Everything You Ever Wanted to Know About Big Data in Transit

The right data analytics platform makes it easy to understand commuter needs.
The Benefits of Data Analytics in Transit.

Metropolitan transportation – the effective movement of people and things to new locations – is a centuries-old problem that still threatens local economic systems and the qualities of life for millions of citizens around the world. Inefficiencies in a transit infrastructure cost local governments money, increase crime rates, intensify air pollution from escalating vehicle emissions, and limit life-saving access to emergency services for its residents.

The seemingly obvious solution is to build more roads, but building roads is often disruptive to the current environment and take enormous amounts of time, money, and perhaps most importantly, real estate. Meanwhile, as cities around the world continue to grow faster than the transportation infrastructure that supports them, local governments need solutions now. Waiting another ten years for a new superhighway is not a viable option. As a result, the transportation industry is turning to data analytics to find better and smarter ways to use the transit systems already in place.

Predicting Future Trends

The use of data analytics is nothing new for the transportation industry. After all, this is essentially the same system that allows transit executives to track the number of people who take a particular bus route each day. While the system is in place for counting people, agencies aren’t using this information to its fullest. These systems are usually lacking when it comes to using the data effectively. Additionally, analysts aren’t taking data from other sources (social media, GIS, weather, demographics) into account and therefore see only a small piece of the puzzle. By pulling data from other sources, we can answer questions like:

• Does the passenger take this route every day?
• Does this passenger also own a personal vehicle?
• How many bus transfers does this passenger make before reaching his or her final destination?
• How long does the passenger wait at each transfer location for the next bus or train?
• What is the passenger’s preferred method of payment?
• Are our buses operating on schedule?
• What is the impact on ridership when we take external elements into account?

The answers to these types of questions can help transit authorities predict future trends in transportation more accurately and well before they become an overwhelming problem for the community. In a city the size of Montreal in Quebec, Canada, where nearly 1.3 million passengers use public transportation every weekday, transit executives can use up-to-the-minute data analytics to modify bus and rail schedules to accommodate the changing needs of the community. If Montreal can reliably transport over a million people to their final destinations five minutes’ earlier on a daily basis, the positive impacts would be monumental.

Furthermore, by improving overall efficiency, perhaps government officials will be more successful in increasing ridership levels. If more people find public transportation easier, faster, and more comfortable that spending countless hours stuck in traffic while driving a private vehicle, then the entire community benefits significantly. Citizen morale increases, air pollution decreases, and access to emergency police, fire, and ambulatory services expedites.
Switching to a Multi-Modal System

While focusing on a community’s public transit data is a very good beginning, most modern cities are now taking the use of data analytics to the next level. The benefits of switching to a multi-modal system that also includes bicycle traffic, pedestrian traffic, carpooling, and other modes of transportation are becoming more increasingly apparent. As public transportation continues to grow in popularity, the need for a seamless integration between multiple modes of transportation becomes even more critical. A perfect example is the ability of local bike riders to instantly and effortlessly place their bicycles on an easily accessible rack on the front of a bus. Twenty years ago, this was not even a possibility. Today, bike-friendly buses are the norm.

But this multi-modality requires a previously incomprehensible amount of data collection. As more advanced geo-location technologies continue to become readily available, we are witnessing a surge of data collected from more unstructured sources, such as traffic cameras, in-vehicle GPS systems, and car sensors. Even today, many metropolitan areas are accumulating this valuable data faster than they can analyze it.

If local governments want to unleash the unlimited potential of transportation data analytics, then they need systems in place that can manage this diverse data ecosystem much faster and far more effectively than is usually in existence. While almost all transit industry insiders agree that smartphone technology is advancing at a rapid rate, they are also in agreement that its maximum, untapped potential for data mining is still unknown. Meanwhile, the automobile industry is now including mobile computing technology as a standard feature in many of their latest models, resulting in an even greater sense of urgency for highly efficient data analytics systems.

Data Mining and Transit Payments

Transit authorities across the United States are facing a dilemma. Their financial coffers are usually lacking, which makes the creation, implementation, and management of these much-needed data analytics or big data systems very challenging. The first reaction might be to raise the price of a bus or train ticket, but this defeats the ultimate goal of boosting ridership numbers. Without enough incoming revenue to support their dreams of maximized data analytics systems, cities must better manage their current systems while funneling the savings into new technology.

Nearly a decade ago, the complexity of the Quebec transit network was reaching a breaking point. With six different operators, each with their own payment methods, citizens using intercity public transport between Montreal, Laval, Longueuil, Sorel-Varennes, Quebec City and other regions were facing tremendous obstacles. To complicate matters further, the combined fleet consisted of nearly 3,000 buses, 4 metro lines, and another 5 suburban rail systems. The demand for a shared ticketing system that simultaneously encouraged multi-modal transportation for its passengers was never more critical.

The solution is the successful implementation of the OPUS contactless card that can now be used to access the major transit systems, including the RTC (Réseau de Transport de la Capitale), the STL (Société de transport de Laval), the STM (Société des Transports de Montréal), and the AMT TRAM (Agence métropolitaine de transport). Without the traditional technology of magnetic strips, the OPUS card is even more user-friendly than a standard credit card. As long as the user simply flashes the card in close proximity (contactless) to the Atlas® modular payment system, the passenger is ready for safe travel by bus, metro, or train throughout Quebec. Meanwhile, transit authorities employ data analytics to determine the numbers of passengers taking advantage of each component of the network.
Data Analytics to Change Existing Patterns.

As local governments begin to implement data mining strategies to document and analyze the tiniest transportation decisions of the average citizen, new opportunities to perhaps cause deviations in certain patterns of behavior become instantly apparent. By allowing instant credit card and smartcard access to modern mass transit systems, including their related parking lots and garages, many cities are taking this concept one step further. They are also anonymously tracking those individuals who purchase a parking spot in garages around the city that are not transit-stop-adjacent. In doing so, the newly gathered data is useful in potentially creating deviations in transportation patterns in any number of ways, including:

• Generating more accurate predictions of how weather conditions influence ridership.
• Offering incentive programs targeting specific classifications of riders to bolster ridership, decrease traffic congestion, and reduce air pollution.
• Creating new or increasing the number of public transit routes to less affluent parts of the community.
• Modifying existing travel routes to reduce wait times, increase comfort, or enhance the overall travel experience in some other manner.
• Adjusting travel routes to accommodate more or less frequent stops at individual terminals.

An outdated yet common assumption among many in the transportation industry is that the typical passenger always travels from Point A to Point B. However, as public transportation continues to rise in acceptance, travel between only two points of location may no longer fit the standard model. Through the effective implementation of data analytics strategies, cities can finally uncover these types of incorrect assumptions and adjust the travel experience accordingly.

Fighting Traffic Congestion through Data Analytics

Every municipality is fully aware that a large portion of the community simply will never relinquish their private automobile as their preferred mode of transportation, no matter how attractive the public transit system becomes. And in nearly every case, there is simply not enough space or money to build new infrastructure. With the influx of information provided by data analytics systems, cities can now substantially reduce roadway congestion by manipulating high-occupancy toll (HOT) lanes, or “carpool lanes.”

Through traffic cameras and other monitoring systems, transportation officials can open or close HOT lanes, change the related pricing, or issue warnings of upcoming congestion events to reduce possibilities of traffic accidents. All of these functions can occur instantaneously without a great deal of advanced planning. The system keeps growing with the agency, while consistently manipulating traffic congestion on an almost immediate basis. This same method of traffic manipulation is also useful for cities with regular traffic congestion events occurring from bridge and tunnels entryways.

The Final Analysis

For cities across the globe, the transportation industry is increasing facing the same combination of challenges. Since most metropolitan areas can only expand upward rather than outward, building new infrastructure is largely impossible while the issues of traffic congestion, air pollution, and travel efficiency only continue to compound. By partnering with an expert in transportation data analytics who can effectively organize and consolidate the volumes of data acquired through a multi-modal transportation system, cities like these can proactively overcome enormous obstacles and maximize legacy investments while providing a higher quality of life for its many citizens.

Every $1 invested in public transportation generates approximately $4 in economic returns.