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Grand Paris Express: What We Learn from City Centre Transport Megaprojects in Paris and London

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It was a fitting event to launch a new century: the great Paris Exposition Universelle of 1900 was a showcase for some of the inventions that would go on to become era-defining marvels of the age. Moving pictures, electric cars, and the debut of the diesel internal combustion engine were among them.

But the biggest star of the show—the crowning glory of the French capital's World Expo—was the launch of the Paris Métro. It symbolised a country at the forefront of technology. Launching with just a single line, fittingly called Line 1, the new metro transported passengers in three-car trains from Porte Maillot in the 17th arrondissement in the west to Porte de Vincennes in Bel Air in the east of Paris.

It transformed the look, feel, and economy of the city, and it continues to be a central part of Parisian life.

NEW TECHNOLOGY, NEW DESIGN

The city's ground-breaking underground trains were powered by electric traction, the latest advance in transport technology at the time. It meant that the Paris metro experience in the early 1900s was quite the contrast to the dirty, sooty ordeal of the London Underground, whose first trains were pulled by coal-fired locomotives.

The engineering technique used to tunnel under the city, known as "cut and cover," also defined the look of these modern Parisian stations. The London Underground, built largely through clay, allowed for deep tunnelling that lent itself to a system of narrow tunnels—or tubes. But the nature of the tunnels in Paris—which were created by digging a relatively shallow trench through the city's limestone, laying track, and then covering it over—meant that the stations could be designed as attractive airy vaults, not unlike a wine cellar, with tracks for opposite trains running side by side.

The station entrances, too, were designed to be visually arresting works of art. Designed by French architect Hector Guimard, their beautiful, and immediately identifiable, art nouveau entryways came to symbolise the city's Belle Époque

and are still an iconic part of Parisian urban furniture. Ticket offices were neatly concealed underground to minimise street-level clutter.

THE GRAND PARIS METROPOLIS, REDEFINED

Today's metro currently serves 16 lines with over 300 stations, covering a network of 214 kilometers. However, that's about to change because a little over 120 years since Paris first unveiled its transport vision of the future, the city is about to reinvent itself all over again.

The Grand Paris Express is currently the most extensive infrastructure project in a European capital. Twice the size of Crossrail, and delivered almost all in tunnels, it will add more than 200 kilometers of track to the existing metro network.

By contrast, Crossrail—now renamed the Elizabeth line—serves 41 stations along its 100-kilometre length, connecting Reading and Heathrow to the west with Shenfield and Abbey Wood to the east.

It includes 10 new stations at Paddington, Bond Street, Tottenham Court Road, Farringdon, Liverpool Street, Whitechapel, Canary Wharf, Custom House, Woolwich, and Abbey Wood.

In Paris, their megaproject will see an additional 68 new suburban stations added to the metro network, linking the entire Greater Paris region and defining a new era for the metropolis.

The project is being overseen by Société du Grand Paris (SGP), a public agency set up by the French government to deliver the megaproject. The new lines will form outer circuits to the existing network, providing direct connections between the city's suburbs. They will enable rail passengers to travel between Paris suburbs without having to travel into the centre of the city. There will be four new lines—15, 16, 17, and 18—and two line extensions to lines 11 and 14.

WHAT IS THE WORLD LEARNING FROM CROSSRAIL AND THE GRAND PARIS EXPRESS?

When work began on Crossrail in 2009, digital construction tools were rare and new software was developed to reduce paperwork involved in the drawing review process. Before the digital software was in place, contractors on Crossrail had to print up-to-date drawings, mark them up by hand, and then submit them for approval. This time-consuming and difficult-to-manage process often resulted in communication errors.

Digital software enabled workers to mark up drawings on tablets in the field, progressively creating as-builts during construction as and when changes were observed. All changes were updated and communicated to project stakeholders via the cloud.

A lot had changed in the seven years before work began on the Grand Paris Express in 2016.

However, cost estimates for the Grand Paris Express have risen from EUR 19 billion (USD 22.4 billion) in 2010 to EUR 35 billion (USD 42.6 billion) at present.

Highly complex megaprojects can suffer from a lack of central government accountability, and there is a lack of project management staff with the capability and experience of delivering projects of this scale—a common feature of megaprojects globally.

Analysis by the Global Infrastructure Hub tells us that in its early phases, the project was being procured under the traditional French model. This model sees the client produce an 80% finished detailed design prior to engaging a contractor to de-risk the project.

However, for megaprojects, a failure to involve contractors earlier can result in a reduced number of bids from contractors, increasing the risk of choosing the wrong strategy and technical challenges not being addressed efficiently.

A Cour des comptes (the French government's 'Court of Audit') review found that SGP's supervisory board needed strong technical and financial expertise in the delivery of megaprojects, in addition to political appointees to provide rigorous oversight of project approvals, contracts, funding, cost, and delivery program.

The review also recommended that SGP clearly define its optimal workforce size within the delivery agency (a mixture of direct employees and consultants) over a multiyear period to ensure enough lead time for scaling the organisation's workforce. It would enable SGP to continue delivering efficiently as the project advanced from planning, to procurement, to construction with the workforce requirements flexing accordingly. It also found that engaging contractors earlier in the design process would yield greater de-risking benefits.

Before it is finished, the Grand Paris Express is already leaving a legacy in construction. Last year saw the first pour of Vinci Construction and Ecocem's Exegy ultra-low carbon concrete in the United Kingdom, after its use on the Grand Paris Express. The concrete was developed over four years with the patented alkali-activated binder key to reducing the use of Portland cement in the mix. The first U.K. pour of the concrete took place on EcoPark South in Edmonton, London, which is the first phase of North London Waste Authority's GBP 1.2 billion sustainable management hub and energy recovery facility. The concrete reduced the carbon footprint by 70%, when compared to traditional concrete, and will later be used in the construction of the athletes' village for the Paris 2024 Summer Olympics.

Just as the creation of the Paris Metro in 1900 was a huge driver of innovation, so are today's megraprojects in London and Paris. The world is watching and learning.