GETTING SMART ABOUT TRANSIT
When it comes to public transit, the city of Portland, Ore., stands out. Despite having a metro population ranked 24th in the country, the city has the 11th largest transit system, when measured by passenger trips. Besides bus service, the city has, over the years, invested in an extensive light rail system, a downtown streetcar line as well as commuter rail. And growth continues. In September, Tri-County Metropolitan Transportation District of Oregon (TriMet), the regional transit agency, will open a 7.3-mile extension of its light rail system. Add it all up and Portland has a robust transit network that is the envy of many American cities.

Portland’s transit system gets a lot of national attention partly because of its investments in different forms of transportation, which are well integrated. It also gets high marks for how it uses technology. The agency was an early leader in the use of smartphone apps for trip planning. It was also one of the first transit agencies in the country to let riders use their smartphones to pay fares. Like a growing number of transit systems, TriMet transmits bus location information in real time. Need another minute to finish that cup of coffee before starting your commute? In Portland, riders can find out on their phone, tablet or computer when the next bus will arrive at their stop within a five-minute window.

While transit agencies always have used technology, most of the focus and spending has been directed toward infrastructure — the buses, trains and rails — as well as significant labor costs. Information technology has played a relatively quiet role as a tool rather than as an overall strategy. But that thinking is beginning to change as mobile computing, social media, GPS, data analytics — as well as other forms of automation — have opened up new ways to improve service and, hopefully, attract more riders.

Transit agencies are using advances in technology in three broad areas. First, there are technology solutions that are meant to make transit appeal to a broad ridership, not just the traditional users who are typically low income or don’t have a car. This is what Terry C. Bills, global transportation industry manager of Esri, calls the Madison Avenue approach, where transit agencies use data and cool technology to market transit so that it appeals to urban professionals and to better understand their needs. “For new urban riders, what’s important is that transit service is on time, clean and fast,” he said.

Second, agencies are increasing the use of intelligent systems to streamline and improve fare collection, scheduling and routing of transit services. Agencies can track not just where their buses and trains are in real time, but they can also know exactly how many people are riding a particular vehicle at a particular time. When this information is put into a database and analyzed, transit officials
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PUBLIC TRANSIT FACTS:

- In 2013, Americans took 10.7 billion trips on public transportation — the highest in 57 years.
- Since 1995, public transit ridership is up 37.2 percent, outpacing population growth, which is up 20.3 percent, and vehicle miles traveled, which is up 22.7 percent.
- Every $1 invested in public transportation generates approximately $4 in economic returns.
- Every $10 million in capital investment in public transportation yields $30 million in increased business sales.
- From 2006-2011, residential property values performed 42 percent better on average if they were located near public transportation with high-frequency service.
- Every $10 million in operating investment yields $32 million in increased business sales.
- Public transportation is a $57 billion industry that employs more than 400,000 people.
- More than 7,200 organizations provide public transportation in the United States.
- People board public transportation 35 million times each weekday.

SOURCE: AMERICAN PUBLIC TRANSPORTATION ASSOCIATION

...can better predict how many buses are needed on given routes at different times of the day and can control when they arrive at a stop, so fewer are too late or too early. Intelligent transportation systems can help control light rail and subway trains, allowing more on the tracks during rush hour, without risk of an accident.

Third, transit agencies are adopting social media for two-way interaction to increase transparency and accountability, while improving how they monitor transit service. The goal is to keep riders well informed and to also mine social media for ways to improve services. Twitter, Facebook, Instagram and other social media platforms have become essential tools for customer-focused transit agencies.

But the application of new technologies, many of which are not expensive to deploy, is far from uniform across the country’s 7,865 transit agencies. Transit officials will be the first to tell you they are broke and don’t have the funds to spend on high-tech tools. Still, a number of cash-strapped agencies, such as TriMet, continue to adopt new technologies, especially those that have an impact on services. This report will examine some of the leading trends in transit technology, and not only explain what they are and how they work but, more importantly, why they can make a positive change in urban transit.

MOBILITY & ITS

In 2013, Americans took 10.7 billion trips on public transit, the highest number in 57 years, according to the American Public Transportation Association. For decades the demographic profile for the typical transit rider was someone who was low income and often had no other means of transportation. In other words, people who used public transit did so because they had to, not because they wanted to.

But since 1995, public transportation ridership has grown 37.2 percent, almost double the amount of the country’s population growth at 20.3 percent, according to APTA. Clearly a new generation of transit riders has stepped forward. Many of them are so-called “choice riders” who have other options to get around besides buses and trains, but prefer using public transit. To keep these choice riders coming back, experts say that transit agencies must offer a ride that is reliable, fast and clean. They also want convenience.

THE APPLICATION OF NEW TECHNOLOGIES IS FAR FROM UNIFORM ACROSS THE COUNTRY’S 7,865 TRANSIT AGENCIES.

One way that transit agencies can make the daily commute convenient for riders is with mobile ticketing. With approximately 91 percent of adults using a cellphone, according to Pew Research, the push to collect fares via an app on a mobile phone is extremely appealing to transit agencies. Not only does the technology make it easy for people to purchase rides, but mobile ticketing also lowers the cost of fare collection because riders pay for the fare equipment — the mobile phone — not the agency. In a 2013 Accenture survey of transit riders in nine major cities, more than half of respondents said they would be willing to pay more per ride for tech enhancements like paperless ticketing, and 75 percent said travel would be easier with electronic ticketing.

In 2013, Dallas Area Rapid Transit launched one of the first mobile phone fare collection systems in the country. Technology for the system was developed by the Danish...
Public transit data is growing exponentially as agencies expand the use of automation to collect information that can improve transit service for both riders and for operations. The problem is that not all agencies are equipped and trained to analyze and use the data to improve performance.

One obvious solution is to publish the data so that third-party developers can make use of it for public consumption. More than 200 transit agencies worldwide are publishing their schedules, fares and station locations to Google’s TransitDataFeed in a common data standard and for free, according to Stephen Goldsmith, the former mayor of Indianapolis and professor at Harvard’s Kennedy School of Government (and also a Government Technology columnist). In the United States, a growing number of city transit agencies have set up developer portals and created application programming interfaces to give the public and programmers the ability to create tools and apps that help riders plan trips, receive accurate arrival times for buses and trains, and learn about service updates.

One of the first transit agencies to release its data to the public was Portland’s TriMet, which launched the practice in 2005. Since then, the agency has expanded the number of published data sets and has met with developers several times to explore new types of transit applications. Other open data portal leaders include: Chicago Transit Authority; San Francisco’s Bay Area Rapid Transit; the Metropolitan Transit Authority in New York City; Massachusetts Bay Transit Authority; and the Washington Metropolitan Area Transit Authority.

Some members of the American Public Transportation Association believe that open data has triggered more innovation in public transit than any other factor in the last three decades, according to Goldsmith. But open data has its drawbacks. The quality of the tools and applications can diminish considerably if the data isn’t clean, isn’t updated on a timely basis or isn’t available in standardized formats.

Prior to launching the service, TriMet knew that 50 percent of its riders had a smartphone; today the number is closer to 60 percent, according to Chris Tucker, TriMet’s director of revenue operations. Mobile ticketing allows riders to buy tickets anytime, anywhere. “We’re seeing a big shift in how riders purchase fare tickets,” said Tucker. “Fewer are heading to retail stores or a ticket vending machine to buy their ticket.”

The current version of the mobile ticketing system is a stand-alone system that operates in conjunction with the agency’s legacy fare collection system. But TriMet is developing a new, comprehensive fare collection system that, when finished, will allow the agency to get rid of aging and expensive fare collection equipment and reduce the cost of fare collections as a percentage of revenue. Mobile ticketing will be a fully integrated feature. GlobeSherpa, an Oregon-based mobile payment and ticketing company, is helping TriMet develop the digital fare system.

Not surprisingly, other agencies are moving in this direction. Long Island Rail Road, the nation’s largest commuter rail system, expects up to 25 percent of its riders to use its yet-to-be-launched mobile ticketing app within five years. The Massachusetts Bay Transportation Authority rolled out a mobile ticketing service for commuter rail riders in 2012. Both ticketing systems were developed by Masabi, another mobile ticketing software company.

firm Unwire, which has extensive experience with mobile ticketing in Europe. In the same year, TriMet also unveiled the first mobile ticket for use on both buses and trains. A year later, the agency sold nearly 1 million mobile tickets, surpassing expectations. “Our mobile ticketing app has been an overwhelming success, quickly surpassing our expectations,” said TriMet General Manager Neil McFarlane in a release.

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But mobile ticketing isn't just a convenience for riders. To keep mobile ticketing attractive to riders and to entice new riders to use TriMet's transit services, the agency plans to offer a discount system in the form of fare caps, which will allow passengers to ride for free once they've used the full value of the fares they have purchased. Tucker compared the fare cap system to a retail gift card, but with discounts built in. “This is going to be exciting for everyone, because it will be much easier to use,” he said. “It really frees up the options riders have as to how they plan their journey.”

INTELLIGENT TRANSIT
Mobile ticketing isn't the only feature available for riders with smartphones. A growing number of agencies (and third-party providers) offer bus and train arrival time via apps. There are different ways agencies can calculate when a bus arrives at a stop, but the most popular and ubiquitous is automatic vehicle location (AVL) technology.

AVL, part of the constellation of intelligent transportation system (ITS) technologies that have been developed in recent decades, consists of two major components: Onboard GPS that tracks the location of each bus in real time and software that displays the location of the buses on a map. The technology has been a boon for commuters who want to know when the next bus or train will arrive. But it also helps transit managers respond to unplanned service disruptions as well as monitor distance between buses and on-time performance.

Some agencies have coupled AVL data with signal prioritization systems to improve scheduling. In Portland, transit officials decided that in order to make public transportation more reliable (and popular), they would concentrate on the on-time performance of buses that served area schools and hospitals — two places where being on time is critical, according to Esri’s Bills. Signal prioritization technology can synchronize, as well as delay, signal changes for traveling buses to keep them on schedule. By linking AVL data with a signal prioritization system, bus schedules become easier to control, reducing the possibility of a bus arriving too early or too late at a stop next to a school or hospital.

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service, while helping to control costs, is the automated passenger counting (APC) system. Using infrared sensors, APC records the number of passengers who board and debark a bus at each stop. APCs are far more accurate than the old-time manual checking systems agencies used to deploy.

An APC can help agencies more accurately figure out how many buses they should run on each route, said Chris MacKechnie, a transportation expert and service planner with the Long Beach, Calif., Transit Agency. “The data from APCs can be used to determine schedule adherence and whether bus routes need more or less running time,” he said.

APC and AVL systems aren’t cheap, however. They can cost between $80,000 and $100,000 — each — per bus, according to MacKechnie. While the feds provide grants to fund ITS technology projects, users tend to be the larger transit agencies, he added.

For those agencies with the funds and resources to automate their fare collection, bus and train routing and passenger monitoring capabilities, the next step is to analyze the reams of data generated by these systems, look for patterns and develop new transit services and strategies.

Applying analytics to transit data is a new discipline, according to Wade Rosado, director of analytics at Urban Insights, a subsidiary of Cubic Transportation Systems, a global transportation IT company. “You can’t just use existing databases,” he said. “You have to create a new, integrated database.” Done correctly, models can be generated of how people use bus and rail routes and, more importantly, new routes can be designed that best meet the needs of the customers who use transit, Rosado added.

The San Diego Metropolitan Transit System used Urban Insights to analyze information from its disparate databases to understand ridership patterns. The data is complex, involving point-to-point travel times, transfer points, geospatial demographic information, ridership levels and even results from ridership satisfaction surveys. But the deep dive into data and analytics can pay off handsomely.

Ridership on San Diego’s bus and trolley lines has increased, service has improved, with improvements in on-time performance and reductions in fare subsidies, according to Earl’s Bills, who has followed the work of these agencies used to deploy.

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The field of transit data analysis is so leading edge that most agencies rely on firms like Urban Insights, Cambridge Systematics and a handful of others that have the expertise to mine the various types of data. One of the newer entrants to the field is Urban Engines, a firm launched by Stanford University Professor Balaji Prabhakar and Shiva Shivakumar, a former Google executive. Urban Engines emphasizes spatial analysis and behavioral economics to help agencies reduce congestion on transit systems.

To reduce crowding on bus and train lines, Prabhakar said it’s useful to know how, when and where congestion hot spots occur. For example, a bus route may have a hot spot that affects just 20 percent of the route’s length during rush hour. By analyzing APC information and other data sets, agencies can figure out how to deploy more buses that run along just the most congested portion of a route, rather than the entire route. More efficient use of buses not only helps alleviate congestion, but it can also reduce wear and tear on buses that no longer have to run the entire route, just those sections where there are the most riders.

SOCIAL MEDIA & TRANSIT

Traditionally, connecting with riders hasn’t been a top priority for transit agencies. To find out what riders thought of transit service, agencies used periodic surveys to gauge performance, interest in new transit projects and to monitor conditions. But thanks to social media, agencies now have an opportunity to connect with their customers, putting a personal face on what appears to be a faceless bureaucracy. Social media tools and platforms — ranging from Facebook pages and Twitter feeds to Instagram photo sharing, YouTube’s media sharing and Foursquare’s location platforms — have created new avenues through which agencies can engage riders. According to a 2012 report issued by the Transportation Research Board, the reasons transit agencies use social media fall into five broad categories: timely updates, public information, citizen engagement, employee recognition and entertainment.
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## ON THE GO.

**2012 INCREASE IN SALES**

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<tr>
<td>Tablets</td>
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¹ Insights, IC Insights Research on data for Tablets, Notebooks and Total PC Shipments
² Center for Digital Government, “Mobility and Security Research” September, 2012
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SOCIAL MEDIA: STILL A WORK IN PROGRESS

In 2012, the Transportation Research Board surveyed transit agencies about their social media practices. The results were published in the report Uses of Social Media in Public Transportation. The research identified best practices as well as barriers and concerns about using social media in transit. It also identified gaps in knowledge about social media that needed further study. They included:

SOCIAL MEDIA POLICY. Although industry experts believe having a social media policy is critical, only one in four transit properties participating in the survey had such guidance in place. More research could identify elements of a social media policy that are relevant to public transit agencies.

SOCIAL MEDIA METRICS. Most of the surveyed agencies measured the effectiveness of their social media activities by using built-in metrics, such as counting “friends” or followers, and by using a third-party application such as Google Analytics. While these metrics can give a good overview of activity, they don’t provide the information agencies may need to better understand the effectiveness of their social media activities. Additional research could provide transit agencies with the tools for estimating the costs and benefits of social media, perhaps by including sample metrics or performance indicators drawn from other industries.

INTERNET SECURITY. Industry experts consistently emphasized the vulnerability of social media applications to security threats, including viruses and malware. Additional research could help determine whether social platforms leave transit agencies especially vulnerable to cyber threats and, if so, recommend appropriate actions.

ACCESS FOR PEOPLE WITH DISABILITIES. Though federal agencies are required to conform to Section 508 accessibility guidelines for their Web applications, some analysts argue that these rules don’t apply to government use of privately owned social media sites like Twitter and Facebook. Additional research could help organizations identify features to improve the accessibility of social media sites and contribute to the debate about how federal accessibility rules apply to social media.

MULTICULTURAL ISSUES. The characteristics of social media users are not yet well documented and questions remain about whether social media platforms can bridge the digital divide, or the perceived gap between people who have access to information technology and those who do not. While not conclusive, research suggests that social media attract users from multiple demographic categories. Further research could provide more data on the demographics of social media users and help determine whether public transportation agencies must take additional actions to ensure that all riders can access online information and social networking sites.

INTEGRATION WITH OTHER AGENCY ACTIVITIES. Despite the growth in mobile applications and traveler and citizen information services, only a few responding agencies reported integrating social media with these programs. Additional research could quantify the potential for better coordinating social media with other platforms for providing agency information.

REVENUE POTENTIAL. Industry experts anticipate growth in several areas, including location-based technology and social-buying services. Additional research could help identify revenue opportunities associated with these applications.

While there’s no definitive list of transit agencies using social media, a 2014 survey by the American Association of State Highway and Transportation Officials of 44 state DOTs found that 98 percent use Twitter, making it the most popular transit-oriented platform; more than three out of four have adopted social media policies; and about 44 percent of DOTs had staff dedicated to social media.

Similarly, local transit agencies have embraced social media, and the numbers show it. New Jersey Transit has more than 70,000 Twitter followers and another 46,000 likes on Facebook. Hot topics include customer relations, service alerts and arrival times. San Francisco’s Bay Area Rapid Transit has more than 80,000 followers on Twitter and receives 200 to 300 messages daily. Its social media staff monitors the messages—a train car is too hot, smells funny—and will pass along messages to crews if action is needed. But they also create content for riders, such as a video on “the crowded car survival guide” or information about new features, like a recent replacement of seat and carpeting for its fleet of subway cars. The department aggregates messages from riders that deal with bigger topics and they get elevated to proper management, according to Melissa Gordon, a communications representative with the agency. “We are the canary in the coal mine,” she said.

Keeping management informed about serious issues that bubble up through social media chatter is important. It’s also possible that data from social media can be of strategic value to transit agencies that strive to be more customer-focused. Social media can act as a monitoring tool that can help transit agencies improve how their systems run and even increase trust between passengers and agencies. “Transit providers can use aggregate mobile phone data and social media posts to improve..."
Intel Security combines the expertise of McAfee with the performance and trust of Intel to deliver secure computing to consumers and businesses worldwide. We believe that as technology becomes more deeply integrated into life, security must be more deeply integrated into technology. Because when everyone has the confidence to use technology to its full potential they can achieve their full potential. Visit intelsecurity.com.

Kaufman recommends transit agencies develop a “co-monitoring” system that combines staff reports, data analysis and social media to create an improved feedback process, speed up awareness about transit conditions, reduce the cost of infrastructure monitoring, empower riders and improve customer relations.

But elevating social media from an interactive communications tool to a strategic asset that can make transit agencies more nimble, service-oriented and able to perform better overall, isn’t without some pitfalls. These drawbacks range from legal concerns over records retention to a lack of resources to train staff on using social tools in more sophisticated ways. Then there’s the issue of dealing with the digital divide between passengers who use social media all the time and others who aren’t.

Another concern is that, with its anonymous participation, has been shown to invite excessively critical posts. The case for more transit technology

America has been and still is a car-oriented society. In the first decade and a half of the 21st century, the share of public transit in urban mobility was less than 2 percent of all passenger miles, according to Jean-Paul Rodrigue, author of The Geography of Transport Systems. Since the 1920s, the use of public transit in urban areas has been in steady, sometimes precipitous, decline. To put it simply, public transit has plenty of room to grow. Fortunately it’s starting to happen.

Beginning in the 1990s, with increases in government funding for public transportation projects, ridership has started rising again, breaking a 57-year record in 2013. And growth should continue for two reasons. First, despite the paucity in federal funding, the U.S. is expected to invest $71 billion in 2015 in new light rail, streetcar, subway, commuter rail and bus rapid transit lines, including new tracks, rail cars, buses and stations, according to Yash Prabhu, an expert on transit systems. The multi-billion dollar investments will give added capacity to nearly 90 transit systems throughout the country.

Second, as this report has shown, transit agencies are beginning to embrace information technology as a strategy to attract new riders while improving the capacity of existing infrastructure. It starts with convenience. Mobile ticketing is taking off and the quicker transit agencies make the feature available, the better. By giving riders more information about their transit system, especially arrival times and how to plan a trip that reduces transfers and wait times, agencies are making their service more attractive to choice riders. This information is extremely accessible these days, thanks to mobile devices and the publication of open data so that third parties can create transit-oriented apps.

Somewhat more expensive intelligent transportation technology, in the form of vehicle location and passenger counting systems, gives transit agencies the digital infrastructure they need to run buses and trains more efficiently. When the data from these systems is properly analyzed, transit agencies have the ability to put routes where riders need them the most and to accurately gauge capacity. More efficient use of buses and train fleets can also translate into less wear and tear on equipment.

Technology also allows transit agencies to improve how they serve customers. In the private sector, 62 percent of consumers have used social media to report customer service issues and nearly 30 percent of customers expect a service response within one hour when they contact a company via social media, according to Oracle Retail. These same consumers expect similar digital dialogues from their transit agencies. Those agencies that do it correctly will have a higher percentage of satisfied riders.

Making the right investments in transit technology takes time and money. But budgets remain under stress. New York City’s vast transit agency, the Metropolitan Transportation Authority, could be facing $100 million deficits in coming years, according to The New York Times, and has to address a $18 billion shortfall in its capital plan. MTA just announced a fare increase to close the budget gap. Even innovators like Portland’s TriMet aren’t immune. Over a four-year period, the agency has contended with $56 million in budget shortfalls, according to the city’s daily newspaper, The Oregonian.

Yet budget issues, a perennial problem for transit agencies, shouldn’t be an excuse for not using more advanced IT in public transportation. With the right IT leadership and the kind of innovative mentality that is spreading through city governments these days, transit agencies can and should be able to apply technology in cost-effective ways that can reap far-reaching results as more people make public transit their choice for travel. It’s a ride worth waiting for.
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