

Keolis



Case study
on design review
Keolis Hyderabad Metro



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Keolis case study: Hyderabad Metro

EXECUTIVE SUMMARY

With ever-increasing pressure on public spending, transport authorities are looking for ways of procuring efficient rail systems at the lowest life cycle costs. Experience has shown them that focusing on reducing capital expenditure (capex) is not enough since it is just one part of the overall lifetime cost.

Rather, it has become clear that one of the most effective ways of reducing these costs is to involve the future operator early on in the project. The more influence the operator has in the development and design process, the more efficient the resulting system will be for the client.

In the case of the Hyderabad Metro, the concessionaire, Larsen and Toubro (L&T), brought Keolis in early (nearly four years before system launch) to support it in reviewing the functional specifications, as well as technical documents from the suppliers and other design documents. This plugged a key knowledge gap on L&T's side. The concessionaire had key people with engineering and project experience but lacked the user, maintainer and operational know-how.

This is a very successful project, in particular working in a new country and with different sets of engineers, suppliers and consultants. Despite these challenges, Keolis is able to bring a whole-system perspective to the project where, previously, different people worked in silos, focusing only on their specific areas.

This case study further reinforces the growing evidence that early operator involvement in a rail project is critical to its success.

INTRODUCTION

Hyderabad has played a vital role in India's recent economic development. This success has sparked a dramatic increase in the city's population, with forecasts predicting it will rise from 9 million in 2013 to 13.1 million in 2021¹. This population growth places increased demands on both the city's environment and its infrastructure. As a result, the Indian government decided to construct a new metro rail service to meet the future needs of Hyderabad and ensure that the city can continue to play a key role in India's economic growth.

This case study outlines the role that Keolis has played in the development of the Hyderabad Metro project and demonstrates how its early involvement has brought additional benefits to L&T and the project as a whole, particularly in terms of cost efficiency and reliability of the future system. It shows how Keolis has used its years of European and international experience to bring world-class engineering, operations, maintenance and project management techniques to developing a metro that fits the needs of what is becoming one of the world's most important cities.

Throughout this process, Keolis and L&T worked together to understand the transport needs of Hyderabad's residents and find solutions to answer them. Their common goal is to provide a service that offers the best possible passenger experience.

THE VISION² FOR THE HYDERABAD METRO:

“ To create an efficient, safe, reliable, economical and world-class public transportation system in Hyderabad which will facilitate the city's transformation as a competitive global city with a high quality of life. ”

PROJECT STRUCTURE

The Hyderabad Metro project is funded on a Private Public Partnership (PPP) basis, with the Indian government bearing 10% of the cost. The remaining 90% is borne by L&T, India's largest engineering and technology company. L&T is responsible for developing the project, overseeing its specification and construction, as well as appointing all subcontractors.

In November 2011³, L&T appointed AECOM to lead planning and design work on the project. In May 2012, it selected Keolis to operate and maintain the metro, citing Keolis' comprehensive experience working on similar projects across the world as the critical factor.

PROJECT SCOPE



The Hyderabad Metro is a singularly ambitious and significant infrastructure project. It will comprise three lines, covering 71 kilometres of track with 66 stations and 57 trains. It is being built on viaducts that cross the city and is expected to carry an estimated 1.5 million passengers every day. The first phase is due to open in 2015, with the whole system to be completed two years later.

The elevated metro will be automatic although trains will initially have on-board conductors. To ease congestion on the city's over-crowded roads and decrease pollution, it is designed to integrate with other key transport modes, including the airport and bus services.

DIVISION OF RESPONSIBILITIES

TASK	LEAD	KEOLIS' ROLE
Business case	Client	
Functional specifications	Client/L&T	Review
O&M requirements	Keolis	Lead
Technical offer from suppliers	L&T	Review
Implementation	L&T	
Testing and commissioning	L&T	Support
Operate and maintain	Keolis	Lead



1. Source: <http://www.hmr.gov.in/whymetro.html>
 2. Source: <http://hmr.gov.in/Home.html>

3. Source: [http://www.aecom.com/News/_news/AECOM+consortium+awarded+US\\$17.6-million+contract+for+India%E2%80%99s+Hyderabad+Metro+Rail+project?languagehoice=fr_CA&Go=Go&localeHidden=fr_CA&localeFlash=ru_RU](http://www.aecom.com/News/_news/AECOM+consortium+awarded+US$17.6-million+contract+for+India%E2%80%99s+Hyderabad+Metro+Rail+project?languagehoice=fr_CA&Go=Go&localeHidden=fr_CA&localeFlash=ru_RU)

KEOLIS' ADDED VALUE

L&T awarded the contract to Keolis to operate and maintain the new Hyderabad Metro in May 2012. Several months before that, the Keolis Project Director brought together an expert team, drawn from Keolis and SNCF, as well as rail experts who had worked on similar systems, such as the Delhi metro. This meant Keolis was prepared to mobilise immediately once they had won the contract.

ADVANCED MOBILISATION

1

STRATEGIC VISION

2

L&T needed to rely on an expert to operate and maintain the new metro. Keolis, thanks to its extensive experience in operations and maintenance, was able to bring the holistic operational vision to the project that L&T needed.

LIFE CYCLE APPROACH

3

Projects in India can progress very linearly with a lot of emphasis on delivery and costs. However, early involvement of the operator ensures that the client can make informed decisions based on life cycle considerations.

Operators are closest to the end customers (the fare-paying passengers) and so need to assure the clients and themselves that the engineering and systems design will meet the operational and performance requirements. This is why the focus in Hyderabad was to make the design process more collaborative.

4 ADAPTABLE CULTURE

Keolis has years of experience working on PPP projects around the world. For example, in the UK and Australia, the design team usually proposes a design that is expected to meet operational and maintenance requirements provided by the operator. The operator then critically reviews the design, getting modifications made to it until it is fit for purpose. Although the PPP model has yet to reach full maturity in India, by getting involved early on in the process and by exchanging with L&T, Keolis encouraged innovative ways of thinking about the Hyderabad Metro design and adapted its design review procedures to the local environment.

INTERVENTION & EXPERTISE

INITIAL CONSULTANCY WORK

Keolis' initial work was to provide a consultancy service. This required them to undertake a review of the technical specification, making sure that it complied with the business case. The review involved examining many of the documents that had been written by AECOM on behalf of L&T who were acting as the client's engineers.

Review of the basic design

Review of the technical specifications

Procurement support

Review of the detailed design from suppliers

Keolis was then involved in the procurement process and supplier selection, wherein they reviewed key technical documents and gave feedback to the client. In the next stage they reviewed the detailed design submissions and technical offer from the selected suppliers.



OPERATIONAL EXCELLENCE

As the future operator of the system, Keolis needed to make sure that the proposed operation design of the Hyderabad Metro was suitable for the coming years.

To do this, Keolis combined its international experience with local knowledge. It provided technical expertise in reviewing the design documents for rolling stock, the train driver simulator, the graphical user interface, the automatic fare collection system, communications, plans and procedures, train operation and training.

The following issues were identified during the review of the technical specifications and supplier designs:

1 ROLLING STOCK ALARMS

The original specification recommended that the rolling stock fault alarms were to be transmitted via Wi-Fi to automatically transmit data to the line side server. However, Keolis found that this could compromise the live transmission of data from the train to the Operational Control Centre (OCC) in an emergency. It therefore recommended that data should be transferred to the OCC via the signalling channel, which would add greater resilience and robustness to the system. Although it took nearly nine months to resolve, the client took this on board and it was implemented.

2 CREW & ROLLING STOCK MANAGEMENT

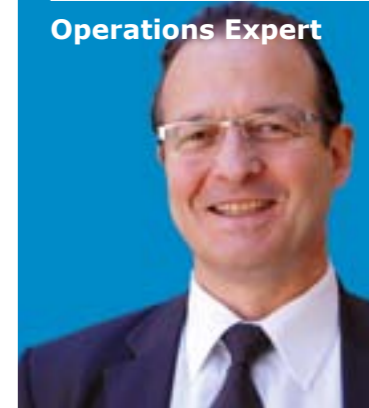
Generally, the crew roster and real-time crew monitoring function is performed manually or by a standalone system and is not linked with a signalling system. However, Keolis experts recommended implementing a link with the signalling system. As a result, the crew management function is integrated with the timetable, and the day-to-day roster is directly managed through the ATS (Automatic Train Supervision) system with a real-time crew monitoring function. This will reduce crew control manpower and improve crew management during both normal and abnormal situations. Similarly, rolling stock information will be available in real-time.

3 TRAIN STARTING IN AUTOMATIC TRAIN OPERATION (ATO) IN TRAIN POWER-ON

As per the proposed design by the signalling contractor, if the train is in power-off, it loses its position and cannot start in ATO. Keolis experts insisted on a design that would enable train starting in power-on in ATO. The design requirement was captured in the technical specifications but not in an explicit manner. The design requirement could not be completely implemented but signalling and rolling stock design was optimised for longer sleep mode for the train without losing positioning and tag-layout on track. This ensures quick positioning in case of train power-on.

“ Keolis’ thorough expertise in driverless metro systems and CBTC signalling brought real added value to the client. We advised them on the choice of technology, making sure that it would reach our standards in terms of safety, efficiency, reliability and provided good value for money. ”

PHILIPPE LEGUAY
Operations Expert



4 PASSENGER INFORMATION

An important lesson that was learned from the Delhi Metro was to review the passenger information systems early in the process. Keolis therefore reviewed the proposed announcement list for both stations and PPI systems on the rolling stock. Using its international experience, it made sure that additional, more current announcements were added.

5 SIMULATOR DESIGN

The operations team added value to the design of the driving simulator, for which little expertise was available locally. This resulted in changes to the simulator layout, capacity, screen layout and visibility. Similarly, changes to rolling stock cab layouts, fault diagnostics and train management system functionalities were suggested and accepted by the client.

6 INNOVATIVE BUSINESS RULE FOR AUTOMATED FARE COLLECTION (AFC) SYSTEM

The client requested the operations team to develop business rules for the AFC system design of the Hyderabad Metro. The business rule Keolis devised complies with applicable local laws and incorporates various innovative features based on local as well as international experience. Important features have been developed to automate all AFC functions. For example, the stock management of fare media, including tokens and smart cards, has been developed to ensure automated and transparent accounting. The business rule is kept flexible to incorporate future needs based on operational experience.

➤ THE PARTICIPATION OF KEOLIS’ OPERATIONS TEAMS IN THE DESIGN PHASE PROVIDED VITAL INFORMATION THAT HELPED TO IMPROVE FUNCTIONALITIES OF VARIOUS SYSTEMS SIGNIFICANTLY IN LINE WITH THE OPERATIONAL REQUIREMENTS, WHILE MEETING TECHNICAL SPECIFICATIONS LIMITS AND TIME CONSTRAINTS.

MAINTENANCE IMPROVING EFFICIENCY AND REDUCING COSTS

As with the operations, the maintenance project team was asked to validate the outline specifications and designs. However, Keolis became involved in the review process at a slightly later stage, after AECOM had completed the design work, and the maintenance team was already developing key documents including the Management Plan, Strategic Maintenance Plan, RAM (Reliability, Availability, Maintainability) strategy, final design review and maintenance manual.



The team contributed further by reviewing the documents made available and expressed their expert opinion in meetings. The focus of the review was to ascertain how the specifications met the maintenance requirements and the performance targets set for them at the operations stage. The team identified several areas that will have a major influence on how the metro will be maintained.

LIGHTING ON SWITCHES AND CROSSINGS

One important area identified was lighting, which was not provided at switches and crossings. This would have made maintenance tasks difficult to carry out and reduce productivity. It would require workers to carry portable lighting to sites to enable them to work safely and efficiently. Keolis was able to influence the design so that lighting was installed, thus reducing whole life costs and making maintenance easier.

HIGHER
PRODUCTIVITY
AND SAFETY

MAINTENANCE SPECIALISTS' TOOLS

The original project specification called for individual software to be carried by the maintainer to analyse faults. This would have meant different systems were needed for different assets, requiring multiple handheld devices. Keolis proposed that all the individual systems be configured in one laptop so the maintainer would only need to take this to the train or trackside.

INCREASED
EFFICIENCY

CENTRALISING FAULT REPORTING

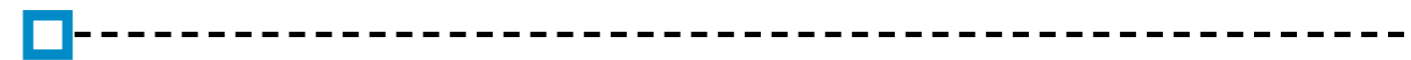
Keolis also proposed that all system faults should be phoned in to one reporting centre so that they are centralised and easier to track. The Keolis team provided the requirements for the categorisation of faults. This suggestion saved both time and money.

TIME AND COST
REDUCTION

IMPROVEMENTS TO THE TICKETING SYSTEMS

In the original design for automatic fare collection gates, there was no cooling arrangement. Keolis proposed introducing some forced cooling. It also introduced additional alarms into the system, supported by an uninterruptible power supply. In addition, Keolis developed a safer and more robust fare collection process, which improved the basic system that had been proposed initially.

MORE RELIABLE
PROCEDURES



LOOKING TO THE FUTURE, KEOLIS WILL BEGIN OPERATING THE HYDERABAD METRO WHEN THE FIRST LINE IS LAUNCHED IN MARCH 2015. TO PREPARE, IT IS CURRENTLY CREATING MAINTENANCE PLANS, TRAINING MATERIALS, RESOURCE PLANS AND THE TECHNICAL ASPECT OF METRO MAINTENANCE. TO INTEGRATE THIS INFORMATION, KEOLIS WILL USE IBM'S MAXIMO ASSET MANAGEMENT SYSTEM.

THE MAINTENANCE TEAM ADDED VALUE TO THE DESIGN PROCESS, ALTHOUGH THIS WOULD HAVE BEEN CONSIDERABLY ENHANCED IF THEY HAD BEEN INVOLVED FROM THE TECHNICAL SPECIFICATION STAGE. A STRUCTURED DOCUMENT MANAGEMENT PROCESS FURTHER HELPED THE TEAM, AS DID EARLY VISIBILITY OF DOCUMENTS FROM SUPPLIERS, WHICH WAS HELPFUL IN THE PREPARATION OF THE MAINTENANCE MANAGEMENT PLANS. THE SKILLS AND EXPERTISE OF THE KEOLIS TEAM WERE COMPLEMENTARY TO THOSE OF L&T AND AECOM.

STATION DESIGN REVIEW

From an operational perspective, passenger flows are the most important consideration when designing a station. The whole system must operate as smoothly as possible, allowing people to get on and off trains safely and easily.

KEOLIS' PHILOSOPHY IS TO THINK LIKE A PASSENGER AND THIS IS HOW IT APPROACHED THE STATION DESIGN REVIEW FOR THIS PROJECT.

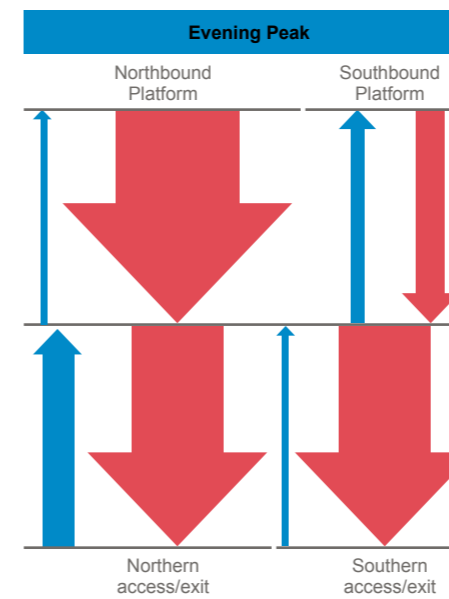
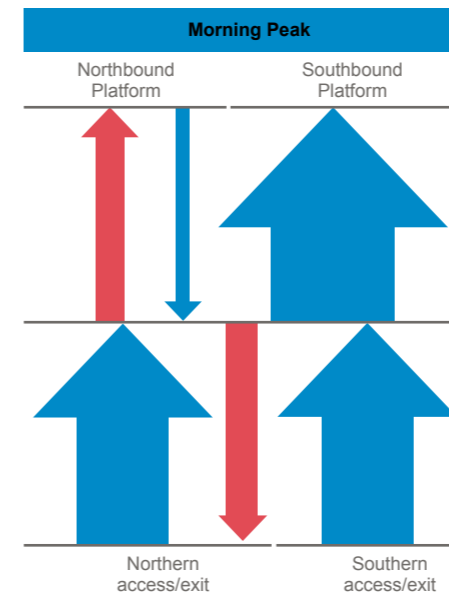
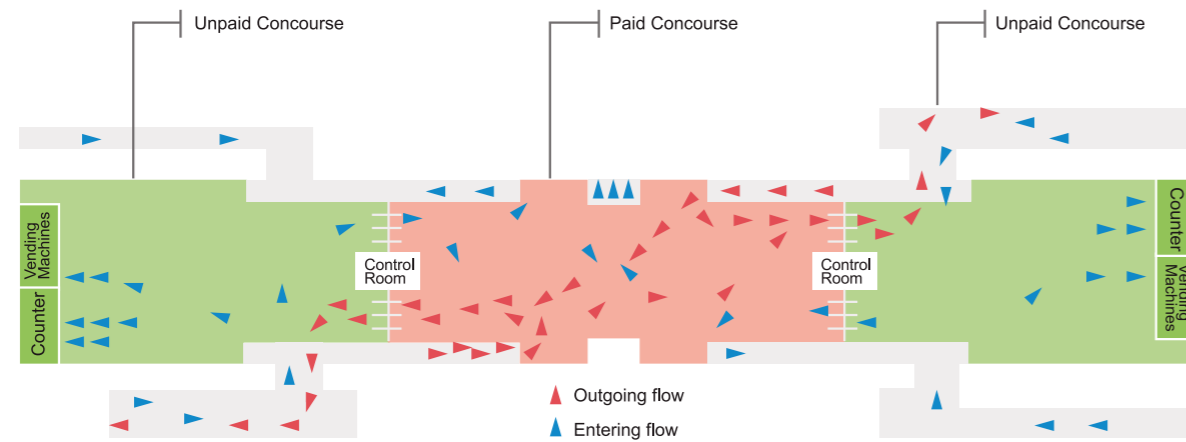
Station transit time
-10%

FLOW MANAGEMENT

Keolis' approach was to examine every element of a passenger's transit through the station, from their entrance from the street to how they got on to the train. This was to ensure that there were no bottlenecks and that the entrance and exit flows did not cross.

An important part of the review was to check the concourse design and how passengers could move between the paid and unpaid areas. Keolis highlighted to L&T that the unpaid area had to be larger than the paid so the volumes of the surfaces complied with the operational needs. In addition, they examined both the horizontal and vertical flows of people, both passengers and staff.

This element brought real value to the project as it showed a human approach in thinking. And it will help the operation of the whole system run smoothly when the service is running.



BY ADDING REAL VALUE TO THE HYDERABAD PROJECT, KEOLIS HAS ENSURED THAT THE JOURNEY EXPERIENCE IS ENHANCED FOR MILLIONS OF USERS.

WAYFINDING

A further, and critical, part of the station design review was to ensure that signage was suitable for passengers. Keolis reviewed this in detail, from the iconography employed, its colour and size, to the type of signage and its location. Its considerable operational experience in this area significantly helped the client design suitable signage.

This also helped to save space and give an uncluttered look. Keolis also reviewed and refined both the layout of the staff accommodation and technical rooms, especially at the terminal stations where shift changes had to be catered for. This again highlighted how Keolis considers human needs when designing a system.

THE STATION SPECIFICATION

Keolis reviewed the width of the platforms to ensure there was sufficient capacity at each station to cope with anticipated use. Moreover, it checked that the number of gates was sufficient for passengers to be able to leave a station before the next train arrived. More importantly, Keolis advised L&T to employ a certain percentage of bi-directional AFC gates instead of single-directional. This makes operations more flexible according to different passenger flow patterns at different times during the day. Keolis used medium- to long-term forecasts for this work to future-proof the system.

STATION CONTROL ROOM LAYOUT

The station control room (SCR) design was greatly influenced by Keolis' philosophy to use technology in an ergonomic way. The layout of equipment in the SCR was optimised from a functional point of view. Keolis recommended control and monitoring system be arranged in a multi-level stacked manner, so that they could be handled easily by a single operator without undue trouble. This also helped to save space and give an uncluttered look.

Keolis also reviewed and refined the layout of both the staff accommodation and technical rooms, especially at the terminal stations where shift changes had to be catered for. This again highlighted how Keolis considers human needs when designing a system.

ALIGNMENT ENHANCED RELIABILITY

Keolis undertook two reviews of the overall system to ensure it was able to function under normal circumstances as well as during times of disruption.

NORMAL ALIGNMENT

This review covered the following areas:

- 1 Stabling capacity at terminal stations, both during breakdown and peak times. This had to cater for work such as cleaning and checking trains before they are brought into service.
- 2 Fitting of the terminal stations, to ensure that technical activities were catered for and the location of switches and crossings were appropriate.
- 3 Flexibility so that, for example, more trains could be introduced to the system in peak times.

DISRUPTION

Because the number of people who will rely on the system is significant, Keolis cannot afford to have any long breaks in service. Its aim, therefore, in reviewing the alignment during times of disruption was to make sure that they could continue to run some service while dealing with the issue.

This led to two significant recommendations:

- 1 Switches should be included along the alignment so that trains could be returned along short loops if a section of track ahead was out of service. This has given the system greater resilience, as an incident in one section of track will not stop the whole line from operating.
- 2 One of the pocket tracks that had been included in the original design could be removed because it did not add value. This had a massive impact for L&T as it reduced the capex on the programme.

€2
million
capex savings

➤➤ KEOLIS INCREASED SYSTEM RELIABILITY WHILE CONSIDERABLY REDUCING CLIENT EXPENSES THROUGH ITS OPERATIONAL KNOW-HOW AND ROBUST APPROACH.



DEPOT DESIGN REVIEW

As with track alignment, Keolis was able to optimise costs by reviewing the depot plans early on.

€5
million
capex savings

CHANGING THE ORIGINAL DEPOT PLANS

Initially, L&T had planned to build three depots, one for each line, with each having operational and maintenance capacity. Keolis suggested that the three lines should be managed as one network, allowing for flexibility and movement between them.

It recommended that the construction of the depot at Falaknuna be postponed indefinitely. Instead, a light stabling and cleaning area was included with the other two depots to carry out all maintenance.

Keolis' recommendations for the remaining two depots at Nagole and Uppal were similarly radical. L&T had initially planned that both should carry out all types of maintenance. Keolis recommended that one should be fitted out for heavy maintenance, such as train refurbishment, while the other was for lighter maintenance.

By creating a hierarchy of depots, Keolis achieved yet more cost savings for L&T as only half the amount of heavy maintenance equipment had to be bought.

DEPOT FITTING AND MAINTENANCE

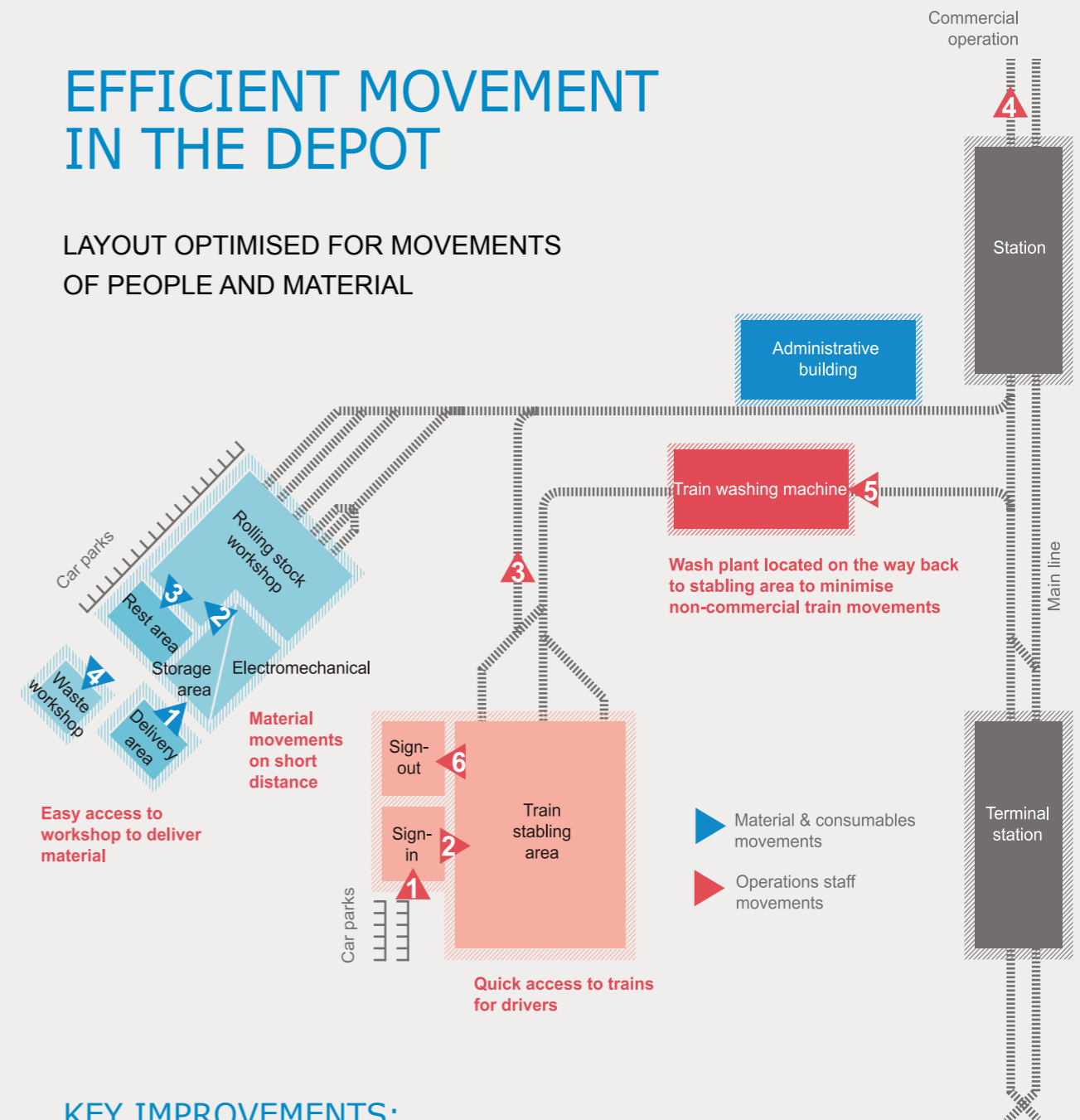
Keolis' goal for fitting out the depots was to ensure its maximum operational ability and minimise movements between the train and technicians. This was particularly important because the depots are built on a massive scale. If their logistical use was not planned carefully, the time it takes for people to move around in them could be wasted. As an example of this attention detail, Keolis recommended that car parks should be located near the stabling area so that drivers could get to their trains in time for the start of their shift.

A final key consideration was how vegetation was managed at depots. If left untreated, areas could quickly become overgrown. Keolis recommended that these areas be treated regularly to ensure that they did not impact depot operations.

Keolis' innate understanding of how depots run and are managed enabled L&T to achieve cost savings in Hyderabad.

EFFICIENT MOVEMENT IN THE DEPOT

LAYOUT OPTIMISED FOR MOVEMENTS OF PEOPLE AND MATERIAL



KEY IMPROVEMENTS:

- > Design for warehouse and spare parts storage with easy access to working areas
- > Internal layout of depot with dedicated workshops, office space, OCC theatre
- > Tooling storage area close to working areas
- > Depot signalling arrangements to ensure fluid train movements
- > Design safety arrangements for staff and contractors (train movement management)
- > Dedicated area for staff working in shift
- > Security: CCTV location (depots and station) and access control

ROLLING STOCK

One of the main reasons that Keolis won the contract for the Hyderabad Metro was its expertise in running automatic metros. Keolis was able to bring best practice from Europe to bear in a key area of the Hyderabad project. The Keolis team was supported in this by engineers from SNCF, who brought valuable experience to the table.

“ We are glad that L&T appreciated and took into account our advice before appointing a supplier of rolling stock. Our expertise operating automatic metros and our engineering skills made a real difference and increased cost efficiency. ”



APPOINTING A SUPPLIER

Keolis was asked by L&T to review both the specification and technical offer for the rolling stock from four suppliers – one from China, another from Korea and two from Europe. Keolis made a number of suggestions and commented on the technical offer while the supplier engagement was led and managed by the client.

Although the client team and their engineering advisors had some knowledge of Asian suppliers, their knowledge of European rolling stock providers was limited. Because European know-how in railway technology is highly developed, getting a European perspective in the review process gave the client an accurate view of all suppliers and helped them make an appropriate choice. Ultimately, the Korean company Hyundai won the contract to supply rolling stock and Keolis was asked to comment on the final design review documents.

DETAILED REVIEW OF THE SYSTEM

The initial technical documents from the suppliers were detailed and covered all the sub-systems. However it quickly became clear that there was no system overview, including a lack of risk analysis, RAMs analysis, global testing plan, global maintenance plan, and no clear picture of how it all worked together.

Keolis therefore flagged this to the head of engineering at L&T who asked Hyundai to bring this all together and show how the system worked in its totality. While this is standard practice in Europe, it is one area which Keolis has introduced to a different market. If Keolis hadn't been part of the project, this key facet would have been missed. Keolis' added value was to offer an expert, strategic view on this part of the project.

EXTENSIVE EXPERTISE IN ROLLING STOCK

Keolis is part of the SNCF Group, the French national railway. Therefore it can offer its clients access to many years' expertise in rolling stock engineering. For Hyderabad, this enabled the team to focus on areas such as train monitoring systems, safety aspects, availability and accessibility of doors. Moreover, Keolis could bring real added-value by giving L&T advice on ordering additional spare parts, which helped to keep their costs low.



THE KEOLIS TEAM WAS LIKE THIRD PARTY ENGINEERS AND IDENTIFIED MANY GAPS IN THE TECHNICAL DOCUMENTS, DESPITE THE MANY EXPERIENCED ENGINEERING TEAMS ON THE CLIENT AND SUPPLIER SIDES. KEOLIS ENSURED THAT L&T WOULD BE ABLE TO START REVENUE OPERATIONS SMOOTHLY, A CRITICAL FACTOR ON SUCH A HIGH PROFILE PROJECT.

WHILE IT WOULD HAVE BEEN MORE EFFECTIVE HAD IT BEEN INVOLVED FROM DAY ONE, KEOLIS' EXPERIENCE AND EXPERTISE WAS RESPECTED BY THE CLIENT TO SUCH AN EXTENT THAT ITS RECOMMENDATIONS WERE FREQUENTLY TAKEN ON BOARD.

SIGNALLING

Keolis' signalling team became involved after the client selected Communications Based Train Control (CBTC) for the Hyderabad Metro. Remarkably this was to be the first CBTC-based system in India.



CBTC is very advanced and known for very high safety and availability. And by enabling automatic operations, it frees up operations and technical staff for customer services.

Before Keolis experts could get involved, L&T and AECOM developed the technical specification. Unfortunately, there were two main issues with the specification:

- 1 It was too prescriptive and would not allow suppliers to come up with efficient solutions.
- 2 It assumed that the clients would want to stay with technology that had already been proven in India.

EXPERT OPINION ON CBTC

The client asked for Keolis' views on the specification, and requested Keolis demonstrate that CBTC was a good choice. This was the first task the team carried out and the client was satisfied with the evidence-based demonstration to support the findings.

REVIEW OF THE TECHNICAL OFFER

When the supplier selection was conducted, the Keolis team was asked to look at the technical offer in order to verify whether or not they were compliant. Some parts of the specification were not suited to procuring the best signalling system at the best cost. So the team commented on those requirements, which as a result were modified.

For example, the specification suggested a "distance to go" system based on track circuit. In the opinion of the Keolis team, this was a mistake. The client agreed to this reasoning and the requirements for the track circuit were dropped. This has resulted in a more efficient but less expensive system.

The specification for a fall back system is also an expensive mistake, and the Keolis team is currently working to prevent the fall back system affecting the performance of the main system.

THE KEOLIS TEAM BROUGHT UNRIVALLED EXPERTISE IN CBTC. THE TEAM WAS ABLE TO IDENTIFY AND RESOLVE MANY RISKS AND MADE SURE THAT AN EFFICIENT SYSTEM WAS PROCURED AND INSTALLED.

OPTIMISING DESIGN

There were a large number of small issues which required careful management and change control. For example, the transmission of information from rolling stock to OCC via the signalling system was included in the signalling system specification, but was missing in the rolling stock specification. Another area was in the disaster management architecture where there was no centralised view.

The Keolis team concentrated on design optimisation. As a result, a low-cost depot for the third line was proposed. This entailed stabling lines and some maintenance facilities. Similarly, some switches and crossings were taken out during the alignment review and at least one pocket track was removed. These changes resulted in cost savings for the project. In other areas, the design review team's recommendations were not accepted, specifically with regard to automatic operations in the depot, centralised compressed air and underground fuel tanks.

NEW WAYS OF WORKING

THIS CASE STUDY SHOWS THAT EARLY OPERATOR INVOLVEMENT IN A PROJECT LEADS TO A BETTER DESIGN. BY HAVING MORE INFLUENCE IN BUYING DECISIONS, NOT ONLY ON THE TECHNICAL SIDE BUT ALSO THE ECONOMIC SIDE, OPERATORS CAN ENSURE THAT EFFICIENT SYSTEMS ARE PROCURED AT AFFORDABLE PRICES.

KEOLIS ADDED CONSIDERABLE VALUE TO THE HYDERABAD METRO PROJECT BUT HAD THEY BEEN INVOLVED EARLIER, IT COULD HAVE FURTHER INFLUENCED THE SPECIFICATION OF THE METRO. ULTIMATELY THIS WOULD HAVE PROVIDED THE CLIENT EVEN BETTER VALUE FOR MONEY.

WHY KEOLIS?

Keolis is an internationally recognised public transport operator with a proven track record of working under different contractual models, including PPPs, across Europe, North America and Australia. It brings multi-modal expertise and a strong knowledge management culture. And, because it has the support of majority shareholder SNCF, the French national railway, it has access to significant engineering and specialist rail expertise.

Thanks to the implementation of operations and maintenance processes targeting the optimal delivery of public transport services, Keolis attains high standards of reliability, availability and punctuality throughout its activities and countries. As a partner to transport authorities, it can adapt to changing needs and expectations, and constantly delivers the high standards of quality and security required by public transport authorities.

One of Keolis' key strengths is its ability to help public transport authorities construct new transport networks or extensions to existing networks. Keolis brings the operator's viewpoint to the table, helping authorities to optimise their operations financially throughout the life of the system. During the period running up to operations, Keolis assigns multinational teams of experts to projects, brings design and engineering expertise to the preparation phase, and leads training programmes for operations staff.

Keolis' key added value is to enable the client to achieve a more broadly specified rail system, and give a strategic view of the system that would otherwise have been missing.

KEY AREAS WHERE KEOLIS BROUGHT EXPERTISE

> SYSTEM MAINTENANCE:

- Meeting performance targets at operations stage
- Streamlined information gathering
- Improved access for maintenance of switches and crosses
- Centralised fault reporting
- Improved ticketing systems

> ROLLING STOCK:

- Overall system review
- Saved money on the purchase of spare parts
- Expertise on the development of the driving cab simulator
- Improved reliability



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