UK Trade
& Investment


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# India Metros: A High Value Opportunity for the UK Rail Sector

# Preface

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## About the Authors

This report has been prepared by Dr Amit Khandelwal, Head of UKTI's Mass Transport Unit and Vijay Narayanan, Managing Consultant at PA Consulting Group.

### Amit Khandelwal

Amit Khandelwal is Head of UKTI's Mass Transport Unit focussing on sectors such as rail, airports and ports. He has over twenty years experience working in sectors such as metals trading, defence, chemicals and pharmaceuticals, and has been involved in exporting and importing commodities to and from countries such as India.

His expertise lies in innovation, knowledge management, marketing, people resourcing, project management, talent management and R&D.

Amit has a Masters degree from Cambridge University in Chemistry. He is PRINCE 2 qualified and has recently obtained a masters in human resource management at Greenwich University where he focused on, and is a practitioner in, organisational leadership and talent management.

### Vijay Narayanan

Vijay Narayanan has over twenty years experience working with top teams in management consulting, marketing, advertising, new media and outsourcing. He has spent the last ten years in senior leadership roles managing large strategy and operations teams. His expertise lies in the areas of Growth Strategy; International Marketing, India based Offshore Strategy and Business Research across a wide range of industry sectors.

A Life Sciences graduate with an MBA from the Institute of Management Studies, Indore, India, he is currently Managing Consultant and Head of the Global Knowledge Centre at PA Consulting Group.

Vijay is a keen observer and participant in the globalisation of businesses, cultures and communities. He lives and works in Bangalore, India.

*Front cover image: Operating Train on Delhi Metro*

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Capital: New Delhi
Population: 1.24 billion
Official languages: Hindi & English

Currency: Rupee
Time difference from GMT: +5.30 hours
Flight time from UK: 8 hours to 10 hours

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**Individuals**

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Rohit Chincholkar, Parag Hazarika, Jake Rudham, Neil Smith and Kevin Thorpe, PA Consulting Group
Sanjay Jamuar, Network Rail Consulting
Ben Aldred and Mukul Verma, UKTI India

**Organisations**

Delhi Metro Rail Corporation Limited
City and Industrial Development Co[illegible]on of Maharashtra Limited (for Navi Mu[illegible]ba[illegible]etro)
Bangalore Metro Rail Corpo[illegible]tio[illegible]imited
Mumbai Metro One Private [illegible]d
Kolkata Metro Rail Corpora[illegible]imited
Kochi Metro Rail Li[illegible]
Jaipur Metro Rail [illegible]rp[illegible]tion Limited
Metro-Link E[illegible]pres[illegible]Gandhinagar & Ahmedaba[illegible]Co[illegible]any Limited
Nagpur[illegible]al Corporation (for Nagpur Metr[illegible]
Pune Mu[illegible]pal Corporation (for Pune Metro)
Rapid Metrorail Gurgaon
Surat Municipal Corporation (for Surat Metro)
British Deputy High Commission

**Photo credits**

Thank you to the organisations listed above for supplying images.

The maps presented in the report are not to scale.


Withdrawn 17 may 2019
New Delhi
Jaipur
Ahmedabad
Mumbai
Bangalore
Kochi

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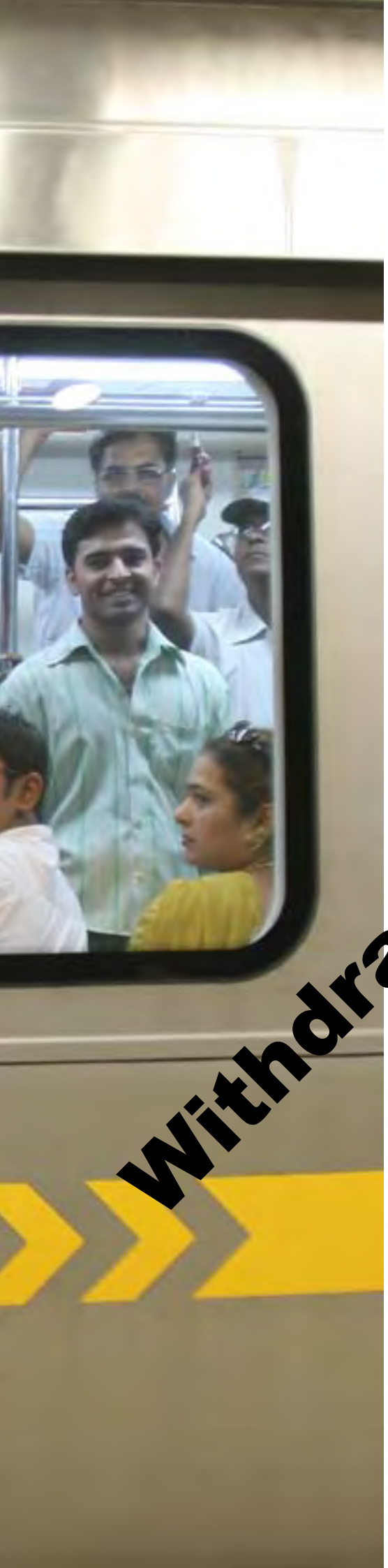

*Commuters on the New Delhi Metro system*

## Foreword

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It gives me great pleasure to present a report on the opportunities for the UK rail industry in the Indian Metro Rail sector. This is published as part of UK Trade and Investment's flagship initiative, the High Value Opportunities (HVO) programme, which identifies large, viable overseas infrastructure projects, selecting those that offer the most accessible and lucrative) opportunities for UK companies.

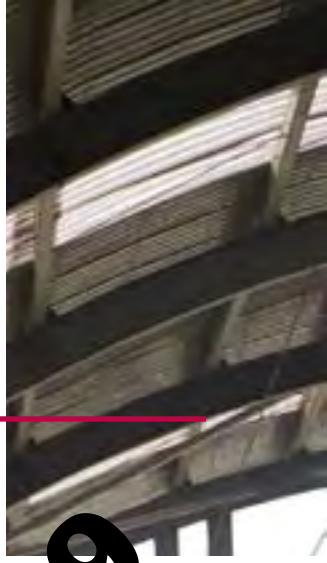
Teams comprising individuals from across UKTI and wider Government are created to provide long-term support to UK companies to help them take advantage of these opportunities.

The transport sector forms a significant element of the HVO programme, and rail projects around the world, especially those focusing on Mass Rapid Transit (with particular emphasis on metros) are an important part of this opportunity. India features prominently in this programme which includes a project entitled *'India Urban Mass Transit Systems'.*

The United Kingdom has a strong and deep relationship with India. This is not only based on our shared historic relationship but also through our core values of democracy and enterprise. We are committed to doubling bilateral trade by 2015 and have made good progress since the British Prime Minister David Cameron's first visit to India in 2010.

India is among the top ten economies in the world by Gross Domestic Product and is the second fastest growing one in the world. This high growth is fuelled and sustained by the country's favourable demographic, its population, an abundance of natural resources and a robust democratic political system.

India is also urbanising at a frantic pace. It has 45 cities, each with a population of one million or more. According to the 2011 census the five



## Foreward continued

largest Indian cities – Mumbai, Delhi, Bangalore, Hyderabad and Ahmedabad - all have a population of over five million and a collective but growing population of over 44 million.

This growth needs to be supported by significant development in the country's infrastructure in all areas. For example, Ernst and Young, in association with FICCI, recently released a report entitled *'India Infrastructure Summit 2012 – Accelerating implementation of infrastructure projects',* which estimates that infrastructure investments in India will grow to over one trillion US dollars during the twelfth five year plan period from 2012 to 20

In order to respond to urbanisation and support economic growth and well-being of the Indian population, the Government of India's Ministry of Urban Development, based in New Delhi, along with various State Governments, have an ambitious plan to develop and operate numerous metro rail systems in major Indian cities. Forty projects are known to be either planned, in development or in expansion in cities such as Ahmedabad and Gandhinagar, Bangalore, Kochi, Jaipur and Mumbai.

UKTI is uniquely placed to respond to these resultant opportunities by providing advice, skills, knowledge and expertise required in the development of these transportation systems across India. For example there are twelve separate metro and light rail networks across the UK.

Together this customer base supports a broad and diverse range of UK suppliers with world leading capabilities. Crucially UK companies span the full metro lifecycle including planning and design, project delivery, technology and equipment supply, operations and service delivery, maintenance and renewal, including asset management.

Hence UKTI commissioned PA Consulting Group to study the Indian Metro Rail sector and present an assessment of the opportunity that the sector provides for UK companies together with the level of international participation and competition that UK companies will face in India. A market scoping mission was also undertaken by UKTI in May 2013 to understand how to address these opportunities.

I hope that you will find this report of value especially in assessing the opportunities available, and in developing your strategies to realise them.

UKTI is fully committed to assisting you with this process. I would encourage you to reach out to our teams in the UK and in India for any

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further information and assistance, contact details of whom can be found at the back of the report.

I believe that UK businesses, whether already in India or wishing to work in India, are uniquely placed to become the *'partner of choice'* and help India achieve its infrastructure ambitions in the urban mass rapid transit arena.

I wish you success in accessing and winning metro opportunities in India.



**Steve O'L**
Directo f I astructure and
Life S ien s

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## About UK Trade & Investment

UK Trade & Investment is the Government Department that helps UK-based companies succeed in the global economy. We also help overseas companies bring their high-quality investment to the UK's dynamic economy, acknowledged as Europe's best place from which to succeed in global business.

UK Trade & Investment offers expertise and contacts through its extensive network of specialists in the UK, and in British embassies and other diplomatic offices around the world. We provide companies with the tools they require to be competitive on the world stage.

### Trade

UKTI staff are experts in helping your business grow internationally.

We provide expert trade advice and practical support to UK-based companies wishing to grow their business overseas. Whatever stage of development your business is at, we can give you the support that you need to expand and prosper, assisting you on every step of the exporting journey.

Through a range of unique services, including participation at selected trade fairs, outward missions and providing bespoke market intelligence, we can help you crack foreign markets and get to grips quickly with overseas regulations and business practice.

### Investment

UKTI's comprehensive range of services assists overseas companies, whatever their size and experience, to bring high-quality investment to the UK. They are delivered in partnership with teams in London and the Devolved Administrations of Scotland, Wales and Northern Ireland.

Our services include providing bespoke information regarding important commercial matters, such as company registration, immigration, incentives, labour, real estate, transport and legal issues.

Deciding where to locate your international business is often a long and involved process. It is UKTI's job to know the UK's strengths and where investment opportunities exist and to help businesses coming to the UK get up and running with speed and confidence.

### How can UKTI help UK organisations succeed in India?

Further information on how UKTI can help your organisation can be found in Annex 8.6.

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*UKTI supports the wide range of British businesses through events and specialist workshops*

## The High Value Opportunities Programme

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The High Value Opportunities Programme is UKTI's flagship initiative which identifies large scale overseas infrastructure projects, selecting those that offer the most lucrative and accessible opportunities for UK companies in the near to immediate term.

Large scale international projects and contracts offer huge opportunities for British businesses of all sizes and specialities. From major infrastructure, manufacturing and engineering, through to large supply or value chain opportunities, in the last two years UKTI has helped many UK companies of all sizes win contracts with a total value exceeding £3.6bn.

Through its overseas network of staff, UKTI has access to a vast amount of intelligence and stakeholder organisations to assist UK businesses in winning contracts from these opportunities. In particular the HVO team:

- Provides intelligence and information on forthcoming and current High Value Opportunities overseas;
- Cascades this information to British businesses and supply chains;
- Facilitates networks and establishes the right contacts in market and within the UK;
- Helps to identify suitable British capability and capacity and facilitating consortia where appropriate;
- Works with UK companies to develop and implement tailored strategies to win contracts.

The HVO programme includes a significant number of rail opportunities across Urban Transit and Mainline projects. The opportunities span the full UK rail capability across professional services, construction and specialist rail products and services.

Projects are at various stages of their lifecycles and the specific opportunities open to UK businesses at any one time will vary. The list of projects continues to evolve as new opportunities develop.

Specifically on India Metro projects, UKTI has a dedicated project team based in the UK and major cities across India who work together to introduce the metro projects to UK businesses. The team works to obtain information on procurement methods, organisations and timing, international competition, local contracts and partnerships.

## Executive Summary

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India's rapid pace of urbanisation linked to its drive for greater economic prosperity has spurred the Government of India to develop mass rapid transit systems (principally metros) across a large swathe of major Indian cities. This is against a backdrop of low investment in modern public transport systems in this vast nation which is currently being addressed.

As of the middle of 2013 there were a total of forty metro projects in various stages of planning, execution and operation/expansion in cities across India such as Ahmedabad, Bangalore, Chennai, Delhi, Jaipur and Mumbai.

The total financial outlay, for the thirty-eight of the forty projects where the budgets are known, is just over £33 billion from 2013-2021. This makes the India metro sector one of the world's major infrastructure development programmes in terms of number of projects and their value.

Hence, this report provides an overview of the metro rail developments that are taking place across India which may present real opportunities for UK companies in the short, medium and long term. The most prominent opportunities identified in this report include:

- Professional services, including architecture, design and engineering, legal and financial services
- Project Management and specialist contracting
- Signalling, telecommunication and traction power
- Automatic Fare Collection Systems
- Electrical and mechanical equipment
- Complex civil engineering and construction works such as tunnelling
- Operations and maintenance of the metros, including asset management technologies and services

Much of the capability required to construct and operate metro systems is available in India. However, given the number of metro developments that are taking place in this market, there are some specialist 'build' opportunities in areas such as track work and electrification to be had for foreign contractors.

74% of the value of the projects in the Indian metro rail sector is open to international bidding and numerous companies from around the world, including the UK, have already won contracts in many of the areas listed above. For example Mott McDonald has won design and consulting work on the Delhi metro whilst Pandrol Group is providing track fastening systems to the Kochi metro.

The research undertaken estimates that for the thirty projects where budgets are known, nearly 2.5% of the budget is accessible to UK companies. A detailed analysis of all the projects, their current status and the availability of budgets was also undertaken as part this work. This reveals that six of the forty projects provide immediate opportunities for UK companies to explore. These are:

- *Ahmedabad-Gandhinagar Metro Phase 1*
- *Bangalore Metro Phase 2*
- *Jaipur Metro Phase 1 and 2*
- *Kochi Metro Phase 1*
- *Mumbai Metro Phase 1 Line 3*
- *Navi Mumbai Metro Phase 1*

*Modern Metro Train in Delhi*

*Station platform in Delhi Metro*

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Together these six projects offer an approximate accessible value of nearly £196 million to UK companies. In addition, there are other projects such as the Delhi Metro, which will start the procurement for Phase 4, which will also offer additional opportunities to UK companies in the future.

Many of these projects, which are being funded by the Government of India, State Governments and soft loans from international lenders mainly from Japan, are being implemented through the use of Special Purpose Vehicles. These have helped to ensure a high degree of transparency in the governance/management structures and an adherence to clear procurement processes.

All these measures are aimed at providing the necessary reassurance and confidence to overseas firms to look more closely at, and engage with, India in its rewarding and lucrative metro development.

This report also presents insights from conversations with the procuring metro authorities on their perceptions of the UK metro rail supply capability and what UK firms need to do to access metro opportunities in India. For example, on-the-ground presence, networking and intelligence gathering in India, marketing capability and technology together with its adaptability in the Indian market were cited as important factors in raising the profile of UK companies.

Manufacturing capability in general, and particularly which is based in India or the intention to establish a manufacturing unit in India, is seen as a critical differentiating factor when ascertaining commitment to the Indian market. The supply and transfer of leading edge technology and skills development is also deemed crucial for capacity and capability building in the metro sector in India.

The report concludes with a section on international participation in the Indian metro rail sector. This shows that competition from nations such as China, France, Japan, Korea, Spain, Switzerland and the US is stiff, even though UK firms have won a number of contracts in this market.

Overall the requirements emerging from the current range of metro projects means that India offers sustainable and recurring prospects for UK business in the short, medium and long term.

*Commuter on Delhi Metro*

1

# Introduction

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India's rapid pace of urbanisation, linked to its drive for greater economic prosperity through growth, has brought with it the predictable problems of traffic congestion and pollution. Consequently, this has created the need to develop and operate more effective and efficient public transportation systems as part of the infrastructure development plan in numerous Indian cities.

To-date public transport in India has principally been restricted to State owned road transport in the form of buses, three-wheel motor rickshaws and taxi cabs. Some cities like Mumbai and Chennai also have an extensive suburban railway network as part of their existing mass transport infrastructure.

In response to the growing challenges posed by urbanisation, and to raise the traditionally low investment in modern rail transport systems, the Government of India (also referred to in this report as the 'Union' or 'Central' Government), has prepared ambitious plans to develop and operate rail based mass rapid transit (MRT) systems across a large swathe of major Indian cities. This has been done through its Ministry of Urban Development (MoUD) based in New Delhi, working closely with various State Governments in places such as Gujarat, Kerala, Karnataka, Maharashtra and Rajasthan.

In the middle of 2013 there were a total of forty metro projects in various stages of planning, execution and/or operation/expansion in India, with many of them offering significant business opportunities for UK companies in the short, medium and long term.

In order to understand the opportunities arising from India's metro developments, UKTI commissioned PA Consulting Group to undertake a thorough evaluation of this market, and undertook a market scoping mission on Indian metro developments in May 2013.

The output of this work is presented in the report which also highlights *'six significant metro rail projects'* that are worth considering as they present immediate and accessible opportunities for UK companies. An overview is also provided on legislation governing metro rail projects, the criteria used to decide on the transportation modes (i.e., metro vs light rail transit vs monorail) for a particular city, investments and project financing in the metro rail sector, typical project life-cycles and governance models.

There is also a section on the procurement environment and the buyer's perspective of UK capability. This includes a list of key stakeholders who play a key role in the development of metro systems in India. The report concludes by focusing upon the current level of international participation to illustrate the competition that UK companies will face in the vast, complex and value conscious Indian market.

A series of annexes are also included for further reference. This includes technical details of the six significant projects. Relevant websites are also cited along with a comprehensive bibliography. Contact details in India and the UK are also provided for more information on India's metro opportunities, mass transport in general as well as the High Value Opportunities Programme.

The research methodology used to collate the information presented in the report is summarised overleaf.

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## Research Methodology

The research undertaken by PA Consulting Group to understand the metro opportunities in India involved a series of semi-structured interviews with stakeholders such as Government departments and metro rail authorities.

The primary research was supplemented by desk-based research using publicly available secondary sources.

Insight and intelligence was also gleaned from UKTI officials covering Mass Transport and the 'India Urban Mass Transit Systems' HVO project by conducting a market scoping mission on Indian metro development in May 2013.

Whilst the research considered opportunities across a range of mass rapid transport systems, this report focuses solely on metro opportunities in India. It does not concentrate on monorail or personal rapid transit opportunities which also feature in India's public transportation plans. This is because metro systems are currently the most preferred urban transportation system in India due to their ability to carry large numbers of people efficiently and due to the substantial number of metro developments that are taking place within this nation.

All the data used and presented in this report was collected between December 2012 and August 2013. An overview of the metro rail sector in India now follows.

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*Figure 1: Route Map of the Delhi Rail Metro System*

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## The Metro Sector in India

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Mass rapid transit systems are not a new concept in India. For example, the first rail based mass transit system has been in operation in Mumbai (in the State of Maharashtra) since 1853 and is part of one of the oldest railway systems in the world.

It is now referred to as the Mumbai Suburban Railway and has the highest passenger density of any urban railway system in the world carrying around 7.2 million people every day. It is one of the world's busiest rail mass transit system in terms of annual ridership.

A similar suburban commuter rail service has been in operation in Chennai, in the State of Tamil Nadu, since 1930 and is used by approximately 1.5 million people every day whilst the first modern metro rail system was started in Kolkata, West Bengal in 1984, which has a daily ridership of 600,000.

All these three mass transit systems are under the purview of the Government of India's Ministry of Railways and are operated by separate organisations under Indian Railways, or by zonal railways such as Western Railway, Eastern Railway and Southern Railway, whose headquarters are in Mumbai, Kolkata and Chennai respectively.

### The Development of Metros across India

In 2002 the capital city of New Delhi became the first Indian city to operate a modern urban mass transit railway system outside the purview of the Union Railway Ministry. This heralded the advent of the first city planned and operated mass rapid transit system in India.

The Delhi Metro is conceived, funded and operated by the Delhi Metro Rail Corporation Ltd. (DMRCL), a State owned company jointly promoted and funded by the Government of India and Government of National Capital Territory of Delhi.

It has an average daily ridership of 2.2 million and is one of the few Metro Rail systems worldwide that operates at a profit without any government subsidies. It is also the first railway project in the world to earn carbon credits under the UN's Clean Development Mechanism. Figure 1 presents a route map of the Delhi Metro in and around India's capital city and shows extension to the network in Phase 3 and Phase 4.

DMRCL has now emerged as a dominant entity in India's Metro Rail sector and is heavily involved in the planning and execution of various other metro projects across the country either directly or in an advisory capacity. In short, they are a key player in the metro scene in India, and their importance should not be underestimated.

With the success of the Delhi metro, a large number of new metro projects have been announced for various other cities in India. As of August 2013 there were a total of forty metro projects in various stages of planning, approval, funding, execution and operation/expansion in India. A list of all these projects can be found in Figure 2, and the cities in India where these metros are located are shown in Figure 3.

*Figure 2: List of forty metro projects in India*

| | | Project Status/Stage | | | | | |
|---|---|---|---|---|---|---|---|
| Serial Number | Project Name | Planned | Approved | Funding Secured | Tendering | Construction | Track Length in kilometers |
| 1 | Delhi Metro Phase 3 | ✓ | ✓ | ✓ | ✓ | ✓ | 136.35 |
| 2 | Hyderabad Metro Phase 1 | ✓ | ✓ | ✓ | ✓ | ✓ | 72 |
| 3 | Chennai Metro Phase 1 | ✓ | ✓ | ✓ | ✓ | ✓ | 45 |
| 4 | Bangalore Metro Phase 1 | ✓ | ✓ | ✓ | ✓ | ✓ | 42 |
| 5 | East-West Kolkata Metro | ✓ | ✓ | ✓ | ✓ | ✓ | 14.67 |
| 6 | Mumbai Metro Phase 1 (line 2) | ✓ | ✓ | ✓ | ✓ | ✓ | 38.24 |
| 7 | Navi Mumbai Metro Line 1 Corridor | ✓ | ✓ | ✓ | ✓ | ✓ | 23.4 |
| 8 | Mumbai Metro Phase 1 (line 1) | ✓ | ✓ | ✓ | ✓ | ✓ | 11.07 |
| 9 | Jaipur Metro Phase 1 | ✓ | ✓ | ✓ | ✓ | ✓ | 12.1 |
| 10 | Gurgaon Metro Phase 1 | ✓ | ✓ | ✓ | ✓ | ✓ | 5.1 |
| 11 | Ahmedabad & Gandhinagar Metro Phase 1 | ✓ | ✓ | ✓ | ✓ | | 63.71 |
| 12 | Kochi Metro Phase 1 | ✓ | ✓ | ✓ | ✓ | | 25.6 |
| 13 | Gurgaon Metro Phase 2 | ✓ | ✓ | ✓ | ✓ | | 6.5 |
| 14 | Bangalore Metro Phase 2 | ✓ | ✓ | ✓ | | | 72 |
| 15 | Mumbai Metro Phase 1 (line 3) | ✓ | | ✓ | | | 33.5 |
| 16 | Pune Metro Corridor 1 | ✓ | | ✓ | | | 31.52 |
| 17 | Chandigarh Metro Phase 1 | ✓ | ✓ | ✓ | | | 37.6 |
| 18 | Jaipur Metro Phase 2 | ✓ | ✓ | ✓ | | | 23.1 |
| 19 | Hyderabad Metro Phase 2 | ✓ | ✓ | ✓ | | | 80 |
| 20 | Surat Metro | ✓ | ✓ | | | | 100 |
| 21 | Lucknow Metro | ✓ | ✓ | | | | 36 |
| 22 | Mumbai Metro Phase 2 (line 4 and 5 | ✓ | ✓ | | | | 20 |
| 23 | Ahmedabad & Gandhinagar Metro Phase 2 | ✓ | ✓ | | | | 18.32 |
| 24 | Nagpur Metro | ✓ | ✓ | | | | 39.8 |
| 25 | Patna Metro | ✓ | ✓ | | | | 40 |
| 26 | Mumbai Metro Phase 3 (line 6, 7 and 8) | ✓ | ✓ | | | | 43.2 |
| 27 | Pune Metro Corridor 2 | ✓ | | | | | 29 |
| 28 | Indore Metro | ✓ | | | | | 32.16 |
| 29 | Kanpur Metro - Line 1 | ✓ | | | | | 27 |
| 30 | Nagpur Metro | ✓ | | | | | 28.5 |
| 31 | Chandigarh Metro Phase 2 | ✓ | | | | | 19.6 |
| 32 | Ludhiana Metro | ✓ | | | | | 28.83 |
| 33 | Chennai Metro Phase 2 | ✓ | | | | | 63 |
| 34 | Navi Mumbai Metro Line 2 Corridor | ✓ | | | | | 32 |
| 35 | Navi Mumbai Metro Line 3 Corridor | ✓ | | | | | 22 |
| 36 | Navi Mumbai Metro Line 4 Corridor | ✓ | | | | | 20 |
| 37 | Navi Mumbai Metro Line 5 Corridor | ✓ | | | | | 9 |
| 38 | Delhi Metro Phase 4 | ✓ | | | | | 216 |
| 39 | Kochi Metro Phase 2 | ✓ | | | | | |
| 40 | Bangalore Metro Phase 2A and 3 | ✓ | | | | | |

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*1) NA: Not Available*

*2) For Hyderabad Metro Phase 2 the Prime Minister of Japan has pledged funding of 17.7 billion yen whilst in 2010, Chennai Metro Project Phase II receives INR 29326 million loan agreement from Japan. Finance Ministry of India signs agreement with Japanese Ambassador to India, Hideaki Domichi.*

| | | Total Outlay/Budget | | | | | |
|---|---|---|---|---|---|---|---|
| Start Date | End Date | in Indian rupee (INR), crore | in British Pound (GBP), million | Budget Used/ Allocated/ Tendered till March 2013 (in GBP million) | Budget Unused till Date (in GBP million) | Available for Foreign Participation: 74% of unused budget (in GBP million) | Accessible to UK companies: 2.5% of budget unused (in GBP million) |
| 2012 | 2016 | 35242 | 4017.59 | 2041.00 | 1976.59 | 1462.68 | 49.41 |
| 2012 | 2017 | 14132 | 1611.05 | 1610.00 | 0.00 | 0.00 | 0.00 |
| 2009 | 2015 | 14000 | 1596.00 | 1199.00 | 397.00 | 293.78 | 9.93 |
| 2006 | 2014 | 11609 | 1323.43 | 1323.43 | 0.00 | 0.00 | 0.00 |
| 2009 | 2015 | 48746 | 555.70 | 555.70 | 0.00 | 0.00 | 0.00 |
| 2009 | N/A | 11550 | 1316.70 | | 1316.70 | 974.36 | 32.92 |
| 2011 | 2015 | 4068 | 463.75 | 360.00 | 103.75 | 76.78 | 2.59 |
| 2006 | 2013 | 2356 | 268.58 | 268.58 | 0.00 | 0.00 | 0.00 |
| 2010 | 2013 | 3151 | 359.21 | 230.00 | 129.21 | 95.62 | 3.2 |
| 2009 | 2013 | 1088 | 124.03 | 124.03 | 0.00 | 0.00 | 0.0 |
| 2012 | 2017 | 10789 | 1229.95 | | 1229.95 | 910.16 | 30.75 |
| 2013 | 2016 | 5082 | 579.35 | 160.00 | 419.35 | 310.32 | 10.48 |
| 2013 | 2016 | 2100 | 239.40 | | 239.40 | 177.16 | 5.99 |
| 2013 | 2017 | 26405 | 3010.17 | 450.00 | 2560.17 | 189 | 64.00 |
| 2013 | 2019 | 23136 | 2637.50 | | 2637.50 | 1 | 65.94 |
| 2013 | 2018 | 8401 | 957.71 | | 957.71 | 7 71 | 23.94 |
| 2013 | 2018 | 8995 | 1025.43 | | 1025.43 | 758.82 | 25.64 |
| 2013 | 2017 | 6581 | 750.23 | | 750.2 | 555.17 | 18.76 |
| 2013 | | N/A | N/A | | | | |
| 2013 | 2018 | 17500 | 1995.00 | | 1995.00 | 1476.30 | 49.88 |
| 2013 | 2017 | 12500 | 1425.00 | | 5.00 | 1054.50 | 35.63 |
| 2016 | 2021 | 6192 | 705.89 | | 5.89 | 522.36 | 17.65 |
| 2013 | 2021 | 8211 | 936.05 | | 936.05 | 692.68 | 23.40 |
| 2013 | N/A | 7350 | 837.90 | | 837.90 | 620.05 | 20.95 |
| N/A | N/A | 8000 | 912.00 | | 912.00 | 674.88 | 22.80 |
| 2019 | 2021 | N/A | N/A | | | | |
| 2016 | 2021 | 9534 | 1086 | | 1086.88 | 804.29 | 27.17 |
| N/A | N/A | 7500 | 855 | | 855.00 | 632.70 | 21.38 |
| N/A | N/A | 6500 | 741 | | 741.00 | 548.34 | 18.53 |
| N/A | N/A | 6000 | 684.00 | | 684.00 | 506.16 | 17.10 |
| | | 23 | 271.32 | | 271.32 | 200.78 | 6.78 |
| N/A | N/A | 00 | 752.40 | | 752.40 | 556.78 | 18.81 |
| | | | N/A | | | | |
| | | | N/A | | | | |
| | | | N/A | | | | |
| | | | | | | | |
| | | | | | | | |
| | 2021 | N/A | N/A | | | | |
| | | | N/A | | | | |
| | | | N/A | | | | |
| | **Total** | **291826.60** | **33268.23** | **8321.75** | **24945.44** | **18459.62** | **623.64** |

*3) Reliance Infrastructure were awarded this contract but later the project was cancelled. Arbitration is currently in progress between between MMRDA and Reliance Infrastructure, and this project stands suspended.*

*4) 1 Crore Indian Rupees = Ten million Indian Rupees*

*Exchange rate as on 12th December 2012.*

*Conversion Rate: 1 INR = 0.0114 GBP/ 1 GBP= 87.71 INR*

*http://www.x-rates.com/historical/?from=GBP&amount=1.00&date=2012-12-12" Source: http://www.x-rates.com/historical/?from=GBP&amount=1.00&date=2012-12-12*

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*Figure 3: Cities in India where the metro projects are located. (Note map not to scale).*

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The total financial outlay, for the thirty out of the forty projects where the budgets are known, is just over £33 billion over the period 2013-2021. £8 billion has already been committed whilst the remainder (£25 billion) is yet to be awarded. This makes the India metro sector one of the world's major infrastructure development programmes in terms of number of projects and their value.

Out of the forty metro projects, currently twenty-six have been approved and eighteen have formally secured funding. A list of these eighteen is presented below in Figure 4.

| Number | Project Name |
|---|---|
| 1 | Delhi Metro Phase 3 |
| 2 | Hyderabad Metro Phase 1 |
| 3 | Chennai Metro Phase 1 |
| 4 | Bangalore Metro Phase 1 |
| 5 | East-West Kolkata Metro |
| 6 | Mumbai Metro Phase 1 (line 2) |
| 7 | Navi Mumbai Metro Line 1 Corridor |
| 8 | Mumbai Metro Phase 1 (line 1) |
| 9 | Nagpur Metro Phase 1 |
| 10 | Mumbai Metro Phase 1 (line 2) |
| 11 | Ahmedabad & Gandhinagar Metro Phase 1 [also referred to as Metro-Link Express for Gandhinagar & Ahmedabad (MEGA) |
| 12 | Kochi Metro Phase 1 |
| 13 | Gurgaon Metro Phase 2 |
| 14 | Bangalore Metro Phase 2 |
| 15 | Mumbai Metro Phase 1 (line 3) |
| 16 | Pune Metro Corridor 1 |
| 17 | Chandigarh Metro Phase 1 |
| 18 | Jaipur Metro Phase 2 |

*Figure 4: List of eighteen metros that have secured funding in India.*

Thirteen of these metro projects are in the process of tendering of which several are already under construction. The remaining three have yet to commence construction. Further information about all these projects can be found in Figure 2.

## Estimated Accessible Project Value likely to be spent with overseas suppliers

From the estimated £25 billion which is yet to be awarded on India's thirty metro projects, it is estimated that 74% (just over £18 billion) is open to international bidding. The remainder (nearly £7 billion) is expected to be reserved for the domestic market.

Approximately 2.5% of the budget that is still to be awarded, nearly £624 million is likely to be the accessible value for metro opportunities in India for British companies operating and/or supporting the metro sector in the United Kingdom. The size of the accessible market can potentially be enhanced through strategic alliances with other companies from both Europe and Asia.

Figure 5 (shown on page 23) presents a breakdown of the accessible opportunities for thirty metro projects.

While some of the metro projects are being executed through Public Private Partnership (PPP), most projects are being implemented through Special Purpose Vehicles (SPVs). This is being done using funding from Central and State Governments and soft loans from international lenders mainly from Japan. The latter is the DMRC model for project structuring and funding and a number of cities will simply replicate this model.

The use of SPVs has helped to ensure a degree transparency in the governance and management structures as well as the procurement process. Furthermore, it has also encouraged overseas companies to participate in metro projects in India. Currently, there are

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numerous companies from Europe, Asia and North America executing orders across the project life cycle in various metro projects. International, nineteen companies from Asia and eleven companies from North America executing orders across the project life cycle in various metro projects. International participation in India's metro projects is discussed in Chapter 6 of this report.

## Opportunities for foreign businesses, especially those from the United Kingdom

Much of the capability required to construct and operate metro systems is available in India. For example large Indian companies such as Larsen & Toubro Limited (L&T), Reliance Industries, Simplex Infrastructures Limited, Gammon India and Punj Lloyd are all operating in this sector. However, with the number of metro developments that are taking place in this market, there are some specialist 'build' opportunities in areas such as track work and electrification to be had for foreign contractors. There are also several specific areas where there is either no domestic capability and this has to be procured from abroad. These areas include:

- Professional services, including architecture, design and engineering, legal and financial services as well as project management and specialist rail contracting or where the volume of work exceeds local capacity and procuring authorities are keen to see new competition and innovative capability in the market
- Automatic Fare Collection Systems
- Electrical and mechanical equipment
- Complex civil engineering and construction works such as tunnelling. There is also an opportunity for tier one and subcontract participation in partnership with local players
- Elevators and Escalators
- Operations and Maintenance, including Asset Management technologies and services to support existing and new metro networks. This would focus on reducing costs, namely, technology, systems and facilities such as at stations and train depots
- Rolling Stock
- Safety, Security and Emergency Services
- Signalling, telecommunications and Control System
- Skills development focusing on construction and railway engineering
- Traction systems and associated support services

Although India is a value conscious market, UK companies have won over twenty contracts in various projects. For example Mott McDonald and Ernst and Young have won design and consulting work in the Delhi and Ahmedabad Gandhinagar metros respectively.

In summary India continues to seek, through global tenders, foreign expertise and equipment in numerous areas outlined above. This represents a clear basis for UK companies to investigate, and bid for, metro contracts or associated work packages in India.

The next section identifies six out of the forty metro projects in India listed in Figure 2, where there are immediate and significant opportunities for UK business.

*A Bangalore Metro train*

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| Tendering Elements | Components | Tendering Element percent share of Budget | Probability of UK winning the available foreign participation budget | Accessible to UK companies (in £ millions) |
|---|---|---|---|---|
| **Professional Services** | General consulting, Detailed Design and Architecture, Financial and Legal consulting | 3% | 40% | 221.44 |
| **Civil** | Elevated Viaduct, Tunnelling, Stations and Depots | 60% | 3% | 332.20 |
| **Rail Systems** | Automatic Fare Collection (AFC), Electrical & Mechanical (E&M), Line Protection, Lifts and Escalators, Platform Screen Doors, Tracks and Traction and Power Supply, Ventilation and Air Conditioning | 10% | 2% | 36.84 |
| **Signalling and Telecom** | Control Systems, Supervisory Control & Data Acquisition Systems, Telecommunications, Signalling | 9% | 2% | 33.15 |
| **Rolling Stock** | Rolling Stock (e.g., Coaches) | 18% | 0% | 0 |
| | | | **Total** | **623.64** |

*Figure 5: Accessible Opportunities to UK Companies in forty metro projects identified in Figure 2; Source: PA Consulting Group*

*1. The £623.64 million figure is calculated on the basis that, with the exception of rolling stock (where there is limited UK capability) and the majority of civil works (likely to be undertaken by local firms), business opportunities in all other areas (such as architecture and design, consulting, project management, traction & general services, operations and maintenance and signalling/ telecommunications & telecom) will be open to British firms.*

*2. Civil costs will be higher where the underground element is a greater component in a metro development project. Furthermore rolling stock share can rise to 25% of the overall project value.*

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## 3.1 The Six Significant Metro Opportunities in India

A detailed analysis of twenty four metro projects (listed in Figure 2 and where project timelines and budgets are known) was undertaken. This was done to identify the most significant and immediate metro opportunities that UK businesses should consider.

The research focused on the current status of the project, the level of funding available and secured together with an analysis of the relative potential in terms of the immediate opportunities they offer to international participants. Figure 6 illustrates the findings which plot the metro rail projects by their timescales and the overall investment.

The bubble chart also provides a framework to prioritise the various projects as high, medium or low on their commercial potential over four years.

By considering factors such as the current stage of completion, progress in the tendering process and commencement of new phases of work, specific projects have been identified as presenting the most *'immediate and accessible opportunities'* for UK companies with end dates which are between 2013 and 2019.

These are classified as the 'significant six', and are:

- Ahmedabad-Gandhinagar Metro Phase 1
- Bangalore Metro Phase 2

*Nehru Place station - Delhi metro*

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- Jaipur Metro Phase 1 and 2
- Kochi Metro Phase 1
- Mumbai Metro Phase 1 - Line 3
- Navi Mumbai Metro Phase 1

The total budget for these project is just over £9 billion from a period 2012 - 2019, together with an accessible value of nearly £196 million. This could potentially be significantly enhanced if more UK companies forge strategic alliances with other Indian and international companies that are active in the sector.

A general overview of these six projects is presented in Figure 7, on pages 28 and 29.

*formation graphics the Delhi Metro*

| Metro Project | Total Available Opportunity (in GBP billion) | Project Start Date |
|---|---|---|
| Delhi Metro Phase 3 | 4.02 | 2012 |
| Hyderabad Metro Phase 1 | 1.61 | 2012 |
| Chennai Metro Phase 1 | 1.60 | 2009 |
| Bangalore Metro Phase 1 | 1.32 | 2006 |
| East-West Kolkata Metro | 0.56 | 2009 |
| Mumbai Metro Phase 1 (line 2) | 1.32 | 2009 |
| Navi Mumbai Metro Line 1 Corridor | 0.46 | 2011 |
| Mumbai Metro Phase 1 (line 1) | 0.27 | 2006 |
| Jaipur Metro Phase 1 | 0.36 | 2010 |
| Gurgaon Metro Phase 1 | 0.12 | 2009 |
| Ahmedabad & Gandhinagar Metro Phase 1 | 1.23 | 2012 |
| Kochi Metro Phase 1 | 0.58 | 2013 |
| Gurgaon Metro Phase 2 | 0.24 | 2013 |
| Bangalore Metro Phase 2 | 3.01 | 2013 |
| Mumbai Metro Phase 1 (line 3) | 2.64 | 2013 |
| Pune Metro Corridor 1 | 0.96 | 2013 |
| Chandigarh Metro Phase 1 | 1.03 | |
| Jaipur Metro Phase 2 | 0.75 | 2013 |
| Hyderabad Metro Phase 2 | N/A | 2013 |
| Surat Metro | 2.00 | 2013 |
| Lucknow Metro | 1.4 | 2013 |
| Mumbai Metro Phase 2 (line 4 and 5) | 0.1 | 2016 |
| Ahmedabad & Gandhinagar Metro Phase | 4 | 23.40 |
| Nagpur Metro | 0.84 | 20.95 |
| Patna Metro | 0.91 | N/A |
| Mumbai Metro Phase 3 (lin 8) | N/A | 2019 |
| Pune Metro Corridor 2 | 1.09 | 2016 |
| Indore Metro | 0.86 | N/A |
| Kanpur Metro Lin | 0.74 | N/A |
| Bhopal M | 0.68 | N/A |
| Chandig etro Phase 2 | 0.27 | N/A |
| Ludhiana Metro | 0.75 | N/A |
| Chennai Metro Phase 2 | | |
| Navi Mumbai Metro Line 2 Corridor | | |
| Navi Mumbai Metro Line 3 Corridor | | |
| Navi Mumbai Metro Line 4 Corridor | | |
| Navi Mumbai Metro Line 5 Corridor | | |
| Delhi Metro Phase 4 | | |
| Kochi Metro Phase 2 | | |
| Bangalore Metro Phase 2A and 3 | | |

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- Delhi Metro Phase 3
- Chennai Metro Phase 1
- Hyderabad Metro Phase 1
- Bangalore Metro Phase 1
- East-West Kolkata Metro
- Mumbai Metro Phase 1 (line 2)
- Navi Mumbai Metro Line 1 Corridor
- Mumbai Metro Phase 1 (line 1)
- Jaipur Metro Phase 1
- Gurgaon Metro Phase 1
- Ahmedabad & Gandhinagar Metro Phase 1
- Kochi Metro Phase 1
- Gurgaon Metro Phase 2
- Bangalore Metro Phase 2
- Mumbai Metro Phase 1 (line 3)
- Pune Metro Corridor 1
- Chandigarh Metro Phase 1
- Jaipur Metro Phase 2
- Surat Metro
- Lucknow Metro
- Mumbai Metro Phase 2 (line 4 and 5)
- Ahmedabad & Gandhinagar Metro Phase 2
- Nagpur Metro
- Pune Metro Corridor 2
- Chandigarh Metro Phase 2

*Projects marked in red are excluded in the bubble chart as project time lines and/or the budgets are not available*


*New Delhi Metro route map*

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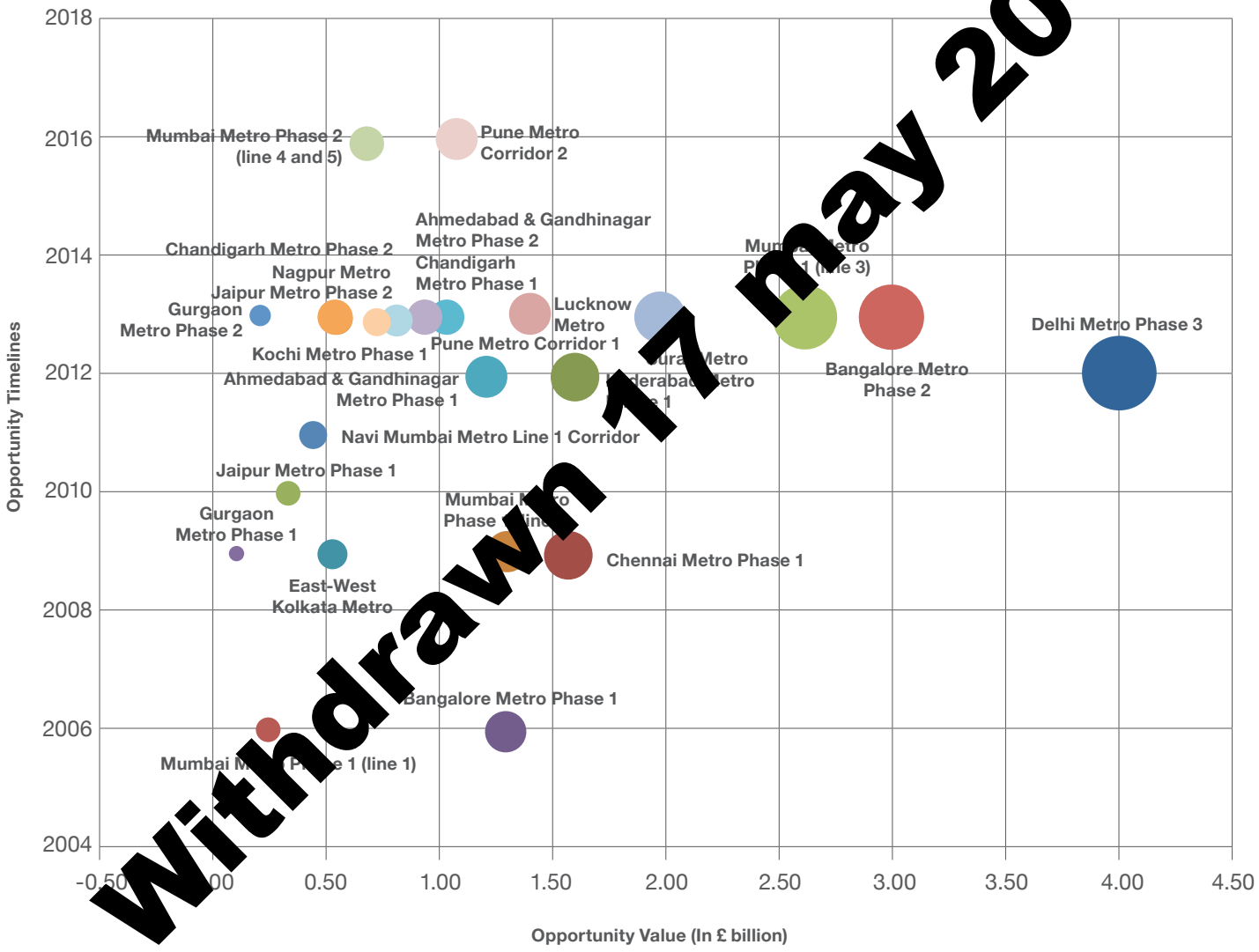


*Figure 6: Relative Commercial Potential of the various Metro Rail projects in India*

*Source: PA Consulting Group*

| Metro Rail Project | Serial Number | Track Length, kilometre | Timelines (Start-End) Date | Approximate Project Costs, GBP million | Budget used/ allocated/ tendered till March 2013, GBP million | Budget unused till date, GBP million | Available for Foreign Participation: 74% of unused budget, GBP million |
|---|---|---|---|---|---|---|---|
| **Ahmedabad Gandhinagar Metro Phase 1** | 11 | 63.71 | 2012-2017 | 1229.95 | | 1229.95 | 910.16 |
| **Bangalore Metro Phase 2** | 14 | 72 | 2013-2017 | 3010.17 | 450.00 | 2560.17 | 1894.53 |
| **Kochi Metro Phase 1** | 12 | 25.6 | 2013-2016 | 579.35 | 160.00 | 419.35 | 310.32 |
| **Jaipur Metro Phase 1** | 9 | 12.1 | 2010-2013 | 359.21 | 230.00 | 129.21 | 95.62 |
| **Jaipur Metro Phase 2** | 18 | 23.1 | 2013-2017 | 750.23 | | 750.23 | 555.17 |
| **Mumbai Metro Phase 1 - Line 3** | 15 | 33.5 | 2013-2019 | 2637.50 | | 2637.50 | 1951.75 |
| **Navi Mumbai Metro Phase 1** | | 23.4 km | 2011-2015 | 463.75 | 360.00 | 103.75 | 76.78 |
| **Total** | | | | **9030.17** | **1200.00** | **7830.17** | **5794.32** |

*1) Only the Phase 1 of the Ahmedabad & Gandhinagar Metro is listed in above figure. There is Phase 2 for this project (serial number 23 in Figure 2) from 2013-20121 which will provide additional and new opportunities for UK companies once funding is secured.*

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| Accessible to UK companies: 2.5% of budget unused, GBP million | Project Status |
|---|---|
| 30.75 | • Appointment of M/s Grant Thornton as Internal Auditors<br>• The 1st lot of tenders are currently being awarded for most of the tendering elements – from consulting to rolling stock<br>• Opportunities exist in sub-contracting deals and as prime contractors for the next lot of tenders. For example, an expression of interest for the appointment of the detailed design for stations has recently been floated |
| 64.00 | • Preliminary work for Phase 2 has already started and geo-technical surveys are underway<br>• Rail India Technical and Economic Service are to commission the pre-feasibility study and Detailed Project Report (DPR) for phase 2A and 3 consisting of five corridors of a total 150.94 km track length<br>• The time required for preparing the pre-feasibility study is around six to nine months and that for DPR is about one and a half years<br>• Phase 2A also envisages extension of the Metro line from Nagawara to Bangalore international airport |
| 10.48 | • The tendering process started in January 2013. Delhi Metro Rail Corporation Limited has been tasked with to helping Kochi Metro in the tendering and vendor selection process<br>• Kochi Metro Rail Limited (KMRL) has entrusted CDM Smith to carry out detailed surveys for forecasting reduction of carbon emissions along the Metro alignment area from 2018 to 2048<br>• Kochi Metro Rail Limited handed over 2 acres of the land in the premises of Vyttila Mobility Hub to DMRCL on 01 August 2013. This land will be used for the construction of the station building as well as viaducts for the Metro Project in Mobility Hub premises |
| 3.23 | • Tenders for phase 1B underground tunnelling work have been floated and work is expected to start from September 2013 |
| 18.76 | |
| 65.94 | • The Union Cabinet gave the project approval on 27th June 2013 to convert the present special purpose vehicle called Mumbai Metro Rail Corporation into a 50:50 joint venture between the Government of India and the State Government of Maharashtra<br>• Mumbai Metro Rail Corporation will execute the Mumbai Metro Rail project phase 1-line 3 project. This will be an underground corridor (33.5 km long) from Colaba to the Santacruz Electronics Export Processing Zone (Special Economic Zone) in Andheri East via Bandra in Mumbai<br>• The project work is expected to begin later this year and is scheduled to be completed in six years, by March 2019. The tenders are expected to be floated towards the end of 2013 |
| 2.59 | • The contract for systems and rolling stock worth £116.28 million of Belapur–Pendhar line will be awarded soon<br>• The phase 1 (Line1) of 23.4 km km consists of three stages to be completed on a high priority basis by 2016<br>• Other proposed corridors will be taken up after the completion of Phase 1 (Line 1). However, the planning of these corridors may be taken up soon |
| **195.75** | |

*Figure 7: Six Significant Metro Rail Projects in India*
*Source: PA Consulting Group*

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Further details on these six metro rail projects (such as technical specifications, funding and prime contractors that have been appointed and a route map) can be found in Annex 8.2 of the report.

The policy governing metro rail projects and the criteria used to decide the type of mass transit systems are discussed below. This section also reviews the financing of metros in India, their ownership and project lifecycles.

## 3.2 Metro Rail Policy and Criteria for the Type of Mass Rapid Transit Systems in India

### Metro Rail Policy

The construction and operations of all the Metro Rail projects in India are governed by a number of legislative Acts, two of which are:

- The Metro Railways (Construction of Works) Act 1978
- Delhi Metro Railway (Operation and Maintenance) Act, 2002

Further details about these Acts can be ascertained from http://www.pib.nic.in/newsite/erelease.aspx?relid=47074.

In 2009 the Indian Parliament amended both of these Acts to provide an extension to the National Capital Region and Metropolitan areas, as defined in Article 243 P of the Indian Constitution. The amendments allowed uniform legislative cover for all Metro projects in India, whether within one municipal area or beyond.

In addition to these (union) Acts of Parliament, different States within India and Local authorities may also impose certain local regulations. This is due to the federal and state governance structure in India. For example, the Government of Maharashtra has used the Indian Tramway Act 1886 to authorise the City and Industrial Development Corporation of Maharashtra Limited, often referred to as CIDCO, to act as the implementation agency for Navi Mumbai Metro Line 1 Corridor on the 30th September, 2010.

In general, all heavy rail based metros are being constructed under the Metro Railways Act 1978 and its amendment of 2009 - the lead technical Ministry being the Ministry of Railways which looks after the engineering aspects whilst the main Ministry responsible for the construction and maintenance of the metros is the Ministry of Urban Development.

### Criteria for type of Mass Rapid Transit Systems in India

Proposals for Metro Rail projects are initiated by State Governments in India, and they base their choice of mass transit system on a number of factors such as the aspiration of people, population density, availability and opportunity cost of land, per capita income and mobility with well networked connectivity.

India's Planning Commission, through its Working Group on Urban Transport for the 12th Five year plan (2012-2017), has also recommended detailed guidelines for deciding on metro rail projects for cities.

The principal parameters governing these guidelines are peak hour direction Traffic in 2021, population as per 2011 census (in million) and the average trip length for motorised trips (in kilometres). These are illustrated in Figure 8 for metro rail, light rail transit and monorail projects in India.

The Government of India's Ministry of Urban Development also plays an important role by supporting the State Governments in their selection of mass rapid transit systems. It does this by helping them with the preparation of detailed project reports for all cities in India with a population of 2 million or more.

| Mode Choice | Peak Hour Peak Direction Traffic (PHPDT) in 2021 | Population as per 2011 census (in million) | Average trip length for motorised trips (in km) |
|---|---|---|---|
| **Metro Rail** | >=15,000 for at least 5 km continuous length | >=2 | >7-8 |
| **Light Rail Transit (LRT)** | =<10,000 | >1 | >7-8 |
| **Monorail** | =<10,000 | >2 | About 5-6 |

*Figure 8: Criteria for selecting a Mass Rapid transit System in India*
*Source: Recommendations of The Working Group on Urban Transport for 12th Five Year Plan, Planning Commission of India*

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## 3.3 Investment requirements in the Metro Rail Sector

The Working Group of Urban Transport for India's 12th Five year plan 2012-2017 also reviewed the level of investments required to meet the future planned development of metro rail systems in India. It estimates that an investment in excess of £16 billion will be required over this period. However, as more projects are announced, the total planned outlay for the approved metro rail projects in India is likely to at least double to £32 billion over the next two five year plans 2012-2017 and 2017–2022.

Figure 9 presents a breakdown of the estimated investments in the metro rail sector in India by type of work. This figure also shows those areas accessible to the UK. For example, consultancy, specialist works, traction and general services and signalling and telecommunications.

## 3.4 Financing of Metro Projects in India

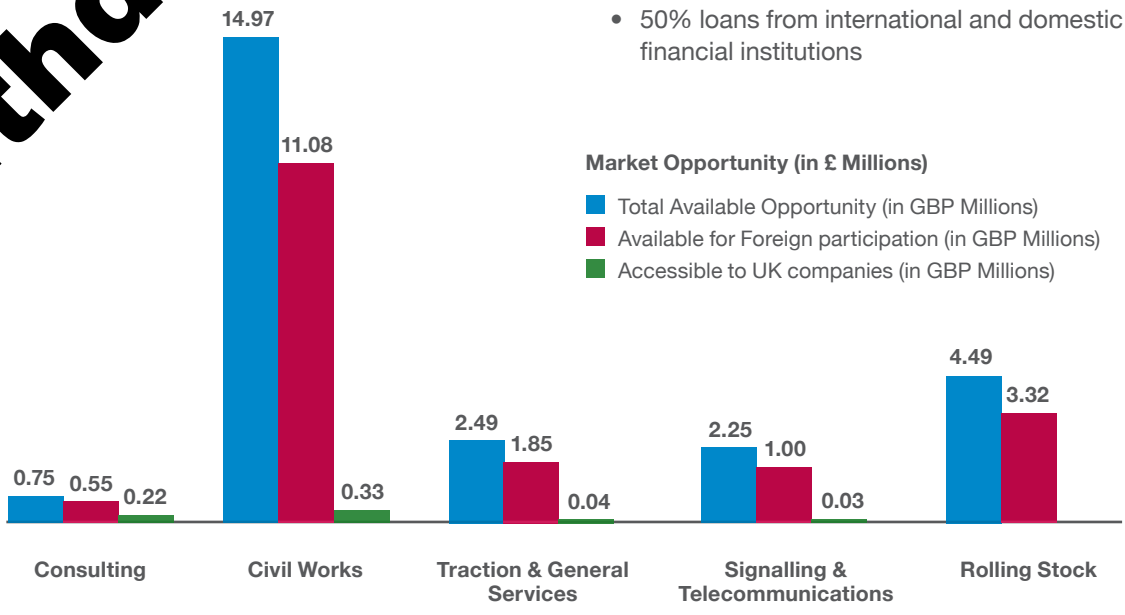
The Working Group of Urban Transport for 12th Five Year Plan has also reviewed the financing of various metro projects in India. They envisage that government will be the primary funding agent for these projects given the large investment required. The notable exception will be high density and above ground construction where PPP might be feasible.

Funding for the metro projects is likely to come from the following components: and sources:

- 20% of all metro rail projects will be financed via a PPP model. The funding for these will be made up of:
  - 20% viability gap funding from the Union Government of India
  - 20% viability gap funding from the concerned State Government
- For the remaining 80% of metro rail projects, it is envisaged that funding will be obtained from the following sources:
  - 50% loans from international and domestic financial institutions

*Figure 9: The estimated market opportunity in the Metro Rail sector by type of work in India*

*Source: PA Consulting Group*




*The general civil works area is already very crowded and competitive with local Indian players. It is likely that no more than 10% of all civil work contract will be primed or sub-contracted to foreign companies.*

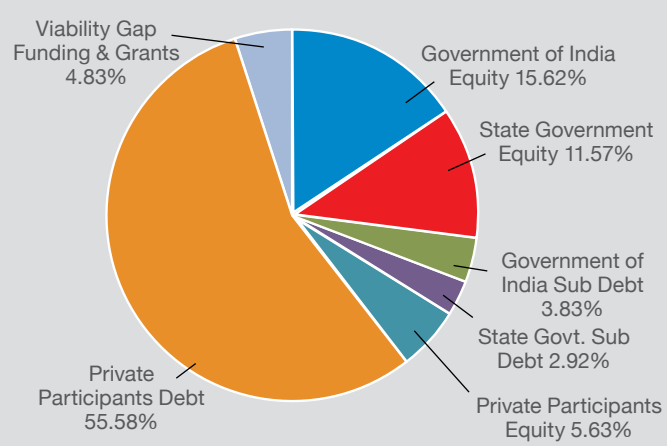



*Figure 10: Sources of Funding in India's Metro Rail Sector*
*Source: PA Consulting Group*

*This figure shows the contribution by type of funding for metro projects in nine Indian cities, and is indicative of the general trend of percentage contribution from different sources. Private Participants Debt is funding from organisations such as JICA, Agence Française de Développement, Housing and Urban Development Corporation Limited, ILFS and other private financial institutions.*

*The biggest slice, Project debt, is raised on Government guarantee, through budgets provided either by sovereign wealth funds and/or via international agencies like JICA. This agency has provided funds to the Delhi Metro Rail Corporation and numerous other projects such as Bangalore metro Phase 1 and 2 and Mumbai metro Pha[illegible] 1.*

- 20% (30% in exceptional cases) from the Union Government of India as combination of equity/subordinate debt/grant
- 20% from the concerned State Government or State Government agencies
- 5% from property development
- 5% from developmental agencies

For metro projects in Indian cities such as Delhi, Kolkata, Gurgaon, Kochi, Chennai, Hyderabad, Mumbai, Bangalore and Jaipur (where details of funding is currently known), 50% of the capital project cost is made up of funding derived from a mix of domestic and international sources. These comprise of a mixture of public and private debt and private equity from both the domestic and international market. Figure 10 illustrates the various sources of funding for metro projects located in the nine Indian [illegible]

There is a lobby of opinion in India w[illegible] firmly believes that all infrastructure pro[illegible] the country, particularly those t[illegible] critical to Indian transport connectivity [illegible] economic success, should be fully St[illegible]nded, owned and operated. This [illegible] the case with the existing metros in the [illegible] for metropolitan cities such as Delhi, Kol[illegible] and Chennai.

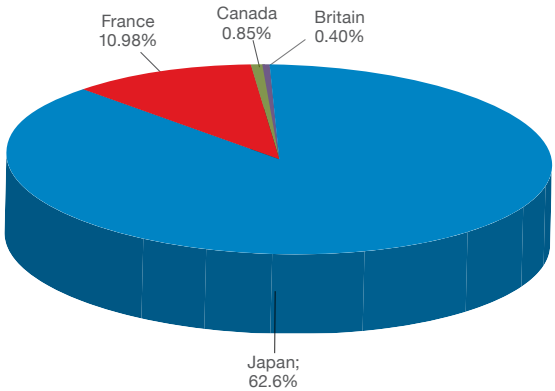
However, there is an increasing level of fund[illegible] coming from private investors and intern[illegible]na development agencies in the smaller p[illegible]jects as well as providing minority funding in the large ones. For example, Japan is the leading international investor in the metro sector in India. This investment is led by Japan's International Cooperation Agency, commonly referred to as JICA. It is currently funding metro developments in Mu[illegible]

As more projects get off the ground and become operational, it is expected to boost the confidence of international capital to enter the sector. Current trends indicate that several development agencies and banks such as the World Bank and Asian Development Bank, will support the development of the metro rail sector in India. This in turn will encourage private infrastructure funds to view the metro sector in India more favourably as an investment destination.

Figure 11 shows the distribution of foreign funding in India's metro rail sector. Japan leads in this, followed by France and Canada and then the United Kingdom.

| Inflow of [illegible] from Foreign Countries/Foreign firms for Metro (Debt +Equity) | INR Million | GBP Billion | % contribution |
|---|---|---|---|
| Japan | 629500 | 7.1763 | 87.78% |
| France | 78730 | 0.897522 | 10.98% |
| Canada | 6063.2 | 0.06912048 | 0.85% |
| Britain | 2870 | 0.032718 | 0.40% |
| **Grand Total** | **717163.2** | **8.176** | |

*Figure 11: Source of Foreign Funding in India's metro rail sector*
*Source: PA Consulting Group*

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*Expanding transport infrastructure in Delhi*

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| Structural Models for Governance and Ownership of Metros | Financing | Detail |
|---|---|---|
| **50:50 joint venture ownership between the central and State Government** | A mixture of funding from both the Central and State Governments in India. This is done through equity and debt<br>Loans from multilateral and domestic financial institutions tend to be facilitated through Government guarantee | A project financed by both the Central and State Governments in India is the preferred mode for taking up metro projects. DMRCL is an example of such a model<br>Projects tend to have a 50:50 joint ownership between the Central and State Government<br>The Union Cabinet must sanction new projects wishing to follow this model<br>A SPV is created which is jointly owned by the Central Government (through MoUD) and the concerned State Government<br>Metro rail projects like Bangalore, Chennai, Delhi, Kochi and Kolkata (East-West, and are currently following this structure |
| **Government of India** | 100% by Ministry of Railways, Government of India | Projects funded under this mode requires Union Cabinet sanction and is part of zonal railways or a SPV under the Ministry of Railways, Government of India<br>Kolkata Metro Railway North and South corridor and other metro projects in Kolkata have been taken up by the Ministry of Railways<br>The State Government can also contribute part funding as a grant to the Ministry of Railways. This is the case for Kolkata metro |
| **State Government Projects** | 100% by the State Government | These projects are funded solely by a State Government in India. Their appraisal is undertaken by MoUD who also sanction the project. Stage 1 of Jaipur Metro has been sanctioned using this model<br>The implementation of the project is undertaken by a State Government SPV. For example, the Ahmedabad-Gandhinagar metro project where the Government of Gujarat has formed an SPV called Metro-Link Express for Gandhinagar & Ahmedabad (MEGA) Company Ltd to implement Metro Rail Project under the Companies Act, 1956<br>It is noteworthy that some projects are executed under the Indian Tramway Act 1886 and 1902 which allows the State government to take full control of the project implementation. An example of this is the appointment of CIDCO to lead the development of Navi Mumbai Metro Line 1 Corridor |
| **Private sector projects** | 100% Private sector | This represents the fourth type of model where the entire project is being delivered privately<br>There is little to no government intervention in the project, except for overall governance purposes<br>MoUD undertakes an appraisal of the project on receipt of the proposal by a State Government, and acts as the sanctioning authority for the project<br>The State Government or its agencies will be the concessioning authorities<br>Currently Rapid Metrorail Gurgaon has taken up this model. It is noteworthy that the Hyderabad Metro is also predominantly privately funded and managed by a concessionaire, L&T Metro Rail Hyderabad Ltd |

*Figure 12: Structural models of Governance and Ownership*
*Source: PA Consulting Group and Recommendations of Working Group on Urban Transport for 12th Year Plan*

| Metro Project Lifestyle Stages | Detail |
|---|---|
| **Planning and Conceptualisation** | • The Government at union level, State level and the city together commission a DPR to study and validate the feasibility of a Metro Rail project<br>• The DPR is usually contracted to an independent expert organisation from either the public of private sector. A number of DPR have been prepared by RITES or DMRCL, the latter emerging as key influencer in decision-making |
| **Project Approvals** | • Once the Union and State Governments agree that a Metro Rail project is feasible, they need to gain multiple approvals at every level of Government. For example, approvals are typically required by the key Ministries in the Government of India, particularly Urban Development, Railways, and Environment<br>• The State's legislature too has to approve the project including key aspects such as land acquisition, funding structures and administrative governance of the project<br>• It is at this stage that the project's SPV – the corporation that will be the nodal agency or the 'M tro il Company - is set up and incorporated. More often than not, the SPV is a State owned entity th in some projects, the State is an equal or minority partner. In cases like DMRC, the SPV is jo t own by Union and State Governments |
| **Funding** | • Typically a significant portion of the funding will be secured by the time a project is pp d. In most of the metro projects, the Union and State Governments together provide up t 0% th funding. The balance is usually raised through private debt or equity, with public sec banks, infrastructure development companies and international development agencies playing a maj t<br>• Metro Rail sector is one area where the Indian Government is welcomin Foreig Direct Investment as it is a key area of national infrastructure development<br>• Several international agencies and global capital funds are showing a interest in the sector as the intent and commitment to execute these projects professionall operl e the metro profitably becomes more apparent |
| **Construction** | • The key aspects of construction are land acquisition; c ac and physical construction. Land acquisition can be a very challenging aspect of any p frastructure project in India and is prone to prolonged contention and litigation. However, of late, s been observed that the local Governments provide more vigorous support in resolving t se proble s to ensure minimal slippages and delay<br>• Even though this is the stage at which m t o e commercial procurement appears in the public domain, many of the tender documents are ge rally m fied from other Metro Rail projects, particularly if DMRCL is involved in the project<br>• Projects in the construction arena are likel to be awarded to bidders with prior experience in the built environment sector in India (i.e., to major India based prime contractors and international contractors who have successfully delivered c x projects ideally in the mass rapid transit arena |
| **Testing** | This phase has the rolling st k o e tracks and all pre and post rolling tests performed on the civil works, tracks, signalling and all al, mechanical and electronic systems |
| **Operation** | This phase involves th mercial operation of the system. Most of the systems are operated by the Metro Rail Company se e purpose, but in some cases, the entire operations and maintenance could be outsourced on a Build perate Transfer model |
| **Expansion** | This is ine ble extension of all systems in operation and involves extending the coverage of services in a planne se manner as well as upgrading existing systems. Currently the Mumbai, Kolkata, Chennai, Delhi and B metro projects are being expanded |

*Figure 13: Life Cycle Stag metro rail projects in India* *Source: PA Consulting Group*

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## 3.5 Gov nce, Financing and O ship Models of Metro Proj s in India

The Government at both central and State level within India plays a significant role in the conceptualisation, financing and governance of metro rail projects. The private sector is also now increasingly becoming involved in the funding, management and operations of metros in India.

Four types of institutional and governance models for the implementation and management of metro projects are in operation in India. These are outlined in figure 12.

## 3.6 Metro Project Life Cycle in India

Research was undertaken to identify the main components of a metro rail project in India. Seven stages were identified representing the typical life cycle of such a project. These are planning and conceptualisation, project approvals, funding, construction, testing, operation and expansion. Figure 13 provides more detail on each of these stages.

The next section deals with the important issue of the procurement environment in India for metro projects.

4

# The Procurement Environment

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Procurement in India's metro rail sector is open, transparent and follows international best practices in awarding both prime contracts and in overseeing the sub-contracting process.

There has not been any public notice or investigation of any procurement irregularities, charges of wrongdoing or corruption in all the procurement tenders for metro rail projects that have been floated and closed till 2012, and this is testament to a strong sense of professionalism in the delivery of metro rail projects in India.

This has also been helped by creation of special purpose vehicles, an example of which is the Metro-Link Express for Gandhinagar & Ahmedabad (MEGA) Company Ltd, to undertake and deliver these projects. SPV's are autonomous bodies, manned by professionals and follow international best practices in procurement processes which are often overseen by independent procurement advisors.

Furthermore, these entities are accountable to both the Indian Parliament and State legislatures as well as being audited by the Comptroller and Auditor General of India. They are also guided by Government of India bodies such as the Central Vigilance Commission, an apex body created in 1964 by the Government of India to address governmental corruption.

They are also subject to guidelines issued by the Department of Public Enterprises, which administers and advises public sector enterprises to increase profitability through efficiency and better resource utilisation.

Much of the sub-contracting follows the Fédération Internationale Des Ingénieurs-Conseils (also known as FIDIC) norms and need to be approved by the SPV before they are awarded.

Overall, a professional procurement environment has been created to encourage international businesses to participate in the metro rail sector in India. It offers not only a degree of confidence in the ease of doing business and the assurance of full legal redress where necessary, but also adherence to ethical business practices.

It is noteworthy that the procurement of professional services in India is likely to be more open for foreign entities compared to the supply of goods. For example, for the supply of rolling stock it is very likely that the tendering authority will require local manufacture of either the train itself or the supply of locally manufactured components through Indian vendors. This is sometimes referred to as the 'progressive indigenisation' agenda and often is linked to technology transfer into India.

The current procurement guidelines require all foreign bidders to demonstrate and meet certain conditions in order to submit tenders for metro rail projects in India. These are described below.

## 4.1 Conditions for Foreign Participation in India's Metro Rail Projects

Although the Indian Metro Rail sector is open to foreign participation, there are some general conditions that need to be met for the supply of goods and services. These tend to be specified in all metro rail tenders, and a select number are mentioned below.

### Indian Partner and local ownership

- The current procurement guidelines require that all foreign bidders demonstrate that 26% of their company has Indian participation. What this means in practice is that a foreign company that does not have an India based


*Electronic signs on metro trains*

entity, must form a joint venture partnership with an Indian company that will need to have a minimum 26% stake or interest in the arrangement.

- Alternatively, a wholly owned Indian subsidiary of a foreign company registered in India under the Companies Act, 1956 must have a minimum of 26% local participation.
- If the tender applicant is a consortium of companies, at least one of the members should be a company duly incorporated under Indian Companies Act 1956. In case any consortium member is incorporated outside India, it should legally be competent to carry out relevant business in India.
- The number of joint venture partners or consortium members is restricted to a maximum of three companies. At least one of the three consortium members should be an Indian company with 26% participation in the consortium.

## Defects Liability

If the tenderer is located outside India, it should have an Indian associate for the Defects Liability Period and Defects Liability Period obligations, who should have at least 3 years of experience of manufacturing the machines for railways/metro applications and/or of giving after sales service for machines used in railways/metro.

## Commissioning Agents

A foreign company or consortium that presents an application in response to a tender must submit a certificate confirming 'the tenderer' does not have any commission agent in India. Furthermore, no agency commission will be paid otherwise the tender shall be rejected.

## Pricing

- Foreign tenderers need to quote their prices on the basis of Freight on Board (FOB) to the nearest shipment handling facilities and also quote the sea freight charges up to Chennai Port.
- Another requirement is that in the case of a foreign contractor, machines shall be delivered by them FOB onto the vessels and/or port or ports named in the quotation.

## Complying with legislation, including work-force related issues

- Contractors must comply with all laws, bylaws, rules and regulations pertaining to the employment of local or imported labour.

They and their sub-contractors need to comply fully with all laws and statutory regulation such as the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Workman's Compensation Act, 1923, Contract Labour (Regulations and Abolition's) Act, 1970, Employer's Liability Act, 1938, Industrial Disputes Act, 1947, Maternity Benefits Act, 1961, Employees Provident Funds and Miscellaneous Provisions Act, 1952, Employees State Insurance Act, 1948, Equal Remuneration Act, 1976, Payment of Gratuity Act, 1972, Apprentices Act, 1965, Mines Act, 1952, and other laws or regulations framed by the legislative authorities.

- Contractors must make adequate arrangements, at their own expense, for housing, supply of drinking water, canteen and provision of latrines and urinals, for staff and workmen employed on the works, directly or through sub-contractors.

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*Completed tunnel*

- Contractors are responsible for providing, at their own expense, first aid and preliminary medical facilities on site. They are also responsible for safety provisions and for maintaining the labour camps in a sanitary condition taking all necessary precautions to protect staff and labour from an outbreak of infectious diseases.
- Unless otherwise provided for in the contract, contractors are responsible for making their own arrangements for the engagement of all labour and for providing their transport, housing and payment.

The next section of the report identifies the key decision makers in [illegible] development projects. It also provides insights on the buyer's perspective of UK's metro capability.

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*Tunnel under construction*

5

# Stakeholders and the Buyers Perspective of UK's metro supply capability

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## 5.1 Influential Stakeholders on Metro Projects in India

Every metro rail project around the world is a complex entity with political, economic and social development considerations. India is no such exception. There are multiple stakeholders like central and State Governments, city administrations, suppliers, contractors and citizen groups on both the buy side and supply side.

In India there are also numerous influencers who support the Government and metro rail corporations in various stages of decision making, either as paid advisors or as experts nominated by various statutory bodies and ministries. This is illustrated in Figure 14.

The principal decision makers include:

- Ministry of Urban Development, Government of India
- Consultants producing the detailed project report, most notably the Delhi Metro Rail Corporation and Rail India Technical and Economic Service
- Funding partners such as JICA and Sovereign Wealth Funds
- Major Primes like Larsen & Toubro, Reliance Infrastructure, Alstom, Bharat Earth Movers Limited and Punj Lloyd
- State Governments and their agencies
- Other Government of India Ministries regulating infrastructure developments such as the Ministry of Environment and Ministry of Railways

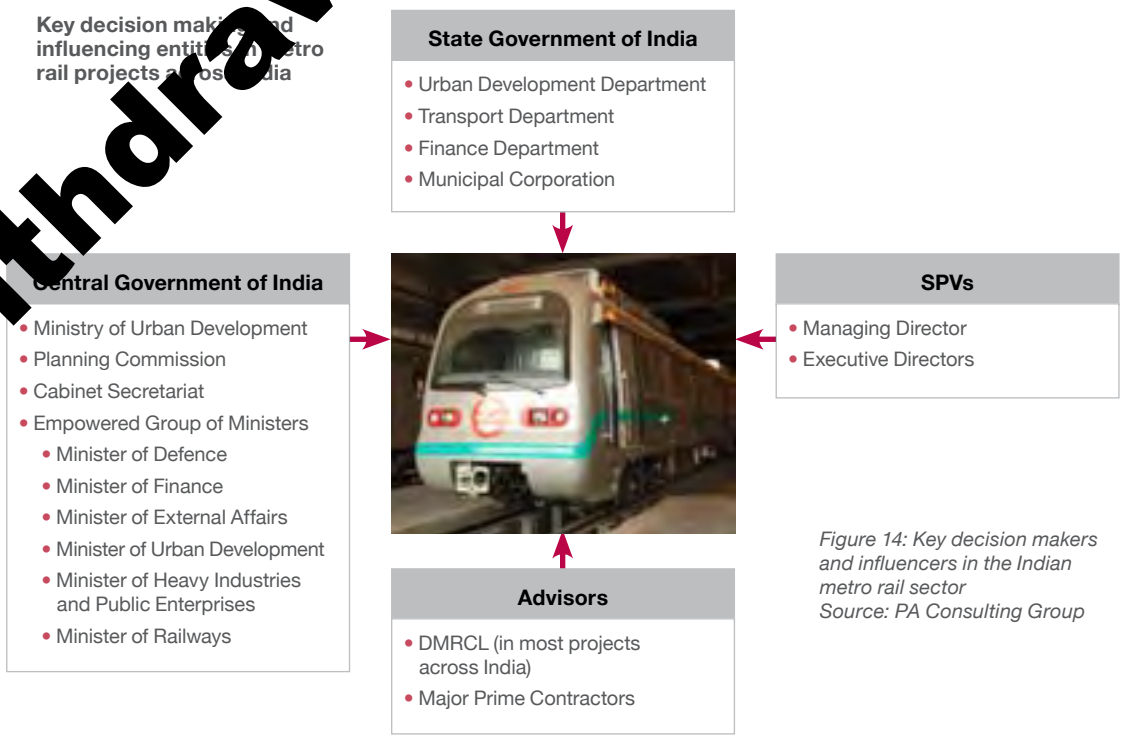


*Figure 14: Key decision makers and influencers in the Indian metro rail sector*
*Source: PA Consulting Group*

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## 5.2 The Buyers Perspective of the UK's metro supply capability

During the course of the research numerous conversations were held with various stakeholders such as the metro rail corporations and local agencies (such as CIDCO and Pune Municipal Corporation) overseeing the projects in some cities. This was done to ascertain the buyer's perspective on international participation in the metro rail projects, especially from the UK.

As far as technical and supply chain capabilities are concerned, UK capability in the Metro Rail sector, which is relevant in India, was restricted to design and consultancy. This constitutes up to 3% of the overall project budgets as shown in Figure 15.

All the metro systems that were consulted were emphatic that they were keen to see greater participation by UK companies in the metro projects in India. It was cited that potential areas for collaboration could be in sustainable construction, signalling, telecommunications and train operations and maintenance and rolling stock. However, and worryingly, there was also a view that the UK might not possess significant and relevant capability in some of these high value areas. Industrial capability was seen to reside in countries such as France and Japan who are seen as leaders in these fields.

Manufacturing capability, particularly that which is based in India, or an intent to establish a manufacturing unit in India, was also seen as a critical differentiating factor when ascertaining organisational commitment to the Indian market.

Not having such an operation could contribute to a competitive disadvantage compared to other overseas competitor organisations, some of whom are either already established or are setting up a base in India. For example, companies like Alstom and Thales are winning signalling and telecommunication contracts because (i) they have invested in local manufacturing capability and (ii) they have positioned themselves as leaders in their areas of technical expertise. Hence they are able to bid more aggressively than their competitor organisations that might not be based in India. Emphasis was also placed on the importance of applying leading edge technology that is suitable, or can be readily adapted, to the Indian environment. Skills development is another area deemed important to the metro sector in this nation.

Another clear message from the buyer community is that UK companies need to invest in better on-the-ground presence and intelligence gathering in India. In addition, they need to market their capability more vigorously, perhaps through the participation in local trade shows or through regular meetings with the metro authorities or with the primes to whom contracts have been awarded. Numerous foreign companies were adept at undertaking such an activity, aided by having local offices in India.

The buyer community emphasised that there is no connection between the sources of funding and the award of bids to companies from the funding country. In fact, some funding contracts have a specific clause to ensure that there is transparency and competitive bidding in place for the projects concerned. The assessment of bids would be done on fulfilling the requirements of the tender, for example, meeting the technical specification and on price.

What is clear is that decision makers in India's metro sector want to see a clear and long-term commitment to the local market. For UK companies to be successful in India they will need to be part of the 'industrial ecosystem' that is developing in this vast market.

## Capital Budget Allocations

The research set out to ascertain the capital budget allocation in India across various tendering elements in a metro rail project, the findings of which are illustrated in Figure 16.

The next section focuses on the current level of international competition and participation in India's metro rail projects.

| Tendering Elements | Components | Tendering Element per cent share of Budget | Probability of UK winning the available foreign participation budget |
|---|---|---|---|
| **Professional Services** | General consulting, Detailed Design and Architecture, Finance and Legal consulting | 3% | 40% |
| **Civil** | Elevated Viaducts, Tunnelling, Stations and Depots | 60% | 3% |
| **Rail Systems** | Automatic Fare Collection, Electrical and Mechanical (E&M), Fire Protection, Lifts and Escalators, Platform Screen Doors, Tracks work, Traction and Power Supply, Ventilation and Air Conditioning | 10% | 2% |
| **Signalling and Telecom** | Control Systems, Supervisory Control and Data Acquisition Systems, Telecommunications, Signalling | 9% | 2% |
| **Rolling Stock** | Rolling Stock (e.g., Coaches) | 18% | 0% |

*Figure 15: Typical break-up of cost across tendering elements in India's metro rail*
*Source: PA Consulting Group*

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6

# International Participation in Metros Rail Projects within India

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## 6.1 Introduction

Many foreign companies are looking at the Indian metro rail sector as a lucrative market across the project lifecycle in areas such as rolling stock, track, telecommunications, signalling and control systems, power systems and supplies, including third-rail electrification, operations and maintenance. These areas also represent a big opportunity for large and established foreign companies such as Alstom (France), Siemens (Germany) and Balfour Beatty (UK).

UK companies alongside those from France have already won a number of contracts in market. The majority of these contracts involve project management, design and architectural services, which constitute a relatively small share of the overall project budget. There are also some specialised niche opportunities such as track and electrification to be had for contractors from the UK. This is simply due to lack of capacity in a country that has embarked on an ambitious number of metro development projects over a tight time framework.

Although numerous foreign companies are winning contracts directly with their Indian subsidiary as a partner, the preferred route to entry to bid for some of the large contracts is being part of a consortium and establishing a strategic partnership or a joint venture with an Indian counterpart.

However, forming consortia or joint ventures largely depends on the type of contract. Furthermore, the routes to entry in different segments of the metro rail supply chain could require a different strategy and pathway to be followed. A series of case studies presented below illustrate some of the routes to entry that number international companies have adopted in India.

### Consortium/Joint Ventures

**Case Study 1:**
Rail India Technical & Economic Services Limited formed a consortium which included three international consultants (Oriental Consultants Company Limited, Japan, Parsons Brinckerhoff International - now a part of UK's Balfour Beatty Group and Systra, France) to provide technical design and project management services to the Bangalore Metro Rail project.

**Case Study 2 :**
A consortium led by a German civil engineering firm is building a section of Delhi Metro Phase 3.

Dyckerhoff & Widmann, a leading German civil engineering firm, formed a consortium to carry out turn-key design, civil and tunnelling works for the underground section in Delhi's metro from the Inter State Bus Terminal at Kashmiri Gate to Central Secretariat, a distance of 7 km.

The other consortium partners include: Samsung Corporation (South Korea), Shimizu Corporation (Japan), L&T (India), IRCON International Limited (India) and Mott MacDonald (UK).

### Strategic Partnerships

**Case Study 3:**
Veolia Transport and RATP Développement, are both leading transportation operators in France. They have partnered together in order to increase their Asian footprint. For example, Veolia Transport and RATP have formed a joint venture to enter the Indian metro rail sector.

In India, Veolia Transport RATP India Private Limited. through its subsidiary Metro One Operation Private Limited., will operate Mumbai Metro Line 1, the first private metro system in India that is currently under construction. The Indian subsidiary will provide all activities related to operation, maintenance and sales for the metro line.

*Commuters boarding a train*

**Case Study 4:**
L&T (India) and Ramboll (UK) formed a strategic joint venture to provide civil engineering consulting services for infrastructure projects.

L&T and Ramboll are distinguished companies that formed a consultancy firm in 1998. The partnership has delivered work on the following metro projects:

- Hyderabad Metro: Design and Traffic consultants
- Nagpur Metro: Prepared the Metro Rail plan for city of Nagpur in 2004 and also revised it in 2008
- Bangalore Metro: Comprehensive consultancy services for five elevated railway stations along the Bangalore metro line. The scope of work involves detailed planning of the layout including passenger handling, platform and concourse design, passenger amenities and full mechanical and electrical services

### Single Bidder

**Case Study 5:**
ABB Switzerland has won an order worth approximately US$115 million to provide power solutions for the Bangalore Metro Rail project. As part of the contract ABB will design, supply, install and commission four substations and provide associated supervisory control and data acquisition (SCADA) system to monitor and control the installations.

Apart from Bangalore, ABB has also provided power solutions to Delhi, Mumbai and Kolkata urban rail networks in India.

**Case Study 6:**
In 2011, Nippon Signal Company., Japan won an order from Chennai Metro. This is to provide an Automatic Fare Collection (AFC) system incorporating an automatic passenger gate system for two lines due to open in 2014. This will be the first occasion for a Japanese company to deliver an AFC system in India.

**Case Study 7:**
Siemens Mobility, Germany has been contracted by the Rapid Metro Rail Gurgaon Limited to provide a full range of solutions. From vehicles to complete electrification and signalling to system integration Siemens Mobility delivers complete system to build a metro line in the urban business district of Gurgaon Cyber City.

## 6.2 Overseas Companies Currently Executing Contracts in India

As of early 2013 a substantial number of contracts in the metro rail sector in India are being delivered by foreign companies from countries such as China, France, Germany, Japan, Korea, United Kingdom and the US. The distribution of global participation in the metro rail sector in India is illustrated in Figures 16 and 17 (shown overleaf).

Figure 16 illustrates the distribution of global participation in the metro rail sector in India whilst Annex 8.3 presents details of the areas in which foreign companies have won contracts in market.

Figure 17 provides the current number of contracts won by companies from different countries in the Indian metro rail sector from 2003 – to-date. Currently UK and France lead in terms of the number of contracts won in the sector although there is active interest from companies around the world including those from the Japan, Korea, Spain and the US.

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## Competitive Market Share


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*Figure 16: Current International Participation in the Indian Metro Rail sector*
*Source: PA Consulting Group*

*DMRC achieves first night tunnel breakthrough at Jorbagh*

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| Country | Consulting | Civil | Traction and General Services | Telecom and Signalling | Rolling Stock | O&M | TOTAL |
|---|---|---|---|---|---|---|---|
| **United Kingdom** | 16 | 1 | 1 | 1 | | 4 | 22 |
| **France** | 5 | | 4 | 7 | 3 | 3 | 22 |
| **Japan** | 10 | 3 | 2 | 2 | 1 | | 20 |
| **United States** | 12 | | 2 | 1 | | | 15 |
| **Germany** | | 1 | 3 | 3 | 1 | | 8 |
| **Korea** | | | 2 | | 5 | | 7 |
| **Switzerland** | | | 4 | | | | 4 |
| **Spain** | 1 | 1 | 1 | | 1 | | 4 |
| **China** | | | 1 | | 1 | | 2 |
| | | | | | **Total** | | **104** |

*Figure 17: Number of contracts won by companies from different countries in the Indian metro rail sector from 2003 onwards*
*Source: PA Consulting Group*

*The modern Bangalore Metro system*

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Selected examples of companies from the United Kingdom that have won contracts are provide[d] in [F]ure 18 below.

| Area | Company | Example of Work Undertaken |
|---|---|---|
| Design and Consulting: | Mott McDonald | **Delhi Metro:** Mott MacDonald was designer for a consorti[u]m of international contractors for Delhi Metro Contract MC1B, which involves detailed arc[h]itectural, structural, electrical and mechanical (E&M) and heating ventilatio[n] and air conditioning (HVAC) design of 6 underground stations<br>**Hyderabad Metro:** Detailed design engineer for si[x] stations which includes - providing architectural, structural and public health desi[g]n services for the three interchange stations and design services for th[e] other stations |
| | Interfleet Technology | **Bangalore Metro:** Verification of t[h]e bogie design to international safety standards |
| | Parsons Brinckerhoff | **Bangalore Metro:** Member of the winning the consortia led by RITES that is tasked with providing general consulting<br>**Mumbai Metro:** Providing Engineering and Project Management Consultancy (along with Systra) for Mumbai Metro Line 1 |
| Civil Infrastructure | Keller | **Delhi Metro:** Ground Engineering<br>**Bangalore Metro:** Ground Engineering |
| Traction Systems | Pandrol Gro[up] | **Kochi Metro:** Providing track fastening system through its JV with Rahee group in India |
| Operations and Maintenance | Se[rco] | **Gurgaon Metro:** The contract for depot plant & machinery was awarded to Serco |
| | Tra[nsport] for London | **Mumbai Metro:** Mumbai Metropolitan Region Development Authority (MMRDA) has signed a MoU with the Transport for London for the development of Mumbai metro. The MoU will facilitate an exchange of information, personnel and technology transfer to help MMRDA to develop and operate the Mumbai Metro |

*Figure 18: Examples of UK companies that have won contacts in India*
*Source: PA Consulting Group*

Annex 8.3 provides a details about international companies participating in the metro rail sector in India.

In summary, overseas companies feature prominently in the development of India's metro sector. This is principally to address the lack of capacity in some areas and capability in others. Although the competition is stiff, the UK has done particularly well in areas such as design and consulting, civil infrastructure, traction systems and operations and maintenance.

7

## Conclusion

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India's rapid pace of urbanisation has propelled the Government of India to develop modern urban mass rapid transit systems across this country. Several cities such as Ahmedabad, Bangalore, Delhi, Kochi, Jaipur and Mumbai have already begun to improve their public transport systems, and metro rail is a key component of the transportation modal mix.

Forty metro rail projects to-date are in various stages of planning, approval, funding, construction and operation/expansion in India. An analysis of them reveals that the follo six provide immediate opportunities for UK companies. These are:

- *Ahmedabad-Gandhinagar Metro Phase 1*
- *Bangalore Metro Phase 2*
- *Jaipur Metro Phase 1 a 2*
- *Kochi Metro Phase*
- *Mumbai Metro Phase 1 Line 3*
- *Navi Mumbai Metro Phase 1*

Togethe ey offer an approximate accessible value £1 million to UK companies

metro systems, especially the six above, re esent an attractive and accessible market ith plenty of opportunities for UK companies. However, India is more than a one-off export opportunity.

A number of UK companies have already recognised the potential that India offers and are active in the market in metro rail and wider infrastructure opportunities. This includes the likes of Balfour Beatty, Ernst and Young, Mott McDonald, Pandrol Group, Parsons Brinckerhoff, Interfleet Technology and Serco.

The most prominent opportunities identified in this report for UK firms include:

- Professional services, including architecture, design and engineering, legal and financial services
- Project Management nd ecialist contracting
- Signalling, telecom cation and traction power
- Automati Fa Collection Systems
- Elec and echanical equipment
- k civil engineering and construction ors such as tunnelling
- Operations and maintenance of the metros, including asset management technologies and services

In order to be successful UK companies will need to make a commitment to this value conscious but opportunity rich market. A fly-in/ fly-out approach will not serve well in developing relationships with clients, decision makers and partners.

Eventually companies will need to consider a permanent presence in India and develop relationships with local partners who can support them and provide access to the opportunities. In essence UK companies will have to embrace the *'progressive indigenisation'* agenda (i.e., operating as an Indian entity).

The need for on-the-ground presence, networking and clear and regular marketing of UK capability and technology prowess to key Indian decision makers should not be underestimated. This is especially so when the competition from nations such as France, Germany, Japan and Korea are doing so in a concerted manner.

In conclusion, given the size and volume of the current range of metro rail projects and concomitant opportunities that arise, India should be not be ignored. Its metro opportunities offer an attractive proposition for UK firms wishing to do business there through sustainable and recurring prospects in the short, medium and long term.

8

# Annex and references

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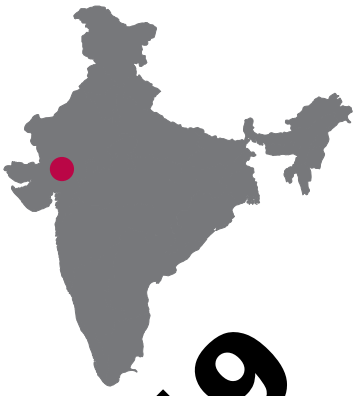
## 8.1 List of Abbreviations

| Abbreviation | Definition |
|---|---|
| AFC | Automatic Fare Collection |
| ATC | Automatic Train Control |
| ATP | Automatic Train Protection |
| CIDCO | City and Industrial Development Corporation (in the State of Maharastra) |
| DMRCL | Delhi Metro Rail Corporation Limited |
| DPR | Detailed Project Report |
| E&M | Electrical and Mechanical |
| FOB | Freight on Board |
| GBP | British Pound |
| HVAC | Heating Ventilation and Air conditioning |
| HVO | High Value Opportunity |
| INR | Indian Rupee |
| JICA | Japan's International Cooperation Agency |
| KMRL | Kochi Metro Rail Limited |
| L&T | Larsen & Toubro |
| MEGA | Metro-Link Express for Gandhinagar & Ahmedabad |
| MMRC | Mumbai Metro Rail Corporation |
| MMRDA | Mumbai Metropolitan Region Development Authority |
| MoU | Memorandum of Understanding |
| MoUD | Ministry of Urban Development, Government of India |
| MRT | Mass Rapid Transit |
| PPP | Public Private Partnership |
| RITES | Rail India Technical and Economic Service |
| SCADA | Supervisory control and data acquisition |
| SPV | Special Purpose vehicle |
| VAC | Ventilation and air conditioning |
| UKTI | UK Trade and Investment |



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## 8.2 Technical Details of the Six Significant Metro Opportunities in India

### 1. Ahmedabad Gandhinagar Metro

The Metro cum Regional Rail Transit System connects the two cities of Gujarat, Gandhinagar and Ahmedabad. It also connects the eastern & western parts of Ahmedabad city and the Ahmedabad International Airport. Metro-Link Express for Gandhinagar and Ahmedabad (MEGA), which is which is ISO 9001:2008 certified, a Government. of Gujarat undertaking will be implementing this project.

### Funding*

| Financer | Type of Fund | Amount (₹ million) | Percent |
|---|---|---|---|
| Not Available | Equity | 1299.6 | 60% |
| Not Available | Debt | 866.29 | 40% |

The project is being funded by the State Government and MEGA is exploring the possibility of Government of India taking an equity stake in the project. Once the Central and State Governments finalise the funding structure, including their equity contribution, the balance would be raised as debt from financial institutions.

### Technical Specifications

**System:**
Light Metro System

**Construction:**
Single, Twin, Triple and Four track viaduct; underground tunnel partly and cut & cover for station; Min 5.5 m vertical clearance from Right of Way, Open Profile Girder Sleek Twin U girder design of 25-30 m span, obligatory span as per site condition & monopile foundation

**Rolling Stock:**
Metro (driverless) - All cars motorised, about 3.6 m wide with 4 -doors on each side, 1676 mm gauge 2-car set expandable to 4-car train set by automatic coupling mechanism; axle load - 18 tonne

**Traction and Power Supply**
- **Voltage:** 1500 V DC with cathodic protection for viaduct & station structures
- **Power Collection:** Third Rail Bottom Collection

**Type of Signalling:**
Communication Based Train Control specifically developed for metro use with Automatic Train Protection, Automatic Train Operation and Automatic Train Stop (axle counters as fall back)

**Telecommunication:**
Terrestrial Trunked Radio Communication system and SCADA for support system control with gigabit Ethernet network backbone

**Fare Collection:**
Automatic fare collection system

**Prime Contractors:**
- **Consulting:** Ernst and Young

*Source: PA Consulting Group*

## 2. Bangalore Metro

Bangalore Metro Rail Corporation Limited, a joint venture of Government of India and Government of Karnataka is a Special Purpose Vehicle which has been entrusted with the responsibility of implementation of Bangalore Metro Rail Project. This is the First Metro Rail project in India commissioned with 750V DC Third Rail on Standard Gauge.

## Funding*

| Financer | Type of Fund | Amount (£ million) | Percent |
|---|---|---|---|
| Government of India | Equity | 154.34 | 11% |
| State Government of Karnataka | Equity | 154.34 | 11% |
| Government of India | Sub-Debt | 102.89 | 8% |
| State Government of Karnataka | Sub-Debt | 174.[illegible] | [illegible]% |
| JICA | Senior Term Debt | [illegible].65 | 31% |
| Asian Development Bank | Senior Term Debt | 162.90 | 12% |
| Agence Française Développement | Senior Term Debt | 93.08 | 7% |
| Housing and Urban Development Corporation Limited | Senior Term Debt | 85.32 | 6% |

**The data for funding components presented in this annex have been obtained from a variety of sources. They do not equate to the total budget for each of the six significant projects given in Figure 2 but present an overview of the funding structure.*

## Technical Specifications

**System:**
Light Metro System

**Construction:**
Elevated viaducts and a small section [illegible] underground tunnels

**Rolling Stock:**
Modern light weight stainless steel rolling stock. 6 coaches per train are [illegible] planned

**Traction and Power Supply**
- Voltage: [illegible] DC
- Power supply source: 66 kV AC
- Power collection: Third Rail Bottom Collection

**Type of Signalling:**
Cab Signalling and continuous Automatic Train Control with Automatic Train Protection

**Telecommunication:**
Integrated system with fibre optic cables, SCADA, train radio, public address system

**Fare Collection:**
Automatic fare collection system

**Prime Contractors:**
- **Consulting:** RITES, Systra, Oriental Consultants, Parsons Brinkerhoff, Interfleet, SNC-Lavalin
- **Civil Infrastructure:** SOMA, IVRCL, Costal Projects Limted, NCC, JVC Projects (India) Ltd., L&T, URC, Simplex Infrastructure Ltd., Punj Lloyd, Ahluwalia Contracts Ltd., ITD - ITD CEM JV
- **Traction and General Services:** Kalindee, NXP, Astro Physics Inc, Firepro, Samsung, Blue Star, Johnson, NICE, Bosch, Schindler, ABB
- **Signalling and Telecoms:** Thales, Alstom, SE, Sumitomo Corporation
- **Rolling Stock:** BEML, Hyundai Rotem, Mitsubishi Electric Company
- **O&M:** CPS

*Source: PA Consulting Group*

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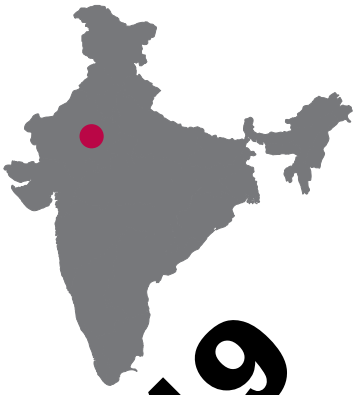

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## 3. Jaipur Metro

Jaipur Metro Rail is an urban mass rapid transit system for the city of Jaipur in the State of Rajasthan. Jaipur Metro Rail Corporation Limited is a SPV formed to implement the Metro Rail project in Jaipur which is a wholly owned company of the Government of Rajasthan.

### Funding*

| Financer | Type of Fund | Amount (£ million) | Percent |
|---|---|---|---|
| Government of India | Equity | 53.87 | 19.5% |
| State Government of Rajasthan | Sub-Debt | 17.96 | 6.5% |
| JICA | Debt | 203 | 74% |


### Technical Specifications

**System:**
Light Metro System

**Construction:**
Underground section with Tunnel Boring and station in underground station cut and cover and elevated viaduct using pressurised concrete "Box" shaped Girders on Single pier with pile / Open foundations

**Rolling Stock:**
2.9 m wide modern rolling stock with stainless steel body, axle load of 16 tonnes, longitudinal seating arrangement with capacity of 4 coach unit - 1034 Passengers

**Traction and Power Supply**

- **Voltage:** 25 kV Rigid Overhead Equipment system
- **Power supply source:** 220/132 kV AC voltage through cable feeders
- **Power collection:** Overhead Current Collection system

**Type of Signalling:**
Cab Signalling and continuous Automatic Train Control with Automatic Train Protection

**Fare Collection:**
Automatic fare collection system with passenger operated machines and smart card

**Prime Contractors:**

- **Consulting:** Mott MacDonald, Deloitte, Luthra & Luthra
- **Civil Infrastructure:** Reliance Infrastructure, SOMA, Essar Projects, Gammon India
- **Traction and General Services:** Alstom, Samsung
- **Signalling and Telecoms:** Alstom
- **Rolling Stock:** Hyundai Rotem, Mitsubishi Electric Corporation, BEML
- **O&M:** DMRCL, Jaipur Metro

*Source: PA Consulting Group*

## 4. Kochi Metro Phase 1

Kochi Metro Rail is an urban mass rapid rail transit system for the city of Kochi in the State of Kerala. The SPV, Kochi Metro Rail Limited. (KMRL) is tasked with implementing the Metro Rail project in Kochi. DMRCL is the lead consultant helping KMRL with the project implementation.

## Funding*

| Financer | Type of Fund | Amount (£ million) | Percent |
|---|---|---|---|
| Government of India | Equity | 123.24 | 19% |
| State Government of Kerala | Equity | 247.11 | 39% |
| JICA | Debt | 266.81 | 42% |


## Technical Specifications

**System:**
Light Metro System

**Construction:**
Elevated viaduct carried over pre-st[illegible]oncrete 'U' shaped girders with pile/ oper[illegible]ndat[illegible]s

**Rolling Stock:**
2.7 m wide modern rolling [illegible]with stainless steel body, standard gauge a[illegible]ad of 13 tonnes and coach capacity of 60[illegible]ssengers

**Traction and Power Supply**
- **Voltag[illegible]** 25[illegible] AC
- **Po[illegible] supply source:** 110Kv AC
- **Po[illegible]llection:** Third Rail Bottom Collection

**Type of Signalling:**
[illegible] Signalling and continuous Automatic Train Co[illegible]ol with Automatic Train Protection

**Telecommunication:**
Integrated system with fibre optic cables, SCADA, train radio, public address system

**Fare Collection:**
Automatic fare collection system with combination of smart card & computerised paper tickets

**Prime Contractors:**
- **Consulting:** DMRCL
- **Civil Infrastructure:** DMRCL

*Source: PA Consulting Group*

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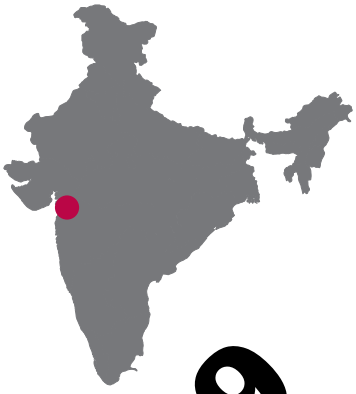
**The data for funding components presented in this annex have been obtained from a variety of sources. They do not equate to the total budget for each of the six significant projects given in Figure 2 but present an overview of the funding structure.*



## 5. Mumbai Metro Phase 1 – Line 3

Mumbai Metro Rail Corporation (MMRC) is a 50:50 JV between Government of India and the Maharashtra State Government. It is a SPV formed to implement the Mumbai Metro Rail project.

### Funding*

| Financer | Type of Fund | Amount (£ million) | Perce |
|---|---|---|---|
| JICA | Debt | Not Available | N Availabl |


### Technical Specifications

**System:**
Light Metro System

**Construction:**
Underground cut and cover structure

**Rolling Stock:**
1,435mm standard gauge, light stainless steel body with axle load of 17 tonnes. Capacity of 4 cars-1,178 passengers, 6 cars-1,792 passengers, 8 cars-2,406 passengers

**Traction and Power Supply**
- **Voltage:** 25 kV AC Rigid OHE system

**Type of Signalling:**
Computer Based Interlocking, signalling and continuous automatic train control with Automatic Train Protection

**Telecommunication:**
Integrated system with optical fibre cable, Light Emitting Diode/Liquid Crystal Display based boards, mobile radio, Public Address systems, train information system, control telephones and centralized clock system

**Fare Collection:**
Automation fare collection system with contactless smart card and retractable type control gates, ticket office machine

**Prime Contractors:**
- **Consulting:** Padeco, Oriental Consultants
- **Other areas:** Not awarded

*Source: PA Consulting Group*

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## 6. Navi Mumbai Metro Phase 1

Navi Mumbai Metro is a mass rapid transit rail project in the State of Maharashtra being overseen by CIDCO. It is a tripartite agreement signed by CIDCO, Indian railways and Maharashtra Government to construct the project. Implementing agencies will be CIDCO, MMRDA and Navi Mumbai Municipal Corporation for the proposed five corridors (Lines 1-5).

### Funding*

| Financer | Type of Fund | Amount (£ million) | Percent |
|---|---|---|---|
| CIDCO | Not Known | Not Available | Not Available |
| JICA | Debt | Not Available | Not Availa |

### Technical Specifications

**System:**
Light Metro Rail Transit System

**Construction:**
Elevated stations and viaducts

**Rolling Stock:**
Standard Gauge width (1,435 mm), 2.80 m wide and 4.05 m high stainless steel lightweight coaches with length of 21.34 m for (MC and 21.64 m for DMC. The system would be designed for 16 tonne axle load. Initially 4-car train (1500 passengers) and planned upgrade to 6-car train (2250 passengers) by 2021

**Traction and Power Supply**
- **Voltage:** 25 kv AC overhead power collection system

**Type of Signalling:**
Continuous Automatic Train Control system comprising of automatic train protection, operation and supervision (Automatic Train Operation and Automatic Train Supervision)

**Telecommunication:**
Radio system, Close circuit television, public announcement and information display system, telephone

**Fare Collection:**
Automation fare collection system

**Prime Contractors:**
- **Consulting:** DMRCL, LEA, Louis Berger, Balaji Railroad Systems Limited
- **Civil Infrastructure:** SanJose Constructora

*Source: PA Consulting Group*

Withdrawn 17 may 2019

**The data for funding components presented in this annex have been obtained from a variety of sources. They do not equate to the total budget for each of the six significant projects given in Figure 2 but present an overview of the funding structure.*

## 8.3 Details of international companies participating in the Metro Rail Sector in India

The following set of tables provides details of the distribution of international companies participating in the various projects by functional areas.

### Design and Consulting

The design and consulting space is dominated by UK headquartered companies. However, a true participation in terms of actual UK expertise being used is yet to be seen. Most of participation either comes through their Indian subsidiaries or strategic acquisition and joint ventures.

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| Company | Country | Example of Work Undertaken |
|---|---|---|
| Interfleet Technology | UK | **Bangalore Metro:** Verification of train design to international safety standards |
| Mott McDonald | UK | **Delhi Metro:** Mott MacDonald was designer for consortium of international contractor for Delhi Metro Contract MC1B, which involves detailed architectural, structural, E&M and HVAC design of 6 underground stations<br><br>**Bangalore Metro:** Civil and structural design consultant for underground stations and tunnels in the underground stretch of east - west corridor of Bangalore metro. Detailed design consultant for the proposed Majestic interchange station between the North South Metro and East West Metro lines in Bangalore. Detailed engineering services for all electrical and mechanical works including low voltage distribution, lighting, hydraulics, fire, SCADA, uninterrupted power systems and diesel generators for six underground Bangalore metro stations and associated tunnels<br><br>**Kolkata Metro:** Detailed design services for the structural components of the viaduct, six elevated stations<br><br>**Chennai Metro:** Mott MacDonald was appointed detailed civil and structural design engineer for ten elevated metro stations in Chennai Metro Rail project by Consolidated Construction Company Limited<br><br>**Jaipur Metro:** Technical and general consultant assisting in the bid process management, preparation of technical documents and review of the already executed work<br><br>**Hyderabad Metro:** Detailed design engineer for six stations which includes - providing architectural, structural, architectural and public health design services for the three interchange stations and design services for three other stations |

| | | |
|---|---|---|
| L&T Ramboll (a joint venture between L&T (India) and Ramboll (UK)) | India-UK | **Hyderabad Metro**<br>Design and Traffic consultants<br>**Nagpur Metro:**<br>Prepared the Metro Rail plan for city of Nagpur in 2004 and revised [illegible]008<br>**Bangalore Metro:**<br>Comprehensive consultancy services for six elevated railway stati[illegible] along the Bangalore metro line. The scope of work involves deta[illegible]lanning of layout including passenger handling, platform and concourse design, [illegible]r amenities and full E&M services |
| Parsons Brinckerhoff | UK | **Bangalore Metro:**<br>Member of winning the consortia led by RITES [illegible] tasked with providing general consulting<br>**Hyderabad Metro:**<br>Provision of programme/project ma[illegible]ment as well as detailed Engineering and Station/Depot Architecture<br>**Mumbai Metro:**<br>Providing Engineering [illegible]d Projec[illegible]anagement Consultancy (along with Systra) for Mumbai Metro Line |
| URS/Scott Wilson | UK | **Chennai Metr[illegible]**<br>Technical consultin[illegible]ervices |
| Allen & Overy | UK | **Chenna[illegible]etro:**<br>Provi[illegible]l services in partnership with Trilegal (India) |
| E&Y | UK | **[illegible]dabad Gandhinagar Metro:**<br>[illegible]rate Advisors<br>**Hyderabad Metro:**<br>Construction Design and Management Regulations Consultant |
| A.C.Nielsen | US | **Gurgaon Metro:**<br>They are the traffic consultants for phase 1 |
| IFC | [illegible] | **Gurgaon Metro:**<br>Lead advisor in the structuring, marketing, bidding and negotiation of the O&M contract |
| Louis Berger [illegible]oup | US | **Hyderabad Metro:**<br>Independent Engineers and responsible for verifying designs and drawing, inspect and monitor quality of construction works, test coaches and various other components<br>**Navi Mumbai Metro:**<br>Louis Berger Group is providing general consultancy services in partnership with Balaji Rail Road Systems |
| Deloitte | US | **Jaipur Metro:**<br>Financial consultants |
| Lee Harris Pomeroy Architects | US | **Kolkata Metro:**<br>As part of joint ventures, Lee Harris Pomeroy Architects will provide architectural consultancy services for Kolkata Metro Rail East West Corridor Project |
| CES - acquired by Jacobs Engineering | US | **Bangalore Metro:**<br>Detailed Design and Engineering services for Bangalore Metro Phase 2<br>**Kolkata Metro:**<br>Part of a consortium that is providing general consulting services |

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| | | |
|---|---|---|
| Maunsell Consultants (acquired by AECOM) | US | **Chennai Metro**<br>As part of a joint venture, AECOM is responsible for pr[illegible]ment, provision of scheme design as well as construction management<br>**Kolkata Metro:**<br>As part of a joint venture, AECOM is providing ge[illegible]eral consultancy services which include procurement, construction supervision, te[illegible]ing and commissioning of the complete Kolkata Metro Rail East West Corrido[illegible]ect<br>**Hyderabad Metro**<br>General consultants in partnership with Feedback ventures |
| IMG | Japan | **Gurgaon Metro:**<br>Traffic consultants for phase 1 |
| Yachiyo Engineering Corporation | Japan | **Chennai Metro:**<br>Member of a consortium led by Egis Rail to provide general consulting services to Chennai metro CC to be responsible for architecture<br>**Kolkata Metro:**<br>As part of joint ventures, AECOM is providing general consultancy services which include[illegible]urement, construction supervision, testing and commissioning of the com[illegible]e Kolkata Metro Rail East West Corridor Project |
| Padeco | Japan | **[illegible]ai Metro:**<br>Padeco was appointed as interim consultant for line 3. It will provide consulting services which include determination of the alignment and station locations, soil testing survey, preliminary design of underground tunnel and stations and also tender document preparation |
| Oriental Consultants Company Limited | Japan | **Bangalore Metro**<br>Part of the consortium led by RITES and provides general consulting<br>**Delhi Metro**<br>General consultants |
| Eptisa Ingeni[illegible] | Spain | **Hyderabad Metro:**<br>They were awarded the contract for safety consulting and audit work |
| Keoli[illegible] | France | **Hyderabad Metro:**<br>Review system's design and also provide its perspective on vendor solutions for efficient operation |
| Egis Rail S.A. | France | **Chennai Metro:**<br>General consultancy services which includes: procurement, construction supervision, civil engineering structures, testing and commissioning, tracks, signals, air conditioning and ventilation, rolling stock, telecom facilities, traction and power supply, maintenance depots, stations, operation control centre, elevated, surface and underground sections over the project routes, offices, station integration areas, bridges, flyovers, integration with other modes of transport<br>**Kolkata Metro:**<br>As part of a joint venture, Egis Rail is providing general consultancy services which include procurement, construction supervision, testing and commissioning of the complete Kolkata Metro Rail East West Corridor Project. Egis Rail India was chosen as sub-consultants to Egis Rail to provide all the local key experts and support engineers and staff |

*Mumbai Metro station under construction*

| | | |
|---|---|---|
| Systra | France | **Bangalore Metro:**<br>Member of the winning consortia led by RITES that is t[illegible] providing general consulting<br>**Mumbai Metro:**<br>Civil design consultant for the line 2, Charkop - B[illegible]ndra - Mankhurd Corridor |

*Source: PA Consulting Group*

## Civil Infrastructure

Civil infrastructure work has mostly been restricted to large construction companies in India. Foreign participation is rare and seen only in specialized tasks such as tunnelling.

| Company | Country | Example of Work Undertaken |
|---|---|---|
| Kumagai Gumi | Japan | **Delhi M[illegible]**<br>Mem[illegible]f the consortium that won the contract for design and constructional works and [illegible]ntilation and air conditioning (VAC) |
| Itochu Corporation | Japan | **[illegible]hi Metro:**<br>Member of the consortium that won the contract for design and construction of civil works and VAC |
| Shimizu Corporation | Japan | **Delhi Metro:**<br>Member of the consortium that won the contract for design and constructional works and VAC |
| Skanska International Civil Engineering | [illegible]eden | **Delhi Metro:**<br>Member of the consortium that won the contract for design and constructional works and VAC |
| Dyckerho[illegible] Widm[illegible] | Germany | **Delhi Metro:**<br>Lead member of consortium to carry out civil and tunnelling works and turnkey design and construct contract for the underground section from ISBT station to Central Secretariat of seven km |
| Transtonnelstroy | Russia | **Kolkata Metro:**<br>They won the contract for civil works in a joint venture with AFCONS Infrastructure Limited (part of Shapoorji Pallonji Group which is the third largest construction group in India)<br>**Chennai Metro:**<br>They were awarded the contract for civil works in a joint venture with AFCONS Infrastructure Limited |
| Keller | UK | **Delhi Metro:**<br>Ground Engineering<br>**Bangalore Metro**<br>Ground Engineering |

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*Tunnel construction site*

| | | |
|---|---|---|
| Emirates Trading Agency LLC | UAE | **Chennai Metro:** They were awarded the contract for design and build w[illegible] Ventilation System |
| San José Constructora | Spain | **Navi Mumbai Metro:** Design and construction of five elevated stations [illegible] the Phase 1 (Line 1) |

*Source: PA Consulting Group*

## Rail Systems

While most of the track work and electrical and mechanical work is being carried out by Indian contractors, foreign participation is largely seen in supply and installation of products (lifts, escalators, automated fare collection systems, surveillance) and track electrification services.

| Company | Country | Example of Work Undertaken |
|---|---|---|
| VNC-Rail.One | Germany | **Mumbai Metro:** VNC-Rail.One from Germany has been awarded the contract for laying the tracks |
| Alstom | France | **Chennai Metro:** Alstom was involved in design, supply, installation, testing and commissioning of track-works as part of a joint venture with Larsen and Toubro |
| Cobra and ELIOR | Spain | **Delhi Metro:** They won the contract for system-wide- traction, SCADA and power distribution for line 2 |
| ABB | Switzerland | **Bangalore Metro** They have won the contract for providing power solutions for the phase 1<br>**Jaipur Metro** Power solutions for the phase 1<br>**Delhi Metro:** Turnkey electrification package for Phase II |
| MVM Rail | Australia | **Delhi Metro:** Supply, installation, testing and commissioning of ballastless track |
| Vossloh | Germany | **Delhi Metro:** DMRCL uses Vossloh 336 fastening system which are designed and manufactured by Vossloh AG and track work in being done through its JV with the Patil group in India |

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| | | |
|---|---|---|
| Pandrol Group | UK | **Kochi Metro:**<br>Providing track fastening system through its joint ventu[illegible] group in India |
| Alcatel CGA Transport | France | **Delhi Metro:**<br>They were awarded the contract for Automatic Fa[illegible] Collection System for line 2 |
| Thales | France | **Gurgaon Metro:**<br>The automatic fare collection system was [illegible]ontracted to Thales by ITNL ENSO Rail Systems Ltd (IERS), a IL&FS group compa[illegible]<br>**Bangalore Metro:**<br>Supply Light emitting diode dis[illegible]r metro stations |
| The Nippon Signal Company. Ltd. | Japan | **Chennai Metro:**<br>They received order[illegible]anufacture & supply of Automatic Fare Collection System for Chennai metro in 2011 |
| Samsung SDS | Korea | **Bangalore Me[illegible]:**<br>Samsung SDS – Kali[illegible]dee consortium was awarded the contract for design, supply, manufacturing and installation of Automatic Fare Collection System<br>**Hyde[illegible]ad [illegible]etro:**<br>Au[illegible]a[illegible]Fare Collection System |
| NXP Semiconductors | Netherlands | **B[illegible]ngalore Metro:**<br>[illegible]ARE DES Fire platform by NXP Semiconductors will be used to manage the Automated Fare Collection System |
| OTIS | US | **Mumbai Metro:**<br>They won the contract to supply lifts for the Versova - Andheri - Ghatkopar corridor |
| Schindler | S[illegible]erland | **Mumbai Metro:**<br>They won the contract to supply escalators for the Versova - Andheri - Ghatkopar corridor |
| SJEC Corpo[illegible]ion | China | **Bangalore Metro:**<br>Joint venture with Johnson Lifts to manufacture & supply escalators |
| Fire Pro[illegible]ms Pvt Ltd. | Japan | **Bangalore Metro:**<br>Fire protection equipment supply & maintenance for Bangalore metro phase 1 from M.G. Road to Baiyappanahalli |
| Astrophysics Inc | US | **Bangalore Metro:**<br>They are suppliers of x-ray inspection systems for baggage |
| NICE Systems | Israel | **Bangalore Metro:**<br>Internet protocol video surveillance, video management system, video analytics for automatic intrusion detection for certain areas along the tracks and at the train's operations control centre |
| Bosch | Germany | **Bangalore Metro:**<br>Supply of Surveillance cameras and system for metro stations |

*Source: PA Consulting Group*

*Com[illegible]ters [illegible] the Bangalore Metro*

## Signalling and Telecom

India relies heavily on foreign companies for its telecom, signalling and control systems need for Metro Rail projects. The market is currently being dominated by the French and the Germans. This market is dominated by industry leaders such as Alstom, Thales and Siemens.

| Company | Country | Example of Work Undertaken |
|---|---|---|
| Alstom | France | **Delhi Metro:** Designing & supplying [illegible]alling & telecommunication system and automatic train control<br>**Jaipur Metro:** Design, Manufacture, Supply, Installation, Testing and Commissioning of the train control, [illegible]alling systems and traffic management for Jaipur metro phase 1<br>**Ban[illegible]e Metro:** Des[illegible], [illegible]nufacture, supply, installation, testing and commissioning of Signalling and [illegible]ntrol system for phase 1 |
| Thales | France | **Bangalore Metro:** They were awarded the contract for signalling and telecom<br>**Hyderabad Metro:** Signalling and train control, Communication contract was awarded to Thales by L&T<br>**Mumbai Metro:** They won the contract for installing communication systems between operators and passengers |
| Alcatel | [illegible]rance | **Delhi Metro:** As part of the consortium led by Alstom India, Alcatel Portugal will provide train control and communication system for line 2 |
| Siemens | Germany | **Gurgaon Metro:** Signalling & Power systems for phase 1<br>**Mumbai Metro:** Signalling system for the Versova - Andheri - Ghatkopar corridor<br>**Chennai Metro:** They won the contract for design and build of signalling, platform screen doors and telecommunications |
| Ansaldo STS | Italy | **Kolkata Metro:** They were awarded the contract for signalling & telecom for the east-west Kolkata metro line of 14.7 km |

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*New rolling stock for Delhi Metro*

| | | |
|---|---|---|
| Sumitomo Corporation | Japan | **Bangalore Metro:** Member of a consortium that was awarded the contract [illegible] train control and signalling system<br>**Delhi Metro:** Member of the consortium that was awarded the contract for system-wide-signalling for line 2 |
| Arthur D Little | US | **Chennai Metro:** Installation of screen doors at underground stations and safety assessment of signalling & train control system |

*Source: PA Consulting Group*

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## Rolling Stock

Rolling stock is another area where India relies heavily on foreign manufacturing. Although Hyundai Rotem emerges as the leader in terms of rolling stock supplier to India Metro Rail projects, other large manufacturers are making in-roads in the market.

| Company | Country | Example of Work Undertaken |
|---|---|---|
| Hyundai Rotem | Korea | **Jaipur Metro:** Supply of components to BEML for manufacturing metro cars (coaches)<br>**Bangalore Metro:** Member of the consortium led by BEML for manufacture and supply of rolling stock for phase 1<br>**Delhi Metro:** Manufacture and supply of rolling stock<br>**Hyderabad Metro:** Supply of 171 cars for 57 trains to Hyderabad Metro |
| KOROS | Korea | **Delhi Metro:** They are a member of the consortium for the manufacture and supply of rolling stock |
| CAF | Spain | **Kolkata Metro:** The company had won the contract to supply (84 coaches) 14 rakes to KMRCL |
| Alstom | France | **Chennai Metro:** Supply of 168 metro cars |

| | | |
|---|---|---|
| Faiveley Transport | France | **Delhi Metro:** Bombardier ordered the automatic door control sensor [illegible]ey Transport for Delhi metro train coaches<br>**Bangalore Metro:** Supply of automatic door control sensor systems [illegible]ed in the train coaches |
| Bombardier | Canada | **Delhi Metro:** Manufacture and supply of rolling stock [illegible] metro |
| CSR Nanjing | China | **Mumbai Metro:** The rolling stock contract was [illegible]to CSR Nanjing for supplying 16 metro trains |
| Siemens Mobility | Germany | **Gurgaon Metro:** The contract for rol[illegible]ck was awarded to Siemens India Ltd/ Siemens AG, Germany |
| Mitsubishi Electric Corporation | Japan | **Bangalore Metro:** Member of the consortium for manufacturing and supplying rolling stock |

*Source: PA Consulting Group*

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*Tunnel construction equipment*

*Cleaning and maintenance operations*

## Operations and Maintenance

Operations and Maintenance is mostly retained in-house and run by the SPVs. However, some of the Metro Rail projects have started looking for foreign participation to help them run the operations efficiently. Currently only UK and French companies are actively involved in this area.

| Company | Country | Example of Work Undertaken |
|---|---|---|
| Halcrow | UK | **Hyderabad Metro:** Internal safety asses[illegible] conduct independent audits |
| Serco | UK | **Gurgaon Metr[illegible]** The contract fo[illegible] plant & machinery was awarded to Serco |
| Transport for London | UK | **Mumbai Metro:** Mumba[illegible]politan Region Development Authority has signed a Memorandum of Und[illegible]ding (MoU) with the Transport for London for the development of Mumbai met[illegible] The MoU will facilitate an exchange of information, personnel and technology [illegible] to help MMRDA to develop and operate the Mumbai Metro |
| Keolis | France | **Hyderabad Metro:** Operating and maintaining Hyderabad metro for a period of eight years. The company will also be responsible for testing, commissioning and trial runs |
| RATP DEV | Franc[illegible] | **Mumbai Metro:** A joint venture between Veolia Transport and RATP. to operate Mumbai metro line 1 through its subsidiary Metro One Operation Private Limited |
| Veolia Transport | [illegible]ance | **Mumbai Metro:** A joint venture between RATP and Veolia Transport to operate Mumbai metro line 1 through its subsidiary Metro One Operation Private Limited |

*Source: P[illegible]sulting Group*

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### Ahmedabad and Gandhinagar Metro

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## 8.5 List of Websites

This section presents a list of selected key websites relevant to metros in India.

### General

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| Kolkata Metro Rail Corporation Limited (E t t Metro) | http://kmrc.in/ |
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## 8.6 How can UKTI help UK organisations succeed in India?

UKTI can provide UK organisations with a wealth of assistance to succeed in India. This is done through an extensive UKTI network across India which is headquartered at the British High Commission in New Delhi. The types of trade support services that UKTI offers include:

- Tailored support for companies wanting to address metro opportunities, whether as primary contractors or contributors to the supply chain.
- Up to date market intelligence and general information on how the metro projects are developing through to making contacts at the right decision-making level. This includes the monitoring of metro tenders and altering relevant UK companies to the opportunities as well as covering cultural, political and business issues.
- The identification of potential partners to form consortia, with companies in India, the UK and other countries such as Japan.
- Arranging and facilitating general and bespoke networking activities between UK and Indian organisations that engaged in the metro sector.
- Delivering a range of events and missions in the UK and in India tailored to the metro opportunities. This includes meet the buyer type events. A bespoke programme for UK organisation wishing to engage with commercial players and Government institutions in India can also be provided.

Furthermore, the UK Government network in India can help promote organisational capability and expertise in market, especially at a time when tendering opportunities are likely to be released or bids are being made. Contact details within UKTI are provided at the back of this publication, and we would encourage companies to speak to us.

## Find out more

If you are interested in pursuing business opportunities in India, you can register your interest on www.ukti.gov.uk and arrange for an International Trade Adviser based in your UK region to help you.

## Contact us

For further information on metro opportunities in India, Mass Transport activities and the HVO Programme, please contact:

**UKTI India**

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**Mass Transpor tiv es and Projects**

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**High Value Opportunities Programme**

hvopteam@ukti.gsi.gov.uk

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