STREETLIGHT

CONGESTION SOLUTIONS GUIDE

# EVERYTHING BUT HIGHWAY EXPANSION

## Better Data to Support Faster Congestion Mitigation

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# Why adding a lane is falling out of favor

Managing congestion is one of the core requirements of state, regional, and local transportation agencies and the AEC firms that support them. Timely and well-planned congestion mitigation is a critical way to keep the community moving and the economy growing.


Historically, the default solution to persistent congestion has been highway expansion. This approach makes intuitive sense and may satisfy some constituents, business groups, and political leaders in the short term — after all, if a highway is flooded with too many cars, why not make more room for them?

Expansion also does not require as much cross-agency coordination as other solutions, especially in cities, where congestion often builds.

But research has shown that this short-term solution often fails in the long term and creates "induced demand," resulting in more cars on the expanded highways and renewed congestion.[1]

Highway expansion is also extremely costly and time-consuming, and it often disrupts traffic flow in the construction process. The Highway Economic Requirements System put the average cost per mile of adding a lane on an urban freeway back in 2014 at $15 million.[2]

In the face of congested, unsafe, and inequitable roadways, ideas are shifting regarding the function of our transportation system.

Instead of a vehicle-centric transportation system, there's growing momentum for a people-centric transportation system.

**Highway expansion is increasingly seen as at odds with a people-centric approach, which calls for prioritizing investments that improve public health, safety, and equity.** These are now seen as goals of equal or greater importance than moving cars and trucks around as quickly as possible.

But transportation leaders proposing alternatives to expansion may face steep obstacles if they don't have the right tools to identify and communicate their solution.

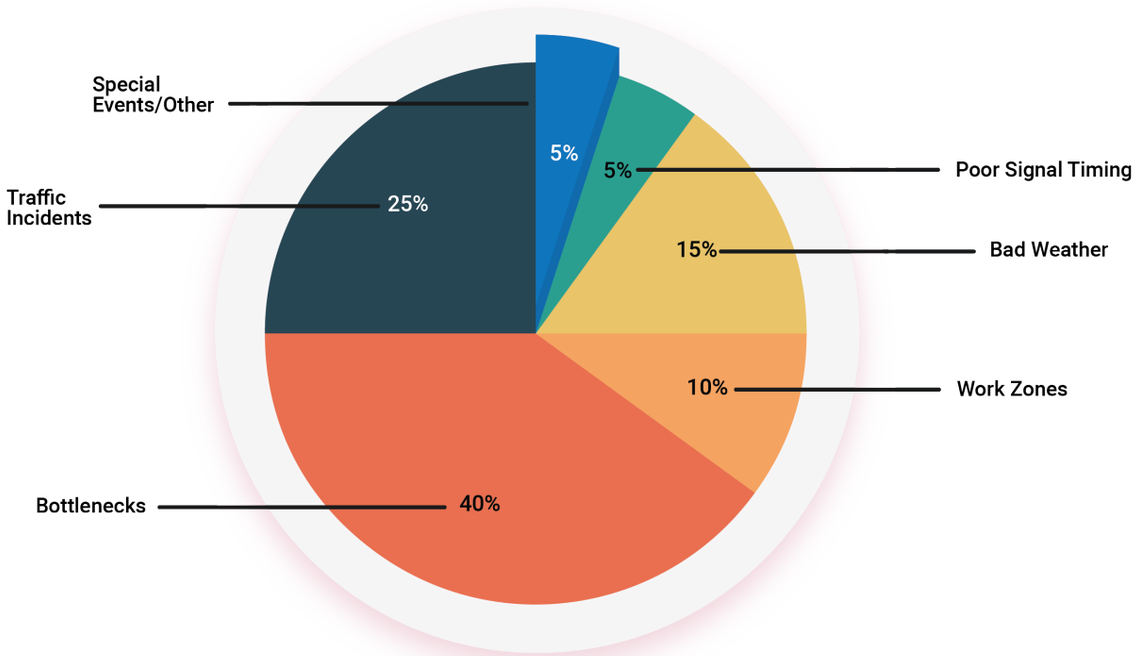
In this report, we look at how analytics can support transportation leaders and planners in their efforts to diagnosis and implement alternative congestion mitigation solutions.

[1] Noland, Robert B. "A review of the evidence for induced travel and changes in transportation and environmental policy in the US and the UK." Transportation Research Part D: Transport and Environment, January 2002.
[2] FHWA. State of the Nation's Highways, Bridges, and Transit. Appendix A: Highway Investment Analysis Methodology," October 2020.

# Precise diagnosis enables faster mitigation

The Federal Highway Administration (FHWA) classifies congestion sources[3] and their share of the overall traffic picture. Bottlenecks and traffic incidents lead, followed by bad weather and work zones.

Although only bottlenecks and signal timing represent persistently located congestion issues, every one of these congestion types can be studied and potentially mitigated by looking at historical trends and effectively quantifying future demand.




**Source:** The FHWA identifies the share of congestion by source.

There are some key questions to address when looking at each of these congestion types:

1. Where is this traffic going to and coming from?
2. Who is in this traffic jam?
3. Why are they on the road right now?
4. What are the time trends in this hotspot?
5. What are the alternatives?

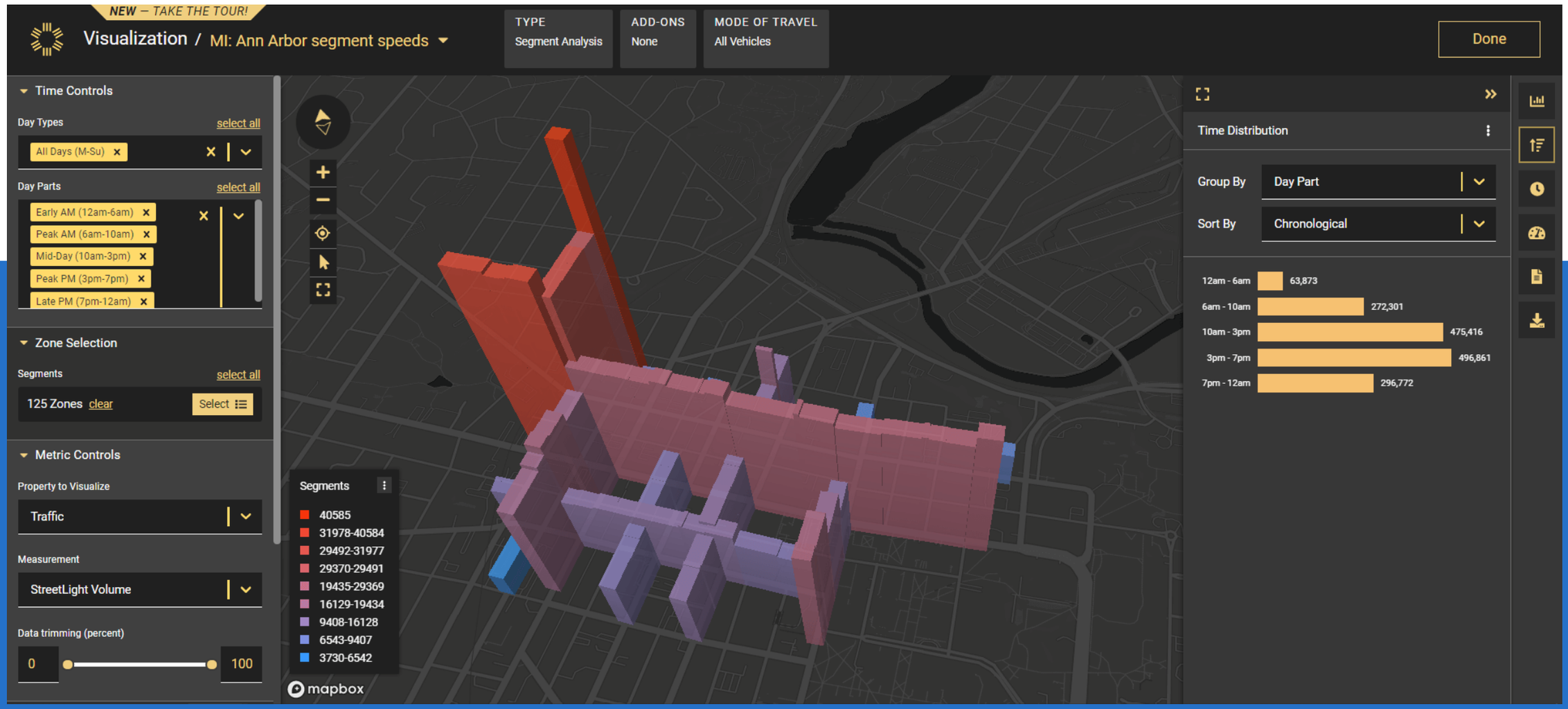
**Remedies aren't effective without a clear, specific diagnosis.** For many transportation agencies, looking beyond the basics of AADT volume or extrapolated traffic counts and diving deep into each of these questions is critical to identify and facilitate targeted congestion solutions.

[3] FHWA. Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation, March 2020.

# Your modern congestion toolkit

## Go deep on time trends and traffic distribution

While spikes in demand may seem unavoidable, deep data analysis enables agencies to better respond to shifts in travel behavior.

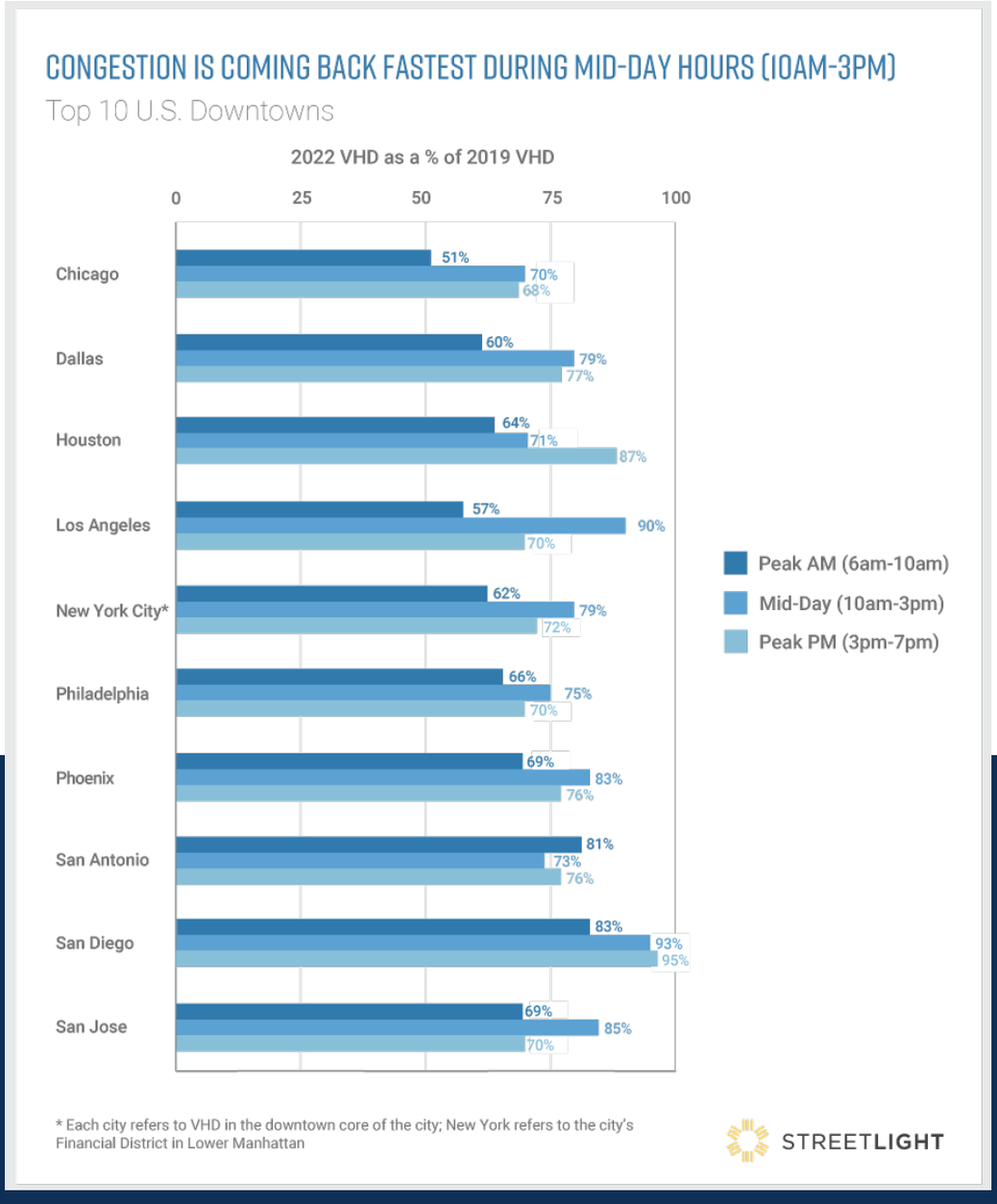



**3D visualization of StreetLight's Segment Analysis metrics sorted by daypart reveals the precise distribution of traffic throughout the day in Ann Arbor, MI.**

COVID was a demonstration of how quickly traffic patterns can change. And even now, we have not yet reached a new travel “normal.”

**A vehicle hours of delay (VHD) analysis of the 10 biggest U.S. downtowns** showed that since COVID, rush hour has pushed later in the day and spread out. This has implications for opening and closing lanes of traffic, timing HOV lane compliance, using personnel to manage congested arteries, and more.

Effectively monitoring and pulling down VHD also has a positive impact on the local economy with fewer hours lost to traffic.




**Where VHD is coming back in the top 10 U.S. downtowns, broken out by weekday daypart.**

Engineers looking at where traffic is happening now can **perform the same diagnosis** on their streets to understand how rush hour is changing. While downtowns may see less traffic overall, suburban main streets may be the new site of unsafe congestion patterns in the work-from-home era.

COVID is a dramatic example, but land use changes may also rapidly shift traffic patterns. When studying the impact of a new corporate office or a stadium opening, seeing travel shifts in narrow time bands and at the street-segment level can help speed up resource reallocation.

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# Understand trip purpose to contextualize traffic

What's causing traffic in a region is often a contentious community issue. Locals are sure congestion is caused by people coming from elsewhere, while out-of-towners resist subsidizing transit investments because they don't believe they'll benefit from them.

Finding out whether people are driving for work or pleasure, and whether they're passing through or stopping in a congested location, can be a helpful way to find factual support for effective solutions.

In the **case of Napa Valley**, the community was sure that congestion was caused by tourists in the region. But planners performed an in-depth trip purpose analysis using StreetLight that included a look at the percentage of commuter versus winery traffic, as well as distribution of trips by day of week. The data showed that *commuters working in the region were the top cause of traffic.*

| TRIP PURPOSE | Avg Mon-Thu Trips | Friday Trips | Saturday Trips |
|---|---|---|---|
| Total | 345,346 | 362,253 | 159,541 |
| Internalized | 26,369 | 25,223 | 8,647 |
| Home-Based Work | 60,393 | 62,932 | 10,618 |
| Home-Based Other | 57,867 | 58,163 | 16,015 |
| Non Home-Based | 49,803 | 53,261 | 6,399 |
| Winery | 47,811 | 56,639 | 50,273 |
| Imported Trip | 66,194 | 67,963 | 34,995 |
| Exported Trip | 36,909 | 38,072 | 32,593 |
| Total Winery Trips (including work trips) | 52,070 | 61,333 | 54,883 |
| Winery Trips from Winery Regression Analysis | 52,245 | 62,217 | 54,713 |
| Difference | -175 | -883 | 170 |
| External Trips (including pass-through) | 125,490 | 128,431 | 88,046 |
| External Trips from Vehicle Classification Counts | — | 126,736 | — |
| Difference | — | 1,695 | — |

**Distribution of trips in Napa Valley based on trip purpose.**

Subsequent surveys of Napa's major employers discovered that 97% of respondents used personal vehicles to commute to work more than half the time, but nearly half said they would use public transportation if it was expanded and convenient. Planners optimized bus schedules based on the information.

Traffic data can also help show where demand isn't, and the analyses can be repurposed for economic development uses. While Napa residents initially pushed for light rail, the data showed demand couldn't support the investment. It did, however, back up a push for affordable housing for Napa Valley workers.

In the case of Lafayette, CA, planners wanted to understand **what could be causing downtown congestion**. They decided to focus on a few different cohorts — public transit-bound commuters, drivers accessing a state highway, students getting dropped off at nearby schools, and shoppers heading to downtown retail stores.

When the analysis showed that the biggest proportion of trips were drivers coming to the downtown retail strip from the state highway, it supported improving connections to highway ramps on nearby access roads.

# Scan for high-priority congestion hotspots

Ultimately, how agencies manage congestion depends on their priorities. Funding and resources are limited, and needs are vast. Locating the biggest trouble spots ensures more targeted allocation of resources. It also enables transportation leaders to prove the even-handedness of their decisions to constituents.

The Northwest Louisiana Council of Governments (NLCOG) MPO used StreetLight to get a **high-level snapshot of their regional roadways** to see precisely where traffic was backing up across 158 miles of corridor. The MPO used the data to calculate a Speed Reduction Factor and found that there was actually no serious congestion on the vast majority of roadways. Instead, the MPO could focus on just 3 corridors with over one mile of severe traffic out of 13 studied. These became top priorities for mitigation efforts.

Findings also revealed that delays occurred on specific roadway sections, signalized intersections, and roadways with two or three inadequately spaced signals (near interstate onramps). Planners prioritized these trouble spots for improvements, focusing on any congestion that impacted transit services.

Similarly, the Eastgate Regional County of Governments MPO in Ohio used StreetLight to refine its identification of congestion corridors in its Congestion Management Process report. [4]

*Table 5.3 – "Severely Congested" (By SRF) Sub-Corridor Determinations*

| Corridor Name / Extents (by cross street) | Direction of Travel | Peak Period | Average SRF | Average Peak AADT | Fixed Route Transit | Programmed Improvement Project/Strategy |
|---|---|---|---|---|---|---|
| Airline Dr (LA 3105) / | | | | | | |
| Beene Bv – I-220 EB Ramp Signal | SB | PM | 63.5% | 5,502 | Yes | Yes – TIP 2023-2026 |
| Viking Dr – Douglas Dr | Bi-direct. | PM | 58.2% | 9,434 | Yes | No |
| Shed Rd – Hilton Dr | Bi-direct. | PM | 61.2% | 8,911 | Yes | No |
| Benton Rd (LA 3) / | | | | | | |
| Hospital Dr – I-220 EB Ramp Sig. | SB | PM | 61.8% | 4,538 | Yes | Yes – TIP 2023-2026 |
| Tilman Dr – I-220 WB Ramp Sig. | NB | PM | 58.9% | 6,209 | Yes | Yes – TIP 2023-2026 |
| Benton Rd – Clovis St | Bi-direct. | PM | 64.3% | 8,274 | Yes | No |
| Bert Kouns Ind. Loop (LA 526) / | | | | | | |
| Highland Hosp. Access-Jump Run | Bi-direct. | PM | 63.4% | 5,873 | Yes | No |
| US 79-80 (E. Texas St.) / | | | | | | |
| Mid-south Loop-Bellevue Signal | WB | PM | 54.4% | 3,376 | No | No |
| Hillcrest Cir-Retail access Bellevue | EB | PM | 59.7% | 5,071 | No | No |
| Segment past Bellevue Rd Signal | EB | AM | 62.3% | 1,889 | No | No |
| Youree Dr (LA 1) / | | | | | | |
| Gator Dr-South Circulation Dr | SB | PM | 57.7% | 5,535 | Yes | No |
| South Circulation Dr-seg past 70th | NB | PM | 55.8% | 4,898 | Yes | No |

**NLCOG ranked corridors by Speed Reduction Factor and other features to prioritize improvements.**

[4] Eastgate Regional Council of Governments. *Congestion Management Process,* July 2019.

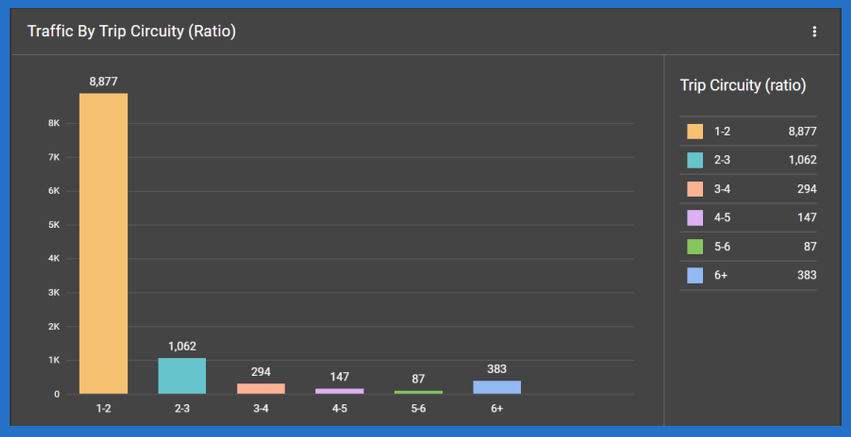
# Identify short, circuitous trips for mode shift

Analyzing congestion mitigation opportunities goes beyond identifying where and when trouble occurs. On-demand analytics make it possible to identify specific types of trips that would be better served by alternative modes.

In Northern Virginia, one of the most congested regions in the country, regional transportation agencies knew there were limited resources for building new roads or expanding the highway. Instead, project partners **pre-scanned hundreds of locations for *trip reduction potential.***

The planners ranked the shortest, most circuitous (least direct) trips, including trips internal to the zone. This highlighted regions with the most potential for road network or connectivity improvements to replace short vehicle trips with bike or pedestrian travel.

**Trips in Streetlight Insight® can be categorized according to circuity to understand the volume of inefficient routes and identify candidates for mode shift.**




| Link Description & Direction | Flow (000) | Top O-D Pair (%) | Trips < 5 mi (%) | Trips < 2 mi (%) | Trips < 1 mi (%) |
|---|---|---|---|---|---|
| Neabsco Mills Rd (US 1 - Optiz Blvd) SB | 67.5 | 10.7 | 2.9 | 0.7 | 0.2 |
| VA-28 (1-66 to Westfields Blvd) SB | 60.3 | 1.4 | 3.4 | 1.1 | 0.3 |
| 1-66 (US-29 to VA-120) WB | 55.7 | 2.0 | 0.0 | 0.0 | 0.0 |
| US-50 (VA-286 to I-66) EB | 51.3 | 1.4 | 3.3 | 1.4 | 0.4 |
| VA-123 (George Wash. Pkwy to Chain Bridge) | 47.8 | 10.6 | 0.5 | 0.1 | 0.0 |
| US-50 (Stringfellow Rd to VA-286) EB | 47.6 | 1.5 | 5.5 | 1.5 | 0.4 |
| US-50 (VA-28 to Lees Corner Rd) EB | 45.0 | 1.6 | 10.2 | 4.4 | 2.0 |
| US-50 (Stringfellow Rd to VA-286) WB | 43.2 | 1.4 | 3.8 | 1.4 | 0.3 |
| I-66 (t-495 to VA-7) WB | 41.0 | 0.9 | 0.4 | 0.1 | 0.0 |

**Northern Virginia used a prioritization framework to identify segments with high trip reduction potential.**

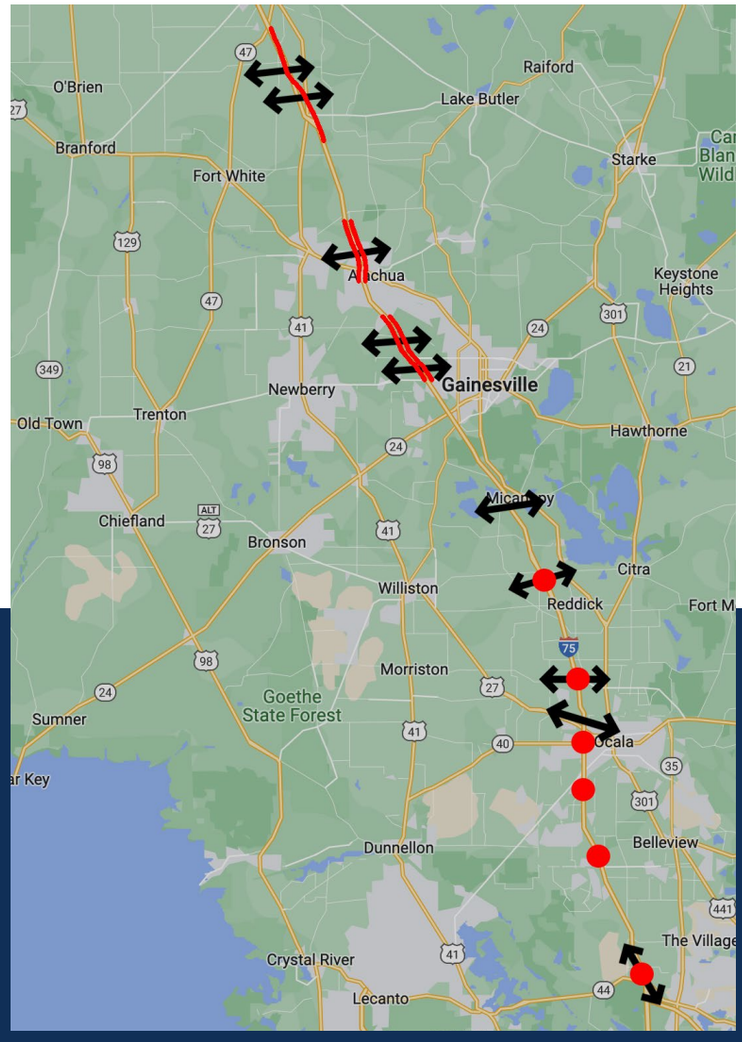
Metrics around the George Mason University area showed that increasing pedestrian, biking, and transit connections, while simultaneously introducing more competitive pricing at nearby parking lots, could remove between 250,000 and 400,000 vehicle trips per year. Additionally, several thousand highly circuitous vehicle trips of less than one mile originated in the neighborhood immediately adjacent to a metro station. Adding limited-use crossings for bikes and pedestrians could remove between 100,000 to 152,000 vehicle trips per year.

By improving transit and active transportation infrastructure in these areas, planners can encourage mode shift, which can help reduce the community's transportation emissions and facilitate more equitable outcomes.

# Reroute truck traffic

Trucks play a significant role in congestion and an even bigger role in emissions production. Gaining a nuanced understanding of the makeup of commercial vehicles on the road (light- versus medium- versus heavy-duty), as well as freight routing patterns, goes a long way to effectively rerouting truck traffic to enable safer routes, less congestion, and lower emissions.

In the case of the Florida DOT, the agency wanted to understand how much of the truck traffic it saw on I-75 was **short- versus long-haul,** knowing that it would be easier to reroute long-haul traffic to alternative routes and free up space on the highway. An analysis using StreetLight found that a greater percentage of southbound trucks were long-haul, allowing the agency to focus on rerouting this freight movement.




**Freight study area of I-75 in central Florida.**

More recently, increased truck activity has caused more congestion and unsafe conditions on local, residential roads throughout the country. To understand and address the **impact of truck traffic around the busy Port of Oakland region,** planners focused on a large area scan of freight activity. They then drilled down to understand hourly traffic volume and see whether trouble spots occurred when freight movement coincided with regular commute periods.

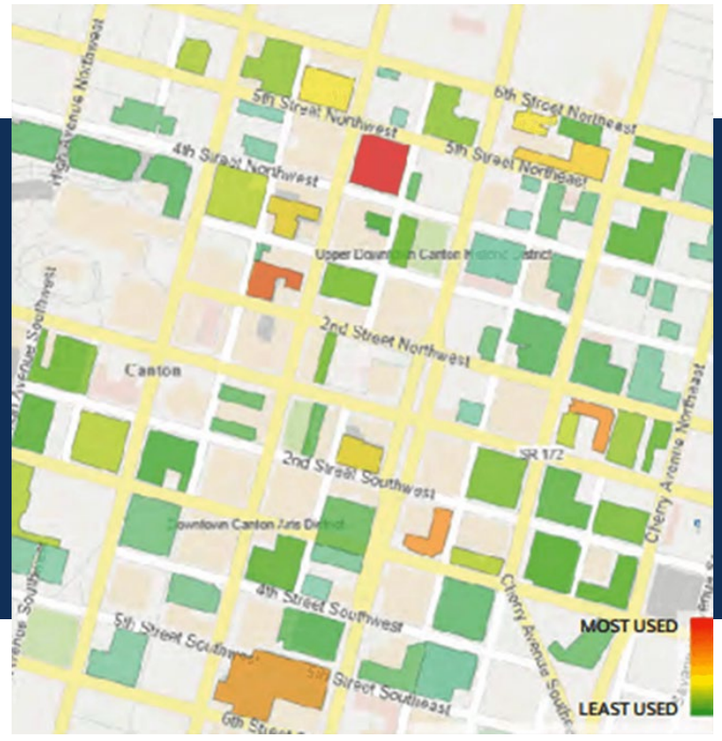
StreetLight's Top Routes Analysis revealed that route preference did not always align with established truck routes, and identified factors (such as heavy traffic and long-distance trips) that caused trucks to deviate from established routes. These insights enabled the agency to make recommendations to local authorities for easing truck congestion.

# Manage traffic for special events and attractions

Anyone caught in traffic around a major tourist attraction knows how much it can ruin an otherwise fun day. It's one example of why the intersection between land use and traffic is so important. A new attraction or a special event will cause a major traffic backup if not managed properly. (The FHWA notes that special events account for 5% of congestion sources.)

In the case of the Pro Football Hall of Fame in Ohio, the new attraction was expected to multiply tourism in the region by 10, which could put a **major strain on roadways,** especially during Enshrinement Week.

When planners analyzed travel and parking patterns, however, they found that most visitors came from within 25 miles of the site. Instead of building new parking structures, they were able to identify underutilized parking structures downtown and encourage the use of shuttles and pedestrian walkways to reach the Hall.

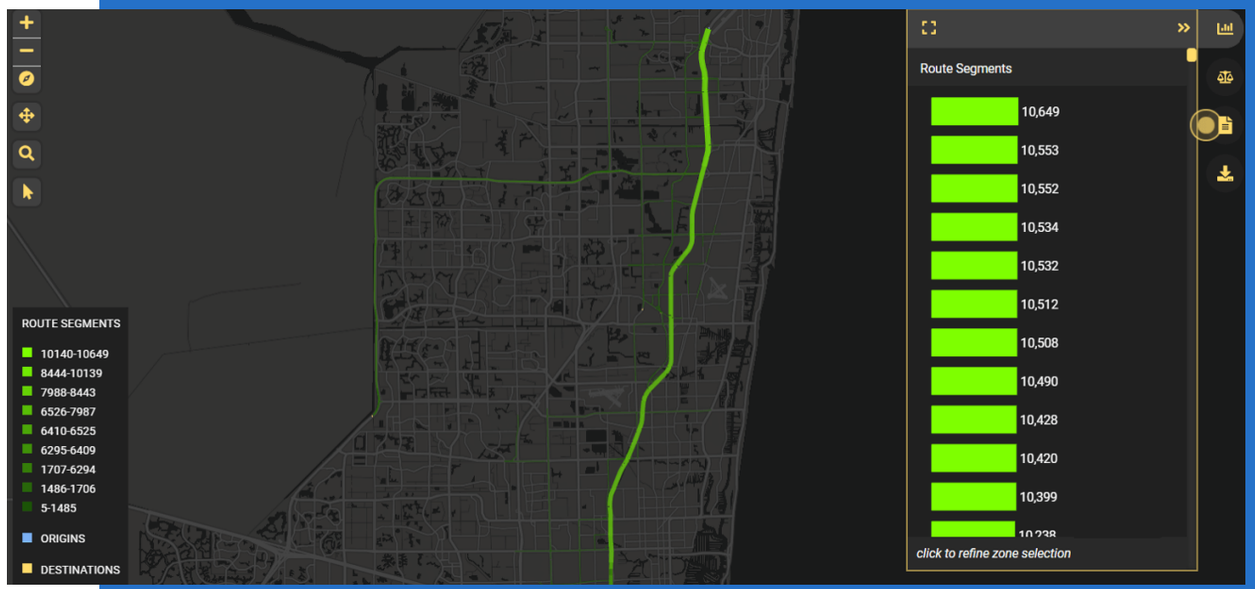



**Downtown parking lot comparison in downtown Canton.**

The analysis also showed the one key corridor that most travelers used to access the Hall, enabling planners to focus improvements on this road.

# Proactively plan work zones for safety and congestion

Roadway workers face unique safety challenges that result in over 700 fatalities in work zones each year. Many of these work zone crashes involve large trucks and buses due to their limited maneuverability and large blind spots.




**Streetlight's Top Routes feature can be used to highlight alternate routes or assess route diversions for work zone planning.**

While efforts to tame congestion in a work zone are important (work zones account for 10% of congestion sources, per FHWA), they must work in concert with safety strategies.

**Analytics support this** by enabling work zone planners to know the peak hours and traffic conditions surrounding work zones so they can properly plan for safe and efficient mitigation strategies such as temporary traffic control. Up-to-date road volumes for the route under construction and alternative routes can also help planners understand whether a full or partial road shutdown may be advisable.

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# Quantify impact of congestion pricing, managed tolling, and HOV lanes

Congestion pricing is a politically charged issue, but it has the potential to make a significant impact on congestion. It can help with load balancing, especially if pricing is responsive to heavy usage times and encourages higher-occupancy travel options.

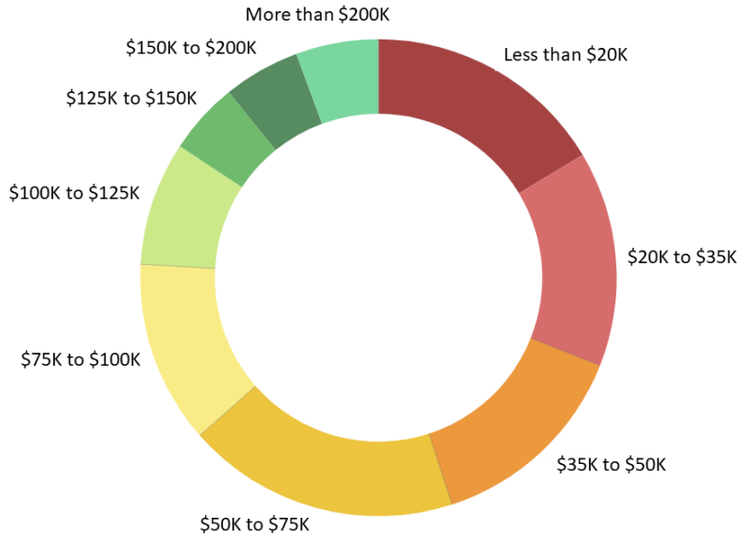
A critical part of any congestion pricing effort is gaining deep understanding of who's using the roadway network, in terms of driver demographics, trip purpose, and route, among other details.

But running a major congestion study is difficult and costly, especially when trying to include household travel surveys, employer surveys, and travel demand modeling. Often, by the time this information is collected and analyzed, it is already outdated, and covers only a small sample of the population.

For Atlanta, one of the fastest-growing metros in the U.S. and among the most congested cities, StreetLight's **analysis of Spring Street,** a major commuter road in Midtown, shows that 29,000 daily trips took place at the time of analysis.

More relevant for congestion pricing — only 22% of weekday rush hour trips came from Atlanta locals. The rest came from outside Atlanta. In fact, 66% of trips on Spring Street during the morning peak period came from more than 10 miles away.

There are often concerns with who will foot the bill for congestion pricing. Will the burden fall disproportionately on lower-income commuters? The Spring St. analysis showed that people making less than $35K/year made up 26% of trips, while 30% of trips were made by people making more than $100K.




**Distribution of household income for Spring Street's morning rush hour drivers.**

Other types of price-managed roadway projects incorporate nuanced differences in pricing, such as free access for high-occupancy vehicles (HOV) or buses. The Maryland DOT undertook a major review of how price-managed lanes on I-495 and I-270 would affect traffic and revenue, with the contracted AEC using StreetLight travel pattern data to model impact. [5]

Pricing on major roadways may become a more urgent issue **as electric vehicles become more common and gas taxes decrease.** A pricing system for roadway usage may be needed to support roadway maintenance. Whether you call it congestion pricing or not, understanding who is using the roadway, along with where they're coming from and going to, is critical to any pricing strategy effort.

[5] MDOT Maryland Department of Transportation State Highway Administration. *I-495 and I-270 Phase 1 Priced Managed Lanes Comprehensive Traffic and Revenue Study,* November 2019.

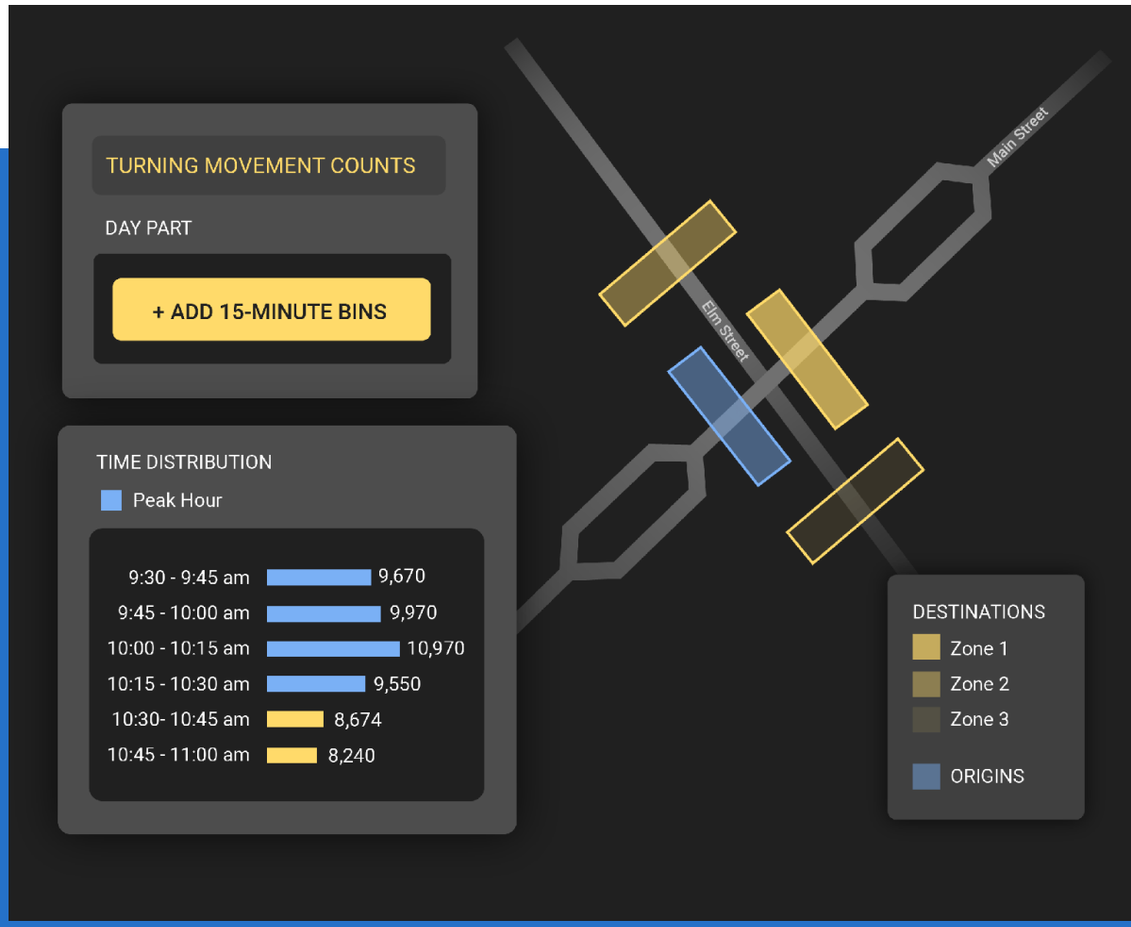
# Optimize signal timing and roundabouts for better intersection traffic flow

Efficient intersections are crucial for mitigating traffic.

The Insurance Institute for Highway Safety (IIHS) notes that roundabouts are a safer alternative to traffic signals and stop signs, and they improve traffic flow. [6]

In Maine, the DOT used StreetLight for its Bangor St. road diet proposal, noting the particular usefulness of Big Data analytics to get turning movement count data at the Bangor St. roundabout. Roundabouts pose a **particular challenge for traditional data collection** due to the complex nature of vehicle movements at these intersections. Analytics enabled the capture of this data, which was then used to model how a proposed update would impact future traffic conditions.

Turning movement count (TMC) data can also be useful for signal retiming efforts. The city of Brownsville and the LADOT both used StreetLight's TMC data for COVID-era signal retiming. Similarly, the MPO NLCOG  in Louisiana used StreetLight's traffic count data in their signal retiming efforts as part of the broader congestion mitigation strategy discussed earlier.




**Streetlight's Turning Movement Count (TMC) product can be used to optimize signal timing.**

[6] Insurance Institute for Highway Safety. *Roundabouts*, July 2022.

# Congestion is always a hot-button issue. These metrics enable faster congestion solutions:

- VMT
- Origin-Destination
- Speed
- Trip Duration
- Traffic Volume
- Vehicle Hours of Delay
- Turning Movement Counts
- Top Routes
- Circuity Analyses
- Demographics

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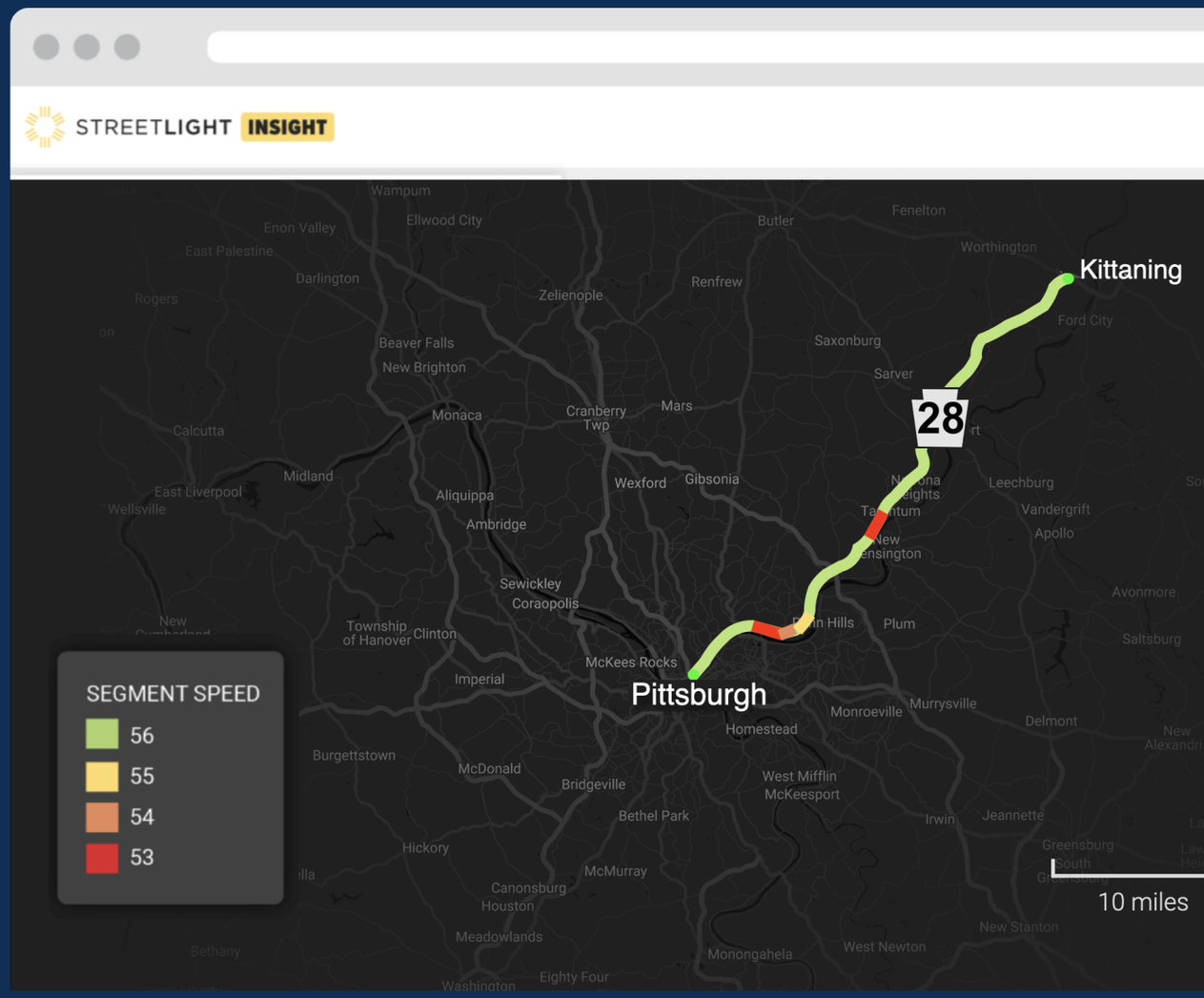

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StreetLight pioneered the use of Big Data analytics to shed light on how people, goods, and services move, empowering smarter, data-driven transportation decisions. StreetLight applies proprietary machine-learning algorithms and its vast data processing resources to measure travel patterns of vehicles, bicycles, and pedestrians, accessible as analytics on the StreetLight InSight® SaaS platform. Acquired by Jacobs as a subsidiary in February 2022, StreetLight provides innovative digital solutions to help communities reduce congestion, improve safe and equitable transportation, and maximize the positive impact of infrastructure investment. For more information, please visit:

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