Smart City Transportation Optimization
Using Teradata Analytics

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New data and analytic capabilities enable a deeper look at smart city transportation.
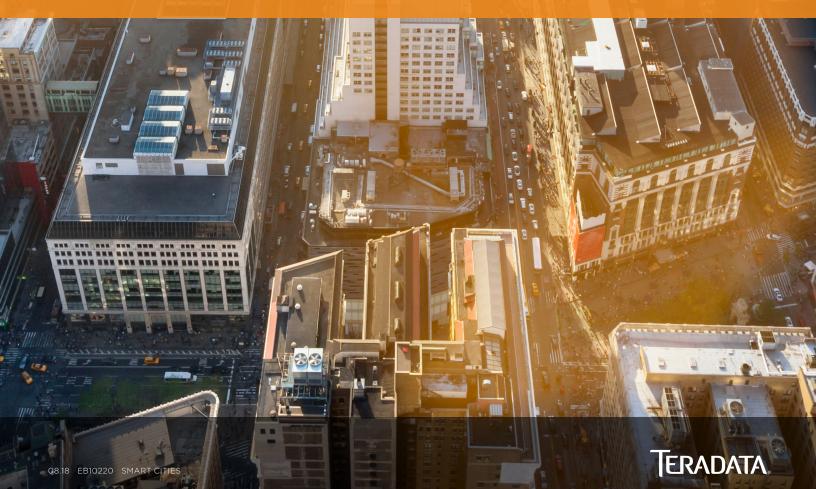
Efficient and effective transportation is a big-ticket item for most major U.S. cities. Transportation capital and operating expenditures dominate budgets. Estimates show that the global smart city market could be worth as much as $1.2 trillion by 2022, with transportation a significant component, according to research firm MarketsandMarkets™.

In the U.S., 29 percent of the energy consumed is used to propel our transportation systems. Therefore, it's vitally important to ensure that transportation investments are optimized, services are closely aligned with the needs of city visitors and citizens, and efficiency is maximized. These are areas where Teradata can help.

Teradata has the solutions and expertise to support new approaches to transportation optimization within a smart city. We know that the demand for transportation in a city varies over time, and several different user groups are categorized together and collectively referred to as "travelers." These include people of different ages, genders, demographics, and physical capabilities. A complete approach to the optimization of a smart city transportation system would account for this variation in user groups and analyze how the demand for transportation and supply conditions vary over time and space.

Many approaches to performance management for urban transportation services tend to focus on individual modes of transportation. For example, bus and rail service performance and quality are managed with a focus on the use and performance of buses and trains. Likewise, traffic signal operation is optimized by matching traffic signal timings to currently experienced traffic flows.

These are prime examples of mode-specific performance management that do a good job of providing insights into the operation of the individual transportation types. However, they do not reveal how the operation of the mode impacts overall service quality for transportation in the city.

One reason for the focus on individual modes is that it is easy to obtain the required data. Another reason is because we have developed organizations that are focused on each type. Using the examples of bus and rail service and traffic signals, this solution brief explores how Teradata's experience, expertise, and smart city solutions can provide actionable insights into urban transportation performance.

Tactical, Not Strategic

The two examples illustrate another shortcoming in mode-specific performance management: the performance of the mode is measured from system entry to exit points, and not from the original origin to the ultimate destination for the traveler.

For traffic signals, the performance of the system is measured from where the vehicle enters the traffic signal network to where it leaves. For buses, performance is typically measured from when the passenger boards the bus to when he or she gets off.

Teradata has adopted a tactical approach to transportation service delivery. We believe that the most effective approach to smart city transportation optimization is multimodal, strategic, and tactical, using the latest smart data management and analytic techniques.

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Performance Management is More Than Just Measurements

The famous management expert Peter Drucker is credited with saying, "If you can't measure it, you can't manage it." In today's world of big data and advanced analytic capabilities, we extend his quote to fit present day realities, "If you can't measure it, you can't manage it. And if you're only measuring it, then you're still not managing it."

While performance measurement is central to the enablement of performance management, it is not the whole story. Collecting vast volumes of data does not provide a complete solution to the optimization of urban transportation. It is necessary to go beyond measurement and data collection to convert data into information and insights that form the basis for action. This is Teradata's definition of complete performance management for urban transportation systems.

At the tactical level, we do a great job of monitoring and managing the islands of transportation supply within a smart city. This provides a solid foundation for optimizing the operational management of individual modes. Ideally, we would apply citywide analytics to show how the combined effects of the operation of each mode come together to provide a total picture of urban transportation supply.

Scientific, Results-Driven Transportation Investment in a Smart City

New possibilities exist for what we call "scientific transportation investment planning." This involves using a detailed understanding of the results of prior investments to guide future investments. It's a different approach from the typical index-linked budget development process.

Scientific transportation investment planning can give a deeper context to traffic signal management optimization as well as bus and rail service performance and quality. This planning should be applied across the entire smart city transportation system that includes all modes and also accounts for the connectivity between modes to optimize the transportation as a service objective.

"If you can't measure it, you can't manage it. And if you're only measuring it, then you're still not managing it."

Teradata believes that an urban accessibility index is a strong candidate for the service objective that will act as a focal point for planned investments and operational management for smart city transportation services. Recent work with Ohio State University and several leading transportation agencies indicates that the use of an urban accessibility index can bring new insights. It would also make existing performance management solutions for transportation and smart cities more powerful.

Urban Accessibility Index

Our definition of an urban accessibility index measures the ease or difficulty of getting from one part of a smart city to another part based on these components:

1. Travel time between zones

2. Travel time reliability between zones

3. Cost of travel as a proportion of household income

The accessibility index takes into account the purpose of the trip and the available modes of travel. For example, accessibility to employment, healthcare, education, or retail can be measured and form components of the accessibility index. The index can also consider a private vehicle, rideshare, and other transit modes, either individually or as a trip chain, from the initial starting point through the ultimate destination.

Urban Accessibility Data

Our approach to urban accessibility analytics is to establish a transportation data repository within the smart city. While the data repository will ultimately capture all forms of transportation data and support many use cases and analytics, we anticipate that a preliminary data repository will contain these datasets to support the creation of the accessibility index:

Census tract data. A publicly available data source that can reveal information about households, such as total income, number of inhabitants, and geolocation of the home.

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Mobility analytics data. Sourced on an anonymous basis from smartphones, the data establishes the initial origin and the ultimate destination for a large sample of trips within the smart city. The data also provides "breadcrumbs" that outline the journeys taken between the origin and the destination.

Transit data. This includes published schedules that contain transit frequencies and the geolocation of transit entry and exit points. In a case of a bus service, scheduled bus frequencies and stop locations are obtained.

Teradata's Smart Data Management Enables Urban Accessibility Analytics

Agencies can leverage our long and successful record of accomplishments to utilize and benefit from big data and analytics. Our experience and analytic solutions have enabled major banks, airlines, telecommunications, Internet of Things (IoT), and other industry sectors to harness their data for high-value business outcomes. We bring the same experience and solutions to transportation applications to:

- Securely manage data from multiple public and private sources.

- Create an information repository for mobility as a service.

- Support advanced analytics.

- Use the best integration approach to share data and analytics.

- Provide the horsepower to support efficient mobility as a service.

We believe that the best approach to big data and analytics for urban accessibility involves the use of smart data management (see figure). This is a purposeful and structured approach to the development of data management capabilities for a smart city. It is the only way to extract the maximum value from investments in data collection and data management. Leveraging Teradata's Analytics Platform, smart data management moves cities in the most cost-effective way from data to information to insights to actionable strategies for smart city planning and operations.

Figure: Smart Data Management Approach

From our perspective, smart data management features include:

- A series of planned investments that deliver immediate and clear value while providing the business justification for further investments.

- 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.

- The establishment and management of a centralized repository that enables data to be both shared and persisted.

- Support for multi-genre analytics that can be shared across the enterprise.

- A scalable approach that provides immediate value and benefits while delivering a framework that is easily expandable for future needs.

- 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 sharing.

Bringing Global Experience to Smart Cities

Talk with us to find out more about our approach to smart data management and how our urban accessibility analytics can be implemented in the most cost-effective and efficient manner possible while supporting the performance management needs for transportation services in the smart city. We bring our global experience in the practical application of analytics to the table and work with city agencies to deliver practical results.

We can help agencies evolve from standalone or narrowly focused smart city projects to tightly integrated business driven operations. For more information, visit **Teradata.com**.

Urban Accessibility Measurement in Action

Teradata and Qlik recently sponsored a design-a-thon and subsequent hack-a-thon (HACKOHIO) in conjunction with Ohio State University, and Cisco supported it with onsite staff. Under the auspices of this activity, Teradata made movement analytics and census tract data from the greater Columbus, Ohio, area available to participants.

With support from Teradata and Qlik data analytic specialists, more than 700 students took part in the event, with one team making use of our data to provide outstanding results for a transit solution. **Click here** to learn more.