

# Trends in Transportation: The Future of GIS in Smart Transportation

Terry Bills

# Current Trends in Transportation

## *Change and Disruption*

- **Decline in Auto Ownership by Millennials**
- **New Means of Transport (Transportation Network Companies - TNCs)**
- **Growth (but also dissatisfaction) in Public Transport**
- **Increasing Congestion in Cities**

# Smart Cities Challenge

Requires Solving our Transportation and Mobility Issues



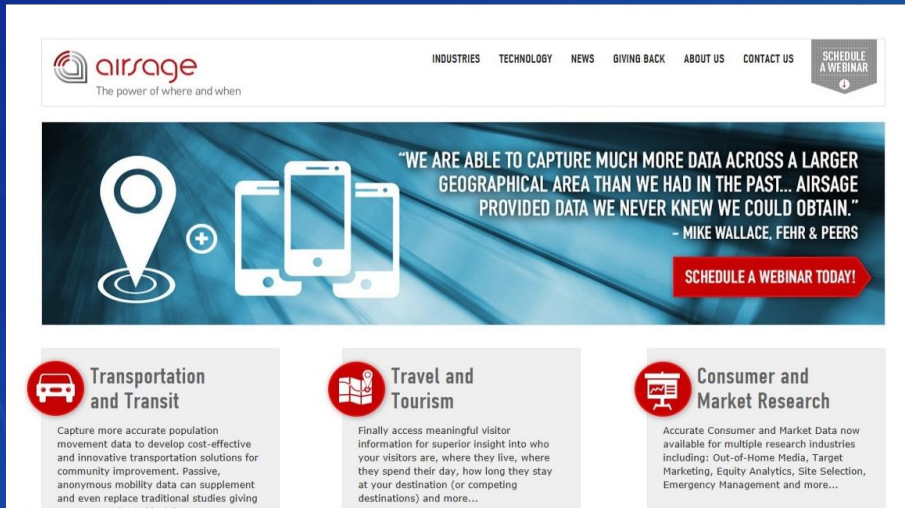
# Opportunities in Transportation

## To Address Change and Disruption

- **New Data Sources to Better Understand Mobility Patterns**
- **Big Data Analytics and Spatial Analysis**
- **Breaking Down the Silos**
- **“Smart Cities / Smart Transportation”**

# New Data Sources

## Leveraging Cellular Data for Travel Information



The screenshot shows the AirSage website with a navigation bar including links for INDUSTRIES, TECHNOLOGY, NEWS, GIVING BACK, ABOUT US, and CONTACT US. A 'SCHEDULE A WEBINAR' button is also present. The main banner features a graphic of a location pin and mobile phones, with a quote from Mike Wallace, Fehr & Peers: "WE ARE ABLE TO CAPTURE MUCH MORE DATA ACROSS A LARGER GEOGRAPHICAL AREA THAN WE HAD IN THE PAST... AIRSAGE PROVIDED DATA WE NEVER KNEW WE COULD OBTAIN." Below the banner are three sections: Transportation and Transit, Travel and Tourism, and Consumer and Market Research, each with a brief description of the data's application.

**air sage**  
The power of where and when

INDUSTRIES TECHNOLOGY NEWS GIVING BACK ABOUT US CONTACT US SCHEDULE A WEBINAR

"WE ARE ABLE TO CAPTURE MUCH MORE DATA ACROSS A LARGER GEOGRAPHICAL AREA THAN WE HAD IN THE PAST... AIRSAGE PROVIDED DATA WE NEVER KNEW WE COULD OBTAIN."  
- MIKE WALLACE, FEHR & PEERS

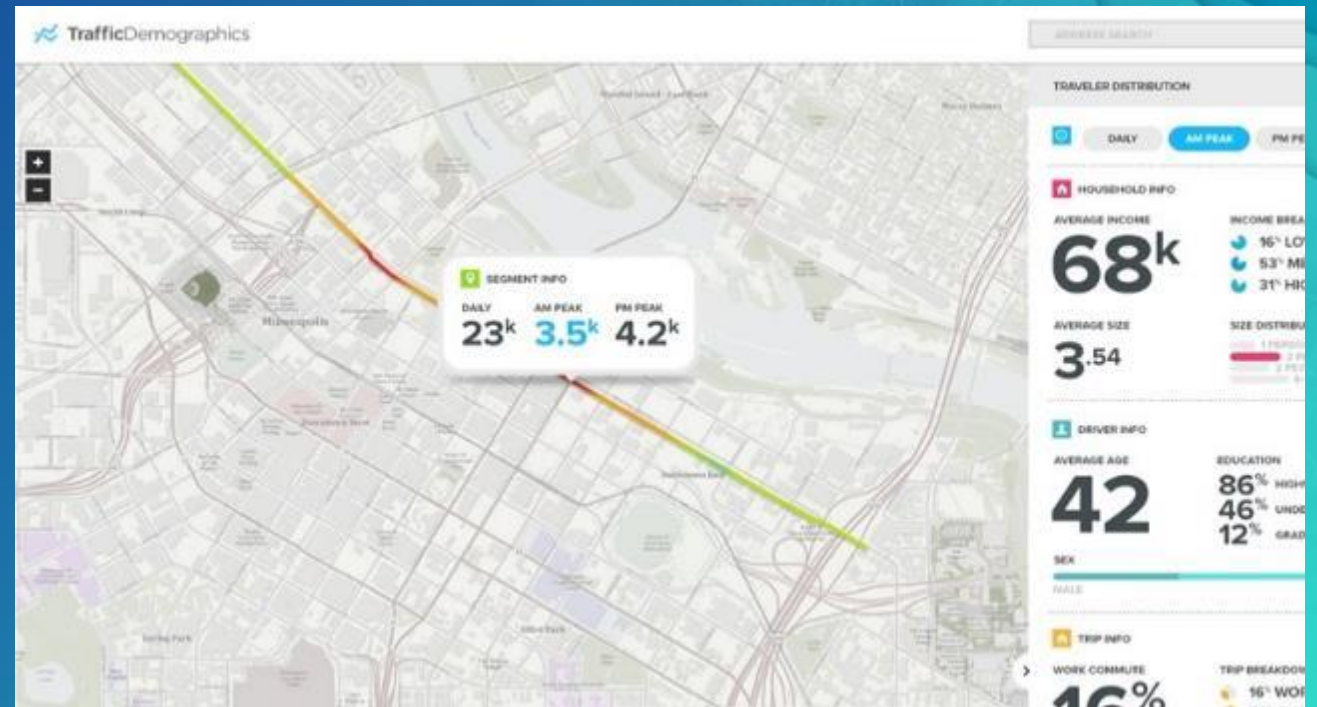
SCHEDULE A WEBINAR TODAY!

**Transportation and Transit**  
Capture more accurate population movement data to develop cost-effective and innovative transportation solutions for community improvement. Passive, anonymous mobility data can supplement and even replace traditional studies giving

**Travel and Tourism**  
Finally access meaningful visitor information for superior insight into who your visitors are, where they live, where they spend their day, how long they stay at your destination (or competing destinations) and more...

**Consumer and Market Research**  
Accurate Consumer and Market Data now available for multiple research industries including: Out-of-Home Media, Target Marketing, Equity Analytics, Site Selection, Emergency Management and more...

- AirSage Cellular Tracking Data



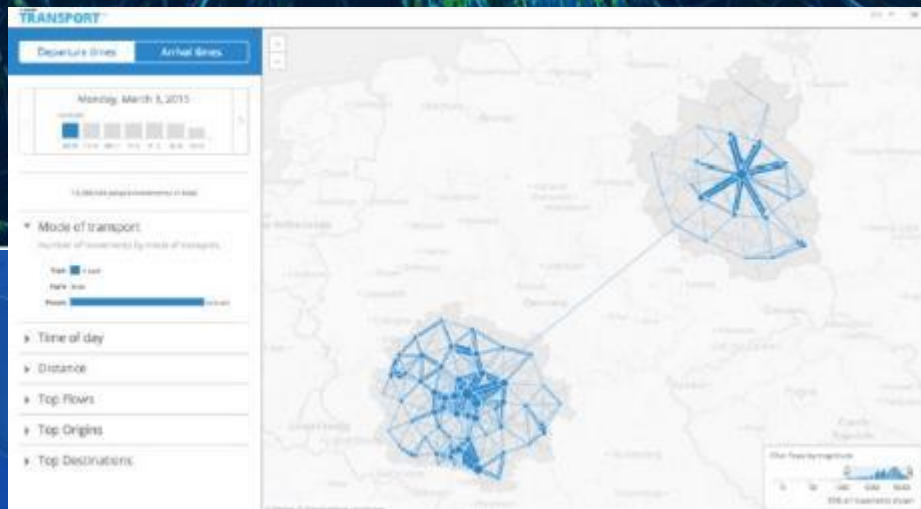
Citilabs Streetlytics Demographic data

# New Data Sources

## Leveraging Cellular Data for Travel Information

### TERALYTICS MOBILITY INSIGHTS

Human Behavior from Telecom Data



[Home](#) [Location Data](#) [Careers](#) [Blog](#)

### WE PREDICT THE PAST.

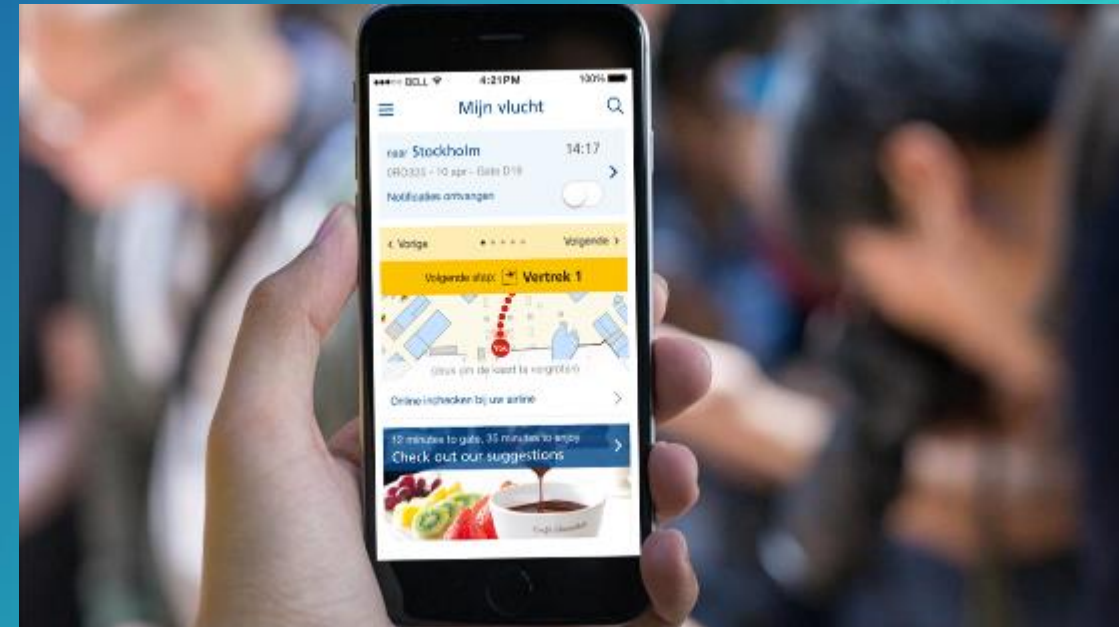
SafeGraph is unlocking the world's most powerful data so that machines and humans can answer society's toughest questions.

SafeGraph

# New Data Sources

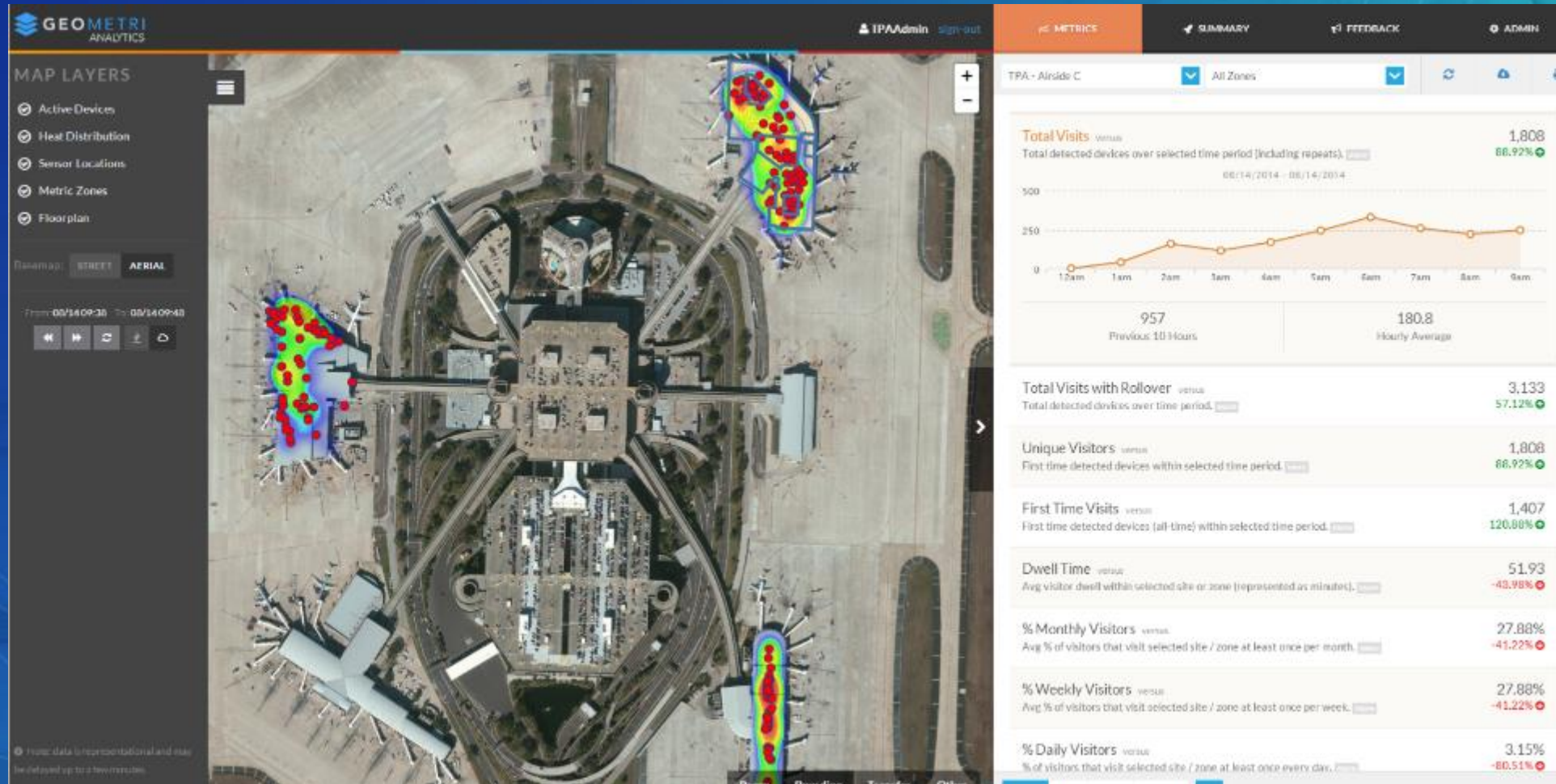
## Leveraging Cellular Data for Travel Information

- Twitter Posts
- Indoor (Bus) Tracking with Wi-Fi and Bluetooth
- *"We are just beginning to understand how we can use the technology for understanding consumer behavior."*
- *Josh Kavangh U of Washington*



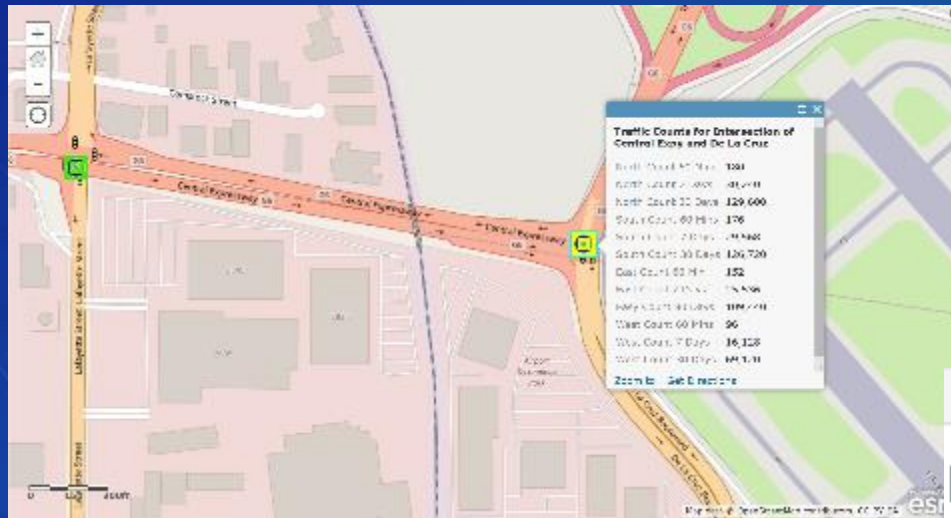
# New Data Sources

## Leveraging Cellular Data for Travel Information



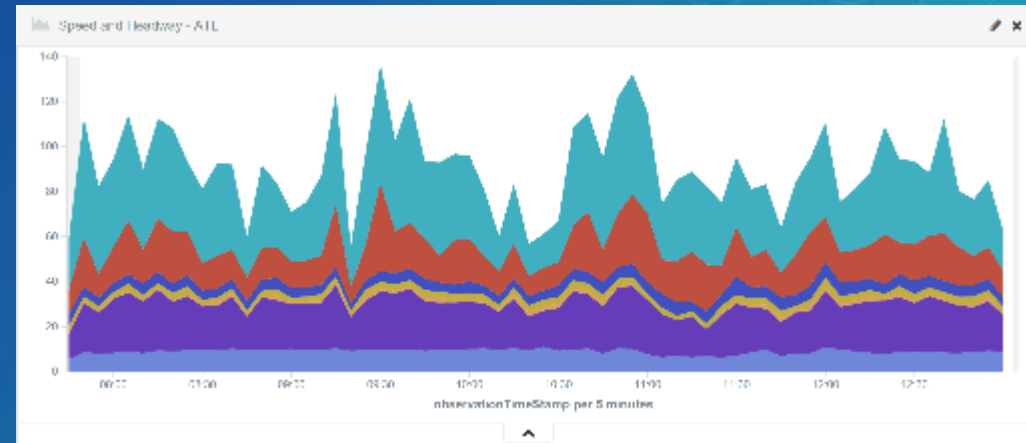
# New Data Sources

## Leveraging Traffic Cameras for Real Time Counts and Speed Data



4 Way Traffic Counts from Traffic Camera

Metrotech



Speed and Count - ATL		
Table Request Response Statistics		
observationTimeStamp per 10 minutes	Count	Average speed
October 1st 2016, 03:30:00.000	73	10.247
October 1st 2016, 03:40:00.000	175	9.948
October 1st 2016, 03:50:00.000	194	9.985
October 1st 2016, 04:00:00.000	174	10.77
October 1st 2016, 04:10:00.000	203	9.872
October 1st 2016, 04:20:00.000	211	10.458
October 1st 2016, 04:30:00.000	220	11.373
October 1st 2016, 04:40:00.000	213	11.089
October 1st 2016, 04:50:00.000	277	10.838
October 1st 2016, 05:00:00.000	275	11.580

*“MetroTech converted our traffic cameras into 24 x 7 count stations, providing us with enhanced traffic data. From this data, we were able to improve our signal timing, mitigating overall congestion.”*

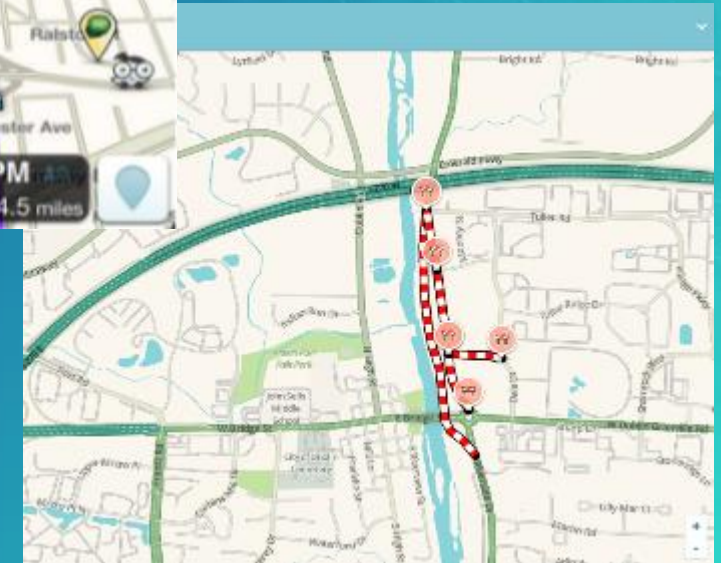
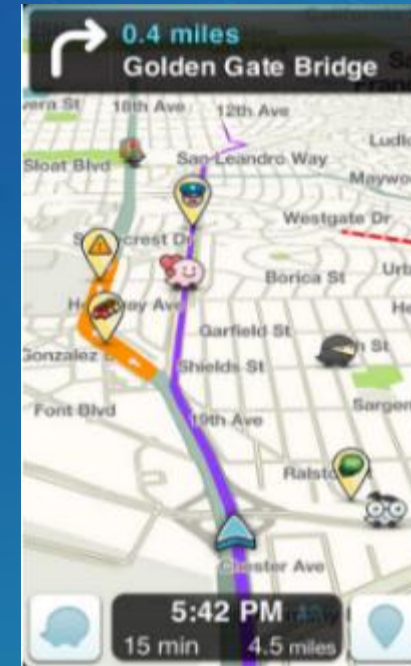
Ananth Prasad Senior Civil Engineer County of Santa Clara

# Leveraging Crowd Sourcing

## Every Citizen is a Sensor



*Waze Partnership*



# Understanding Big Data

- **Sensor Information and Big Data:** generating massive amounts of data
- **Three V's of Big Data: Volume, Velocity and Variety:** the sheer amount, the speed, and the different types of data
- **Magnifies the problem of understanding and context**



# Smart GIS Embeds Advanced Analytics and Visualization

Providing a System of Insight



*Enabling Smarter Transportation*



# Real-Time

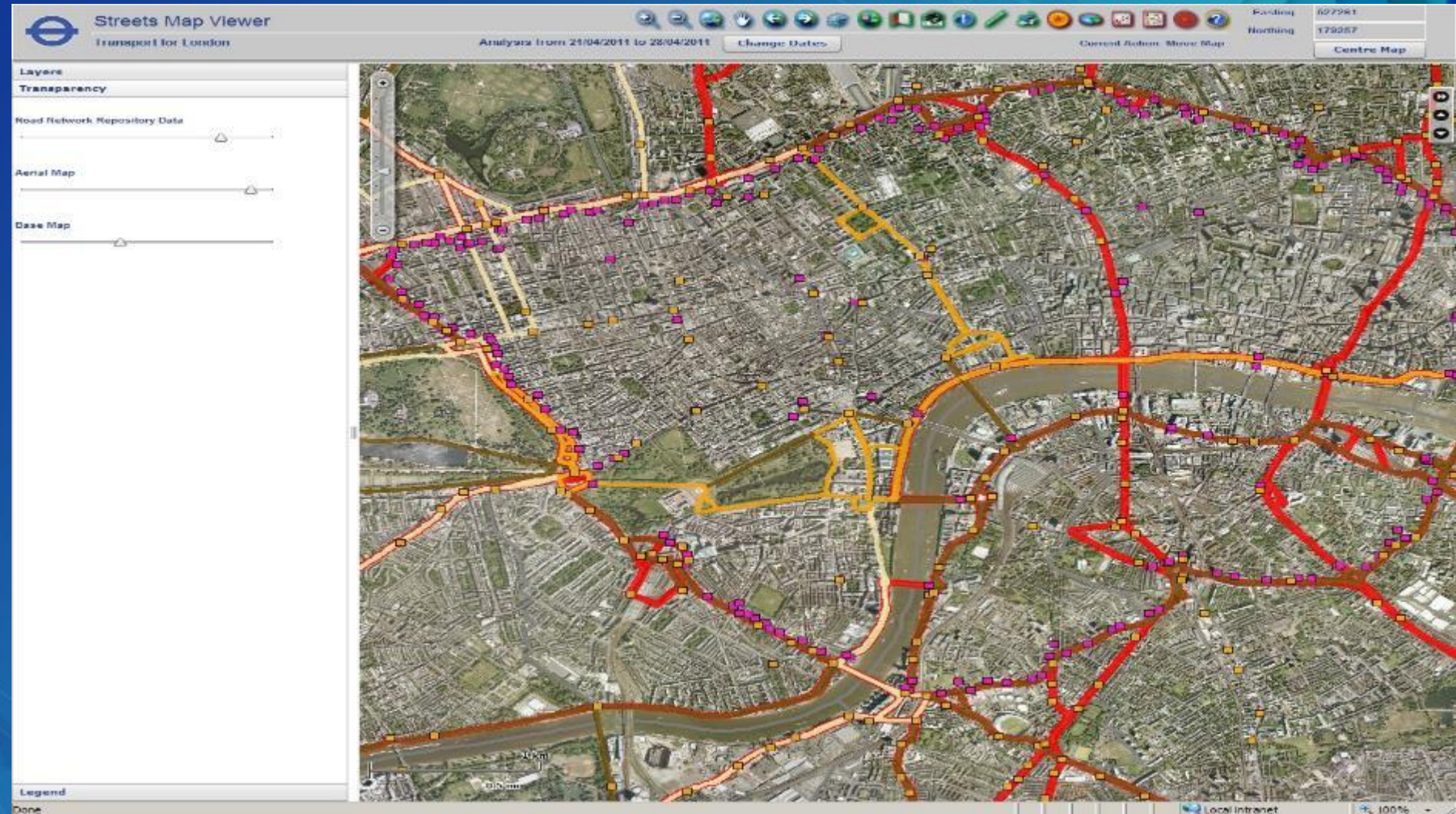
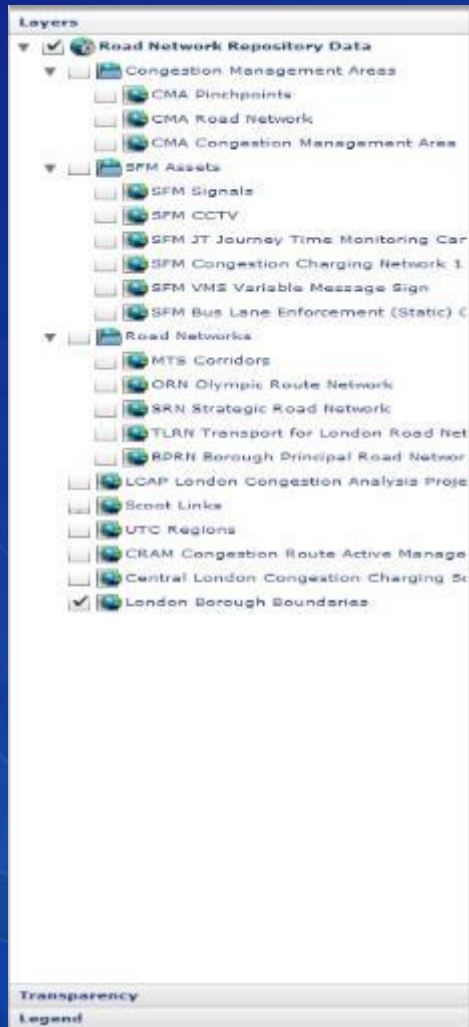
## Integrating Sensor Networks and the IoT

- High-Velocity Data Streams
- Monitoring and Alerting
- Dynamic and Big Data Analytics

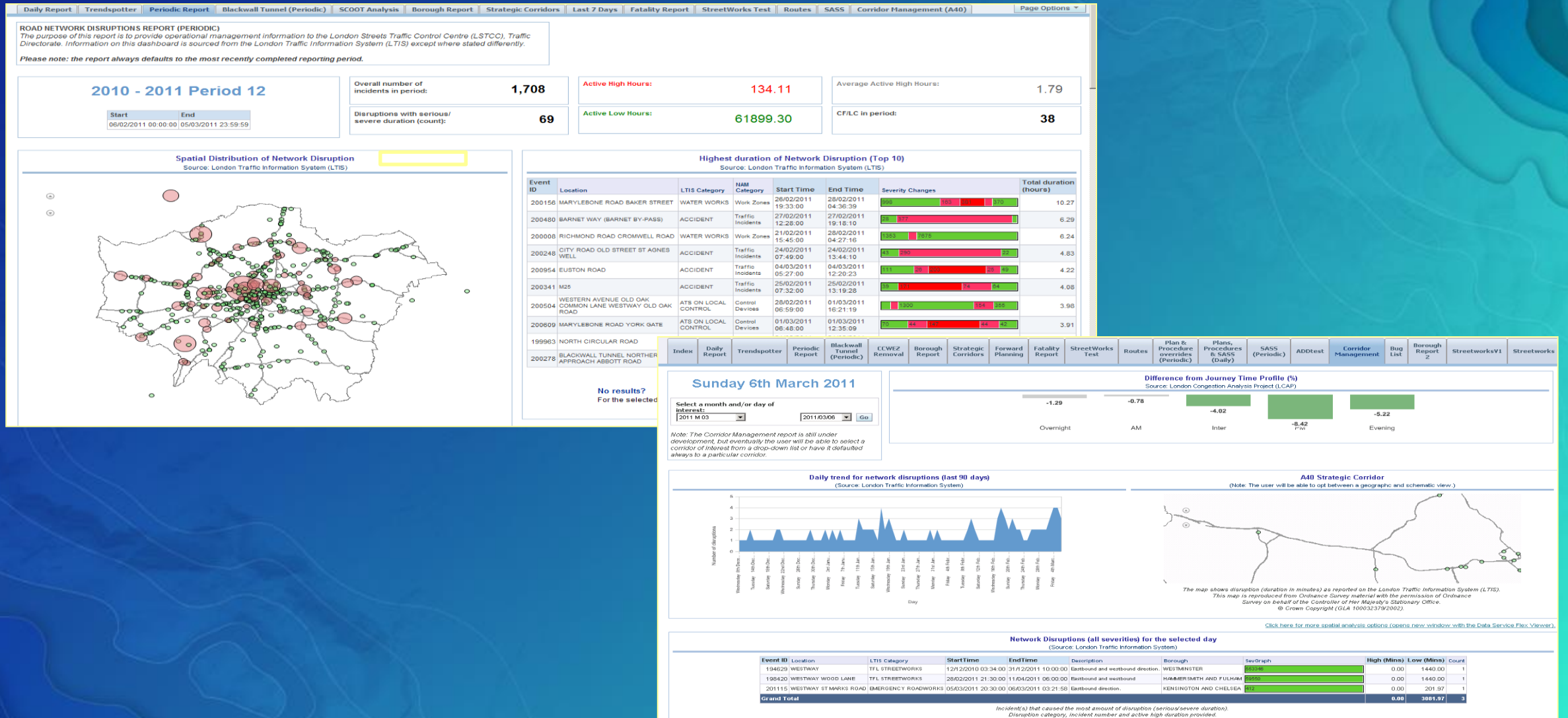


*Supporting Real-Time GIS Applications . . .  
... Enabling Smarter Organizations*

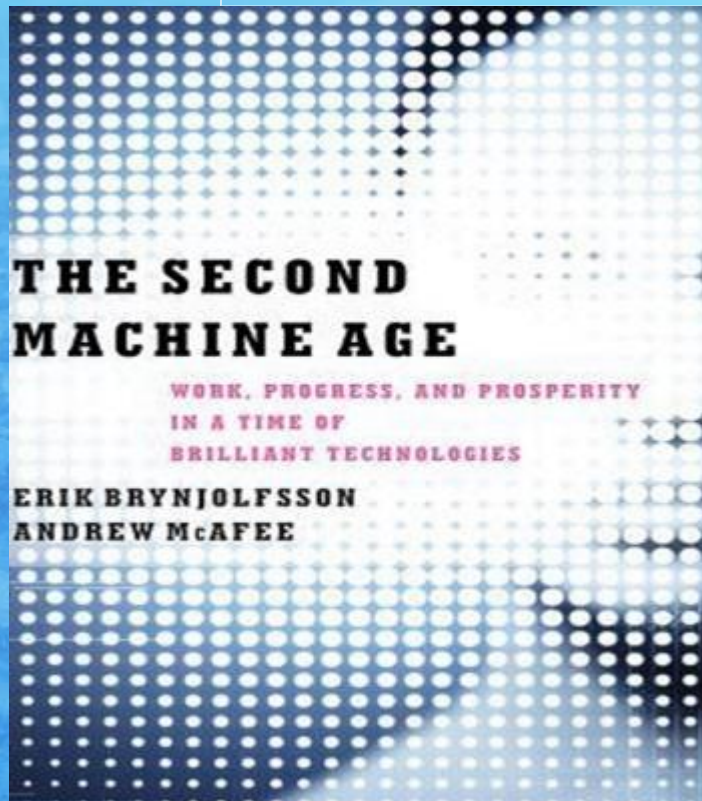
# Big Data Analysis



# Big Data Analysis



## Leveraging GIS and Big Data Analysis



**Adaptive Signal Control Systems  
Connected Vehicle  
Intelligent Operations Center**



# Everything is Driven by Location



Connected Vehicles



Car Insurance

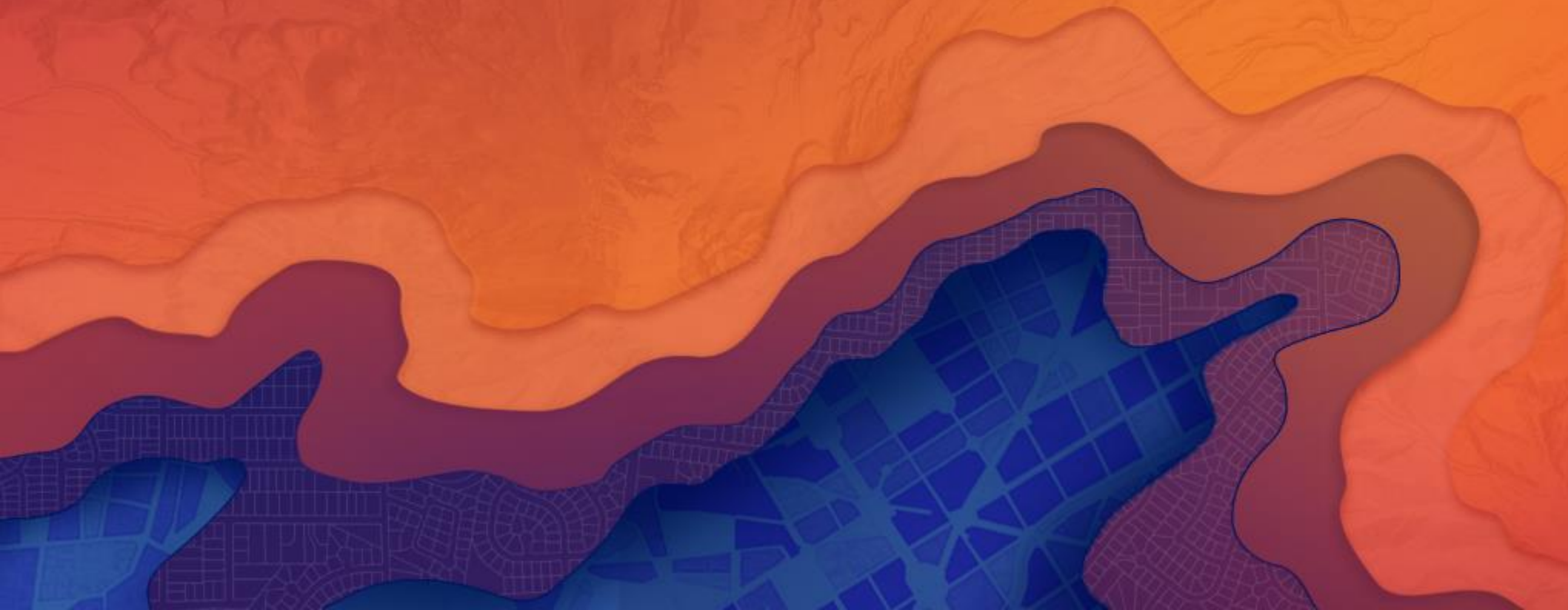


Parking Fees and Management



Toll Collection Systems

Mobility



# Transit Accessibility

"As states and regions strive to put Americans back to work, policymakers should be careful not to sever the transportation lifelines between workers and jobs."

## Missed Opportunity: Transit and Jobs in Metropolitan America

Adie Tomer, Elizabeth Knoebone, Robert Puentes, and Alan Berube

### Findings

An analysis of data from 371 transit providers in the nation's 100 largest metropolitan areas reveals that:

- **Nearly 70 percent of large metropolitan residents live in neighborhoods with access to transit service of some kind.** Transit coverage is highest in Western metro areas such as Honolulu and Los Angeles, and lowest in Southern metro areas such as Chattanooga and Greenville. Regardless of region, residents of cities and lower-income neighborhoods have better access to transit than residents of suburbs and middle/higher-income neighborhoods.
- **In neighborhoods covered by transit, morning rush hour service occurs about once every 10 minutes for the typical metropolitan commuter.** In less than one quarter of large metro areas (23), however, is this typical service frequency, or "headway," under 10 minutes. These include very large metro areas such as New York, Los Angeles, Houston, and Washington. Transit services city residents on average almost twice as frequently as suburban residents.
- **The typical metropolitan resident can reach about 30 percent of jobs in their metropolitan area via transit in 90 minutes.** Job access differs considerably across metro areas, from 60 percent in Honolulu to just 7 percent in Palm Bay, reflecting variable transit coverage levels and service frequencies, and variable levels of employment and population decentralization. Among very large metro areas, the share of jobs accessible via transit ranges from 37 percent in Washington and New York to 16 percent in Miami.
- **About one-quarter of jobs in low- and middle-skill industries are accessible via transit within 90 minutes for the typical metropolitan commuter, compared to one-third of jobs in high-skill industries.** This reflects the higher concentration of high-skill jobs in cities, which are uniformly better served by transit. It also points to potentially large accessibility problems for workers in growing low-income suburban communities, who on average can access only about 22 percent of metropolitan jobs in low- and middle-skill industries for which they may be best qualified.
- **Fifteen of the 20 metro areas that rank highest on a combined score of transit coverage and job access are in the West.** Top performers include metro areas with noted transit systems such as New York, Portland, San Francisco, and Washington, but also Salt Lake City, Tucson, Fresno, and Las Vegas. Conversely, 15 of the 20 metro areas that rank lowest are in the South.

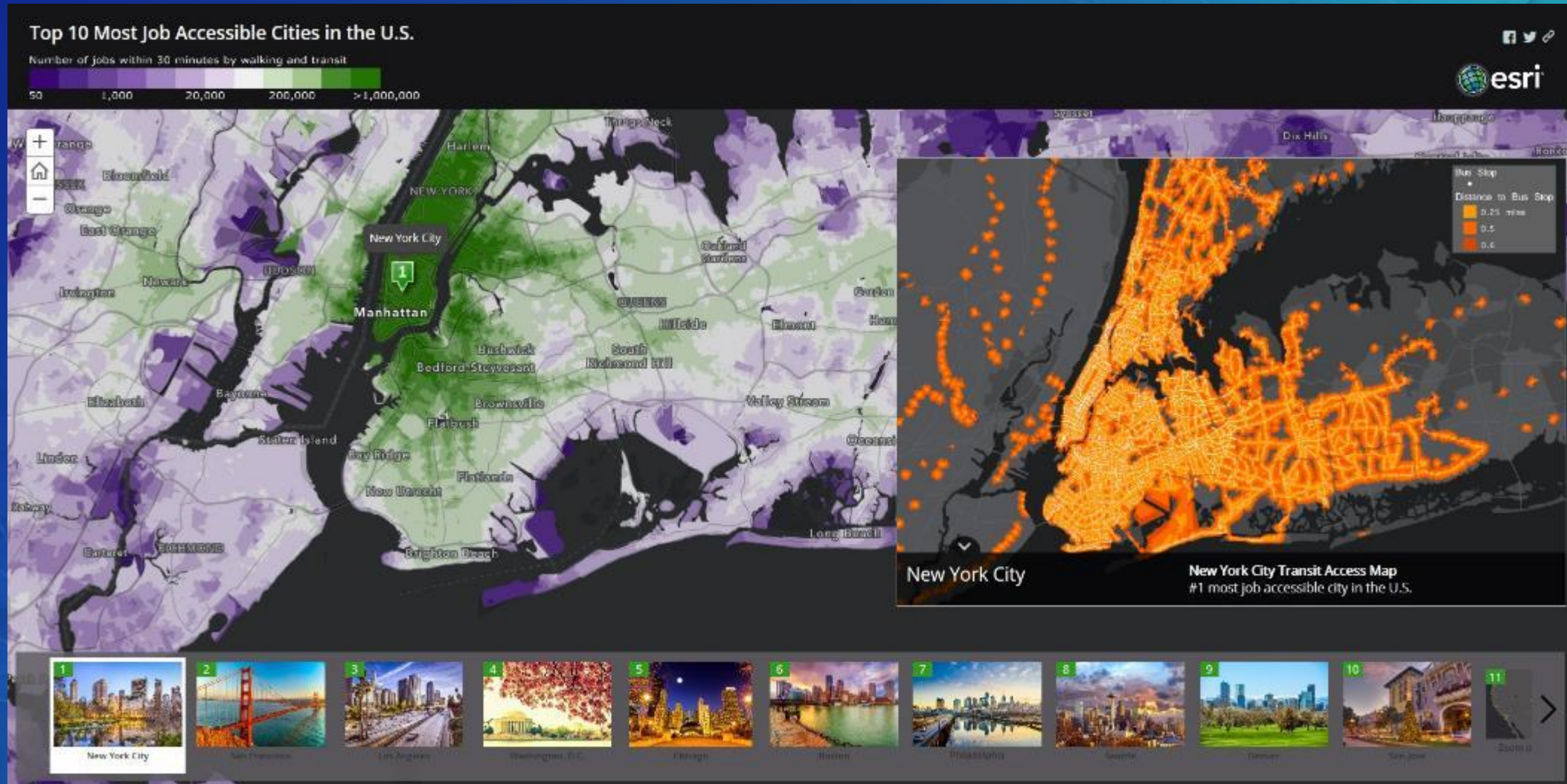
These trends have three broad implications for leaders at the local, regional, state, and national levels. Transportation leaders should make access to jobs an explicit priority in their spending and service decisions, especially given the budget pressures they face. Metro leaders should coordinate strategies regarding land use, economic development, and housing with transit decisions in order to ensure that transit reaches more people and more jobs efficiently. And federal officials should collect and disseminate standardized transit data to enable public, private, and non-profit actors to make more informed decisions and ultimately maximize the benefits of transit for labor markets.

### Metropolitan Transit Access: Coverage

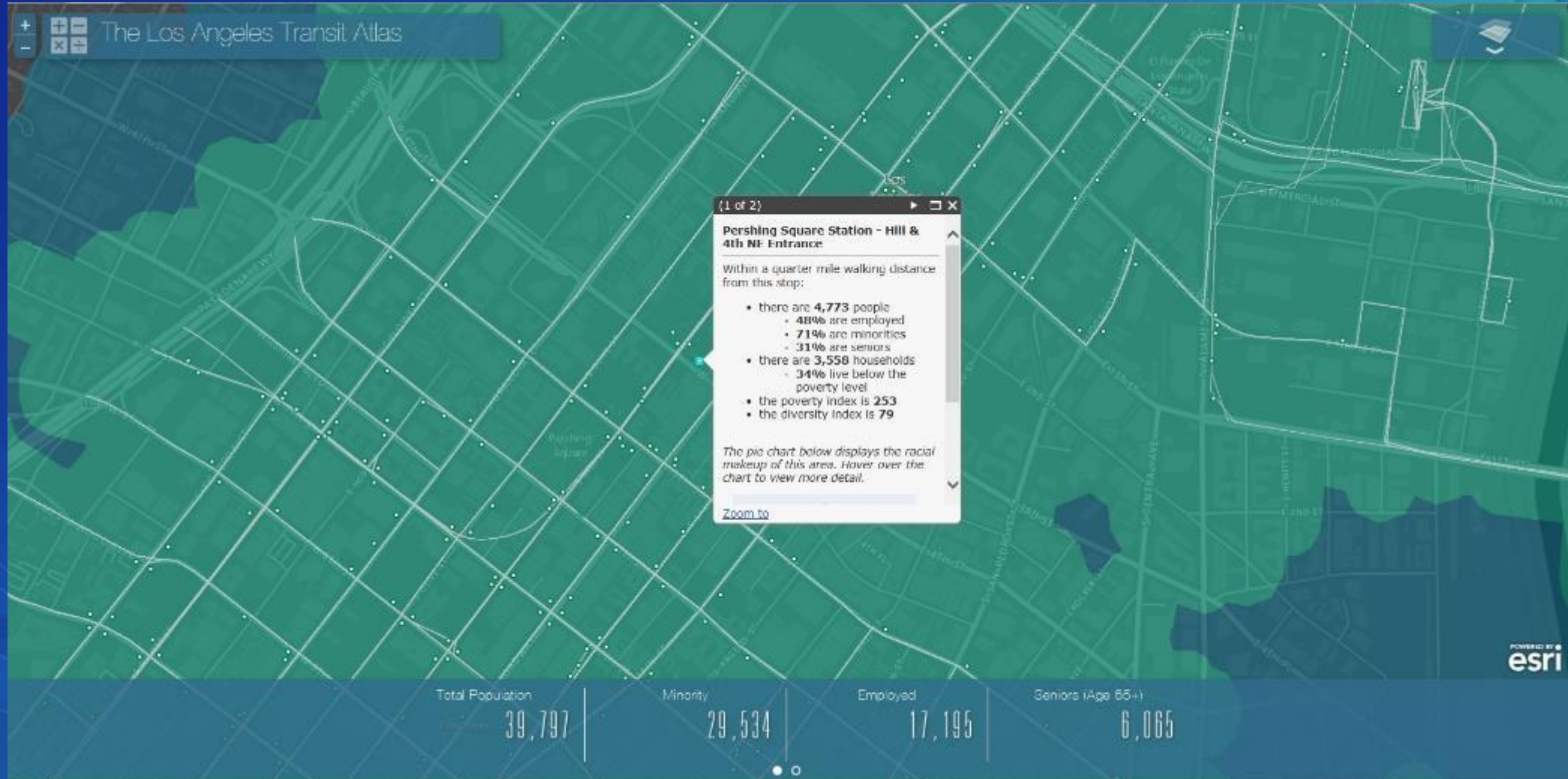
Share of working-age population within 3/4 mile of a transit stop



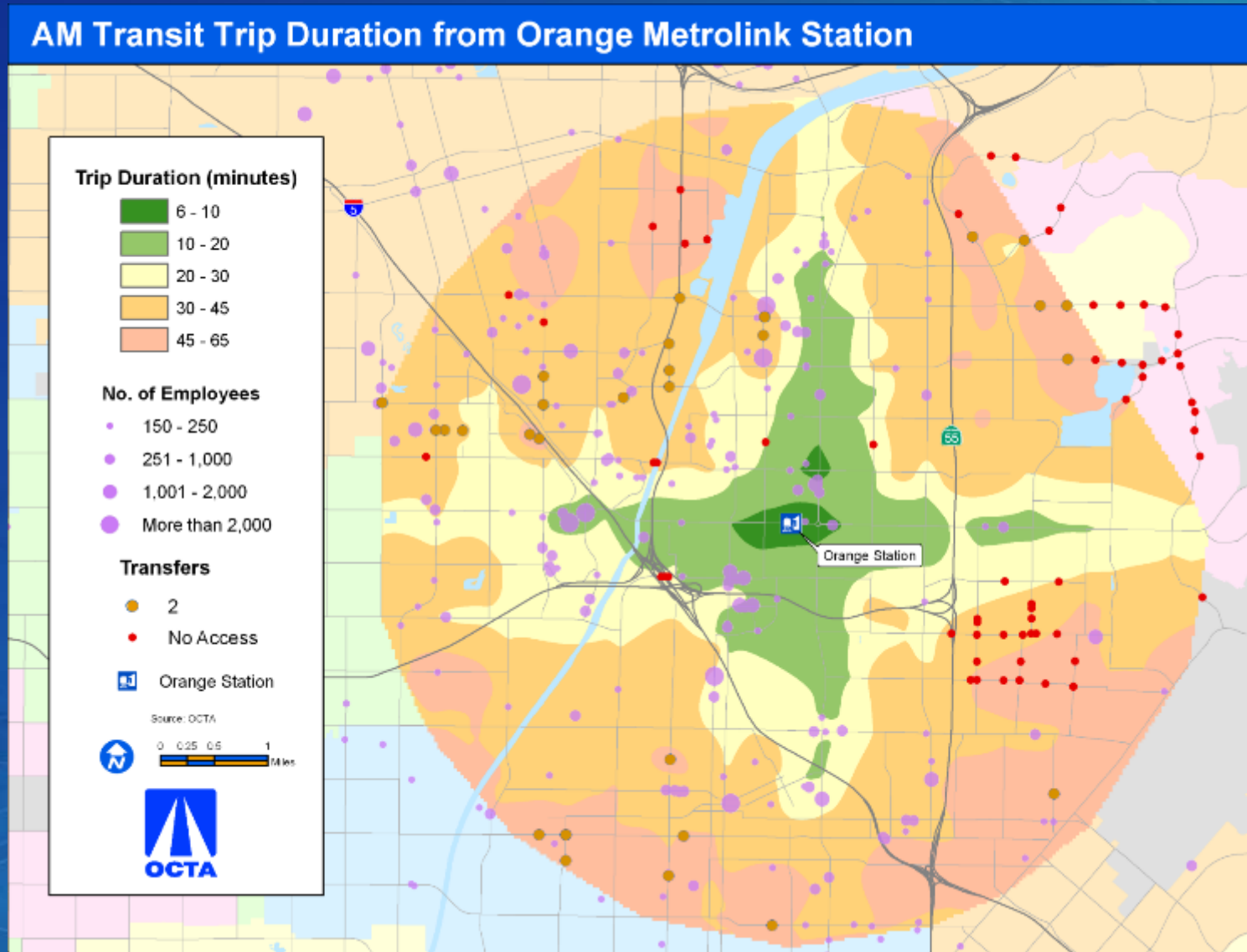
# Transit Accessibility



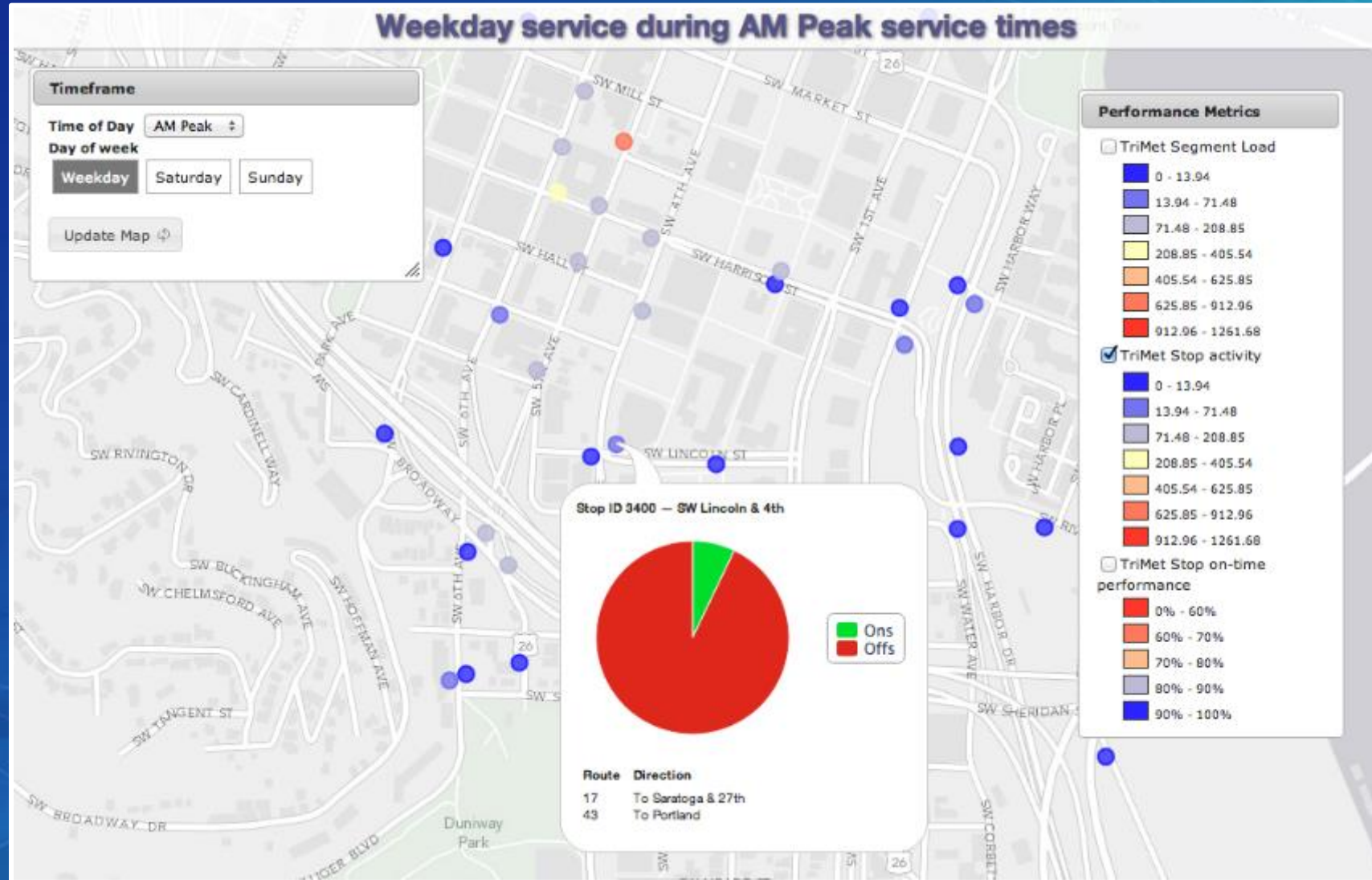
# Transit Accessibility



# Transit Accessibility



# Performance Monitoring



# Real Time Performance Monitoring: Spain



# Real Time Data: Madrid



# Real Time Data: Finland

Live train map - VR - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Live train map - VR

www.vr.fi/en/index/aikataulut/liikennetilanne/livetrainmap.html

Google

**Live train map**

Like 3 likes. Sign Up to see what your friends like.

With the Live train map you can track the movement of trains. The information is based on train GPS tracking. The application is a beta version. Read the [service instructions](#). The mobile version of the service is being developed and will be launched at a later date.

Base map transparency: [slider]

**VR mobile services**

**Live train map**

With the Live train map you can track the movement of trains with your smart phone. The data is based on train GPS tracking.

Download the free of charge service for your iPhone and Windows Phone 7 devices.

[Live train map for smart phones »](#)

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# Real Time Data: Abu Dhabi

The screenshot displays the DARB (Department of Municipal Affairs and Transport) website interface. The main map shows a real-time traffic view of Abu Dhabi, with roads color-coded by traffic status (green for clear, yellow for moderate, and red for heavy). Key locations labeled on the map include Al Lulu Island, Al Maryah Island, Al Zahiyah, Al Reem Island, Al Bateen, Al Khaldiyyah, Al Manhal, Al Marshaf, Abu Dhabi, and Haddat Al Za'faraniyah. The left sidebar features a 'Home' button, a 'Plan your journey' section with 'From' and 'To' input fields, and a 'Welcome to DARB' message. The bottom of the sidebar includes social media sharing options and app download links for the App Store and Google Play. The top right corner shows the DARB logo and a 'Live traffic' button. The bottom right corner contains a scale bar (1km) and a 'Satellite' view option.

Find a place of interest...

Al Lulu Island

Al Maryah Island

Al Zahiyah

Al Reem Island

Al Bateen

Al Khaldiyyah

Al Manhal

Al Marshaf

Abu Dhabi

Haddat Al Za'faraniyah

Emirates Palace

Abu Dhabi Golf And Equestrian Club

Live traffic

Home

Plan your journey

From

To

Welcome to DARB

DARB is an interactive map that will provide you with all the information you may require about your itinerary whether by Air, Land or Sea, throughout the Abu Dhabi Emirate

Share

Available on the App Store

ANDROID APP ON Google play

find your way around Abu Dhabi

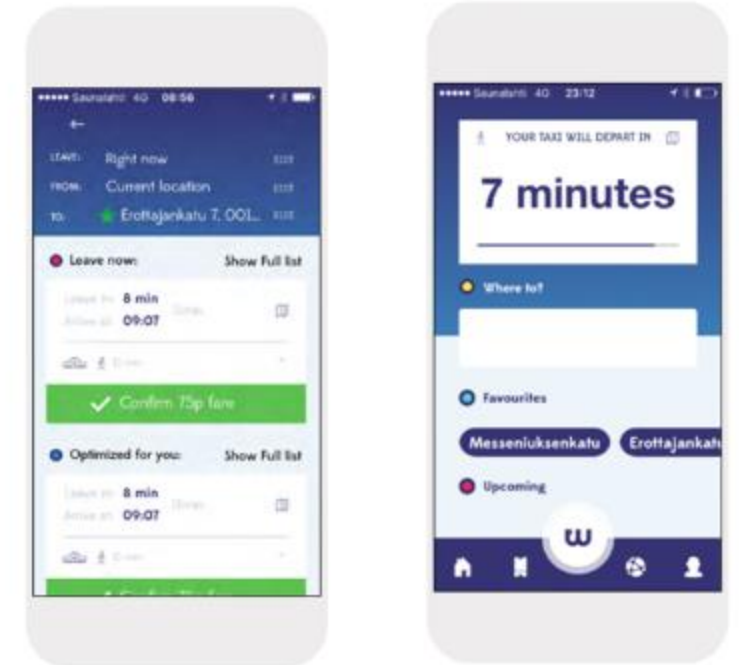
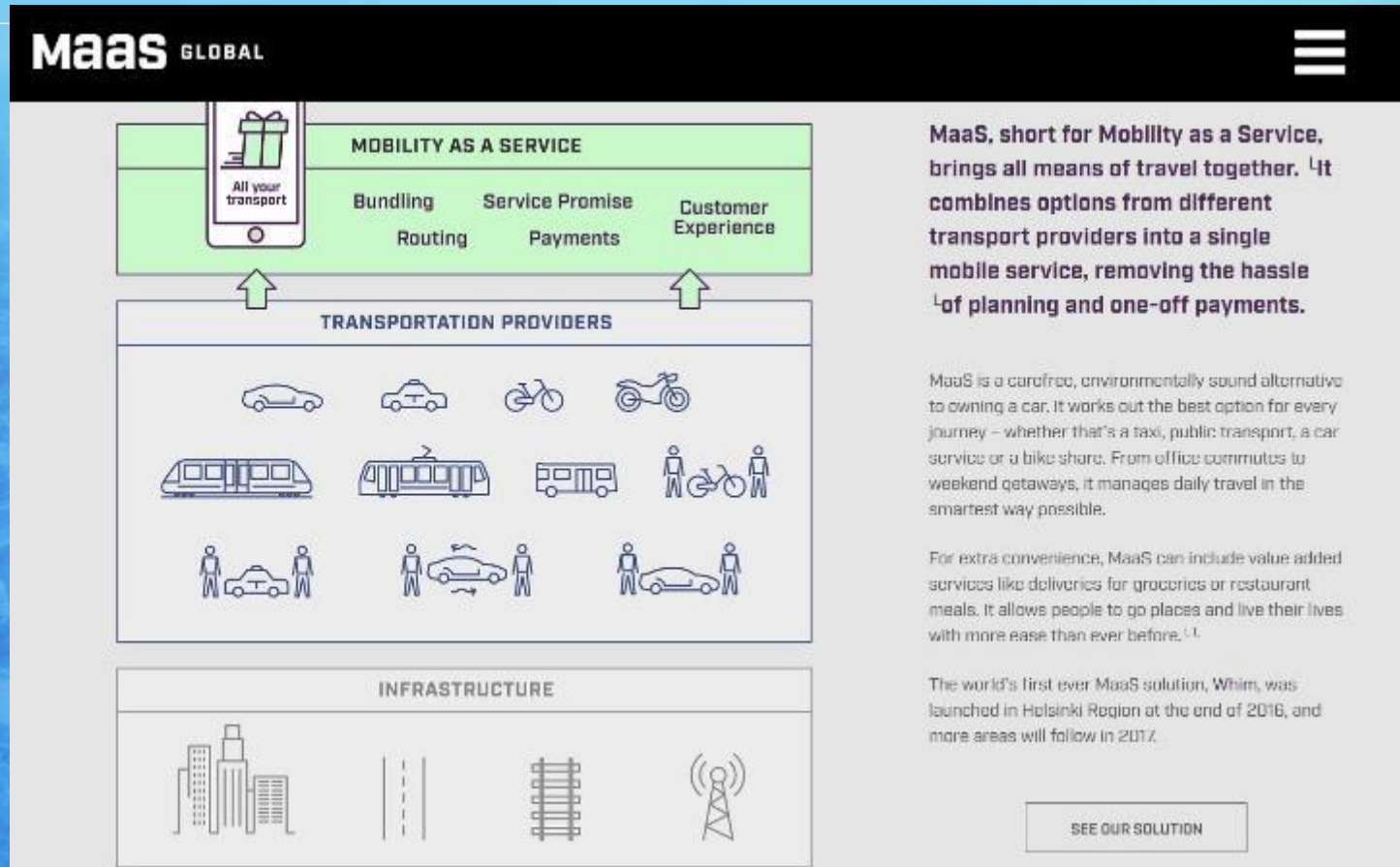
Satellite

1km

Abu Dhabi Government © - All Rights Reserved 2015 Terms

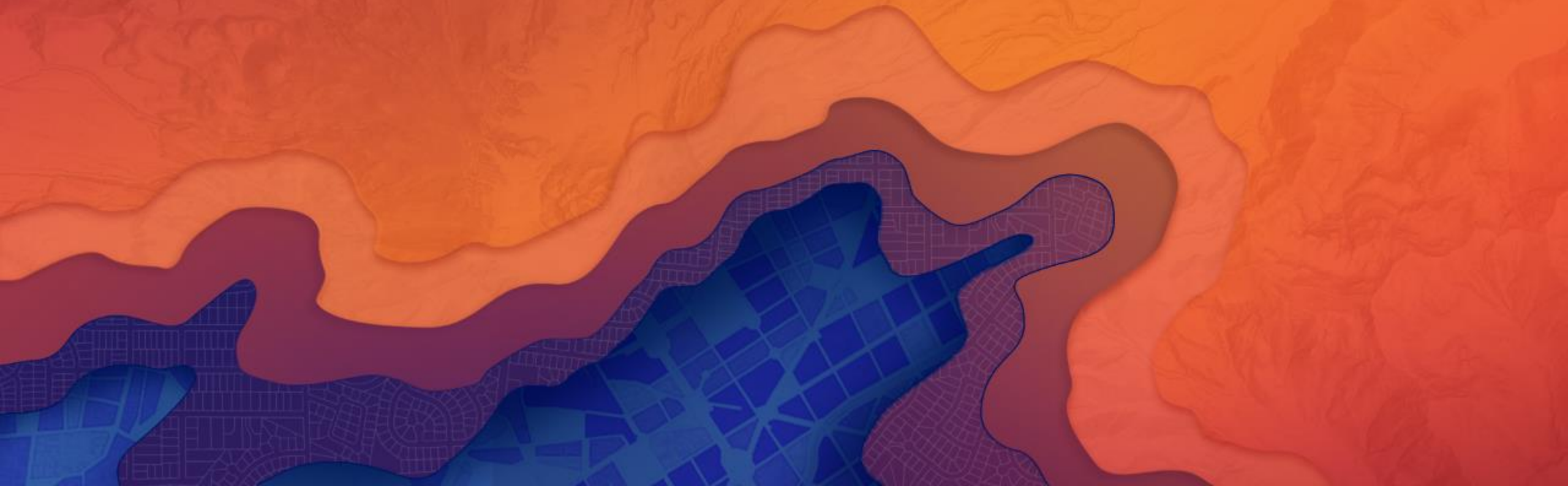
# Mobility as a Service (MAAS)

## Change and Disruption



***Mobility as a Service***

# Breaking Down The Silos



# Breaking Down the Silos



# Breaking Down the Silos

## Making Auckland the World's Most Livable City

A story map

### Our Vision: The World's Most Livable City



Fair, Safe and Healthy



Green



Prosperity and Opportunity



Connected and Accessible



Culturally Rich and Creative



Beautiful and Loved



A Maori Identity



# Breaking Down the Silos

HOME GALLERY MAP GROUPS SIGN IN

**UPLAN**  
UDOT MAP CENTER

«

A map showing various colored lines representing different functional classes of roads.

UDOT Functional Class Map

A photograph of a large yellow excavator working on a construction site.

2013 Top Ten Construction Projects

Asset Management

UDOT Asset Management Map Gallery

A photograph of a yellow road construction vehicle, possibly a paver or grader, working on a road.


UDOT Pavement Management Map

»

# GIS for Smart Cities: San Francisco

San Francisco Planning Department

⚙ Edit



No issues detected

## 1. URBAN CONTEXT

These maps represent the physical and regulatory context of the city. Click on the buttons below to see the city in various ways.

Traditional maps were 2 dimensional and static, representing a limited view fixed in time.

Traditional 2D Map

Dynamic 3-dimensional scenes allow you to 'mash up' visual information to see the city in a new way. These buildings represent the city schematically and make a great base for visualizing information.

3D Schematic View

These buildings represent the city realistically and help provide a sense of place – the feeling of understanding a real place, even if virtually.

3D Realistic View

Volumes of current height districts can be shown along with realistic buildings.

Current Height Districts


While current land use can be visualized on the buildings themselves.

Current Land Use by Building

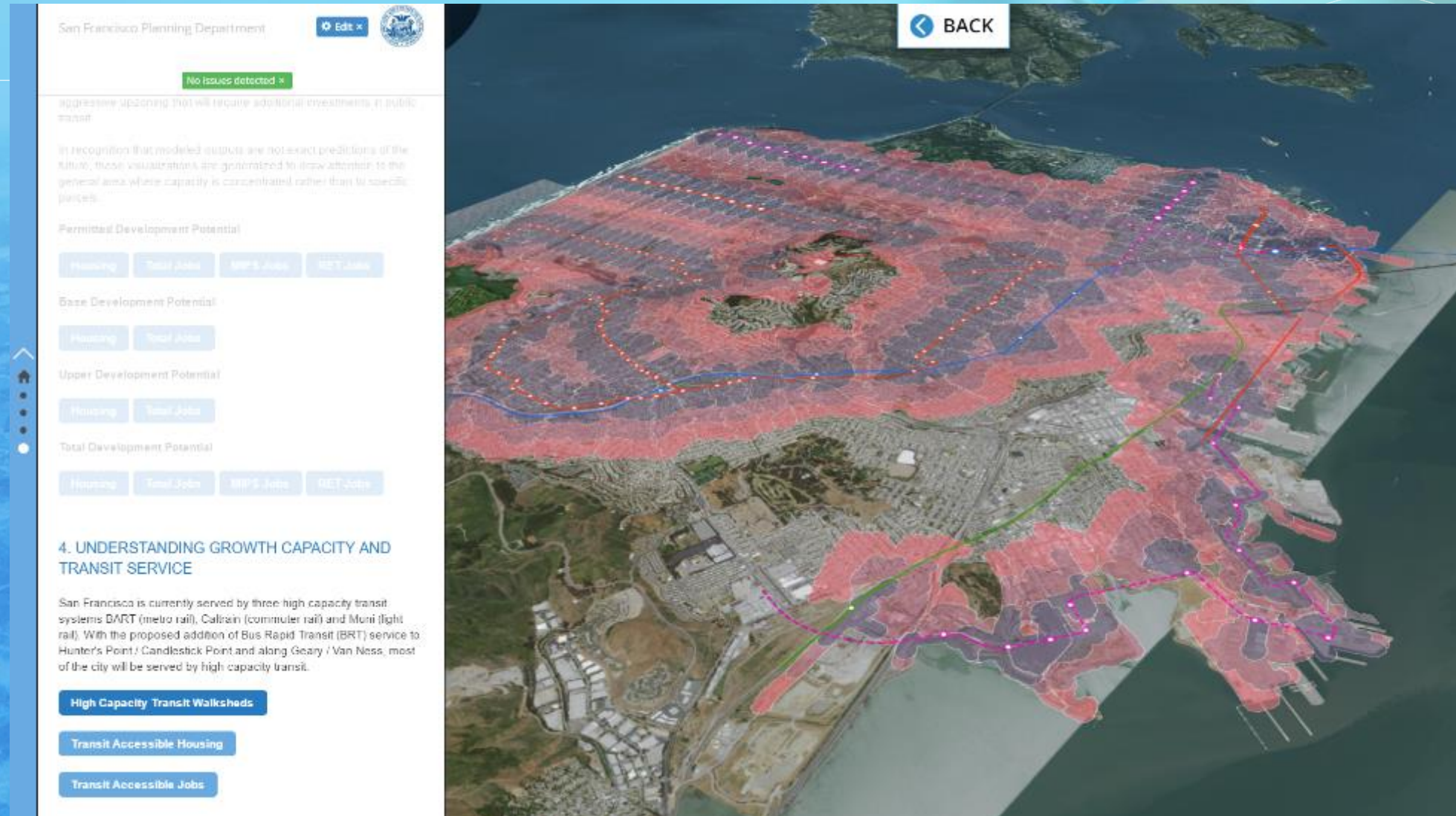
## 2. UNDERSTANDING GROWTH CAPACITY

The next few sections show how much capacity is possible at three important scales – at the neighborhood level, by transportation analysis zone, and by parcel. It is easier to see patterns when the data is shown at a parcel level, but more difficult to understand overall totals at the neighborhood level. Transportation analysis zones (TAZ)

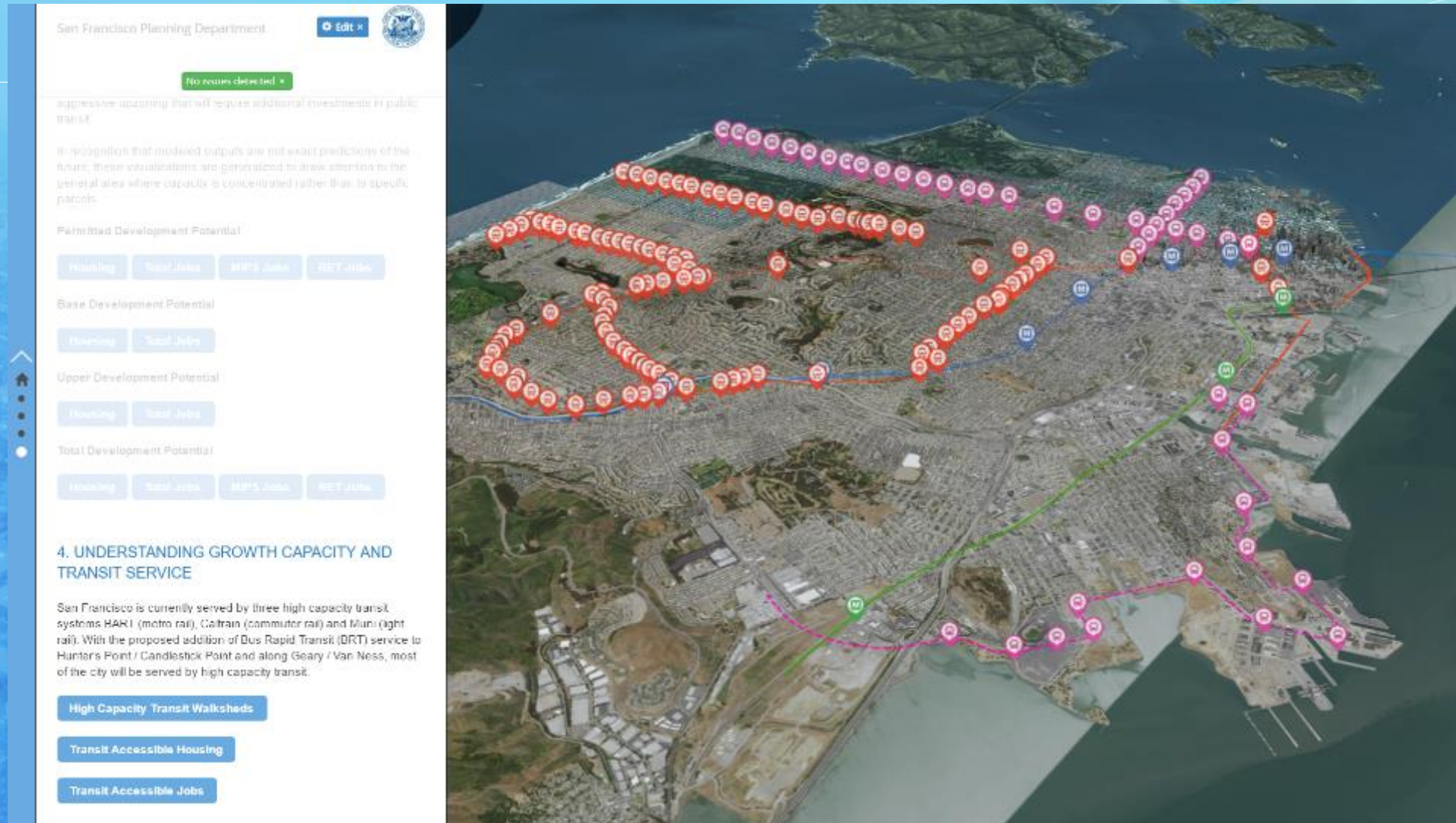
BACK



# San Francisco: Transit Accessibility



# San Francisco: Designing High Capacity Public Transit



# City of Los Angeles

Is Already Implementing a Community GIS

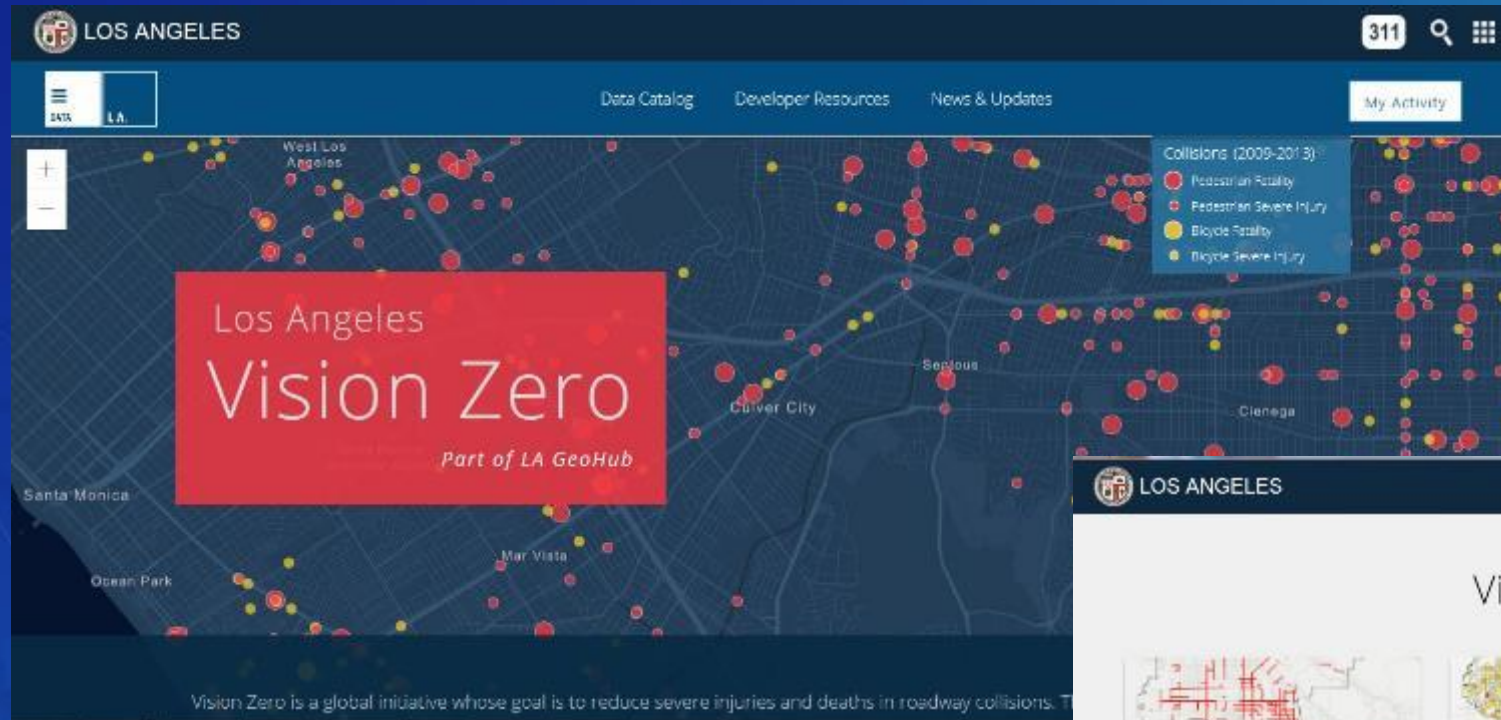
## Solutions Cross Departments



# Expanding Their GIS to Support Everyone



# Smart Cities



The screenshot shows the "Vision Zero Maps & Applications" page. The header includes the Los Angeles logo, a 311 icon, a search icon, and a grid icon. The main content area features four cards, each with a map thumbnail, a title, a description, and "Open" and "Details" buttons.

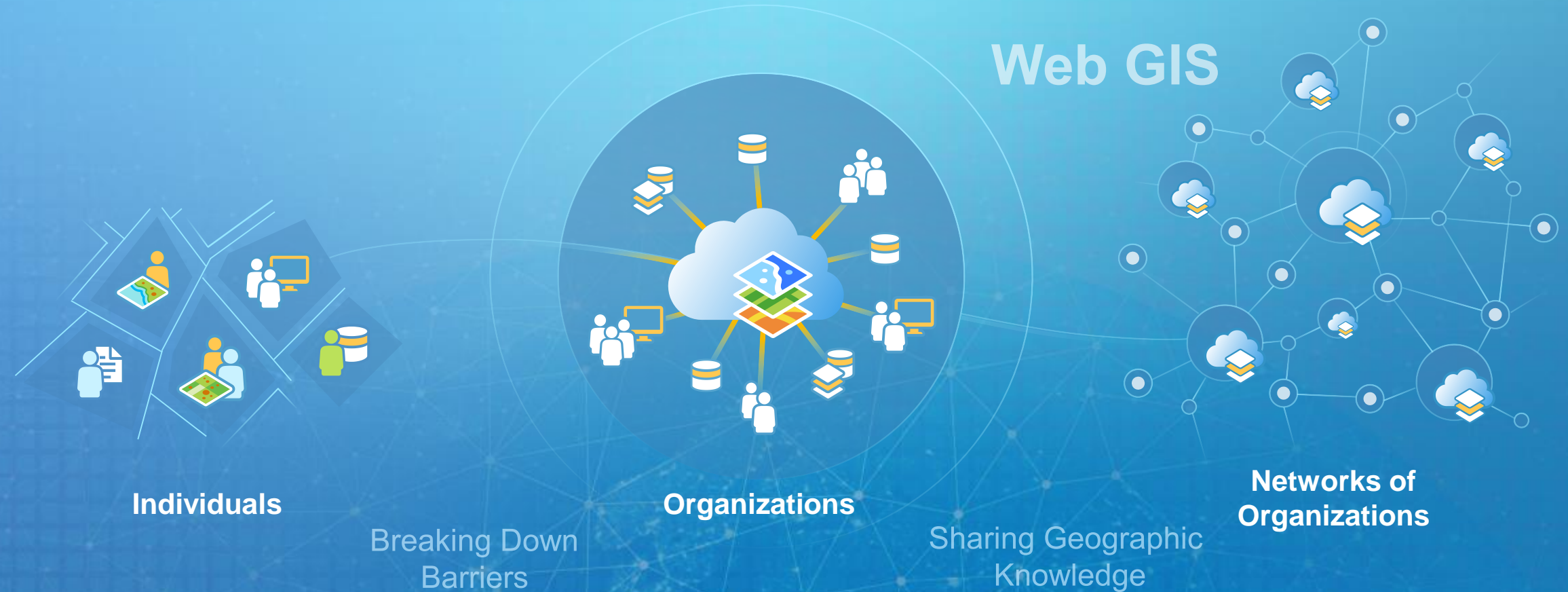
High Injury Network	Vision Zero: A Data-Driven Approach	Vision Zero Los Angeles	Collision Landscape in Los Angeles
<b>High Injury Network</b>	<b>Vision Zero: A Data-Driven Approach</b>	<b>Vision Zero Los Angeles</b>	<b>Collision Landscape in Los Angeles</b>
This Story Map explores the High Injury Network in relation to health outcomes, and other ongoing strategic planning efforts.	A walk through of Los Angeles' data-driven approach to Vision Zero.	The plan to eliminate traffic fatalities in the City of Los Angeles by 2025.	Five years of fatal and severe crashes involving pedestrians or bicyclists (2009-2013).
<a href="#">Open</a> <a href="#">Details</a>	<a href="#">Open</a> <a href="#">Details</a>	<a href="#">Open</a> <a href="#">Details</a>	<a href="#">Open</a> <a href="#">Details</a>

# Open Data – Mobility Options



# Smart GIS Enables New Types of Collaboration

Connecting Individuals, Organizations and Communities



*... Creating a Nervous System for Our Planet*



esri

THE  
SCIENCE  
OF  
WHERE