

WHITE PAPER

How Smart Spaces are Transforming Public Transportation Operations

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There are many innovations, incredible new data sources and emerging technologies that are helping transit agencies achieve these goals in countries around the world. By gaining new insights into their operations, passenger experience, and safety efforts, agencies are making smarter decisions about how they manage assets, passenger flows, and schedules to reduce costs, improve management to do more with what they have, and help their teams be more successful. But understanding and managing the vast new streams of data flowing into, through and around your transportation system is far easier said than done. How do you ingest, analyze and visualize data for better decision making? How do you unify multiple streams of information and disparate systems? How can you “see” what is happening across your entire system – in real-time? How do you extrapolate what is meaningful and draw conclusions to assist you in managing your operations? The answers lie in the implementation of what many are calling “Smart Spaces.”

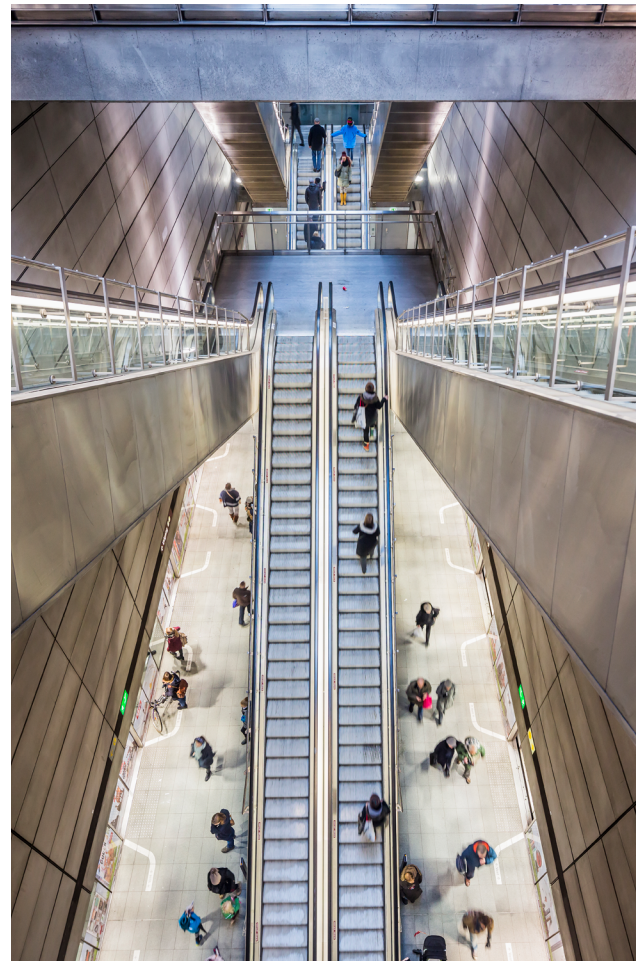
Intelligent Transportation Moves Smart Communities

The days of public transportation operating in a vacuum are gone. The age of the smart community requiring intelligent multimodal and public transportation solutions is now. According to multiple studies, millennials want more transit options, and a majority of them say having public transit nearby is a major factor when they decide which city or neighborhood to live in. They also want to solve their last mile requirement with multimodal and microtransit options that make it easier for them to use transit.¹ To make intelligent, fully integrated mobility a reality requires us as transportation leaders to:

- Enhance multimodal journeys (including transit schedules that need to be built to be more relative to a customer’s journey).
- Optimize parking availability and pricing, including at transit park-and-ride lots.
- Ensure the safety and security of system users.
- Provide real-time information to passengers about occupancy and availability.
- Improve planning, maintenance, costs, and service using real-time and historical insights, along with predictive analytics about passenger flows and numbers in stations, on vehicles, and across time and events.

Public transportation systems differ, but their managers have similar goals:

- Improve on-time performance and system reliability.
- Maximize safety and minimize accidents, both in frequency and severity.
- Improve the passenger experience.
- Increase revenues and farebox ratio.
- Integrate more efficiently with the emerging micro-transit and shared transportation ecosystem.



¹ Source: <https://observatory.journalism.wisc.edu/2018/03/21/what-do-millennials-want-more-trains-and-buses-fewer-automobiles/>

Successful Public Transit will Understand and Implement Smart Solutions

In the age of the internet of things (IoT) and artificial intelligence (AI), choosing what technology to leverage and knowing how to deploy it, let alone how to use the information soon to be at your fingertips, can be downright intimidating, especially because disruptive innovations are rapidly changing the transit landscape. With limited time and resources to dedicate to understanding your choices, it can seem like there are more questions than answers for transit managers looking to keep up with the innovations available to them. And, with urban populations worldwide expected to nearly double from 3.6 billion to more than 6.0 billion by 2045², the need to find answers quickly will only accelerate. This acceleration will occur alongside the mounting stress on ageing public transportation infrastructure and the requirement to manage it more efficiently.

The power of data to transform your operation and improve the passenger experience is not only real, it is enormous. So, understanding how to access and use data is an imperative, not an option. Data is the key to enhanced efficiencies, improved passenger experiences, and reduced costs. With technology and expertise, and the right data analytics partners, you can harness the power of your data to produce meaningful outcomes and improve mobility.

Another question to consider: What if you already have some of the key digital infrastructure needed to start transforming your spaces into smart spaces? What if we told you that infrastructure is video?

Intelligent Technologies are Advancing Public Transportation

Because of advances in AI, such as computer vision and machine learning (ML), video data is now able to produce a wealth of insights and real-time alerts, from counting passengers in stations and counting vehicles, to analyzing traffic and parking, to monitoring human behavior on platforms. The best part is that the software that analyzes this type of information can often leverage video footage from your existing security or traffic cameras.

3D lidar, which is like radar, but uses lasers rather than radio waves, is also being deployed to deliver insights with the advantage that it does not collect any personally identifiable information (PII). By combining video and lidar data, it is possible to make measurable what was previously unmeasurable. And, thanks to intelligence “at the edge,” (meaning compute power and sensors installed on vehicles or in stations) these data can be analyzed near the source, which reduces transmission costs, protects privacy, and increases speed of insights.

Connected smart spaces, like intelligent transportation systems, can link their data with other intelligent environments and operate in concert. “Communities are complex ecosystems,” said Justin Bean, director of Smart Spaces marketing for Hitachi Vantara. “Transportation and mobility managers across the globe are all looking for the same outcomes of keeping people safe, while operating more efficiently and effectively. At the same time, everyone wants passengers to have a great experience.”

According to Bean, a transit agency in a major Midwestern metro area that carries passengers throughout multiple cities sets a good example of creating a holistic approach of data-driven safety. This agency started by building a secure transit system across multiple cities and jurisdictions, and then connecting it with other agencies in the community for more coordinated responses to safety and security issues. This same platform can help multiple agencies and departments share data to collaborate as a true smart city.

The [City of Moreno Valley](#), California monitors real-time traffic and adjusts signal timing, improving traffic and emergency response, while enhancing public safety. “[The Hitachi solution] allows us to monitor traffic in real time as we adjust the signal timing,” said Eric Lewis, Traffic Engineer for the City of Moreno Valley. “We have central control software for both traffic management and emergency vehicle pre-emption. Now we can see exactly what’s happening, what resources to deploy, and make any changes on the fly.”

Additionally, [Copenhagen's driverless metro rail](#) is working with Hitachi on a headway solution, which dynamically deploys trains and adjusts frequency to meet demand. This solution senses the number of people at each station, and could be tied to local event data to make predictions about how resources should be allocated seasonally, throughout the weekday, and down to the minute. Occupancy information like this could also be delivered to passengers ahead of time so they know how full trains and buses are before they choose when to embark.

These technological advantages are not limited to ground transportation. [New York Waterways](#) is the area’s largest ferry operator, with more than 30,000 daily passengers. The ferry operator has connected its fleet to be able to monitor vessels in real time, while tracking them on the same system and connecting to bus and train schedules so they can adjust speeds to save fuel when there’s enough time to slow down, or speed up to help passengers make their connections.

Even longer-range transit is learning from data. [The Intercity Express Programme](#) swiftly whisks passengers along the eastern seaboard of the UK, using high speed, hybrid electric trains. Hitachi is delivering this program with partners through a “Trains-as-a-Service” model, whereby the company operates and maintains the trains based on [predictive maintenance](#).

² United Nations, World Urbanization Prospects, 2014.

and intelligent operations that leverage more than [3.6 million data points per second](#). With this enormous amount of data, operations and maintenance are optimized, energy is recaptured, and trains are monitored in real time.

These systems are all leveraging the power of their data to accomplish their respective mobility missions and improve quality of life in the communities they serve.

Putting Data to Work for You

In today's increasingly connected world, it is important for transportation officials to find ways to use data-driven insights to make communities and transportation safer and more efficient for everyone. In many cases these solutions can utilize IT infrastructure, such as video cameras, data centers, and security systems, that are already in place. They can also integrate external data from social media and other third-party sources to provide additional information on systems and incidents as they are occurring.

By utilizing big data from a wide variety of sources, it is possible to establish solutions that provide real-time, actionable information that transportation officials can use to make operations run smoother, improve safety and increase mobility.

Hitachi's [Lumada Video Insights](#) and [Smart Spaces](#) solutions are prime examples of such technology. These solutions can provide transportation officials with an integrated view of their operations, including asset tracking, passenger volume and flow, traffic, parking, safety and security. Existing cameras in train stations, at bus stops, and on trains and buses provide rich video data that can be analyzed for a myriad of information including possible intrusions into restricted areas, incidents of unattended suspicious bags, and accurate counting of people in vehicles or terminals.

Combining this data with other data sources like social media that can be geo-fenced around stations or surrounding areas can help enrich the depth of insights that can be gained. For example, you may be able to tell that a train station is unusually busy from video data, but by integrating social media data about a large event happening nearby may explain why the station is crowded, if there's an emergency to proactively respond to, and whether sentiment regarding your service is negative or positive.

In other cases, the train route information and arrival/departure times can also be integrated with in-terminal retail sales data. This can be used to help terminal operators and the retailers better understand the purchasing trends of passengers and then use the trend information to help personalize the retail experience for passengers.



The possibilities for operational improvements that can be driven by these solutions are virtually endless, with new applications being created as mass transit operators implement and further understand what the technology can do for them.

Keeping it Simple: One View for All Transportation Data and Intelligence

With all these data-based solutions, it is as important as ever to keep the reporting and analysis of the data simple and straightforward. While more insights may sound fabulous, the reality is that the insights need to be made available in a way that is easy for consumers of the information to digest. Simply presenting pages upon pages of disconnected data points on multiple systems could end up confusing decision-makers and front line operations teams. Instead, operators need a "system of systems" to gain a holistic view of how the insights can be applied to their operations.

One way to do so is to present multiple disparate systems and insights on a single pane of glass. This should include geospatial and graphical analysis, video, operational data, GPS tracking of mobile assets, data from buildings and vehicles, social media and other sources. When automation and alerts are included in the mix, this visual representation of data is not only insightful, it will also help to power proactive responses to incidents.

Take the Next Step Toward Deeper Intelligence

Technology is helping transportation agencies become smarter and safer. By using IoT, analytics, AI, and other proven technologies, communities and the transportation agencies they serve are harnessing the power of intelligence to become smarter, which increases efficiency, enhances safety and security, and improves the way people work and live.

These solutions are rapidly improving and evolving, which makes it critical for you to work with partners who understand not just information technology (IT) but also how operational technology (OT) works, and can provide holistic solutions to help you reach your long-term goals – while minimizing integration headaches. With a long history in IT, OT and transportation systems such as [high-speed rail](#), Hitachi is a trusted partner to transportation agencies around the world, providing [intelligent solutions for maintenance and repair](#), and asset operations as well. To learn more about Hitachi solutions for transportation operations, [click here](#).

Be sure to look for the next white paper in this short series, which will focus on the safety and security of the passenger experience.

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HV-CBE-WP-Hitachi-Solutions-for-Transportation-Operations-22Aug22-A