Improving Urban Accessibility with Data and Analytics

07.18 EB10174 GOVERNMENT/SMART CITIES/BRIEF

TERADATA

According to a United Nations report, by 2030, two-thirds of the world's population will be living in cities.

2/3

Urbanization poses significant opportunities and challenges for agencies and city planners whose focus is to improve urban accessibility (the measure of how easy or difficult it is to get from one part of a city to another) and urban mobility (the quantity or volume of travel that is available to a household), as both are essential components in raising the quality of urban life.

Many smart cities have launched initiatives to improve urban accessibility and mobility. For instance, they have come up with ways to measure the effectiveness of transportation services, such as with average travel times and the percentage of population within a certain distance of a transit stop. There is now anonymized movement analytics data from smart phones, which helps to assess the usage of urban transportation. However, the *direct measurement of accessibility* remains a challenge due to the lack of suitable data and the application of the right analytics on it. As a result, existing transportation options may fail to conveniently connect people to jobs, and urban housing growth may be distant from essential public services. This lack of insight into accessibility makes it difficult for cities to support equitable and sustainable development that ultimately helps people get where they need to go.

Improving the Performance of City Services via Analytics

As a recognized leader in the application of big data and analytics techniques to solve practical problems related to planning and operations, Teradata extends its expertise to the realms of smart cities and transportation. Teradata helps smart cities create a data analytic ecosystem that integrates data from a wide range of sources, measure the performance of smart city services (see Figure 1), and deliver rich insights needed to enable automation or inform people who can take appropriate action.

Services	Analytics
Asset and maintenance management	Asset performance, asset maintenance standards compliance, optimal intervention points
Connected vehicle	Lane changes per mile, steering angle compared to road geometry, brake applications per mile, driving turbulence, minutes per trip, trip time reliability, number of stops per trip
Connected, involved citizens	Citizen awareness, citizen satisfaction
Integrated electronic payment	Transit revenue per passenger, transit seat utilization, toll revenue per vehicle and per trip, premium customer identification, parking revenue per slot, payment system revenue achieved compared to forecast and addressable market
Intelligent sensor-based infrastructure	Data quality, transportation conditions, trip time variability
Low-cost efficient, secure and resilient Information and Communication Technologies (ICT)	Network load compared to capacity, network latency, cost of data transfer, network security
Smart grid, roadway electrification and electric vehicle	Electric vehicle charging points per mile, electric vehicle charging points per head of population, number of electric vehicles as a percentage of the total fleet, electric vehicle miles per day, electric vehicle miles per trip, electric vehicle miles between charges
Smart land use	Observed trip generation rates for different land uses, observed actual trips between zones, relationships of land value to transportation, zone accessibility
Strategic business models and partnering	Percentage of private sector investment, number of partnerships, improvement in service delivery for each private sector dollar invested
Transportation governance	Transportation efficiency for each dollar spent, supply and demand matching, transportation agency coordination, partnership cost-saving measures, cost of data storage and manipulation compared to services provided
Transportation management	Mobility index, citywide job accessibility, citywide transportation efficiency, reliability, end-to-end time including modal interchanges
Traveler information	Traveler satisfaction, decision quality information measures, behavior changes
Urban analytics	Number of analytics in use, value of services managed by analytics, money saved through efficiencies gained by analytics
Urban automation	Percentage of automated vehicles within the entire citywide fleet, percentage of automated vehicles in use by city agencies and private fleets, proportion of deliveries made by automated vehicles, proportion of passengers carried by automated transit
Urban delivery and logistics	Cost of urban delivery, time for end-to-end delivery, freight and logistics user satisfaction, freight management satisfaction
Urban accessibility and mobility	Citywide accessibility and mobility indices, user satisfaction, transportation service delivery reliability

Figure 1: Services and Associated Analytics Used to Measure Smart City Services Performance

We believe that urban accessibility, if measured accurately, can be a very powerful performance indicator for smart city transportation services. The traditional method of estimating accessibility is using a transportation simulation model, which rely on very small samples of data and sophisticated algorithms to estimate trips between zones and the accompanying accessibility. Recent availability of big data sources of mobility data promises to make the estimation of urban accessibility more accurate. By complementing the traditional method with these new data sources and Teradata 4D Analytics, simulation models can leverage the basic accessibility index data and make predictions for both short-term and long-term future planning.

An urban accessibility index can be a powerful performance indicator for multiple smart city transportation services.

Urban Accessibility Index

We view an urban accessibility index as a powerful and foundational performance indicator of urban accessibility. This ability presents a new opportunity to smart city practitioners who are tackling the tough challenges around accessibility.

The Teradata urban accessibility index measures the ease or difficulty of getting from one part of a smart city to another, using the following components:

1. Travel time between zones

2. Travel time reliability between zones

3. Cost of travel as a proportion of household income

The urban accessibility index takes into account the trip purpose and modes of travel available. For example, accessibility to employment, healthcare, education or retail can form components of the accessibility index; and private car, rideshare, and transit modes can be considered, either individually or as a trip chain from initial origin to ultimate destination.

Urban Accessibility Data

Our approach to urban accessibility analytics is to establish a transportation data ecosystem that captures the relevant activity within the smart city. While the data ecosystem will ultimately capture all forms of transportation data and support many use cases and analytics, we anticipate that the following data will support the creation of the urban accessibility index:

1. Census related data: a publicly available data source that reveals vital demographic information such as total household income, number of inhabitants, and geolocations of households and city services. It is also a rich repository of trip generation and commute patterns, which can effectively complement other sources of mobility data. Comprehensive coverage, frequent updates and granular data collection make census data uniquely powerful when integrated with other private sector sources.

2. Movement analytics data: drawn on an anonymous basis using the GPS capabilities of smart phones, the data enables the establishment of initial origin and ultimate destination for a large sample of trips within the smart city area, along with breadcrumbs that outline the journey taken between origin and destination. Movement analytics data overcomes the challenges of many other data sources that tend to come from a single source; these data cover all modes and provide a new insight never before available.

3. Transportation data: covers transit, roadways and other mobility options such as bikes and pedestrian volumes. Transit data includes published schedules as well as operations actuals. Routes, frequencies, transit stops, trip times, and actuals, in terms of passenger counts and variances from schedules can be included. Selected data from roadway sensors can also be included to enable car travel times and congestion volumes. A growing set of data is emerging on other mobility options, including ridesharing, bike share locations, bikeways, and even pedestrian volumes.

"Commutability Score" for Commuters and City Planners

Urban accessibility analytics is key to improving the "commutability" to work locations. When work locations were concentrated in city centers and mobility choices were limited to car and transit, commutability was less of a concern. Today, because work places are more distributed, mobility choices and commutability are more important and understanding accessibility is a higher priority.

> "Our experience is that corporations can find themselves surprised at the impact of commutability on their employees, especially after corporate relocation decisions."
>
> – Mike Bradley
> VP Planning,
> Central Ohio Transit Authority

In a Teradata-sponsored smart transit design-a-thon, participants from city and transportation agencies, community services, and academics in transportation and urban planning came together to explore a range of mobility topics that were top of mind. A commutability index, or "commutability score", by work location was identified as one of the top six ideas to emerge from this session.

This idea was put into practice at the HackOHI/O event, held annually at Ohio State University, where some 700 students compete to solve real world challenges. Along with our partners, Teradata made movement analytics and census data available for the Greater Columbus area.

The winning team developed an analytic visualization usable by individuals and city planners alike. It factored in ingredients that affect a commute into scores that were presented alongside other mobility measures. For example, the scores could be filtered by socioeconomics data from HUD, or viewed together with commute volumes from census. These could then be compared to the actual "ground truth" of trip volumes derived from movement analytics data provided by Cuebiq.

By compiling open and proprietary data at scale using enterprise grade software platforms and modern web technology, the students created a "living lab" that integrated real-time trip data with structured Federal open data, and private sector big data on mobility. The "commutability" ecosystem can help with planning location decisions and bus routes, finding optimal commute times, evaluating new mobility choices, scheduling road repairs, and other tasks essential to making a city run smoothly.

How Teradata Smart Data Management Can Help with Urban Accessibility Analytics

Teradata has a long and successful pedigree in helping organizations, across major service industries, evolve from standalone or narrowly-focused projects to highly integrated, business-driven operations.

We believe that the best approach to the delivery of urban accessibility is through big data and analytics, enabled by Smart Data Management. Smart Data Management is a cost-effective, step-by-step approach for smart city planning and operations. From data to information, to insight, to actionable strategies—the critical steps and expected outcomes of Smart Data Management are:

- **Build an approach that can evolve over time.** This approach consists of a series of planned investments that deliver immediate and clear value, while providing business justification for further investments.
- **Create a data lake and data ecosystem.** The establishment and management of a centralized repository or data lake enables data to be shared and analyzed.
- **Provide the horsepower to support efficient handling of all types of data.** This results in a coordinated and coherent data stream from multiple sources—including sensors, other automated sources, and anecdotal data—ingested into a single platform using advanced automation.
- **Enable advanced analytics.** This provides support for using multiple tools and techniques across any enterprise data.
- **Share data (and analytics).** This provides support for a data market approach that enables data to be valued from a public and private perspective and provides a mechanism for a "freemium" approach to data (and analytics) sharing.

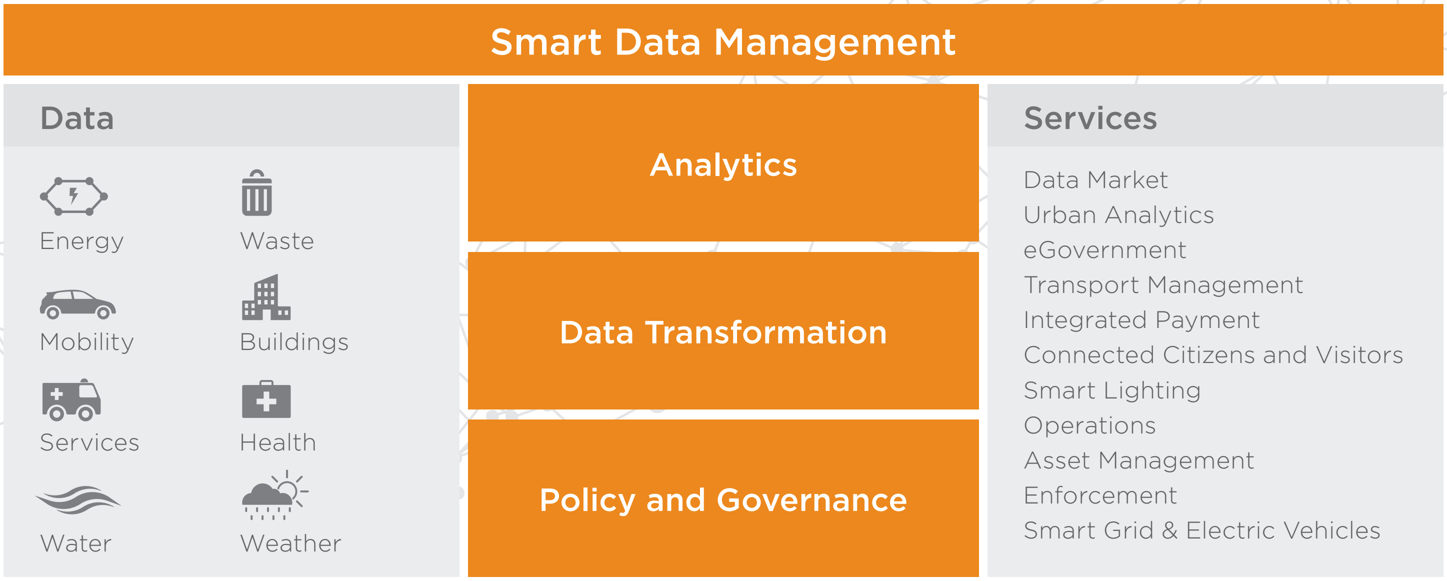

Figure 2: Smart Data Management

- **Create an infrastructure that enables future services, such as mobility as a service.** This requires a scalable approach that provides immediate value and benefits, while delivering a framework that is easily expandable for future needs.

Urban accessibility involves understanding the needs of smart city citizens, government and services. It is vital for smart city governments to have the information and insight required to manage and design the user experience within a smart city, rather than just letting it unfold. The end result is an improvement in the mobility and the user experience across the entire suite of smart city services.

By leveraging Smart Data Management to integrate, analyze and share data, smart cities can improve urban accessibility, mobility and land use—resulting in operational efficiency, better public safety, enhanced citizen services, and new revenue streams that help the community to thrive.

For more information about Teradata Smart City solutions, visit Teradata.com.

Insights on Urban Accessibility

Teradata empowers public and private sector enterprises to gain insights—through business solutions for analytics, coupled with industry-leading technology and architecture expertise—to deliver high-impact business outcomes for your enterprise.

10000 Innovation Drive, Dayton, OH 45342 **Teradata.com**

07.18 EB10174