



# Metro Railways – A Journey of Transformation

## *The five Cs for urban railways to meet future mobility needs*

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For those of us who live and work in big cities – well over half the world's population today, a figure projected to increase to **70% by 2050** – metro railways are an ever-present part of daily life. Today there are 148 cities with metro operations carrying over **150 million passengers per day**, with about a third in Asia, a third in Europe, and the rest split between the Americas, the Middle East and Eurasia. Metros are critically important assets for the world's cities if they are to meet the challenge of maintaining urban mobility, both in established cities and those undergoing rapid growth through urbanization.

Many metro systems have been around for a very long time – for example, the London Underground, the world's oldest metro, was opened in 1863, and Paris Metro started operations in 1900. Others are far more recent. The Delhi metro has only been in operation since 2002, yet already has nearly 2.5m daily passengers and is the fifth largest in the world in terms of track length. The rate of expansion is accelerating, with 45 new city metros having been built since 2000, of which over half in Asia (see Table 1).

Metro railways are critically important assets for the world's cities if we are to meet the challenges of maintaining urban mobility. For established metros, responding to the needs of the future is no easy thing. In this brief article the authors look at some of the key issues and how metros are starting to transform themselves, focusing on the "five Cs".

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<sup>1</sup> Refer to "The Future of Urban Mobility", Prism 1 2014

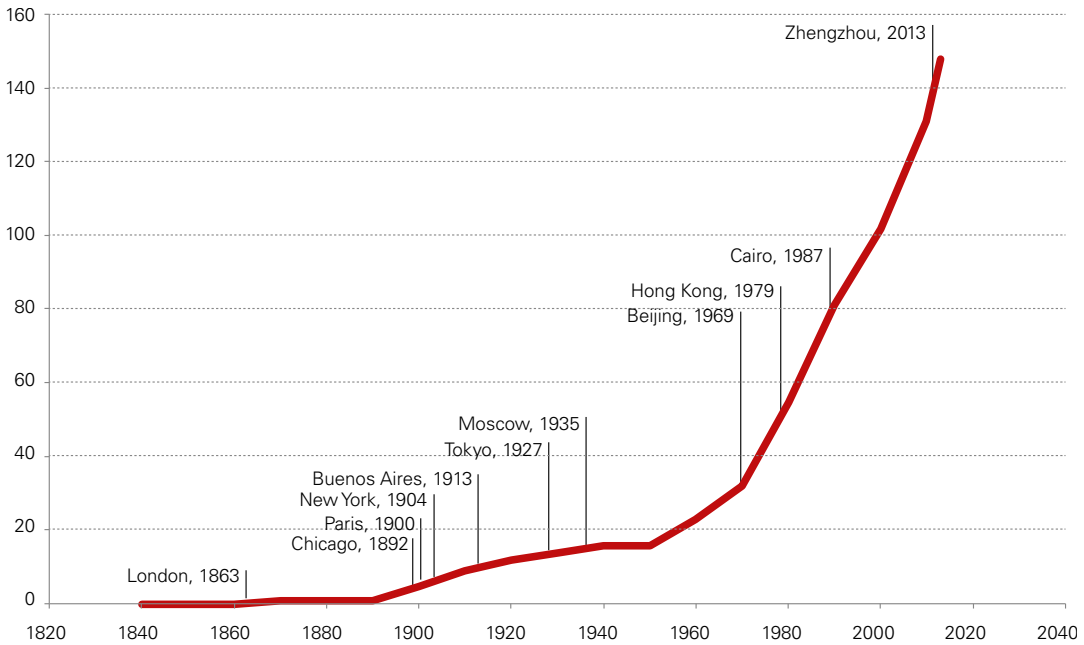


Table 1 Number of cities with metros, and some key opening dates

Source: UITP Statistics Brief dd Oct 2014, based on 2013 data

Today, six of the world’s top 10 busiest metros in terms of passenger numbers are located in Asia (see Table 2).

For established metros, responding to future demands is not easy. Maintaining and improving levels of service is difficult due to disruption caused by aging assets, constant renewals and replacements, and complex interfaces between new-build and the running railway. For many metros the scale of investment needed for replacing life-expired track, structure, signaling and rolling stock – let alone extensions and expansions – is almost prohibitive. To make matters worse, passengers (or, rather, “customers”), are becoming increasingly demanding about reliability and comfort, and as urban mobility pressures increase, so metros are having to worry much more about the entire end-to-end journey from door to door, not just the metro trip itself.











City/Operator		Annual passenger trips	City/Operator		Annual passenger trips
	Tokyo	3,294		Guangzhou	1,841
	Seoul	2,467		New York City	1,661
	Moscow	2,464		Mexico City	1,609
	Beijing	2,460		Paris	1,541
	Shanghai	2,269		Hong Kong	1,482

Table 2 **Busiest metro networks in 2012 (millions of passengers)** *Source: UITP Statistics Brief dd Oct 2014*

All this means that metros around the world are having to undergo a major rethink in how they operate. In this brief article we look at some of the key issues they face, and how metros are responding, focusing especially on the customer service dimension. We think this also provides some useful lessons for other asset-intensive industries that face a challenging future.

### Key issues and solutions for metros: The “Five Cs”

In our work with metro companies we find that the key issues and solutions to drive the necessary changes can be usefully categorized in terms of what we would call the “ Five Cs”:

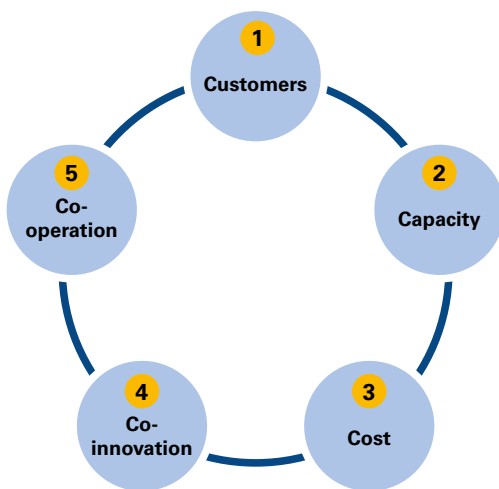


Table 3 **The Five C’s for metro railways**

*Source: Arthur D. Little*

The first three of these, Customers, Capacity and Cost, represent the well-established central concerns of any public transport service provider – but all of them need to be managed differently to meet the demands of the future. The last two, Co-innovation and Co-operation, represent newer areas of focus that most metros still need to get to grips with effectively.

Below we outline each of the Five Cs and describe the solutions leading companies are already starting to implement in each area:

### **Issue 1: Customers – Focus on the customer, and become truly customer centric**

Customer centricity is becoming the top priority for metro operators in the developed world. Customers have more choices around preferred modes of transport, travel more frequently, and are increasingly digitally savvy and connected to the world around them. No longer do they just expect trains to run on time, they now have much higher expectations around a seamless journey, comfort and facilities. They now have many more channels to voice perceptions, make complaints and influence each other, and in many cities such as Hong Kong, metro disruptions become literally front-page news.

For private metro operators or those operating under government franchises, customer satisfaction has a **direct impact on the bottom line**. Consistent poor performance can even result in a loss of a license to operate – metros typically have quantified performance standards set by their respective governing bodies. For example, the Hong Kong government requires a minimum of 98.5% “passenger journeys on time” from metro operator MTR, a level which it consistently exceeds. Those metro operators which are launching in developing urban centers such as Jakarta and Dubai have a huge job on their hands if they are to entice motorists out of their cars and onto public transport. Others, such as Mexico City, face severe overcrowding.

For many metros, generating **non-fare income** is also a strong driver to become more customer-centric. For example, many metros also have significant retail and property revenue streams which are closely connected with their service networks. Other metros

are looking at even more diverse ways to generate income, such as the provision of telecommunications services.

All this means that customers now have a much more important influence over how metros are developed and expanded. To become more customer-centric, some leading metros have sought to enhance customer experience as a key pillar of their overall vision and strategy. London Underground's vision for its future assets is to "deliver a reliable train service with high standards of customer care, efficiently, through our people and technology", with customer service as one of four pillars for its overall strategy<sup>1</sup>. Other transport operators and organizations in adjacent industries such as retail and lifestyle goods have gone further, putting customer behavior and emotions at the center of their operating models. Ryanair attributes a 22% rise in customer numbers during 2014 to initiatives set out in its "Always getting better" customer experience program, which is now in its third year<sup>2</sup>.

Creating a favorable customer experience requires a clear vision and strategy, aligned across the organization and implemented through a set of principles and actions aimed at building a world-class sustainable offering, including:

- **Designing the experience** – what the passenger experiences is the heart of it. Designing that experience, and the service management design to enable it, is based on identifying needs from demographics, segmentation, persona analysis, and getting a full understanding of the end-to-end customer journey, critical touch points, and "hot spots" where issues need resolving.
- **Voice of the customer** – having a dynamic approach to gaining genuine customer insight. Traditional methods of market research should be integrated with other techniques, including real-time feedback, use of digital, and leveraging the typical "big data" available through transport card systems and other mechanisms.

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<sup>1</sup> LU Asset Management Strategy Summary, 2013. Available at: <https://tfl.gov.uk/cdn/static/cms/documents/lu-asset-management-strategy.pdf>

<sup>2</sup> The Guardian, December 2014. "Ryanair upgrades passenger and profit forecasts after bumper November."

- **Organization and governance** – having one team responsible for driving forward the customer agenda, along with the right metrics and governance structures, to ensure the rest of the organization is aligned and working with them to deliver change.
- **Customer-oriented culture** – everyone in the organization should feel they can influence the customer experience. Culture change is often needed as staff interaction with customers is a key lever and influence on customer experience.

Customers have ever-higher expectations of their journey experience, from stepping outside their door to arriving at their final destinations. Many of these strategies aim to create an “end-to-end” journey for customers, from the moment a customer steps outside their front door, to the point at which they arrive at their destination. Integrated mobile applications such as Citymapper offer real-time transport and destination planning from one point to another in central London. The Hong Kong Metro, operated by MTR, is progressively transforming its stations into “destinations” rather than straightforward transport interchanges, incorporating retail outlets and other services into station infrastructure. Some cities are beginning to demonstrate joined-up transport, integrating metro operations with other modes of transport such as bus and cycle hire. This requires an integrated approach with both city transport authorities and other transport providers – our second lesson.

## **Issue 2: Capacity – Manage growth in both patronage and metro networks**

Managing the growth in metro networks is a key challenge for many operators. As network capacity is more highly utilized, there is less margin for error and operators are forced to work smarter, predicting and reacting faster to changing needs or operational challenges. It is important not only to make optimal use of existing assets and lines, but also to effectively manage the development of line extensions and new lines, including their integration with the existing railway. In terms of managing existing capacity, there are several factors to consider, such as:

- **Focusing on maintaining capacity availability**, especially during peak periods. That means making sure all operations, engineering and technical resources work together on the right things.
- **Looking for smart ways to improve capacity**, especially during peak hours. Of course, this can include new signaling (which usually frees up capacity), but also means finding ways to evaluate network constraints, and removing bottlenecks.

And it is not just the train service itself. Stations need to be designed to manage passenger flows on a day-to-day basis, and there is an array of new tools and innovative technologies available to help operators do this.

### **Issue 3: Cost – Achieve cost effective operations**

In building new metro capacity, new assets need to incorporate future demands and customer requirements. In the past the response was simply to build something that was fit-for-purpose with sufficient capacity. Most operators are familiar with how to squeeze more capacity out of their current operations, for example, by upgrading signaling systems. However, today this is much more about optimization, achieving a balance with the needs of customers and other stakeholders. This means being much more explicit about trade-offs between meeting ever-increasing expectations and providing a cost-effective metro railway:

- **Full automation** is one key way to achieve cost-effective operations, provided that customer expectations and operational risk can be adequately managed. Increasingly, operations station staff are being utilized to focus on customer needs, as driverless trains and contactless and cashless ticketing negate the need for traditional operator services.



- **Value engineering** is crucial. Effectively replacing assets at the optimal time with value-based, cost-effective solutions, while considering all the options, is critical for those metros with an ageing asset base, where asset replacement costs can mount up. Taking a lifecycle view of costs, and an innovative view of the options available can make a substantial difference to both capex and opex. This means having value engineering at the heart of all major asset replacement thinking, and not simply opting for like-for-like replacements.
- **The way maintenance is delivered**, and who delivers it, can make a substantial difference. There may be different options available to outsource maintenance, and these should be fully evaluated. This includes having a well-thought-through sourcing strategy based not only on the financial impact, but also on competency development needs.

#### **Issue 4: Co-innovation – Progressively co-develop new technologies to maximize their effectiveness**

Metro rail operators continually need to replace assets which are life expired or becoming obsolete, as well as building new infrastructure to support network expansion. Given the costs and complexities of asset installation and replacement programs, obtaining the right technology, at the right time, which delivers the best solution the first time around, is absolutely critical.

In most cases, metro operators do not conduct their own research and development, and are reliant on procuring new technologies from original equipment manufacturers (OEMs). A turn-key, off-the-shelf solution is seldom available, and considerable testing and trialing may be needed before a metro operator is confident that a technology is fully ready for operational use.

As a result, the pace of technology evolution in the metro rail sector has historically been quite slow, though this is now changing. Digital technologies in particular are becoming increasingly important to the modern metro, which have much faster technology development cycles and obsolescence rates. Their rise in impor-

tance also means that metro operators need whole new areas of capability in, for example, cyber security and artificial intelligence. Some metros have sunk huge amounts of resources into enterprise-level information technology (IT) systems in the rush to access new technologies, which have become quickly obsolete, requiring expensive replacement. To overcome this growing challenge, the world's leading metros are becoming very good at being "intelligent customers" for new technologies. They have done this by:

- Taking a **whole-systems approach** to planning for new technologies, by drawing together the needs of different parts of the operating railway into a single overview and understanding where synergies and trade-offs lie.
- Becoming very good at **proactively engaging with OEMs** to help jointly set technology direction, so that new assets are ready on time and fit for purpose.
- Progressively **building up new capabilities** in both organizations so that the skills are already in place for when the technology arrives. Having a clear articulation of what's needed in the medium and longer term (5-10 years) enables a balanced development strategy to be put in place, including outreach, recruitment, internal training and use of partners.
- Ensuring a **single point of coordination for describing technology needs** (as is the case with the London Underground Innovation Team within its Engineering Directorate).
- Putting in place **in-house R&D and technology management** resources. For example, London Underground has a small in-house R&D team, and SMRT Seoul and JR East both have extensive R&D centers).
- Conducting **technology-scanning activities**, in particular to identify partially developed technologies from adjacent sectors such as aerospace; the use of satellite-based positioning technology for maintenance is one such example.

Some metros have developed an **agile approach** to developing quickly evolving digital technologies, which ensure that IT systems are made modular and future proof to prevent the need for extensive overhaul, and better manage obsolescence. Box 1 describes how this has been achieved with asset information systems, a relatively new concept to enter the metro rail sector.

**Box 1: Asset information management<sup>3</sup> as an enabler of a whole-systems approach in the modern metro**

As metro railways become increasingly digitalized, managing a large quantity of wide-ranging information and sharing it across the organization is becoming increasingly important. Many assets today can be monitored remotely, and in real-time. Likewise, passenger usage of the metro generates huge quantities of information, which can be used to provide valuable intelligence on passenger flow and network usage, which can then inform capacity expansion and guide new technology development.

Underpinning the management of this data is effective asset information management. Traditionally, metros have opted for enterprise-level databases and systems which seek to provide a single solution to asset information needs. Today, many metros such as London Underground and New York City Transit have moved towards a modular and agile approach to maintain flexibility, make the best use of existing systems, and minimize costs and disruption to information technology systems. Transport for London's TrackerNet and New York City Transit's ISIM-B<sup>4</sup> system provide real-time data on train positioning and have been developed using modular systems and multiple technology pilots to quickly arrive at proof of concept and enable progressive improvement.

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<sup>3</sup> See also "Effective Infrastructure Asset Management – Making the transformation" (pp. 72-87).

<sup>4</sup> Integrated Service Information and Management, B Division.

### **Issue 5: Co-operation – Develop an integrated approach with city transport authorities and other transport providers**

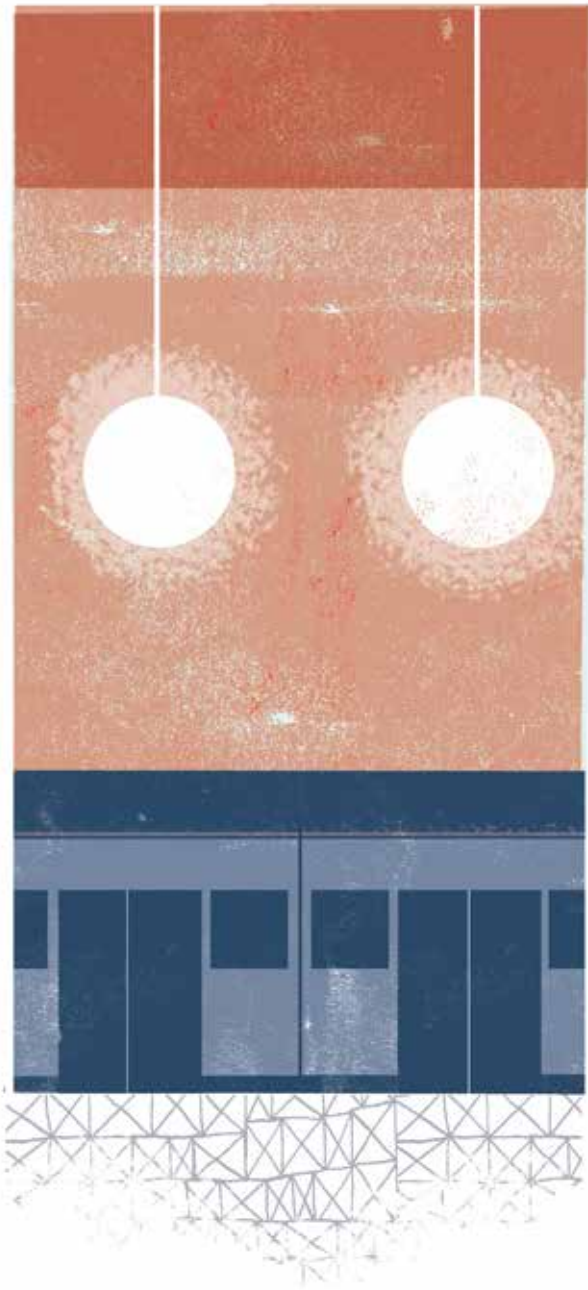
The urban mobility challenges of the future require closely coordinated and integrated action from a variety of stakeholders, including transport authorities, planning authorities, transport providers, telecoms providers, utility/infrastructure companies, property developers, retailers and businesses<sup>5</sup>. A strategic approach is needed which takes into account both transport demand (for example, social, economic and land-use planning, and factors that influence passenger behavior) and transport supply (such as available modes and connections)<sup>1</sup>.

Metro operators differ considerably in their ownership and governance structures – many are part of integrated transport authorities (such as London Underground, which is part of Transport for London), whilst others are more independent. Whatever the structure, metro operators are having to significantly change the way they approach their strategies for the future, for example:

- Becoming much smarter at managing multiple stakeholder relationships, including both authorities and peer companies. In practice this means, for example, being proactive in engaging with others on integrated transport policies and programs, taking a leading position in orchestrating multi-stakeholder debates, and developing formal approaches for stakeholder management.
- Building capability in multiple transport modes beyond metro, including bus, personal transport, bike, etc. Capability in these areas is important, even if the current role of the organization is limited to metro only.
- Acquiring entrepreneurial and technology skills to work with external partners and innovators to develop new and innovative end-to-end journey solutions, especially in the digital sphere. Being able to understand and manage the rapid development cycles of digital technologies in the context of long-term metro hardware asset cycles is especially important.

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<sup>5</sup> Refer to “The Future of Urban Mobility 2.0”, Arthur D. Little and UITP 2014. Available at [http://www.adlittle.com/viewpoints.html?&no\\_cache=1&view=644](http://www.adlittle.com/viewpoints.html?&no_cache=1&view=644)



## Insights for the executive

For many metros, especially those which have been through previous decades of minimum funding and a “make-do-and-mend” philosophy, the future looks challenging. By focusing on the “Five Cs” – and adopting the good change management practices outlined elsewhere in this issue – metro companies have a good chance of achieving the sort of transformation they need.

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