ENTERPRISE ASSET MANAGEMENT

Meeting tomorrow's challenges: How Enterprise Asset Management keeps transit rolling

Public transit is widely considered an essential service in medium and large urban areas in the United States and Europe. Yet the sector is chronically underfunded, faces a substantial shortfall in maintenance funding, and is largely an afterthought for strategic investment. In both markets, the largest share of transit services is concentrated in a relatively limited number of larger cities, reflecting a historical predisposition toward private vehicles as well as the larger critical mass of population and transit demand required to sustain a more extensive system.

No enterprise has unlimited financial resources. But when funding is notably short, it becomes even more important to make optimal use of every dollar, pound, or Euro, and of every asset in an organization's inventory. For transit agencies, this challenge points directly to the connection between operational efficiency and a more strategic approach to enterprise asset management.

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Case Studies: Transit Asset Management in action

When assets are complex and expensive, a strategic approach to transit asset management is essential to control costs; optimize reliability, safety, and operational efficiency; manage the design and implementation of new capital projects or equipment acquisitions; and get the most out of every asset throughout its life cycle.

The following case studies are examples of the current state of play in applying that rule to transit asset management.

- With 19,000 employees across 242 locations and 350 separate maintenance contracts in place, Cincinnati-based First Transit used a company-wide enterprise asset management (EAM) solution with built-in mobile capability to cut parts expenses 3-4% per year over 10 years, while empowering technicians to suggest process improvements and cost savings.
- The San Francisco Municipal Transportation Agency (SFMTA) introduced a 25-year EAM life cycle to standardize practices and processes, support compliance with State of Good Repair (SGR) standards, break down departmental siloes, and encourage and reward innovation.
- ScotRail uses cloud-based EAM to optimize the reliability of the 292 trains it operates across eight different suburban, regional, and intercity fleets, representing 92% of Scotland's rail network. The system boosts visibility across a diverse inventory of rolling stock, enabling the company to manage planned and corrective maintenance, boost productivity, and improve reliability.
- Vancouver's TransLink has been refining and enhancing its EAM system since 1994. The system has evolved through multiple customizations and generations of software to serve a system with 935 buses on 14 different chassis, 6,700 employees, and 385 million boardings in 2016.
- The Shenzhen Municipal Metro Group in Guangdong province, China, uses EAM to integrate its maintenance and asset management systems and improve operational control of its organizational structure, processes, key performance indicators, routine reporting, and information technology.

The bigger picture: A history of incremental gains

Not so long ago, the state of the art in transit asset management was as simple and challenging as sharing practices, manuals, and definitions. In 2005, the U.S. Federal Transit Administration (FTA)'s Transit Cooperative Research Program (TCRP) saw the need to directly encourage transit operators to document their bus maintenance practices and share them with other agencies.

"People involved in maintenance of transit buses must frequently address issues for which no internal written maintenance practices are available," wrote consultant John Schiavone of the Transit Resource Center in Guilford, CT. Then when they do, "the results of such efforts are not typically shared with the rest of the transit industry," leading to significant duplication of effort.

In that period, recalled one veteran U.S. asset management consultant, manufacturers were often the only source of advice or solutions when transit authorities ran into problems with the equipment they had acquired. Some manufacturers or vendors would refer customers to other users that had reported similar problems. Others, seeking to minimize the risk of litigation, were sometimes less forthcoming. Maintenance managers might glean essential guidance from service bulletins, or from hallway conversations at industry conferences. But in an era before national databases or even the most rudimentary online discussion boards, transit operators would sometimes improvise their own predictive maintenance programs, pulling vehicles off the road to proactively replace key components with known problems rather than have them fail in service.

Peer learning and information-sharing is now a much more established practice, and if front-line maintenance teams can track a specific condition in which a piece of equipment fails, manufacturers are often willing and eager to learn from the user community. But spotting and acquiring the best equipment and components is a continuing challenge.

On the whole, even as practices have evolved and improved over the last decade, there is ample scope for agencies to gather new knowledge, develop more effective systems, optimize their asset management investments, and improve operating performance. However:

- Transit systems in the United States and the European Union lack sufficient funds to meet their current maintenance needs or keep up with projected or accelerated growth in customer demand.
- While there is some recognition of the potential for a more integrated, enterprise-wide approach to transit asset management, understanding and application appear to be inconsistent.
- At present, this gap is most urgent for larger transit authorities operating older networks. But that means the more established agencies are just a bellwether for more recent arrivals. There is no area of infrastructure investment where any manager can ever assume that all needs have been permanently addressed. Even the newest installation should be subject to a preventive maintenance plan, to anticipate the reality that it will inevitably deteriorate and eventually fail, without consistent preventive or predictive maintenance.
- Cities, transit operations, and surrounding transportation networks are being transformed by changes in technology, systems, environmental standards, and customer expectations that would have been unimaginable in years past. If agencies are already scrambling to keep up with today's demands, it stands to reason that they will need every possible advantage—including state-of-the-art enterprise asset management systems—to embrace a more dynamic, demanding business environment that may attach higher value to effective transit services.

Transit in the United States

In 2015, users in the United States took 10.6 billion trips on various modes of transit, according to the **American Public Transit Association**. FTA's **National Transit Database** listed 897 urban transit providers, 778 of them cities, counties, transit authorities, non-profits, or planning organizations. FTA reported that those agencies' operating budgets grew 41.8%, from $31.3 to $44.4 billion, between 2007 and 2015, with the federal government covering less than 10% of operating but about 42% of capital costs.

U.S. transit volume

America's transit system today is largely an embodiment of the 80-20 rule, with the greatest share of activity and business potential flowing from a small proportion of agencies. A list of the country's 16 top transit agencies by 2011 trip volume, drawn from DOT's ranking of 42 Urbanized Areas (UZAs) with populations over a million as of 2010, shows that the country's transit leaders broke into three tiers:

- The New York-Newark metropolitan area.
- A half-dozen cities with volume above or just below 400 million trips per year.
- Three communities with annual volume in the range of 100 to 200 million trips, two of which ranked higher for transit ridership than they did for population.

The 42 communities in the DOT ranking accounted for only 8.6% of UZAs in the United States, but 62.5% of the urban population, 88.4% of the transit passenger miles travelled, and more than four times the trips per capita. This cross-section shows that demand for transit—and for the enterprise asset management services that keep transit systems up and running—is more likely to reflect local planning choices than current population levels. The Washington, Boston, and San Francisco metropolitan areas had transit ridership out of proportion to their populations, while Miami, Dallas-Fort Worth-Arlington, and Houston were at the opposite end of the scale.

Top U.S. Urban Areas by Transit Trips and Population				
Rank		Urbanized Area (UZA) Name	Unlinked Transit Trips (Million/2011)	Population (2010)
Trips	Pop			
1	1	New York-Newark, NY-NJ-CT	4,017.7	18,351,295
2	2	Los Angeles-Long Beach-Anaheim, CA	661.8	12,150,996
3	3	Chicago, IL-IN	644.5	8,608,208
4	8	Washington, DC-VA-MD	487.3	4,586,770
5	5	Philadelphia, PA-NJ-DE-MD	403.9	5,441,567
6	10	Boston, MA-NH-RI	389.6	4,181,019
7	13	San Francisco-Oakland, CA	388.4	3,281,212
8	14	Seattle, WA	187.1	3,059,393
9	4	Miami, FL	158.7	5,502,379
10	24	Portland, OR-WA	112.0	1,849,898
11	19	Baltimore, MD	98.3	2,203,663
12	15	San Diego, CA	98.1	2,956,746
13	16	Minneapolis-St. Paul, MN-WI	93.1	2,650,890
14	18	Denver-Aurora, CO	89.6	2,374,203
15	7	Houston, TX	81.1	4,944,332
16	6	Dallas-Fort Worth-Arlington, TX	71.3	5,121,892

A growing asset management gap

With U.S. **transit demand outpacing growth** in both population and vehicle miles travelled since 1995, what all of these agencies and communities are likely to have in common is a large and growing funding gap for asset management and maintenance. "Over the past 20 years, U.S. public ridership has risen 39%, far outpacing the 21% rise in U.S. population," wrote **Richard White**, acting president and CEO of the American Public Transit Association. But "many transit agencies haven't been able to expand capacity to keep up with this spreading demand. What's more, several of the nation's older, most well-used systems are under the greatest stress, beset by aging equipment and service interruptions that can challenge the best-run transit agencies."

Writing in 2016, **White cited 2010 data** in FTA's 2013 assessment that listed 40% of the country's buses and 25% of its rail transit assets in marginal or poor condition, adding up to an $86-billion backlog in equipment replacement and deferred maintenance. After that, "the nation would have to invest $43 billion annually to improve system performance and condition to accommodate an anticipated 2.4% annual growth in transit passenger-miles," or more if the growth in public demand exceeds current projections. On the other hand, improved maintenance performance between 2004 and 2012 was reflected in a 21% increase in the average number of miles between failures across all modes.

In its 2016 Conditions & Performance Report, which reported 2013 data, the FTA calculated that 31.4% of guideway elements, 15.1% of transit agency systems, 4.8% of maintenance facilities, 4% of vehicles, and 2.1% of stations were in a poor state of repair.

White points to municipalities as a powerful potential ally in making the case for reversing the maintenance and asset management gap. Transit "represents a powerful strategic advantage as they strive to attract business investment and talent, strengthen their economies, and deliver on the promise of an outstanding quality of life," he writes.

Transit Asset Management in the United States

The resources on the FTA's **Transit Asset Management (TAM) website** reflect a largely tactical approach to maintenance and repair, suggesting either the FTA's expectation or the on-the-ground reality that most local transit agencies are at a fairly rudimentary stage in their own TAM planning.

"The large transit agencies are concerned about the consequences of under-investment, but use asset management systems that are elementary and limited," stated a **2011 report** by the U.S. Transportation Research Board's Transit Cooperative Research Program (TCRP). "Most agencies have systems that track all assets and are frequently updated; however, these systems have limited ability to estimate the consequences of not making asset replacements when needed. The systems also lack the ability to test the impacts and consequences of different funding scenarios.

This approach contrasts with a presentation to the **FTA's First State of Good Repair Roundtable in 2009**, which pointed toward the highway community's much broader definition of asset management:

Transportation Asset Management is a strategic and systematic process of operating, maintaining, improving, and expanding physical assets effectively throughout their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision-making based upon quality information and well-defined objectives.

"For many, 'asset management' is synonymous with a single component, such as maintenance management," stated presenter Rick Laver. But "true asset management provides a broader, multidisciplinary, and agency-wide perspective on the optimal long-term management of capital assets." He urged an approach that:

- Is strategic and long-term, not tactical
- Balances the competing needs of operations, maintenance, reinvestment, and system expansion
- Operates across the organization, integrating perspectives from planning, engineering, funding, and IT
- "Seeks to make informed and prioritized decisions regarding the use of scarce resources based on reliable data." (emphasis added)

Laver contrasted this vision of a more integrated, strategic approach to asset management with traditional maintenance functions that are typically carried out by different staff teams, covering different periods of analysis, with insufficient coordination, and performed in different ways by different agencies. His presentation focused on the asset inventory and current condition data required for capital inventory planning, and the decision support tools that could help asset managers "conduct 'what-if' analyses and better predict and prepare for future outcomes."

He encouraged transit agencies to learn from the more sophisticated asset management approaches that were taking shape in the highway community. "State DOTs, AASHTO (the American Association of State Highway and Transportation Officials), and the Federal Highway Administration (FHWA) have been applying and refining highway asset management concepts for more than a decade," his presentation stated, and "while highway practices are still not fully 'matured', the highway community is well out front of transit for TAM implementation."

As recently as 2014, TCRP still saw the need to publish a more basic, **step-by-step guide** to developing a transit asset management plan, suggesting that agencies were operating across a continuum from tactical to more strategic TAM approaches.

State of Good Repair compliance

State of Good Repair entered the U.S. transit lexicon in July 2012 with the adoption of the **Moving Ahead for Progress in the 21st Century Act** (MAP-21). The FTA identifies "helping transit agencies maintain bus and rail systems in a State of Good Repair (SGR)" as **one of its highest priorities**. In its **fact sheet** on SGR formula grants, the FTA describes the program as its first stand-alone initiative written into law that is dedicated to repairing and upgrading the nation's rail transit systems, along with high-intensity motor bus systems that use high-occupancy vehicle lanes, including bus rapid transit (BRT).

The fact sheet lists a variety of investments that qualify for 80% federal support under the SGR program, including development and implementation of transit asset management plans.

FTA's final TAM rule took effect on October 1, 2016. It defines transit asset management as the strategic and systematic practice of procuring, operating, inspecting, maintaining, rehabilitating, and replacing transit capital assets to manage their performance, risks, and costs over their life cycles, for the purpose of providing safe, cost-effective, and reliable public transportation.

Some of the support for that planning activity comes from the **American Public Transit Association**, which works with member agencies on a consensus basis to develop standards and recommended practices.

APTA's recommended practice guide, **Creating a Transit Asset Management Program**, positions TAM as a response to the federal SGR initiative and places it at the intersection of agency strategies for managing performance, assets, and risk.

The Association's **Defining a Transit Asset Management Framework to Achieve a State of Good Repair** lists minimum components of a TAM framework, including:

- An accurate asset inventory, covering "all asset procurements, implementations, and disposals"
- A condition assessment, to provide an overall measure of SGR
- A system of asset performance measures, to assess each asset's adequacy for its intended purpose and compare planned and actual operation
- Life cycle cost tracking, as a basis for comparing asset management strategy options
- Financial planning, to identify funding needs and communicate them to stakeholders
- Continuous improvement, to assess and increase the effectiveness of the program itself
- Risk evaluation, based on the criticality of each asset

The industry consultant cited earlier in this paper warned that federally-mandated SGR will fail if it seeks to define a single best practice for all transit agencies, from the large, integrated systems in Los Angeles and New York to rural operators with one or two vans. Rather than specifying quantitative targets—like a 14-year lifespan for a streetcar—that are bound to be arbitrary, the consultant said SGR could much more productively focus on the process of life cycle planning, and the human resource management at the heart of a working system.

The consultant also pointed to the irony of a federal framework that resorts to financial penalties for transit authorities that consistently miss their targets—a rule that ends up targeting the agencies in greatest need of financial resources to meet a higher asset management standard, which then fall farther behind and lose more ridership and revenue. An underlying challenge is that new equipment or infrastructure is a much more newsworthy investment that lends itself far better to a high-profile ribbon cutting than a new maintenance building or TAM system. The problem is that, the more often those ribbon cuttings take place, the more urgent it will be to get a TAM system in place and operational.

APTA's guidance on TAM frameworks cites information technology as "a vital tool that transit operators should employ as part of an overarching asset management strategy, with 'management' being the key word." It cautions that "acquisition and installation of an asset management software system is not sufficient in and of itself to validate that a transit operator is in fact doing a good job of asset management. Software should be viewed as a tool, much like any other tool used by staff executing physical maintenance, upgrade, or replacement projects."

Over the past several months, the precise place or priority of SGR and TAM initiatives has been in flux. Messaging as of April 2017 focused on infrastructure investment at the federal level, and continuity for many state and local programs that treat transit as an essential priority. What is certain is that the need to maintain and upgrade fleets and physical infrastructure will be a continuing reality that transcends politics and partisanship.

Transit in the European Union

The European Union's International Association of Public Transport (UITP, or Union Internationale des Transports Publics) reports that 2014 "saw the highest number of local public transport journeys in the 28 EU Member States since the turn of the millennium," with urban and suburban public transport systems carrying about 185 million passengers on the average working day and "providing the backbone of urban mobility in many EU cities." Out of 57.6 billion journeys across the EU in 2014, the association reports 9.34 billion on metro networks, 8.38 billion on trams and light rail, and 7.84 billion on suburban railways.

The broad policies guiding transportation infrastructure investment in the EU seem to give only secondary attention to urban transit networks, apart from an interest in "seamless door-to-door mobility" (p. 23) and processes to support urban mobility planning (pp. 25-26). On the other hand, EU Cohesion Policy could be a "substantial source of investments in clean urban transport" through 2020, according to a 2015 working paper for the EU Directorate-General for Regional and Urban Policy that introduced a new methodology for comparing transit access across cities. EU data show no consistent correlation between the population of a metropolitan area and the modal share taken up by public transport.

Top European Union Transit Agencies by Modal Share and Service Area Population				
Rank		Agency/Largest City Served	Public Transport Modal Share %	Service Area Population (2010)
Trips	Pop			
1	12	Budapest	45.0	1,757,618
2	2	TFL/London	43.0	8,600,000
3	3	CRTM/Madrid	28.4	6,454,440
4	10	SL/Stockholm	27.9	2,198,044
5	16	HSL-HRT/Helsinki	26.1	1,198,989
6	15	RUTER/Oslo	23.0	1,232,575
7	11	MOVIA/Copenhagen	21.0	1,768,125
8	1	STIF/Paris	20.2	12,014,814
9	5	ATM/Barcelona	18.7	5,026,709
10	14	SYTRAL/Lyon	16.1	1,300,000
11	4	VBB/Berlin	16.0	5,927,721
12	9	VRS/Stuttgart	15.0	2,443,892
13	8	MRDH/Rotterdam	14.0	2,250,000
14	7	SMITA/Birmingham	12.0	2,808,400
15	6	RMV/Frankfurt	10.0	5,003,889
16	13	Stadsregio Amsterdam/Amsterdam	10.0	1,464,578

The UITP is reporting a renaissance in light rail transport (LRT), with new systems opening in 42 cities around the world between 1985 and 2000 and another 78 from 2000 through October 2015. Of the 388 cities world-wide with LRT systems, **the association lists** 206 in Europe, including 123 in Germany and Russia, and the 10 cities with the highest ridership were all in Europe.

Limited emphasis on asset management

The available literature reveals no coherent policy support for Transit Asset Management, or any equivalent, in the EU. The UITP's overview of its Integrated Global Work Programme lists **six strategic priorities**, but contains no reference to maintenance or asset management, not even as a funding issue. The agenda for the association's 2017 maintenance and **asset management training** did include segments on the fundamentals of asset management, life cycle planning and costing, and predictive maintenance of facilities and fleets.

The future is demanding... and disruptive

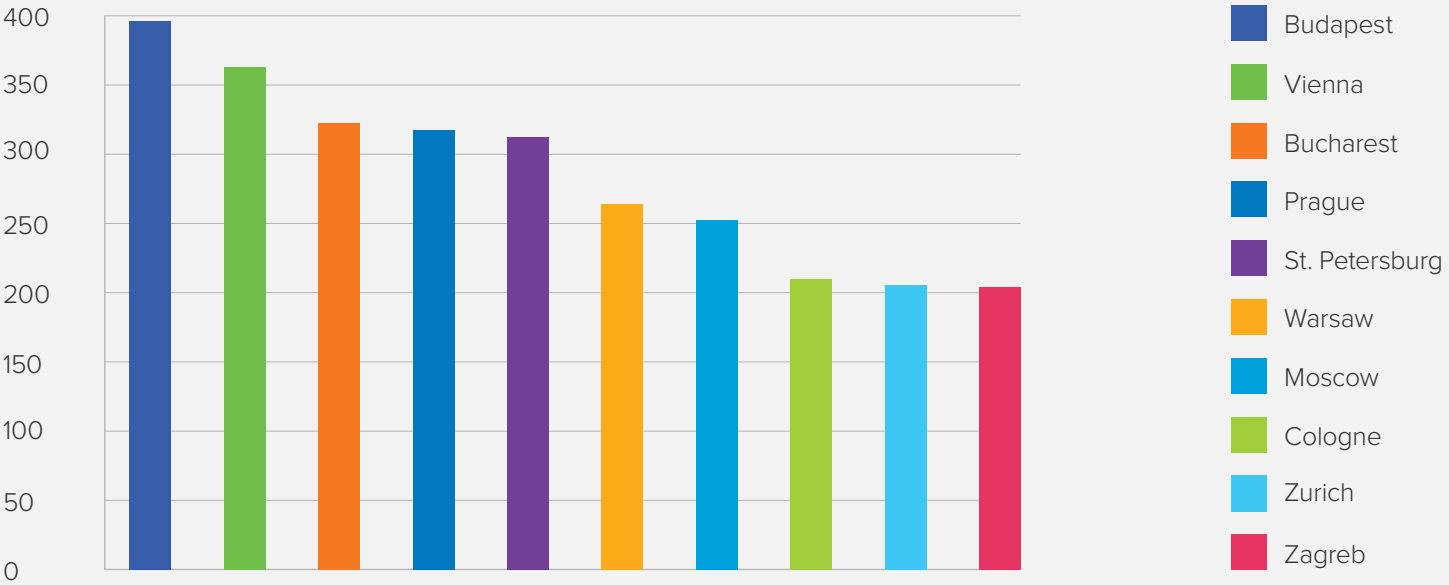
The disruptive change and emerging opportunities facing transit and transportation dictate a more strategic approach to future planning, veteran **analyst Todd Litman** of the Victoria Transport Policy Institute argues in a November 2016 sector review.

"Good planning does not simply extrapolate trends, it investigates underlying factors that cause change," Litman writes. "Transportation professionals help create the future, so it is important that we consider the overall context of long-term planning decisions."

Litman foresees a series of changes ahead, some of them unprecedented and many of them under-recognized by most research, that could quickly and drastically shift individual and community demand for transportation modes other than private vehicles. He lists an array of factors that influence travel demand, including demographics, incomes, geographic location, travel speed (which has increased 24-fold since 1888), the availability of transportation options, and new technologies, many of which "conventional analysis tends to overlook or undervalue."

Against this backdrop, Litman is sharply critical of "official predictions" that do little more than extrapolate past trends into the future. "These models assume that recent vehicle travel declines are temporary, caused by recent fuel price spikes and the global financial crisis, so in the near future VMT [vehicle miles travelled] will grow at similar rates as in the past," he writes.

LRT system with the highest number of annual passengers (Millions)



Factor	Consideration in Conventional Analysis
Economic Factors of Productivity, Incomes and Prices	
Demographics (age, school and work status, income, physical ability)	Generally considered
Area economic activity (productivity and types of industries)	Generally considered
Vehicle costs including vehicle fees, fuel prices, road tolls and parking fees	Fuel prices and tolls generally considered, other factors often ignored
Public transit fares	Generally considered
Company car policies and taxes	Only considered in special studies
Quality of Available Transport Options	
Traffic congestion	Generally considered in traffic models
Public transport service quality	Speed considered, comfort often ignored
Walking and cycling conditions (sidewalks, bike lanes, etc.)	Only considered in special studies
Street planning and management, including complete streets policies	Only considered if they affect traffic speeds
Parking supply, management and prices	Only considered in special studies
Intercity travel conditions (road, rail and air travel)	Only considered in special studies
Mobility substitutes such as telecommunications and delivery services	Overlooked by models that extrapolate trends
Vehicle rental and sharing options	Only considered in special studies
Land Use Factors	
Land use development patterns (density, mix, etc.)	Considered in integrated models
Smart growth/New Urbanist/transit-oriented development practices	Considered in some integrated models
Local neighborhood retail and service quality	Considered in integrated models
Roadway connectivity	Partly considered in traffic models
Emerging Social Patterns and Preferences	
Vehicle ownership and travel time budget saturation	Overlooked by models that extrapolate trends
Transportation demand management programs	Only considered in special studies
Changing transport preferences (declining 'love affair with the car')	Overlooked by models that extrapolate trends
Reduced importance and greater barriers to young people's drivers licensing	Overlooked by models that extrapolate trends
Health and environmental concerns	Overlooked by models that extrapolate trends

From Todd Litman, The Future Isn't What It Used To Be: Changing Trends And Their Implications For Transport Planning, November 25, 2016.

"Such projections are proving to be inaccurate, yet the models are often not corrected to reflect underlying factors that affect travel demands."

Litman draws favorably from a 2012 study, How Not to Predict Traffic, in which analyst Clark Williams-Derry argues that:

"Running a linear regression, with no other information for context, is a nonsensical way to make a forecast of the future. Instead, a real estimate of future traffic would look at macro-economic forecasts, land use projections, future gas prices and fleet mpg, population growth, population age structure, recent trends by age and demographic groups, and a host of other factors. Even with all of that baked in, of course, a forecast will almost certainly be wrong; very few predictions, even the most sophisticated and thoughtful, hit their mark."

Long-term visions and projections published by transit associations in the United States and the European Union tend to anticipate the future at a similarly broad level, without drilling down to operational issues facing local or regional transit agencies.

The **American Public Transportation Association's 2050 vision** argues that North American "population trends, urban growth trends, energy trends, environmental trends, and economic trends all point favorably to a ripe, robust future for public transportation." As elements of its **2050 narrative**, it points to population, urbanization and placemaking, internal migration, demographic shifts, climate change and sustainability, and public demand for accessibility and mobility options as key drivers of a multi-modal, interconnected transportation system.

The International Association of Public Transport's latest **assessment** of public transport trends cites many of the same emerging issues, along with a globalized economy in which the BRICS nations (Brazil, Russia, India, China, and South Africa) lead the growth in public transport, while Africa and the ASEAN countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam) assume greater prominence.

"Besides challenges linked to quantitative growth, public transport must make significant qualitative improvements in order to become more attractive," UITP states in its executive summary of the trends report. "Customers expect the same kind of lifestyle services and connectivity from public transport vehicles and stations as they already have in their own environment and living space."

The notion of quality in public transport "should also be created through operational excellence, which includes enhanced frequency, punctuality, and reliability of the service thanks to optimized network design and service performance," the association adds. The summary notes that technology-driven services like smart ticketing and integrated travel information "contribute to making public transport customer/user-friendly, while facilitating accessibility for all citizens."

All of these future visions point to two questions that could have major implications for transit demand, and for the scope of the asset management challenge confronting transit agencies (with or, more likely, without adequate funds to respond): How quickly and how far will transit demand increase in different urban centers? And which forms of disruption will be most influential in shaping tomorrow's transit systems and answering broader questions about land use and modal mix? The least that can be foreseen is that transit agencies will have to make absolute best use of every physical asset at their disposal, and every financial resource available for operations and maintenance.

In brief, here are some of the specific trends and challenges that will shape or reshape transit agencies' operations in the years ahead.

Passenger safety

Passenger safety is the most basic gold standard for any transportation agency. In the United States, transit agencies are required to report any safety or security events that involve any one of nearly a dozen outcomes, including:

- A death that results within 30 days of the incident
- Injuries that call for immediate medical attention or transport
- Estimated property damage of at least US$25,000
- Collisions that require a transit vehicle to be towed from the scene

Between 2008 and 2015, U.S. transit agencies logged 46,432 major events, 83% of them on some mode other than rail, according to the FTA's **National Transit Summary & Trends 2015**.

The U.S. transit sector reported 255 deaths in 2015, 170 of them involving the public, and another 67 involving customers who were not on board vehicles at the time of the incident. At the most basic level of operational effectiveness, a sound maintenance strategy for equipment and infrastructure is a cornerstone of the effort to prevent safety risks for transit customers, staff, and the general public.

Congestion and congestion relief

Persistent congestion is the defining feature of too many commuters' daily relationship with the mobility infrastructure they depend on. **The Texas Transportation Institute** calculated that the average U.S. driver wasted an average of 41 hours in traffic in 2012, for an astonishing all-time high of 6.7 billion hours across the population. In its White Paper on Transport, the European Union cites congestion as one of a handful of factors, alongside looming climate change and (at the time) rising oil prices, as factors warranting a "radical overhaul" of the continent's transport system. With a "business as usual" response, it states, "congestion costs will increase by about 50% by 2050."

Transit has obvious potential as a form of congestion relief, if only based on the sheer number of private vehicles taken off the road when their occupants choose to travel by bus or rail instead. In that sense, keeping transit systems in a state of good repair is a lynchpin for any of the underlying values attributed to congestion relief: from convenience and time savings, to lower commuting costs, to air quality improvements and greenhouse gas reductions due to reduced idling and vehicle miles traveled (balanced against the higher environmental impact of diesel vehicles).

With a wide variety of congestion relief solutions on the immediate horizon, asset management will be just one of the areas where transit authorities will be called to respond with greater creativity and efficiency. In different parts of the United States, transportation providers have looked at **synergies between bus rapid transit and price-managed lanes**, transportation apps, and even electrically-powered, vertical take-off and landing **(VTOL) vessels** to relieve highway congestion. The first two could represent significant opportunities for transit agencies, while Uber's VTOL initiative may emerge as a long-term threat to their market share.

Urban design and transit-oriented development

For years, a combination of economic, social, and environmental factors has been driving urban planning philosophies and practices in the direction of more compact, higher-density development. As cities and suburbs seek to improve air quality, reduce greenhouse gas emissions, boost local economies, ensure community safety, encourage walking and biking, and build a deeper sense of community around vibrant neighborhoods and town centers, they're finding synergies and interdependencies with transit.

Cities in the U.S. and Canada, Latin America, Europe, Asia, and Oceania have introduced transit-oriented development (TOD) policies and strategies to reduce citizens' dependence on private vehicles and encourage wider use of transit.

In its Great Communities Toolkit, the San Francisco Foundation's **Great Communities Collaborative** notes that:

"In a compact neighborhood, stores have enough local customers to stay in business, transit systems have enough riders to justify the public investment, and parks have people strolling through keeping the neighborhood safe. Community services including child care, medical offices, banks, and post offices also have branch locations frequented by people living within walking, biking, or transit distance.

Key to making the connection between TOD and housing is the built-in ridership provided by a variety of compact housing types, from apartments, to condominiums, to starter homes. Locating compact development next to transit often results in improved service, as transit agencies can justify the improvements based on consistent ridership levels."

A Harvard University study also identified transit as "the single strongest factor in the odds of escaping poverty," the **New York Times reported** in 2015. "The longer an average commute in a given county, the worse the chances of low-income families there moving up the ladder."

As more municipalities embrace TOD—as an end in itself, or in support of broader community objectives—transit agencies' ability to maintain or expand services and maximize cost-effectiveness will clearly depend on optimizing the management of every asset available to them.

Solving the first and last mile: A wider menu of options

A persistent challenge for transit is to solve the "first mile/last mile" problem, a reference to the ground a user has to cover between their home or workplace and the nearest transit stop. Transit-oriented development seeks to address the issue by locating the densest built areas within a quarter- to half-mile radius (400 to 800 meters) of central transit stops, a distance that is considered suitable for pedestrians.

In the absence of broader TOD strategies, transit agencies typically try to address first mile/last mile with park-and-ride lots. But now, ride-hailing service **Uber is highlighting its ability** to offer "transportation that covers every mile".

The **connection between transit and ride-hailing**—and, soon enough, autonomous vehicles—is new and potentially disruptive. But the **American Public Transit Association** is all for it.

Acting President and CEO Richard White states that:

We cannot restore and expand our public transportation system without reaching outside of our conventional agency silos to achieve greater collaboration. We must view emerging concepts such as ridesharing as accelerators of positive change, not as competitors. In fact, I contend that autonomous vehicles (soon the car, and ultimately the bus and train) will be game-changers for public transportation.

Meanwhile, as noted above, real-time passenger information (RTPI) systems are driving increases in transit ridership by taking the guesswork out of the walk (or bike ride, or rideshare) to the transit stop.

"People with access to real-time transit information have been shown to spend 15% less time waiting at bus stops than people without this information," reports the World Resources Institute's (WRI's) CityFix blog. "A study of Chicago's bus routes found that access to real-time transit information increased average daily ridership by 2%. And a study on **New York City's bus system** found that this information also led to an increase in ridership, resulting in $5 million per year in additional fare revenue."

Here come the drones

More and more companies and verticals are relying on drones to monitor equipment and infrastructure, and a limited number of transit agencies are tapping into the trend. Trapeze Group, a transit management consultancy in Mississauga, Ontario, lists drones used to enhance security surveillance for a light rail network in Jerusalem, combat graffiti along a large railway line in Germany, and improve the efficiency of general maintenance along the Union Pacific rail line in the United States. (The post also links to **an article on a service provider** for the Massachusetts Bay Transportation Authority that uses Google Glass-like augmented reality gear to optimize maintenance activities.)

In 2016, **Infor** announced an initiative to apply tethered drone technology to enterprise asset management projects, noting that even small applications "can yield a significant impact for the success of an asset. With a tethered drone's ability to perform functions like perch-and-stare, video capture, and laser scanning, the drone can replace many of the dull, dirty, and dangerous functions of inspection and compliance."

The road ahead: How to keep transit rolling

Caught between growing customer demand, serious backlogs in maintenance funding, disruptive change in mobility patterns, and potentially significant increases in public and political expectations for expanded service, transit agencies will face a dynamic but challenging operating environment in the years ahead. The gap between capacity and demand is likely to be particularly acute in more established communities with older transit systems.

Enterprise asset management could and should be one of the most valuable tools in the transit agency toolbox for meeting future expectations. But the industry's approach so far to Transit Asset Management (TAM) or State of Good Repair seems to be mostly tactical, possibly reflecting a stratification between large and extra-large agencies and the rest of the sector.

As the need for preventive and predictive maintenance becomes ever more obvious, it will be increasingly important for agencies to identify the information technology systems that can help them plan and execute wider TAM strategies, optimize the resources available to them for maintenance and repair, make the case for more where necessary, and ensure that all the assets in their inventories contribute to their core mission to keep transit rolling.

Learn more ›

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