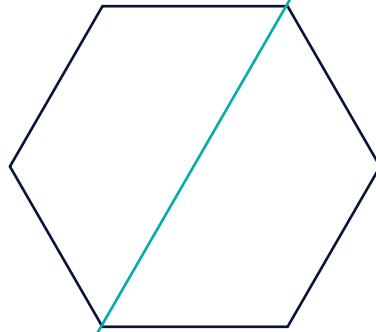# MULTI-MODAL TRANSPORT MANAGEMENT: CHARTING THE PATH TOWARDS DIGITIAL MOBILITY

CUBIC™

For decades, city authorities in urban centers struggled with a host of ever growing issues–population growth, congestion, harmful emissions, urbanization–each one with its own unique challenges and implications for local neighborhoods, cities and entire regions. And for decades, cities have made slow progress in addressing these issues, often because they approached them in a fragmented fashion, with each local authority working in silo and focusing on its own area of jurisdiction. Today, in a bid to find new solutions to old problems, global cities are increasingly embracing the idea of "digital mobility"–defined by Cubic as the digitization and integration of mobility management and operations systems to achieve larger equity, sustainability and policy goals.[1] Multi-modal transport management sits at the heart of digital mobility, providing a necessary level of operational synergy required in order to foster collaboration and a shift towards more proactive thinking. As cities consider the next wave of technology investments they should look to multi-modal transport management solutions as a way to lay the foundation for digital mobility. By augmenting and extending the benefits offered by various control systems that today serve as critical components of a smart city infrastructure, a multi-modal transport management platform can help cities chart a path towards greater innovation and more effective problem solving, ultimately delivering more choice and better transport for all.

Introduction

Governments around the world are pouring billions of dollars into infrastructure projects. The Global Infrastructure Outlook, which analyzed investment across 56 countries, forecasts a collective spend of US$ 8.9 trillion on road infrastructure alone between 2022 and 2030.[2] This investment is intended to enable cities to provide equitable, reliable and sustainable mobility options while managing the growth of congestion, stifling harmful emissions, enacting effective policy changes and improving the safety of road users and pedestrians.

US$ 8.9 trillion infrastructure spend includes:

United States:
US$ 1.19 trillion

Australia:
US$ 152 billion

United Kingdom:
US$ 111 billion

India:
US$ 173 billion

Yet, transport authorities know that these issues cannot be fully resolved by building new roads, highways or bridges. While modernizing existing infrastructure and adding capacity is critical to improving our transport systems in the long term, it alone is not enough to counter years of urban sprawl, worsening air quality and car dependency. The emergence of new mobility services and an increasingly multi-modal nature of user journeys poses its own challenges and calls for improved coordination of modes across a city, region, or country. As populations swell, urban centers become increasingly dense and transportation multifaceted, many cities are turning to technology to help them manage smarter, coordinate better and ultimately realize their individual goals.

Today, the interest in technology as a critical enabler of transport innovation has never been greater. The global smart transportation market size is estimated to reach US$ 285.12 billion between 2022 and 2030, representing a growth of 158%.[3] From helping to optimize and automate bus schedules, connecting commuters to empty seats in private cars, or addressing the first- and last-mile problem, the digitization of transportation is transforming the way we plan, build, coordinate and operate transport networks around the world.

In this paper, Cubic Transportation Systems proposes that transport authorities should work together to augment existing control systems in the pursuit of a more sustainable future. It outlines a path forward towards embracing digital mobility by investing in its most critical component: a multi-modal transport management platform that transcends various transport environments to enable holistic, city- or region-wide transport coordination.

A single, integrated platform that brings together existing Infrastructure such as roads, rail or parking, different modes of transport, including cars, freight and public transit, and various transport service providers, offers the advantages of mobility integration at scale. It sits at the heart of digital mobility, enabling cities and local transport authorities to drive holistic improvements and efficiencies that go well beyond the road network, benefiting travelers, third-party service providers, and the city or region itself. Most importantly, it empowers transport leaders to engage in proactive network management, enhances decision-making across modes and supports policy enactment by offering visibility unheard of before.

Such a multi-modal transport management platform is not merely an aspiration; Cubic has partnered with Transport for New South Wales (TfNSW) to deploy Cubic's Transport Management Platform in Sydney, offering a model for implementation in other large cities worldwide.

As populations swell and urban centers become increasingly dense, many cities are hoping technology can help them realize their sustainability goals.

As user journeys evolve, transport management must evolve with them.

A Common Transport Operating Picture

Cities have been taking advantage of technology to address emerging issues for years. As populations grew, congestion worsened and transport choices evolved, transit agencies tackled the resulting challenges one-by-one, usually by resorting to solutions focused on specific implementations.

The first wave of investment included intersection management solutions: reversible lane control systems to help ease traffic flow during peak hours, adaptive traffic signal control systems to improve travel time reliability, tunnel management systems to reduce accidents and increase capacity. As city managers recognized individual solutions were insufficient at addressing larger mobility challenges that plagued urban centers, they started integrating existing micro-level solutions into broader traffic management systems, focusing the next wave of investment on control solutions, which apply surveillance and control strategies to improve traffic flow on highways and streets within their areas of operation.[4] Such solutions often include a combination of advanced traffic management systems (ATMS), also known as urban management traffic and control (UTMC) systems and operations management and control systems (OMCS), depending on the complexity of the transport network.

Many legacy investments made sense at the time but have left cities with a patchwork of solutions of various generations and technologies.

Today, control systems have become the essential building blocks of smart city infrastructure and serve as important tools for monitoring and controlling a transport agency's traffic and ITS infrastructure, contributing to safer and more efficient traffic operations. However, the challenges posed by a dynamically changing, increasingly complex and multilayered mobility ecosystem call for a greater level of integration and an evolved approach to technology investment.

The emergence of 'new mobility' services, such as bike-sharing or ridesharing, and the growing need to manage end-to-end journeys has complicated interrelations between different modes of transport. Cities feel the pressure to adapt and manage available road space more effectively to accommodate trends such as electrification or vehicle-to-vehicle and vehicle-to-infrastructure connectivity.

Cities need a high level of operational integration to address the dynamically changing, increasingly complex and multilayered mobility ecosystem.

This pressure is further exasperated by our changing ideas about work-life balance and a growing interest in active transport, such as walking or cycling. Those trends impact travel choices and push cities to make sure healthier travel options are safe and convenient. Finally, advancements in trip planning services, payments and ticketing, and dynamic routing, are raising the traveling public's mobility expectations, underlying the importance of providing reliable, real-time information about available services.

As user journeys evolve to cover multiple transport modes and services within a single end-to-end trip, transport management must evolve with them, augmenting existing control solutions, typically focused on road-based traffic operations. While many of these solutions made sense at the time of investment and have proven successful in enhancing the operational effectiveness of a single transport mode or service, they are not sufficient to address the larger societal, environmental and economic changes impacting urban centers at scale. What's more, many control systems were implemented in a piecemeal fashion and at various points in time, eventually leaving cities with a patchwork of solutions of various generations and technologies, with limited expandability.

On the contrary, sustained research across major cities shows a growing need for integrated, multi-modal transport management that responds to dynamic changes in mode preferences. Such a solution requires a coordinated effort across government agencies, city authorities and private mobility providers at a local, regional or even national level to find effective long-term solutions to current transport headaches.[5]

To date, many city governments were simply not structured in a manner that was conducive to maximizing the opportunities offered by increased integration. Transport services in major cities were split between various political jurisdictions and a mix of public and private mobility players with diverse, sometimes opposing interests, leaving the responsibility for improving mobility in a given city or region fragmented across multiple institutions. However, city leaders increasingly recognize the need for connectivity and interoperability that cuts across jurisdictions and service providers. Some cities, such as London, UK, have consolidated services under a common agency (Transport for London). Others, including Las Vegas or San Diego prefer to bring representatives from different agencies (as well as local, state and federal organizations) to work together on holistic solutions.[6]

Achieving unity and integration at a decision-making level requires proper support tools that go beyond isolated, discrete software solutions. A single, comprehensive, multi-modal platform, such as Cubic's *Transportation Management Platform*, can be the first step towards enabling digital mobility. Cubic's platform drives visibility and standardization and can serve cities for years to come. It does not require a wholesale replacement of existing systems, rather, it offers an untapped chance to connect data points, analyze patterns, predict demand, introduce efficiencies across the entire network, and optimize the performance and interoperability of existing surface transport assets on a regional or national scale.

Towards a System of Systems

A cooperative, multi-modal transport management platform augments the benefits offered by control systems and their specific implementations. It serves as a cross-modal transport information and coordination solution, giving transit agencies and city planners a holistic view of the entire network. By drawing on the appropriate mix of real-time data sources, it centralizes critical information from numerous individual control solutions, supporting data-driven decision-making and efficient network management on a large scale.

It provides cities with functions to manage congestion, incidents and events at a preferred level–local or regional. It can display externally sourced data in a single, common operating picture, enabling multiple transport agency operators to log onto the platform and work collaboratively to equilibrate supply and demand across different modes. It has the ability to fully integrate with external systems and devices, such as traffic sensors and signals, internet-of-things devices, and more to enhance the level of operational insight and control. It serves as a fully future-proof solution with virtually unlimited scalability that can adapt and grow with a city. The platform is configurable on multiple levels and is both backward-compatible with legacy systems and forward-compatible with future innovations through open APIs.

Achieving unity and integration at a decision-making level requires proper support tools that go beyond isolated, discrete software solutions.

A multi-modal digital mobility transport management platform offers the benefits of integration at scale.

By bringing two or more existing control solutions together, a multi-modal transport management platform allows transport executives to understand what's going on in the network, predict what will happen, make informed decisions to mitigate operational issues and enact policy goals.

In addition to these high-level benefits, by using a multi-modal mobility platform, transport executives can:

- **find operational efficiencies** by eliminating the overhead related to the management of multiple, disconnected systems, and lower development costs through more effective planning;

- **build a common operating picture of the entire network** and take advantage of true situational awareness of real-time and predicted transport conditions across all transport modes and parties involved in transportation management, including public and private players;

- **benefit from improved visibility and information exchange** across local and regional transport networks, agencies, emergency responders and travelers to help support dynamic decision making;

- **better meet strategic objectives** around reducing road deaths, limiting the environmental impact of transport and encouraging the adoption of mass transit, enacting policy at a regional level and holistically influencing traveler behavior;

- **be able to measure the performance of the transport network** and operational capability and understand the impact of operational changes and improvements.

Importantly, the benefits of advanced integration offered by a multi-modal transport management platform extend beyond transit agencies or geographic expansion and scale. They touch on two areas that are crucial to addressing the macro-trends affecting cities worldwide: proactive network management and policy enforcement.

A multi-modal transport management platform can be used for long-term evaluation, enabling transport leaders to test various interventions into the transport system and analyze their effects on the network.

Driving Change with a Multi-Modal Approach

A multi-modal transport management platform gives leaders practical new tools to effectively drive change. Providing cities with a 10,000-foot view of the entire network and breaking down data silos enables city managers to proactively match demand with capacity and manage incidents, moving beyond reactive-only transport management. The platform can also be used for long-term evaluation, enabling transport leaders to test and comprehend various interventions into the transport system and their possible effects on transport nodes and modalities. By using the platform in that way, planners and decision-makers can better comprehend the trade-offs between different investment choices and model their impact on the city's infrastructure, network capacity or the high street. This could lead to more constructive, data-driven decision-making, resulting in better mobility options and access for all citizens, including those in low-income neighborhoods or the unbanked, extending service to geographies and populations that are most in need, lowering transport costs and helping better connect people to opportunities.

The chance to understand and predict how shifts in mobility choices would affect other transport modes also facilitates city leaders' ability to successfully incentivize or discourage certain travel choices at specific times or in particular areas of the city, according to current network needs. While the so-called 'nudging' needs to be supported by other systems to ensure maximum effectiveness (mobile channels to reach users, unified payments to simplify reward collection, etc.), it can significantly improve the overall flow of traffic and network throughput and help cities enact policy and encourage travelers to make more sustainable mobility choices.

A multi-modal transportation management platform can help achieve future policy goals by enabling transport leaders and planners to align the network's operations and investments in line with city priorities. For example, this may mean supporting mobility strategies that help limit carbon emissions by identifying areas in the city that could most benefit from new environmentally friendly services such as bike-sharing schemes or electric bus routes. Because the platform offers complete situational visibility, city leaders can collaborate more effectively with third parties to direct investments in places where it's needed most while also watching the impact of such investment on the overall network and ensuring travelers have options to transfer to other modes should they need to. Furthermore, on days with poor air quality, cities could offer discounts for travelers who opt for healthier travel modes, like walking or cycling and use dynamic pricing to discourage road use. Since the platform provides visibility into measures taken by other parties involved in transport management, it allows city leaders to direct usage sustainably without creating bottlenecks for other modes. A multi-modal transport management platform offers truly versatile options, laying the foundation for cities to effect specific changes that support local or regional policy goals through digital mobility, which ultimately offers long-term solutions to challenges such as congestion, population growth, carbon emissions, and urbanization.

Final Considerations

Successful evolution from legacy control systems to a multi-modal transport management platform requires some preparation on the part of transport executives and city authorities. While some technological challenges are to be expected, as with any deployment of new technology, the most significant barriers to greater mobility integration will almost always play out on a political level. That's why it's crucial that city authorities, local governments, transit agencies and any third parties who will have access to and will benefit from the platform come together early on in the planning process and agree on a shared vision for the tool. The alignment of goals should happen on several levels: executive, to secure buy-in and ensure proper governance; operational, outline the scope and manage expectations; and end-user, to ensure the vision provides tangible solutions that deliver value to citizens promptly.

It's also essential that transport executives and city leaders take a close look at existing control solutions and identify priority functionalities that they would like mirrored or improved in the multi-modal transport management platform, as well as those that are not effective and therefore do not need to be transferred to the platform. It's also important that they identify gaps that existing solutions cannot address but a multi-modal transport management platform could.

While a multi-modal transport management platform will broadly provide cities with similar benefits, each deployment will look differently, depending on several factors inherent to each city, such as the age and type of existing transport solutions, the complexity of the transport network and the specific goals that the city hopes to accomplish. Establishing a multi-modal transport management platform can be a significant endeavor that might take several years. Yet, each milestone and deployment brings cities a step closer to their desired outcomes.

Conclusion

Today, cities worldwide share a common goal: to confront pressures that growing populations, increased urban density, the emergence of 'new mobility' services and the aftermath of the COVID-19 pandemic are putting on transport infrastructure and citizen's mobility options. Traffic management systems have offered partial answers to these challenges, but today's issues require the flexibility, scalability, and levels of integration that control solutions simply do not possess. An integrated approach to mobility management that connects various transport environments offers an opportunity to evolve the city's response to emerging mobility challenges to better serve societal, environmental, economic, and political outcomes. While change and transition aren't always straightforward, an integrated, multi-modal transport management platform is a critical step towards embracing digital mobility. Together with other user-facing systems, such as journey planning, unified payments or Mobility-as-a-Service (MaaS) and a shift towards proactive thinking, digital mobility can help cities balance supply and demand in accordance with their goals and chart a path towards greater innovation and more effective problem solving, ultimately delivering more choice and better transport for all.

Cubic's Transportation Management Platform is an innovative, next-generation cloud-based traffic and transportation management, information and control platform designed to support all aspects of transportation collectively. By replacing out-of-date components with current strategic level technology, Cubic Transport Management enables the management of all customers' assets such as road, train, light rail, buses and ferries through a single open platform and shared operational view.

References

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CUBIC™

Over the last 50 years, Cubic Transportation Systems has reshaped how travelers navigate their communities. We have dedicated ourselves to integrating systems, elevating operator management and inventing solutions that keep citizens safe and cities humming.

As passenger preferences shift towards multi-modal travel, the future of intelligent urban transportation lies in the broader integration of mobility services to empower a seamless traveler experience. We are committed to helping transit organizations realize their critical mission of responding to changes in infrastructure needs and supporting regional growth and shifting travel trends.

We listen to our customers, work in collaboration and develop solutions to meet their specific needs. Today, Cubic offers a defined product roadmap, R&D investment, innovation and collaboration with some of the world's leading technology providers.

We've worked with partners from all transportation modes, including transit agencies, airports, highways, intersections and corridors across small communities, metropolitan cities and regional authorities. Whether you're after a small-scale cloud-based, real-time passenger information system, a regional congestion management platform or a complex traffic management system for urban networks delivered in an as-a-Service model, we're here to support you and your customers—every step of the way.