| | |
|---|---|
| **Kansas Expressway** | |
| Grand to Sunshine | Battlefield to Republic Road |
| **National Avenue** | |
| Battlefield to Republic Road | |
| **US 160** | |
| Route AA to Route CC | At Route CC |
| **US 60** | |
| At Route M/Route MM | |
| **Route 14** | |
| At US 160 | At US 65 |

# Introduction

The Congestion Management Process (CMP) is a systematic approach to addressing congestion within the Ozarks Transportation Organization's (OTO) planning area, shown in Map 1. The process was developed through a collaborative effort involving area jurisdictions and technical experts. The intent of the CMP is to improve the efficiency and effectiveness of both the existing and future transportation system through the implementation of Transportation System Management (TSM), which includes Intelligent Transportation Systems (ITS) and Travel Demand Management (TDM) techniques.




Map 1: Ozarks Transportation Organization Metropolitan Planning Area Map

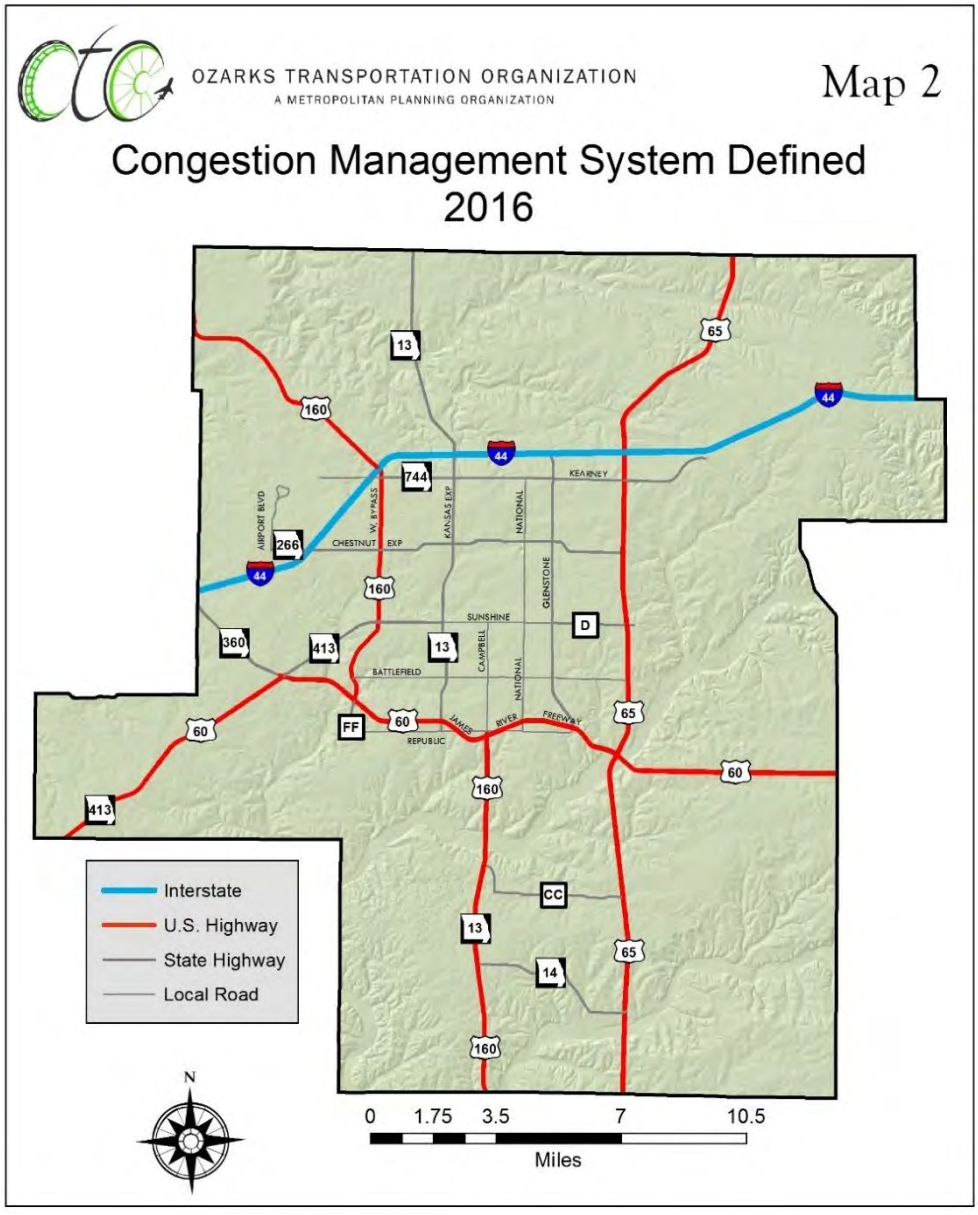
## Overview of Previous Phases

The CMP consists of three main phases. Phase I, completed in 2005, is a methodology to identify congestion and designate specific strategies to address congestion. Phase II, completed in 2008, is the identification of where congestion is occurring or is expected to occur during the 20-year plan horizon and the implementation of identified strategies. Phase III, first completed in 2012, is the development of a monitoring program to determine if selected strategies are effective in dealing with congestion at

identified locations, and if not, identify other strategies to alleviate congestion. This 2016 Congestion Monitoring report is an update to Phase III and should be updated every three to five years.

## Network Redefined

Phase I and II of the CMP identified the CMP network as OTO-area roadways that are part of the National Highway System (NHS). With passage of MAP-21, the CMP network was expanded in Phase III to include the Enhance-NHS, the traditional NHS plus principal arterials. In addition, committee members chose to include segments of some principal arterials not included in the Enhanced-NHS, such as National north of Chestnut Expressway or Kearney west of I-44. These additional segments provide useful local information. No major changes were made in response to the passage of the FAST Act. The CMP network in 2016 can be seen in Map 2 below.



# Congestion Monitoring

The following four measures are the indicators the OTO has elected to monitor to determine where congestion is occurring. These measures are *(1)* Volume-to-Capacity Ratio, *(2)* Accident Frequency, *(3)* Average Travel Speed, and *(4)* Intersection Level of Service. These measures are defined in this congestion monitoring report.

## 1. Volume-to-Capacity Ratio

The first measure OTO utilizes to monitor congestion is peak hour volume-to-capacity ratio. This ratio is used to determine which roads have peak volumes that exceed the road's capacity and which roads are approaching capacity. Peak hour traffic volumes that are used in the ratios can be found on **Map 3.1**. These traffic volumes are calculated from intersection turning movement studies conducted over the last few years. Data is not available for all road segments. Roadway capacities are a function of the number of traffic lanes. Capacities have been calculated for each type of road in the OTO area, including the section of 4+1 lane expressway National Avenue, south of Walnut Lawn, and the 5+1 lane section of Campbell, south of Primrose. An important indicator of traffic volumes is Vehicle Miles Traveled (VMT). The indicator represents the total number of miles driven by the OTO population each day. If VMT is rising, it is likely associated with increased traffic volumes. Recent trends show a rebound in VMT for the area.

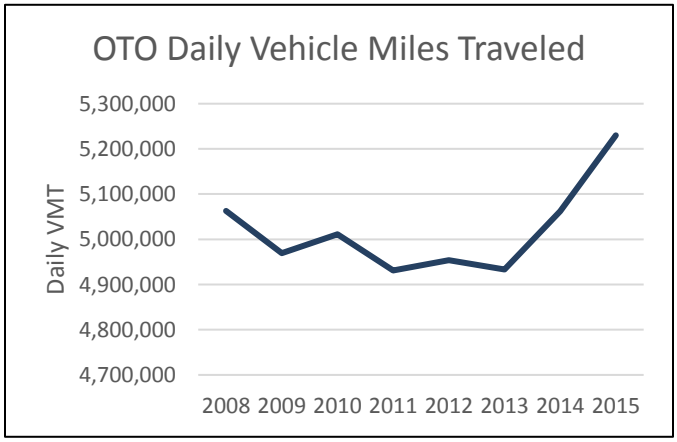
### Daily Vehicle Miles Traveled (VMT)

**Table 1** shows the VMT for the OTO area is reversing its downward trend of the 2008 to 2013 period. The recent increase is associated with a stronger national economy and lower energy costs. Data shows the VMT increase of 166,916 miles traveled or 3.30 percent of VMT from 2008 to 2016, a record high for the region. This table also shows a decline of VMT per capita of 0.91 miles during this time frame, or 5.37 percent, despite population growth of about 9.2 percent in the 7-year period. From 2013 to 2015, the network mileage sampled for VMT calculation declined 0.5%. The increase seen in VMT during this period is likely due to increases in traffic, not increases in lane mileage.

**Table 1: OTO Daily Vehicle Miles Traveled**

| Year | VMT | OTO Population | VMT per Capita |
|---|---|---|---|
| **2015** | 5,229,938 | *326,321 | 16.03 |
| **2014** | 5,061,794 | *323,031 | 15.67 |
| **2013** | 4,933,188 | *320,259 | 15.40 |
| **2012** | 4,954,024 | *316,298 | 15.66 |
| **2011** | 4,931,037 | *312,126 | 15.80 |
| **2010** | 5,010,884 | 310,283 | 16.14 |
| **2009** | 4,969,336 | *303,720 | 16.36 |
| **2008** | 5,063,022 | *298,910 | 16.94 |

*Census Estimate



## Volume-to-Capacity Ratio

**Map 3.2** includes volume-to-capacity ratios broken into three categories: *below capacity*, *nearing capacity*, and *at or above capacity*. Segments with a volume-to-capacity ratio of 0 to 0.77 are I and offer an LOS of A, B, or C. Segments with a ratio of .78 to .86 are *nearing capacity* and offer a LOS of D. Ratios of 0.86 or above offer LOS E or F and are *at or above capacity*. For purposes of this study, LOS A, B, C, or D are acceptable. The volume-to-capacity ratio of 106 of the 203 segments surveyed in 2016 have stayed or improved to an acceptable level of service (LOS A, B, C, D). Data was missing or invalid for 32 segments. Changes can be seen in **Table 2** below

**Table 2: Changes in Volume-to-Capacity Ratio, 2012-2016**

| Intersection | Segment North of: | Segment South of: | Segment East of: | Segment West of: |
|---|---|---|---|---|
| Battlefield and US 65 SBR* | *N/A* | *N/A* | | |
| Battlefield and US65 NBR* | *N/A* | *N/A* | | |
| Campbell and Battlefield | | | | |
| Campbell and Plainview* | | | *N/A* | *N/A* |
| Campbell and Republic* | | | *N/A* | *N/A* |
| Campbell and Sunshine | *N/A* | | | |
| Campbell and Walnut Lawn | | | *N/A* | N/A |
| Chestnut and Grant | *N/A* | *N/A* | | |
| Chestnut and I44 | *N/A* | *N/A* | | No Data |
| Chestnut and US65 NBR | *N/A* | *N/A* | | |
| Chestnut and US65 SBR | *N/A* | *N/A* | | |
| Glenstone and Battlefield* | | | | |
| Glenstone and Chestnut | | | | |
| Glenstone and Division | | | *N/A* | *N/A* |
| Glenstone and Grand | | | *N/A* | *N/A* |
| Glenstone and I44 EBR | | | *N/A* | *N/A* |
| Glenstone and I44 WBR | | | *N/A* | *N/A* |
| Glenstone and Kearney | | | | |
| Glenstone and Sunshine | | | | |
| Glenstone and US60 WB* | | | *N/A* | *N/A* |
| I44 and US65 | | | | |
| Kansas Expressway and Battlefield | | | | |
| Kansas Expressway and Chestnut | | | | |
| Kansas Expressway and Division | | | *N/A* | *N/A* |
| Kansas Expressway and Grand | | | *N/A* | *N/A* |
| Kansas Expressway and I44 | *N/A* | *N/A* | | |

| Key |
|---|
| Stayed LOS A,B,C,D |
| Improved to LOS A,B,C,D |
| Declined to LOS E,F |
| Stayed LOS E,F |

| Table 2: Changes in Volume-to-Capacity Ratio, 2012-2016 | | | | |
|---|---|---|---|---|
| **Intersection** | **Segment North of:** | **Segment South of:** | **Segment East of:** | **Segment West of:** |
| Kansas Expressway and US60 EBR | No Data | No Data | No Data | No Data |
| Kansas Expressway and US60 WBR | | | *N/A* | *N/A* |
| Kansas Expressway and Kearney | | | | |
| Kansas Expressway and Norton Rd | | | *N/A* | *N/A* |
| Kansas Expressway and Republic Rd | No Data | No Data | No Data | No Data |
| Kansas Expressway and Sunshine | | | | |
| Kansas Expressway and US44 EBR | | | *N/A* | *N/A* |
| Kansas Expressway and US44 WBR | | | *N/A* | *N/A* |
| Kearney and Barnes | | | | |
| Kearney and US 65 NB | *N/A* | *N/A* | | |
| Kearney and US 65 SB | *N/A* | *N/A* | | |
| Kearney and US65 | | | *N/A* | *N/A* |
| MO 13 and O | No Data | No Data | *N/A* | *N/A* |
| MO266 and Airport Blvd | No Data | No Data | No Data | No Data |
| MO266 and US44 WBR | *N/A* | *N/A* | | |
| National and Battlefield* | | | | |
| National and Chestnut | | | | |
| National and Division | | | *N/A* | *N/A* |
| National and Grand | | | *N/A* | *N/A* |
| National and Republic* | | *N/A* | | |
| National and Sunshine | | | | |
| Sunshine and US65 | *N/A* | *N/A* | | |
| US 160 and Hughs | | | *N/A* | *N/A* |
| US 160 and Hunt | | | *N/A* | *N/A* |
| US 160 and JRF EBR | | | *N/A* | *N/A* |
| US 160 and JRF WBR | No Data | No Data | *N/A* | *N/A* |
| US 160 and Plainview | | | *N/A* | *N/A* |
| US 160 and MO 14 | | | *N/A* | *N/A* |
| US 160 and Northview | | | *N/A* | *N/A* |
| US 160 and RT CC | | | | *N/A* |
| US 160 and South | | | *N/A* | *N/A* |
| US 160 and Tracker | | | *N/A* | *N/A* |

| Key |
|---|
| Stayed LOS A,B,C,D |
| Improved to LOS A,B,C,D |
| Declined to LOS E,F |
| Stayed LOS E,F |

| Table 2: Changes in Volume-to-Capacity Ratio, 2012-2016 | | | | |
|---|---|---|---|---|
| **Intersection** | **Segment North of:** | **Segment South of:** | **Segment East of:** | **Segment West of:** |
| US 160 and AA | | | *N/A* | *N/A* |
| US 60 and MO 125 | *N/A* | *N/A* | No Data | No Data |
| US60 and RT M/ RT MM | *N/A* | *N/A* | | |
| US60 and RT P/ RT N | *N/A* | *N/A* | | |
| US65 SBR and MO14 | *N/A* | *N/A* | | |
| West Bypass and Republic Rd | No Data | No Data | No Data | No Data |
| West Bypass (US 160) and Battlefield | | | | *N/A* |
| West Bypass (US 160) and Chestnut | | | | |
| West Bypass (US 160) and Grand | | | *N/A* | *N/A* |
| West Bypass (US 160) and Kearney | | | | |
| West Bypass (US 160) and Sunshine | | | | |
| West Bypass and Division | | | *N/A* | *N/A* |
| MO-14 and Ridgecrest | *N/A* | *N/A* | | |
| MO-14 and Cheyenne * | *N/A* | *N/A* | | |
| MO-14 and Fremont | *N/A* | *N/A* | | |
| James River Freeway and MO 413 | *N/A* | *N/A* | | No Data |
| James River Freeway at Campbell | *N/A* | *N/A* | | |
| James River Freeway at Glenstone | *N/A* | *N/A* | | No Data |
| US 65at MO 744 | | No Data | *N/A* | *N/A* |
| US 65 at MO 14 | | | *N/A* | *N/A* |
| US 65 at US 60 | No Data | | *N/A* | *N/A* |
| US 65 at Battlefield | No Data | | *N/A* | *N/A* |
| I 44 at Rt B | *N/A* | *N/A* | No Data | |
| I 44 at MO 266 | *N/A* | *N/A* | | No Data |
| I 44 at MO 13 | *N/A* | *N/A* | | No Data |
| I 44 at US 65 | *N/A* | *N/A* | No Data | |
| **Recently improved.* | | | | |

| Key |
|---|
| Stayed LOS A,B,C,D |
| Improved to LOS A,B,C,D |
| Declined to LOS E,F |
| Stayed LOS E,F |

One hundred and two of 180 segment with valid measurements have stayed acceptable from 2012 to 2016. Overall, the number of segments with acceptable Volume-to-Capacity Ratios has declined.

### Volume-to-Capacity Level of Service Summary

Over the last 4 years, there has been a minor decline in utilization of traffic capacity in the OTO area. More segments have acceptable levels of service than unacceptable LOS in 2016, thought the number of acceptable segments is 20 lower than in 2012. The reduction in acceptable segments corresponds to the increase seen in VMT and VMT per capita since 2012. Also, we saw no noticeable improvements in historically problem areas, such as US 160, between Springfield and Nixa, and National, north of James River Freeway.

## 2. Accident Frequency

Accident frequency is important to consider because it affects the reliability of the transportation system. A fender bender may only cause traffic to back up for a few minutes, but for every 1 minute a lane is blocked, it takes four minutes for traffic to return to normal flows. This slow recovery helps contribute to congestion. Accident data used in this analysis is provided by the Missouri Highway Patrol and the Missouri Department of Transportation. In 2016, a new method was used to map and analyze accident rates. Previously, accident rates for intersections and along roadways were combined and compared to MPO average accident rates for arterials and freeways in 2005. In 2016, changes were made to the way accidents are combined and reported. First, accident frequencies for intersections and along roadways were separated. Intersection accident frequencies were compared to same year average accident frequencies for large intersections (*greater than 30,000 entering volume*) and small intersections (*less than 30,000 entering volume*) in the MPO. Range, or roadway, accident frequencies are compared to same year MPO accident frequencies for each type of road; such as freeway, expressway, 5-lane, or 3-lane. Similarly, accident frequencies, rather than accident rates, are used. The accident frequency is adjusted for segment length, but not traffic volumes. This change is shown in the maps made for 2012 and in 2016. This new method allows policy makers to better understand where accidents occur and where improvements are most needed. Data used for these new maps include data from 2009-2011 and 2012-2014.

**Map 4.1** and **4.2** contains accident frequency information for both intersections and segments, for the OTO area and the City of Springfield respectively.

### Range Accident Frequency

The roadway segment accident frequency is calculated by using the formula below. The 3-year accident frequency for each segment is then compared to the MPO average accident frequency for that period for that type of segment, i.e. freeway or 5-lane.

**Formula for Accident Frequency (Range):** Segment Crash Frequency = $\frac{\text{Number of Crashes (3yr)}}{\text{Length of Segment}}$

**Below Average:** A road segment is considered to have a low accident frequency if the frequency for that segment is 50.0 percent or less of the MPO average accident frequency for that type of road during the same period.

**Average:** A road segment is considered to have an average accident frequency if the frequency for that segment is between 50.1 percent and 150.0 percent of the MPO average accident frequency for that type of road during the same period.

**Above Average:** A segment of road is considered to have an above average accident frequency if the frequency for that segment exceeds 150.0 percent of the MPO average accident frequency for that type of road during the same period.

**Tables 3, 4, 5, 6,** and **7** show the change in accident frequencies along CMP road segments. Nine segments along five roads experienced decreased accident frequencies, and seven segments along six roads experienced increases.

| **Table 3: Range Accident Frequency INCREASED from Average (brown) to Above Average (red)** | |
|---|---|
| Glenstone | |
| Chestnut to Bennett | |
| US 65 | |
| Route CC/NN to Greene County Line | |

| **Table 4: Range Accident Frequency INCREASED from Below Average (green) to Average (brown)** | |
|---|---|
| Glenstone | |
| Seminole to Sunset | |
| Massey (US 160) | |
| Guin (RT AA) to Mt. Vernon | |
| I-44 | |
| US 65 to Mulroy | |
| MO 413 (US 60) | |
| Route M/MM to Oakwood | |
| US 160 | |
| Jackson to I-44 | |

| **Table 5: Range Accident Frequency DECREASED from Above Average (red) to Average (brown)** | |
|---|---|
| Kansas Expressway (MO 13) | |
| Kearney to Division | |
| US 60 | |
| US 65 to Farm Road 189 | |

| **Table 6: Range Accident Frequency DECREASED from Average (brown) to Below Average (green)** | |
|---|---|
| Campbell (US 160) | |
| Farm Road 157 to Greene County Line | |
| Kansas Expressway (MO 13) | |
| Sunshine to Battlefield | |
| MO 413 | |
| US60 (Oakwood) to Hines | |
| US 65 | |
| Route CC/NN to Jackson (MO 14) | |

| Table 7: Range Accidents Frequency DECREASED from Above Average (red) to Below Average (green) | |
|---|---|
| Kansas Expressway (MO 13) | |
| Battlefield to Republic | Nichols to Walnut |
| Radio Lane to Norton | |

Overall, 10% of CMP segment length have accidents frequencies above the MPO average. This amount is essentially unchanged from 2012, with 11% of segment length above average.

### Intersection Accident Frequency

The intersection accident rate is calculated by using the formula below. The 3-year accident frequency for each intersection is then compared to MPO average intersection accident frequencies for that period. Two values are calculated for MPO intersection accident averages, intersections at or above 30,000 entering volumes and intersections below 30,000 entering volumes.

**Formula for Accident Frequency (Intersection):**

Intersection Crash Frequency = Number of Crashes (3yr)

**Below Average:** An intersection is considered to have a below average accident rate if the three-year accident frequency is 50.0 percent or less of the MPO average accident frequency for signalized intersections during the same period.

**Average:** Intersection is considered to have an average accident rate if the three-year average accident frequency for that segment is between 50.1 percent and 150.0 percent of the MPO's average accident frequency for signalized intersections during the same period.

**Above Average:** An intersection of road is considered to have an above average accident rate if the three-year accident frequency for that segment exceeds 150.0 percent of the MPO's average accident frequency for signalized intersections during the same period**.**

**Tables 8, 9, 10, 11,** and **12** show the change in accident frequencies at CMP intersections. Fifteen intersections experienced increases in accidents, compared to MPO averages. Fourteen intersections experienced decreases in accidents. Overall, 176 of the 218 signalized intersections have an acceptable frequency of accidents.

| Table 8: Intersection Accident Frequency INCREASED from Average (brown) to Above Average (red) | |
|---|---|
| Glenstone and Division | Glenstone and Cherry |
| Kansas Expressway and Walnut Lawn | Glenstone and Erie |
| Route 60 and MM/M | Sunshine and West Bypass |

| Table 9: Intersection Accident Frequency INCREASED from Below Average (green) to Average (brown) | |
|---|---|
| Chestnut and I 44 EBR | Kearney and US 65 NBR |
| Glenstone and St. Louis | Sunshine and Venture |
| US 160 and Jackson | Kansas Express (13) and I 44 EBR |
| Mt. Vernon and Ridgecrest | Kearney and LeCompte |
| Sunshine and Enterprise | |

| **Table 10: Intersection Accident Frequency DECREASED from Above Average** (red) **to Average** (brown) | |
|---|---|
| Glenstone and Barataria (Mall) | Massey (US160) and Kathryn |
| MO 413 and MO 174 | Sunshine and Marion |

| **Table 11: Intersection Accident Frequency DECREASED from Average** (brown) **to Below Average** (green) | |
|---|---|
| Glenstone and Cherokee | Jackson (MO 14) and 18th St |
| Kansas Expressway and Walnut | Kearney (MO744) and Neergard |
| Republic and Kansas Expressway* | South (BU 65) and 3rd/Selmore |
| Sunshine and Bedford | Sunshine and Blackman |

| **Table 12: Intersection Accidents Frequency DECREAESD from Above Average** (red) **to Below Average** (green) | |
|---|---|
| Campbell (US 160) and Plainview* | US 160 and Guin (Route AA) |

*Recently Improved

Overall, 19% of intersections have above average accident frequency. This is the same percentage as in 2012.

### Accident Frequency Summary

Within the OTO area, increasing numbers of intersection accidents is concerning. Fifteen intersections saw an increase in accidents, compared to only five road segments with increased accident frequencies. However, only 42 of the 218 (19%) signalized intersections on the CMP network are above average accident frequencies. The increasing number of accidents could be the result of increased VMT per capita from 2012 to 2016. These accidents are also negatively impacting the experienced level of service at the affected intersections.

## 3. Average Travel Speed

Historical data collected through real-time traffic monitoring programs Acyclica© and HERE© was used to calculate travel speeds along the CMP network in 2016. Data from the morning rush, 7:00am to 8:59am, and evening rush, 4:00pm to 5:59pm, was collected for four work weeks in April 2016. Samples ranged from several hundred travel times to several thousand, depending on the corridor and time of day. To better represent the range in delay experienced, 25$^{th}$ percentile speeds were used in delay calculations.

For previous years, travel time runs were conducted on all roadways comprising of the CMP network utilizing Global Positioning System (GPS) units. These units collected data to determine the average time it takes to travel a corridor. This data was used to determine segments in which the average speed was at least 20 mph below the posted speed limit. These segments are identified in red as AM peak time and PM peak time on **Maps 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7** and **5.8.**

**Average Travel Speed Scale:**

(Green) Above the speed limit to 4.9 mph
(Yellow) 5.0 to 9.9 mph below the speed limit
(Orange) 10.0 to 19.9 mph below the speed limit
(Red) 20.0 + mph below the speed limit

It should be noted, the method used to calculate delay is 2016 represents a significant change from previous years. Delay for 2016 is calculated from major intersection to major intersection. Delay for previous years was calculated based on a series of small segments, often just a few blocks long. The previous analyzes were more detailed. For example, the 2012 analysis of National from Chestnut Expy. to Grand revealed delay 'mid-block', along the university, but little delay near Grand or Chestnut. From this analysis, traffic engineers could meaningfully target improvements along the corridor. The 2016 analysis, only reveals 'orange' delay along the entire corridor. Traffic engineers cannot say if this delay is caused by a few problem areas or if delay is evenly experienced along the corridor.

**Table 13** identifies the average peak hour travel time delays in miles per hour by direction of travel. It is important to note that the CMP was expanded in 2008 to include additional arterials and would have an effect on the 2008 data. In 2008, the average mph below the posted speed limits was 9.09. This number decreased to 8.77 in 2012. In 2008 and 2012, the greatest delay was in the PM Northbound and Southbound directions. PM Southbound continues to be an issue in 2016, though PM Eastbound traffic has surpassed PM Northbound as the most delayed time and direction. In fact, Eastbound traffic is the most delayed and third most delayed direction in 2016, PM and AM respectively.

**Table 13: Average Delay-MPH Below the Posted Speed Limit**

| Peak Hour / Direction | 2005 | 2008 | 2012 | 2016 |
|---|---|---|---|---|
| | Average Delay | Average Delay | Average Delay | Average Delay |
| AM Eastbound | 5.69 | 5.03 | 7.86 | 11.7 |
| AM Westbound | 5.73 | 8.23 | 7.26 | 8.7 |
| AM Northbound | 6.51 | 9.93 | 7.06 | 9.3 |
| AM Southbound | 7.58 | 8.62 | 7.68 | 8.8 |
| PM Eastbound | 6.31 | 8.43 | 8.76 | 12.7 |
| PM Westbound | 6.57 | 8.87 | 8.53 | 10.9 |
| PM Northbound | 9.11 | 12.42 | 11.89 | 10.2 |
| PM Southbound | 9.95 | 11.21 | 11.14 | 12.2 |
| Average | 7.19 | 9.09 | 8.77 | 10.6 |

Source: Data from OTO Travel Time Runs, Acyclica and HERE Data Analysis

## Travel Speed Summary

The change in traffic time calculations make it difficult to draw conclusions related to changes in travel speed over the CMP period. Data for 2016 does indicate eastbound travel, considering both AM and PM peak periods, experiences more delay than any direction. PM southbound speeds are also a problem. As

future monitor reports are completed, a larger set of Acyclica© and HERE© data will be assembled. Trends can then be identified from new set of data.

# 4. Intersection Level of Service (LOS)

Intersection level of service is a function of delay. Accordingly, an intersection with LOS A would have a shorter delay than an intersection with LOS F. The longer traffic is delayed at an intersection, the lower/worse the level of service for that intersection. **Maps 6.1, 6.2, 6.3** and **6.4** show an improved LOS at many intersections. Intersection upgrades have been made throughout the CMP system showing an overall improvement to the system.

**Level OF Service Scale:**
LOS A, B, C (Green)
LOS D (Yellow)
LOS E (Orange)
LOS F (Red)

**Table 14** and **Table 15** contains key changes to intersection LOS across the CMP network from 2012-2016. The table does not contain the LOS of every intersection. It simply contains those intersections where improvements or declines occurred. The largest category change occurred as 28 intersections declined to LOS D. During this time, 21 intersections improved to LOS A, B, C.

Overall, 94% of intersections are providing acceptable Levels of Service in 2016. This is down from 96% in 2012.

### Intersection LOS Summary

Overall, OTO's intersections are providing acceptable service. On the margin, more intersections experienced declines in service than experienced improvements. These declines could be due to increased VMT per capita from 2012 to 2016. Five of the eight intersections declining to LOS F are associated with the US 160 corridor between Springfield and Nixa. This corridor continues to be a problem area.

| **Table 14: Acceptable Intersection LOS:** Key Changes Across CMP Study Area | |
|---|---|
| **LOS A, B, C in 2016** | |
| **Improved to LOS A, B, C** | |
| During **AM** Peak | During **PM** Peak |
| ↑ Chestnut Expressway & Grand | ↑ Campbell & James River Frwy EBR* |
| ↑ Kansas Expressway & Walnut Lawn | ↑ Chestnut Expressway & Barnes |
| ↑ MO 413 & Scenic | ↑ Chestnut Expressway & College |
| ↑ National & Republic* | ↑ Chestnut Expressway & Haseltine |
| ↑ West Bypass & Chestnut Expressway | ↑ MO-413 & Scenic |
| ↑ Route J & Route NN | ↑ National & Cherry |
| ↑ Route J & 17th St. | ↑ National & Republic* |
| ↑ West Bypass & Mt. Vernon | ↑ Sunshine & Fremont |
| | ↑ West Bypass & Battlefield |
| | ↑ National & Montclair |
| | ↑ Route J & 17th St. |
| | ↑ Route J & Route NN |
| | ↑ West Bypass & Chestnut Expressway |
| **LOS D in 2016** | |
| **Improved to LOS D** | |
| During **AM** Peak | During **PM** Peak |
| | ↑ Glenstone & Seminole |
| | ↑ Campbell & Walnut Lawn |
| **Declined to LOS D** | |
| During **AM** Peak | During **PM** Peak |
| ↓ Glenstone & Independence | ↓ Battlefield & Kansas Expressway |
| ↓ US 65 & Battlefield SB Ramp | ↓ US 65 & Division NB Ramp |
| ↓ Chestnut Expressway & Jefferson | ↓ Battlefield & Jefferson |
| ↓ Battlefield & Ingram Mill | ↓ Chestnut Expressway & Belcrest |
| ↓ Chestnut Expressway & College | ↓ Glenstone & Barataria |
| ↓ Glenstone & Cherry | ↓ Glenstone & I-44 WB Ramp |
| ↓ Glenstone & Chestnut Expressway | ↓ Glenstone & Independence |
| ↓ Glenstone & Kearney | ↓ Kearney & Grant |
| ↓ Kansas Expressway & Chestnut Expressway | ↓ National & Division |
| ↓ National & Division | ↓ West Bypass & Mount Vernon |
| ↓ Sunshine & Deeswood | ↓ US 160 & Route AA |
| ↓ West Bypass & Kearney | ↓ US 160 & Tracker |
| ↓ US 160 & Route AA | ↓ US 160 & Wasson |
| ↓ Chestnut Expressway & Benton | |
| ↓ West Bypass & Sunshine | |

*Recently Improved

| **Table 15: Congested Intersection LOS:** Key Changes Across CMP Study Area | | | |
|---|---|---|---|
| **LOS E in 2016** | | | |
| **Declined to LOS E** | | | |
| During **AM** Peak | | During **PM** Peak | |
| ↓ | US 65 & Division SB Ramp | ↓ | Chestnut Expy & Benton |
| ↓ | US 65 & Chestnut Expressway NB Ramp | ↓ | Glenstone & Chestnut Expy |
| ↓ | US 65 & Chestnut Expressway SB Ramp | ↓ | Glenstone & Sunshine |
| ↓ | Battlefield & Kansas Expressway | ↓ | West Bypass & Sunshine |
| **LOS F in 2016** | | | |
| **Declined to LOS F** | | | |
| During **AM** Peak | | During **PM** Peak | |
| ↓ | US 65 & Division NB Ramp | ↓ | Sunshine & Deeswood |
| ↓ | Campbell & Plainview | ↓ | US 160 & Route CC |
| ↓ | Glenstone & I-44 EB Ramp | ↓ | US 160 & Aldersgate/Kathryn |
| ↓ | US 160 & Aldersgate/Kathryn | | |
| ↓ | US 160 & Tracker | | |

## Congested Facilities

**Maps 7.1 and 7.2** identify facilities in which three congestion indicators were met. These facilities are considered to be "congested" and are identified in the **Map 7.1** and **Map 7.2**.

**Map 7.1** evaluates the congested facilities specific to "Accident Rate Higher than 150% of the MPO Average", along with *V/C Ratio* and *Average Travel Speed*.

**Congested facilities include:**

| Table 16: Congested Facilities with Method 1 | |
|---|---|
| **Battlefield Road** | |
| Campbell to Battlefield Mall | |
| **Chestnut Expressway** | |
| Sherman Avenue to Boonville Avenue | |
| **Glenstone Avenue** | |
| I-44 to Division Street | Chestnut Expressway to Seminole |
| **Kansas Expressway** | |
| Grand to Sunshine | Battlefield to Republic Road |
| **National Avenue** | |
| Battlefield to Republic Road | |
| **US 160** | |
| Route AA to Route CC | |
| **US 60** | |
| At Route M/Route MM | |
| **Route 14** | |
| At US 160 | At US 65 |

There are more facilities identified as congested in 2016 than in 2012 using this method. Several north/south routes south of Battlefield are now congested, along with portions of Battlefield. Additional congestion has developed along Sunshine/MO-413.

**Map 7.2** evaluates the congested facilities specific to "Intersections Level of Service (LOS) E of F" along with *V/C Ratio* and *Average Speed*.

**Congested facilities include:**

| Table 17: Congested Facilities using Method 2 | |
|---|---|
| Glenstone and EB I-44 Ramps | Glenstone and Chestnut Expressway |
| Glenstone and Sunshine | Battlefield and Kansas |
| US 160 and Route CC | |

The same number of intersections are considered congested in 2016 as in 2012. However, there is no overlap between the 2012 and 2016 intersections.

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# Strategies for Recurring Congestion Mitigation

Phase I of the adopted Congestion Management Process outlined 5 main strategies on which to focus the OTO Congestion Management Process. Strategies which have been implemented between 2008 and 2016 are listed below along with system improvements, policy changes and encouragements to reduce demand at peak travel times.

## Strategy #1: Improve Roadway Operations

- **Intersection Geometric Improvements:** The following interchange and intersection improvements were made to improve overall efficiency and operation.

Interchange Improvements

- Chestnut Expressway at US 65 new diverging diamond interchange
- Glenstone Avenue at James River Freeway (US 60) relocated eastbound ramp signal to Harvard Street
- Kansas Expressway at I-44 new diverging diamond interchange
- MO 125 at I-44 north outer road in Strafford signal improvements and turn lanes
- MO 14 at US 65 relocated signal and improved interchange capacity
- National Avenue at James River Freeway (US 60) converted to diverging diamond interchange
- US 60 at US 65 eliminated at-grade R/R crossing and added directional flyover and flyover ramp
- JRF ramp improvements between Kansas and Campbell, and Campbell and National
- US and Battlefield Rd new diverging diamond interchange
- Kansas and James River Freeway
- James River Freeway and US 65

Intersection Improvements

- Campbell Avenue at El Camino Alto Drive/Cardinal Street intersection widening to 6-lanes
- Campbell Avenue at Lakewood Avenue intersection widening to 6-lanes
- Campbell Avenue and Plainview Road intersection improvements
- Campbell Avenue and Primrose intersection improvements
- Chestnut Expressway and Sherman intersection improvements
- Glenstone Avenue at Battlefield Road added turn lane storage
- Glenstone Avenue at Republic Court widened to 3 lanes northbound and southbound
- Glenstone Avenue at Valley Water Mill added turn lane
- Kansas Expressway at Division Street replaced R/R overpass w/ minor intersection improvements
- Kansas Expressway at Norton Road diverging diamond interchange improvements
- Kansas Expressway at Sunset Street left turn lane extension
- Kansas Expressway at Walmart/Golden Plaza

- Kearney and Mulroy intersection improvements
- MO 14 at 20th Street intersection widening
- MO 14 at Route NN new turn lane added
- MO 14 at US 65 ramp intersection widening
- National Avenue and East Trafficway intersection improvements
- National Avenue and Grand Street intersection improvements
- National Avenue and Seminole Street intersection improvements
- National Avenue and Republic Road intersection improvements
- Sunshine Street and Fort Avenue intersection improvements
- Sunshine Street and Fremont Avenue intersection improvements
- Sunshine Street at Eastgate Street intersection realignment / turn lane improvements
- US 160 at Division Street upgraded to offset left turn lane
- West Bypass and Mount Vernon Street intersection improvements
- Mount Vernon and Orchard Crest intersection improvements (Off-CMP)
- Primrose and Kings intersection improvements (Off-CMP)
- Oak Grove and Catalpa intersection improvements (Off-CMP)
- Walnut Lawn and Maryland constructed Roundabout (Off-CMP)
- Kimbrough Avenue and Walnut Street intersection improvements (Off-CMP)
- US 60 and Oakwood
- US 160 and MO 14

Turn Lanes

- Battlefield at Glenstone added westbound right turn lane
- Battlefield at Campbell improved eastbound right turn lane
- Campbell Avenue at Sunset Street added northbound right turn lane
- Eastgate Avenue at Sunshine Street added eastbound right turn lane
- Glenstone Avenue at Battlefield Road added eastbound turn lane storage
- Glenstone Avenue at McClernon Street turn lane improvement
- Glenstone Avenue at Peele Street added right turn lane
- Glenstone Avenue at Valley Water Mill added turn lane
- Grand at Campbell added eastbound right turn lane (Off-CMP)
- Grant at Chestnut Expressway added southbound right turn lane
- Jefferson at Sunshine added northbound drop off lane
- Kansas Avenue and Battlefield Road northbound left turn lane
- Kansas Expressway and Norton Road westbound dual left turn lanes
- Kansas Expressway and Republic Road eastbound dual left turn lanes
- Kansas Expressway and Republic Road added dual southbound right turn lanes
- Kansas Expressway at Sunset Street left turn lane extension
- Kimbrough and Grand added northbound right and left turn lanes (Off-CMP)
- MO 14 at Route NN new turn lane added
- Mount Vernon Street and West Bypass southbound right turn lane and northbound left turn lane extension, eastbound separate right turn lane, extended the left turn lane.
- National Avenue and Primrose Street dual left turn lanes plus channelized right turns all directions

- National Avenue and Monroe Street eastbound dual left turn lanes, eastbound channelized right turn lane
- National Avenue and Walnut Lawn Street added eastbound right turn lane
- Sunshine Street and Fort Avenue added westbound right turn lane, northbound separate left and right turn lanes, and southbound separate left turn lane
- US 160 at Gregg Road added turn lane improvement
- US 160 at Mt Vernon Street added turn lane improvement
- Walnut Lawn Street at National Avenue added eastbound right turn lane

Acceleration Lanes

- On SB Kansas Expressway at Broadmoor

- **Intersection Signalization Improvements:** Improving signal operations through re-timing signal phases, adding signal actuation, etc.

Signal Improvements

- Route P and US 60 in Republic
- Elm and US 60 in Republic
- Hines and US in Republic
- MO 174 and US 60
- Adaptive Signal System along US 60 in Republic (Oakwood, Hamilton, MO 174/Independence, Hines, Elm, Route P/Main)

New Signals (Off CMP Network)

- Route EE at Alliance Avenue
- Route M at Route ZZ

New Signals (On CMP Network)

- Glenstone Avenue at Commercial Street added pedestrian signal
- Glenstone Avenue at I-44
- Glenstone Avenue at I-44
- Glenstone Avenue at Valley Water Mill signal improvement
- Kansas Expressway at Atlantic Avenue upgraded signal detection equipment
- Kansas Expressway at Bennett Street changed signal to protected left turn phasing
- Kansas Expressway at Elfindale Street
- Kansas Expressway at Evergreen
- Kansas Expressway at Grand Street changed signal to protected left turn phasing
- MO 14 at 18th Street
- MO 14 at 25th Street
- MO 14 at 3rd Street
- US 160 at Jackson Street in City of Willard
- US 60 at Oakwood Avenue

Signal Phasing/Actuation Changes

City of Springfield network phasing changes, removed protected permissive from:

- Chestnut Expressway at Airport Boulevard change left turn phasing
- Chestnut Expressway at Cedarbrook Avenue change left turn phasing
- Chestnut Expressway at I-44 change left turn phasing
- Chestnut Expressway at Patterson Avenue change left turn phasing
- College Street westbound
- Grand Street and Holland Avenue removed the split phasing
- Grant Avenue westbound
- Kansas Expressway and Republic Road installed protected dual left turn lanes
- Kimbrough Avenue northbound and southbound
- National Avenue at Kearney Street changed left turn signal phasing
- Trafficway Street northbound and southbound
- US 160 At M/FF changed left turn signal phasing
- US 160 at Mt Vernon Street signal improvement
- US 160 at Northview Road change signal phasing- remove split phasing
- US 160 at Tracker Road Change signal phasing – remove split phasing
- US 60 at Hamilton Street changed signal phasing

Time Plans – Off CMP Network

All timing plans including: AM Peak, AM Off, Noon, and PM Peak and Off Peak Early & Late, the following have been retimed for Springfield:

- Central Street
- Division Street
- Grand Street
- Grant Avenue
- Kimbrough Avenue
- Republic Road

Weekend and holiday timing plans were implemented in the Battlefield Retail Area. These timing plans encompass the entire weekend and holiday plans were in place on the weekends from Black Friday through Christmas Day. This plan includes:

- Fremont Avenue
- Primrose Street
- Primrose Street and Delaware Traffic Signal Installation

Timing Plans – On CMP Network

Implemented new AM off, noon, school dismissal timing, the AM off period occurs between 8:30 AM and 11:00 PM. The noon timing plan begins at 11:00 AM and ends at 2:00 PM, the school dismissal timing plan is in place from 2:00 PM until 3:45 p.m.:

- Battlefield Road
- Campbell Avenue
- Chestnut Expressway
- Glenstone Avenue
- Kansas Expressway

- Kearney Street
- National Avenue
- Sunshine Street

Weekend and holiday timing plans were implemented in the Battlefield Retail Area. These timing plans encompass the entire weekend and holiday plans were in place on the weekends from Black Friday through Christmas Day for Springfield. This plan includes:

- Battlefield Road
- Campbell Avenue
- Glenstone Avenue
- National Avenue

- **Coordinated Intersection Signals:** Improve traffic signal progression along identified corridors. The following signalized corridors were improved by installing new fiber optic connections between signal controllers to obtain better progression along the arterial system.

Signal Retiming

- Battlefield Road and Kansas Avenue signalization
- Division Street and Packer Road signalization
- MO 14 at 25th Street to route NN-new time of day plans
- MO 14 at from Gregg Road-new timing plan
- National Avenue and Cherry Street signal improvements
- National Avenue and Monroe Street signal installation
- Re-timed nighttime signal flashing operations city-wide
- US 160 from route AA (Guin Rd) to South Street-new time of day plans

Signal Removed

- Chestnut Expressway at Fremont Avenue eliminated median mounted signal pole
- Jefferson Avenue and Saint Agnes Cathedral pedestrian crossings
- Kimbrough Avenue and McDaniel Street
- Sunshine Street and Delaware Avenue

Fiber Optic Connections

- Installed conduit and fiber from the Busch Municipal Building to the new Greene County Public Safety Center (PSC) to provide network connection between the Transportation Management Center of the Ozarks (TMC) and the Public Safety Center (PSC).
- Installed interconnect conduit and fiber on Campbell Avenue from a point north of Battlefield Road to the Cherokee Street intersection and brought onto the Ozarks Traffic Network.
- Installed interconnect fiber on Battlefield Road from Stewart Avenue to Moulder Avenue, through the existing CenturyTel Conduit and Fiber Sharing Agreement, and brought onto the Ozarks Traffic Network.

- **Incident Management - Detection, Response & Clearance**: Utilize traveler radio, travel alert notification (via e-mail, fax, text, etc.), and public outreach to enhance incident-related information dissemination. MoDOT has provided the list below of their incident management activities:
  - Assist in opening roadways for traffic flow with as few delays as possible.

- Assist with snow removal operations.
- Help in traffic control operations during emergency situations and keep traffic flowing as smoothly as possible during periods of non-emergency.
- Help with emergency situations such as flooding, tornadoes, and other emergencies where the Incident Coordinator needs our assistance.
- Inspect end terminal guardrail heads for damage, visibility and post attachment, notify the proper inspector for replacement if necessary
- Keep the roadways clear of any objects that may interfere with traffic flow
- Monitor all routes every day for any situations that could interfere with a smooth motoring experience
- Monitor traffic flows, volumes, and tendencies to assure a safe driving experience
- Aid the motoring public with vehicle breakdowns
- Repair and replace delineators along the I-44 corridor and various routes in the Springfield Metropolitan area
- Repair and replace mile marker signs along the I-44 corridor
- Repair and replace signs on the I-44 corridor at emergency turnaround points
- Repair guard cable hits along the I-44 corridor and outer roads
- Respond to all incidents and emergencies on the I-44 corridor and other routes as instructed by the Incident Coordinator for MoDOT's Southwest District
- Trim grass and weeds around both permanent and movable message boards so good visibility is maintained for the motoring public
- Utilize our equipment to repair guardrail hits where there is only minor damage, thereby avoiding the need for complete guardrail replacement

- **Bus Turnout Construction:** Currently there are 36 bus turnouts on the CU transit system. The CU Transit services utilize these turnouts 55 times on scheduled routes. All turnouts were constructed prior to 2009 except for 1 new location at Orchard Crest Avenue and Chestnut Expressway location (Northbound constructed Feb 10, 2010). The City Utilities has discontinued the construction of future turnouts due to transit service delays caused by reentry of buses into traffic flow.

## Strategy #2: Reduce Vehicle Miles Traveled (VMT) At Peak Travel Times

- **Land Use Policies/Regulations:** The following land use policies and regulations are in place to encourage more efficient patterns of commercial and residential development and to decrease both the total number of trips and overall trip lengths, as well as making transit use, bicycling, and walking more viable:
  - All OTO jurisdictions have implemented future land use plans to encourage more efficient growth patterns.
  - All OTO jurisdictions have implemented regulations that require the construction of sidewalks in new subdivisions.
  - Greene County has adopted a new zoning district that allows for lots as small as 6,000 square feet. Previously the smallest lot size was 10,000 square feet.
  - OTO jurisdictions utilize developer incentives to encourage infill development.
  - The City of Nixa has decreased the minimum lot size for residential development.
  - The City of Ozark has decreased the minimum lot size for residential development.

- The City of Springfield has developed regulations that allow for and encourage higher density infill developments including Planned Unit Development Ordinances and Zoning Overlay Districts.
- The Republic School District has built a new high school in a location that discourages traffic within the City of Republic.

- **Employer Flextime Benefits/Compressed Work Week:** Encouraging employers to consider allowing employees to maintain a flexible schedule - thus allowing the employee the option to commute during non-peak hours.
  - MoDOT allows flextime
  - OTO allows flextime
  - Greene County allows for a compressed work week
  - City of Springfield allows for a compressed work week
  - City Utilities allows flextime
  - Area school districts offset starting times to utilize the same buses for different schools
  - Hospital shifts area set as off-peak times

## Strategy #3: Shift Trips from Automobile to Other Modes

This strategy includes improvements beyond those made adjacent to roadways that are included in the Congestion Management Process network. Improvements made anywhere in the OTO study area that encourage people to use alternative modes may lessen the impacts of traffic system area wide.

- **Fleet Expansion/Bus Service Expansion:**
  - Bus service expansions and modifications include the following:

**October 4, 2010:** Line 8 was extended on west Kearney Street to serve Expedia. Line 6 inline transfer point was changes to Grand Street and Scenic Avenue and Saturday service to Catalpa Street was discontinued.

**January 3, 2011:** Line 1 was extended one time per hour north to the Fulbright Springs development, this was discontented on May 3, 2011

**January 18, 2011:** Line 14 was extended one time per hour south to Calhoun Street near Drury University, this was discontinued on May 23, 2011

**May 2011:** Line 12 was changed to travel north on Jefferson Avenue between Powell Street and Battlefield Road, instead of Campbell Avenue

**July 2011:** Line 10 and 15 morning peak service was reduced from 30-minute service to 60-minute service making these routes 60-minute service all day

**October 8, 2012:** Line 1 was extended north to Fulbright Springs development on a trial basis at 7:12 AM, 7:42 AM, 3:42 PM and 4:12 PM

**October 31, 2012:** Line 5 inbound to Transfer Station, at Kimbrough Avenue continue west on St. Louis Street left on Jefferson Avenue, and right on McDaniel Street

**October 31, 2012:** Line 5 at Harvard Avenue and Independence Street turn left to Glenstone Avenue and continue north on Glenstone Avenue on regular route

**November 23, 2012:** Line 1 extension to Fulbright Springs Development was discontinued due to lack of ridership

**January 7, 2013:** Line 16 was put into service and Line 1 was reconfigured into lines 14 and line 2.

**April 7, 2013:** Line 11 will begin at 8:56 AM and end at 5:25 PM; Line 9 will have an extra hour of 30-minute service in the afternoon until 6:00 PM; lines 4 and 13 will have 30-minute service from 2:35 until 5:05 PM; line 16 will be in service an extra hour on weekdays until 6:45 PM at the Battlefield Mall

**June 2013:** Line 3 E. Division was added to see how the route would perform, however the official start date will be July 7, 2013 for Line 3.

**July 2014:** The Line 3 was discontinued before July 2014.

**July 2014 – May 2016:** There were no substantial changes made between July 2014 and May 2016.

**May 8, 2016:** All lines were adjusted around downtown for entry and departure to the new Transit Center located west of the square at 211 N. Main.

- Line 2 was left relatively unchanged.
- Line 3 was added to the system as a combination of Lines 4 & 10. It runs hourly on weekdays.
- Line 5 was redesigned with Line 12 and runs south on Glenstone to Peele, Harvard and Independence. Line 5 now heads west on Independence, north on Weller, east on Bradford Parkway, north on Delaware, east on Primrose and north on National. Its inbound pattern is Elm to Campbell to College to Main.
- Line 6 was extended northbound on Scenic to Mt. Vernon west, bypassing the Madison to Golden route. When Line 6 approaches West Bypass, it goes south to Sunshine, making a stop in the Wal-Mart parking lot and then continuing north on West Bypass and picks up the regular route westbound on Mt. Vernon. Travelling westbound on Chestnut Expressway, Line 6 continues to College east to Scenic south, bypassing the Golden to Walnut path.
- Line 7 was left relatively unchanged.
- Line 9 was extended east on Battlefield to Jefferson, south to Walnut Lawn westbound to regular route. Line 9 runs hourly on weekdays.
- Line 12 was redesigned with Line 5 and runs regular route to southbound on Fremont continuing south to Battlefield, west to National, south to Primrose, east to Fremont, south to Independence, east to Glenstone, north to St. Louis, west into the Transit Center.
- Line 14 was left relatively unchanged.
- Line 22 was left relatively unchanged. Line 22 runs hourly on nights and Sundays and runs twice an hour all day on Saturdays.
- Line 25 was left relatively unchanged. Line 25 runs hourly on nights and Sundays and runs twice an hour all day on Saturdays.

- Line 26 was left relatively unchanged. Line 26 runs hourly on nights and Sundays and runs twice an hour all day on Saturdays.
- Line 27 was essentially designed to run in an opposite direction. It was extended south on Campbell to the Library Center following the path of the Line 7. It was extended west on Bennett to Scenic, bypassing the Kansas Expressway to Catalpa path. Line 27 runs hourly on nights and Sundays and runs twice an hour all day on Saturdays.
- Line 31 was created as a partial combination of Lines 11 and 16. Line 31 starts on Sunshine at Mercy Hospital heading eastbound to Neighborhood Market's parking lot, north on Blackman, west on Sunshine, south on Ingram Mill, west on Battlefield, north on Luster, west on Barataria, south on Glenstone, west on Republic Rd, north on Fremont, west on Primrose, north on South, east on Powell, north on Jefferson, east on Battlefield, north on Fremont, west on Seminole, north on National to Sunshine. Line 31 runs hourly on weekdays and nights through 10 p.m. and hourly on Saturdays from 8 a.m. – 5 p.m.
- Line 36 was created as a partial combination of Lines 11 and 16. Line 36 starts on Sunshine at Mercy Hospital heading eastbound to Fremont, south to Seminole, west to National, south to Republic Rd. west to Golden, north to Battlefield, east to Scenic, north to Sunshine, west to Sunshine and West Bypass stopping in the Wal-Mart parking lot. Line 36 then continues east on Sunshine returning to Mercy Hospital. Line 36 runs hourly on weekdays and nights through 10 p.m. and hourly on Saturdays from 8 a.m. – 5 p.m.
- Line 38 was created as a partial combination of Lines 8 and 13. Line 38 starts at Wal-Mart at Kearney and Glenstone, heading west on Kearney, north on Glenstone, west on McClernon, west on Norton, south on Grant, west on Kearney, north on Kansas, turning around behind Casey's, continuing south on Kansas, west on Nichols, north on Hutchinson, east on Calhoun, north on Glenn, east on Division, north on Campbell, east on Court, south on Boonville, east on Division, north on National, east on Evergreen, south on Fremont, east on North, south on Delaware, east on Kearney to Wal-Mart. Line 38 runs hourly on weekdays and nights through 10 p.m. and hourly on Saturdays from 8 a.m. – 5 p.m.
- Line 35 was created as a combination of the Line 15 and the west end of the Line 8. Line 35 starts at Wal-Mart at Kansas and Kearney, heads west on Kearney, south on Kansas, east on Turner, east on Kearney, north on Partnership Blvd, east on Mustard Way, West on Kearney, south on Alliance, east on Division, north on Golden, east on Kearney to Wal-Mart. Line 35 is an express route with limited stops serving both Partnership Industrial Centers hourly between 6:30-9:30 a.m. and 3:30-6:30 p.m. on weekdays
- Lines 4, 8, 10, 11, 13, 15 and 16 were discontinued and absorbed by other routes.

**June 14, 2016:** Line 27 heading west on El Camino Alto turns north on Campbell, bypassing the Cardinal path.

**June 24, 2016:** Line 12 was extended south on National past Primrose, using Cox South Hospital's drive to the west, outer road to the south, under the bridge to the east, picking up Bradford Parkway east to Fremont where it continued regular route to the south.

**June 30, 2016:** Line 2 was moved from Mill street onto Olive street on both its inbound and outbound paths.

**July 14, 2016:** Line 31 was extended westbound on Primrose to Campbell, north to Battlefield, west to continue regular route. Line 9 was adjusted outbound from the Transit Center south on Main, west on College, south on Grant to continue regular route. It was also adjusted inbound north on South, west on Walnut, north on Campbell, west on College, north on Main to the Transit Center. Line 27 was adjusted westbound on Bennett to go north on Kansas Expressway, west on Catalpa and continue regular route on northbound Scenic.

**August 22, 2016:** Line 3 and 22 share an inbound pattern that was adjust as part of the street improvement project at OTC. When each route is westbound on Pythian, they continue west to the roundabout and then continue west on Central. This pattern bypasses Fremont to Central. Line 3 eastbound on Central was adjusted to take eastbound Pythian out of the roundabout to National northbound. Line 6 was rerouted around Preferred Employment. Traveling eastbound on College continuing to Olive, westbound to southbound on Scenic.

**September 12, 2016:** Line 9 eastbound on Battlefield was adjusted to turn south on Campbell and pick up regular route on westbound Walnut Lawn.

**November 14, 2016:** Line 12 eastbound on Bradford turns north on Kickapoo, east on Primrose, north on Glenstone to regular route.

**November 28, 2016:** Line 6 & 36 changed path on westbound Sunshine, north on Zimmer Rd, west on Springfield Plaza Dr, north on McCurry, east on Sunshine to respective regular routes. Line 31 will not extend to Neighborhood Market between 3-6 p.m. on weekdays and 3-5 p.m. on Saturdays, instead the eastbound pattern on Sunshine will turn south on Ingram Mill during these times.

- **Improved/Expanded Bicycle Network:**
  - The following improvements have been made to the bicycle network:
    - Miles of street marked with bicycle facilities

| | Goal | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| Newly Marked This Year | | | | | | |
| Bike Lanes | | 2.6 | 6.8 | 1.4 | 0.3 | 3.1 |
| Shared lanes | | 1.1 | 7.8 | 1.3 | 1.6 | 13.7 |
| Total Marked | 10 | 3.7 | 14.6 | 2.7 | 1.9 | 16.8 |
| Cumulative | | | | | | |
| Bike Lanes | | 5.7 | 12.5 | 13.9 | 14.2 | 17.3 |
| Shared lanes | | 1.5 | 9.3 | 10.6 | 12.2 | 25.5 |
| Total Marked | | 7.2 | 21.8 | 24.5 | 26.4 | 42.8 |

- The City of Springfield has signed more than 60 miles of designated bike routes and is enhancing the system with additional pavement markings and signs.

- 46.5 miles of street were restriped with bike lanes including:

- Benton Avenue from Commercial Street to Central Street
- Boonville Avenue from Division Street to Chestnut Expressway
- Division Street from Lyon Avenue to Benton Avenue was restriped to include bike shared-lane symbols in the outside lane
- Division Street from Broadway Avenue to Lyon Avenue
- Austin Avenue from Sunset Street to Battlefield Road
- Bennett Street from Barnes Avenue to Glenstone Avenue
- Cherry Street from Dysart Avenue to west of Barnes Avenue
- Fort Avenue from Broadmoor Street to Battlefield Road
- Fremont Avenue from Chestnut Expressway to Saint Louis Street
- Grant Avenue from Walnut Street to Grand Street
- Ingram Mill Avenue from Battlefield Road to Greeley Street
- Jefferson Avenue from Woodland Street to Montclair Street
- National Avenue from Talmage Street to Evergreen Street
- Stewart Avenue and St. Louis Street from East Trafficway to Dysart Avenue
- Sunset Street from Austin Avenue to west of Fort Avenue

- John Q. Hammons Parkway from East Trafficway to Harrison Street (0.55 mile) was signed and marked for the Link including signs and markings for bike shared lanes

- Streets with bike lanes were resurfaced and markings restored including:
  - Bennett St from Weller Av to Glenstone Av
  - Sunset St from Austin Av to Kansas Expwy
  - Austin Av from Sunset St to Battlefield Rd

- Streets with bicycle shared lane markings were resurfaced and markings restored including:
  - 0.78 miles on Grant Av from Grand St from Portland St
  - 0.16 mile of Broadmoor St from Fort Av to Weaver Av
  - 0.09 mile on Fort Av from south of Sunshine St to Washita St

- Street were marked with bicycle shared-lane decals including:
  - A route on and near Fort Avenue from Weaver Avenue at Seminole Street to Deerfield Street at Kansas Avenue
  - Broadway Avenue from Nichols Street to Grant Avenue
  - Grant Avenue from Grand Street to Fassnight Trail
  - Main Avenue from Grand Street to Fassnight Trail
  - Normal Street from Grand Street to Fassnight Trail
  - Sunset Street from Grant Avenue to west of Fort Avenue
  - Talmage Avenue from Summit Avenue to National Avenue
  - Tampa Street from Nichols Street to Grant Avenue
  - The Link from Summit Avenue at Kearney Street to Sherman Avenue at Central Street
  - High St, Albertha Av, and Atlantic St from Clifton Av to Kansas Expwy
  - West Av from Division St to Nichols St
  - Fort Av from Portland St to Washita St
  - Grant Av from Normal St to Portland St
  - Kimbrough Av from East Trafficway to Walnut St
  - South Av from McDaniel St to Madison St

- Madison St and Holland Av from Grant Av to Briggs Transitway at Holland Av
- Bob Barker, Clay Av, and Chestnut St from Sherman Av to Jordan Creek Trail
- Normal St, Dollison Av, Catalpa St, Clay Av, Bennett St, Holland Av, and University St from Missouri State University path to Kimbrough Av at University St
- Kimbrough Av, Cherokee St, and Holland Av from Sunshine St to South Creek Trail
- Kimbrough Av from Sunset St to Battlefield Rd
- Nichols St from Kansas Expwy to Grant Av
- Walnut St from Grant Av to Weller Av
- Commercial St and Nias Av from Washington Av to Blaine St at Nias Av
- Talmage St from Grant Av to Robberson Av
- Edgewood St and Grant Av from Fort Av to South Creek Trail at Grant Av
- Washita St, Kansas Av, Wayland St, Westwood Av, and Broadmoor St from Fort Av at Washita St to Fort Av at Broadmoor St
- Fremont Av from Commercial St to Division St
- Intersection signal detector markings at 26 intersections
- Other streets on the signed bike route system

- Completion of gaps on The LINK with installation of HAWK signalized crosswalk on Sunset Street with 0.13 mile new trail on The LINK connecting South Creek to Kimbrough Avenue and passage under Chestnut Expressway as part of 0.18 mile new trail on North Jordan Creek Trail from existing trail north of Chestnut Street to Sherman Avenue south of Chestnut Expressway

- **Bicycle Storage Systems:** The following improvements have been made regarding bicycle storage systems, 30 bike racks 66 bicycle parking spaces were installed including:
  - 6 in bike corral on South Avenue south of Walnut Street (12 bike parking and five motorcycle / motor scooter parking spaces)
  - 17 additional bike racks on Park Central Square, Park Central East and Park Central West
  - 4 racks and 6 lockers at Busch Municipal Building
  - 3 new racks at 233 Commercial Street (at Drury University design facility)
  - 3 bike racks and 6 bicycle parking spaces were installed, one new racks at 233 Commercial Street (at Drury University design facility)
  - 2 new bike racks on southeast corner of Walnut Street and Jefferson Avenue

- **Improved/Expanded Pedestrian Network:** The following sidewalk and greenway trail improvements have been made:

<u>Greenway Trails</u>

Other sustainable transportation programs include the completion of 105 miles of greenways, 15 streetscape projects in the Center City that provide improved pedestrian and bicycle linkages, a road diet program that reduced the number of automobile lanes to provide for bicycle lanes

- Fassnight Creek Trail between Grant Avenue and Campbell Avenue including grade-separated crossings at Grant Avenue and Campbell Avenue constructed as part of storm drainage project
- Wilson's Creek south of Hattiesburg Hills consists of one mile of Wilson's Creek Trail from Farm Road 150 to Farm Road 156

- South Dry Sac Trailhead consists of a parking lot in David Murray Park and 0.41 miles of trail from David Murray Park to Ritter Springs Park
- Wilson's Creek Trail from Farm Road 156 to South Creek at Kauffman Avenue includes 1.52 mile new trail connecting two shorter segments to create a six-mile trail segment from Rutledge-Wilson Farm Park to Republic Road and a trailhead on Kauffman Av
- Wilson's Creek Trail from Farm Road 156 to South Creek at Kauffman Avenue includes 1.52 mile new trail connecting two shorter segments to create a six-mile trail segment from Rutledge-Wilson Farm Park to Republic Road and a trailhead on Kauffman Av
-

<u>Sidewalks</u>

The City of Springfield has constructed more than 40 miles of sidewalks to elementary schools based on priorities submitted by each school and has identified a goal of having a sidewalk on at least one side of every street within a half-mile of elementary schools

- Bennett Street from Kimbrough Avenue to Jefferson Avenue
- Boonville Avenue from Court Street to Division Street
- Campbell Avenue from Cherokee Street to Battlefield Road
- Campbell Avenue from Olive Street to Mill Street
- Commercial Street from Campbell Avenue to Lyon Avenue
- Holland Avenue from Portland Street to Sunshine Street
- Near Delaware Avenue and High Street
- Near Turner Street and Prospect Avenue
- Portland Street from National Avenue to Kimbrough Avenue
- Summit Avenue west side of Washington Park
- Walnut Street from Kimbrough Avenue to John Q. Hammons Parkway
- Walnut Street from Market Avenue to Campbell Avenue
- (2.5 miles) was signed and marked for the Link including signs and markings for bike shared lanes and sidewalk construction. Summit Avenue, Dale Street, Washington Avenue, Calhoun Street, and Sherman Avenue from Kearney Street to East Trafficway

- New sidewalk included in the Republic Road widening project between Chase Card Services driveway and Fremont Avenue
- Republic Road from Quail Creek Av to Kansas Av (north) is under construction for five motor traffic lanes, bike lanes, and sidewalks
- Campbell Av from South Av to north of Primrose St and Primrose St from west of Campbell Av to South Av is under construction for 7 traffic lanes and sidewalk on Campbell Av and 5 traffic lanes, bike lanes, and sidewalk on Primrose St

MoDOT and the City of Springfield collaborated to:

- Kearney Street: address sidewalk gaps from Kansas Expressway to Glenstone
- Glenstone Ave: address sidewalk gaps from Evergreen to Sunset
- Sunshine St: address sidewalk gaps on south side of street from Glenstone

Sidewalk Construction and Reconstruction

- New and reconstructed sidewalk under sidewalk maintenance contract including
  - 4406 S Reed Rd

- Both sides Central St from National Av to Prospect Av
- North side 1501 E. Walnut St
- Both sides Weller Av from Walnut St to Cairo St
- Both sides College St from Lexington Av to Park Av
- Both sides Johnston Av from Turner St to High St
- Both sides Johnston Av from Kearney St to Turner St
- East side Fort Av from Kearney St to Turner St

**Miles of new sidewalk**:

| | Goal | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|
| This Year | 5 | | | | 8.8 | 10.1 | 4.8 | 2.6 |
| Cumulative | | | | 642.4 | 651.2 | 661.3 | 666.1 | 668.7 |

**Miles of off-street path in Springfield**

| | Goal | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|
| This Year | 0.5 | 0.0 | 0.0 | 0.57 | 0.0 | 0.43 | 1.08 | 0.51 |
| Cumulative | | 17.36 | 17.36 | 17.93 | 17.93 | 18.36 | 19.44 | 19.95 |

**Miles of off-street path in Springfield vicinity**

| | Goal | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|
| This Year | 1.0 | 0.0 | 0.50 | 1.65 | 0.40 | 0.43 | 1.91 | 0.51 |
| Cumulative | | 44.91 | 45.41 | 47.06 | 47.46 | 47.89 | 49.80 | 50.31 |

- Removal of accessibility barriers including ramp construction/reconstruction and sidewalk repair on MoDOT routes Kearney Street from Glenstone Av to LeCompte Av, Chestnut Expressway from Glenstone Av to Belcrest Av, various sections of Kansas Expwy and West Kearney St and intersection of Sunshine St with Scenic Av

Safety

- Boonville Avenue near Webster Street and near Nichols Street ramps and crosswalk improvement
- Fremont Avenue and Battlefield Mall Entrance ADA pedestrian improvements
- National Avenue and Woodland Street ADA pedestrian improvements
- Ramps and crosswalk on Boonville Avenue near Webster Street and near Nichols Street
- Replaced regulatory and warning signs to meet new federal requirements for retro reflectivity
- Sherwood Elementary – Beacons on Scenic Avenue adjacent to the school
- Sunshine Elementary – Beacons on Jefferson Avenue adjacent to the school
- Installation of HAWK signalized crosswalk on Sunset Street for The Link

**Grade separated crossings on off-street path**

| | Goal | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|
| This Year | 1 | 0 | 2 | 3 | 1 | 0 | 3 | 4 |
| Cumulative | | 19 | 21 | 24 | 25 | 25 | 28 | 32 |

## Strategy #4: Shift Trips from SOV to HOV Automobile/Van

- **Rideshare Matching Services:** On April 17, 2009, the Ozarks Transportation Organization implemented a web-based rideshare matching program (www.ozarkscommute.com) where commuters can register and search for commuting partners. The Ozarks Transportation Organization manages the web portal and phone line. Since the development of this program there have been a total of 578 registered users. The City of Springfield has accepted responsible for public awareness through promotional material distributed at local events. At these events registered users have reported that once a carpool is established the carpooling service is rarely accessed until an open seat becomes available.

- **Vanpool/Employer Shuttle Programs:** Several area employers and multifamily housing complexes have implemented vanpool or shuttle programs. Examples include: St. Johns Medical Center, TLC Properties, Missouri State University, and Prime Trucking.

- **Improved/Increased Park-and-Ride Facilities & Capital Improvement**s: There two known parking areas within the OTO area. A private truck parking facility and a MoDOT park-and-ride lot which is currently underutilized. Accordingly, expansion is not planned at this time.
  - 17 space overnight truck parking facility at East Evergreen Street in the City of Strafford
  - 50 space commuter parking at US 65 and Evans Road

## Strategy #5: Add Capacity

- **Capacity Expansion:** The following capacity improvements have been completed:

<u>On CMP Network Capacity Improvements</u>

Campbell Avenue/US 160 from South Avenue to Plainview Road
- Added third northbound lane
- Added third southbound lane south of Melbourne

Glenstone Avenue from US 60 to Battlefield
- Added 3rd northbound and southbound lane along corridor
- Peele Street added right turn lane

James River Freeway
- Added auxiliary lane (6 lane freeway) from Campbell Avenue to National Avenue
- Added auxiliary lane (6 lane freeway from Kansas Expwy to Campbell Avenue

US 65
- Improved to 6 lane freeway from the I-44 and US 65 interchange to the US 60 and US 65 interchange

Republic Road
- Five lane expansion from National Avenue to James River Bridge

National Avenue

- Additional southbound lane south of Walnut Lawn to Primrose

Route 14

- Widened to 5-lane between Jackson and Church.

Off CMP Network Capacity Improvements

- Fremont Avenue widening from Sunshine Street to Cherokee Street
- Packer Road added three lane expansion from railroad tracks to Division
- Constructed three-lane section from West Bypass to Suburban
- LeCompte- Three lane expansion from RR crossing to Kearney

# Effectiveness Analysis, 2008-2016

The objective of this analysis aimed to determine congestion management strategies that are most effective in reducing congestion in the OTO region. The period of 2008 to 2016 was chosen because VMT and VMT per capita was abnormally low in 2012 due to the national recession. The longer time period makes the analysis more difficult but the data is better representative of the OTO region. Several GIS-based methods were explored to identify a connection between capacity improvement strategies and reductions in congestion using hypothesis testing with inferential statistics. Various methods were explored to capture a distance attribute from areas of changes in congestion to congestion management improvement projects and compare for statistically significant differences between areas of change in congestion from 2008 to 2016 and types of congestion management strategies.

## Data

Spatial data for the exploration of methodologies was derived from the identification of congested facilities in Maps 7.1 and 7.2, the congestion measures found in Maps 3.1 through 6.4, and the data contained in Implementation Strategies starting in page 15. Congested facilities were categorized into three groups:

- Areas where congestion had improved from 2008 to 2016,
- areas with no change in congestion from 2008 and 2016, and
- areas with new or emerging congestion in 2016.

In addition to the listings in the Implementation Strategies section, completed improvement projects from TIP years FY2006 through FY2015 were mapped. To simplify analysis, all projects were classified by CMP strategy category, i.e. operations or capacity. Also, year of completion was included for each project.

## Methods

The analysis primarily relied on two methods for exploring the data: (1) drive time service areas and (2) hex bins. These methods allowed the relationship between congestion and implemented projects to be measured. The *drive time service areas* allowed for the inclusion of the road network into the analysis, while the *hex bins* allowed for more sophisticated analysis.

### Drive Time Service Areas

One method was to create drive time service area polygons using the Network Analyst extension in ArcGIS for Desktop. A network dataset for the OTO region was used to model drive time in minutes along the road network from areas of congestion change. The number of capacity and operations improvements within one-, two-, three-, four- and five-minute drive times to improved, no change, and emerging congestion areas were counted, as shown in **Map 8.1** and **Map 8.2**. The proportion of capacity to operations improvements in proximate drive times from the three congestion areas were compared

to the total proportion of capacity and improvement projects for the entire OTO area from TIP years FY2006 through FY2015. A one-sample t-test for proportions was used as the test statistic.

### Hex Bins

An alternate method was used to explore correlations between changes in congestion measures and distance to nearest capacity and operations improvement projects from areas of congestion change. A matrix of hexagonal polygons 1,320 feet in width was constructed covering the entire OTO area. Changes in volume to capacity, accident rate, am travel delay, and pm travel delay from CMP years 2008 and 2016 were spatially joined to coincident hexes that intersected with the CMP network. This method captured changes in these measures along the entire network regardless of whether it met the congested threshold. The near tool in ArcGIS for Desktop was used to capture the distance to the nearest capacity project and the nearest operations project for each hex in the OTO area. These distance measures were then used in conjunction with changes in congestion measures using the Pearson's correlation coefficient as the test statistic. This method of analysis is included in Map 8.3, Map 8.4

## Results

Preliminary results utilizing these methodologies were mixed. Though statistically significant relationships were found, they do not lead to any meaningful conclusions about the effectiveness of OTO's congestion mitigation strategies.

### Drive Time Service Areas

There appears to be a larger number of capacity-adding projects near changes in congestion, as compared to operations related projects. A statistically significant higher proportion of capacity projects are within a one-minute drive time from areas of improvement in congestion. Additionally, a significantly higher proportion of capacity projects was detected within one-minute drive times from areas with no change in congestion. Although there was a significant proportion of capacity projects within one-minute drive times from both these areas, the Z-statistic was far greater in for areas of improving congestion than areas of no change in congestion.

Several statistical relationships were found with the middle drive time ranges, though they reveal few insights. A significantly higher proportion of operations projects were detected in all three areas of congestion change in the middle drive time ranges. Both emerging and improving areas had a higher proportion in the two-to-three-minute drive time polygon and the no change areas had a higher proportion in the three-to-four-minute drive time polygon than the total project population. These middle drive time relationships do not reveal anything truly insightful about the effectiveness of OTO's congestion mitigation strategies.

### Hex Bins

Results from the hex bin correlation approach yielded moderate to weak relationships between changes in congestion measures and proximity to the nearest capacity or improvement project. Relationships

were found between capacity projects and the volume to capacity ratio, and between travel delay and operations related projects. The results can be seen in tables 5, 6, 7, and 8.

**Summary of Pearson's Correlation Coefficient Hexes**

Table 5: All Hexes with values along CMP Segments 2008 and 2016

| | AM Travel | PM Travel | VC Ratio | Accident Rate |
|---|---|---|---|---|
| Capacity distance r | 0.043 | -0.024 | 0.011 | -0.032 |
| Operations Distance r | 0.046 | -0.030 | -0.010 | -0.044 |

Table 6: Improved Congestion Hexes

| | AM Travel | PM Travel | VC Ratio | Accident Rate |
|---|---|---|---|---|
| Capacity Distance r | 0.022 | 0.020 | 0.425 | -0.111 |
| Operations Distance r | 0.136 | 0.099 | -0.035 | -0.174 |

Table 7: No Change Congestion Hexes

| | AM Travel | PM Travel | VC Ratio | Accident Rate |
|---|---|---|---|---|
| Capacity Distance r | 0.202 | 0.113 | 0.280 | -0.312 |
| Operations Distance r | 0.234 | 0.150 | -0.025 | -0.247 |

Table 8: Emerging Congestion Hexes

| | AM Travel | PM Travel | VC Ratio | Accident Rate |
|---|---|---|---|---|
| Capacity Distance r | 0.126 | 0.202 | 0.046 | -0.177 |
| Operations Distance r | 0.288 | 0.382 | 0.142 | -0.330 |

The strongest relationship found was a positive one between distance to the nearest capacity project and change in volume to capacity ratio at 0.425, as shown in table 6. This value can be interpreted as further distances to capacity projects in improved congestion areas correspond with higher increases in volume to capacity ratios for these areas. This relationship decreases for areas of no change and emerging congestion at .280 and .046 respectively, table 7 and 8.

Two relationships were found between operations projects and travel times. Overall, the second strongest relationship is a positive one between the distance to the nearest operations project and change in PM travel delay at .382 for emerging areas of congestion, as seen in table 8. This suggest that in emerging areas of congestion further distances to operations projects corresponds with increases in PM travel delay. A similar but slightly weaker relationship was detected for AM travel delay in these same areas. A positive relationship between these variables was detected in areas of improved congestion although it is considerably weaker.

The preliminary results from this method may indicate that capacity projects are more effective at reducing the volume to capacity congestion measure and operations projects are more effective at reducing travel delays measured during peak traffic flows.

## Possible Improvements

Although the results from both of spatial analyses of congestion management strategy have produced some interesting results, these approaches can both be improved.

- There was no accounting for the year of project completion over the eight-year timeframe for improvement projects.
- Some projects in the improvements database had not been completed
- Better data collection and classification of improvement types are needed
- Annual tracking of congestion measures could yield greater significance
- Network datasets can be improved to model completed improvements and travel times in the region
- An origin/destination matrix to calculate proximity to completed projects would be a better measure than the distance to the nearest project
- There was no accounting for projects of greater length as all projects in the analysis were represented as points with no weighting

These methods and data will continue to be evaluated and improved in future years. Other factors should be considered and included, such as signals and driveways per mile, changes in population and development, and changes in employment centers.

Project specific analysis might be more effective than a system-wide analysis. Since improvements in congestion and capacity/operations projects can only occur on the region's road network, the data exhibits a degree a dependency. This dependency makes typical statistical analysis less reliable. Focusing on a sample of different congestion mitigation project types may yield more meaningful results. The constant flow of data available through the Acyclica Sensors will make project specific analysis more feasible moving forward.

# Action Plan

The OTO will continue to implement the five *Strategies for Recurring Congestion Mitigation* identified in Phase 1 of the CMP. These strategies represent the region's best opportunities for reducing congestion. Specific geometric and engineering solutions are included in the strategies, along with behavioral changes. Additionally, the OTO will evaluate the methods used to measure CMP congestion in light of MAP-21/FAST Act performance based planning requirements. The OTO wants to ensure efficiency and limit duplication in its data collection and analysis.

## Strategies for Recurring Congestion Mitigation

The five strategies for recurring congestion mitigation identified in OTO's CMP continue to be appropriate for the region. Engineering and behavior modifications are activities likely to reduce congestion. Recent priorities are in line with these broad strategies.

It is important to note congestion within the City of Springfield, such as along Glenstone, Battlefield from Campbell to Glenstone, or National from Battlefield to James River Freeway, will be difficult to improve with engineering solutions. Existing development patterns limit the ability to add capacity or remove traffic signals to improve traffic flow. Additionally, accidents in these areas not the result of poor engineering, but rather the result of human error. Significant behavioral changes by regional residents will be needed to address these problem areas.

### Strategy #1: Improve Roadway Operations

The OTO will continue to target ITS and corridor specific projects to address problem areas. For example, the OTO has prioritized specific ITS and corridor projects in preparation for the 2018-2021 Transportation Improvement Plan. The US 160 corridor between Springfield and Nixa is being evaluated for signalized and non-signalized intersection improvements. These improvements should result in improved intersection LOS along this corridor. Additionally, the OTO has prioritized the installation of fiber connections between Springfield and Republic, Nixa, and Ozark. These new connections allow for the synchronization of signals along the US 60, US 160 and US 65 corridors. The goal of these actions is to improve roadway operations in the OTO area.

### Strategy #2: Reduce Vehicle Miles Traveled (VMT) At Peak Travel Times

The OTO will continue to encourage local business to offer flex time and move shift changes to non-peak travel times. The OTO will also work with area communities to encourage land use patterns that facilitate transit service and walking/biking. Behavioral strategies, such as this, rely on expanded cooperation between elected officials in OTO communities and business leaders to implement these local level decisions.

### Strategy #3: Shift Trips from Automobile to Other Modes

The OTO will continue to pursue policies that encourage and facilitate alternative modes of transportation. For example, the OTO is working towards the completion of a Bike and Pedestrian Trail

Investment Study. This study will help the OTO complete an integrated network of trails connecting OTO communities. This trail network will provide a viable alternative to autos for regional intercity travel. The OTO has also prioritized sidewalk construction with all MoDOT sponsored projects. The OTO wants to see sidewalks built along side road projects. The OTO is also involved with *Let's Go Smart*, a community partnership designed to encourage residents to consider their transportation choices every day. The organization encourages walking, biking, riding the bus, and other forms of active transportation. Additionally, CU has updated its bus routes and implemented a 'Where's my Bus?' app to make bus travel more convenient and predictable. The City of Springfield's Sustainability Office helps coordinate city activities related to environmental sustainability, including the sustainability of transportation choices. This office is involved with many area transportation initiatives. These actions all make it easier for OTO residents to shift to other modes of travel.

### Strategy #4: Shift Trips from SOV to HOV Automobile/Van

The OTO is working with the City of Springfield to deploy a new RideShare website for the OTO area. This new portal will offer expanded opportunities for area businesses to encourage carpooling and for residents to find rides on their own. Facilitating the creation of RideShare groups is an important way the OTO can encourage shifts in people's commuting behaviors.

### Strategy #5: Add Capacity

The OTO recognizes that added roadway capacity is often not a long-term fix for a congestion problem. Induced demand and the continuation of existing development patterns often result in increased traffic volumes. However, additional capacity is often needed to serve growing traffic volumes. The OTO has prioritized additional travel lanes along US 60/James River Freeway, MO 14, US 160 towards Willard, and Business 65 in Ozark. For James River Freeway, MoDOT will study existing travel patterns to determine which segments should be expanded first. Over a longer time horizon, the OTO recognizes a need to add capacity to I-44. This added capacity will ensure efficient movement within and across the region.

## Evaluation of Current Congestion Measurement

The performance-based planning required by MAP-21 and the FAST Act will likely result in the OTO reevaluating its methods for measuring congestion. Safety performance measures (PMs) for fatalities and serious injuries and system performance PMs for reliable travel will require annual data collection and analysis. The existing CMP processes may be replaced by these new performance management processes. The annual nature of performance management may result in the CMP being updated annually as well. The annual nature may also result in the simplification of the CMP process. The current CMP is too detailed to be completed on an annual basis. The OTO will not know how the CMP will be affected by the new performance management requirements until the new rules come into full effect. The OTO will ensure any changes made to the CMP will not lower the quality of the process.

# Conclusion

This congestion monitoring report looks at the identified network and the efforts taken to address congestion. There have been extensive efforts undertaken in the past four years which are outlined in the implementation strategies section of the report. To summarize, there have been numerous geometric improvements including two diverging diamond interchanges and lane additions to roadways. Extensive work has been done to better time the traffic signal system. Incident management remains a priority. Great strides have been made in new sidewalk and trail construction. Many miles of bicycle lanes have been signed and striped.

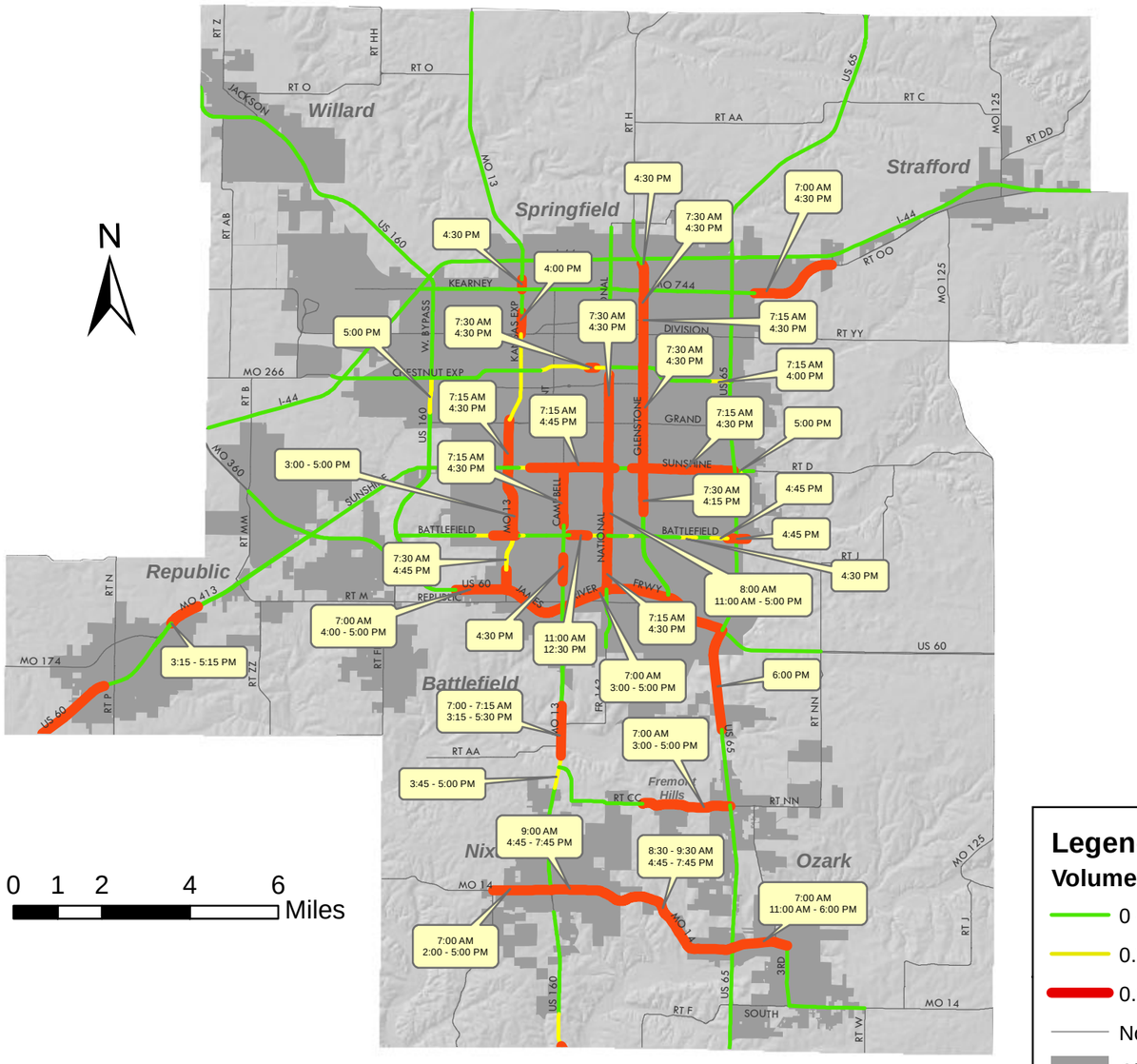
Four indicators of congestion were used to identify areas of significant congestion. The volume to capacity ratio indicated a moderate decline in the overall number of segments that exceeded capacity, though the overall system has adequate capacity. The accident frequencies showed little change in percentage terms from 2012. However, the increase in the size of the CMP network means an increase in absolute numbers of above average accident frequency intersections and segments. The growth of average delay per lane mile indicated an overall reduction in speeds. The intersection level of service ratings relatively unchanged. Ninety four percent of intersections offer acceptable levels of service. The number of LOS E and LOS F intersections did increase from 2012 to 2016.

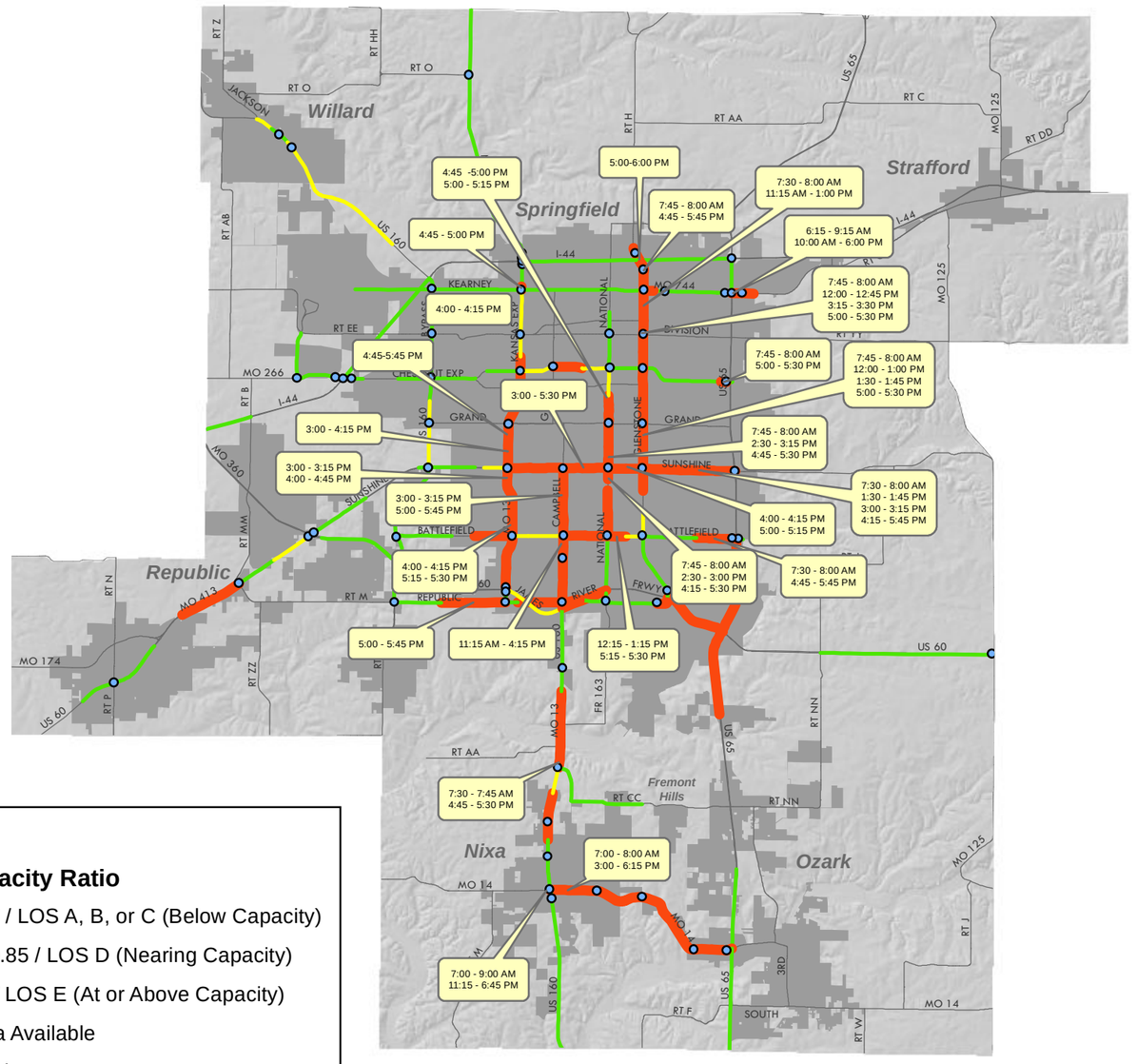
An analysis of congestion mitigation measures and changes in congestion revealed only limited statistically significant relationships between implemented improvements and reductions in congestion. Some relationships were expected, for example between capacity projects and improvement in the volume/capacity ratio, while others didn't reveal anything insightful, for example the high number of operations projects in the middle drive time zones from all three congestion zones. A different approach to measuring the effectiveness of congestion mitigation projects will be used during the next update.

The OTO will continue to pursue the five strategies for recurring congestion mitigation. The strategies include important engineering and behavior solutions for congestion. Early priorities for the 2018-2021 TIP include several projects drawing from these strategies. As the OTO fully implements the new performance management requirements, it will reevaluate how it measures congestion. Calculating annual performance measurements may provide useful data that can be substituted into the CMP.

This update of the CMP has revealed congestion is not a widespread issue in the OTO area. Capacity, accidents, and intersection LOS are all adequate in most area of the region. This analysis did confirm congestion remains in certain problem areas, such as along US 160 between Springfield and Nixa and in the southeastern part of Springfield. Some physical improvements are possible along US 160, but changes in transportation behavior are required to improve traffic within the city.

# Volume to Capacity Ratio




**Legend**

**Volume/Capacity Ratio**

- 0 - 0.77 / LOS A, B, or C (Below Capacity)
- 0.78 - 0.85 / LOS D (Nearing Capacity)
- 0.86 + / LOS E (At or Above Capacity)
- No Data Available
- City Limits
- MPO Area

**2012**

**2016**

Source: City of Springfield
Missouri Dept. of Transportation

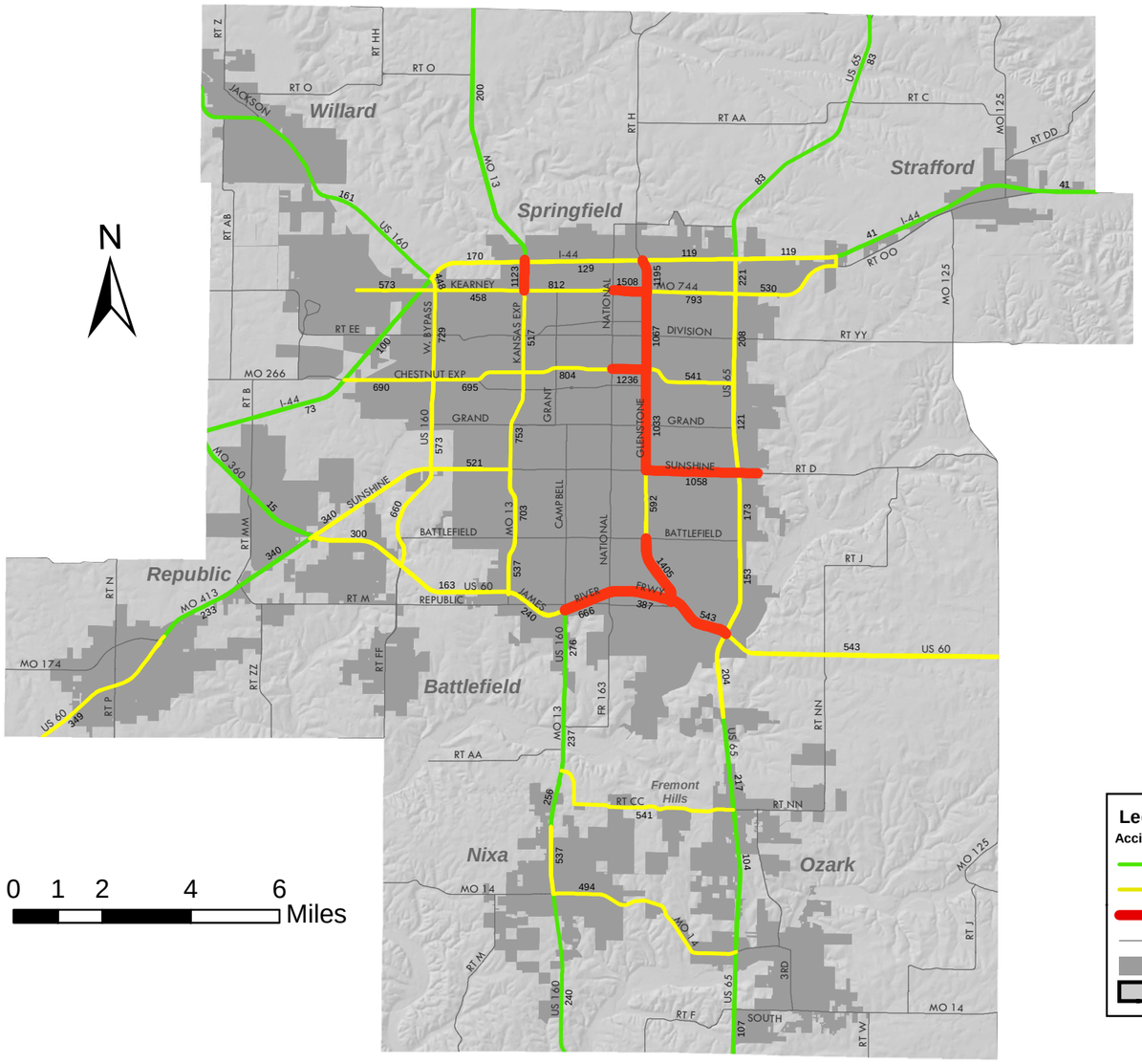
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

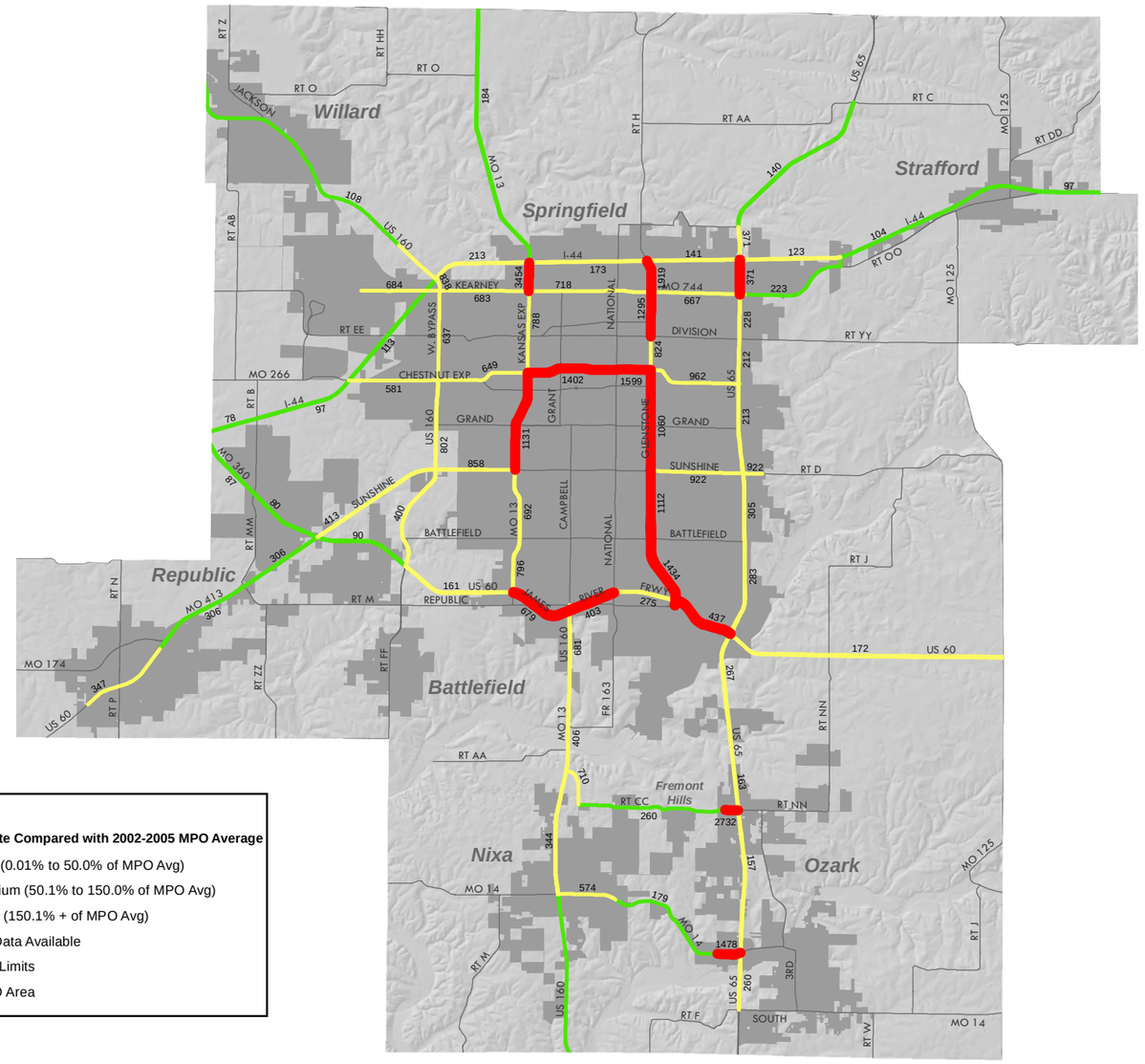
## What facilities are congested during the peak hour?

# Map 3.2

**Traffic Volumes and Roadway Capacities**

# Accident Rates




**Legend**

**Accident Rate Compared with 2002-2005 MPO Average**

- Low (0.01% to 50.0% of MPO Avg)
- Medium (50.1% to 150.0% of MPO Avg)
- High (150.1% + of MPO Avg)
- No Data Available
- City Limits
- MPO Area

**2005**

**2008**

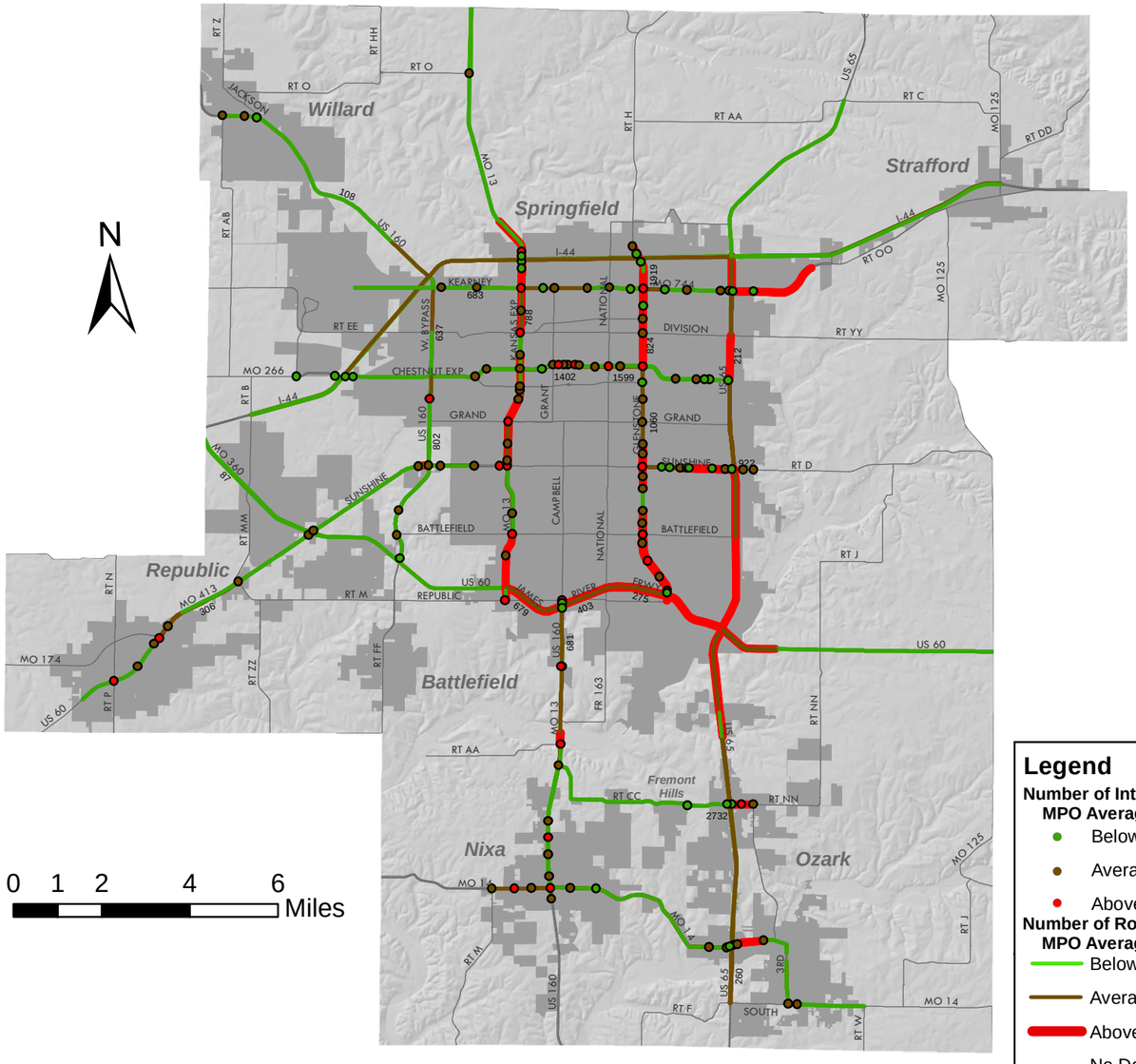
Source: Missouri Dept. of Transportation

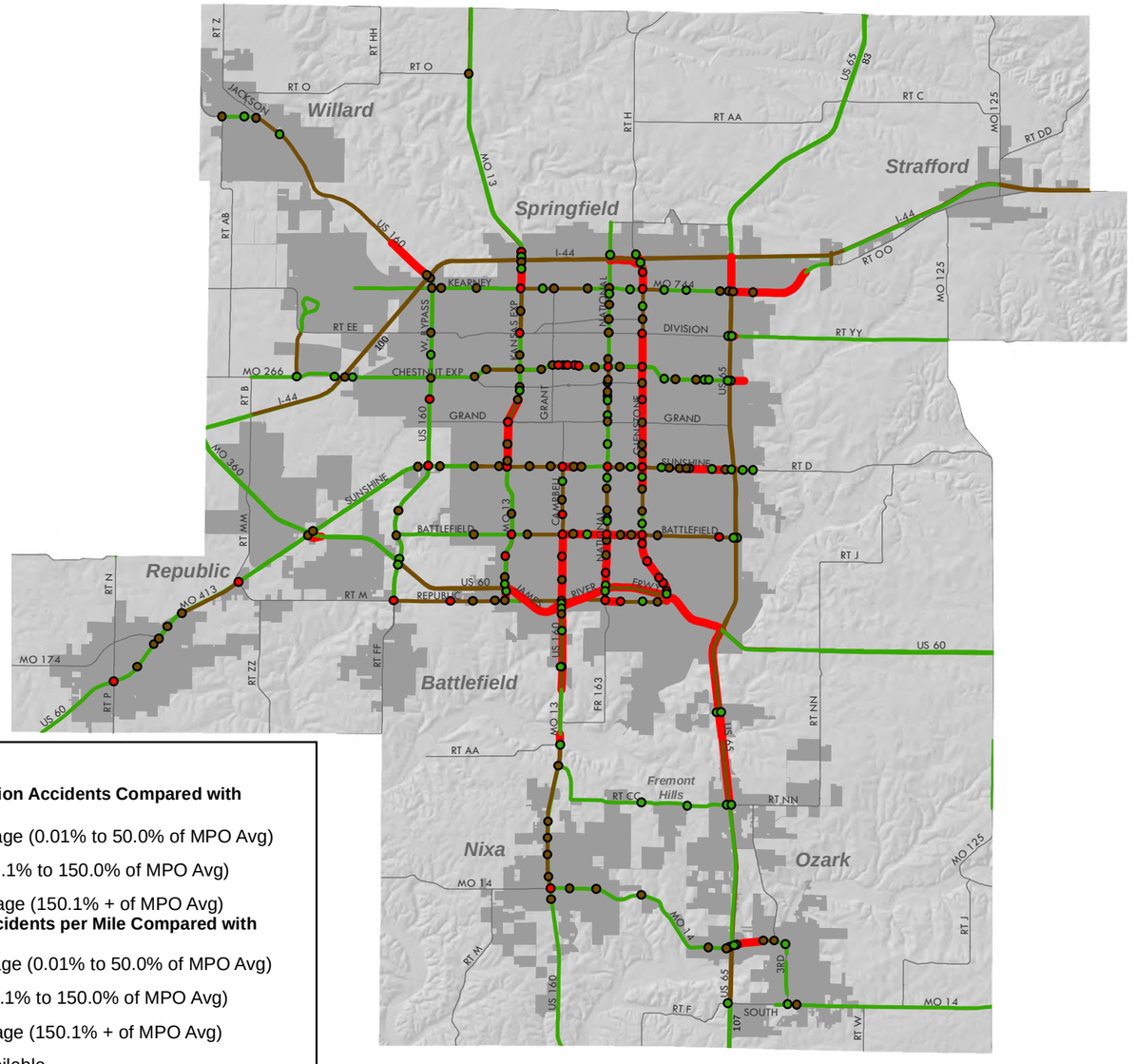
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**What is the impact of accidents on congestion?**

Map 4.1
**Accident Rates**

# Accident Frequency




**2012**

**2016**

## Legend

**Number of Intersection Accidents Compared with MPO Average**

- Below Average (0.01% to 50.0% of MPO Avg)
- Average (50.1% to 150.0% of MPO Avg)
- Above Average (150.1% + of MPO Avg)

**Number of Road Accidents per Mile Compared with MPO Average**

- Below Average (0.01% to 50.0% of MPO Avg)
- Average (50.1% to 150.0% of MPO Avg)
- Above Average (150.1% + of MPO Avg)
- No Data Available
- City Limits
- MPO Area

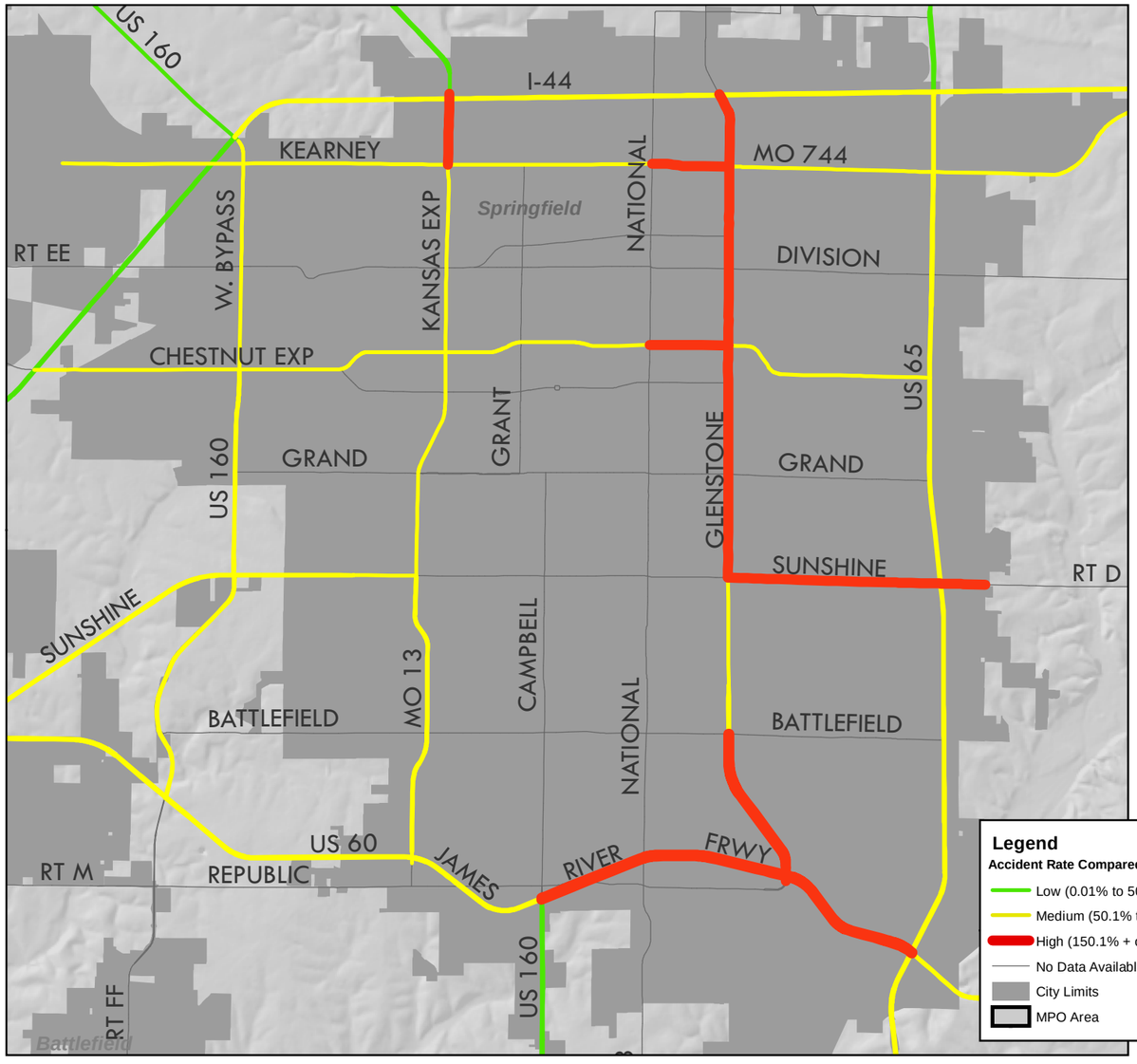
Source: City of Springfield
Missouri Dept. of Transportation

OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**What is the impact of accidents on congestion?**

Map 4.1
**Accident Rates**

# Accident Rates




**Legend**

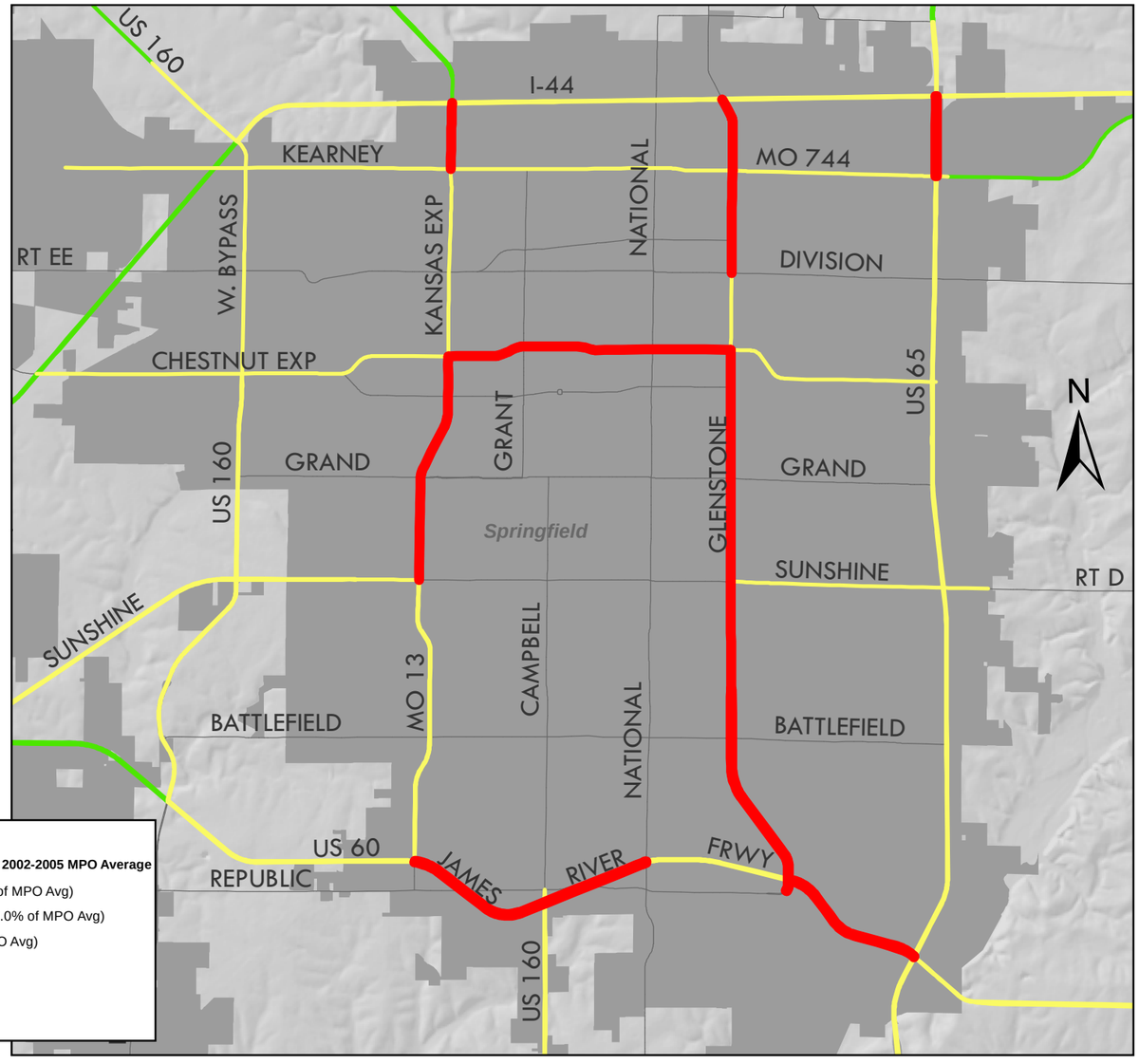
**Accident Rate Compared with 2002-2005 MPO Average**

- Low (0.01% to 50.0% of MPO Avg)
- Medium (50.1% to 150.0% of MPO Avg)
- High (150.1% + of MPO Avg)
- No Data Available
- City Limits
- MPO Area

**2005**

0 0.5 1 2 3

Miles




Source: City of Springfield
Missouri Dept. of Transportation

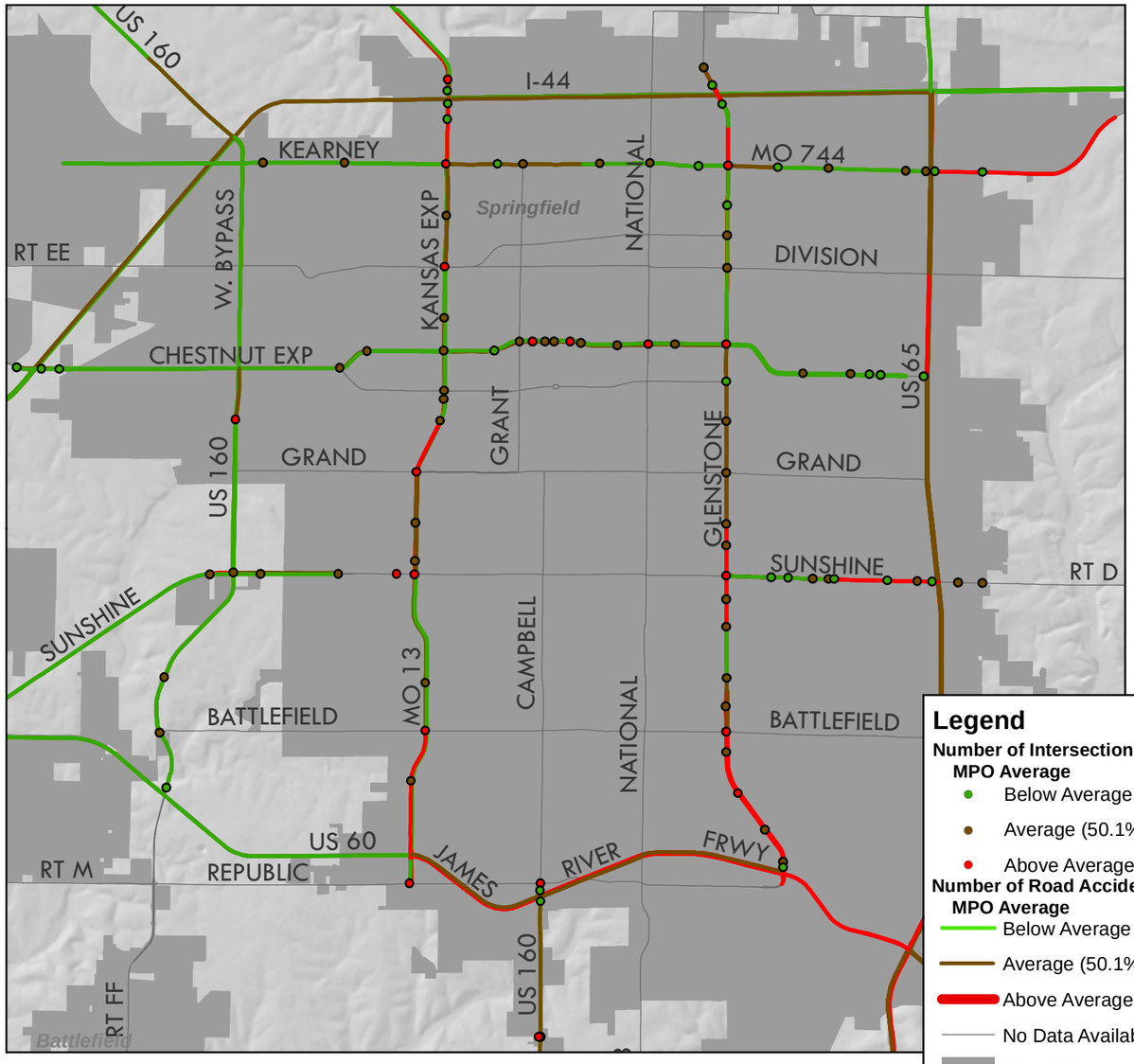
**2008**

OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**What is the impact of accidents on congestion?**

Map 4.2
**Accident Rates**

# Accident Frequency




**2012**

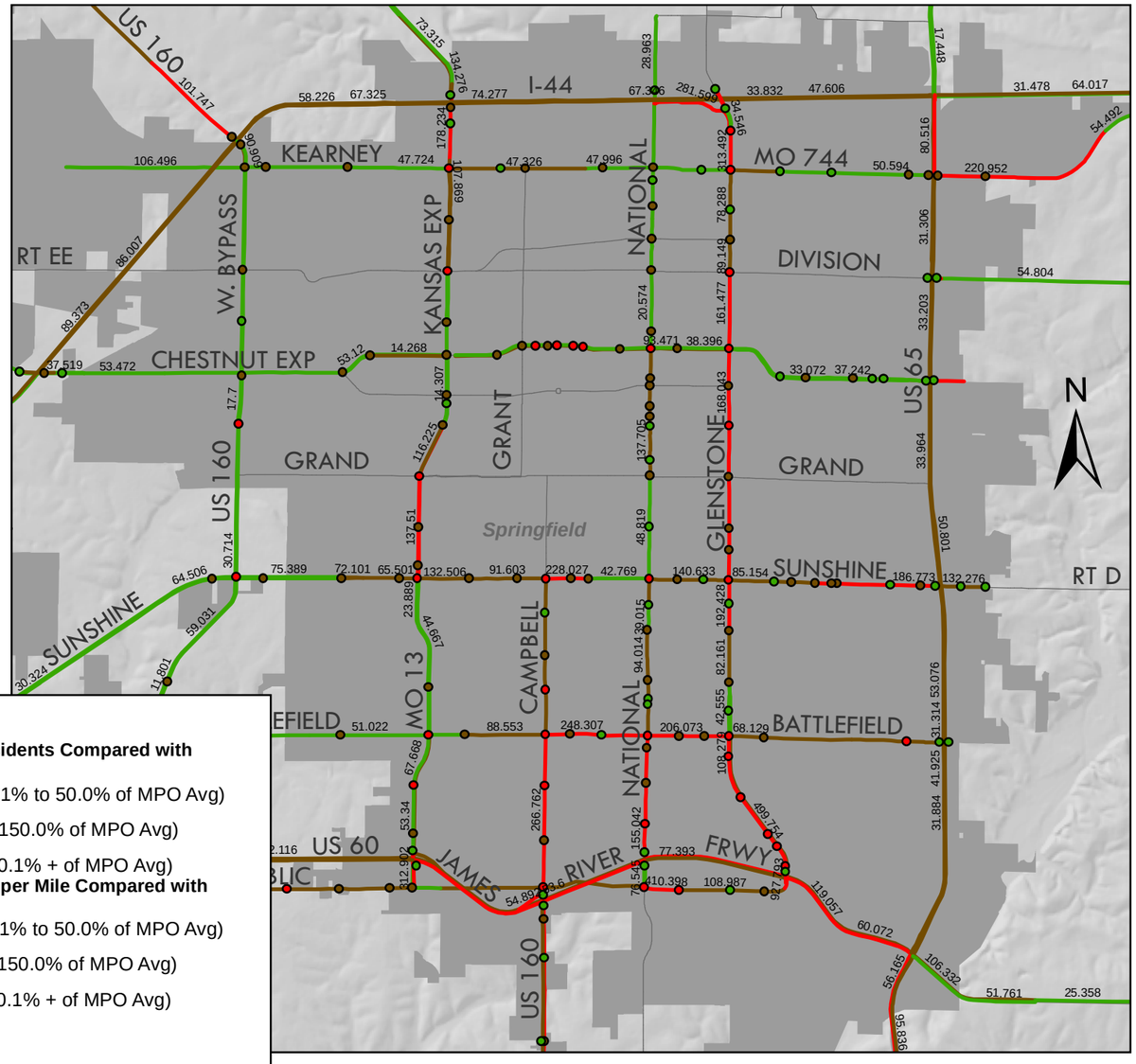
## Legend

**Number of Intersection Accidents Compared with MPO Average**

- Below Average (0.01% to 50.0% of MPO Avg)
- Average (50.1% to 150.0% of MPO Avg)
- Above Average (150.1% + of MPO Avg)

**Number of Road Accidents per Mile Compared with MPO Average**

- Below Average (0.01% to 50.0% of MPO Avg)
- Average (50.1% to 150.0% of MPO Avg)
- Above Average (150.1% + of MPO Avg)
- No Data Available
- City Limits
- MPO Area




**2016**

Source: City of Springfield
Missouri Dept. of Transportation

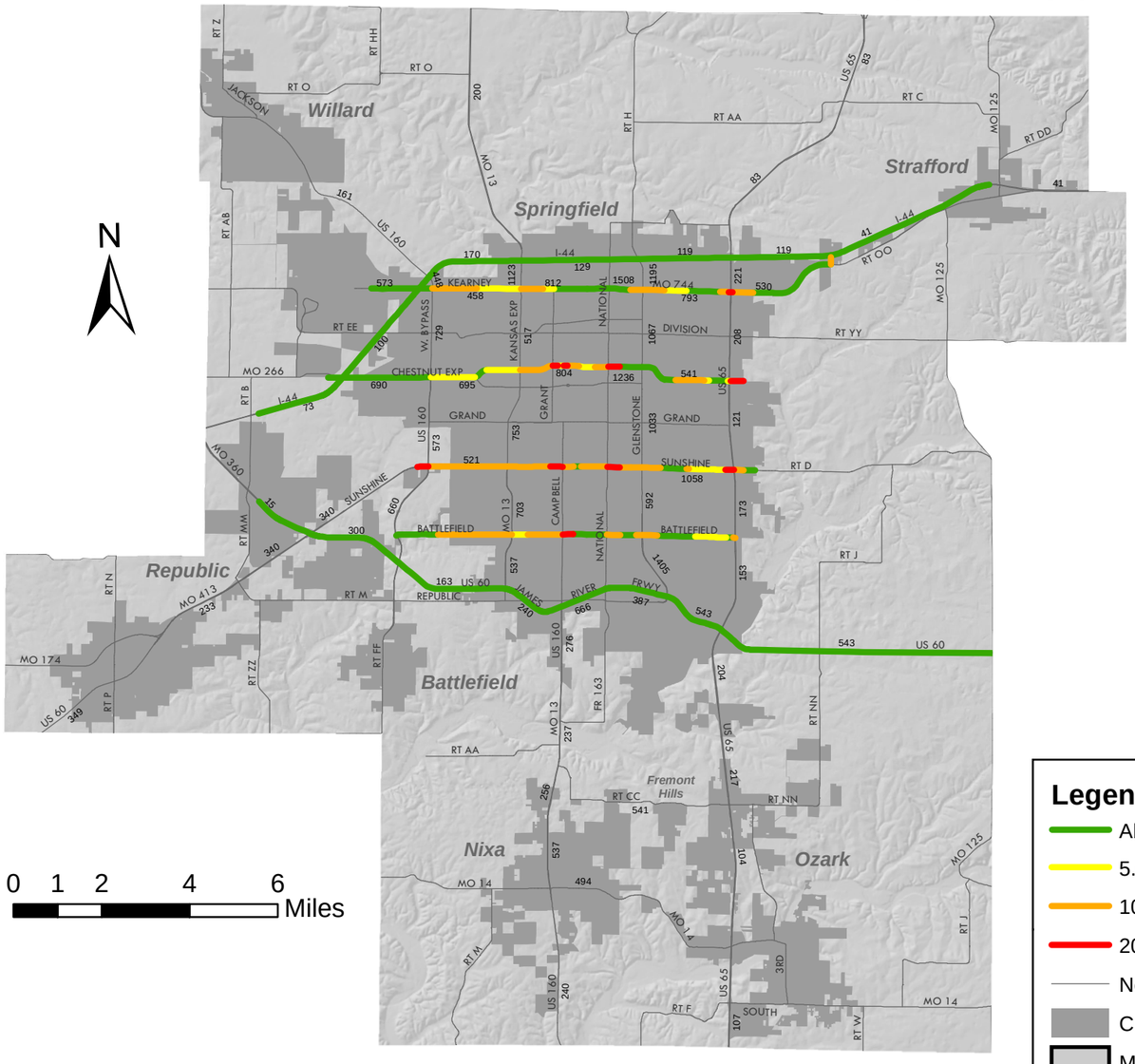
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**What is the impact of accidents on congestion?**

# Map 4.2

**Accident Rates**

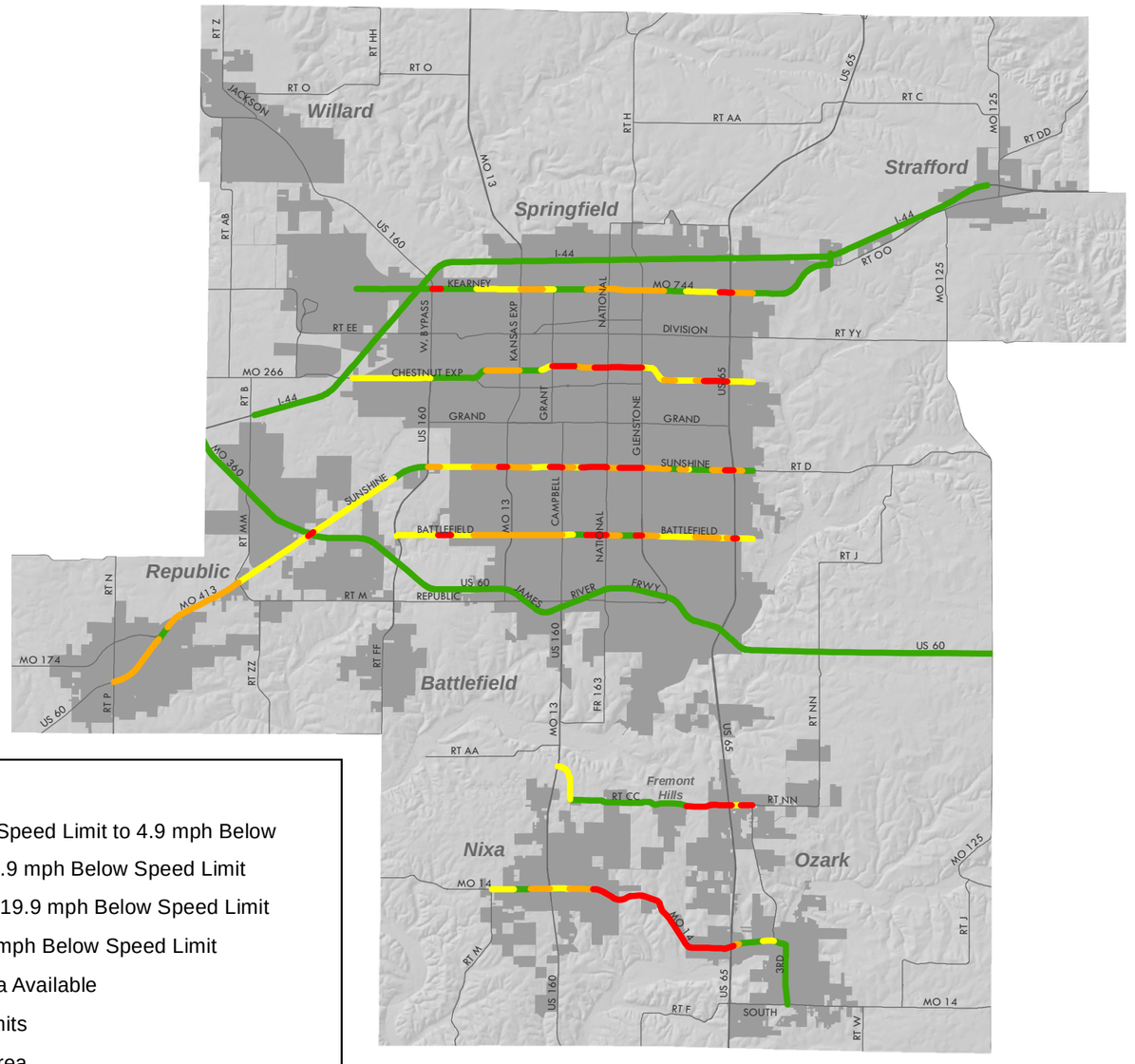
# Average Travel Speeds
# AM Peak Hour - Eastbound Lanes




**Legend**

- Above Speed Limit to 4.9 mph Below
- 5.0 to 9.9 mph Below Speed Limit
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- City Limits
- MPO Area

**2005**




**2008**

Source: CJW Transportation Consultants LLC

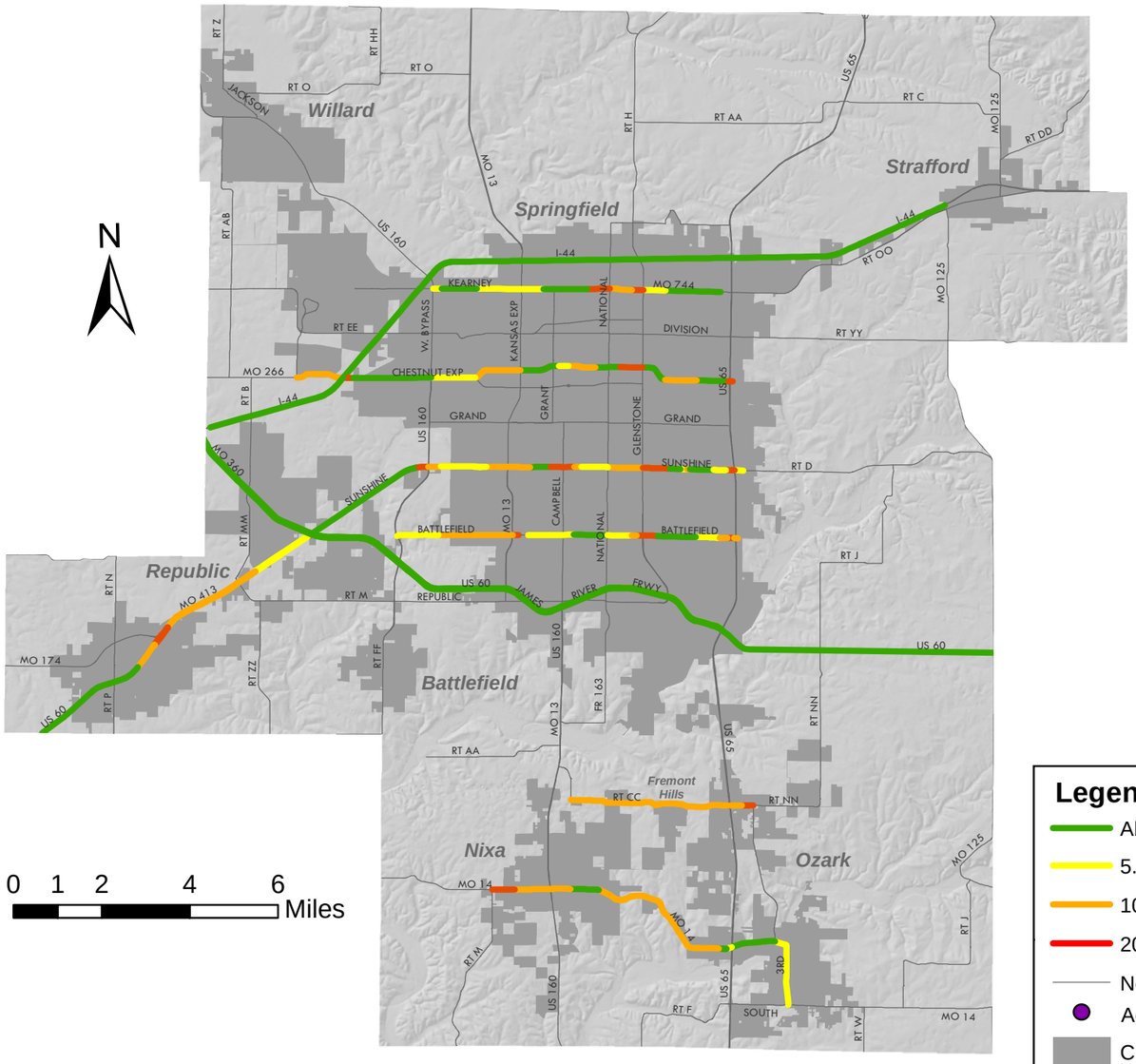
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**How badly are travelers delayed?**

# Map 5.1

**Average Travel Speeds**
**AM Peak Hour - Eastbound Lanes**

# Average Travel Speeds
# AM Peak Hour - Eastbound Lanes




**Legend**

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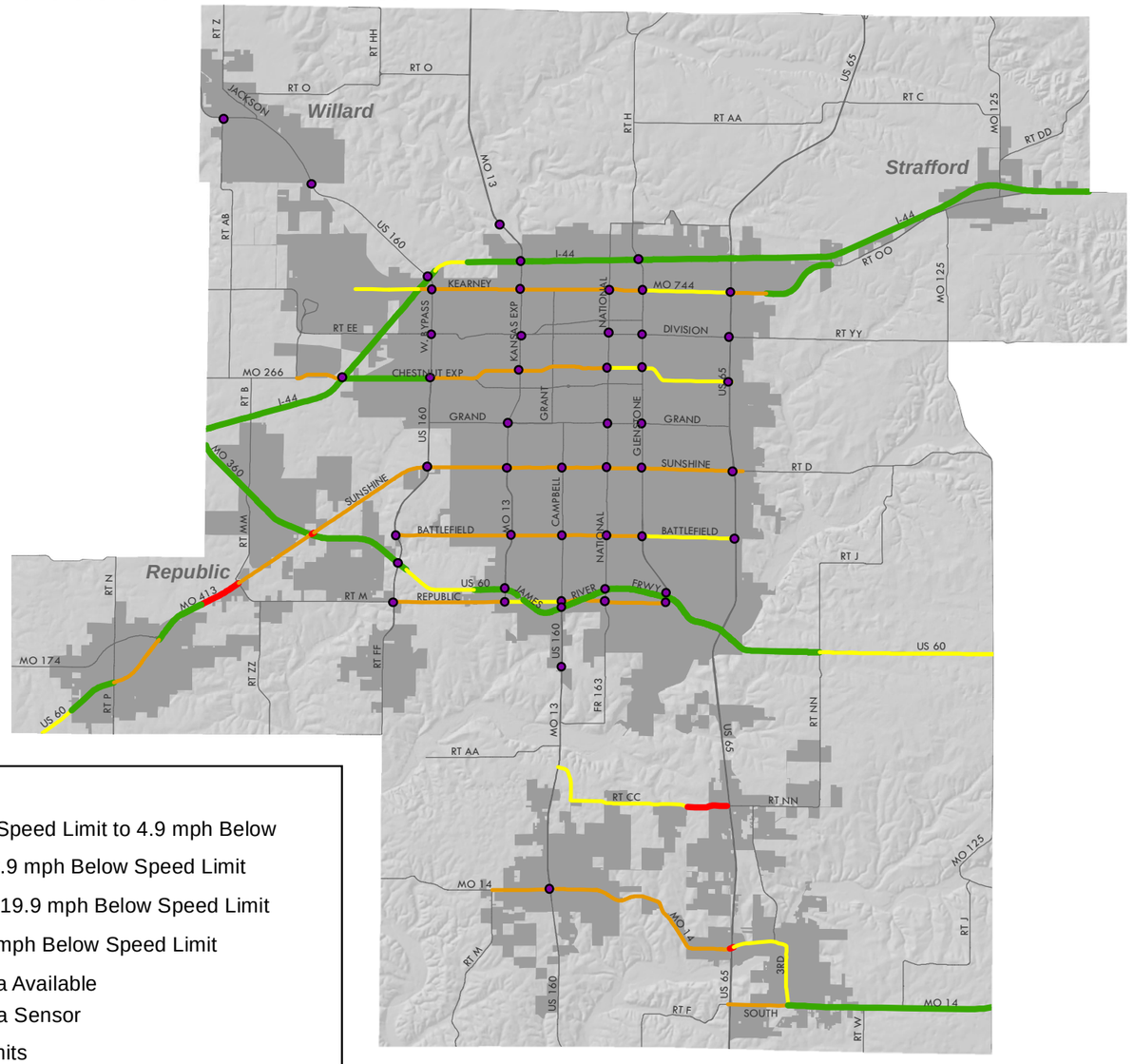
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- Acyclica Sensor
- City Limits
- MPO Area

**2012**




**2016**

Source: CJW Transportation Consultants LLC

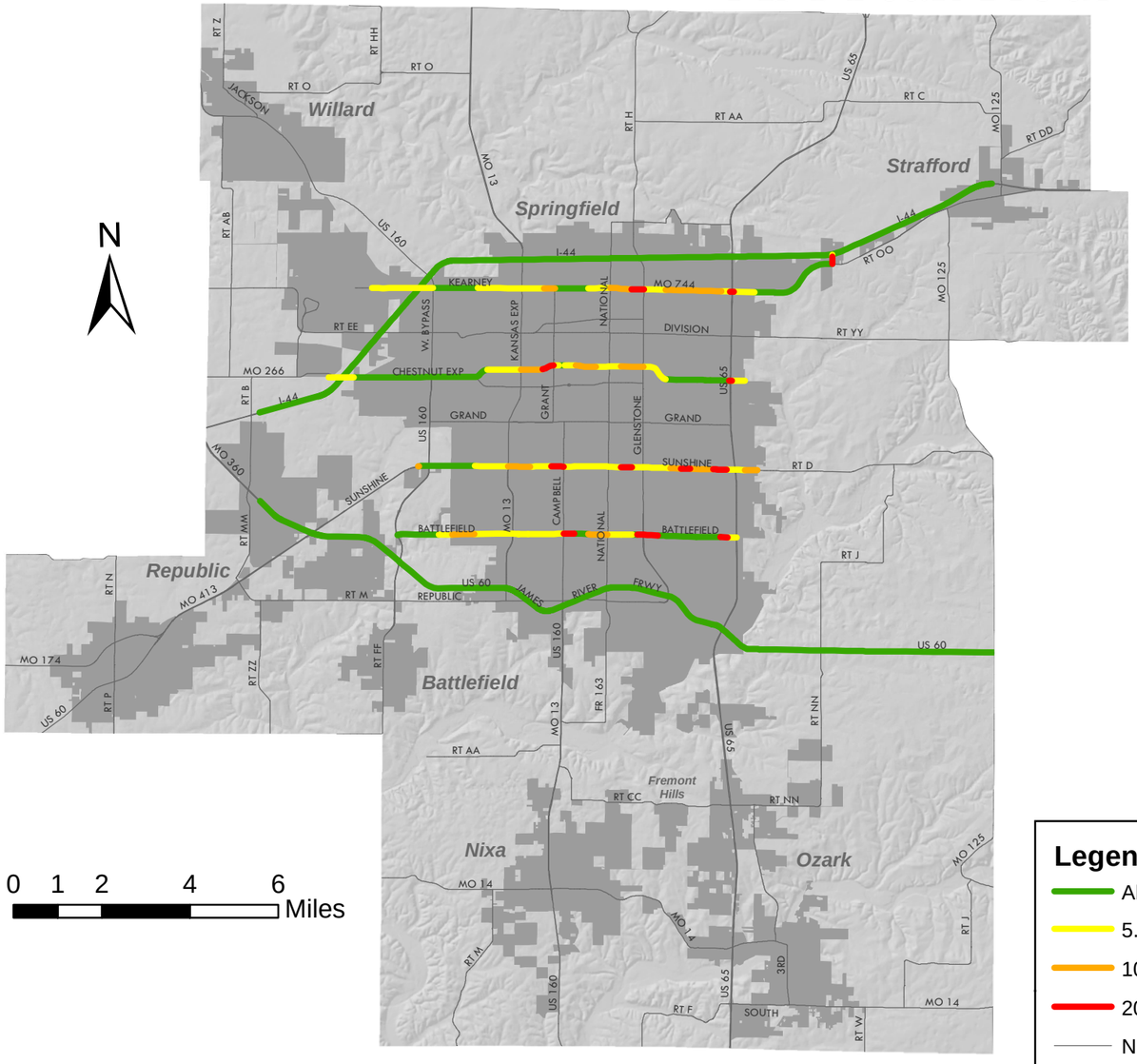
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

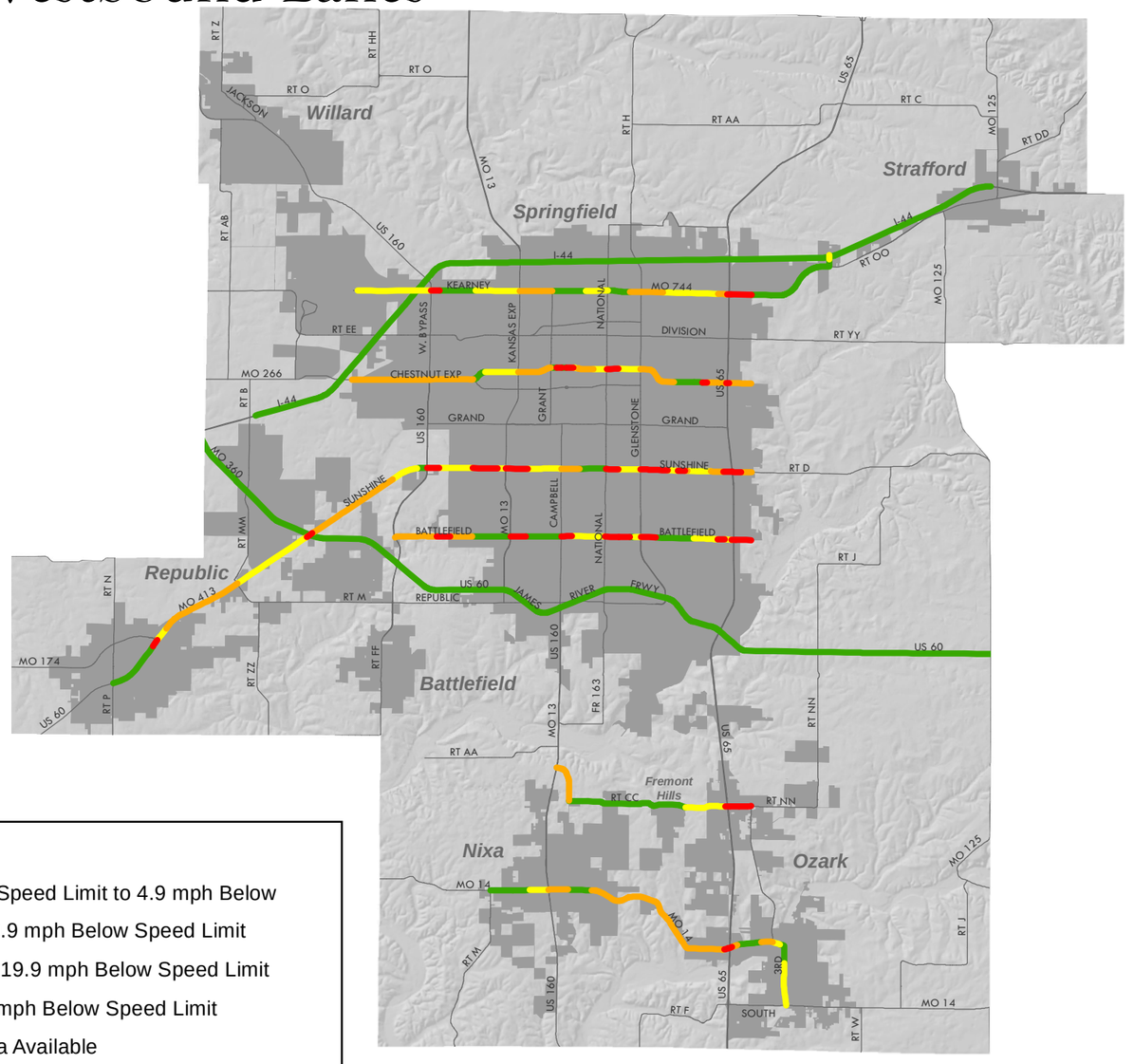
**How badly are travelers delayed?**

# Map 5.1

**Average Travel Speeds**
**AM Peak Hour - Eastbound Lanes**

# Average Travel Speeds
# AM Peak Hour - Westbound Lanes




**Legend**

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- 5.0 to 9.9 mph Below Speed Limit
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- City Limits
- MPO Area

**2005**

**2008**

Source: CJW Transportation Consultants LLC

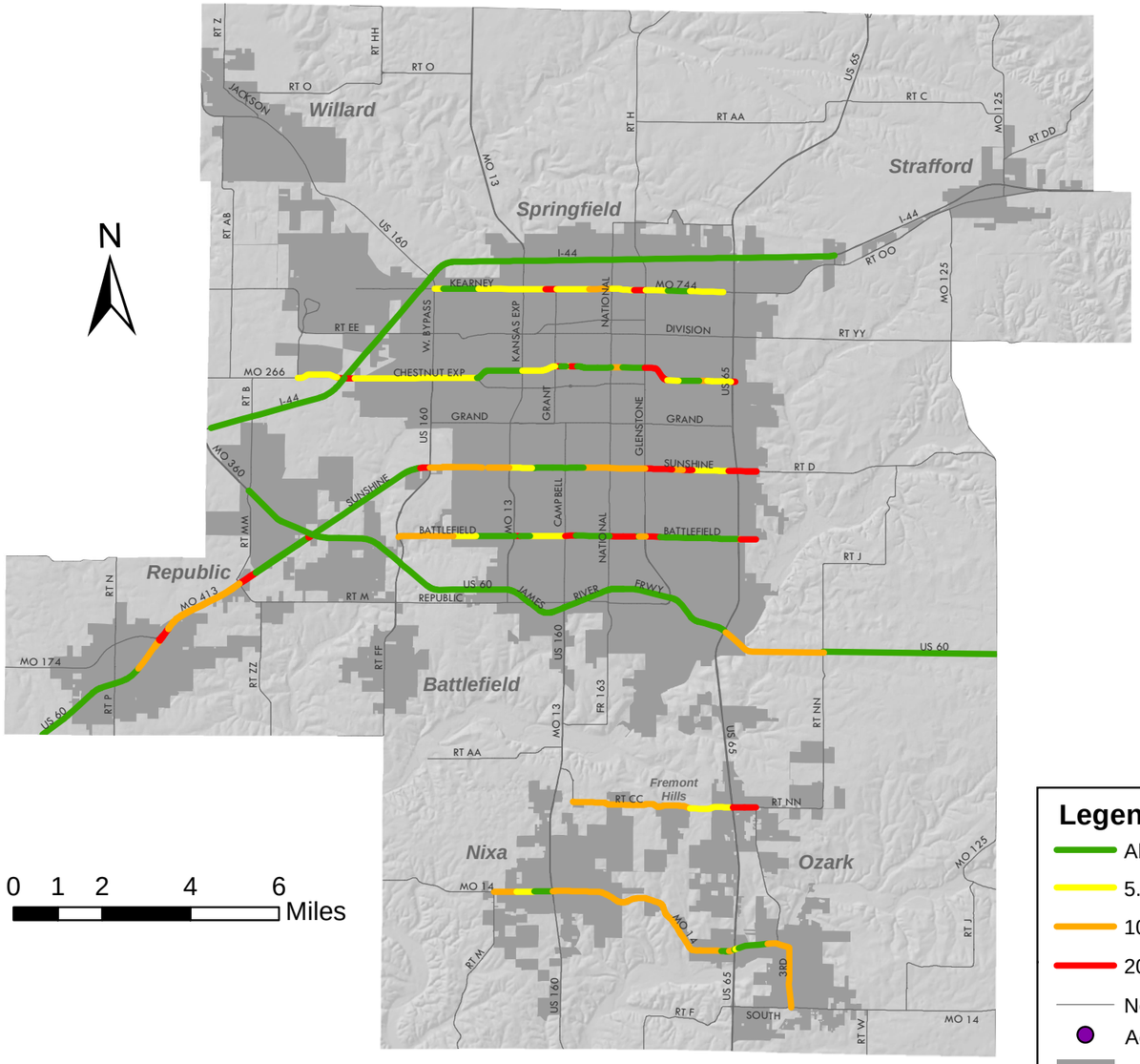
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**How badly are travelers delayed?**

# Map 5.2

**Average Travel Speeds**
**AM Peak Hour - Westbound Lanes**

# Average Travel Speeds
# AM Peak Hour - Westbound Lanes




**Legend**

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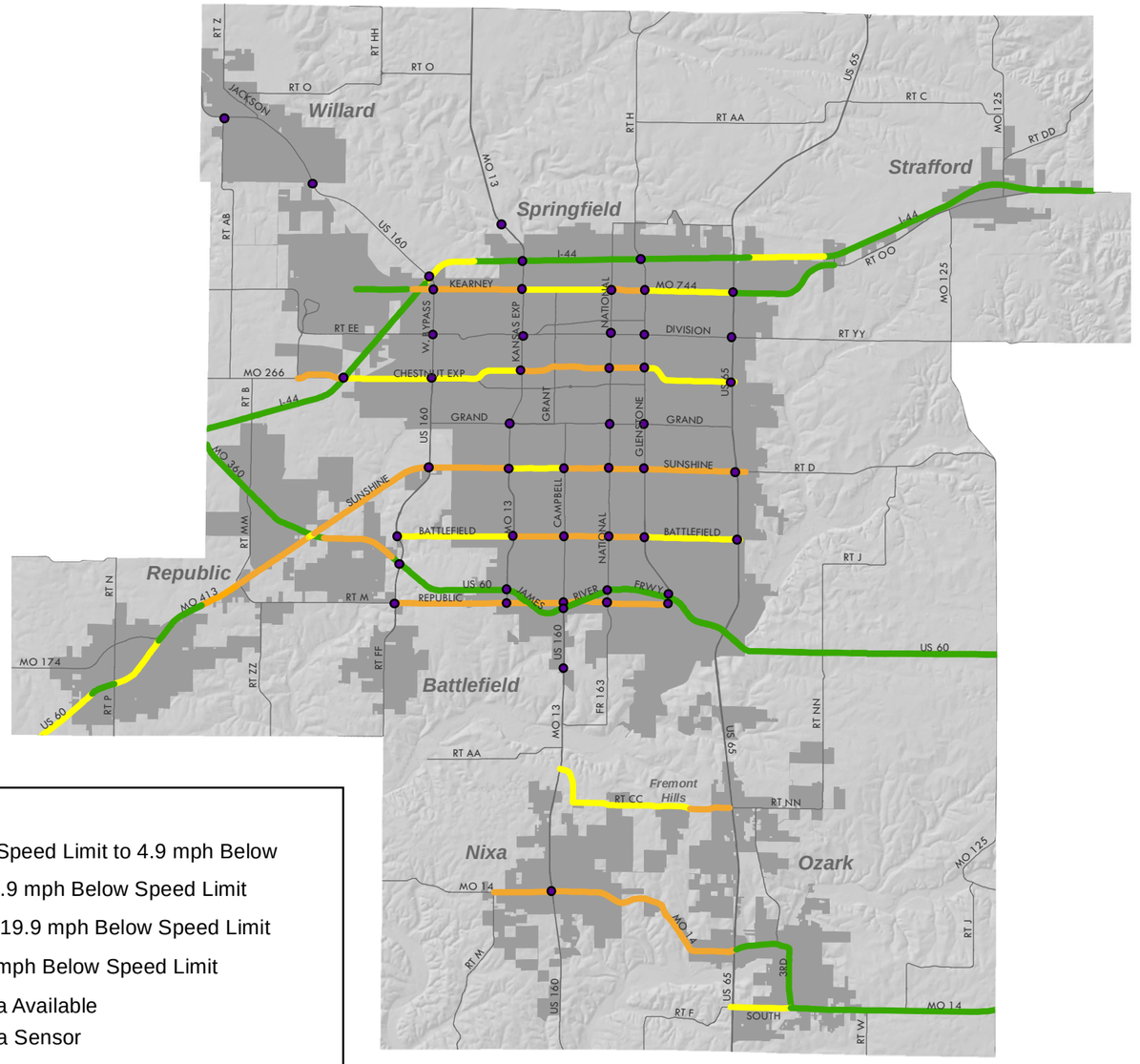
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- Acyclica Sensor
- City Limits
- MPO Area




**2012**

**2016**

Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

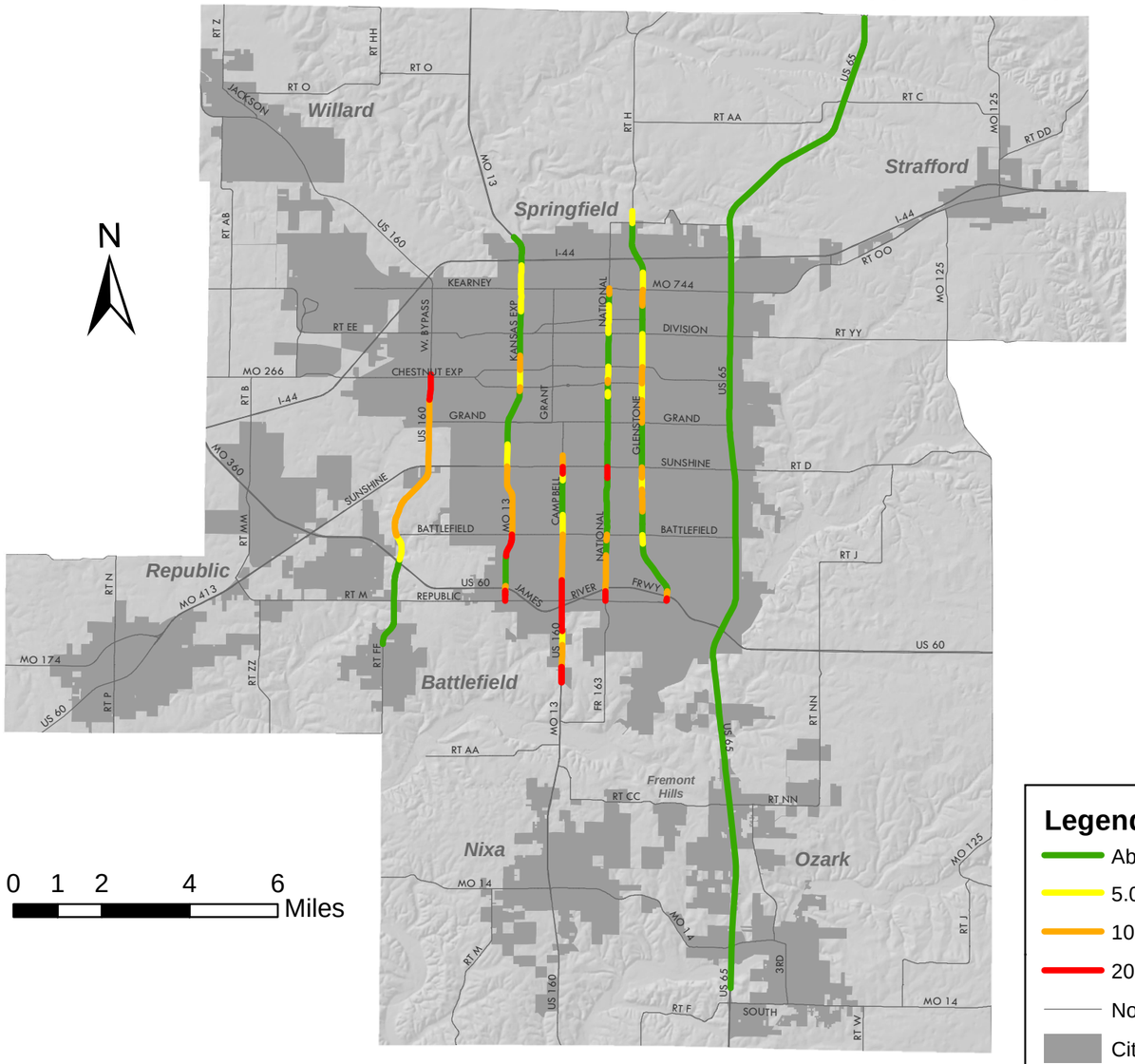
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

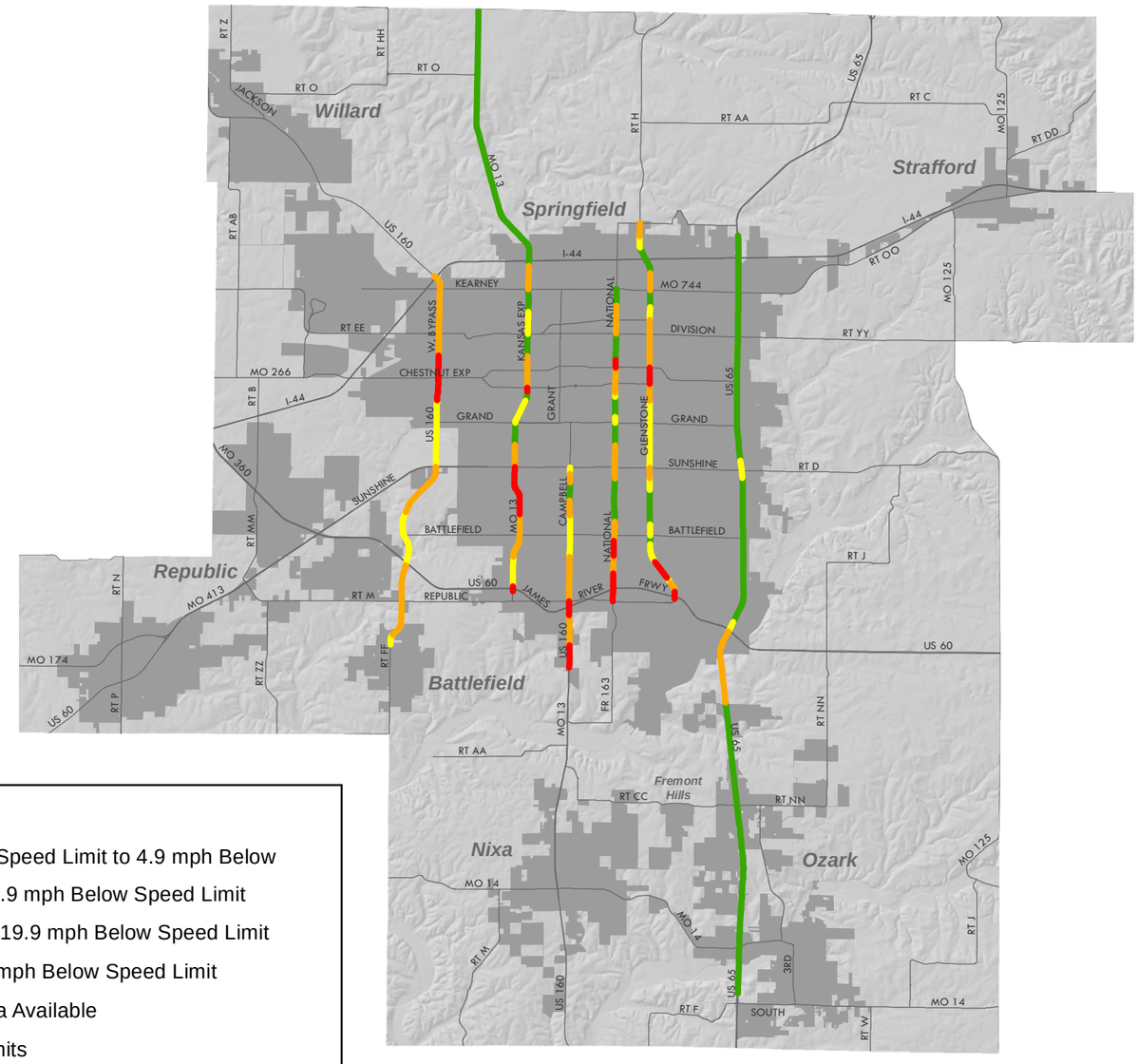
**How badly are travelers delayed?**

# Map 5.2

**Average Travel Speeds**
**Am Peak Hour - Westbound Lanes**

# Average Travel Speeds
# AM Peak Hour - Northbound Lanes




**Legend**

- Above Speed Limit to 4.9 mph Below
- 5.0 to 9.9 mph Below Speed Limit
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- City Limits
- MPO Area

**2005**

**2008**

Source: CJW Transportation Consultants LLC

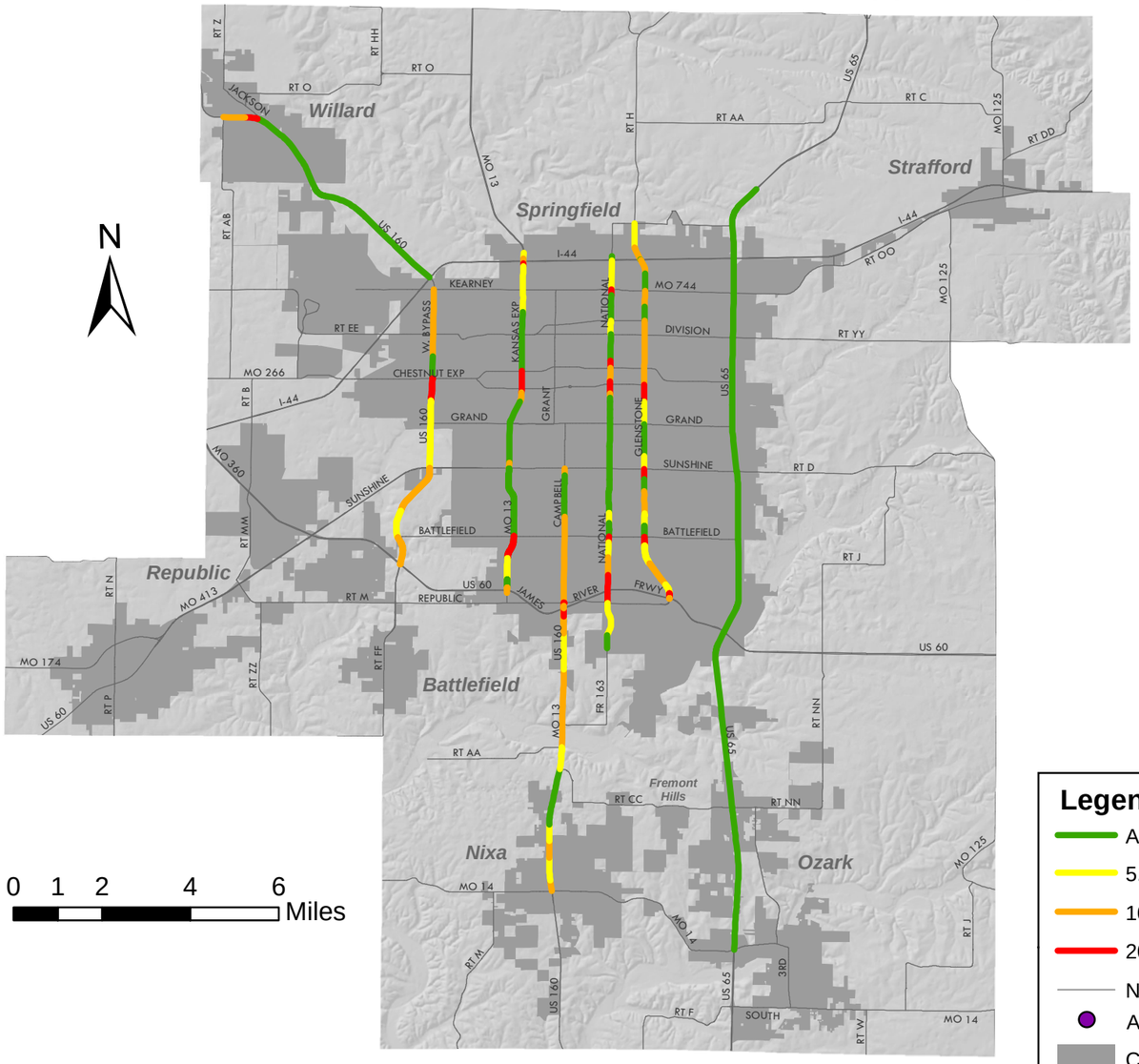
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**How badly are travelers delayed?**

# Map 5.3

**Average Travel Speeds**
**AM Peak Hour - Northbound Lanes**

# Average Travel Speeds
# AM Peak Hour - Northbound Lanes




**Legend**

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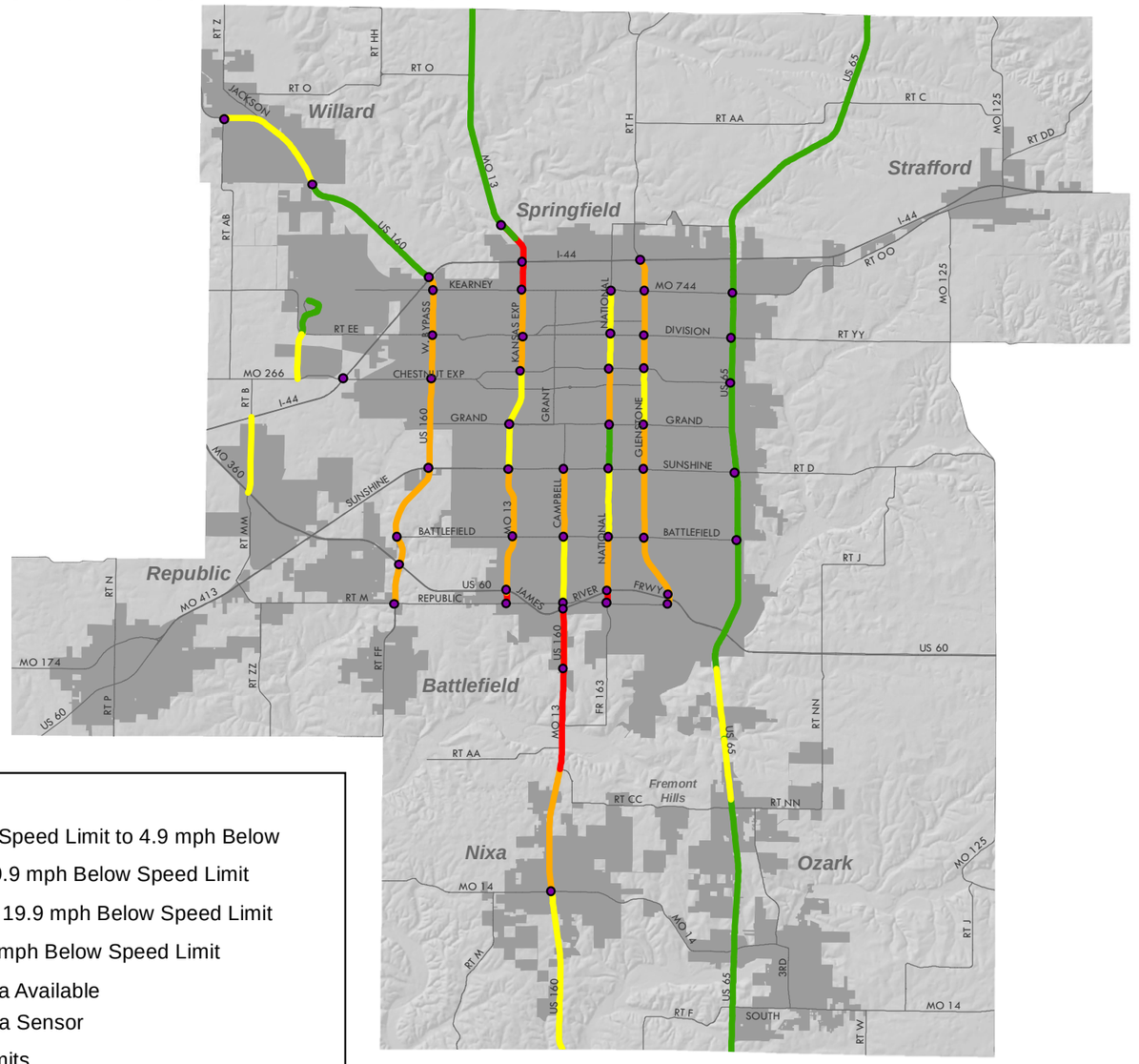
- 5.0 to 9.9 mph Below Speed Limit
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- Acyclica Sensor
- City Limits
- MPO Area

**2012**




**2016**

Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

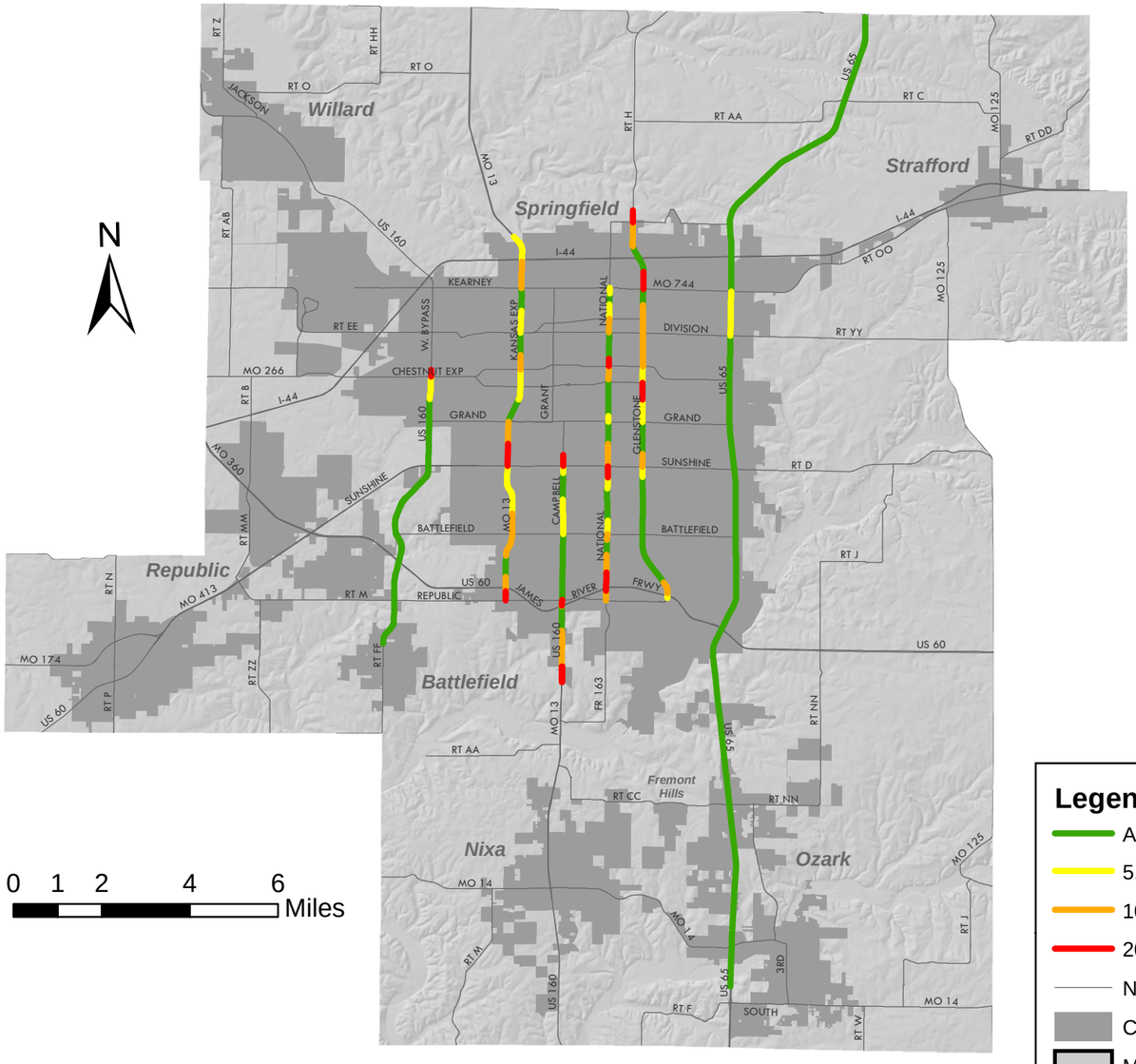
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

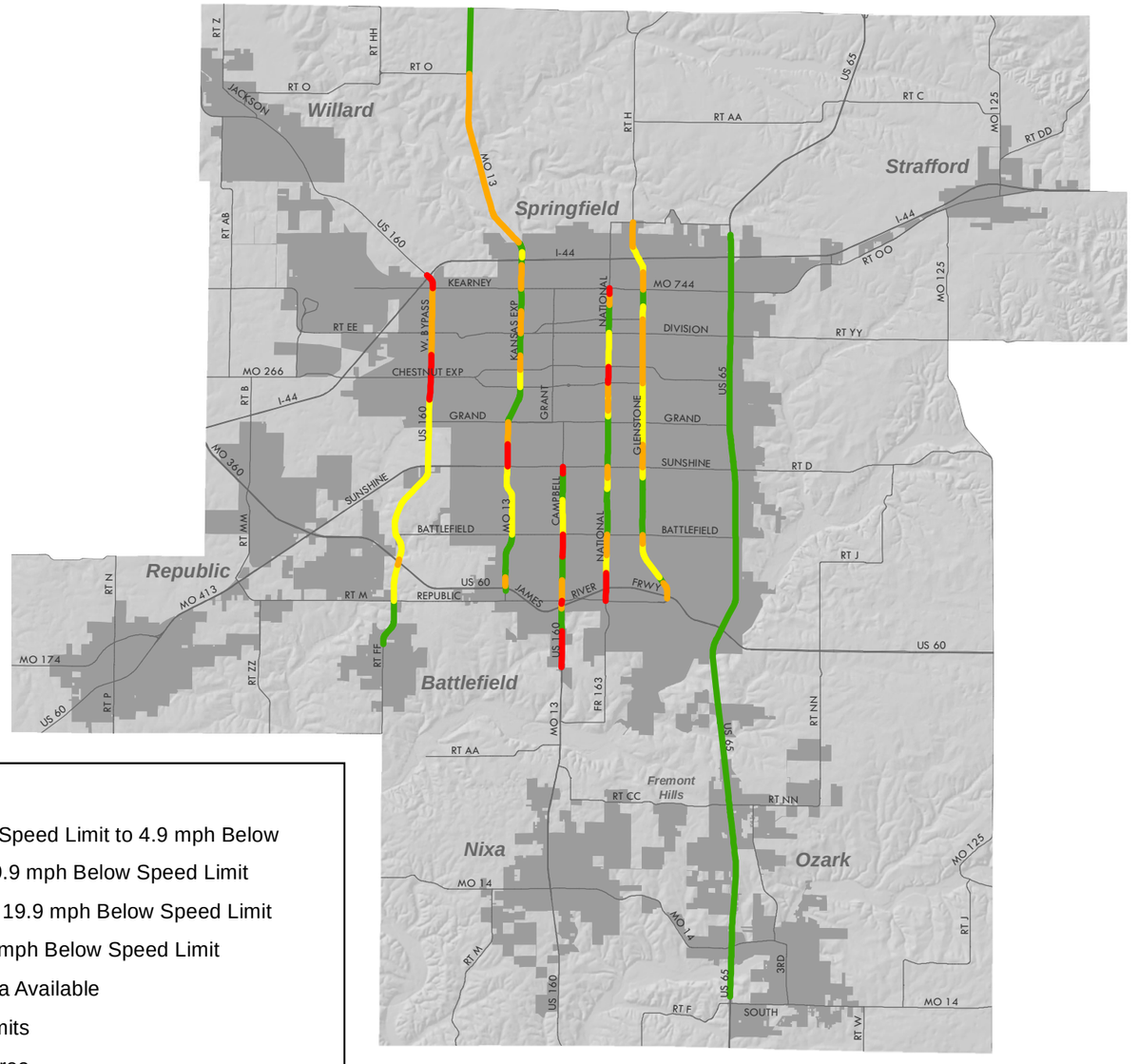
**How badly are travelers delayed?**

# Map 5.3

**Average Travel Speeds**
**AM Peak Hour - Northbound Lanes**

# Average Travel Speeds
# AM Peak Hour - Southbound Lanes




**Legend**

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- 5.0 to 9.9 mph Below Speed Limit
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- City Limits
- MPO Area

**2005**

**2008**

Source: CJW Transportation Consultants LLC

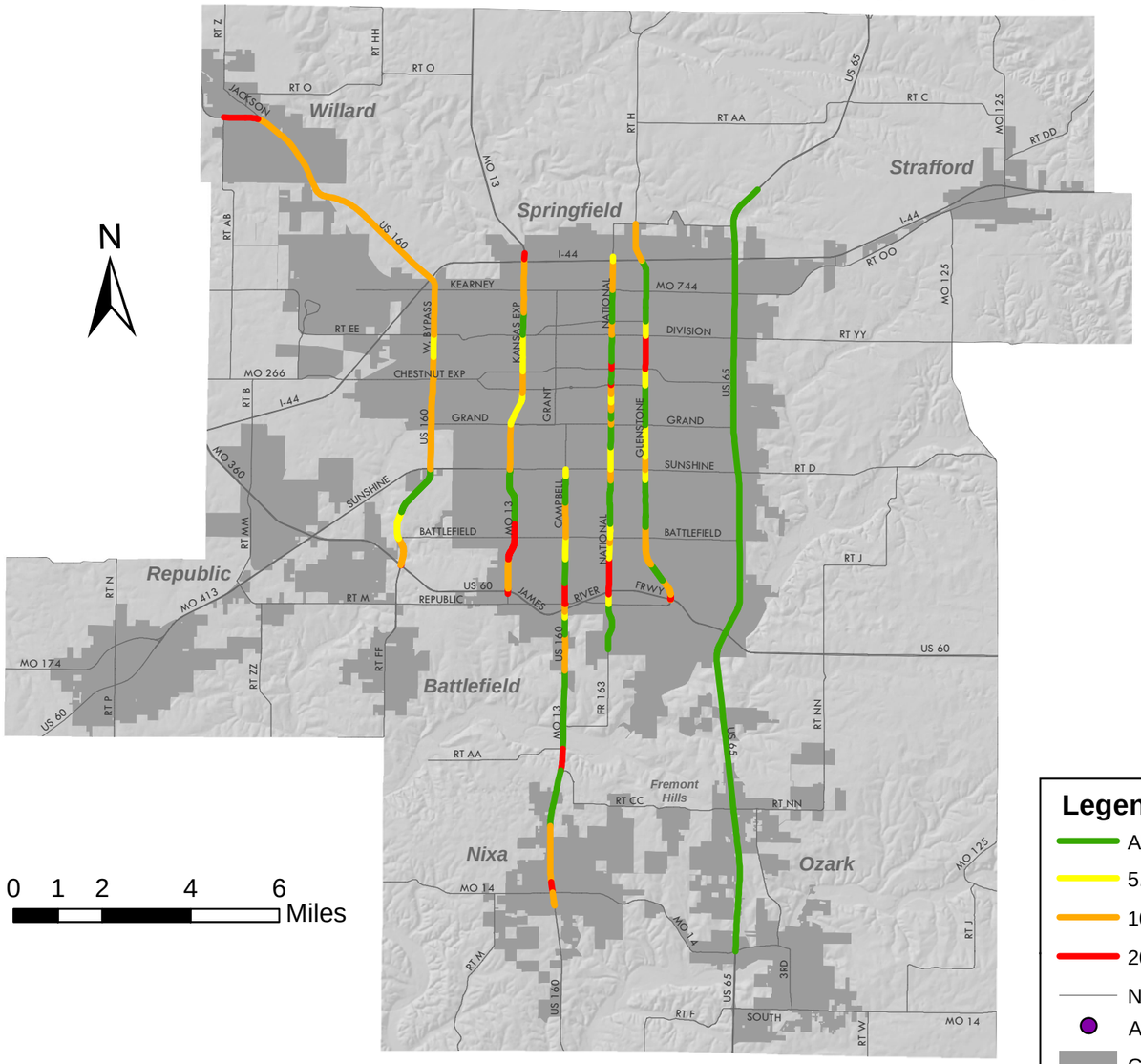
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

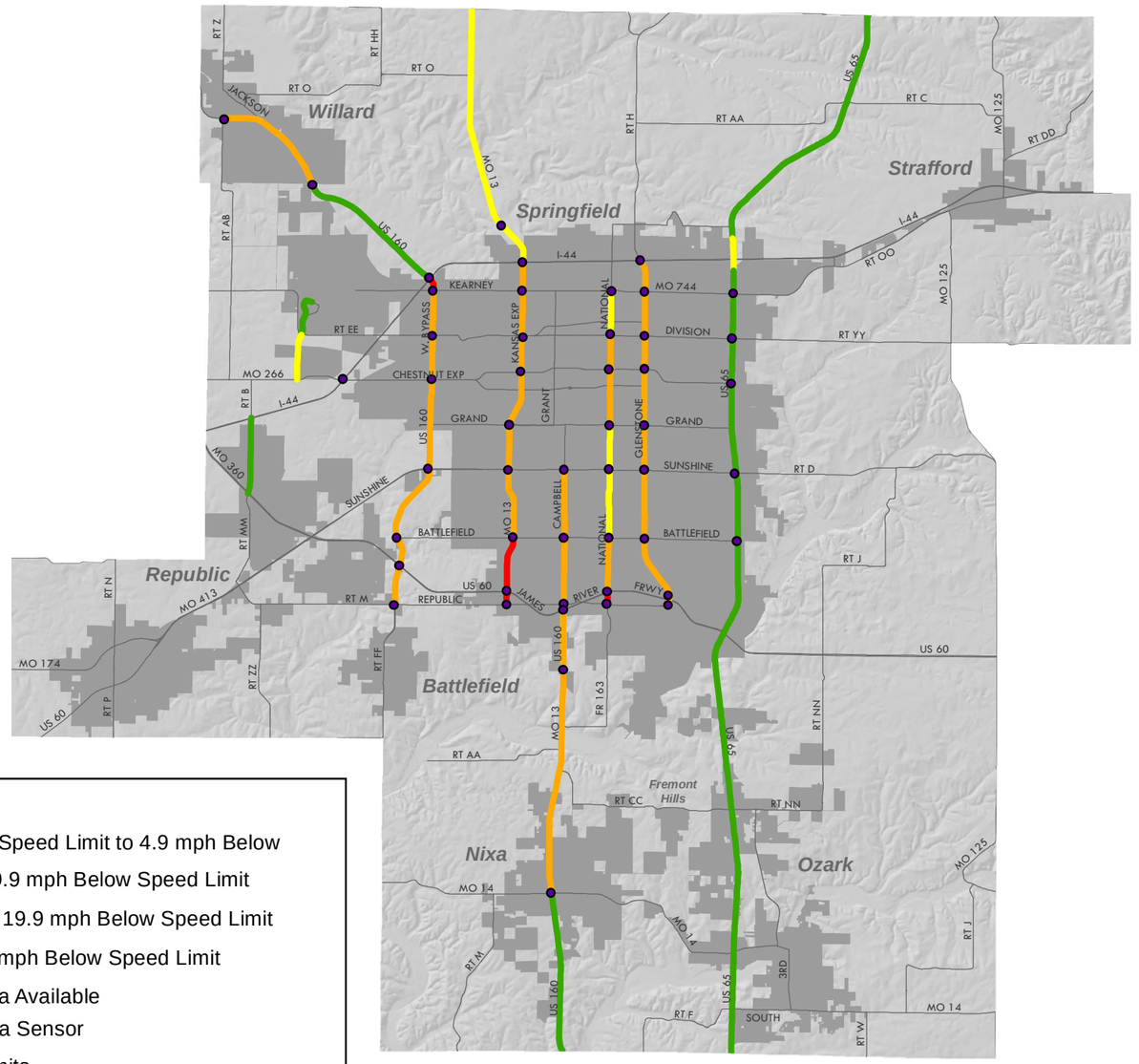
**How badly are travelers delayed?**

# Map 5.4

**Average Travel Speeds**
**AM Peak Hour - Southbound Lanes**

# Average Travel Speeds
# AM Peak Hour - Southbound Lanes




**Legend**

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- 5.0 to 9.9 mph Below Speed Limit
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- Acyclica Sensor
- City Limits
- MPO Area

**2012**

**2016**

Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

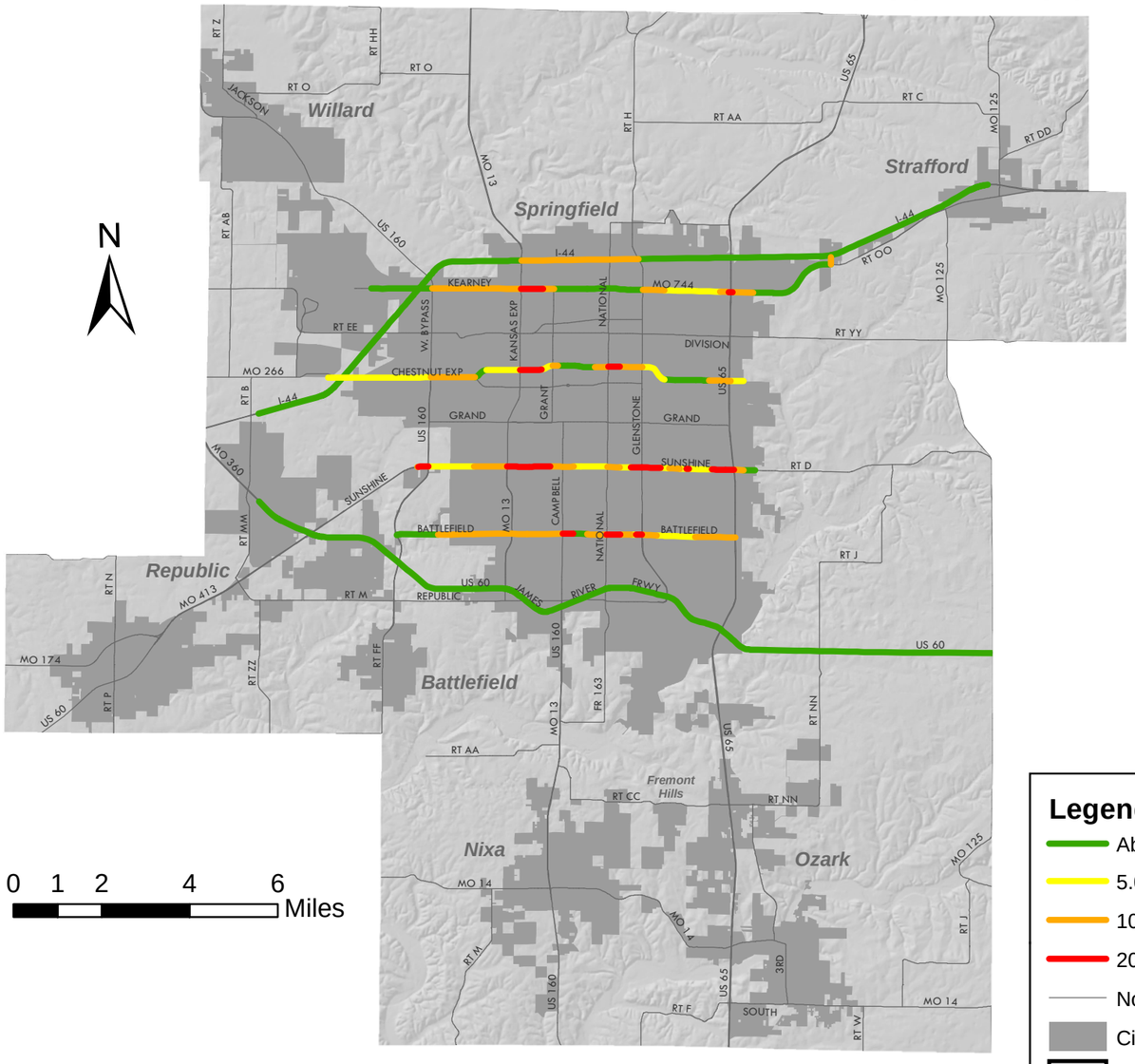
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**How badly are travelers delayed?**

# Map 5.4

**Average Travel Speeds**
**AM Peak Hour - Southbound Lanes**

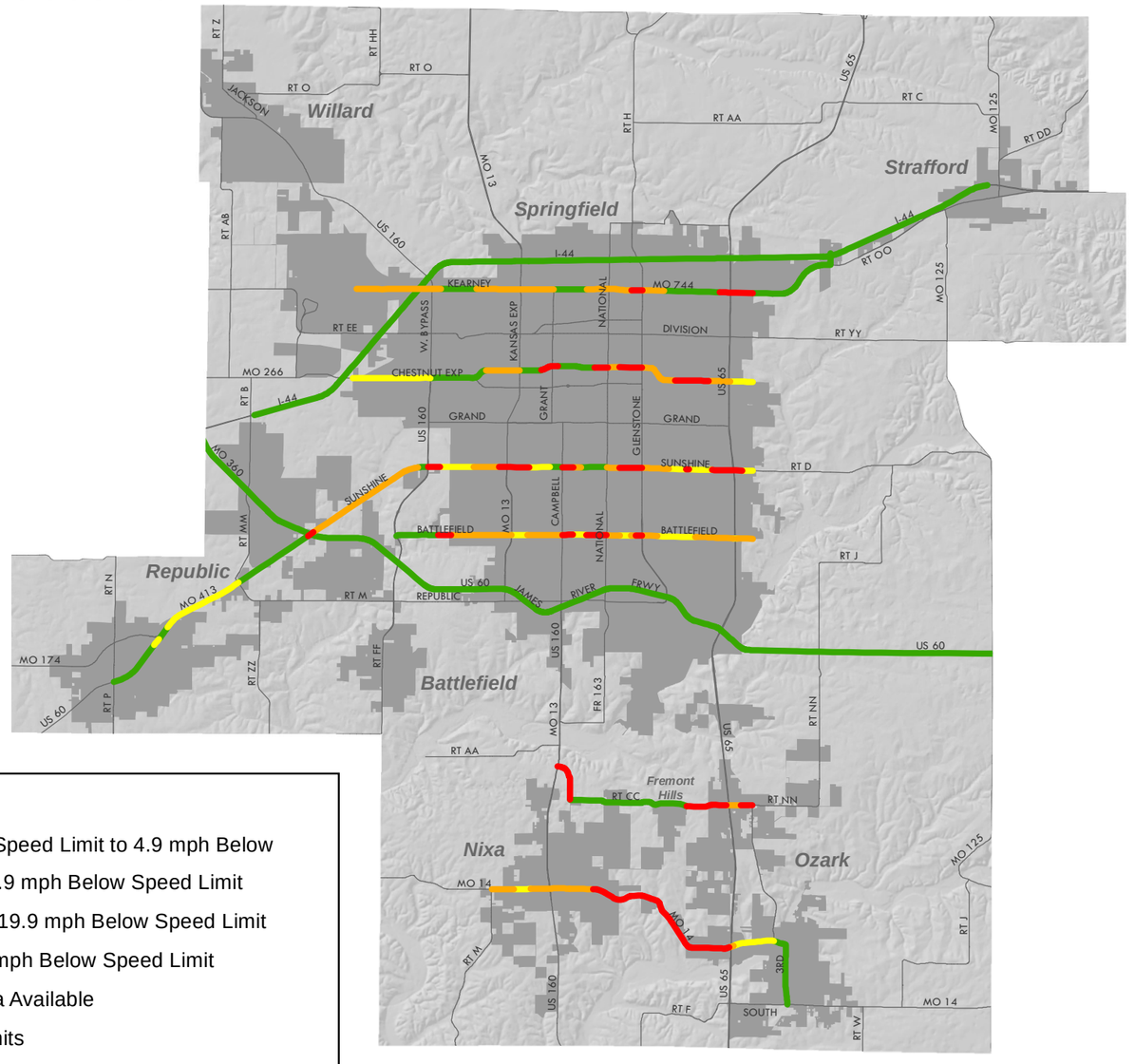
# Average Travel Speeds
# PM Peak Hour - Eastbound Lanes




**Legend**

- Above Speed Limit to 4.9 mph Below
- 5.0 to 9.9 mph Below Speed Limit
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- City Limits
- MPO Area

**2005**




**2008**

Source: CJW Transportation Consultants LLC

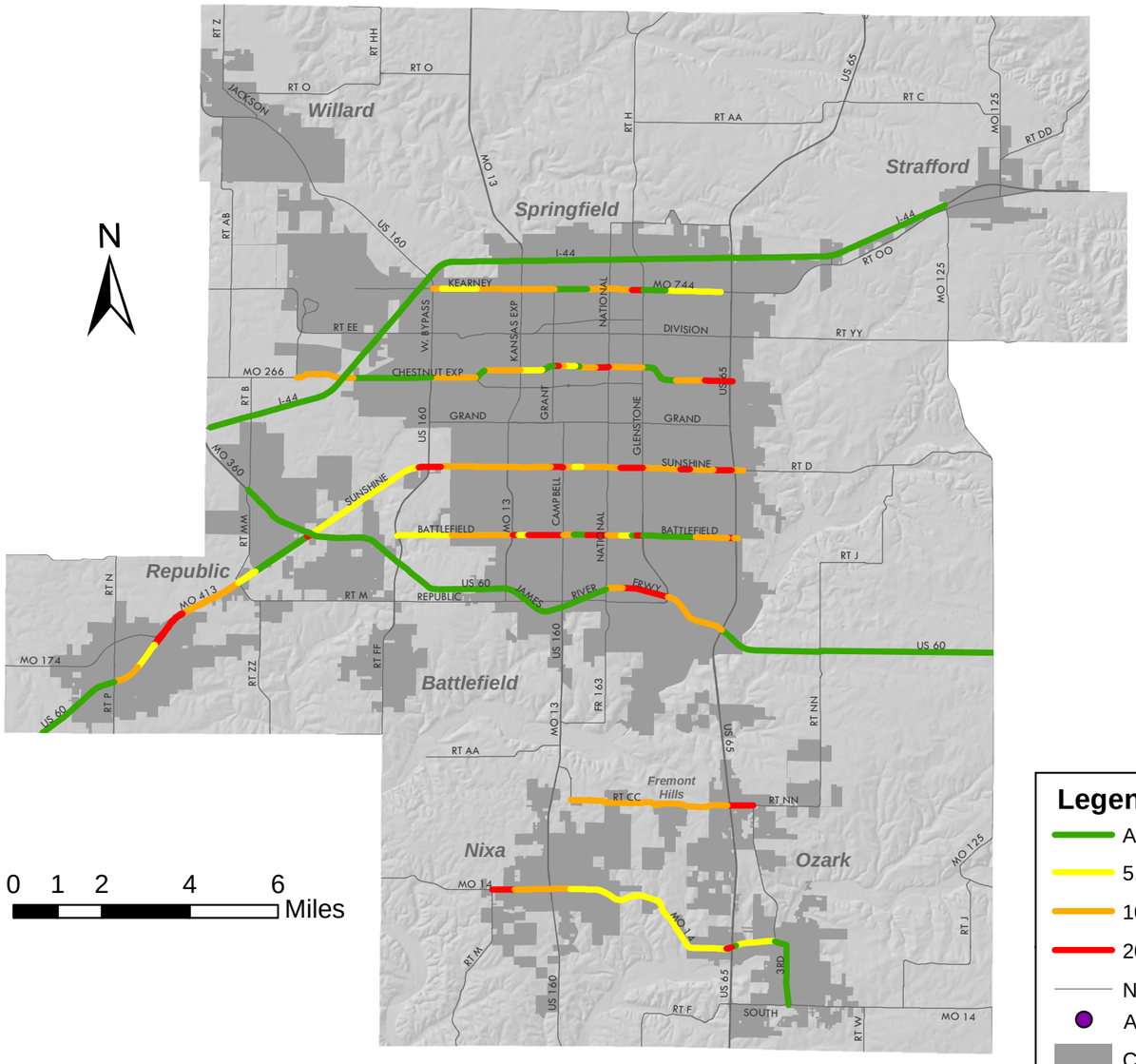
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

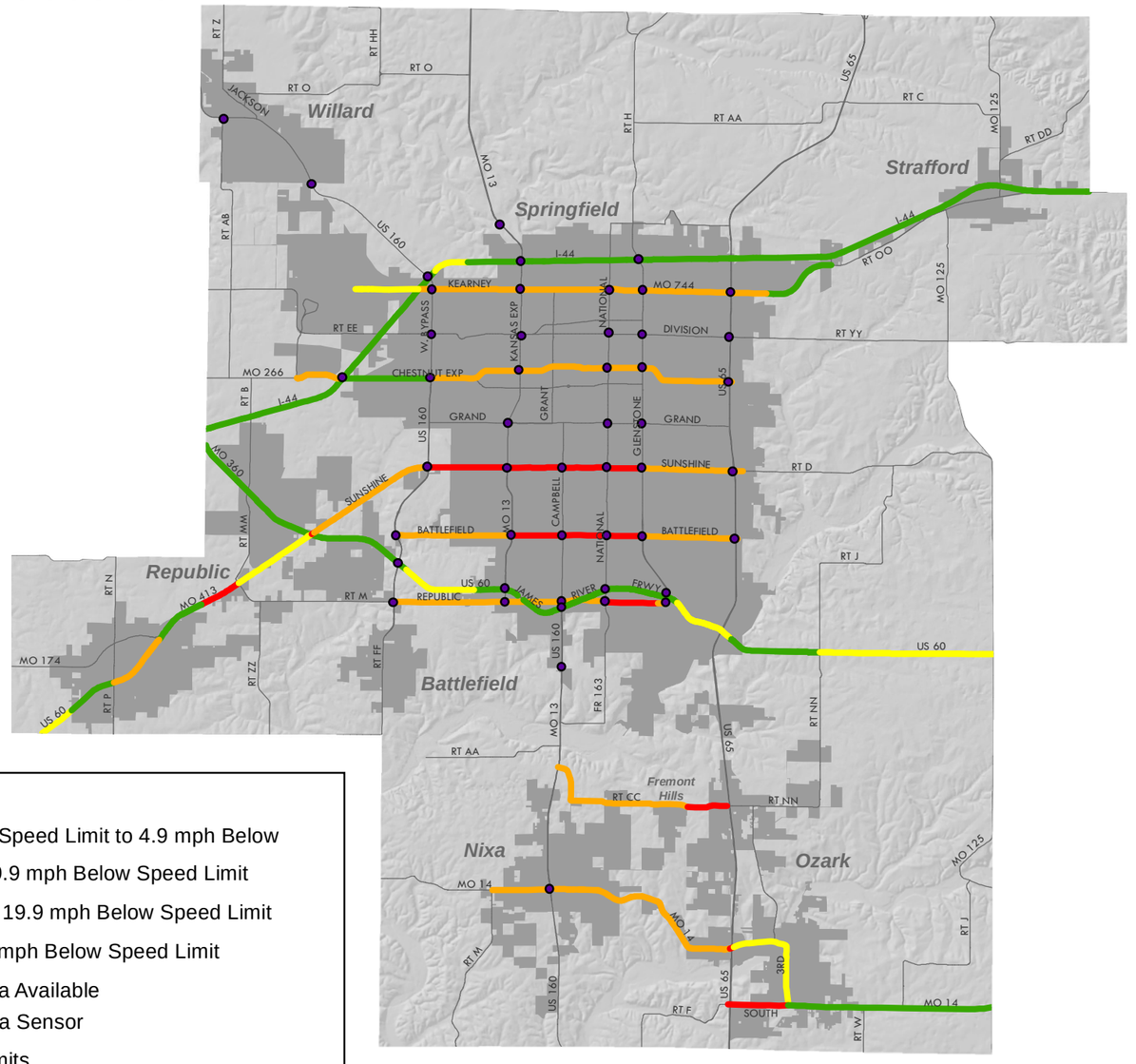
**How badly are travelers delayed?**

# Map 5.5

**Average Travel Speeds**
**PM Peak Hour - Eastbound Lanes**

# Average Travel Speeds
# PM Peak Hour - Eastbound Lanes




**Legend**

- Above Speed Limit to 4.9 mph Below
- 5.0 to 9.9 mph Below Speed Limit
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- Acyclica Sensor
- City Limits
- MPO Area

**2012**

**2016**

Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

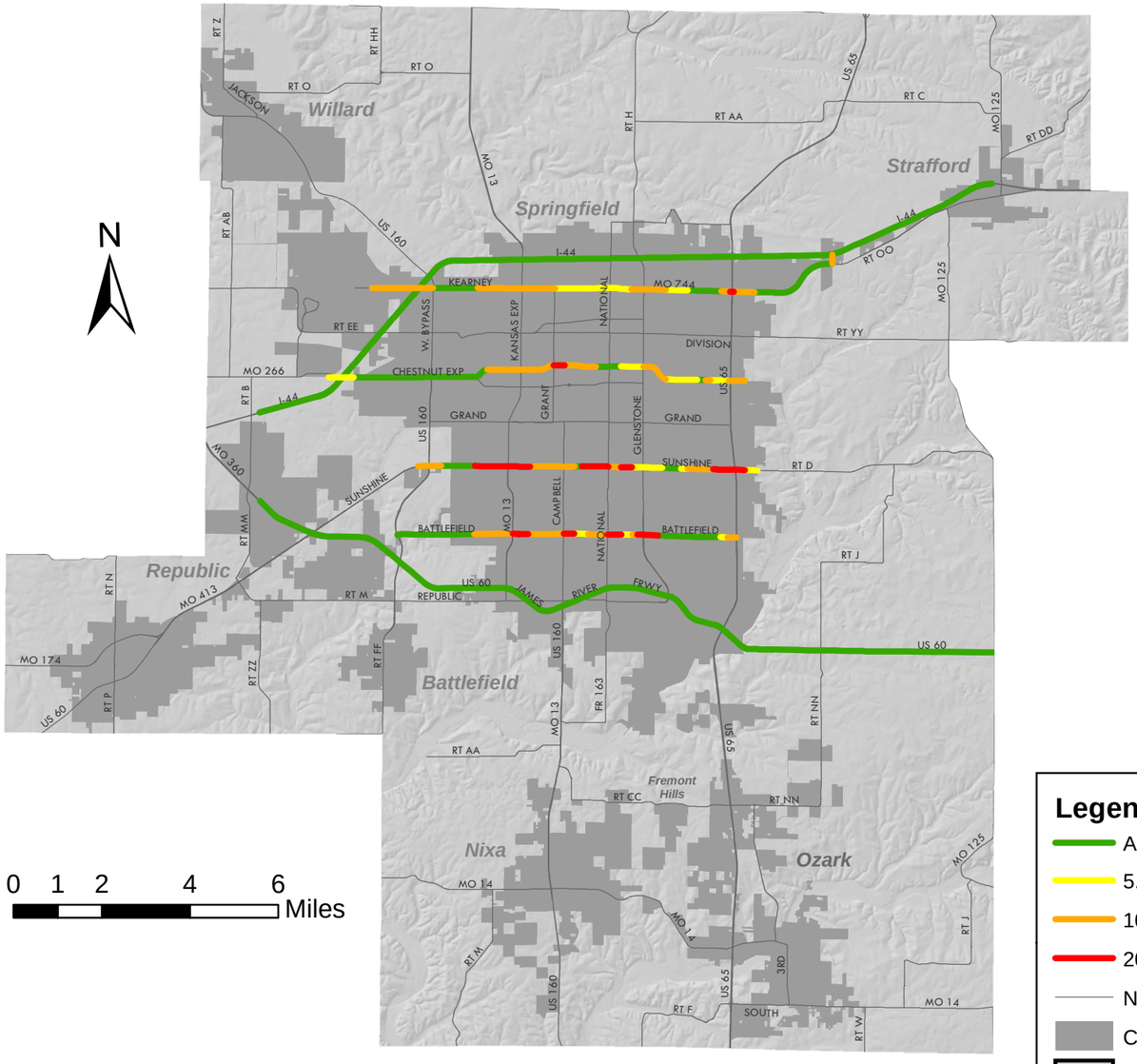
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**How badly are travelers delayed?**

# Map 5.5

**Average Travel Speeds**
**PM Peak Hour - Eastbound Lanes**

# Average Travel Speeds
# PM Peak Hour - Westbound Lanes




**Legend**

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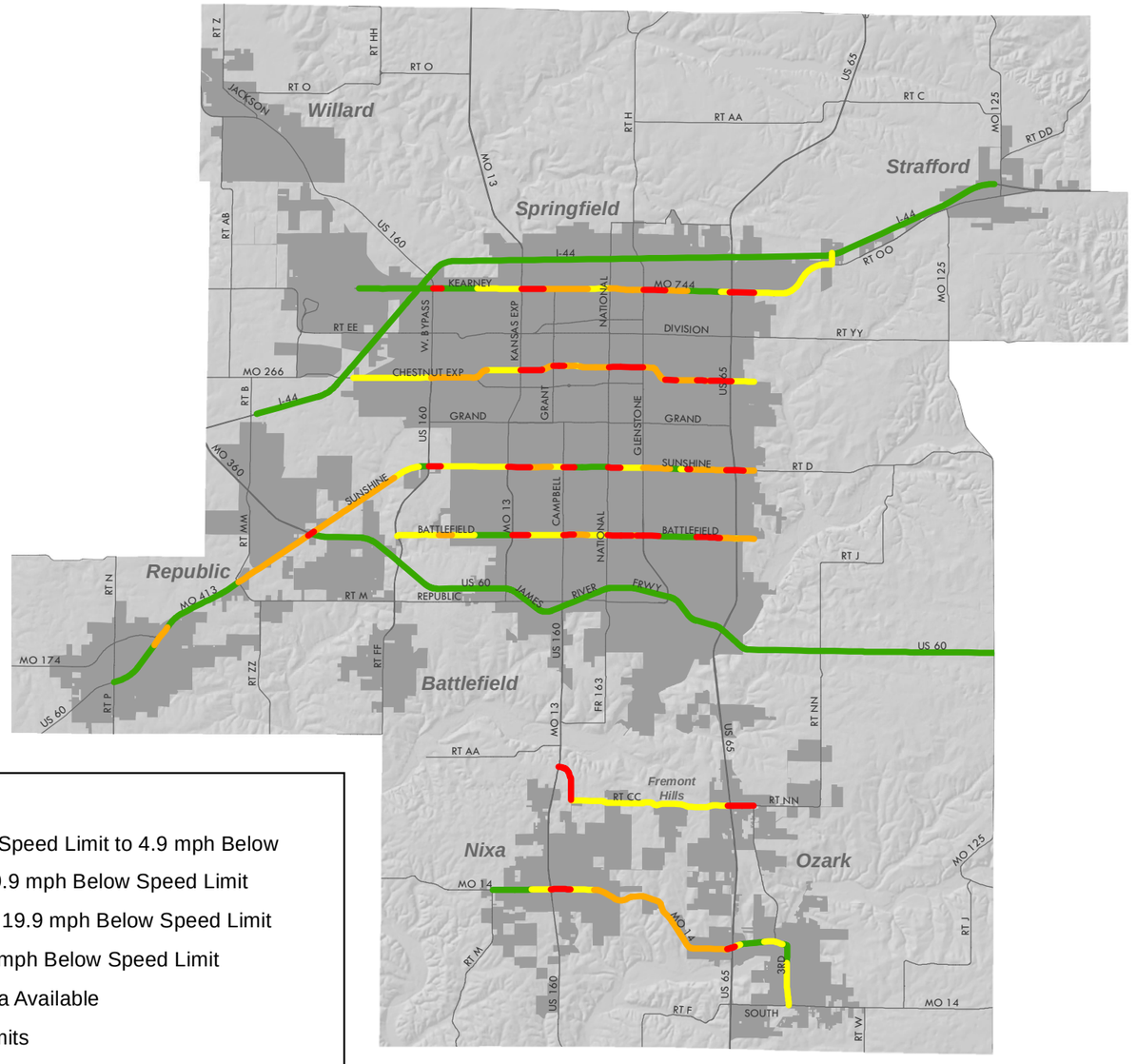
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- City Limits
- MPO Area

**2005**




**2008**

Source: CJW Transportation Consultants LLC

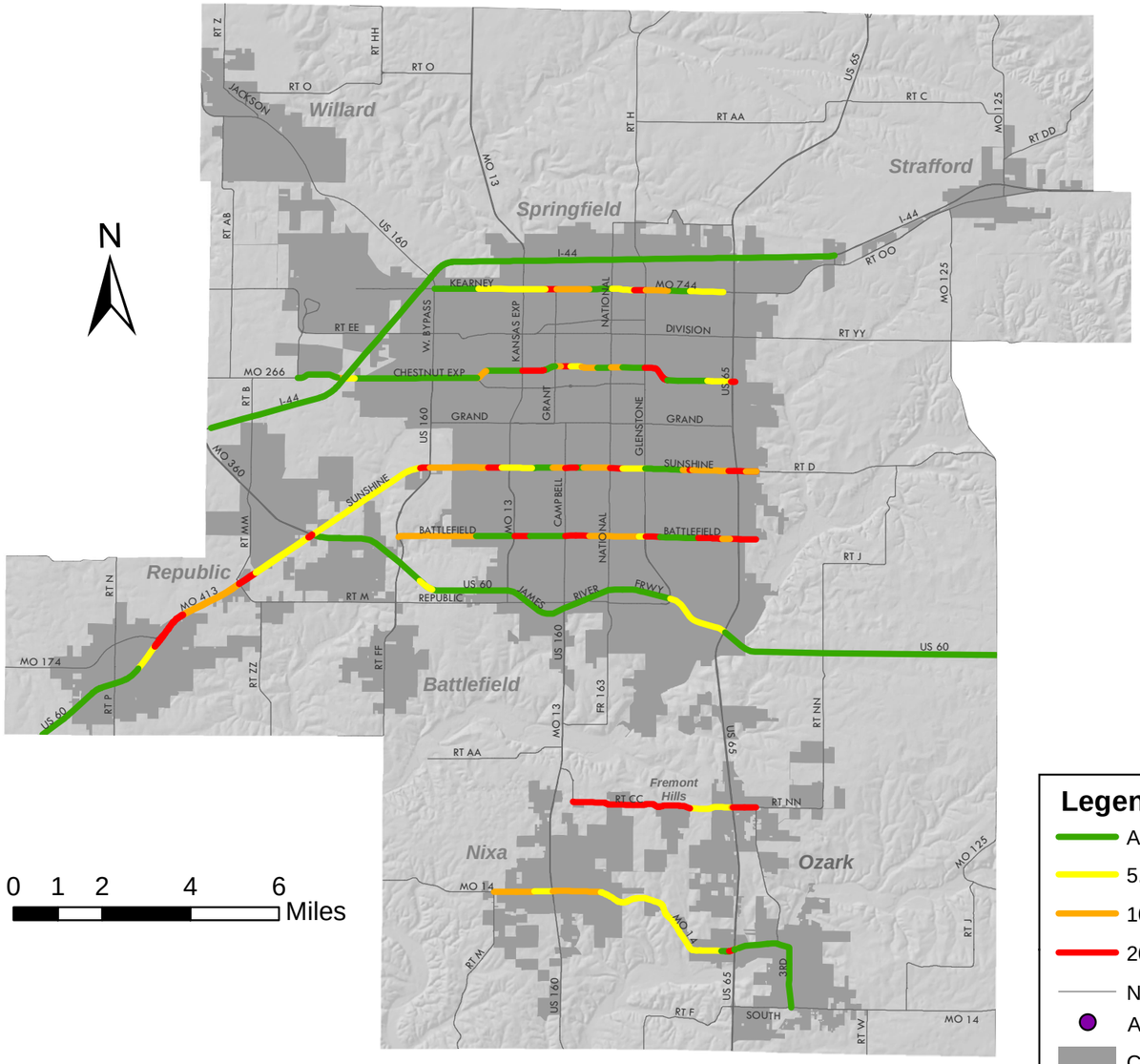
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

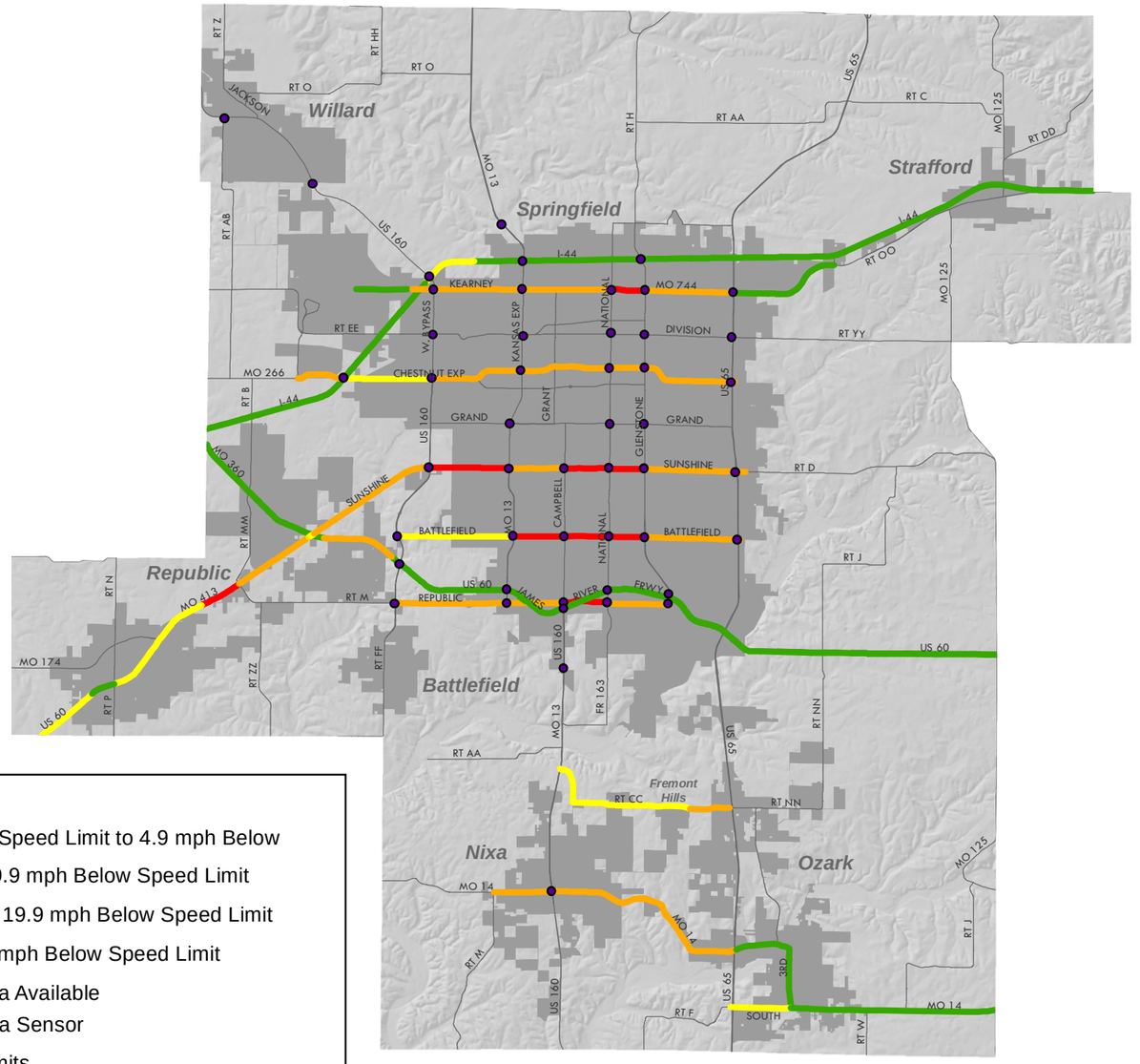
**How badly are travelers delayed?**

# Map 5.6

**Average Travel Speeds**
**PM Peak Hour - Westbound Lanes**

# Average Travel Speeds
# PM Peak Hour - Westbound Lanes




**Legend**

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- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- Acyclica Sensor
- City Limits
- MPO Area

**2012**

**2016**

Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

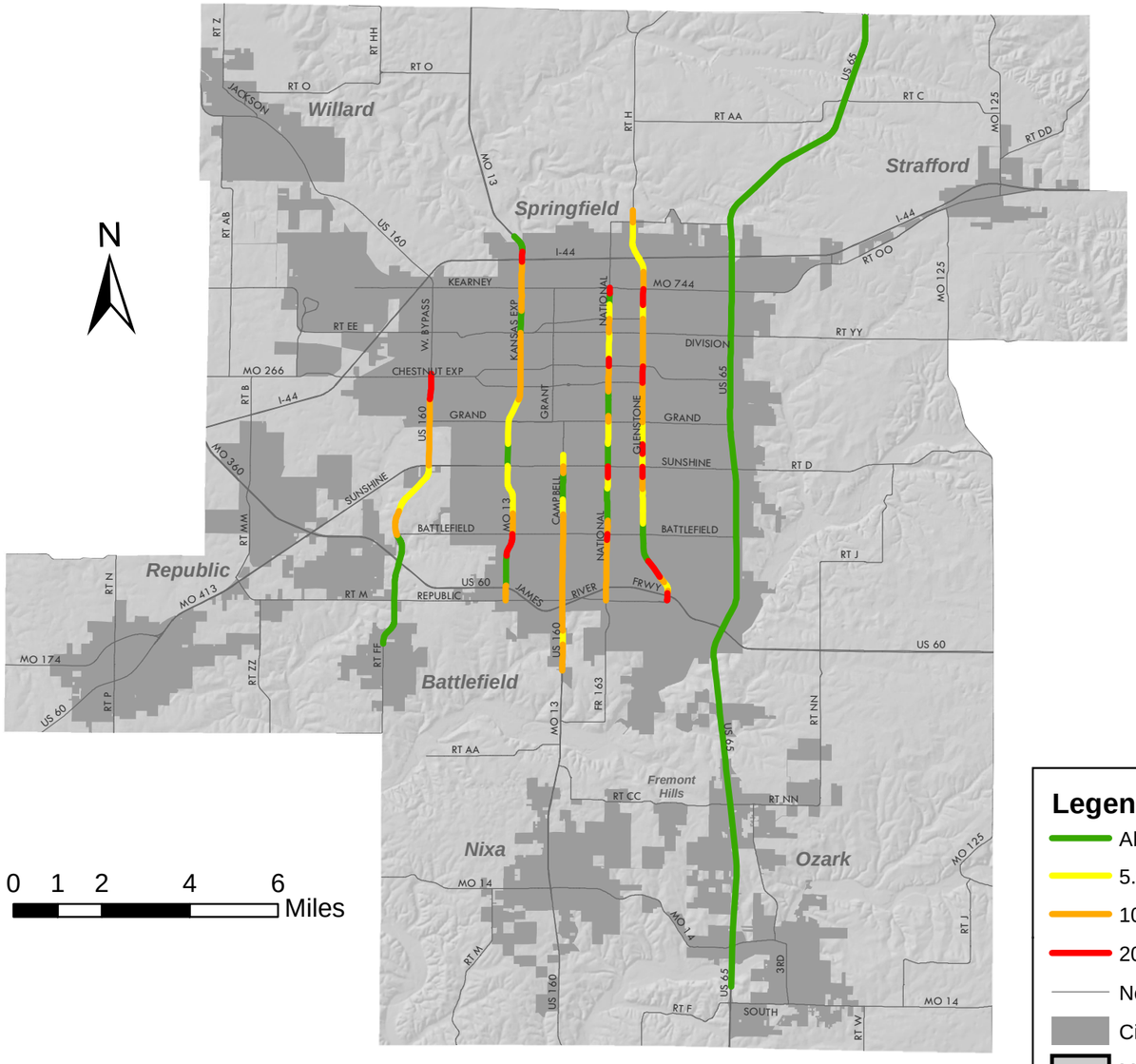
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

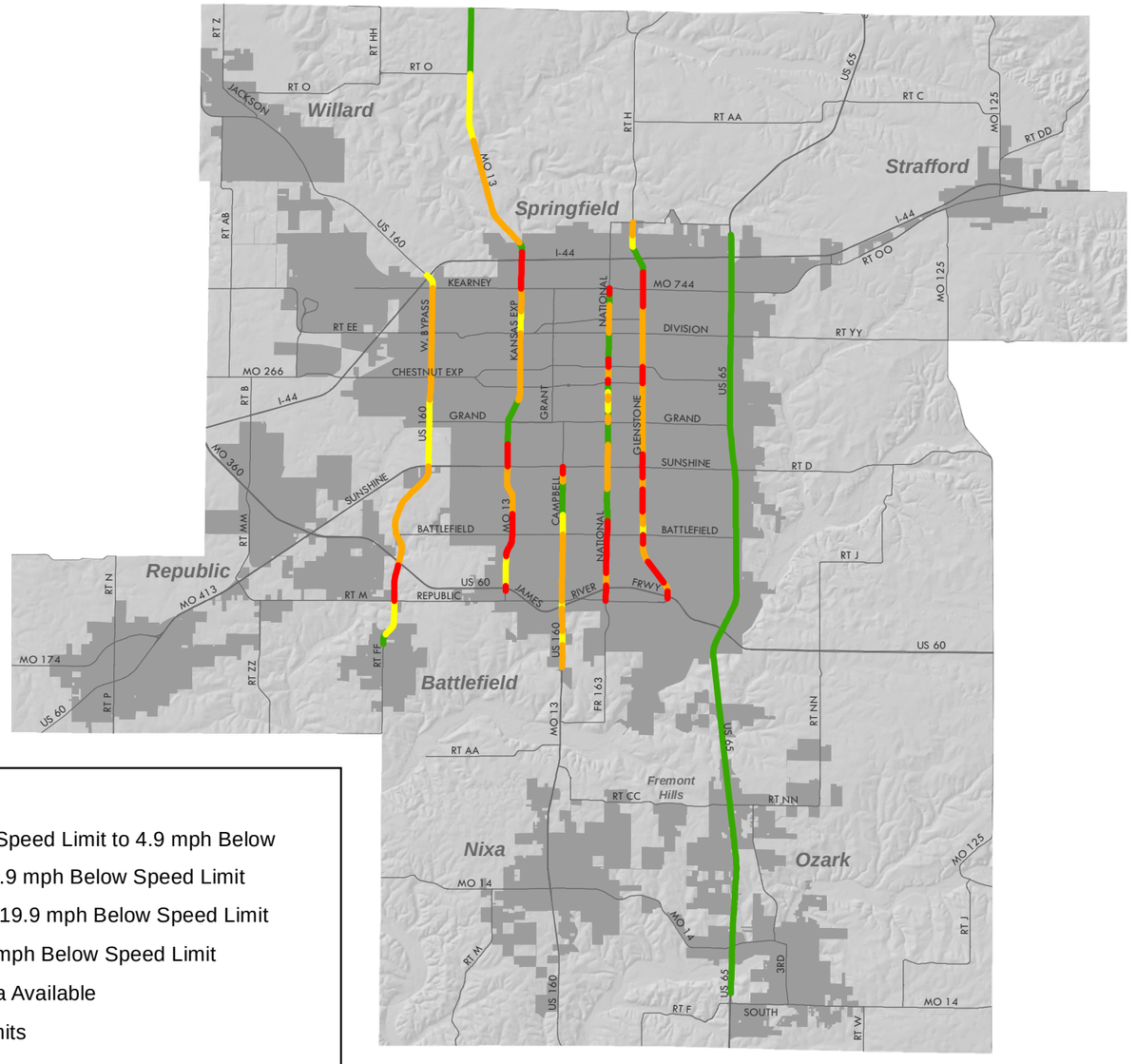
**How badly are travelers delayed?**

# Map 5.6

**Average Travel Speeds**
**PM Peak Hour - Westbound Lanes**

# Average Travel Speeds
# PM Peak Hour - Northbound Lanes




**Legend**

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- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- City Limits
- MPO Area

**2005**

**2008**

Source: CJW Transportation Consultants LLC

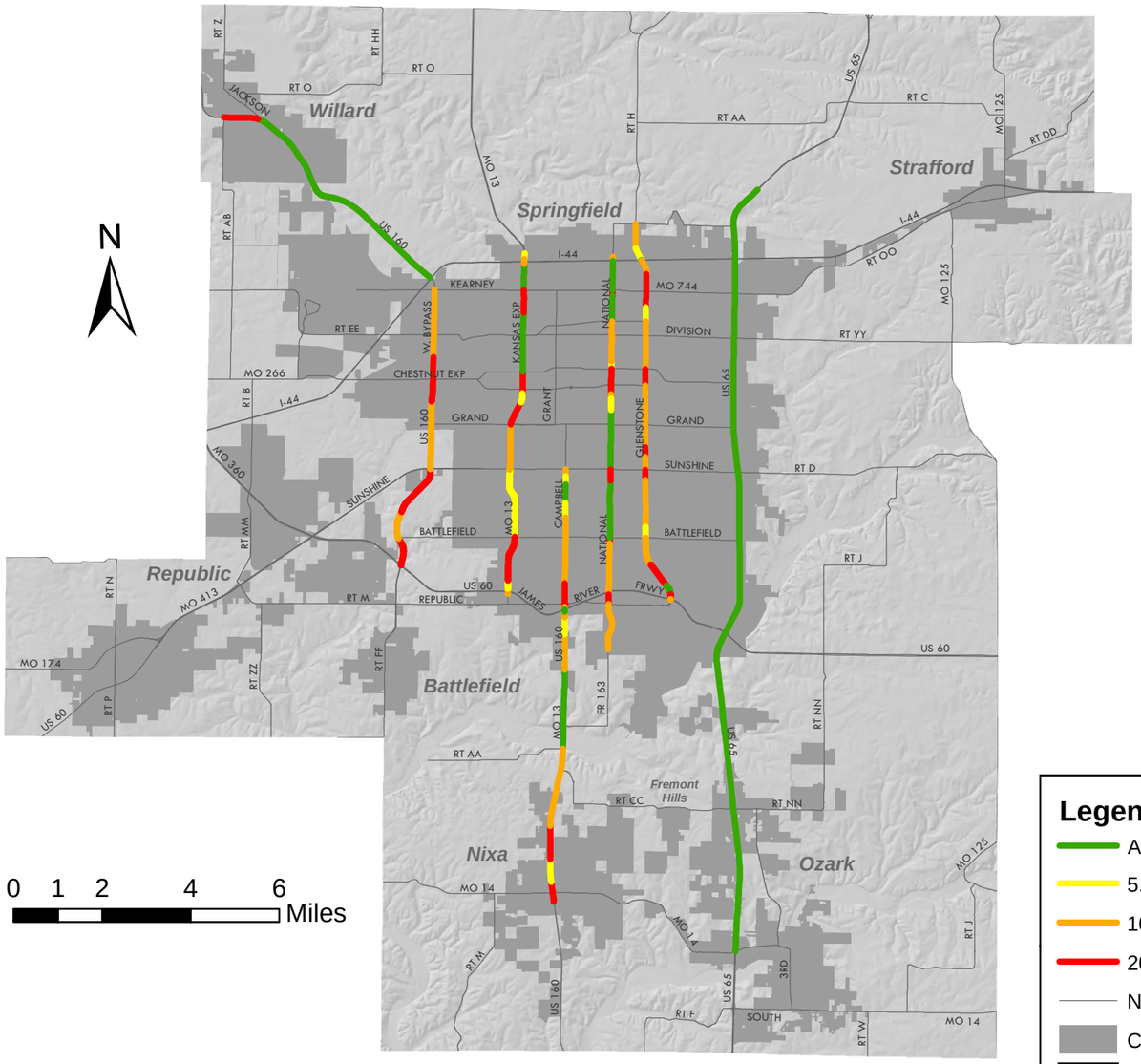
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

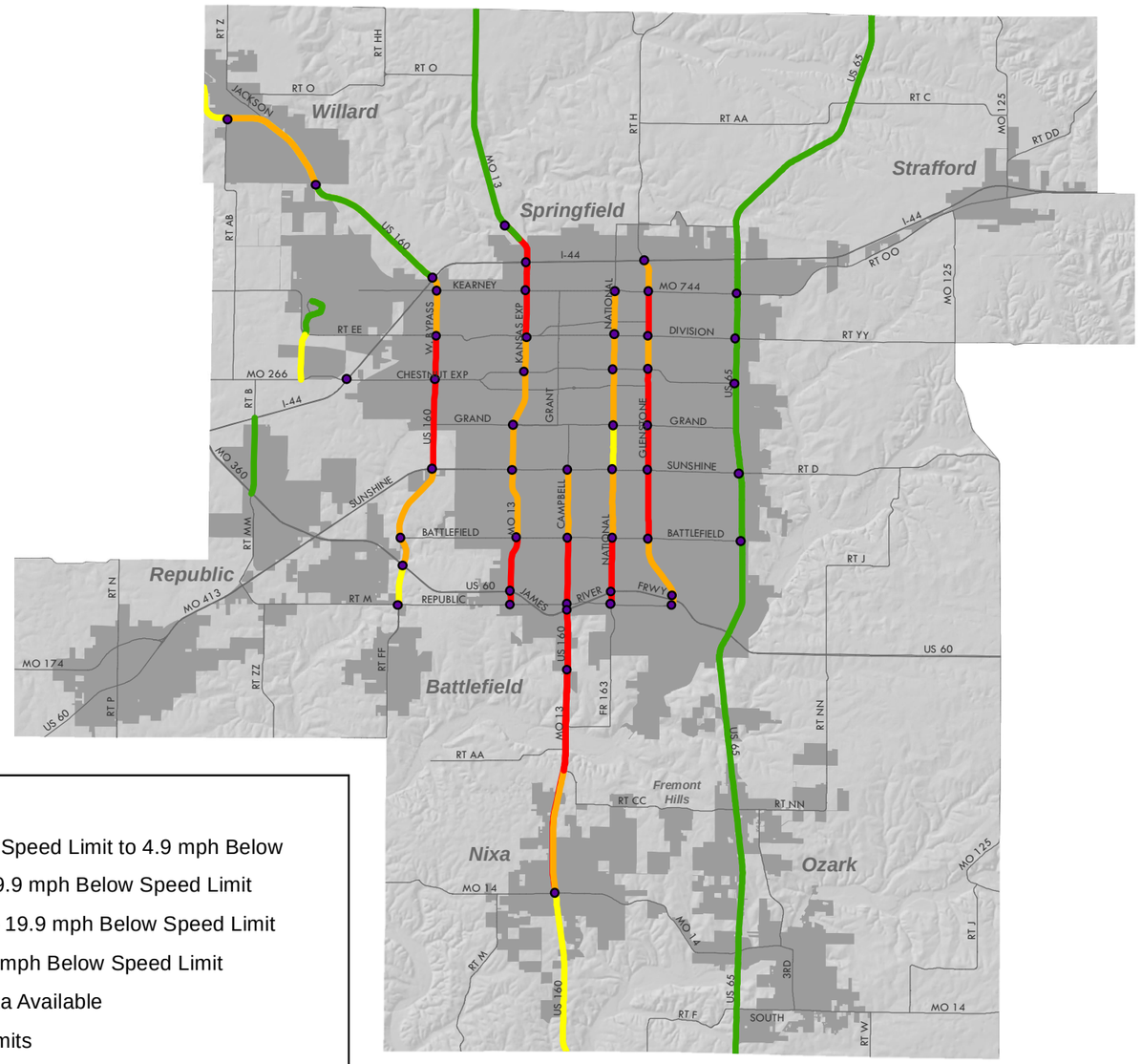
**How badly are travelers delayed?**

# Map 5.7

**Average Travel Speeds**
**PM Peak Hour - Northbound Lanes**

# Average Travel Speeds
# PM Peak Hour - Northbound Lanes




**Legend**

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- 10.0 to 19.9 mph Below Speed Limit
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- No Data Available
- City Limits
- MPO Area

**2012**

**2016**

Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

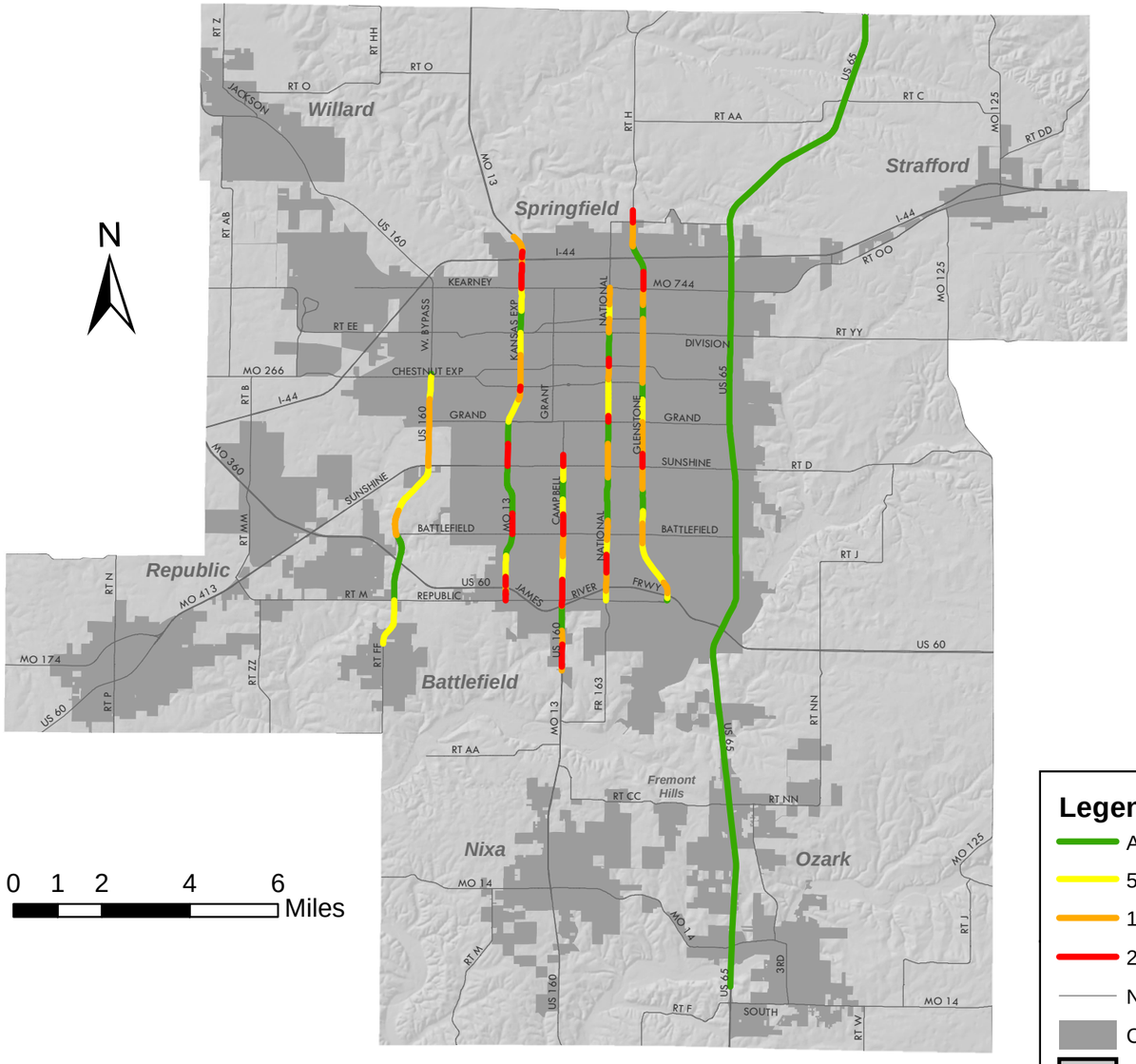
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**How badly are travelers delayed?**

# Map 5.7

**Average Travel Speeds**
**PM Peak Hour - Northbound Lanes**

# Average Travel Speeds
# PM Peak Hour - Southbound Lanes




**Legend**

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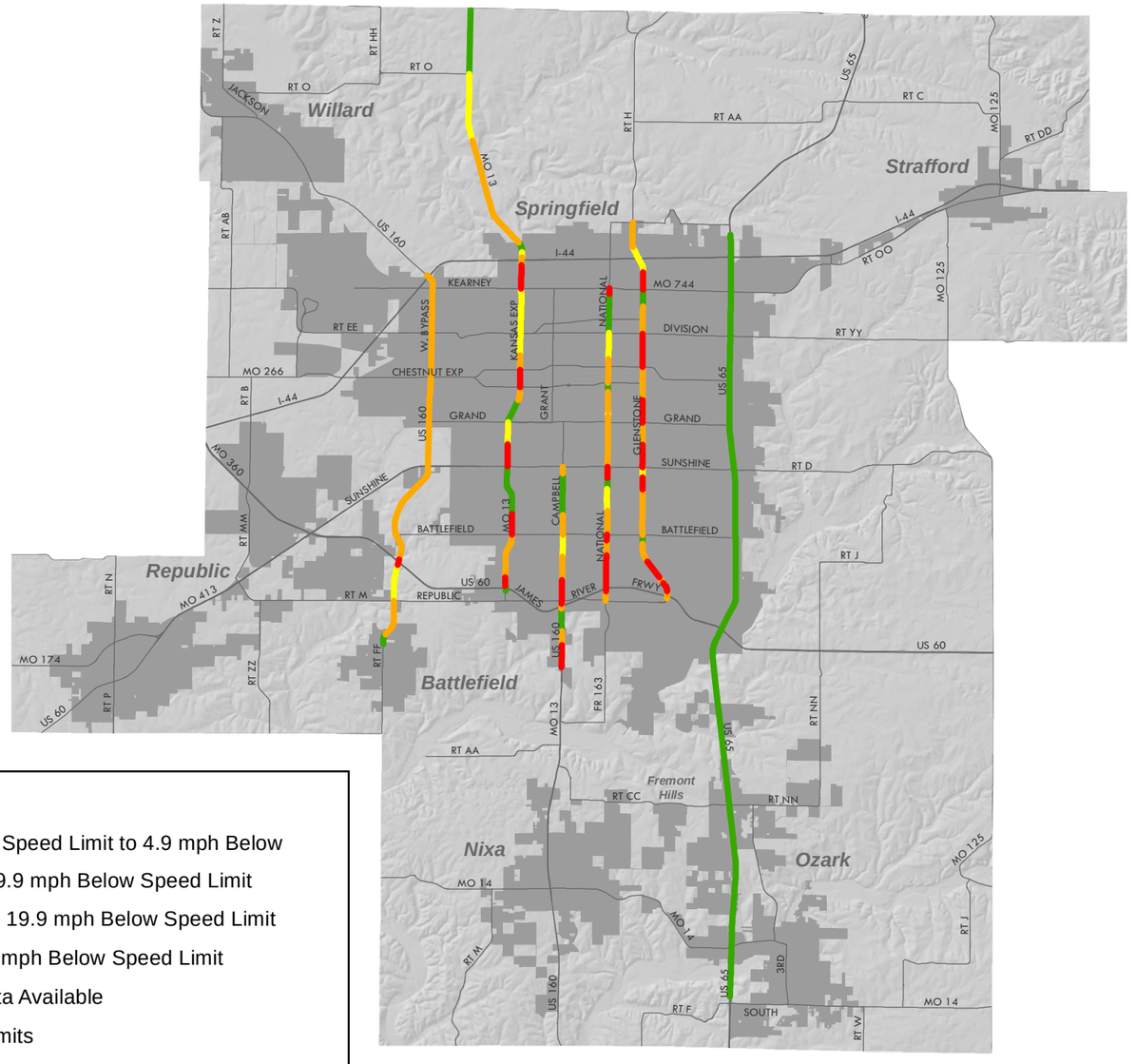
- 5.0 to 9.9 mph Below Speed Limit
- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- City Limits
- MPO Area

**2005**




**2008**

Source: CJW Transportation Consultants LLC

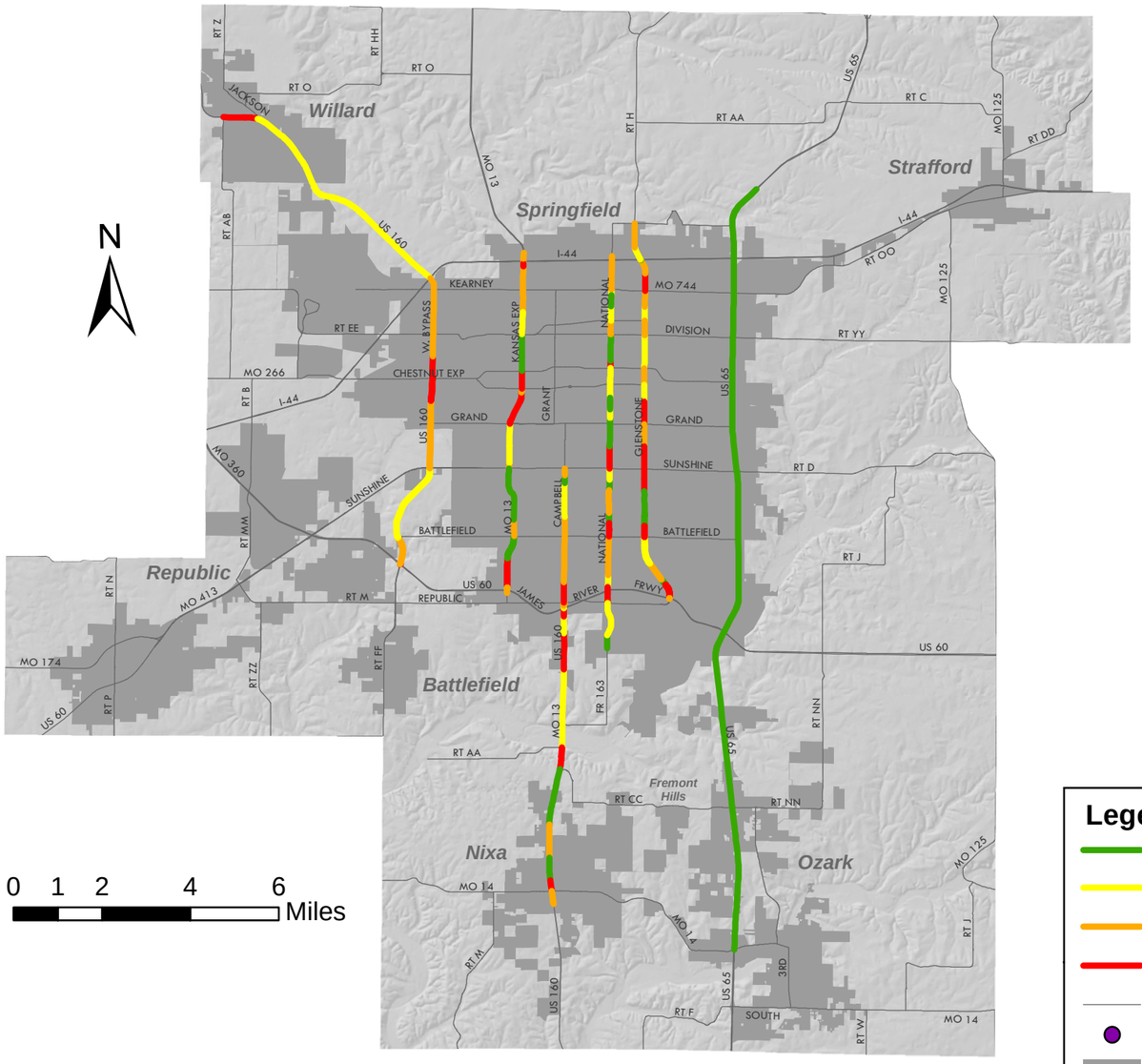
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

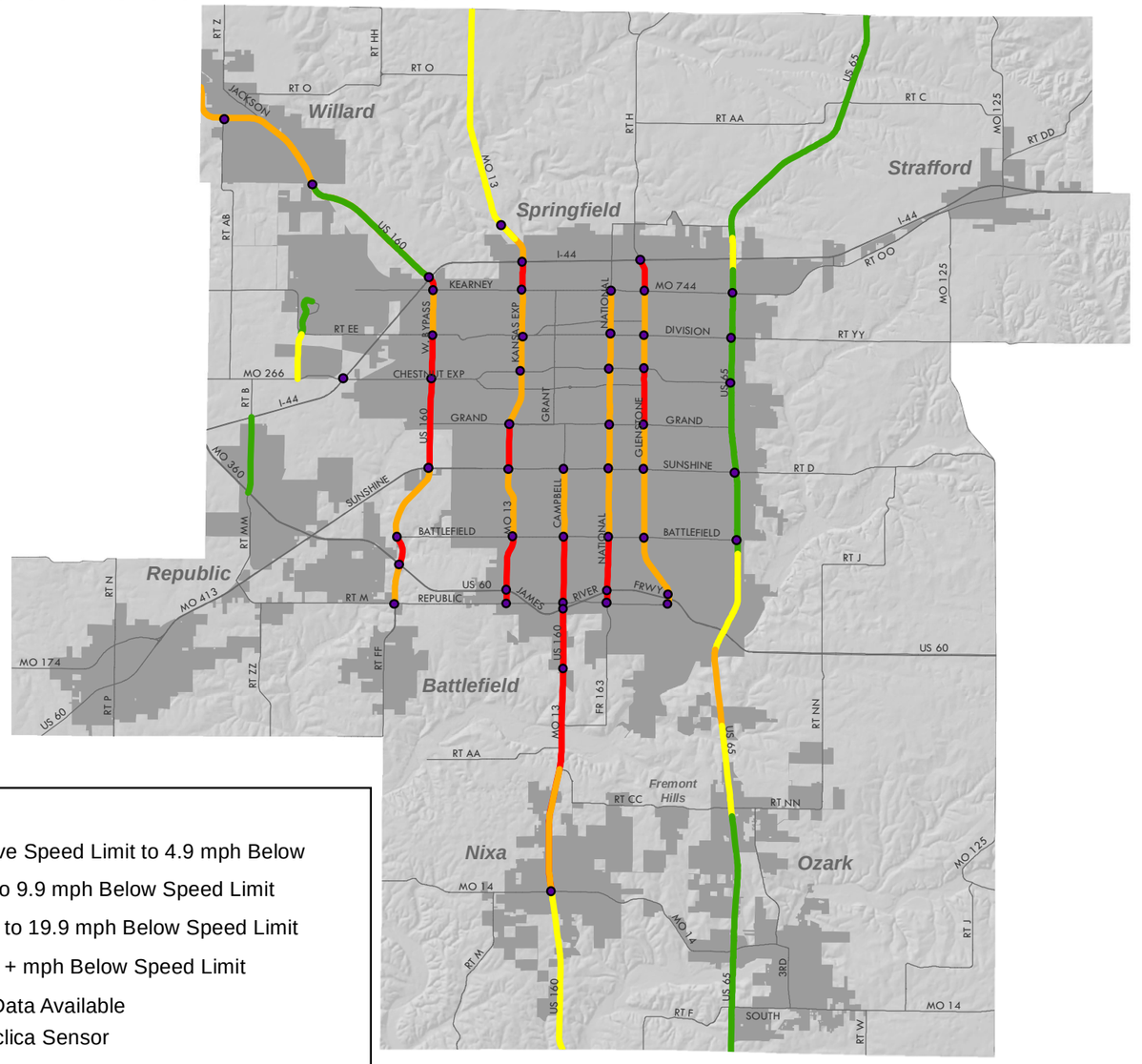
**How badly are travelers delayed?**

# Map 5.8

**Average Travel Speeds**
**PM Peak Hour - Southbound Lanes**

# Average Travel Speeds
# PM Peak Hour - Southbound Lanes




**Legend**

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- 10.0 to 19.9 mph Below Speed Limit
- 20.0 + mph Below Speed Limit
- No Data Available
- Acyclica Sensor
- City Limits
- MPO Area

**2012**

**2016**

Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

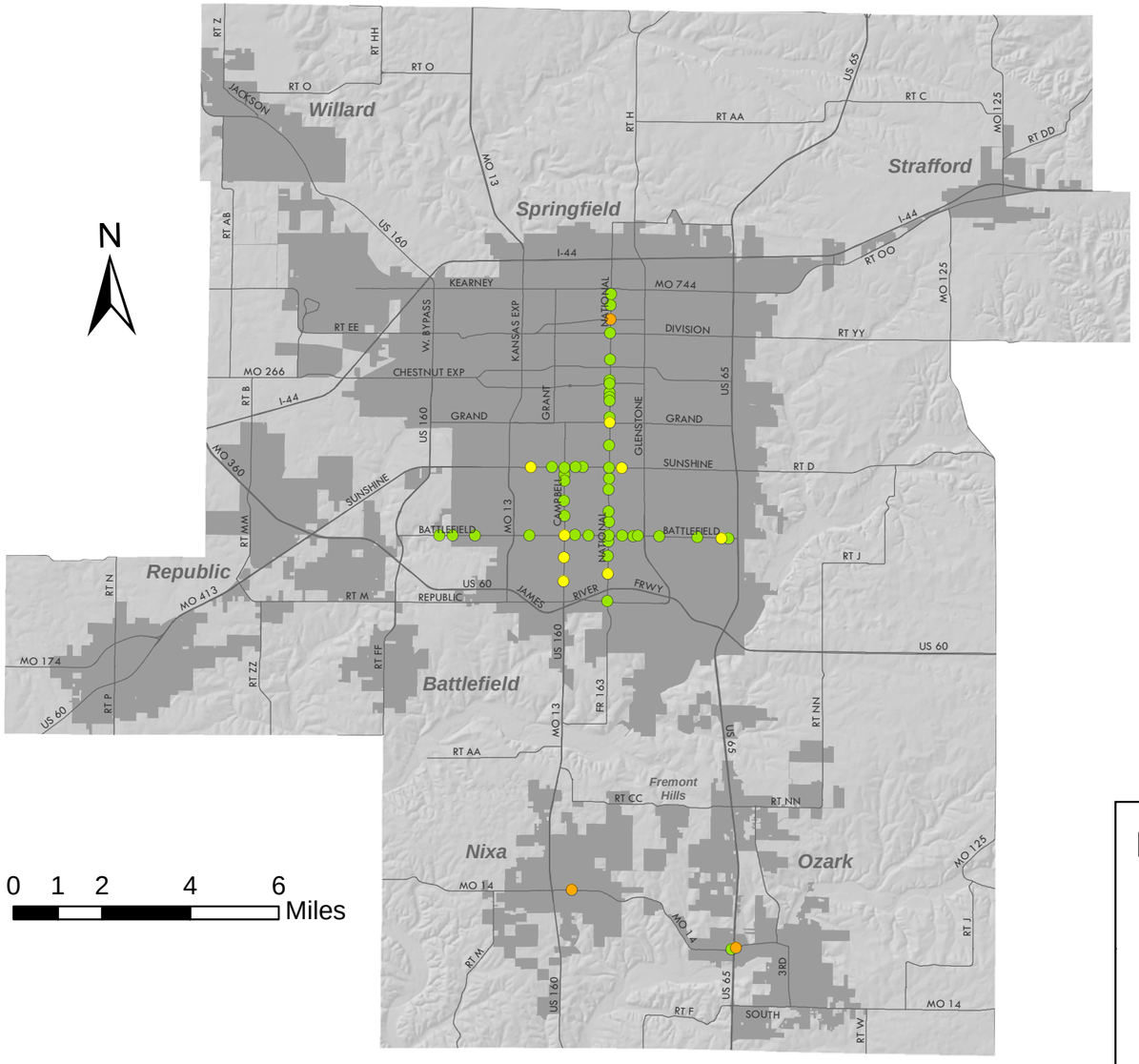
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**How badly are travelers delayed?**

# Map 5.8

**Average Travel Speeds**
**PM Peak Hour - Southbound Lanes**

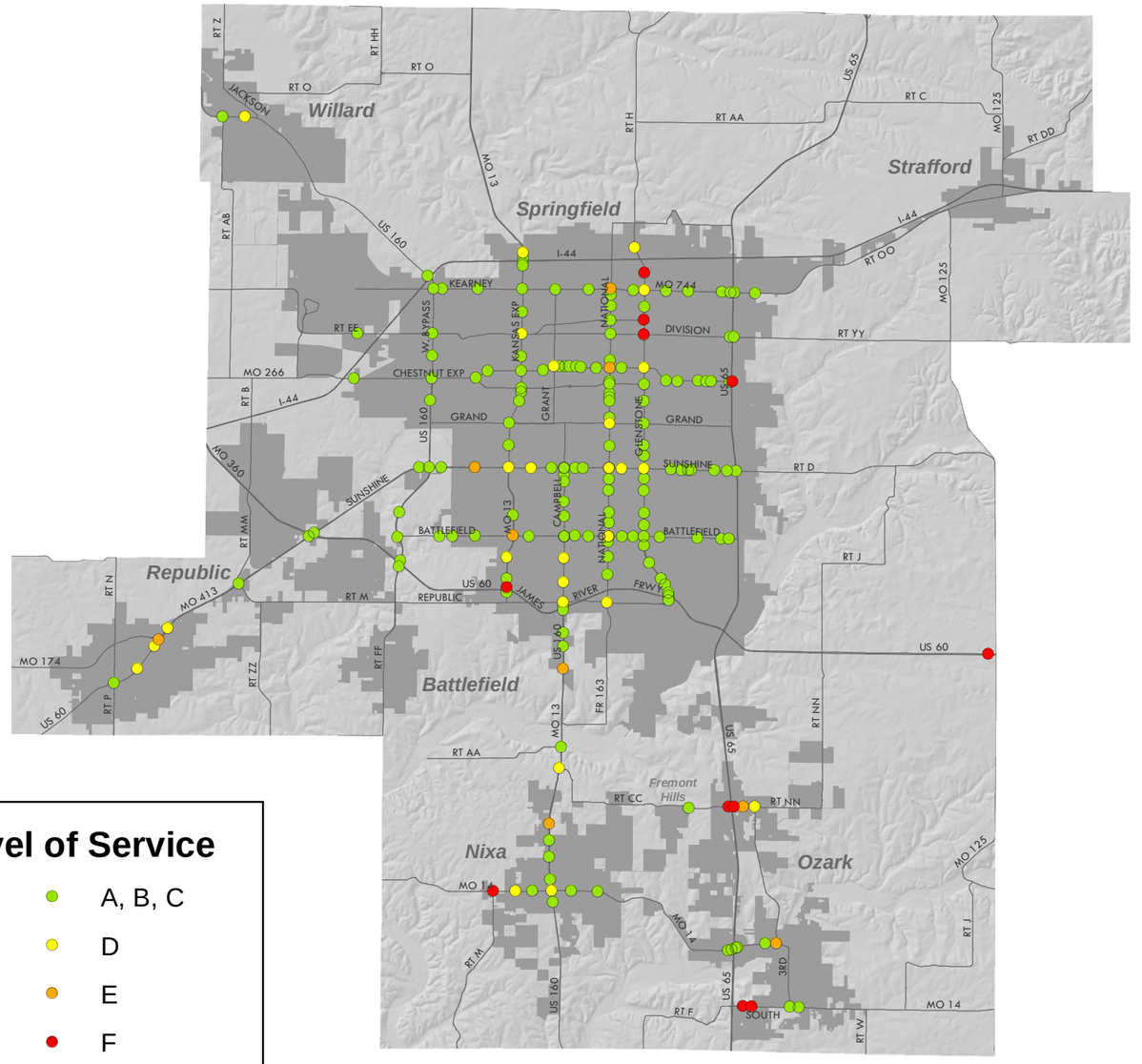
# Intersection Level of Service
# AM Peak




**2005**

## Level of Service

- A, B, C
- D
- E
- F




**2008**

Source: City of Springfield
Missouri Dept. of Transportation

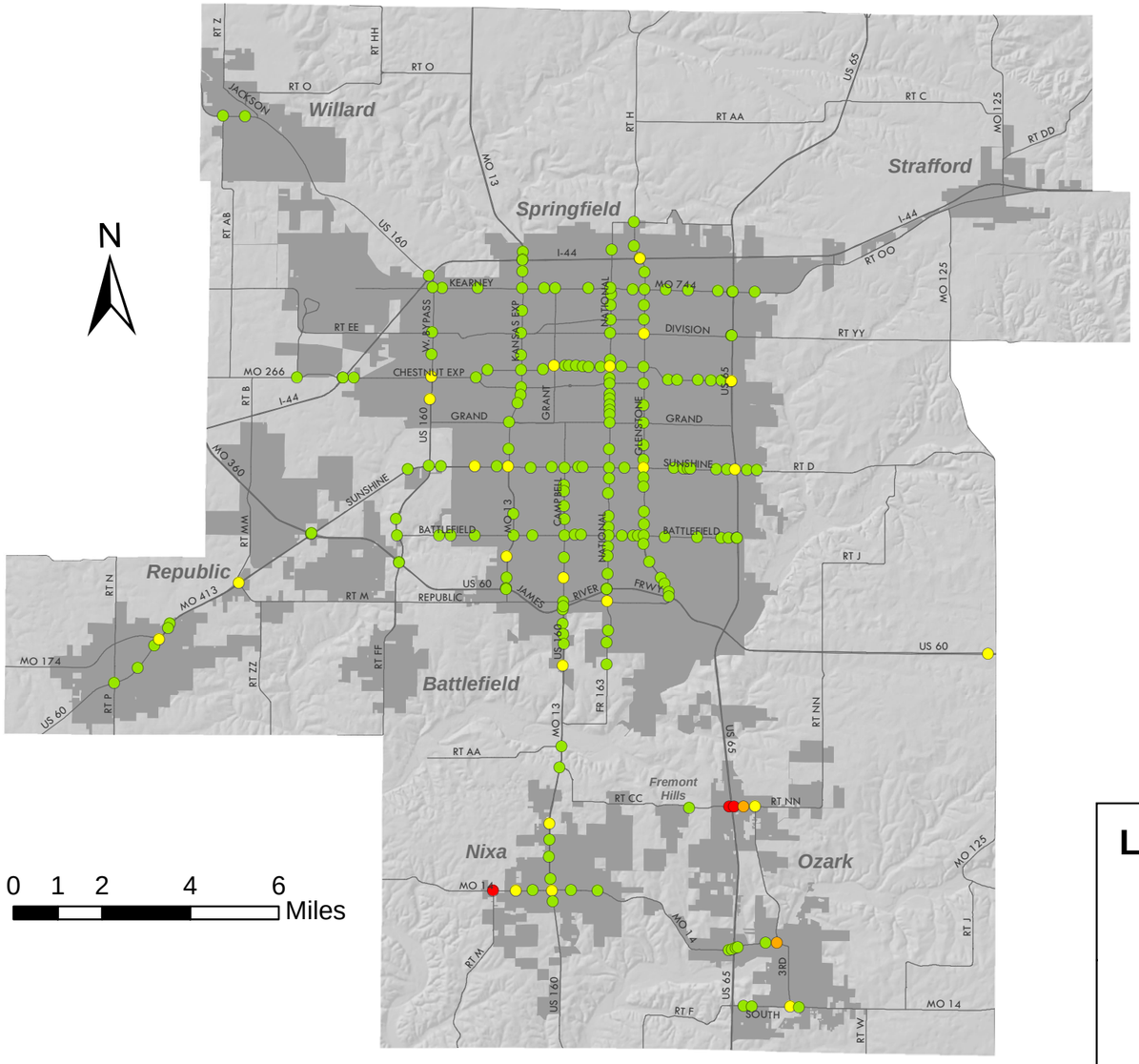
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**What impact does intersection/interchange level-of-service play in determining regional congestion problems?**

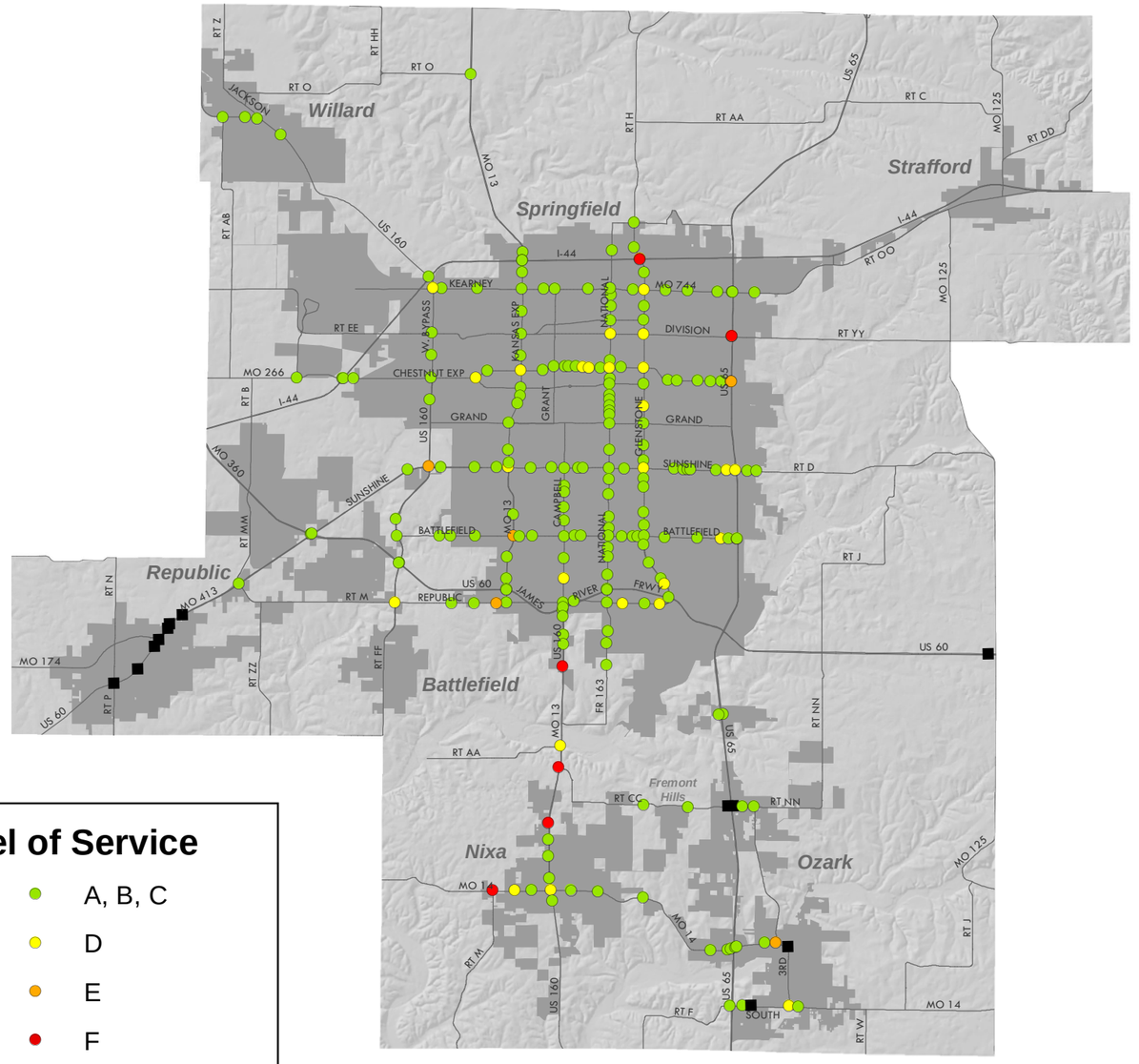
# Map 6.1

**Intersection Level of Service**
**AM Peak**

# Intersection Level of Service
# AM Peak




**2012**




**2016**

**Level of Service**

- A, B, C
- D
- E
- F
- No Data

Source: City of Springfield
Missouri Dept. of Transportation

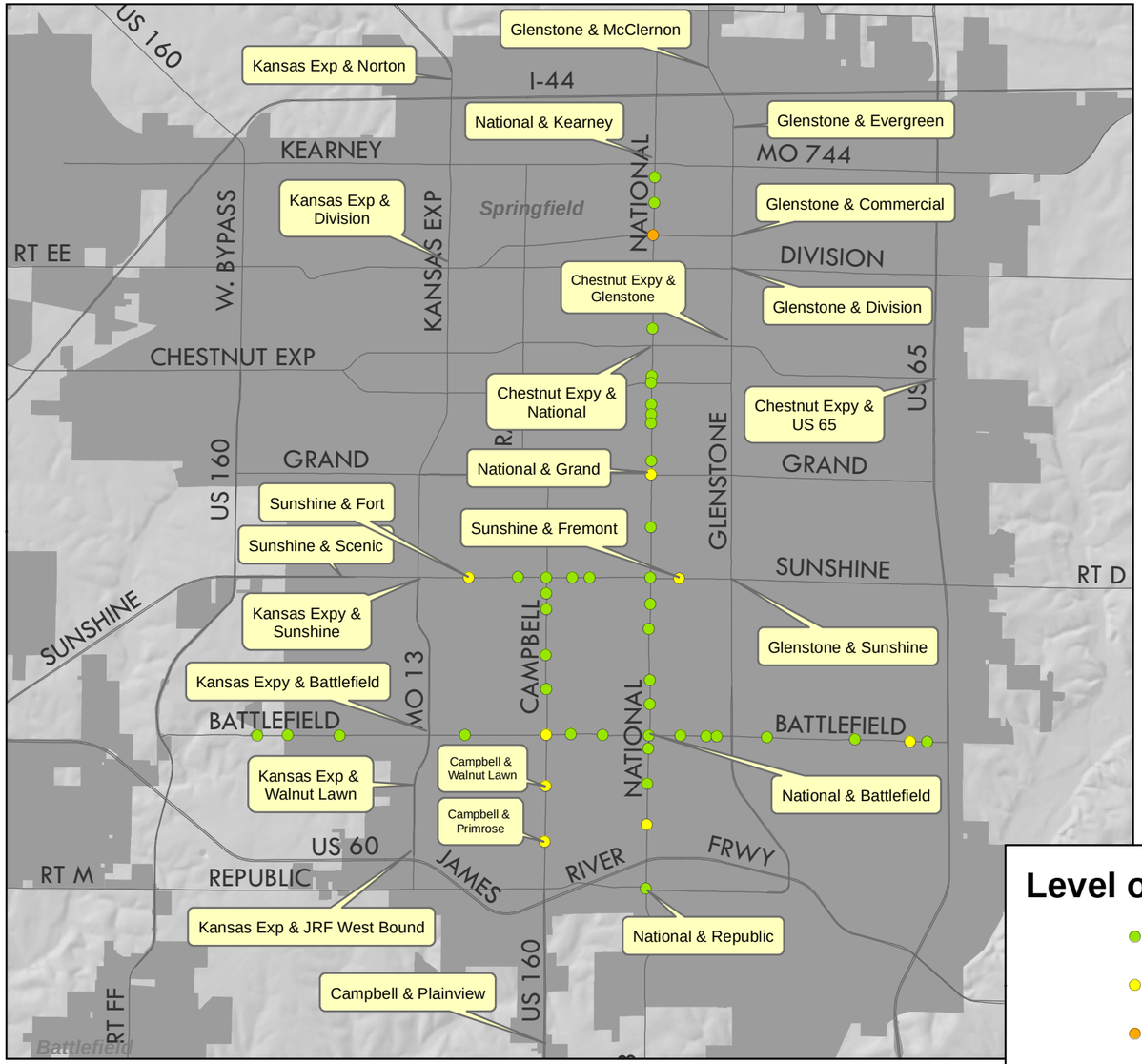
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**What impact does intersection/interchange level-of-service play in determining regional congestion problems?**

# Map 6.1

**Intersection Level of Service**
**AM Peak**

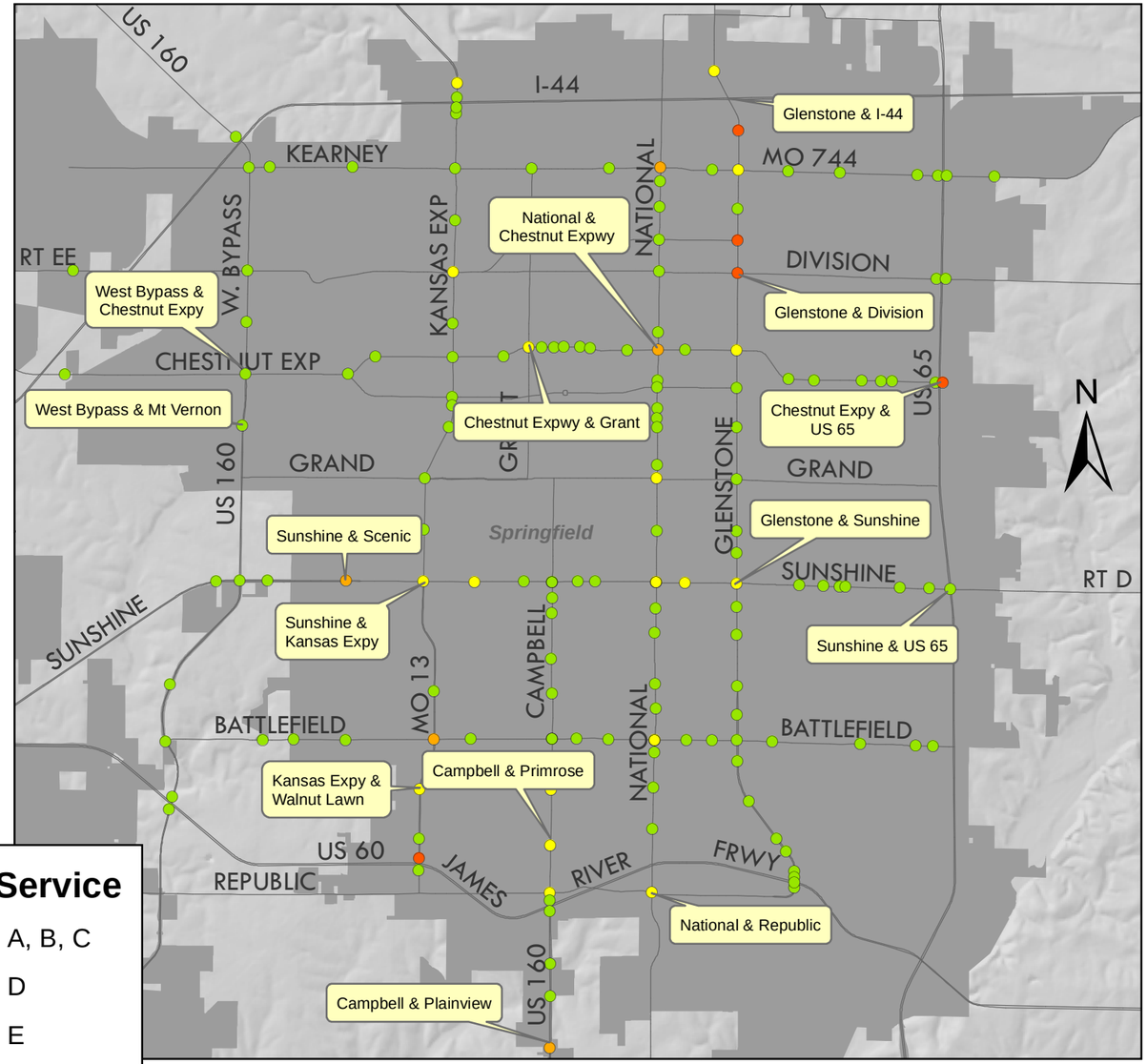
# Intersection Level of Service
# AM Peak




**2005**

0 0.5 1 2 3

Miles




**2008**

## Level of Service

- A, B, C
- D
- E
- F

Source: City of Springfield
Missouri Dept. of Transportation

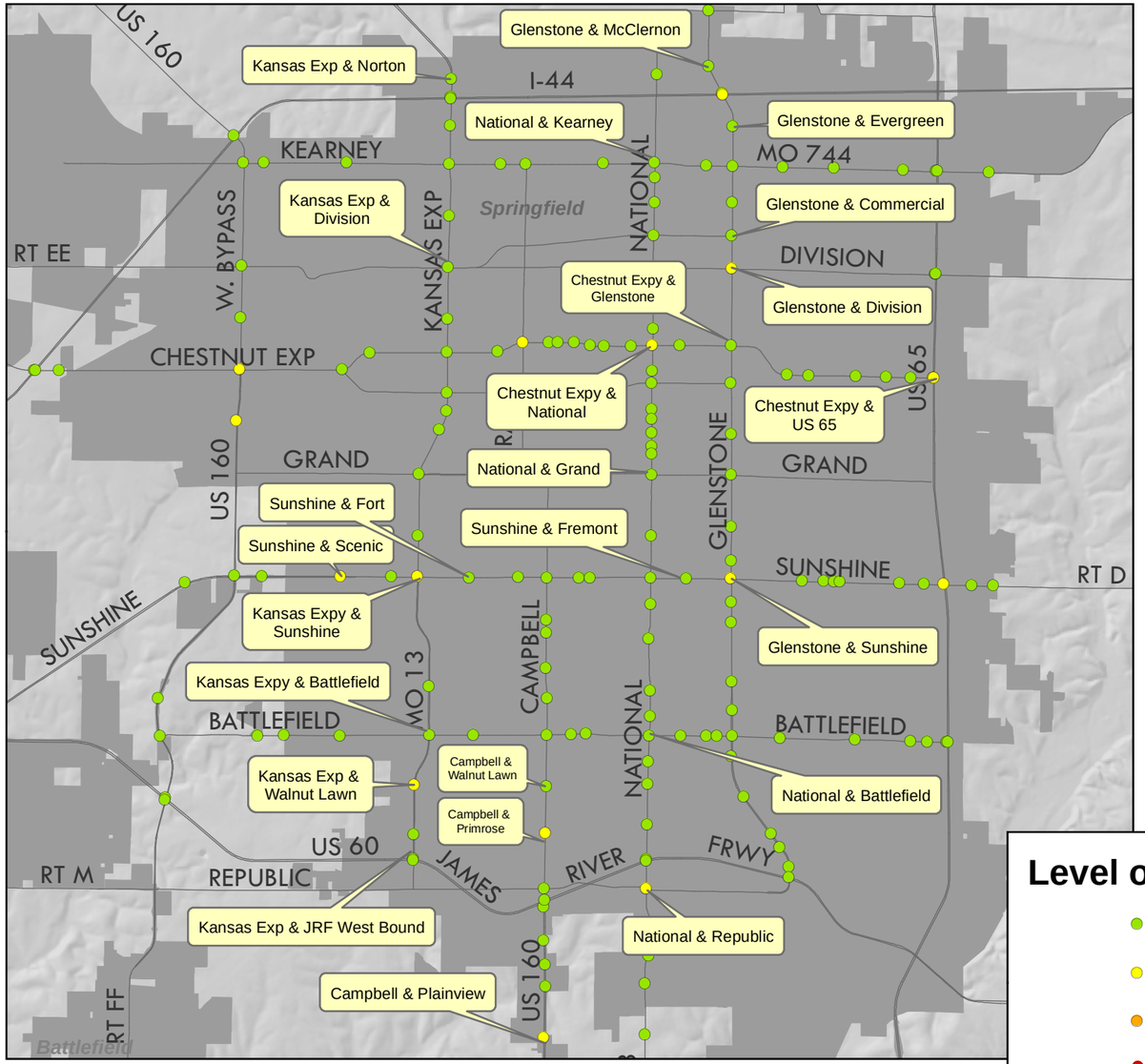
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**What impact does intersection/interchange level-of-service play in determining regional congestion problems?**

# Map 6.2

**Intersection Level of Service**
**AM Peak**

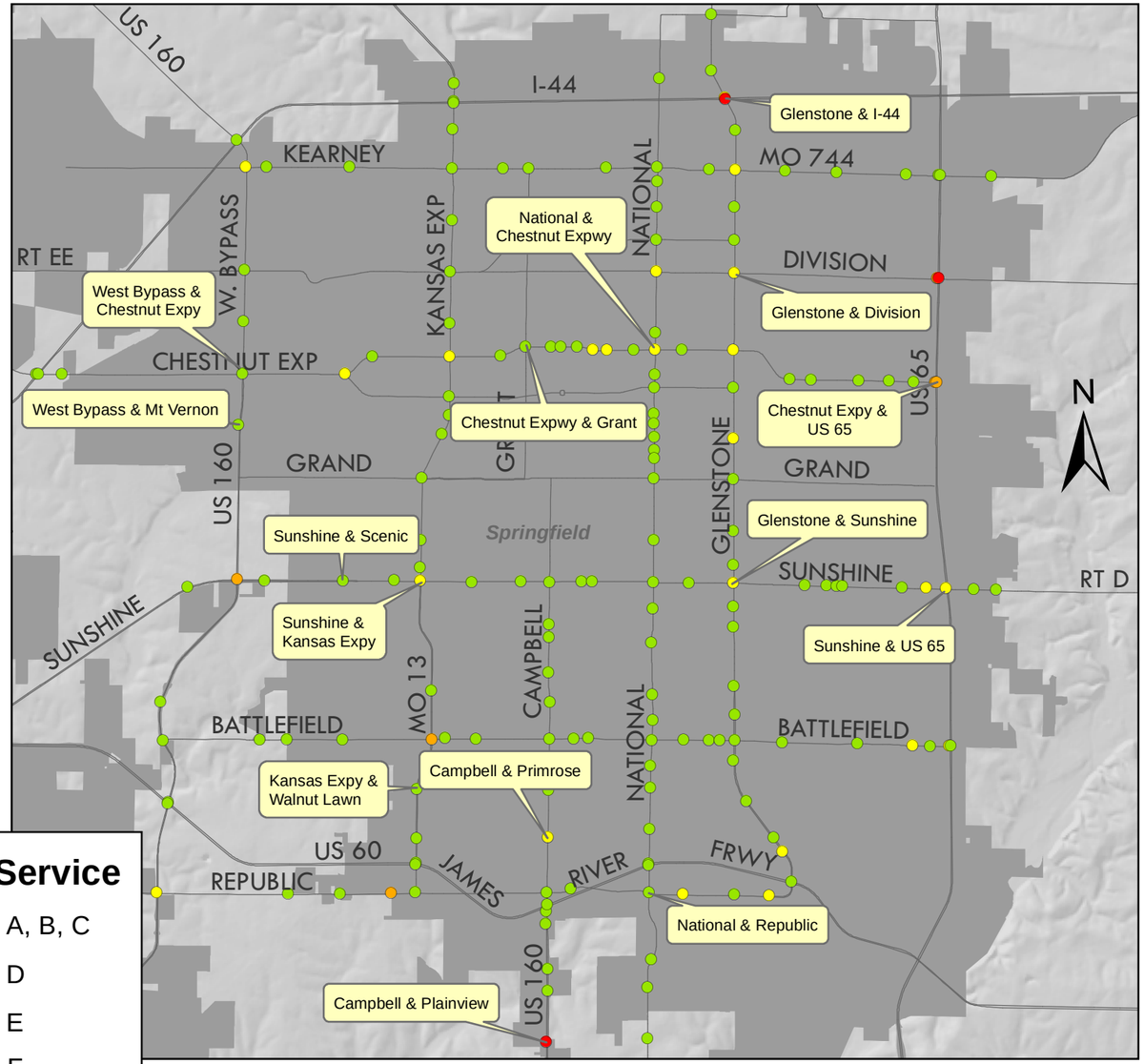
# Intersection Level of Service
# AM Peak




**2012**

0 0.5 1 2 3

Miles




**2016**

## Level of Service

- A, B, C
- D
- E
- F
- No Data

Source: City of Springfield
Missouri Dept. of Transportation

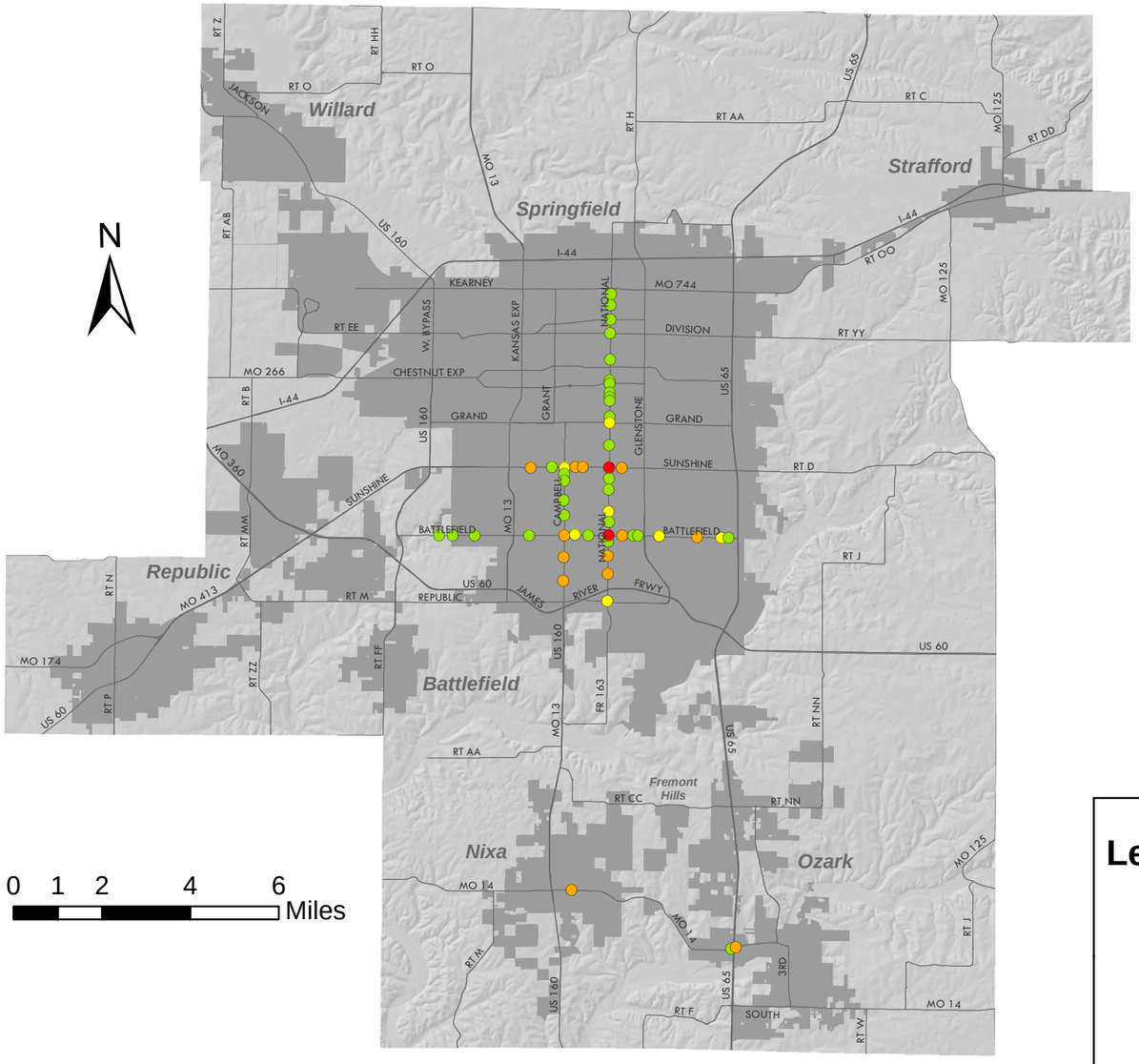
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

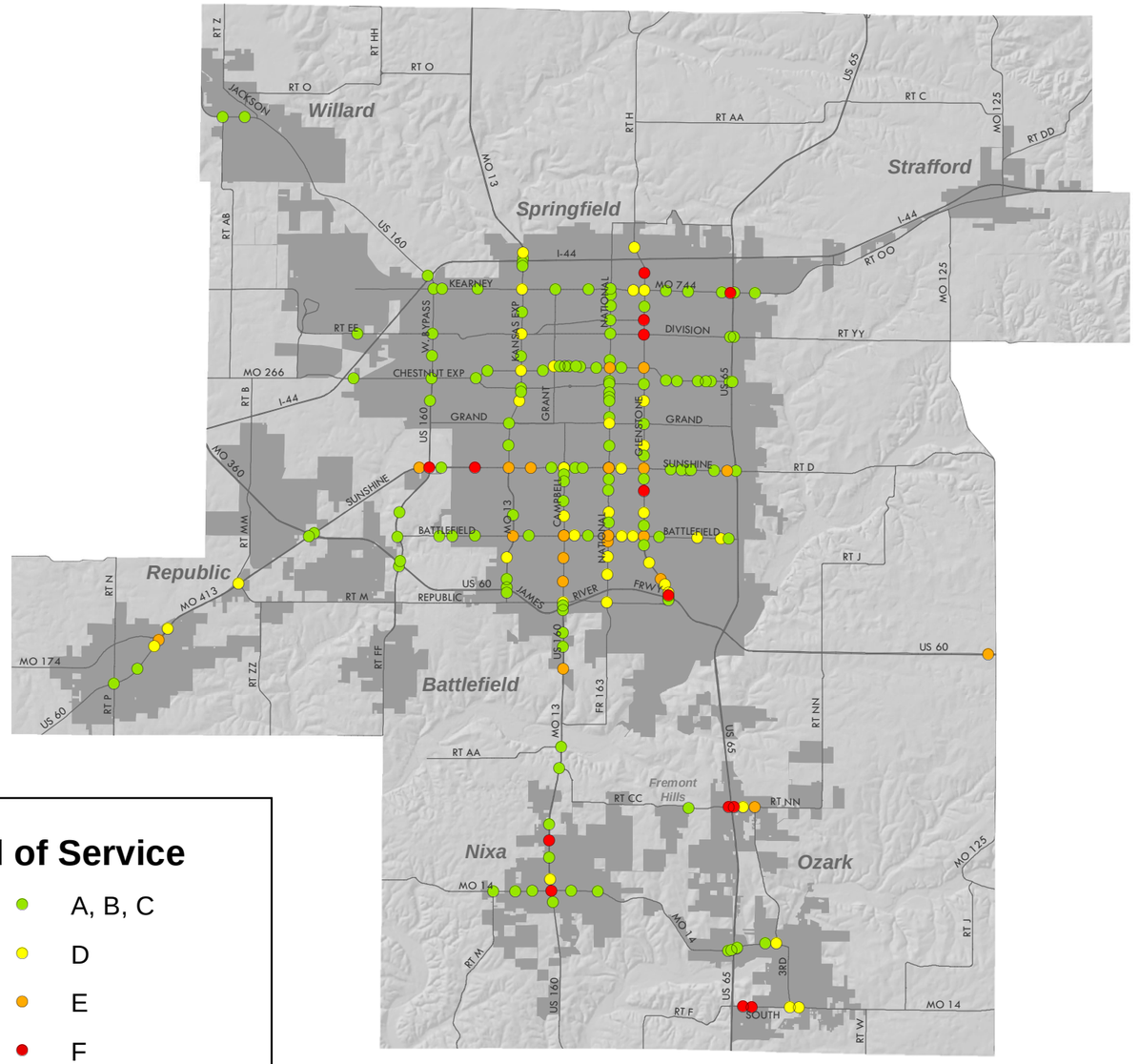
**What impact does intersection/interchange level-of-service play in determining regional congestion problems?**

# Map 6.2

**Intersection Level of Service**
**AM Peak**

# Intersection Level of Service
# PM Peak




**Level of Service**

- A, B, C
- D
- E
- F

**2005**

**2008**

Source: City of Springfield
Missouri Dept. of Transportation

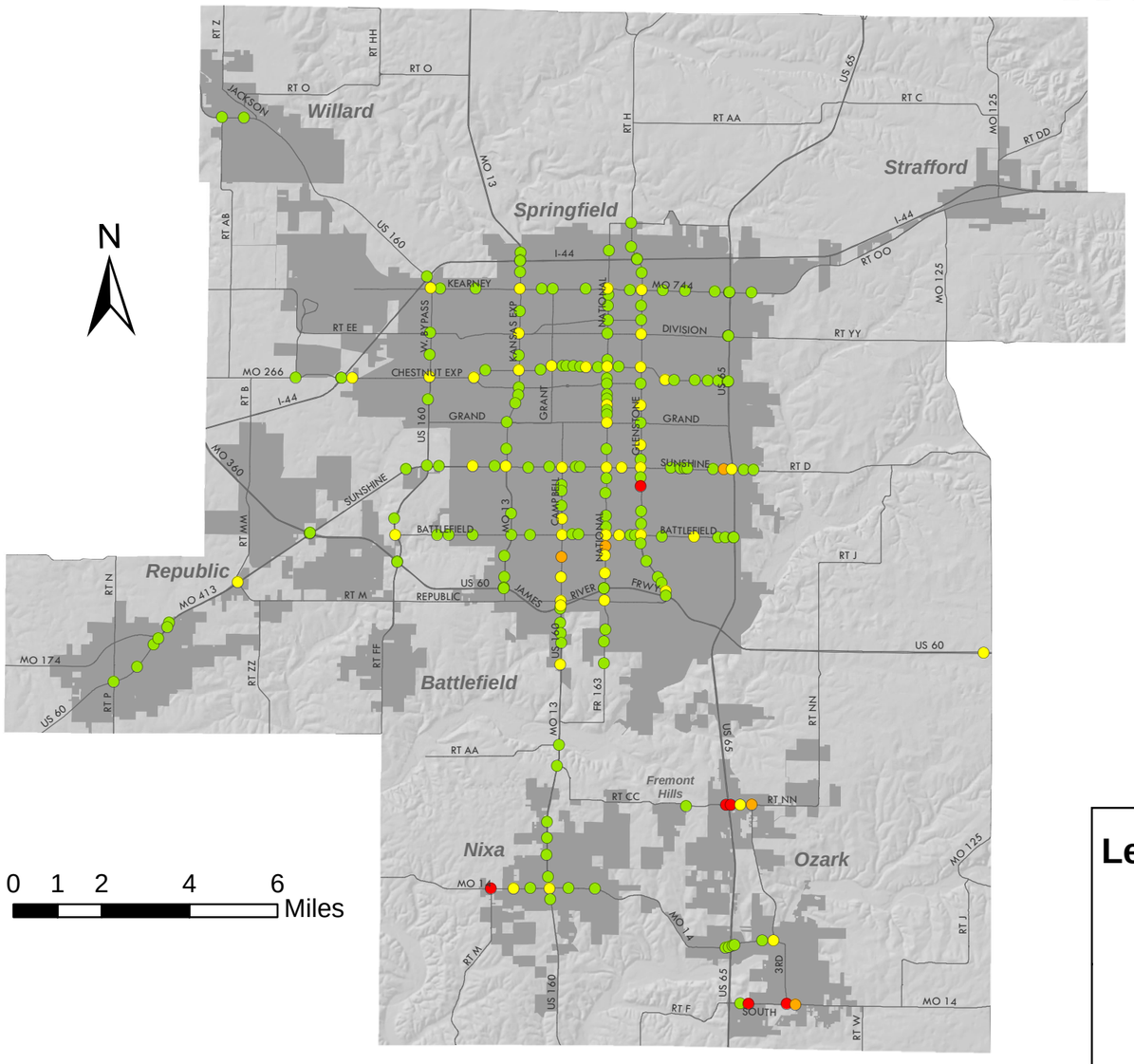
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

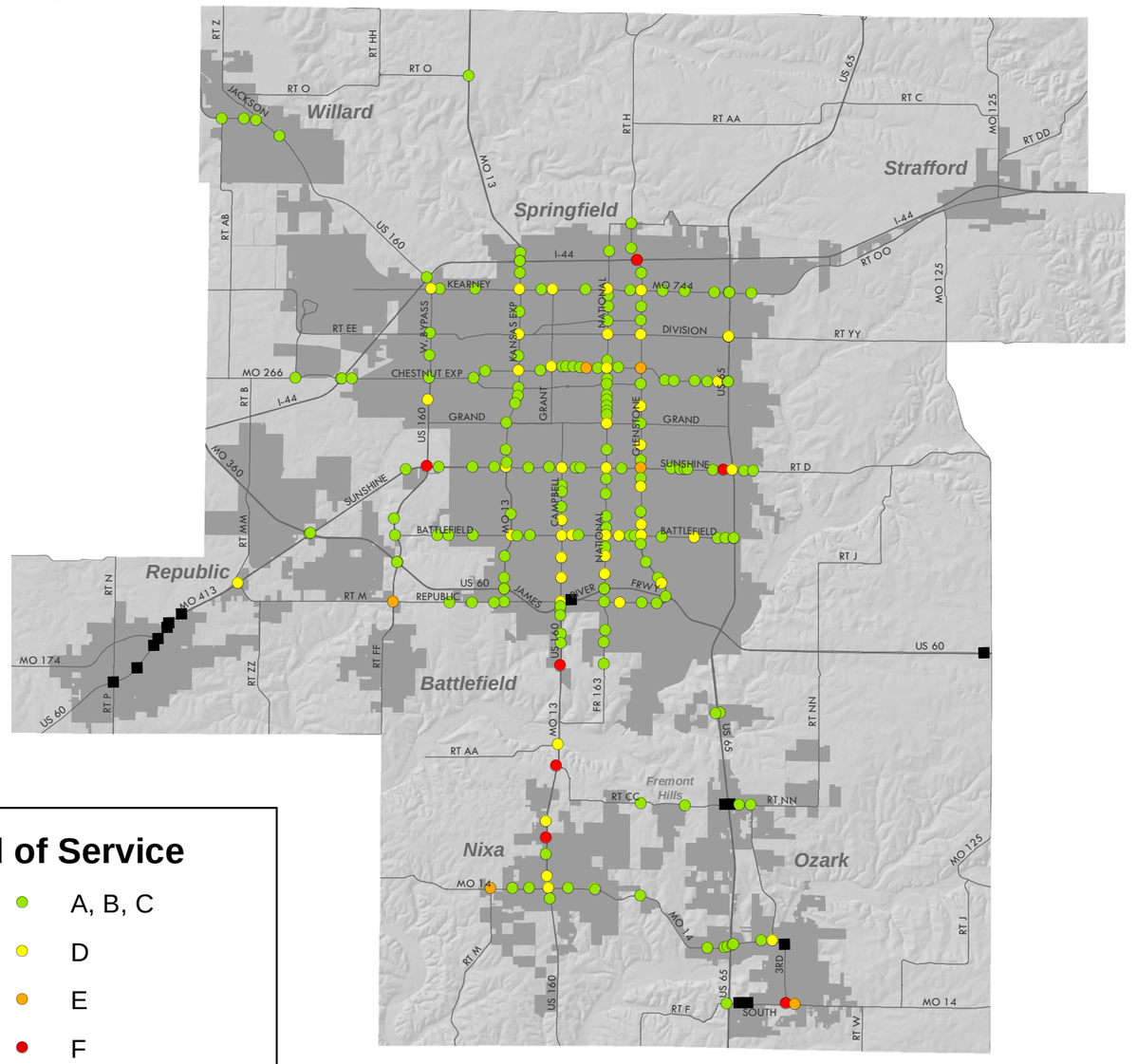
**What impact does intersection/interchange level-of-service play in determining regional congestion problems?**

# Map 6.3

**Intersection Level of Service**
**PM Peak**

# Intersection Level of Service
# PM Peak




**Level of Service**

- A, B, C
- D
- E
- F
- No Data

**2012**

**2016**

Source: City of Springfield
Missouri Dept. of Transportation

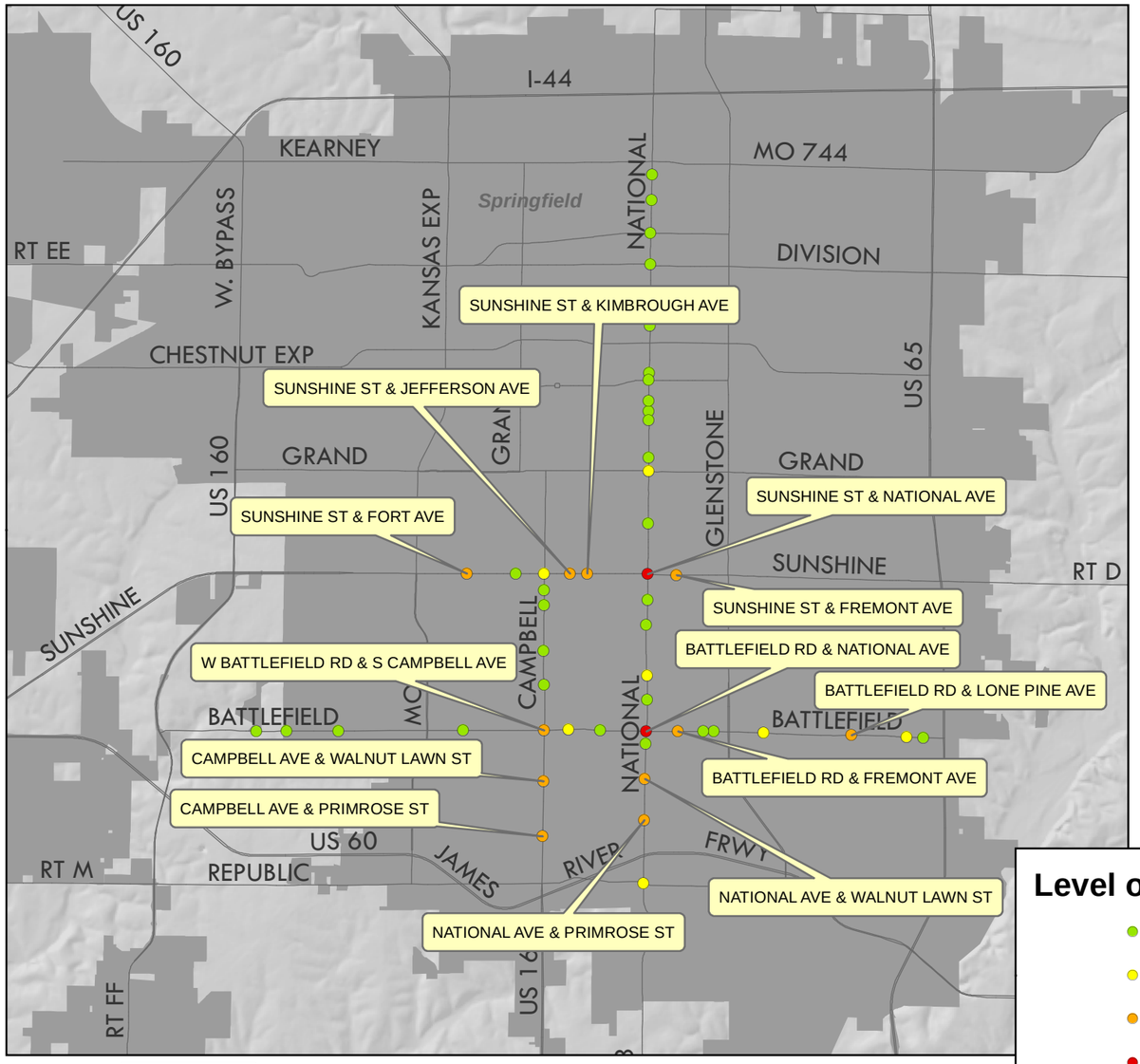
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**What impact does intersection/interchange level-of-service play in determining regional congestion problems?**

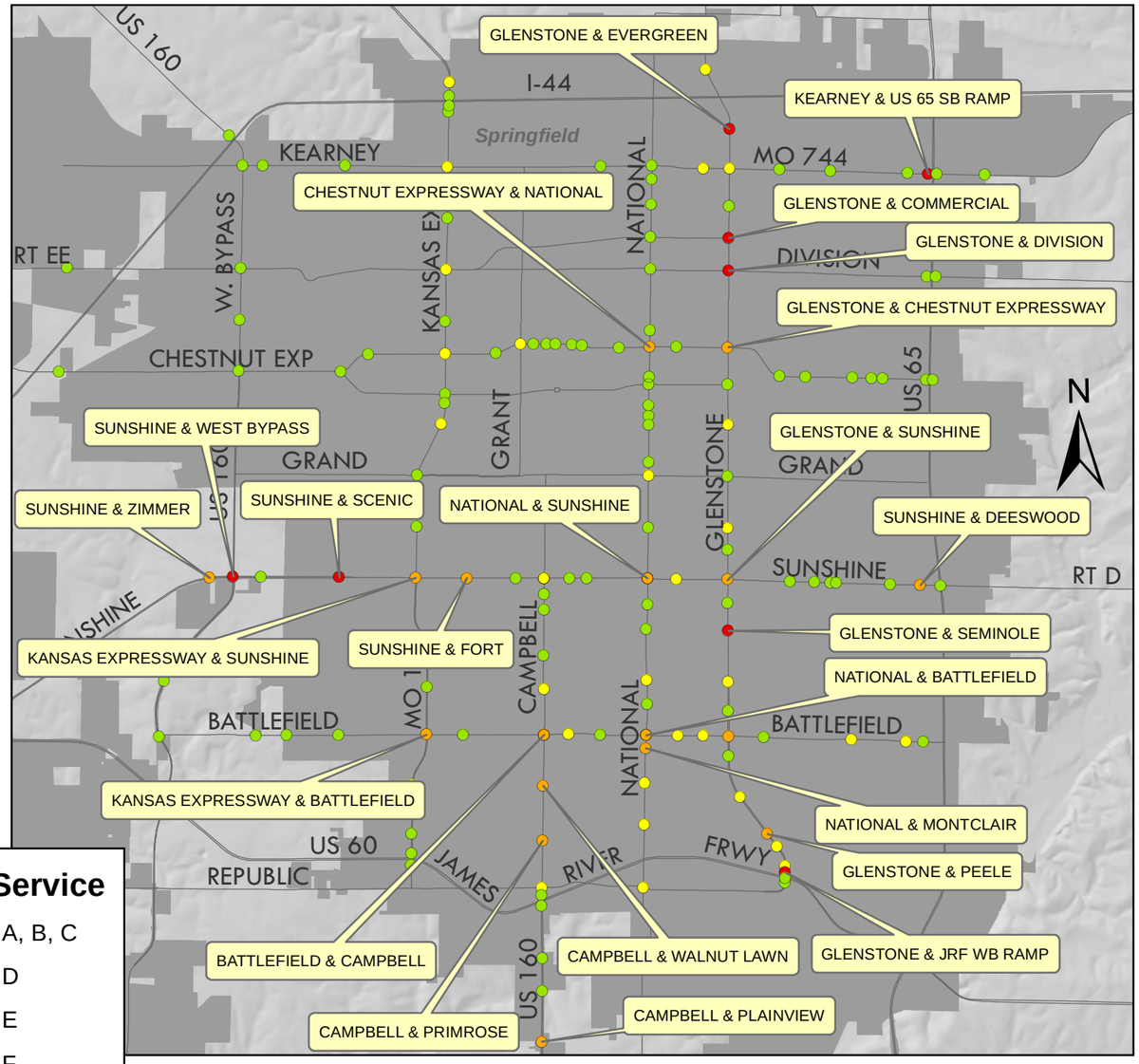
# Map 6.3

**Intersection Level of Service**
**PM Peak**

# Intersection Level of Service
# PM Peak




**2005**




**2008**

## Level of Service

- A, B, C
- D
- E
- F

Source: City of Springfield
Missouri Dept. of Transportation

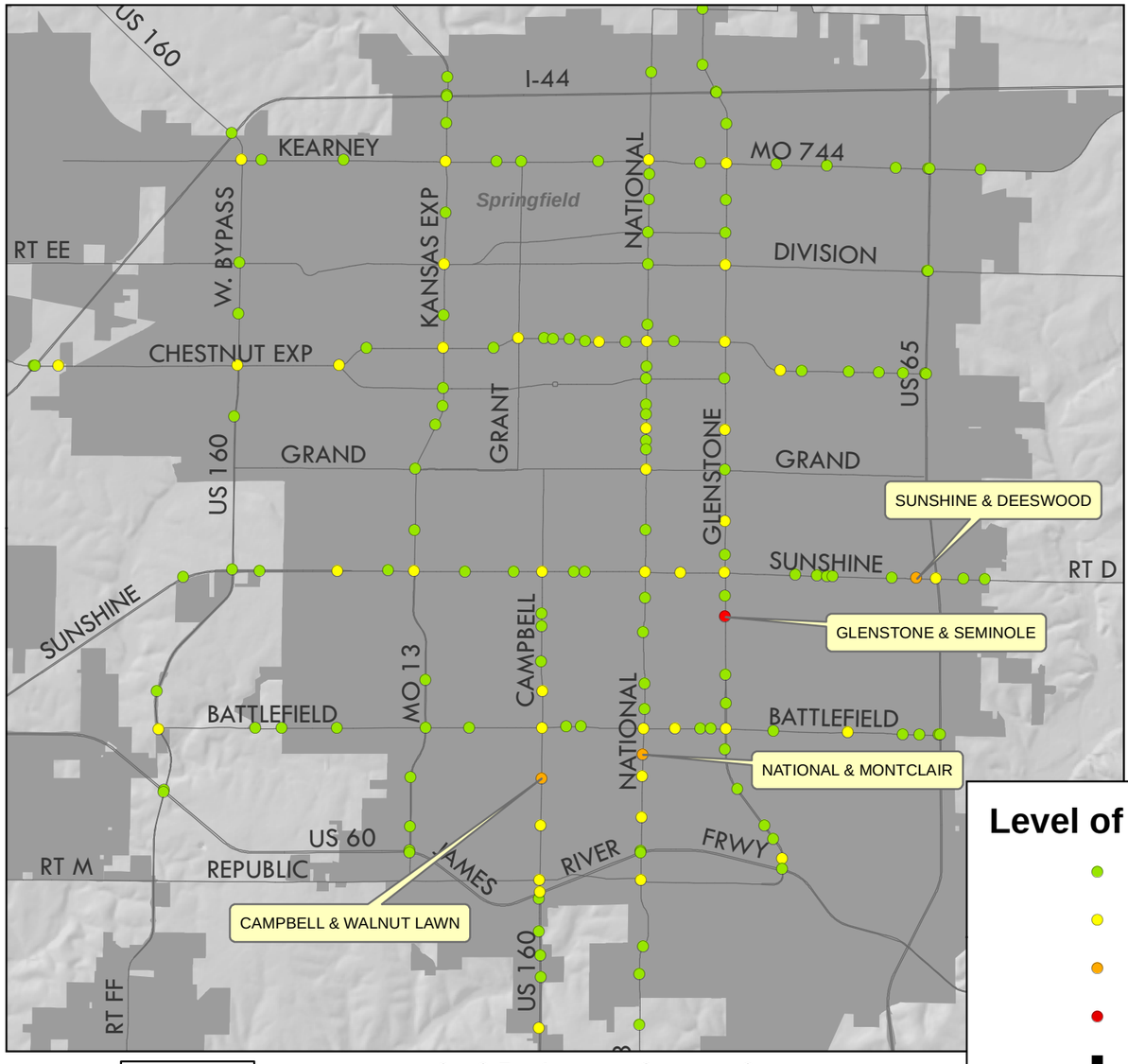
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

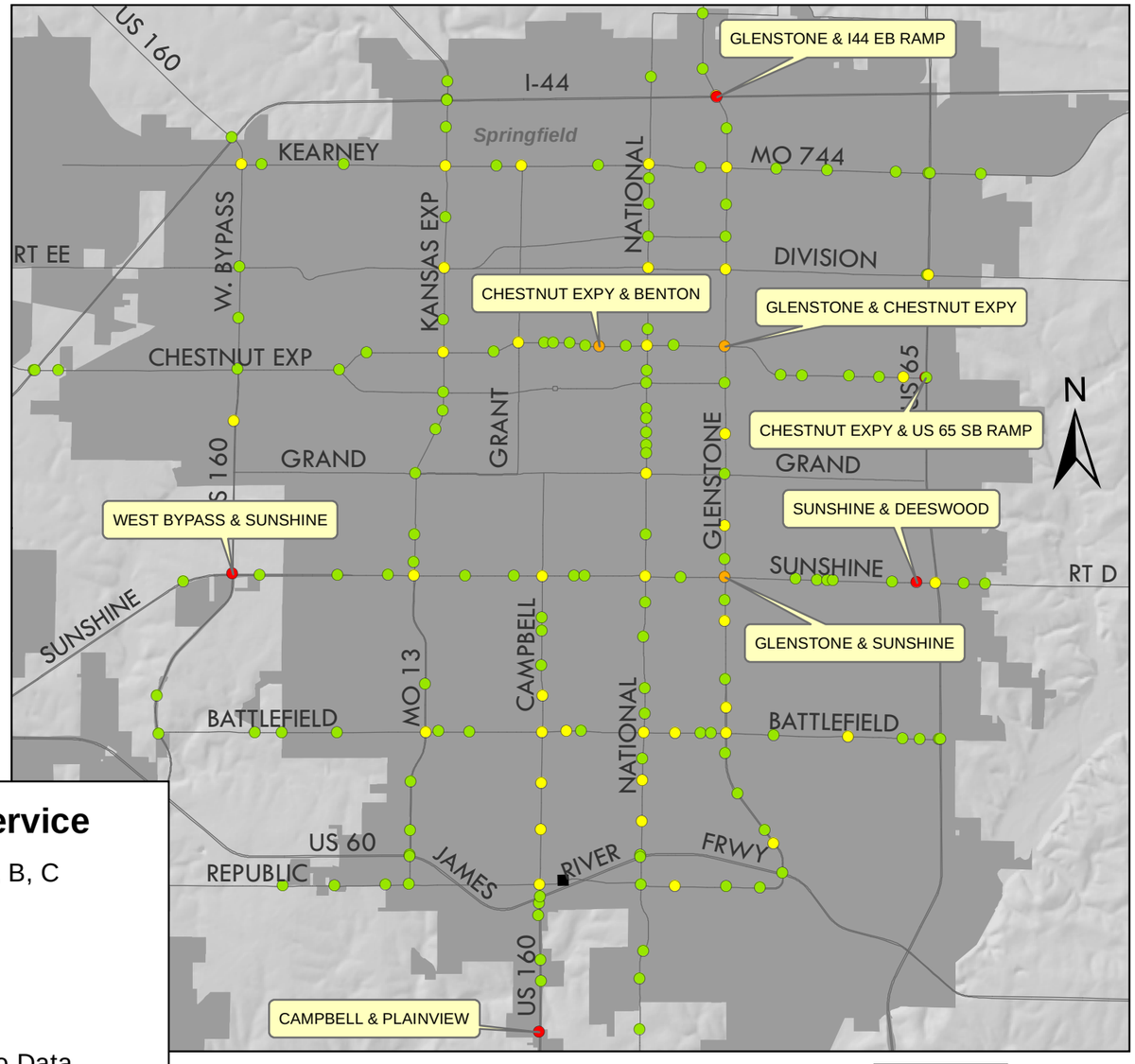
**What impact does intersection/interchange level-of-service play in determining regional congestion problems?**

# Map 6.4

**Intersection Level of Service**
**PM Peak**

# Intersection Level of Service
# PM Peak




**Level of Service**

- A, B, C
- D
- E
- F
- No Data

Source: City of Springfield
Missouri Dept. of Transportation

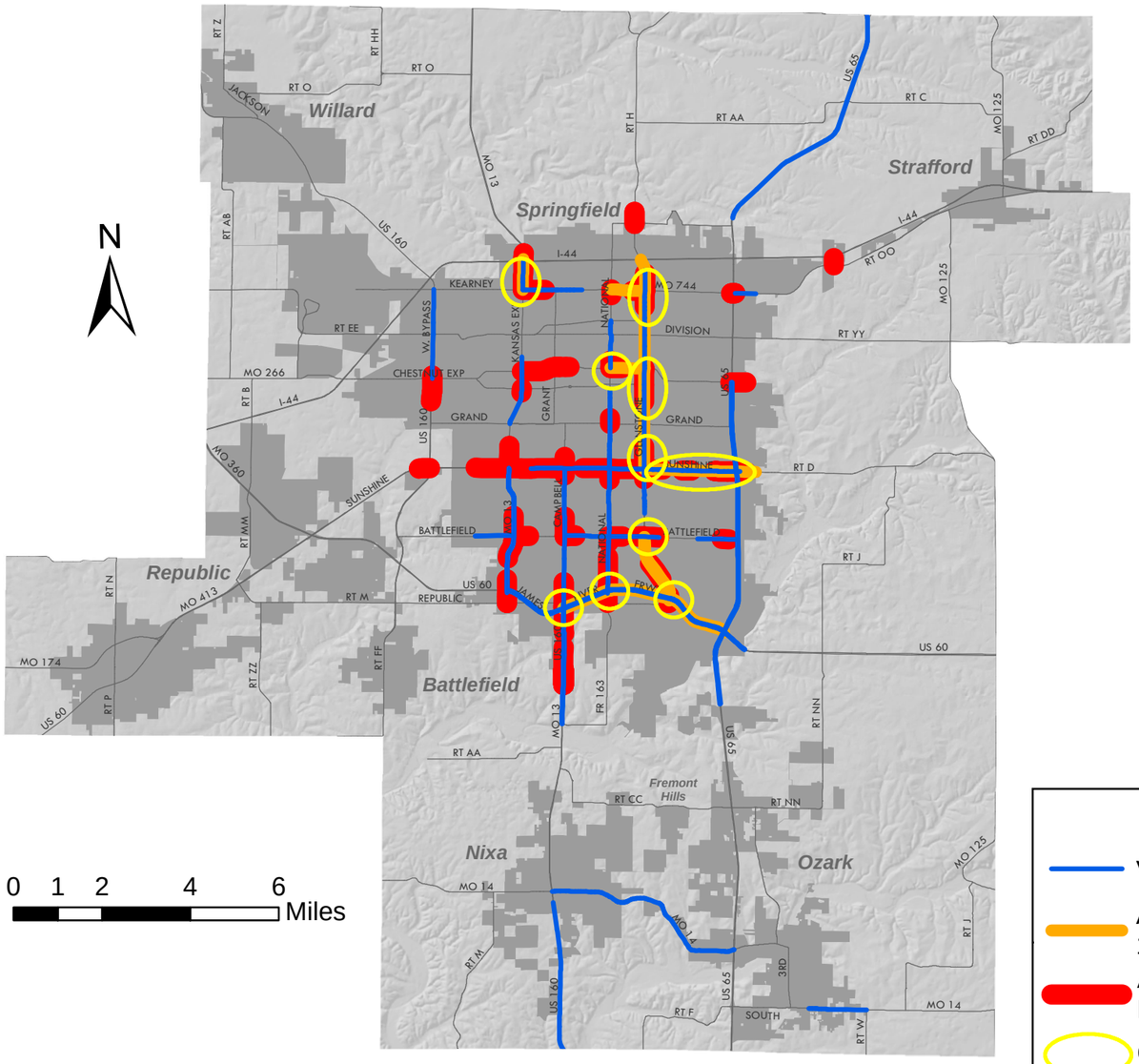
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

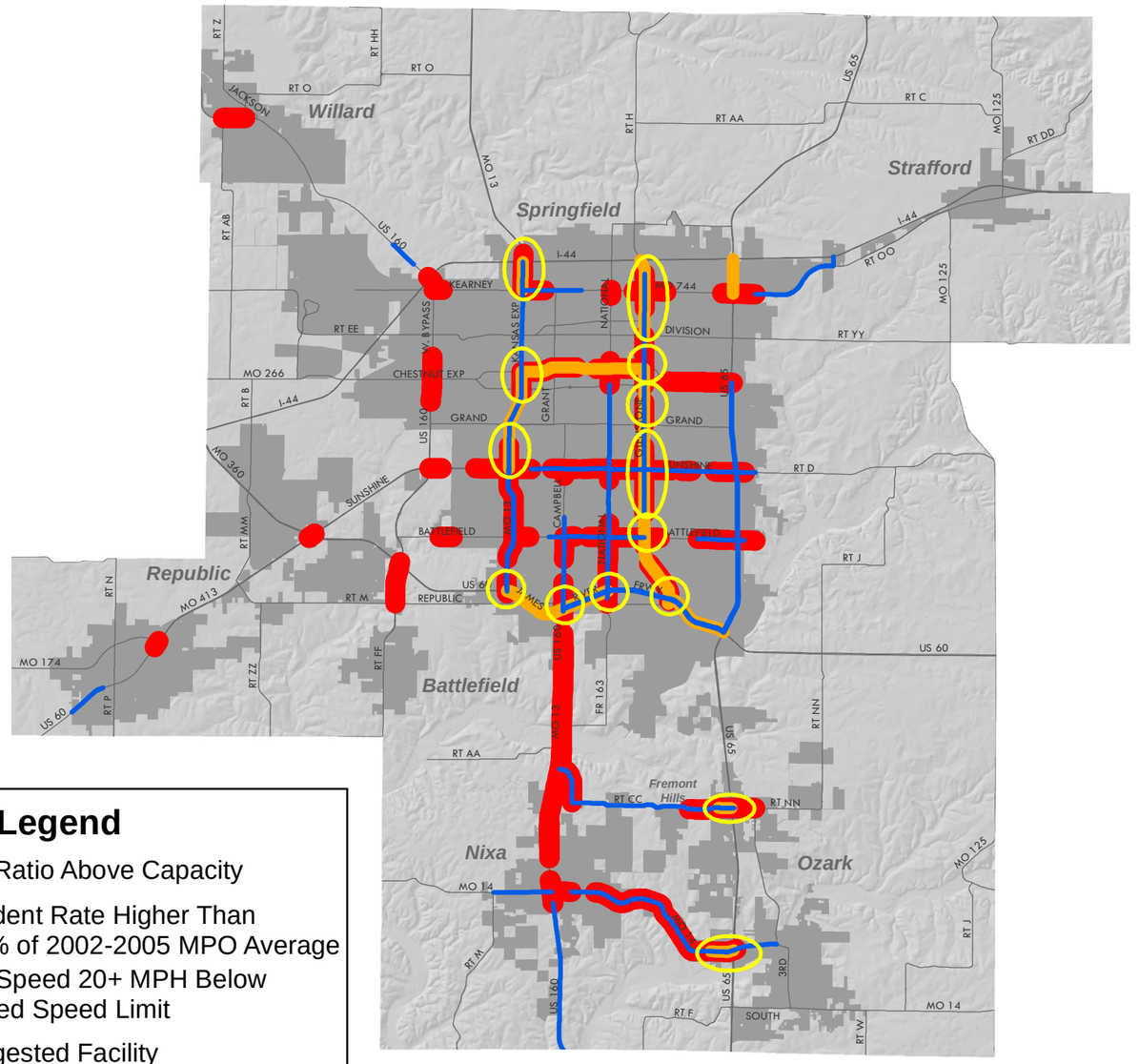
**What impact does intersection/interchange level-of-service play in determining regional congestion problems?**

# Map 6.4

**Intersection Level of Service**
**PM Peak**

# Congested Facilities I




**Legend**

- V/C Ratio Above Capacity
- Accident Rate Higher Than 150% of 2002-2005 MPO Average
- Avg Speed 20+ MPH Below Posted Speed Limit
- Congested Facility

**2005**

**2008**

Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

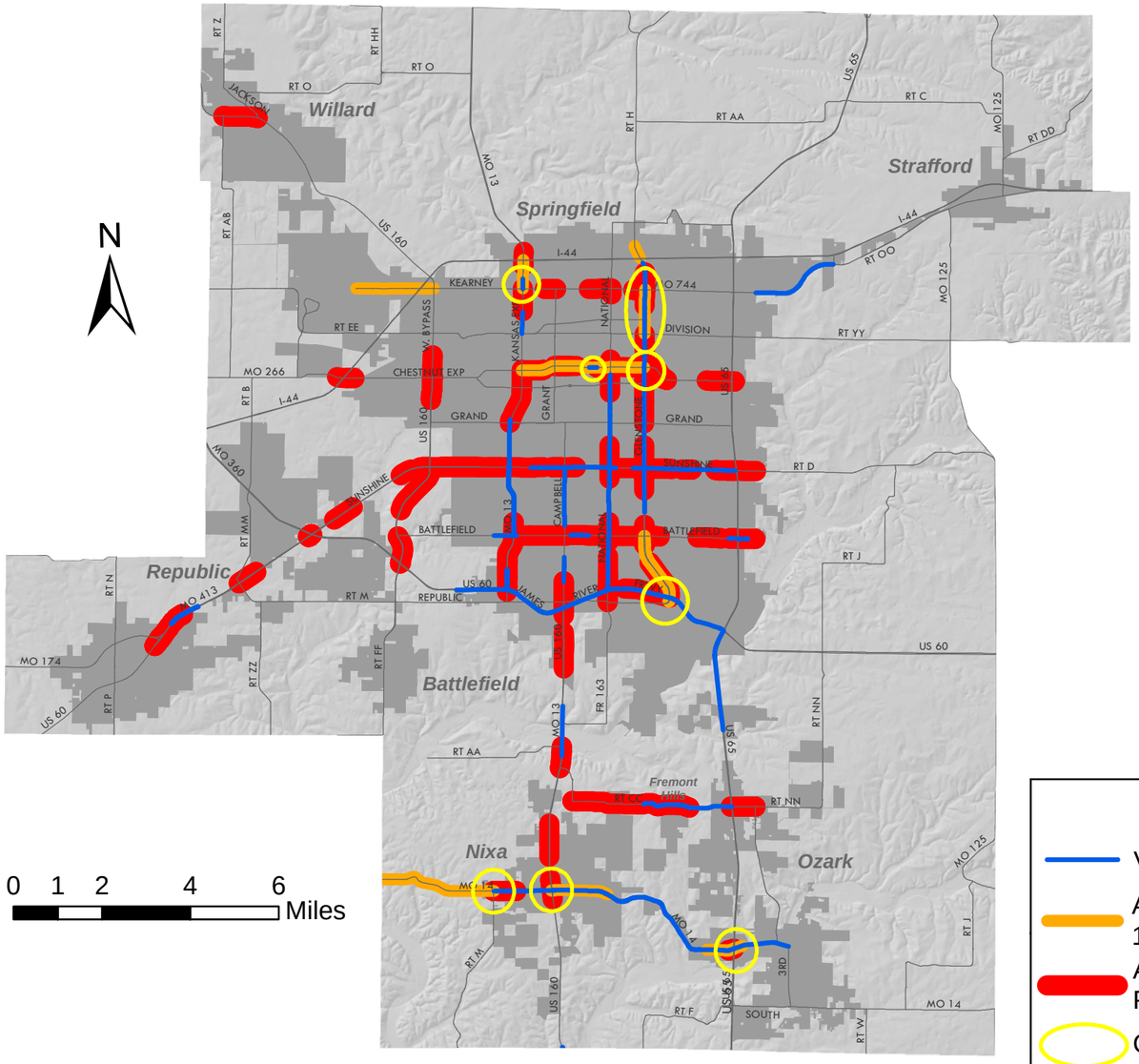
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

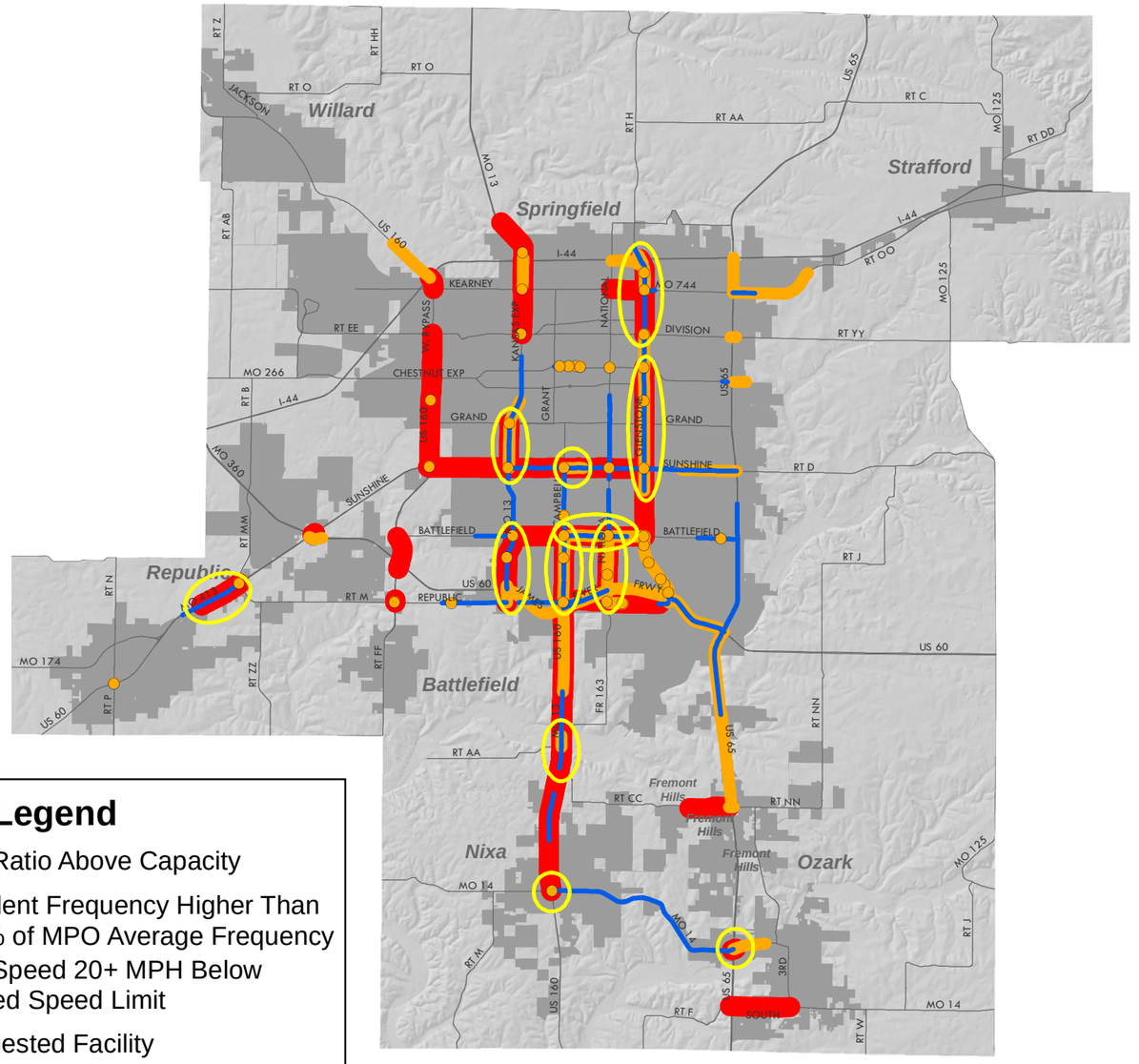
**Roadways which have a significant travel delay, level of service E+ and high accident rate**

# Map 7.1

**Congested Facilities I**

# Congested Facilities I




## Legend

- V/C Ratio Above Capacity
- Accident Frequency Higher Than 150% of MPO Average Frequency
- Avg Speed 20+ MPH Below Posted Speed Limit
- Congested Facility

**2012**

**2016**

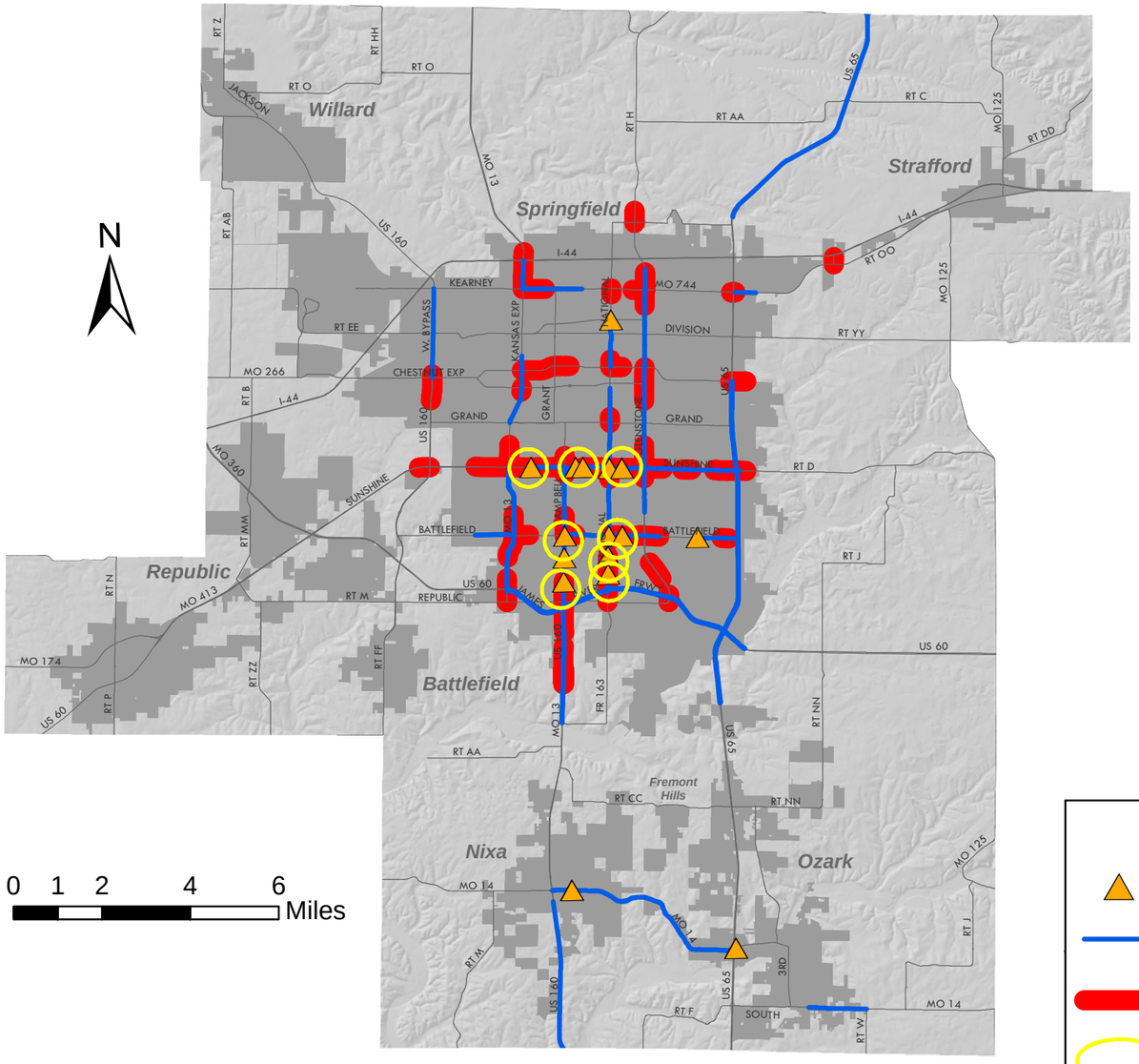
Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

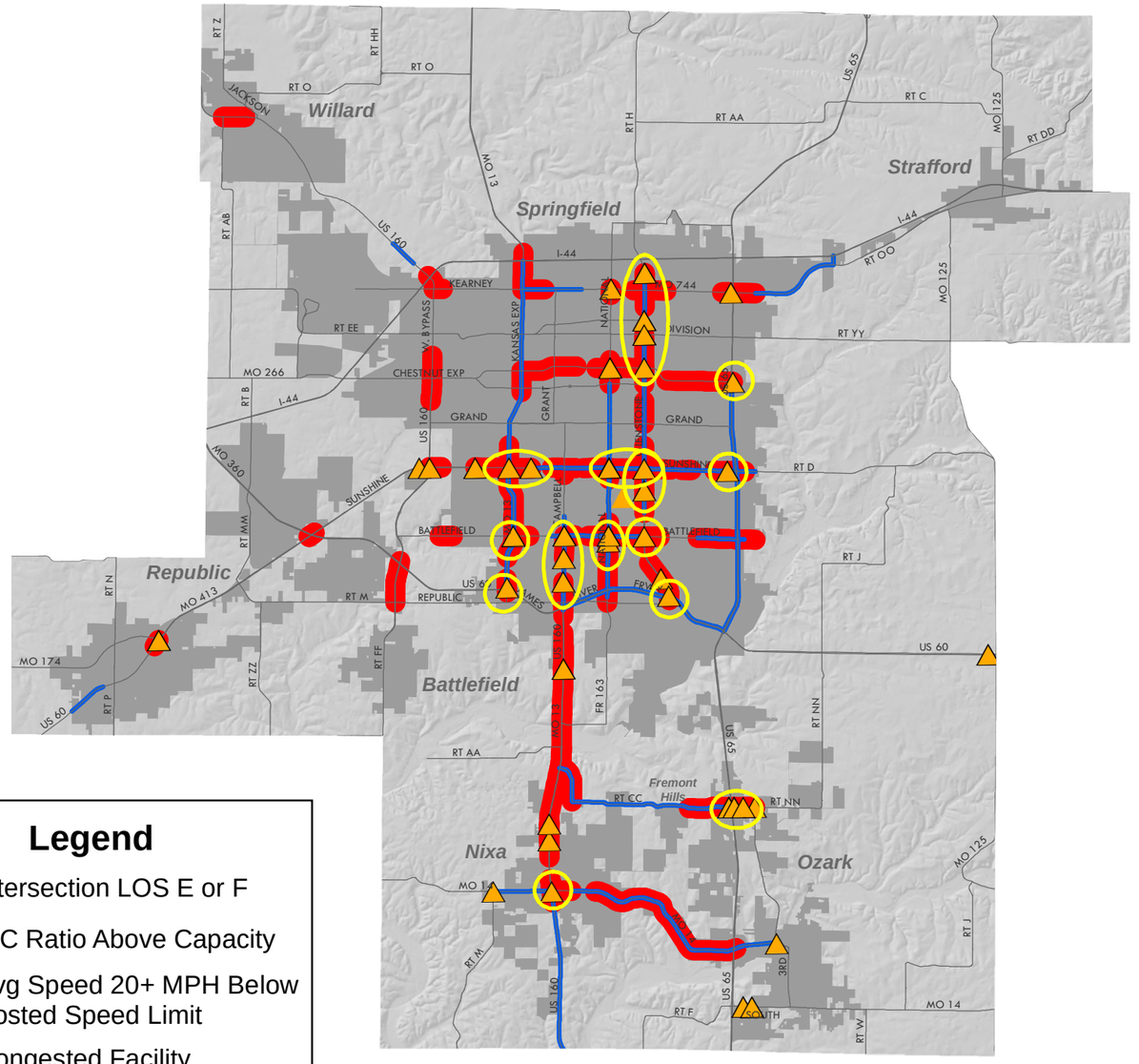
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**Roadways which have a significant travel delay, level of service E+ and high accident rate**

Map 7.1
**Congested Facilities I**

# Congested Facilities II




## Legend

- Intersection LOS E or F
- V/C Ratio Above Capacity
- Avg Speed 20+ MPH Below Posted Speed Limit
- Congested Facility

**2005**

**2008**

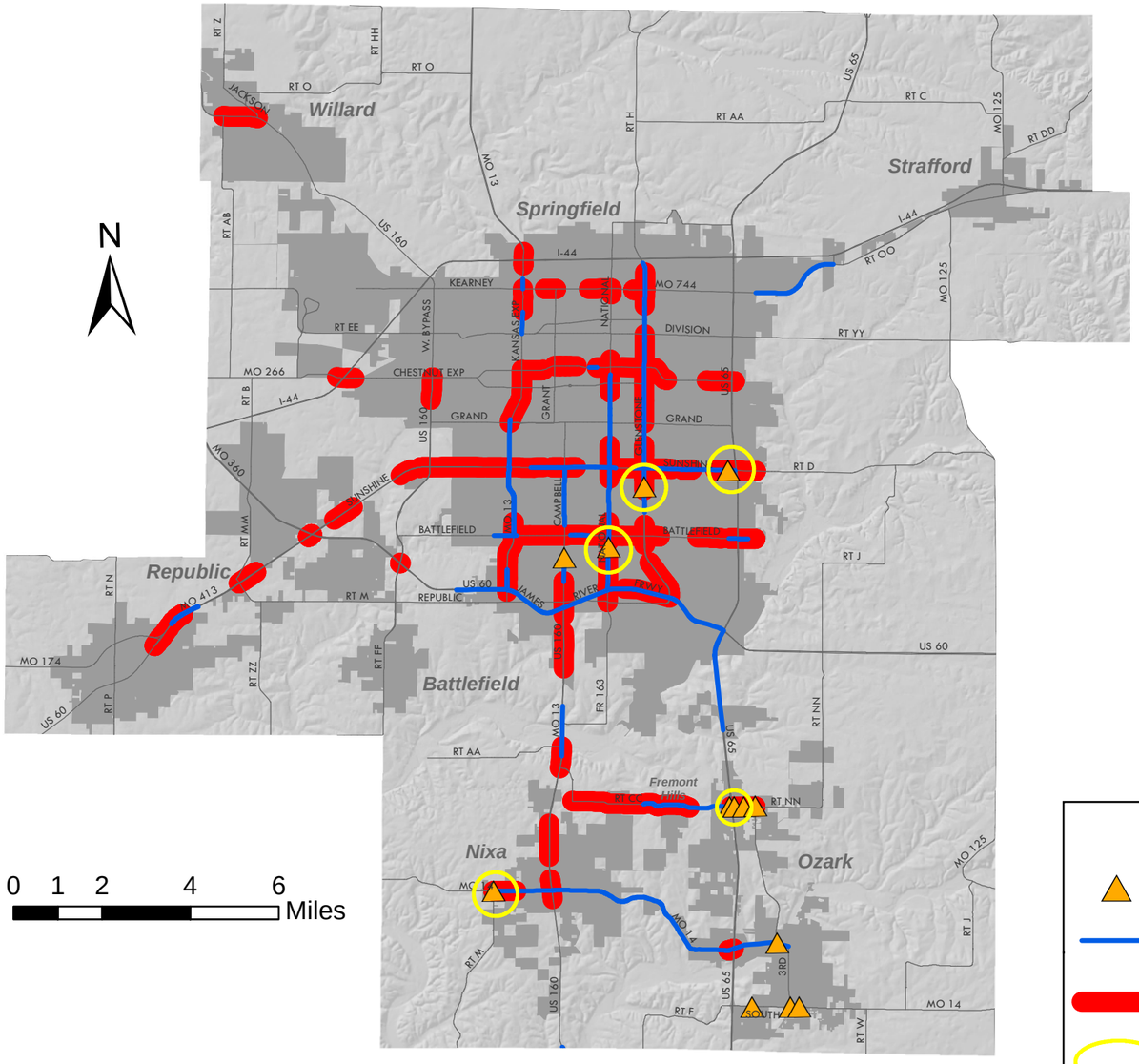
Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

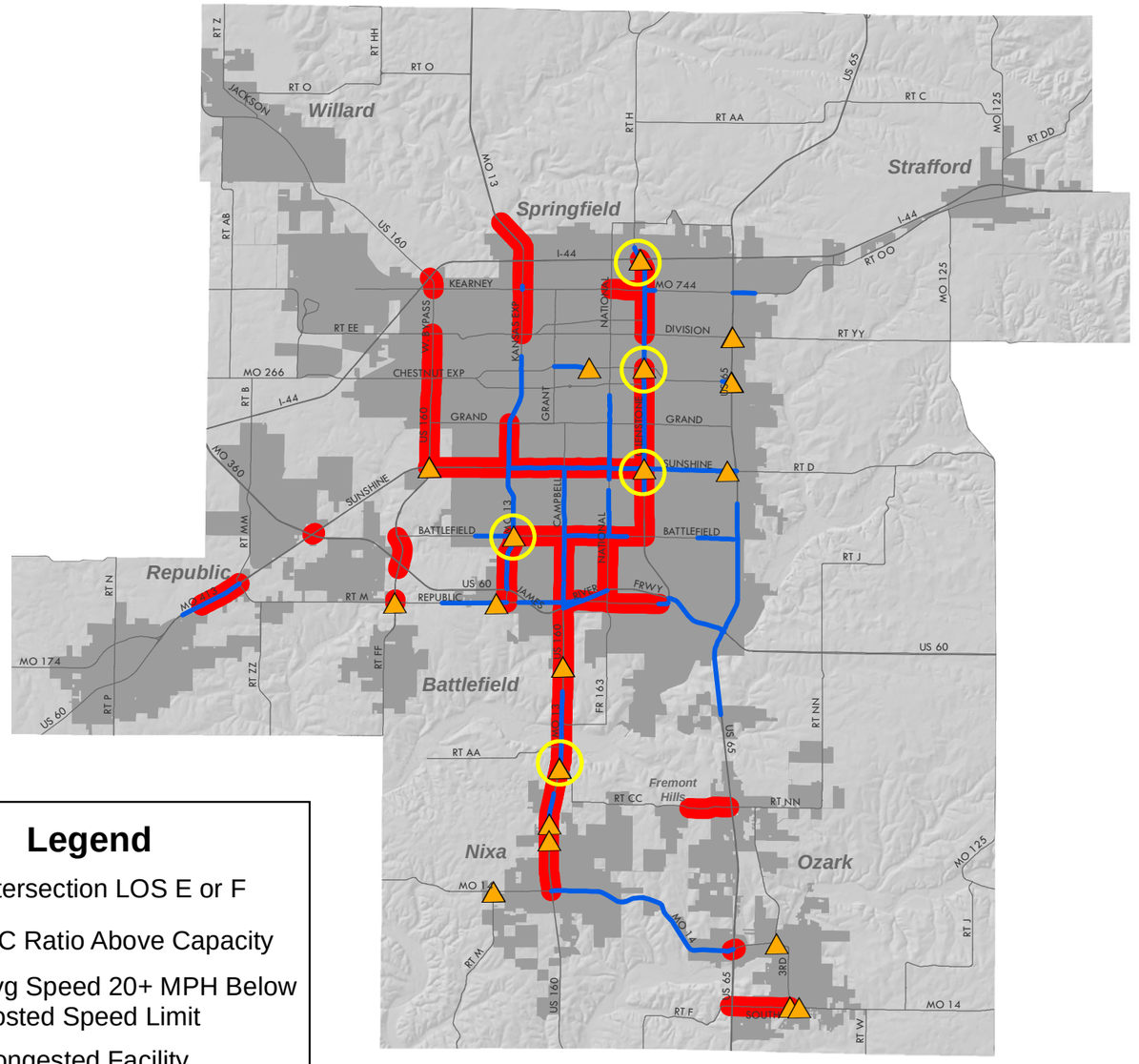
OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**Roadways which have a significant travel delay, level of service E+ and intersection level of service E+**

Map 7.2
**Congested Facilities II**

# Congested Facilities II




**Legend**

- Intersection LOS E or F
- V/C Ratio Above Capacity
- Avg Speed 20+ MPH Below Posted Speed Limit
- Congested Facility

**2012**

**2016**

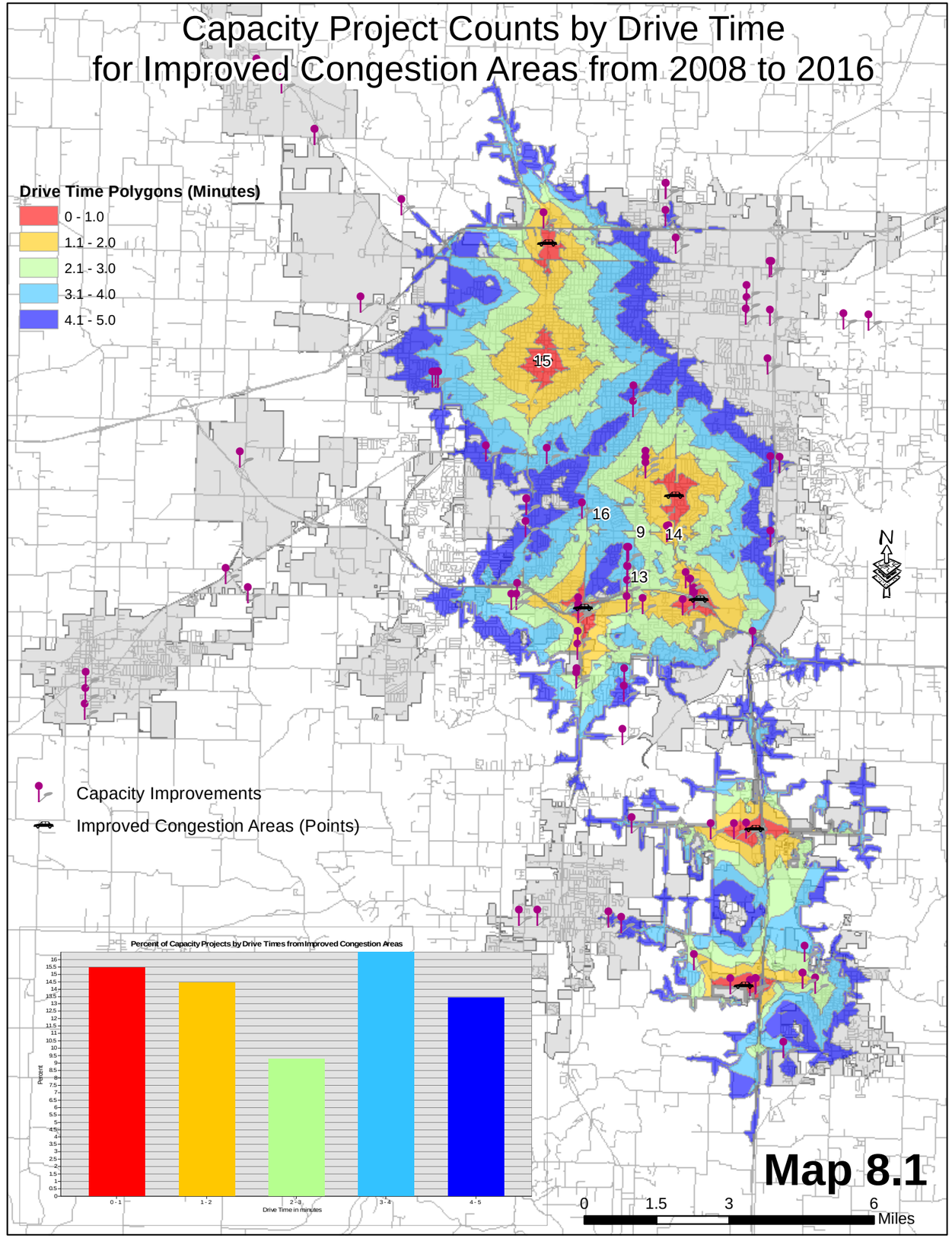
Source: City of Springfield
Missouri Dept. of Transportation
CJW Transportation Consultants LLC

OZARKS TRANSPORTATION ORGANIZATION
A METROPOLITAN PLANNING ORGANIZATION

**Roadways which have a significant travel delay, level of service E+ and intersection level of service E+**

Map 7.2
**Congested Facilities II**

# Capacity Project Counts by Drive Time for Improved Congestion Areas from 2008 to 2016



# Capacity Project Counts by Drive Time for No Change Congestion Areas from 2008 to 2016

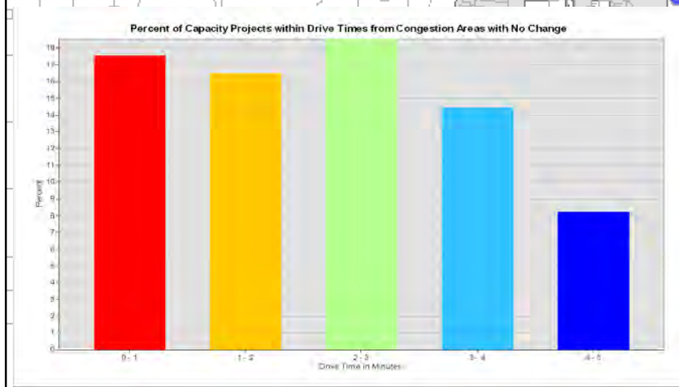
**Drive Time Polygons (Minutes)**

- 0 - 1.0
- 1.1 - 2.0
- 2.1 - 3.0
- 3.1 - 4.0
- 4.1 - 5.0

17
14
18
16
8

Capacity Improvements

No Change in Congestion Areas (Points)




0 1.5 3 6 Miles

# Capacity Project Counts by Drive Time for Emerging Congestion Areas in 2016

**Drive Time Polygons (Minutes)**

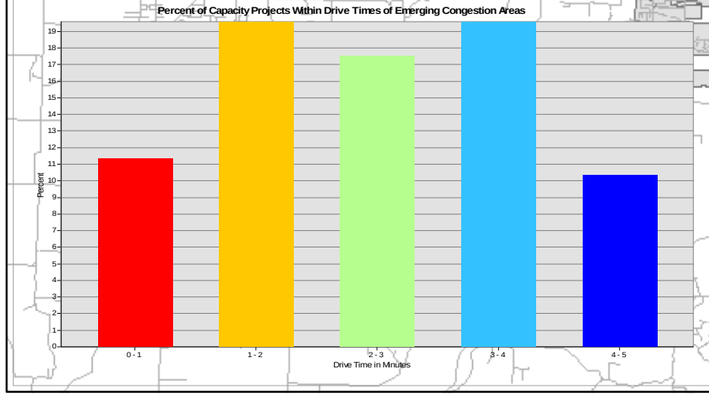
- 0 - 1.0
- 1.1 - 2.0
- 2.1 - 3.0
- 3.1 - 4.0
- 4.1 - 5.0

10
19
11
17

N

Capacity Improvements

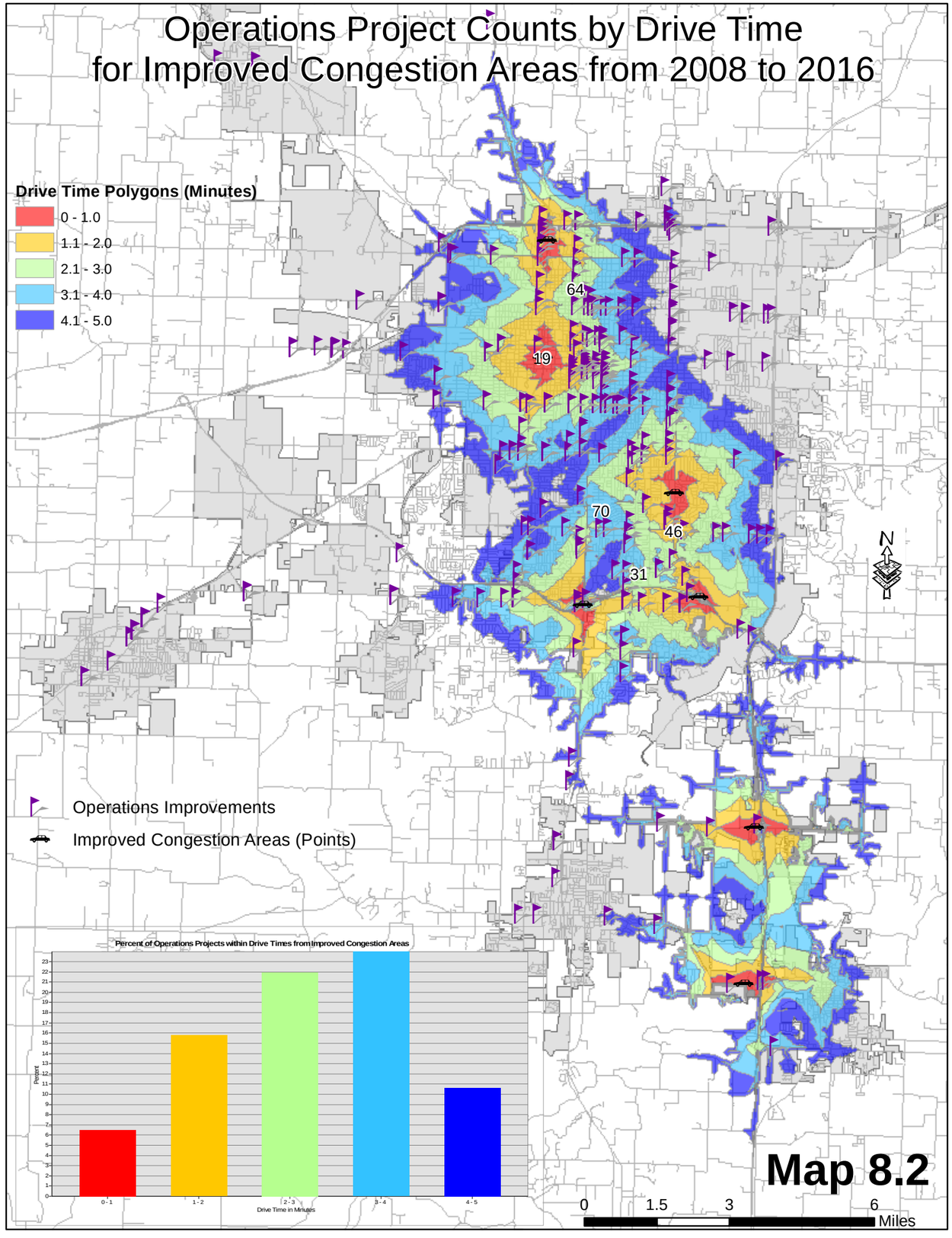
Emerging Congestion Areas (Points)




**Map 8.1**

0 1.5 3 6 Miles

# Operations Project Counts by Drive Time for Improved Congestion Areas from 2008 to 2016




**Map 8.2**

# Operations Project Counts by Drive Time for Areas with No Change in Congestion from 2008 to 2016

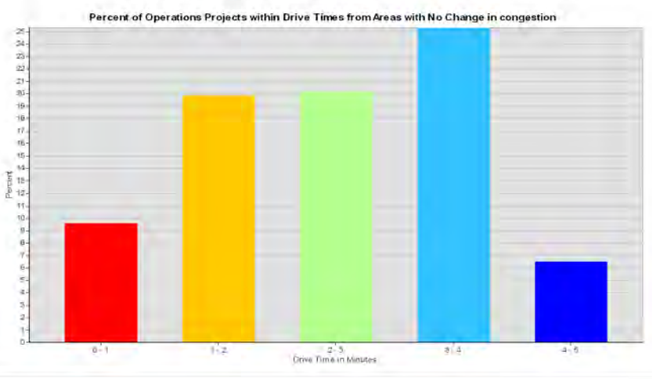
**Drive Time Polygons (Minutes)**

- 0 - 1.0
- 1.1 - 2.0
- 2.1 - 3.0
- 3.1 - 4.0
- 4.1 - 5.0

74
59
28
58
19

Operations Improvements

No Change in Congestion Areas (Points)




0 1.5 3 6 Miles

# Operations Project Counts by Drive Time for Emerging Congestion Areas in 2016

**Drive Time Polygons (Minutes)**

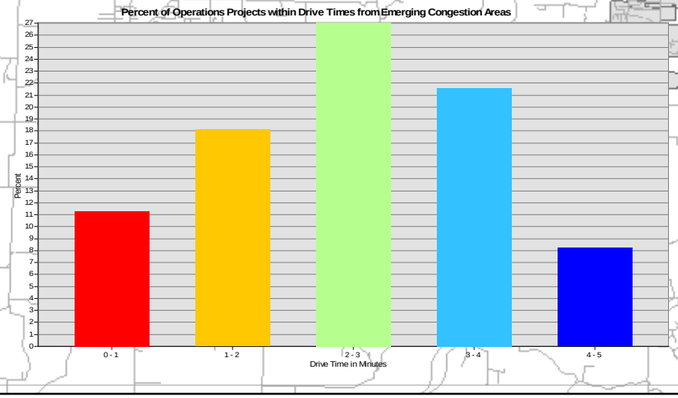
- 0 - 1.0
- 1.1 - 2.0
- 2.1 - 3.0
- 3.1 - 4.0
- 4.1 - 5.0

24
53
63
33
79

N

Operations Improvements

Emerging Congestion Areas (Points)

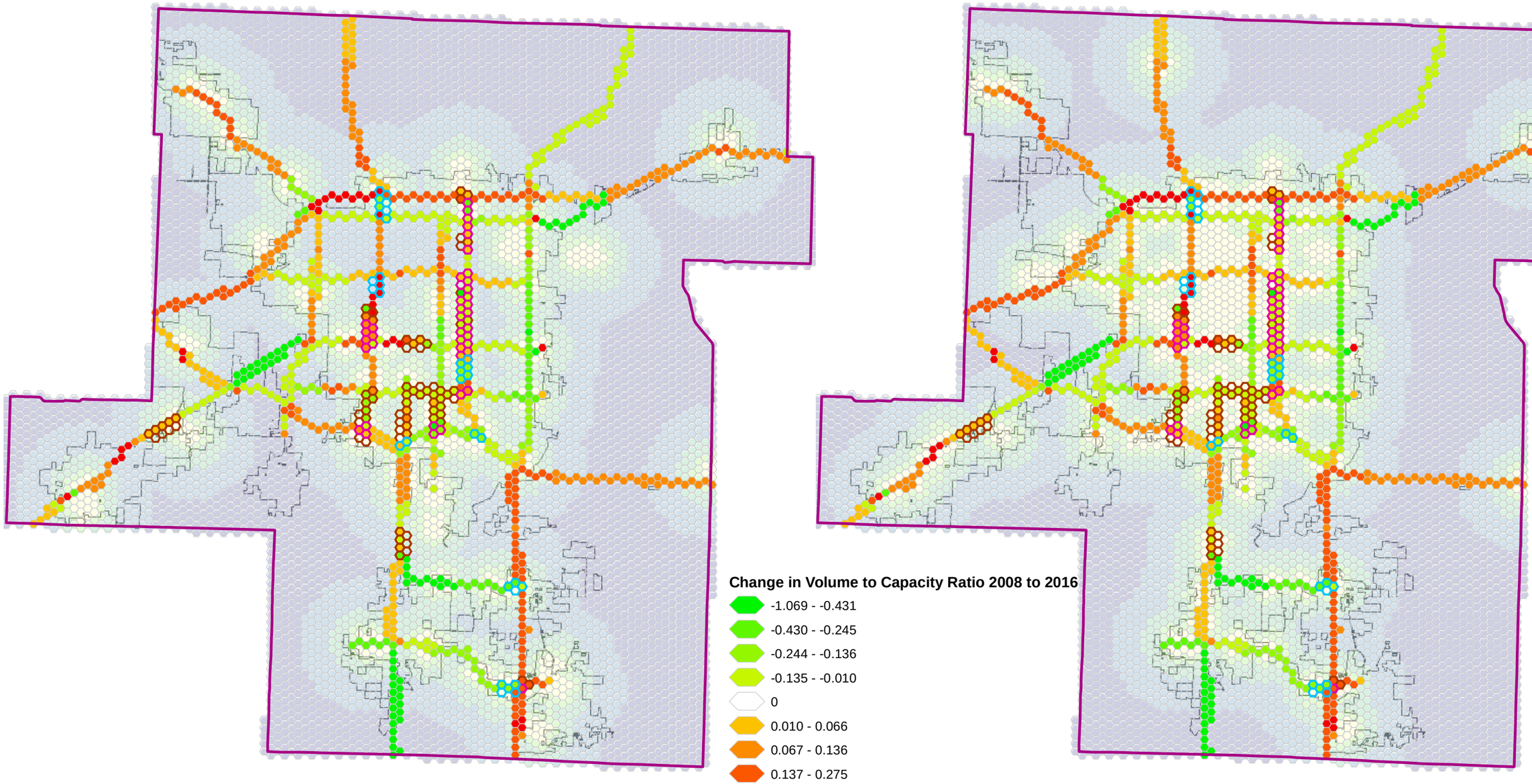



0 1.5 3 6 Miles

**Map 8.2**

## Change in Volume to Capacity Ratio from 2008 to 2016 and Proximity to Nearest Capacity Improvement

## Change in Volume to Capacity Ratio from 2008 to 2016 and Proximity to Nearest Operations Improvement



**Change in Volume to Capacity Ratio 2008 to 2016**

- -1.069 - -0.431
- -0.430 - -0.245
- -0.244 - -0.136
- -0.135 - -0.010
- 0
- 0.010 - 0.066
- 0.067 - 0.136
- 0.137 - 0.275
- 0.276 - 1.143

**Nearest Capacity Project Distance (ft)**

- 0 - 1,320
- 1,321 - 2,640
- 2,641 - 5,280
- 5,281 - 10,560
- 10,561 - 30,866

N

- Inproved Congestion Hex
- No Change Congestion Hex
- Emerging Congestion Hex

- OTO Boundary
- City Limits

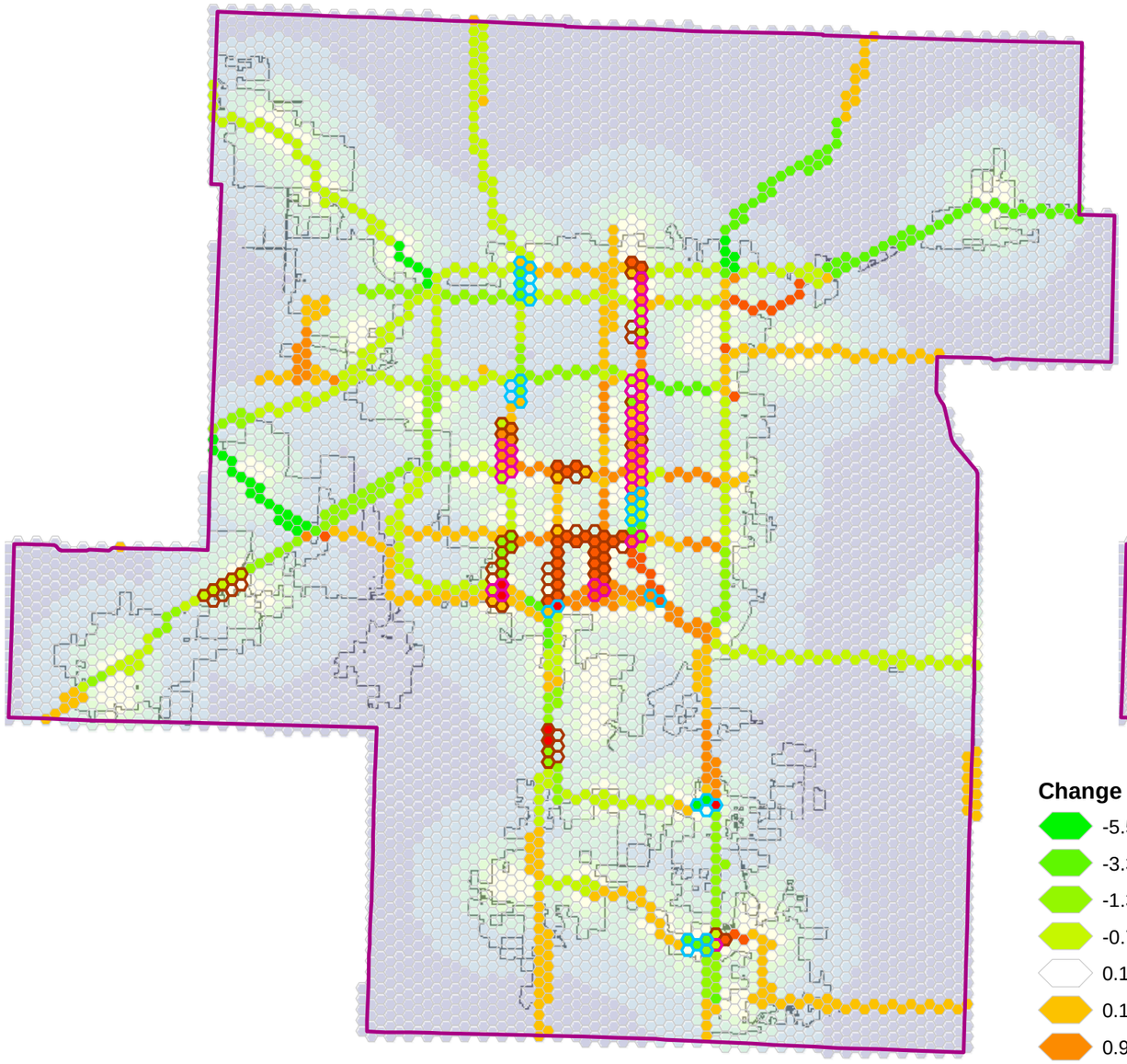
0 1.25 2.5 5 Miles

**Nearest Operations Project Distance (ft)**

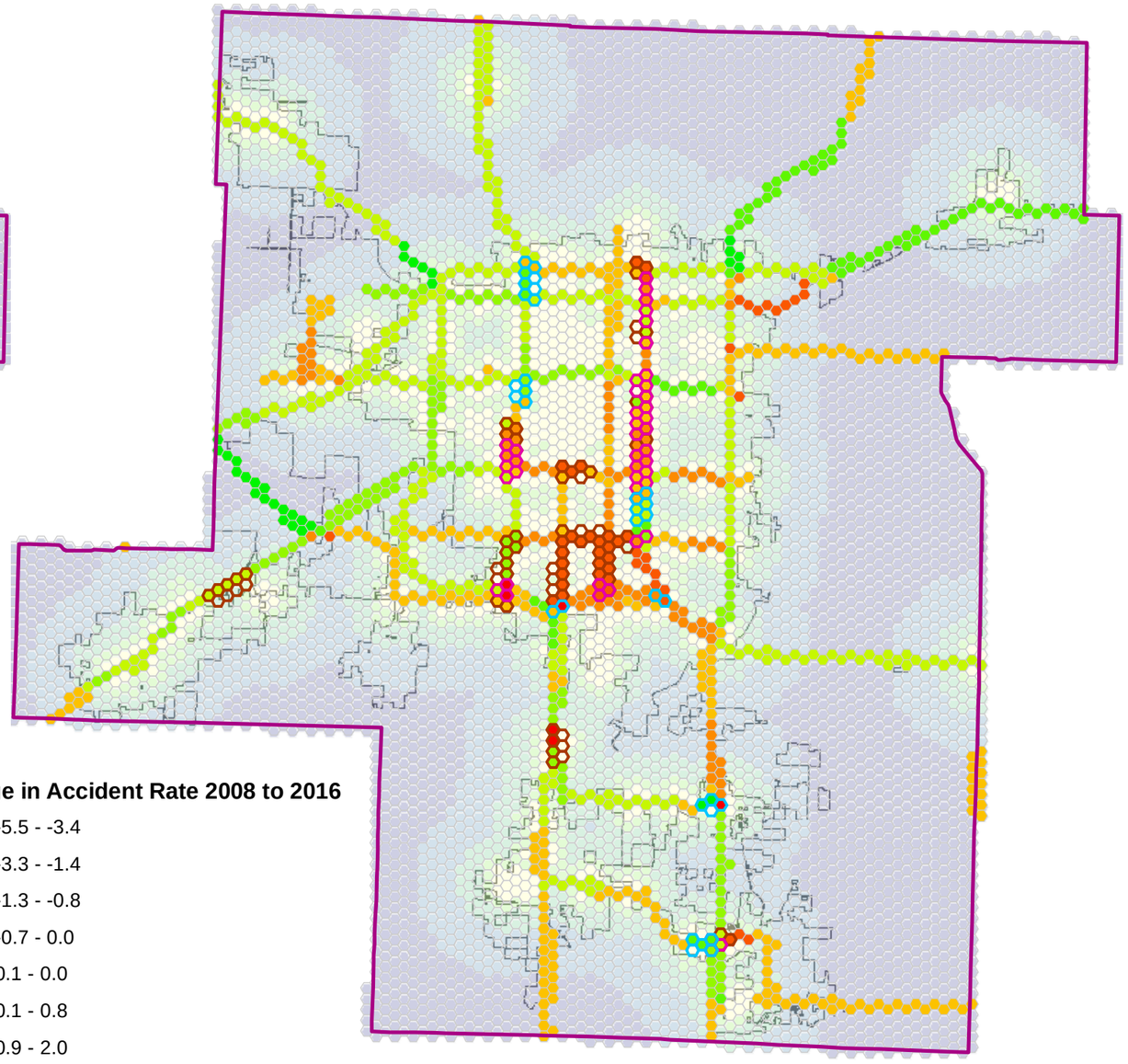
- 0 - 1,320
- 1,321 - 2,640
- 2,641 - 5,280
- 5,281 - 10,560
- 10,561 - 29,636

**Map 8.3**

## Change in Accident Rate from 2008 to 2016 and Proximity to Nearest Capacity Improvement



## Change in Accident Rate from 2008 to 2016 and Proximity to Nearest Operations Improvement



**Change in Accident Rate 2008 to 2016**

- -5.5 - -3.4
- -3.3 - -1.4
- -1.3 - -0.8
- -0.7 - 0.0
- 0.1 - 0.0
- 0.1 - 0.8
- 0.9 - 2.0
- 2.1 - 5.1
- 5.2 - 18.5

**Nearest Capacity Project Distance (ft)**

- 0 - 1,320
- 1,321 - 2,640
- 2,641 - 5,280
- 5,281 - 10,560
- 10,561 - 30,866

N

- Inproved Congestion Hex
- No Change Congestion Hex
- Emerging Congestion Hex

- OTO Boundary
- City Limits

0 1.25 2.5 5 Miles

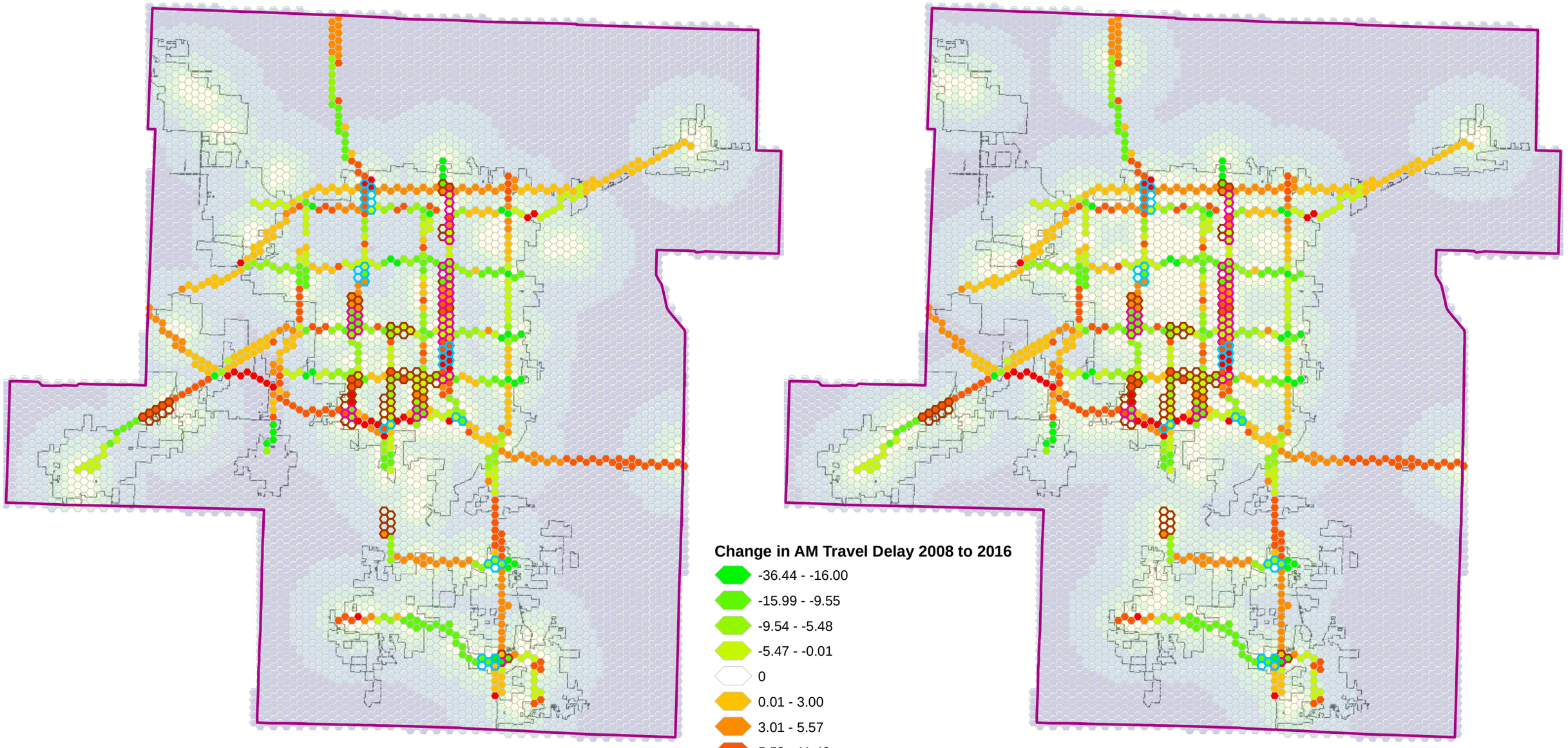
**Nearest Operations Project Distance (ft)**

- 0 - 1,320
- 1,321 - 2,640
- 2,641 - 5,280
- 5,281 - 10,560
- 10,561 - 29,636

# Map 8.4

## Change in AM Travel Delay from 2008 to 2016 and Proximity to Nearest Capacity Improvement

## Change in AM Travel Delay from 2008 to 2016 and Proximity to Nearest Operations Improvement



**Change in AM Travel Delay 2008 to 2016**

- -36.44 - -16.00
- -15.99 - -9.55
- -9.54 - -5.48
- -5.47 - -0.01
- 0
- 0.01 - 3.00
- 3.01 - 5.57
- 5.58 - 11.40
- 11.41 - 32.50

**Nearest Capacity Project Distance (ft)**

- 0 - 1,320
- 1,321 - 2,640
- 2,641 - 5,280
- 5,281 - 10,560
- 10,561 - 30,866

N

- Inproved Congestion Hex
- No Change Congestion Hex
- Emerging Congestion Hex

- OTO Boundary
- City Limits

0 1.25 2.5 5 Miles

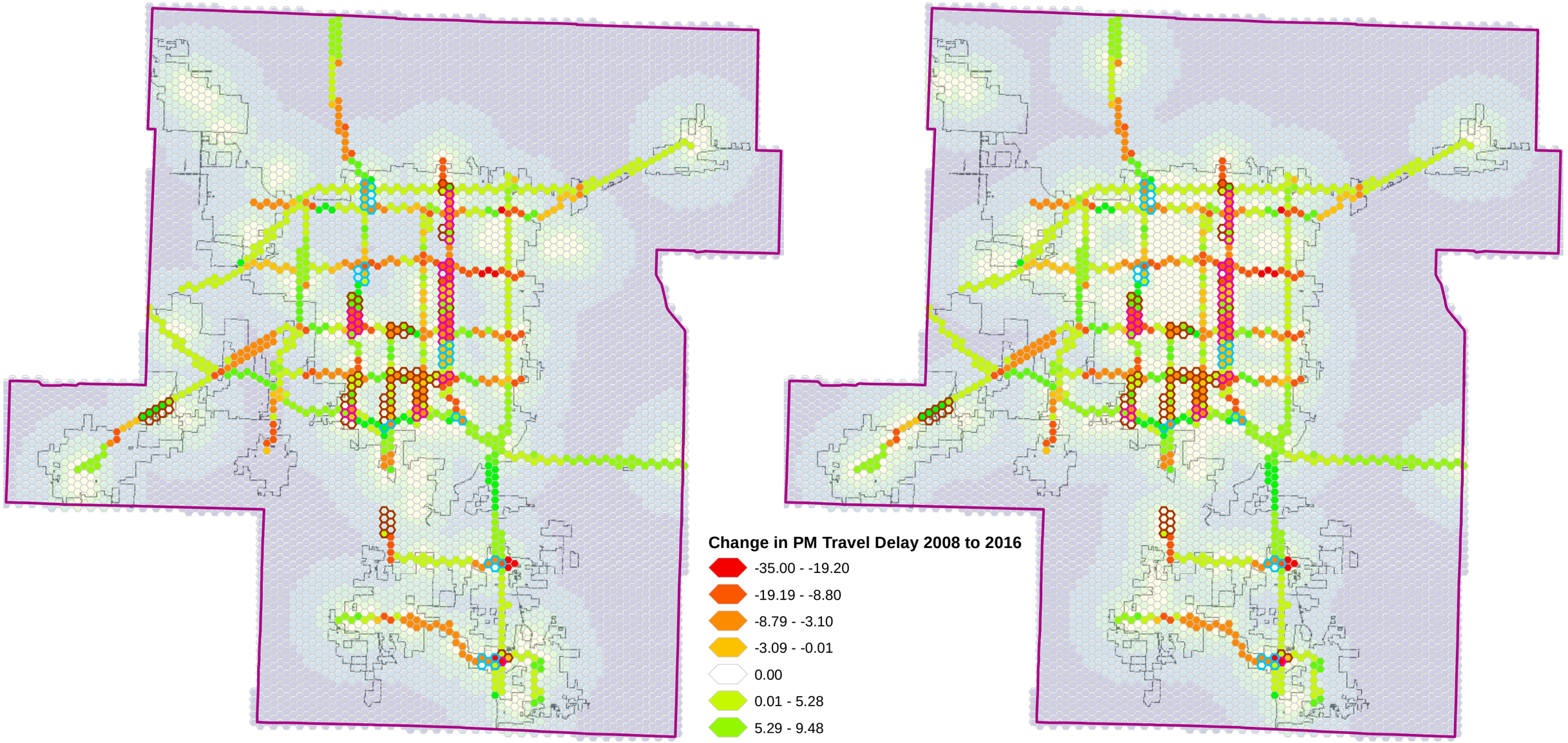
**Nearest Operations Project Distance (ft)**

- 0 - 1,320
- 1,321 - 2,640
- 2,641 - 5,280
- 5,281 - 10,560
- 10,561 - 29,636

**Map 8.5**

## Change in PM Travel Delay from 2008 to 2016 and Proximity to Nearest Capacity Improvement

## Change in PM Travel Delay from 2008 to 2016 and Proximity to Nearest Operations Improvement



**Change in PM Travel Delay 2008 to 2016**

- -35.00 - -19.20
- -19.19 - -8.80
- -8.79 - -3.10
- -3.09 - -0.01
- 0.00
- 0.01 - 5.28
- 5.29 - 9.48
- 9.49 - 16.20
- 16.21 - 35.80

**Nearest Capacity Project Distance (ft)**

- 0 - 1,320
- 1,321 - 2,640
- 2,641 - 5,280
- 5,281 - 10,560
- 10,561 - 30,866

N

- Inproved Congestion Hex
- No Change Congestion Hex
- Emerging Congestion Hex

- OTO Boundary
- City Limits

0 1.25 2.5 5 Miles

**Nearest Operations Project Distance (ft)**

- 0 - 1,320
- 1,321 - 2,640
- 2,641 - 5,280
- 5,281 - 10,560
- 10,561 - 29,636

**Map 8.6**