Trends in Transportation:
The Future of GIS in Smart Transportation

Terry Bills
Current Trends in Transportation

*Change and Disruption*

- Increasing Congestion in Cities
- Connected and Autonomous Vehicles
- Decline in Auto Ownership by Millennials
- Stagnation in Public Transport
- New Means of Transport (Transportation Network Companies - TNCs)
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

AirSage Cellular Tracking Data

Citilabs Streetlytics Demographic data
New Data Sources

Leveraging Cellular Data for Travel Information

SafeGraph
New Data Sources

Leveraging Cellular Data for Travel Information

https://www.downtown.ai

San Francisco Pride Parade June 25, 2017

A time lapse recording of the SF Pride Parade that attracted more than 1 million participants this year. The events layer assists to understand not only where people are, but why they are there.
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

“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
New Data Sources

Leveraging Traffic Cameras for Real Time Counts and Speed Data

https://youtu.be/Cm_oAaQVWZ8
Start at 6:25
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

Big Data GeoAnalytics

Interactive Exploration

Spatial Analysis & Geoprocessing

Web GIS

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
Understanding Big Data

Analyzing traffic accidents in space and time

Space-time traffic accident trends

New Hot Spot
Commoner Hot Spot
Economic Hot Spot

MassDOT 2013 Crash Analysis

Vehicle Crashes

Crash Severity

Count of MassDOT Crash Data

Weather Conditions During Crash

Collision Type

Count of MassDOT Crash Data
Understanding Big Data
Big Data Trends
Leveraging GIS and Big Data Analysis

Adaptive Signal Control Systems
Connected Vehicle
Intelligent Operations Center
Machine Vision: Esri and MobilEye

- New York City Buses & Cabs equipped with Mobileye
  - Use of Machine Vision / Learning to Identify Pedestrians
Esri and MobilEye

Visualizing Mobileye Data

One way to visualize Mobileye data is with points representing the exact collision warning location.
By enriching Mobileye data with Esri demographics, we get a better understanding of the people living within each hex bin.
Esri and MobilEye

Discovering Patterns.

And there are very few evening clusters, yet they still represent hundreds of collision warnings.
Esri and MobilEye

In Manhattan, the average heading of near-collisions is parallel to the street. This means that most warnings occurred with people who were moving in the same direction as the vehicle.
Esri and MobilEye

Discovering Patterns

However, in Brooklyn, most near-collisions occurred as people tried to cross the street.
This mesh view highlights where near-collisions occur throughout the day. Click on the explore button on the bottom right to interact with the map.
NYC’s pedestrian fatalities reached an all-time low in 2017

Mayor Bill de Blasio announced that under Vision Zero, traffic-related deaths are down overall

By Ameena Walker | Jan 8, 2018, 12:15pm EST
Everything is Driven by Location

Connected Vehicles

Parking Fees and Management

Car Insurance

Toll Collection Systems
Mobility
Transit Accessibility

Metropolitan Infrastructure Initiative Series and Metropolitan Opportunity Series

Missed Opportunity: Transit and Jobs in Metropolitan America

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.

Findings

- Nearly 30% 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 Phoenix, Las Vegas, and Dallas, and lowest in Southern metro areas such as Charlotte and Greensboro. 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 should allow drivers to travel 16 minutes for the typical metropolitan commute in less than one-quarter of a large metro area (22). However, in this typical scenario, 50% of workers under 50 minutes. These include only large metro areas such as New York, Los Angeles, Houston, and Washington.

- The typical metropolitan resident can reach about 60% of jobs in their metropolitan area via transit in 60 minutes. Job access differs considerably across metro areas, with 60% of workers in New York and just 7% in Rural Iowa. Differences vary widely based on coverage levels and service frequencies, and vary by levels of employment and population densification.

- Among very large metro areas, the share of jobs accessible via transit ranges from 39% in Washington, D.C., to 19% in Milwaukee.

- About one-quarter of jobs in low- and middle-skill industries are accessible via transit within 90 minutes for the typical metropolitan commute, compared to one-third of jobs in high-skill industries. This reflects the higher concentration of high-skill jobs in cities, which are often better served by transit. It also points to potentially large accessibility problems for workers in growing lower-skill communities, where the share of commuters who are transit-served is only about 20% of metropolitan rates in low- and middle-skill industries for which they may be less appealing.

- 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 strong transit systems such as New York, Portland, San Francisco, and Washington, but also Salt Lake City, Phoenix, El Paso, 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 federal levels. Transportation leaders should choose access to jobs as a critical priority in their planning and policy decisions, especially given the current housing crisis. The fact that our leaders should choose strategies that link transportation and economic development, and by relying on transit by choice to ensure that transit reaches more people and moves them efficiently. And federal officials should collect and disseminate standardized transit data to enable public, private, and non-profit entities to make informed policy decisions and ultimately maximize the benefits of transit to larger markets.
Transit Accessibility

Top 10 Most Job Accessible Cities in the U.S.

New York City

New York City Transit Access Map

#1 most job accessible city in the U.S.
Transit Accessibility

The Los Angeles Transit Atlas

Within a quarter mile walking distance from this stop:
- there are 4,773 people
  - 48% are employed
  - 71% are minorities
  - 31% are seniors
- there are 3,306 households
  - 34% live below the poverty level
- the poverty index is 253
- the diversity index is 70

The pie chart below displays the racial makeup of this area. Hover over the chart to view more detail.
Real time Performance Monitoring: Spain
Real Time Data: Madrid
Real Time Data: Abu Dhabi
Mobility as a Service (MAAS)

MAAS, short for Mobility as a Service, brings all means of travel together. It combines options from different transport providers into a single mobile service, removing the hassle of planning and one-off payments.

MAAS is a carefree, environmentally sound alternative to owning a car. It works out the best option for every journey - whether that’s a taxi, public transport, a car service or a bike share. From office commutes to weekend getaways, it manages daily travel in the smartest way possible.

For extra convenience, MAAS can include value added services like deliveries for groceries or restaurant meals. It allows people to go places and live their lives with more ease than ever before.

The world’s first ever MAAS solution, Whim, was launched in Helsinki Region at the end of 2016, and more areas will follow in 2017.
Breaking Down the Silos
Breaking Down the Silos
Breaking Down the Silos
GIS for Smart Cities: San Francisco

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 3D 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)
San Francisco: Transit Accessibility

4. UNDERSTANDING GROWTH CAPACITY AND TRANSIT SERVICE

San Francisco is currently served by three high-capacity transit systems: BART (metro rail), Caltrain (commuter rail), and Muni (light rail). With the proposed addition of Bus Rapid Transit (BRT) service to Hunter’s Point/Candlestick Point and along Geary-Van Ness, most of the city will be served by high-capacity transit.

- High Capacity Transit Footprints
- Transit Accessible Housing
- Transit Accessible Jobs
San Francisco: Transit Accessibility

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High Capacity Transit Walksheds
Transit Accessible Housing
Transit Accessible Jobs
City of Los Angeles
Is Already Implementing a Community GIS
Expanding Their GIS to Support Everyone
Smart Cities

Vision Zero is a global initiative whose goal is to reduce severe injuries and deaths in roadway collisions. 

Los Angeles Vision Zero
Part of LA GeoHub

Vision Zero Maps & Applications

High Injury Network
This Story Map explores the High Injury Network in relation to health outcomes and other ongoing strategic planning efforts.

Vision Zero: A Data-Driven Approach
A walk through of Los Angeles’ data-driven approach to Vision Zero.

Vision Zero Los Angeles
The plan to eliminate traffic fatalities in the City of Los Angeles by 2025.

Collision Landscape in Los Angeles
Five years of fatal and severe crashes involving pedestrians or bicycles (2009-2013).
Smart GIS Enables New Types of Collaboration

Connecting Individuals, Organizations and Communities

...Creating a Nervous System for Our Planet
Please Take Our Survey on the App

Download the Esri Events app and find your event

Select the session you attended

Scroll down to find the feedback section

Complete answers and select “Submit”