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1.	EXECUTIVE SUMMARY	4
2.	RAILWAYS INDIA – STATUS QUO	5
2.1	Size and importance of the sector	5
2.2	More passengers, improved freight processing, increasing income	6
2.3	Private Operators of Container Trains	8
2.4	Urban Rail Segment	9
3.	STAKEHOLDERS	10
3.1	Indian Railways	10
3.2	Other relevant state-owned companies	11
3.3	The main local manufacturers of railway equipment	13
3.4	Foreign Companies in India	15
4.	TRENDS AND OPPORTUNITIES FOR AUSTRIAN COMPANIES	18
4.1	General Trends	18
4.2	Indian Railways expansion plans	18
4.3	PPP (Public Private Partnership)	22
4.4	Planned major projects by Indian Railways	23
4.5	Metro Rail – Projects	28
4.6	Specific supply opportunities for Austrian companies	39
5.	STRENGTHS AND WEAKNESSES OF THE SECTOR	40
5.1	COVID 19 and Indian Railways	40
5.2	Strengths and Problems	40
6.	TRADE FAIRS	41
7.	SOURCES	42

1. EXECUTIVE SUMMARY

This industry report shall give an overview of the Indian railway and metro sector and show the opportunities for Austrian companies in that field.

While in 1985-1986 the market share of the railroad was 65 % and the share of road traffic was 35 %, the situation has been reversed today: the corresponding figures are only 31 % for rail traffic and 60 % for road traffic.

The Designated Freight Corridor (DFC) project is expected to increase the freight traffic in favour of railway again. With overall physical progress of about 70 % as of March 2020, the mega project is expected to be a game changer in the country's logistic sector.

The government recently approved the restructuring of the Railway Board and it will now have four Members: Infrastructure, Rolling Stock and Traction, Finance, Operations and Business Development.

The government plans to invest Rs 50 trillion during 2018-30 for the development of railway infrastructure. Rs 13.7 trillion worth of investment in the railways is envisioned during 2020-25.

When it comes to trends, the Indian Railways will phase out diesel engine locomotives in the coming years and switch completely to electric ones. Indian Railways has registered its best safety record during 2019-20 (April to February) with zero passenger fatalities.

Indian Railways has been becoming more amenable to newer technologies and solutions to improve its operational efficiency. Here are some such solutions: deployment of track management systems, anti-collision devices, electronic interlocking systems, predictive maintenance systems, aerial LiDAR topographic survey technique, dynamic tamping express machine for track maintenance, GIS based land asset management systems and PPP.

Urban Rail segment - besides Metro, other alternative modes of transit in cities such as Light Rail Transit (LRT), Tramways and monorails are also being encouraged by the government as these are comparatively not as investment-intensive as metros and with limited space requirements in urban areas.

Feel free to get in touch with the AußenwirtschaftsCenter New Delhi for further questions!

2. RAILWAYS INDIA – STATUS QUO

2.1 Size and importance of the sector

Indian Railways - an integral part of the Indian transport network for more than 150 years - is one of the largest railway companies in the world with a route length of 123,236 km and 1.3 million employees. 23 million passengers and 3 million tons of freight are transported every day.

Indian Railways are 100 % state-owned (Ministry of Railways). Indian Railways formulates guidelines, offers services and acts as an authority.

The main source of income for Indian Railways is freight loading forming almost three-fourths of total railway earnings. From 2013-14 to 2017-18, freight earnings grew at a compound annual growth rate (CAGR) of 5.66 %.

So far, passenger traffic has played a secondary role as a source of income and the fares were not revised for a long time. Freight prices have had to be increased in recent years to such an extent that rail transportation was no longer competitive with road transportation. While in 1985-86 the market share of the railroad was 65 % and the share of road traffic was 35 %, the situation has been reversed today: the corresponding figures are only 31 % for rail traffic and now 60 % for road traffic.

This and other factors have led to a deterioration in the operating ratio (expenditure in relation to sales) from a good 93.6 % in 2013-14 to 97.45 % in 2021.

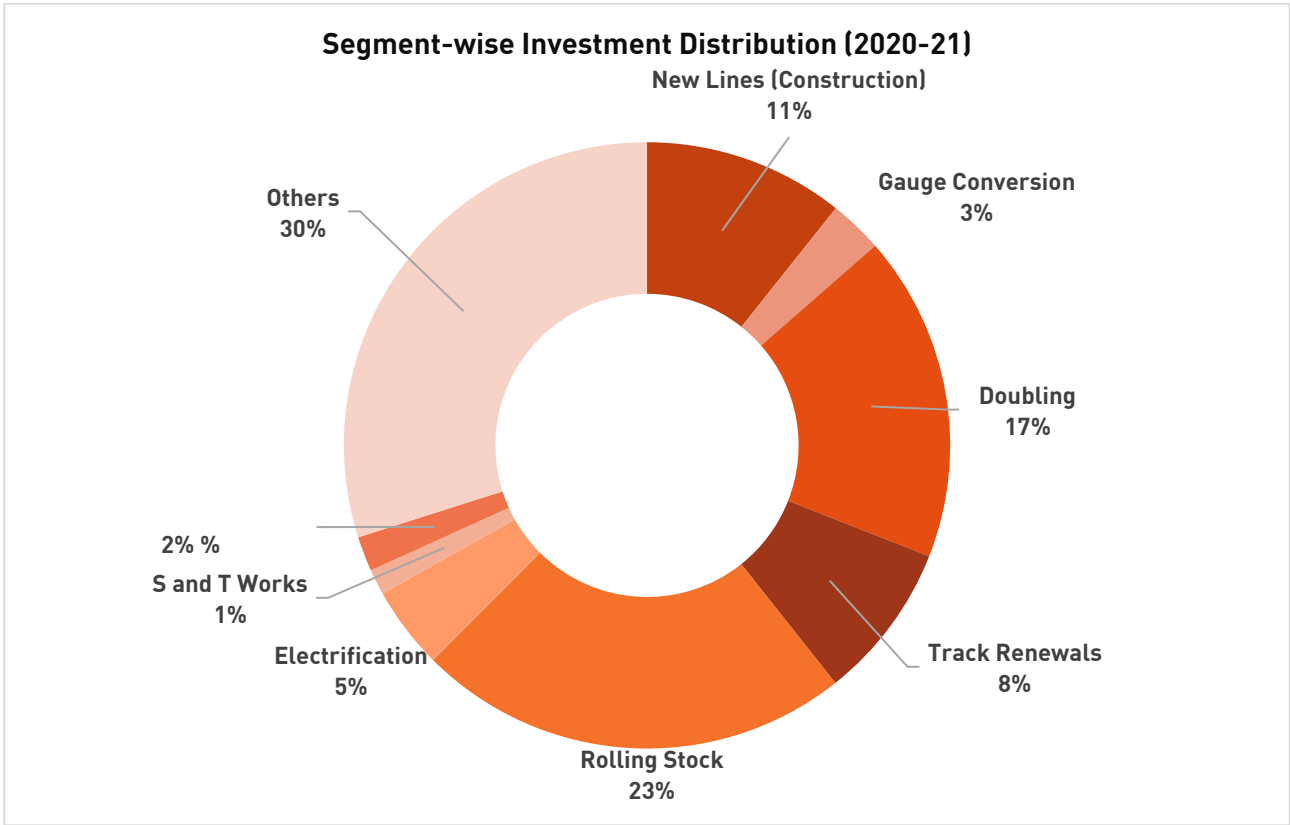
India's lack of infrastructure is hampering the country's economic growth. This lack of adequate infrastructure is also clearly noticeable in the Indian railway sector: in India, the track length is 35 km per 1,000 km², while the global average is 100-150 km. With an average speed of only 25 km / h (in freight traffic), India is far behind other countries (trains in China run on average at a speed of 150 km / h).

The Golden Quadrilateral (Delhi, Howrah, Chennai and Mumbai) link along with Delhi-Chennai and Mumbai-Howrah transports more than 52 % of the passenger traffic and 58 % of the freight traffic of the Indian Railways, according to the Dedicated Freight Corridor Corporation of India Limited (DFCCIL),

With the increased focus from the government, the railway sector has been on a high trajectory since the past few years. While the pace of the infrastructure creation has been at an all-time high, new and innovative ways to improve operational efficiency and passenger experience are also being focused upon.

One key aspect of enhancing the infrastructure and passenger experience on Indian Railways involves roping in the private sector. Indian Railways planned to introduce private trains on its network in phases, with the first dozen due to start running in the 2023-24 financial year and all 151 by 2027. However, in July 2022, the railways said it has no plan to operate regular passenger trains by private operators. Inadequate response from private players could have made the railways put the proposal in cold storage.

Segment-wise Investments in Indian Railways for 2020-21 (INR 1.39 trillion)

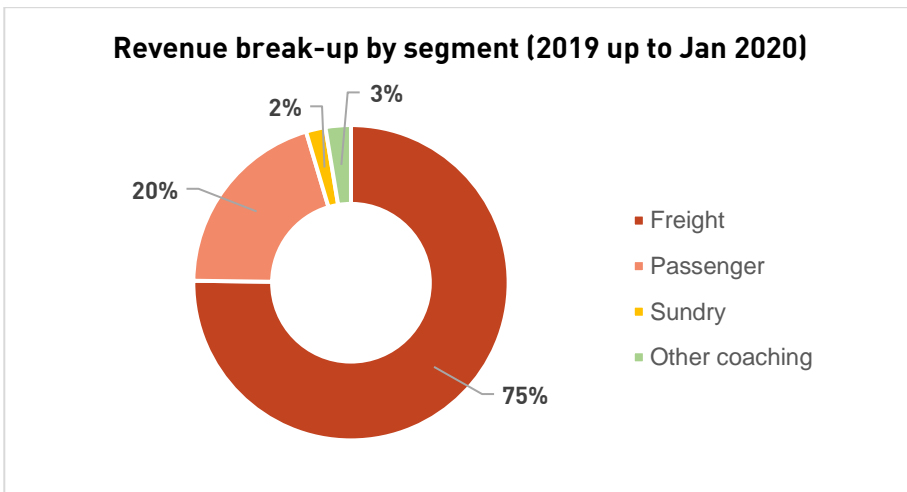


Source: Ministry of Railways

2.2 More passengers, improved freight processing, increasing income

Freight accounts for around two-thirds of railway’s revenues and profits from the freight segment are used to cross-subsidise the passenger segment. Freight accounted for 63.96 % of total revenues in FY20 (up to January 2020), followed by the passenger segment at 30,47 %, other coaching 2.66 % and sundry 2.91 %.

In 2021-22, freight and passenger traffic recovered to a large extent, despite the second Covid wave in April-May 2021.



Source: Ministry of Railways

The growth of freight volume was 15 % from 2020-21 to 2021-22. From 2014-15 to 2018-19, freight earnings grew at a CAGR of 4.71 %.

Freight volumes and earnings

	2017-18	2018-19	2020-21	2021-22
Freight volume (mn tonnes)	1160	1221	1233	1418
Earnings (Rs billion)	1171	1272	1242	1437

Indian Railways passenger traffic, on the other hand, has been making losses due to unviable fare structure. From 2014-15 to 2018-19, passenger earnings grew at a CAGR of 4.85 % while in the same period passenger traffic grew only at CAGR of 0.63 %.

Passenger volumes and earnings

	2017-18	2018-19	2019-20	2020-21	2021-22
No. of Passengers (millions)	8287	8438	8086	1250	3543
Earnings (Rs. billion)	486	510	507	152	389

The routes of Indian Railways are heavily congested with 51 % of its routes carrying 96 % of traffic. Moreover, its seven high-density routes (Delhi-Howrah, Mumbai-Howrah, Delhi-Mumbai, Delhi-Guwahati, Delhi-Chennai, Chennai-Howrah and Mumbai-Chennai) which is 16.5 % of the total network, carry 60 % of the total traffic.

2.3 Private Operators of Container Trains

The government opened the container transportation area to private companies in 2006. In January 2007, a framework concession agreement was signed between Railways and qualified operators of container trains. Following are the private container operators:

Since the launch of this policy in 2005, the following 16 companies have obtained licenses to run container trains:

Company	Website
Adani Logistics Ltd.	https://www.adaniports.com/logistics
Arshyia Rail Infrastructure Ltd.	http://www.arshiyalimited.com/rail-and-rail-infrastructure.html
Boxtrans Logistics (India) Services Pvt.Ltd.	
Central Warehousing Corporation	http://cewacor.nic.in/
Container Corporation of India Ltd.	http://www.concorindia.com/
Container Rail Road Services Pvt Ltd	http://www.dpworldintermodal.com/
ETA Engineering Pvt. Ltd.	https://www.eta-engg.com/
Fourcee Infrastructure Equipment Pvt. Ltd.	
Gateway Rail freight Ltd.	http://gatewayrail.in/
Hind Terminal Pvt Ltd	http://www.hindterminals.com/
India Infrastructure & Logistics Pvt Ltd	http://indialinx.com/
Innovative B2B Logistics Solution	https://inlogistics.in/
KRIBHCO Infrastructure Ltd.	https://kribhcoinfra.com/
Pipavav Rail Corporation Ltd.	http://www.pipavavrailway.com/
Reliance Infrastructure Engineers Pvt. Ltd	https://www.rinfra.com/
SICAL Logistics Ltd. (formerly South India Corporation (Agencies) Ltd.)	https://sical.in/
Trans Rail Logistics Ltd.	http://www.darcl.com/trans-rail

In April 2017, Indian Railways decided to allow private companies to run their own freight trains from their private terminals. Companies from sectors such as cement, steel, auto, logistics, grains, chemicals and fertilisers have expressed their interest in running their own freight trains.

Several private companies in India, including Tata Steel, Adani Agro, Kribhco etc. have their own private terminals from where they can run these trains. However, the trains would not completely be privatised since the railway ministry will still manage the train operations.

2.4 Urban Rail Segment

With the fast-paced migration of population from rural to urban areas, public transport in Indian cities has not been able to cope with rapidly increasing demand so far and Metro systems have been seen as an option that can improve the quality of transportation infrastructure in Indian cities.

The Kolkata Metro was the first such project in India - it started operations in 1995. The Delhi Metro Corporation was founded in the same year. Metro is currently operational in 13 Indian cities with a total length of over 673 km. Delhi with 347 km of metro lines is having the largest network. Further, over 467 kms of metro lines are under construction in various cities and over 1100 kms of new lines are proposed in both new cities and in the cities already having metro lines.

Other alternative modes of transit in cities such as Light Rail Transit (LRT), Tramways and monorails are also being encouraged by the government as these are comparatively not as investment intensive as metros and with limited space requirements in urban areas.

In the near future, the urban rail segment will continue to offer opportunities despite financial challenges.

3. STAKEHOLDERS

3.1 Indian Railways

3.1.1 Railway Board - Ministry of Railways (www.indianrailways.gov.in)

The "Railway Board" formulates the guidelines of Indian railway policy and has the highest control function. The board consists of the Chairman, the Financial Commissioner and so-called "Members" for the areas of "Traffic", "Engineering", "Mechanical", "Electrical" and "Staff Matters".

Under the new approved structure recently, the Railway Board will now consist of 4 members and a chairperson, a reduction from the present number of 8. The Railway Board will now have Members for infrastructure, operations and business development, rolling stock and finance.

3.1.2 Railway Zones

The Indian Railways are administratively divided into 16 zones. Each zone consists of several divisions, each of which is subordinate to a divisional headquarters. There are 67 divisions.

3.1.3 Production Units

Indian Railways manufacturing operations are managed directly by the Ministry. The general manager of a production unit reports to the railway board. The main companies are:

- Chitaranjan Locomotive Works, Chitaranjan - www.clw.indianrailways.gov.in
- Diesel Locomotive Works, Varanasi - www.diesellocoworks.com
- Integral Coach Factory, Chennai - www.icf.gov.in
- Rail Coach Factory, Kapurthala - www.rcf.indianrailways.gov.in
- Rail Wheel Factory, Bangalore www.rwf.indianrailways.gov.in
- Diesel-Loco Modernisation Works, Patiala - www.dcwpatiala.com/pages/stores1.html
- Rail Spring Karkhana, Gwalior

3.1.4 RDSO - Research Design and Standards Organisation (www.rdsso.gov.in)

The RDSO is the only research and development facility of Indian Railways. RDSO is a technical advisor to the Ministry, the railways, their sub-organizations and production units. Every new product must be checked in advance by the RDSO before it is deployed in Railways.

3.1.5 COFMOW – Central Organisation for Modernisation of Workshops (www.cofmow.gov.in)

COFMOW is responsible for the modernization of all production units, workshops and depots. In addition, COFMOW acts as a consultant in questions regarding engineering, technology upgrade, productivity improvement, machine selection, procurement and personnel training.

3.2 Other relevant state-owned companies

3.2.1 Container Corporation of India (www.concorindia.com)

CONCOR is responsible for multimodal logistics in the field of international and national container loads. It is also a freight carrier, container terminal and container depot operator.

3.2.2 Railtel Corp. of India (www.railtelindia.com)

The Railtel Corporation of India is responsible for the modernization of the communication networks, as well as the operating and security systems for the railways. It is also a provider of broadband internet services and reaches rural areas with its communication network.

3.2.3 RITES (www.rites.com)

The consulting company RITES with 2,000 employees and its original focus on railway management now has a comprehensive range of services for transport, infrastructure and related technology areas. It is active internationally with projects in 62 countries (especially in Africa, the Middle East and South America).

3.2.4 Dedicated Freight Corridor Corporation of India Limited (<https://dfccil.com/>)

The Dedicated Freight Corridor Corporation of India Limited is a Public Sector Undertaking corporation run by the government of India's Ministry of Railways to undertake planning, development, and mobilisation of financial resources and construction, maintenance and operation of the "Dedicated Freight Corridors".

3.2.5 Rail Vikas Nigam Ltd. (www.rvnl.org)

The RVNL is 100 % owned by Indian Railways. RVNL is particularly responsible for project development and capital raising in connection with the expansion of the route along the "Golden Quadrilateral" (connection of the 4 metropolises, Delhi, Mumbai, Chennai & Kolkata) and improved port connections.

3.2.6 Mumbai Rail Vikas Corporation (<https://mrvc.indianrailways.gov.in/>)

Mumbai Railway Vikas Corporation Ltd (MRVC Ltd) is a PSU of Ministry of Railways and Government of Maharashtra. MRVC is involved in executing the suburban rail improvement projects under Mumbai Urban Transport Project (MUTP) for enhancing suburban rail transportation capacity. The corporation is also involved in the planning and development of Mumbai Suburban Rail system.

3.2.7 Indian Railway Finance Corporation (www.irfc.nic.in)

IRFC is the finance company of the Ministry of Railways. Their task is to provide partial financing from outside for the projects planned by Indian Railways.

3.2.8 Konkan Railway Corporation Ltd. (www.konkanrailway.com)

Konkan operates as an independent railway company along the west coast of India between Mumbai and Mangalore (Konkan Coast). The construction of this railway line was a technical challenge, it runs through geographically demanding terrain.

3.2.9 IRCTC Indian Railway Catering and Tourism Corporation (www.irctc.co.in)

Indian Railway Catering and Tourism Corporation is a subsidiary of the Indian Railways that handles the catering, tourism and online ticketing operations of the latter, with around 5,50,000 to 6,00,000 bookings everyday.

3.2.10 IRCON International Ltd. (www.ircon.com)

Ircon International Limited, is an engineering and construction organisation, specialized in transport infrastructure. The PSU was established in 1976, by the Government of India. The Ircon is well known for undertaking infrastructure projects, especially in difficult terrains in India and abroad. Ircon has completed over 1650 major infrastructure projects in India and over 900 major projects across the globe in more than 31 countries.

3.2.11 RailTel Corporation of India Ltd. (www.railtelindia.com)

RailTel Corporation a "Mini Ratna (Category-I)" PSU is one of the largest neutral telecom infrastructure providers in the country owning a pan-India optic fiber network on exclusive Right of Way (ROW) along Railway track. The objective of Railtel is to facilitate Railways in expeditious modernizing of train operation, safety systems and network by providing state of art communication network infrastructure.

3.2.12 National Capital Region Transport Corporation (NCRTC) (www.ncrtc.in)

National Capital Region Transport Corporation (NCRTC) – a Joint Sector company of Govt of India and States of Delhi, Haryana, Rajasthan and U.P, under the administrative control of Ministry of Housing and Urban Affairs, is mandated for implementing the Regional Rapid Transit System (RRTS) project across the NCR of India.

3.2.13 National High-Speed Rail Corporation Limited (www.nhsrcl.in)

National High-Speed Rail Corporation Limited (NHSRCL) was incorporated with an objective to finance, construct, maintain and manage the High-Speed Rail Corridor in India. The Special Purpose Vehicle - a joint sector with equity participation by Central Government through Ministry of Railways and Government of Gujarat and Government of Maharashtra.

3.3 The main local manufacturers of railway equipment

3.3.1 Rolling Stock Components

Company	Website
Diesel Loco Modernisation Works (DMW)	https://dmw.indianrailways.gov.in/
Chittaranjan Locomotive Works	https://clw.indianrailways.gov.in/
Diesel Locomotive Works	https://dlw.indianrailways.gov.in/
Modern Coach Factory, Raebareli	https://mcf.indianrailways.gov.in/
Rail Coach Factory, Kapurthala	https://rcf.indianrailways.gov.in/
Rail Wheel Factory	https://rwf.indianrailways.gov.in/
BEML Limited	https://www.bemlindia.in/
Burn Standard Company Limited	http://www.burnstandard.com
Rail Wheel Plant, Bela	https://rwp.indianrailways.gov.in/
Integral Coach Factory	https://icf.indianrailways.gov.in/
Bharat Wagon & Engineering Co. Limited (BWEL)	http://bharatwagon.bih.nic.in/
Braithwaite & Co Limited	https://www.braithwaiteindia.com/
Titagarh Wagons	https://titagarh.in/our-group-companies.php
Jessop & Company Ltd.	https://www.jessop.co.in/
Hindustan Engineering	http://heilindia.com/product.aspx
Jupiter Wagons	http://jupiterwagons.com/
Modern Industries	http://www.modern-industries.co.in/
Jindal Rail Infrastructure Limited	http://www.jindalrail.com/
Texmaco Rail & Engineering Ltd.	https://www.texmaco.in/webfiles/index.html

3.3.2 Track material and service equipment

Company	Website
Elgi Equipments Limited, Coimbatore	www.elgi.com
Jindal Steel & Power Limited, New Delhi	www.jindalsteelpower.com
Simplex Engg. & Foundry Works Ltd., New Delhi	www.simplexengg.in
Speedcrafts Pvt. Ltd., Patna/Bihar	www.speedcraftsindia.com

3.3.3 Signaling and telecommunications equipment

Company	Website
Amara Raja Batteries Ltd.	www.amararaja.net
Exide Industries Ltd.	www.exide4u.com
Aplab Electronics	www.aplab.com
HBL Power Systems Ltd.	www.hbl.in
Siemens India	www.siemens.co.in
Hind Rectifiers Ltd.	www.hirect.com

3.3.4 Electrical Equipment

Company	Website
Best & Crompton Engg. Ltd., Chennai	www.bestcrompton.com
Hind Rectifiers Limited, Mumbai	www.hirect.com
Larsen & Toubro Ltd., Chennai	www.larsentoubro.com
Fedders Lloyd	www.fedderslloyd.com
Medha Servo Drives Pvt.Ltd	www.medhaindia.com

3.4 Foreign Companies in India

3.4.1 Railway Projects

Company	Website
GE Transportation	www.getransportation.com
Knorr-Bremse	www.knorr-bremse.co.in
Koni B.V.	www.koni.com
Servo Corp.	www.servo.com
Timken India	www.timken.com/india
American Torch Tip	www.americantorchtip.com
Blastman Robotics Ltd.	www.blastman.fi
Speno International, S.A.	www.speno.ch
Bombardier Transportation	www.trains.bombardier.com
Siemens	www.siemens.com
ABB	www.abb.com/in
Alcoa Fastening Systems	www.alcoa.com
Alstom Transport	www.transport.alstom.com
Areva	www.areva.com
3M India Ltd.	www.mmm.com
LUCAS-TVS	www.lucastvs.co.in
Motor Industries Co.Ltd	www.boschindia.com
Nencki AG	www.nencki.ch
Nortel Networks	www.nortel.com/corporate/global/asia/india/index.html
EMD Locomotives Technologies Pvt.Ltd	www.emdiesels.com
Faiveley Transport	www.faiveley.com
Lucchini Sidermeccanica SPA	www.lucchini.com
Ansaldo STS	www.ansaldo-sts.com

3.4.2 Metro (U-Bahn) Projects

Company	Website
Kumagai Gumi Co. Ltd. Japan	www.kumagaigumi.co.jp/english
Skanska International Civil Engineering	www.skanska.com
Itochu Corporation, Japan	www.itochu.co.jp/main/index_e.html
Dyckerhoff & Windmann AG, Germany	www.dywidag-international.com/
Shimizu Corporation, Japan	www.shimz.co.jp/english/index.html
Samsung Corporation, Korea	www.samsungcorp.com
Mitsubishi Corporation, Japan	www.mitsubishicorp.com
ROTEM, Korea	www.rotem.co.kr
Mitsubishi Electric Corporation, Japan	https://global.mitsubishielectric.com
Alstom Transport SA, France	www.transport.alstom.com
Alcatel Portugal SA	www.alcatel-lucent.com
Sumitomo Corporation, Japan	www.sumitomocorp.co.jp/en
Dywidag International	www.dywidag-international.com
Cobra, Spain	www.grupocobra.com
ELIOP, Spain	www.eliop.es/
Alcatel CGA Transport, France	www.thalesgroup.com
MVM Rail Pty., Australia	www.mvmrail.com
Veolia Transport	www.veolia-transport.com/en/
Pacific Consultants International, Japan	www.pacific.co.jp
Parsons Brinckerhoff International	www.pbworld.com
Japan Railway Technical Services	www.jarts.or.jp/index_en.html
TONICHI Engineering Consultant, Japan	www.tonichi-c.co.jp
ABB	www.abb.co.in
Bombardier Transportation	www.trains.bombardier.com
CSR Nanjing, China	www.csrgc.com.cn/ens/
Rail One, Germany	www.railone.com

Schindler, Switzerland	www.schindler.com
Leighton, Australia	www.leighton.com.au
Maunsell Consultants, Hong Kong	www.aecom.com
Yachiyo Engineering, Japan	www.yachiyo-eng.co.jp

Construcciones y Auxiliar de Ferrocarriles	https://www.caf.net/en
CSR Zhuzhou	https://www.crrcgc.cc/zjen
Titagarh Firema	https://titagarh.in/our-group-companies
Kawasaki Heavy Industries	https://global.kawasaki.com/
Hitachi	https://www.hitachi-rail.com/

4. TRENDS AND OPPORTUNITIES FOR AUSTRIAN COMPANIES

In the past few years, Indian Railways has taken many initiatives to improve its service. A significant part of the Indian infrastructure, railways has been making investments and taking initiative enabling it to make high growth rates.

4.1 General Trends

Indian Railway handles about 35 % of the total freight transported in the country. As per industry estimates, the cost of rail freight is cheaper than road while being costlier than waterways. However, IR has been losing its share to road transport due to reliability and last-mile factors.

The volume of traffic, however, has more than doubled since 2007. International and domestic freight are already a major strain for the Delhi-Mumbai and Delhi-Kolkata tracks. With the annual growth in freight traffic of 8-10 % as projected by the Ministry of Railways, the pressure will only increase. Passenger traffic can also be expected to increase by 5-8 % annually over the next few years.

The government plans to invest Rs 50 trillion during 2018-30 for the development of railway infrastructure.

4.2 Indian Railways expansion plans

According to the recently announced National Infrastructure Pipeline (NIP), Rs 13.7 trillion worth of investment in the railways is envisioned during 2020-25 which is 12 % of the total infrastructure investment proposed to be made in the country during the period. Seen from the perspective of investments till 2030, railway infrastructure will require funds amounting to Rs 50 trillion. Of the total projects to be implemented in the sector, projects worth Rs 11.97 trillion will be based on EPC (Engineering, Procurement and Construction) mode whereas the rest of the projects worth Rs 1.61 trillion will be on PPP (public-private partnership) basis.

National Rail Plan Vision 2030

The plan aims to create a future-ready railway system by year 2030, a National Rail Plan has been prepared by Indian Railway and the specific aim to increase the share of railways in freight to 45 percent from the current 27 %. Some of the objectives of NRP are – to reduce transit time of freight substantially by increasing average speed of freight trains from present 22Kmph to 50Kmph, identification of new high-speed rail corridors, assessment of the rolling stock requirement, among others.

As part of the National Rail Plan, **Vision 2024** has been launched for accelerated implementation of certain critical projects by 2024. These include 100 % electrification, multitracking of congested routes, upgradation of speed to 160 kmph on Delhi-Howrah and Delhi-Mumbai routes, upgradation of speed to 130kmph on all other Golden Quadrilateral-Golden Diagonal (GQ/GD) routes and elimination of all Level Crossings on all GQ/GD route.

The Vision 2024 document outlines 58 supercritical projects with a total length of 3,750 km worth Rs. 396.63 billion and 68 critical projects with a total length of 6913 km, costing Rs 747,36 billion to be completed by 2024. It targets freight of over 3 billion tonnes by 2030 and over 2000 mt by 2024.

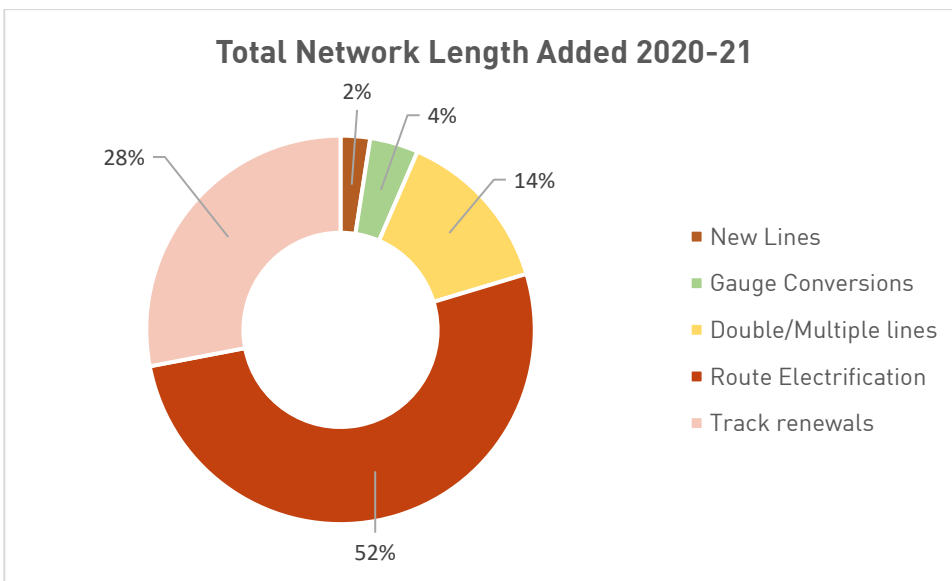
All these projects will provide vast investment opportunities for engineering, procurement, and construction players, rolling stock providers, signalling and telecom players, electrification equipment manufacturers and consultants. There will also be demand for technology and equipment providers.

The private sector could also find opportunities in the development of private freight terminals, rail-based logistics parks, etc., in addition to commercial development around stations, real estate development, multimodal logistics hubs.

4.2.1 Network expansion and decongestion

A total of record 2,904 km of new line/doubling/gauge conversion was achieved in 2021-22 compared to 2,361 km in 2020-21. It is the highest ever commissioning by Indian Railway (excluding DFC).

During 2014-19, track length of 13,124 km has been commissioned which is 173 % of the amount achieved for the 2009-14 period (7,599 km).



As of April 2021, 484 railway projects – comprising 51,165 km of length having an investment of about 7.53 trillion were in different stages of construction.

Key network expansion and rolling stock targets of Indian Railways.

Segment	Details	Target
Electrification	28,000 km	2021-22
New Lines, Gauge conversion, Doubling etc.	3,750 km	2019-20
Coach Manufacturing	21,255 units	2021-22
Electric Locomotives	2,175 units	2021-22

Source: Ministry of Railways

4.2.2 Tracks

New line/doubling/third/fourth line projects

Period	New Line	Day Average	Expenditure (Rs.)
2009-14	7,599 km	4.16 km	115.27 bn
2014-19	13,124 km	7.2 km	260.22 bn
2019-20	3,150 km	-	-

2904 km of new line (including doubling and gauge conversion) was accomplished in 2021-22 compared to 2361 km in 2020-21. During 2021-22 (upto September), 92 track machines were added to the stock of track maintenance machines with Indian Railways, taking the total to 1,178.

Track renewal works are carried out each year to increase train speed and safety

Track Renewals

Period	Target	Actual	Expenditure (Rs.)
2018-19	4,400 km	4,181 km	96.9 bn
2019-20	3,900 km	4,500 km	
2020-21	4,000 km	4363 km	-

Further, IR has set a target of 100 % electrification by 2023 and 80 % of the total broad gauge network (52,247 km) has been electrified as of 1st April 2022.

4.2.3 Bridges

There are about 150,746 railway bridges in the country as of April 2019 and these have increased at a CAGR of 2.1 % from 138,912 bridges in 2014-15. These bridges are inspected twice a year - before the onset of monsoon and afterwards for possible repair works.

4.2.4 Tunnels

Industry research has tracked 1,030 railway tunnel projects in India. It is estimated that by January 2020, 248 km tunnel length has been completed, some 281 km is under development and 131 km has been recently awarded. Of all the completed, ongoing, or awarded projects, Jammu and Kashmir has the highest share at 123 km followed by Uttarakhand with 105 km and Maharashtra with 92 km respectively. Drill and blast method is the most commonly used techniques for tunnels followed by the conventional and New Austrian Tunneling Methods (NATMs) as per this research. Some important tunnelling projects include:

- Udhampur-Srinagar-Baramulla rail-link with 38 tunnels totalling 119 km
- Katra-Banihal with 27 tunnels with one of the tunnels being more than 12 km
- Mumbai-Ahmedabad HSR project involves 21 km tunnel

4.2.5 Rolling Stock

With the introduction of new lines and setting up of freight corridors, the demand for rolling stock is rising rapidly. To meet the growing demand for modern coaches and locomotives, IR has enhanced its rolling stock production. For passenger safety, it has taken the decision in 2014 to switch to Link Hofmann Busch (LHB) coaches from conventional ICF-design ones. During 2018-19 a total of 6,074 coaches were manufactured by IR. LHB coaches with 62 % share are expected to account for the majority of coaches to be produced in 2020-21 and 2021-22. IR will phase out diesel engine locomotives in the coming years and switch completely to electric ones. As per the information given, IR will manufacture 725 electric locomotives each in 2020-21 and 2021-22.

Electric Locomotive production plan (numbers)

Unit	2020-21	2021-22
Chittaranjan LW	340	340
Dankuni	50	50
Diesel LW	275	275
DMW	60	60
Total	725	725

Projected Coach Production (numbers)

Coach Type	2020-21	2021-22
Self-propelled	2,405	2,546
LHB	4,079	4,099
Others	50	50
Total	6,534	6,695

4.2.6 Safety in Train operations

Safety-related expenditure has increased at a CAGR of 14 % from 2014-15 to 2018-19. IR allocated Rs 50 billion to the Rashtriya Rail Suraksha Kosh - its safety fund in 2019-20. The central government has also allocated Rs 200 billion for the fund also. New technologies (e.g., Automatic Block Signalling) are also being added for improved safety standards. IR has registered its best safety record during 2019-20 (April to February) with zero passenger fatalities.

Indian Railways innovation policy - the policy will bring scale and efficiency in the field of operation, maintenance, and infrastructure creation through participation of a very large and untapped startup ecosystem. Through this platform, the startups will get a good opportunity to connect with Railways. Out of over 100 problem statements received from different divisions, zones of Railways, 11 statements like rail fracture, headway reduction etc. have been taken up for phase I of this program. These will be presented before the start ups to find innovative solutions.

4.2.7 Technology trends

Indian Railways has been increasingly becoming more amenable to newer technologies and solutions to improve its operational efficiency. Here are some such solutions:

- deployment of track management systems
- anti-collision devices
- electronic interlocking systems
- predictive maintenance systems
- aerial LiDAR topographic survey technique
- dynamic tamping express machine for track maintenance
- GIS based land asset management systems

4.3 PPP (Public Private Partnership)

Overall, the scope for private sector participation in Railways has been limited due to the very capital-intensive nature of projects and on top of that, such projects take very long to finish.

IR is exploring new sources of generating revenue to fund its projects. The Indian Finance Minister in 2019 announced that the public-private partnership model (PPP) will be used to bring about faster development of the railways including rolling stock manufacturing and the delivery of freight. The use of PPPs has been proposed to ensure faster development in areas such as - completion of tracks, rolling stock manufacturing and delivery of passenger and freight services. In the process of establishing a PPP model to develop the railways, Indian Railways is also planning to select private operators to run the trains on selected routes such Lucknow and New Delhi.

While the government's vision is to rope-in the private sector, it is to be noted, however, that this will happen only when a favourable business climate is created. Experts cite the following areas which need to be addressed on a priority basis given the global experience in public private partnerships

- to consolidate and update the existing PPP guidelines based on the experience gained across different sectors over the recent years as well as best practices in other countries
- an enabling framework to renegotiate concession agreements. Most concession agreements extend to over 20 years and face significant uncertainties around interest rates, traffic volumes, technology-changes, and larger macro-economic and policy-related issues.
- a dispute-resolution process for PPP projects, as long-pending disputes have adverse financial impact and act as a deterrent for private partners.

4.4 Planned major projects by Indian Railways

4.4.1 DFC - Dedicated Freight Corridor

The construction of a freight corridor starts a new chapter in rail freight transport. The first phase of construction will connect the ports of West India with the ports and mines in East India, Delhi and the state of Punjab.

India spends about 15 % of its GDP on logistics, in contrast to an 8 % spend by USA and Germany. Due to inefficiencies in the logistics sector, about \$ 45 billion is lost annually. Given this, the DFC project is both well-timed and much needed.

This project is intended to relieve the existing rail lines, attract investments from industry worth around USD 50 billion and create many jobs.

The construction of this corridor is carried out by a specially founded company (SPV - Special Purpose Vehicle) Dedicated Freight Corridor Corp. of India Ltd. (DFCCIL). Railway operations are handled by Indian Railways.

The DFC project comprises two corridors - the 1,856 km Eastern DFC (EDFC) that runs from Ludhiana to Dankuni and Western DFC (WDFC) from Dadri to JNPT, spanning a length of 1,504 km.

As per the revised figures, the total estimated investment required for the DFC projects is Rs. 1,240 billion.

To finance the west corridor, the Indian government received soft loans worth Rs. 387.22 billion from the Japan International Cooperation Agency in Japan. The World Bank is providing Rs. 124.53 billion funding for the eastern corridor. With overall physical progress of about 70 % as of March 2020, the mega project is expected to be a game changer in the country's logistic sector.

Status of the DFC Project (November 2021)

Corridor	Status
Eastern	
Khurja – Bhaupur stretch 351 km	Commissioned
Bhaupur – Sujatpur 180 km	December 2021
Sujatpur – DDU 222 km	June 2022
DDU - Ganjkhwaja 37 km	December 2021
Ganjkhwaja – Chirailpathu 100 km	Completed
Khurja – Dadri 46 km	December 2021
Pilkhani – Ludhiana 179 km	June 2022
Khurja – Pilkhani 222 km	

Western	
Rewari – Madar 306 km	Commissioned
Madar – Palanpur 353 km	Commissioned
Palanpur – Makarpura 290 km	March 2022
Makarpura – Sachin 135 km	June 2022
Sachin – Vaitarna 186 km	
Vaitarna – JNPT 109 km	
Dadri – Rewari 127 km	March 2022

source: India Infrastructure

Land acquisition is over 99 percent complete in the states of Haryana, Rajasthan, Gujarat, Maharashtra and Uttar Pradesh. Four patches of 0.94 km for the EDFC and five patches of 6.63 km of the WDFC have yet to be acquired.

In addition to EDFC and WDFC, the following four new corridors, with a combined length of about 6,600 km at an investment of INR 3 trillion, are planned.

New Corridors Planned

Corridor	Connecting Cities	Length (km)
East-West Corridor	Kolkata und Mumbai	2,328
North-South Corridor	Delhi und Chennai	2,327
East-West Corridor	Kharagpur und Vijayawada	1,114
Southern Corridor	Chennai und Goa	899

The DFCCIL is currently understood to be firming up its business plan, which includes setting up of multimodal logistics park.

4.4.2 High Speed Rails (HSR)

Indian Railways envisions a high-speed rail (HSR) network along the Diamond Quadrilateral, connecting the cities of Mumbai, Kolkata, Ahmedabad, Delhi, Goa and Chennai, among others. For this purpose, High Speed Rail Corporation (HSRC) Limited was established under Rail Vikas Nigam Ltd. in 2013. Besides fast connectivity, the HSR projects also aim to promote economic development along the corridors.

Mumbai-Ahmedabad HSR is the first such project to be developed by IR, comprising a total length of 509 km stretching from Sabarmati to Mumbai. Japanese government has agreed to provide official development assistance worth Rs 800 billion. The corridor will have a total of 12 stations and will deploy Japan's Shinkansen technology. Currently, 1,248 hectares out of 1,386 hectares of total land required have been acquired. The project has been delayed due to problems related to land acquisition, Covid-19 and contract finalisation. So far, 13 of the total 27 contract packages have been awarded, three are under evaluation and for two packages, tenders have been floated. The project is now expected to be completed by 2026-27.

Feasibility studies are underway for Delhi-Mumbai (1,384 km); Mumbai-Chennai (1,334 km) and Kolkata-Delhi (1,334 km) while feasibility studies are yet to be taken up for Mumbai-Kolkata (1,961 km) and Chennai-Kolkata (1,670 km) are yet to be taken up.

Other upcoming corridors: Some other HSR corridors for which detailed project reports are being prepared are Delhi-Varanasi (865 km), Delhi-Ahmedabad (886 km), Mumbai-Nagpur (753 km), Mumbai-Hyderabad (711 km), Chennai-Mysore (435 km), Delhi-Amritsar (459 km) and Varanashi-Howrah. More destinations are also likely to be connected to the HSR network.

As per reports, Indian Railway is planning four more bullet train corridors to the HSR under the National Rail Plan – Hyderabad – Bengaluru (618 km), Nagpur-Varanasi (855 km), Patna-Guwahati (850 km) and Amritsar-Jammu (190 km).

The success of these projects will depend on their on-time completion, acceptance of the higher fare by the consumers and the process of the land acquisition.

4.4.3 World-class stations, Passenger comfort and commercial use of land

Indian Railways launched the Station Redevelopment Programme in 2015 to develop world-class railway station infrastructure. In 2018, the government approved forming Indian Railway Stations Development Corporation (IRSDC), a special purpose vehicle (SPV) as the nodal agency for station redevelopment. The IRSDC was abruptly shut down in October 2021 and the station development being handled by IRSDC has been transferred to respective railway zones.

Around 600 railway stations in the country have been identified for significant transformation. Fifty train stations have been identified for development in so-called "world-class train stations" - those projects are to be carried out within the framework of public private partnerships (PPPs). Metropolitan train stations like Delhi and Mumbai require world-class passenger comfort and service. The ministry tries to attract investors for this and - similar to airports - allows commercial development outside the company premises. The concession holder is to undertake the construction and maintenance of operating and passenger areas; the income from the development of the property is shared - the project ends when the agreed concession period expires.

Despite the challenges posed by Covid-19, Rani Kamalapati (Habibganj) and Gandhinagar stations - the first air-conditioned railway terminals in India - were inaugurated during 2021.

- Habibganj Station: has been developed on PPP basis with a built-up area of 1.2 mn square feet. This estimated cost for development of this station entailing an investment of Rs 1 billion.
- Gandhinagar Station: has been developed on EPC basis and it will have a 300 room five-star hotel above the station premises entailing a cost of Rs 6.75 billion.

Of the rest, three stations will be on EPC while remaining ones will be on PPP basis. According to the Rail Land Development Authority (RLDA), 40 stations are targeted for development in 2021-22 and another 120 in 2022-23. RLDA is working on 112 stations at present.

Some of the ongoing station redevelopment projects are Chandigarh, Nagpur, Gwalior, Amritsar, Bijwasan, Anand Vihar and Chhatrapati Shivaji Terminus.

Private sector players response has not been very encouraging thus far due to policy uncertainty, the slump in the economy, lack of clarity and operational issues.

4.4.4 Improving Regional Connectivity

National Capital Region Transport Corporation (NCRTC) – a Joint Sector company of Govt of India and States of Delhi, Haryana, Rajasthan and Uttar Pradesh is mandated for implementing the Regional Rapid Transit System (RRTS) project across the National Capital Region, ensuring a balanced and sustainable urban development through better connectivity and access.

Delhi-Meerut Corridor

India's first rapid rail system, which will connect Delhi with Meerut through Ghaziabad is expected to get operational in the first phase by 2023. The total length of the Rapid rail corridor of 82 km is expected to be completed by 2025 and will cost ₹30,274 crore (US\$4.4 billion). The Rapid Rail Transit System (RRTS) is expected to bring down the travel time to around one hour from the current time span of three to four hours by road from Delhi to Meerut with a maximum speed of 160 km/h.

Of the entire length, 68.03 km is elevated, 14.12 km is underground, and 1.45 km will be at grade for connections to two depots that will come up at Duhai, Ghaziabad and Modipuram, Meerut. In densely populated areas of Delhi and Meerut, the route will be underground, including that of the river Yamuna.

The Delhi-Ghaziabad-Meerut RRTS corridor will have a total of 24 stations, including two depot-cum-stations at Duhai and Modipuram.

Recently, the NCRTC has signed agreement with DB India for the operation and maintenance of the RRTS corridor for 12 years.

Delhi-Alwar Corridor

Delhi-Gurugram-Shahjahanpur-Neemrana-Behror (SNB) is the priority section with a stretch of 107 km (71km elevated and 36 km underground). It will consist of 16 stations.

Delhi-Panipat Corridor

The third corridor has a total length of 104 km (93 km elevated, 11 km underground) with 16 stations along the stretch. The estimated cost of investment will be INR 165 billion and is projected to be completed by 2027.

Once operational, the RRTS may prove to be a model that could be replicated in other parts of the country.

4.4.5 Suburban Rail Mobility

Suburban railway systems are key in connecting cities with suburban areas and thus easing life for passengers. Many of the metro cities have well-connected local-train systems but many others do not have dedicated tracks for these. Here are some of the upcoming suburban rail systems:

Bengaluru suburban Rail Network

Bengaluru will have a 148 km long network with 57 stations. The project is planned to be finished in three years. The five lines proposed under the project are:

- KSR Bengaluru Railways Station - Devanahalli 41.4 km
- Balyappanahalli-Chikka Banavara 25.01 km
- Kengeri-Cantonment 18.47 km
- Cantonment-Whitefield 17.05 km and
- Heelalige-Rajanukunte 46.24 km

Expansion of Mumbai Suburban Network

The Mumbai Urban Transport Project (MUTP) is being implemented by the Mumbai Rail Vikas Corporation (MRVC). First phase of the project at the cost of Rs 44.52 billion has been completed. MUTP 2 consisting of 5th and 6th line between Thane and Diva, 5th and 6th line between Kurla and CSMT and 6th line between Mumbai Central and Borivali are being implemented at a cost of Rs. 53 billion. In addition, work is already going on under MUTP 3 (Rs 109.47 billion). Projects worth Rs. 337 billion have been approved already for the Phase IIIA of MUTP for further expansion by 2031.

4.4.3 Electrification and Energy-saving targets

Electricity with 30 % of the operating costs is a major focus area for Indian Railways. Realising that growing electricity consumption has potential for costs saving from electric traction and the reduced carbon footprint, Indian Railways launched Mission 41K in 2015. The target of this mission is to save Rs. 410 billion in electric traction costs by 2025 through an integrated rail energy management system.

Under Mission Electrification (achieving 100 % network electrification), Indian Railways has set a target of electrifying a total of 28,810 km of broad-gauge routes by December 2023. These electrification targets have also increased the demand for additional electric locomotives.

During 2021-22, the progress on electrification was impressive with 6,366 route km being achieved. Out of 65,141 route km of broad-gauge network, 52,247 broad gauge route km has been electrified.

Further, to reduce its carbon footprint, Indian Railways has planned to source about 1,000 MW of solar power under its Solar Mission and 200 MW of wind power. 101.42 MW of solar and about 103 MW of wind power has already been set up. It intends to become a net zero-carbon emitter by 2030.

4.5 Metro Rail – Projects

A boom in the development of metro rail projects in India is not only helping to ease congested streets – but is also generating lucrative business opportunities as the country invests funds to bring its deficient public transport system up to speed.

Delhi Metro is one of the oldest and most successful of the Indian metros. Presently, India has emerged as one of the biggest markets for urban rail-based transportation systems and with the completion of about 500 km under implementation projects, the country will have one of the largest metro rail systems in the world.

The Metro Rail Policy 2017, approved by the Union Cabinet in August 2017, opens a big window for private investments across a range of metro operations making PPP component mandatory for availing central assistance for new metro projects.

To promote the development of metro rail projects, the government provides financial support

- in the form of grants to the states (up to 10 percent of the project cost),
- in the form of 50-50 equity sharing with the state governments, or
- viability gap funding (VGF) to the extent of 20 percent of the capital cost of public transport projects (under the PPP model).

Between 2015-16 and September 2019, the government has released a total of Rs 460.22 billion (EUR 5.8 billion) to various metro rail projects. The PPP mode for funding metro projects has not met with much success so far.

This table lists cities where metro projects are already working, being expanded or where new lines to the existing services are being planned.

Status of Metro Projects in India (in km)

City	Operational	Under Construction	Approved	Proposed New Routes	Planned	Operator
Agra		4	25.4			UPMRCL
Ahmedabad	6	54.1	7.41			GMRC
Aurangabad					60	
Bangalore	55.6	115.86	0	105.55		BMRCL
Bhavnagar Metrilite/Neo						
Bhopal		6.22	21.65	77.13		MPMRCL
Chennai	54.1	83.9	35	15.3		CMRL
Chennai Metrolite					15.5	
Coimbatore					136	
Delhi	348	40.85	24.99	57.3		DMRC
Delhi Metrolite					40.88	
Gorakhpur			27.41			UPMRC
Gurgaon	12.1			200		DMRC
Guwahati					61.4	
Gwalior					105	
Hyderabad	67			58		HMRL
Indore		5.29	26.24	57.18		MPMRCL
Jaipur	11.98			26.36		JMRC
Jammu					43.5	
Kanpur	8.73	4.9	18.68			UPMRCL
Kochi	25	2.94	12.36			KMRL
Kolkata	39.25	56.32	28.2	15.7		Metro Railway & KMRC
Kozhikode			13.13			KRTL
Lucknow	22.9			85		UPMRCL
Ludhiana				28.83		cancelled
Meerut		3	17	15		NCRTC
Mumbai	30.15	150	21.29	136.4		MMOPL, MMRC & MMOCL
Nagpur	24.39	17.3	48.3			Maha Metro
Nashik Metro Neo			32			Maha Metro
Navi Mumbai		11.1		95.3		CIDCO
Noida	29.7		14.95	70		NMRC
Patna		6.1	24.8			PMRC
Prayagraj					42	
Pune	10.35	58.23	4.41	26.46		Maha Metro
Srinagar					25	
Surat		18.62	21.73			GMRC
Thiruvananthapuram			21.82			KRTL
Uttarakhand					58	
Varanasi					29.24	
Vijaywada					66.2	
Visakhapatnam					79.91	
Warangal Metro Neo					17	
Total	745.25	638.73	446.77	1069.51	779.63	

Status as of April 2022

Besides the above cities, metro projects are proposed in Amritsar, Chandigarh, Jalandhar, Jabalpur, Ranchi, Hubli, Mathura, Dholera, Thane, Gwalior, Bareilly, Dehradun, Bhubaneswar, Mysore, Mangalore, and Raipur. Each Indian city and town have a large number of proposed metro lines, most of which might never be implemented.

4.5.1. Current Metro projects

Delhi Metro

The Delhi Metro Rail Corporation Ltd. (www.delhimetrorail.com) was founded in 2002. Delhi Metro operates more than 2,700 journeys on weekdays and its average daily ridership is 4.7 million passengers.

Delhi Metro is an urban Mass Rapid Transit System (MRTS) built with 10 lines and 253 stations to serve Delhi and the National Capital Region (Gurgaon, Noida, and others).

Construction for its 65.1 km Phase I started in 1998 and completed in 2006. Construction on the 124.93 km Phase II was completed in 2011. Except for a small stretch, the 162.495 km Phase III project is almost complete.

DMRC began the bidding process for the construction of the 61.679 km (and growing) Phase IV new lines in mid-2019, and work on its first section started on December 30, 2019. When Phase IV is completed in 2026 (estimated), Delhi's metro network will become approximately 450 km long.

City	Operational	Under construction	Proposed New Routes
Delhi	348	40.85	57.3

Kolkata Metro

Work on the Kolkata Metro Railway - www.kolmetro.com started in 1984 for a very small stretch. Between 1984 and 1995, more sections opened up bringing its total length to 16.45 km.

In the mid 2000's, the metro was extended by 10.94 km to New Garia (Kavi Subhash) Station.

In 2009, construction began on Kolkata Metro's 14.67 km east-west Line-2 from Salt Lake Sector V to Howrah Maidan. The first section of that line opened on February 13, 2020. Further extensions of the line are expected to open between mid-2020 and 2023.

City	Operational	Under construction	Proposed New Routes
Kolkata	39.25	56.32	15.7

Mumbai Metro Rail Projekt (www.mumbaimetro1.com)

Mumbai Metro with 10 lines is an urban Mass Rapid Transit System (MRTS) being built to serve Mumbai, the financial capital of India.

Its development has been entrusted to the Mumbai Metropolitan Region Development Authority (MMRDA), who in 2004 came out with a 146.5 km master plan with multiple lines but has so far only been able to develop 1 metro line in the suburbs connecting Versova – Andheri East – Ghatkopar.

In 2015, a new 118 km master plan was approved, and the push was provided for the development of 2 lines: Dahisar East – Andheri East (Red Line) & Dahisar East – D.N. Nagar (Yellow Line) in addition to the Cuffe Parade – BKC – Aarey Colony (Aqua Line).

In June 2019, a new nodal agency, Maha Mumbai Metro Operations Corporation (MMMOCL), was established for operating and maintaining all Mumbai Metro services on lines owned by MMRDA. In September 2019, the MMRDA unveiled a new 337 km master plan for Maha Mumbai Metro's network consisting of 10 lines (total of 17 sections).

The Delhi Metro Rail Corporation has lent its services as the interim General Consultant for the execution of most lines.

City	Operational	Under construction	Proposed New Routes
Mumbai	11.4	169	136.4

Hyderabad Metro Rail Projekt (<http://hyderabadmetrorail.in/>)

Construction for Hyderabad Metro's 72 km Phase I on the Public-Private Partnership (PPP) model started in April 2012 by its concessionaire, L&T Metro Rail Hyderabad Limited (LTMRHL) and ended in February 2020 when the entire Green Line opened.

Hyderabad Metro's 58 km Phase II is currently in the proposal stage. Its Detailed Project Report (DPR) was submitted to the Telangana government for approval in February 2020.

City	Operational	Under construction	Proposed New Routes
Hyderabad	67		58

Bangalore Metro Rail Corporation Ltd. (www.bmrc.co.in)

Bangalore (Namma) Metro with 2 lines and 40 stations serves Bengaluru, Karnataka's capital and largest city.

Construction for Bangalore Metro Phase I with 42.3 km of stretches began in April 2007. Its first section, connecting Baiyyappanahalli – MG Road opened in 2011. The final section started commercial operations in June 2017.

While the Purple Line's extension to Challaghatta & Green Line's extension to Anjanapura Township will be ready in 2020, the entire phase, including a 13.9 km underground section of the Pink Line, is expected to be ready only by 2024 after which the metro network will become 116.25 km long.

Bangalore Metro's Phase III project with routes totaling 105.55 km is currently on the anvil.

City	Operational	Under construction	Proposed New Routes

Bangalore	42.3	73.92	105.55
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Chennai Metro Rail Project (www.chennaietrorail.gov.in)

Chennai Metro is being built by Chennai Metro Rail Limited (CMRL). Construction on Chennai Metro's Phase I with 45 km commenced in April 2009, with the first section of the Blue Line (Line-1) between Koyambedu – Alandur opening in June 2015. Further sections opened up between 2015-2019, with the final section connecting AG-DMS with Washermenpet opening in February 2019.

The 9 km extension of the blue line (Line-1) as part of the Phase I Extension project, connecting Washermanpet to Wimco Nagar through 8 stations, was inaugurated in February 2021.

Chennai Metro's 118.9 km Phase II project comprising 3 new lines at an estimated cost of Rs. 69,180 crores is awaiting the Central Government's approval.

Of the 118.9 km, 52 km of Line-3 between Madhavaram – Sholinganallur and Line-5's Madhavaram – CMBT, tendering for this mostly underground

City	Operational	Under construction	Proposed New Routes
Chennai	45	9	66.9

Noida - Greater Noida

Noida Metro with 1 line and 21 stations, built by the Noida Metro Rail Corporation (NMRC) connects Delhi to its suburbs of Noida & Greater Noida.

Construction on Noida Metro's 29.7 km elevated Line-1 started in May 2015. This line opened in January 2019 at an estimated project completion cost of Rs. 5,503 crore. In December 2019, the Uttar Pradesh government approved the construction of a 14.95 km extension of Line-1 from Sector 52 to Knowledge Park V with an estimated cost of Rs. 2,682 crore.

More new lines and extension lines are currently being planned.

City	Operational	Under construction	Proposed New Routes
Noida	29.7		70

Kochi (Cochin) Metro Rail Project

Construction for the 25.6 km Kochi Metro Phase IA project connecting Aluva to Pettah with 22 stations started in June 2013. It was opened to the public in June 2017.

In 2014, a 1.92 km eastward extension to Tripunithura from Pettah was approved to be included in Phase I with two new elevated stations. Kochi Metro's Phase II project with a 11.2 km line and 11 stations was approved by

the Kerala government in July 2018 with an estimated cost of Rs 2,310 cr and is currently awaiting the central government's approval and will likely be funded by the Agence Française de Développement (AFD).

City	Operational	Under construction	Proposed New Routes
Kochi	23.8	2.91	

Nagpur Metro Project

Nagpur Metro system is being built by the Maharashtra Metro Rail Corporation Ltd. Construction work on Nagpur Metro's 38.215 km Phase I started in 2015 and is expected to be completed in 2022 with a mix of elevated & ground-level lines.

In January 2019, the Maharashtra government approved the Detailed Project Report, prepared by RITES, for a 48.3 km Phase 2 project comprising of 32 stations.

City	Operational	Under construction	Proposed New Routes
Nagpur	22.9	18.8	

Lucknow Metro

Lucknow Metro is being built in Lucknow by the Uttar Pradesh Metro Rail Corporation Limited (UPMRCL).

Phase I of the project consists of 2 lines totaling 33.976 km. Out of this, Line-1 (22.88 km) is operational while Line-2 is in the planning stage.

Construction for Line-1's 8.5 km elevated 'Priority Corridor' section from Transport Nagar to Lucknow Railway Station (Charbagh) commenced on September 27, 2014. Southern and northern extensions of the line to the airport and Munshipulia opened to the public on March 8, 2019.

In 2017, the Delhi Metro Rail Corporation assisted with preparing the master plan for Lucknow Metro with 6 new routes totaling 74 km.

City	Operational	Under construction	Proposed New Routes
Lucknow	22.9		85

Gurgaon Metro

Gurgaon (Gurugram) Metro or Rapid Metro consists of one metro line with 11 stations developed by Rapid MetroRail Gurgaon (RMRG) led by Infrastructure Leasing & Financial Services Limited (IL&FS).

In Phase I of the project, a 5 km line was built to link the Delhi Metro's Sikanderpur Station (Yellow Line) with DLF Cybercity business district which opened to the public in November 2013.

In Phase II of the project, a further 7 km extension of the line was opened in March 2017.

In October 2019, the Delhi Metro Rail Corporation (DMRC) took over operations of the line after its original operator (RMRG) expressed its inability to run operations due to low footfall and high operational expenditure.

City	Operational	Under construction	Proposed New Routes
Gurgaon	12.1		200

Jaipur Metro Rail Corporation (<http://www.jaipurmetrorail.in>)

Jaipur Metro with one line & 9 stations is a project of Jaipur Metro Rail Corp.Ltd.

Construction work on Jaipur Metro's 9.63 km Phase I (Pink Line) started in 2011 and it was opened in June 2015.

Construction on Jaipur Metro's 2.35 km Phase IB, an underground extension of the Pink Line with two stations, started in January 2014 partially funded through a \$157 million (Rs 969 cr) loan from the Asian Development Bank (ADB). This line started operating from September 2020.

Jaipur Metro's 23 km Phase 2 includes a new orange line which will connect the heart of the city with the Airport and onward to the Sitapura Industrial Area. This line is planned to be built on the Public-Private Partnership (PPP) model and is yet to be approved.

City	Operational	Under construction	Proposed New Routes
Jaipur	9.63	2.35	23.1

Ahmedabad Metro

Ahmedabad Metro is being built by Gujarat Metro Rail Corporation (GMRC) Limited. Construction work on Ahmedabad Metro's Phase I with routes of 39.259 km started in 2015 and is expected to be completed in 2024.

In the Phase II, the 18.522 km Line-2 is planned to be extended northward to connect Mahatma Mandir in Gandhinagar and will feature 1 branch/spur lines to GIFT City.

In February 2019, Union Cabinet approved the construction of a 28.254 km Phase 2 with 2 corridors – a northward extension of Line-2 with a short spur.

City	Operational	Under construction	Proposed New Routes
Ahmedabad	6	33.26	

4.5.2 Under construction

Pune Metro Rail Project

Pune Metro with three lines is under construction in the city of Pune and is being built by Maharashtra Metro Rail Corporation Limited (Maha-Metro) and Pune Metropolitan Region Development Authority (PMRDA).

31.254 km Pune Metro Phase I project's Detailed Project Report (DPR) with 2 metro lines and 29 stations was prepared and submitted by the Delhi Metro Rail Corporation in July 2009, revised in January 2013, August

2014, and finally once again in November 2015 to reflect current prices. The project received final approval from the Union Government in December 2016.

In addition, the Pune Metropolitan Region Development Authority is developing a third line, mostly elevated, connecting Hinjewadi – Civil Court on the public–private partnership (PPP) model.

In September 2019, PMRDA signed a 35-year concession agreement to develop the line with a consortium of TRIL Urban Transport Private Limited (a Tata Group Company), and Siemens Project Ventures GmbH (subsidiary of Siemens Financial Services).

City	Operational	Under construction	Proposed New Routes
Pune		31.25	26.46

Bhopal Metro Rail Project

Bhopal Metro or Bhoj Metro project with two lines and 28 stations is an under-construction project of the Madhya Pradesh Metro Rail Co Limited (MPMRCL).

Bhopal Metro's 105 km master plan envisions six metro lines out of which two lines (line 2 & 5) have been selected for implementation in Phase I. Bhopal Metro's Phase I project's Detailed Project Report (DPR) with routes of 27.87 km was approved by the Central Government in October 2018.

The project is planned to be partly financed through loan from the Asian Development Bank (ADB) and through a 400 million Euro loan from the European Investment Bank (EIB). Construction work on Phase I commenced in January 2019 and is expected to be completed in 2026.

City	Operational	Under construction	Proposed New Routes
Bhopal		6.22	77.13

Kanpur Metro

Kanpur Metro, with two lines and 30 stations, is under construction and being built by the Uttar Pradesh Metro Rail Corporation Limited (UPMRCL). Kanpur Metro Phase I's DPR with 32.385 km of routes was prepared by RITES and approved by the Central Government in February 2019.

The Phase I project will be financed through equity from central as well as state government on a 50-50 basis, and through a EUR 650 million loan from the European Investment Bank (EIB).

Construction work of Line-1's 8.728 km Priority Corridor (IIT Kanpur – Moti Jheel) commenced with piling works on November 15, 2019.

City	Operational	Under construction	Proposed New Routes
Kanpur		8.73	

Indore Metro

Indore Metro is an under-construction metro development project of the Madhya Pradesh Metro Rail Co Limited (MPMRCL). Indore Metro's master plan with 94 kms of routes envisions four metro lines and two spurs criss-crossing the city out of which one line has been selected for implementation in Phase I.

Indore Metro's Phase I project's Detailed Project Report (DPR) with 33.53 km of routes was approved by the Central Government's cabinet in October 2018.

The project will be funded by the Asian Development Bank (ADB) and New Development Bank (NDB) for \$225 million. Construction work commenced in February 2019 and is expected to be completed in 2026.

City	Operational	Under construction	Proposed New Routes
Indore		5.29	57.18

4.5.3 Rolling Stock, Signalling and Financing

Rolling Stock in Metro Rails

In the various metro projects, 4,847 coaches have either been procured or are under procurement at present. Of these 3,446 coaches have been deployed on the operational stretches spanning over 670 km of metro network. Delhi Metro with approximately 347 km of metro length deployed 2,206 coaches. The yet to be delivered 1,401 coaches are for metro networks in Kolkata, Bengaluru, Delhi, Navi Mumbai, Mumbai, Hyderabad, Nagpur, Ahmedabad-Gandhinagar and Chennai.

The size of the metro coach market is set to increase further with the development of new metro projects as well as expansion of existing lines. Light metro projects in Vijayawada and metro projects in Bhopal, Indore, Patna, Agra, Meerut and Kanpur which are about to start, will create a huge market opportunity for rolling stock manufacturers.

Signalling and Train Operations

Metro rail projects in India mainly use automatic train control (ATC) ensuring safety of the trains and directing other train operations. During the past years, these advanced signalling and telecommunications (S&T) systems have become the norm with the majority of under-construction and upcoming projects. The market for these systems has been steadily increasing over the years with a compound annual rate of growth rate of 22.9 %. The market size of this segment was estimated to be about INR 7.5 billion in 2006 which increased to INR 23 billion in 2013 and currently is estimated at INR 29 billion. Till 2008, the market was dominated by Alstom, Thales and Bombardier. Overall, most of the contracts in India have been secured by Alstom, Bombardier and Siemens. Other key companies present here include ABS India, Alcatel Lucent India, Consort Digital, Nippon Signal, Temaco and Valiant Communications.

Financing in the Urban Rail Projects

The joint venture model has been the most dominant in the metro rail sector with both the central and state governments sharing project costs on a 50-50 basis. Delhi, Mumbai (Line 3), Chennai and Nagpur have been funded this way.

The role of private developers has been very limited due to various factors - low financial viability, high capital expenditure and very long payback period. Gurugram, Delhi Airport Express, Hyderabad and Mumbai metro projects were on public-private partnership (PPP) basis.

The major source of income for mass transit projects is fare revenue. With the fares being low in India, these are not sufficient to cover the operating costs. Recently, some metros - notably Delhi, Gurgaon Rapid and Chennai metros have started generating non-fare revenue accounting for over 50 % of the total revenue through innovative measures like train-wrapping and branding of stations.

In India, there is a great potential in capturing value from land and using it to develop infrastructure as has been done in various cities across the world. Although some cities have started it, the potential of value capture financing (VCF) is yet to be realised. The Value Capture Finance Policy Framework was released in 2017 by the government. Additionally, Metro Rail Policy, 2017 also urges the states to adopt VCF measures to mobilise resources for funding.

The role of multilateral agencies including the ADB, the Japan International Cooperation Agency, KfW, the European Investment Bank and Agence Francaise de Developpement have been key in continuously providing financial assistance to Metro projects. Recently, Asian Infrastructure Investment Bank has also started financially supporting metro projects.

4.5.4 Alternative Mobility options

With rapid urbanisation, there has been a huge increase in the number of private vehicles on the road as the efficient public transport in the country lacks. While Metros have become the default option for commuters given the convenience and connectivity they offer in Delhi and Kolkata, these projects are quite investment intensive affairs for non-metro cities. Further, the congested urban areas pose a challenge to the development of metro systems. Additionally, ridership data reveals there is insufficient footfall in many cities (Nagpur, Kochi) and even in some corridors of the Delhi metro. To address this issue, the government is promoting alternative modes of transit. As a result, the central and state governments have been encouraging the development of alternative modes of transit.

Light rail transit system (LRT)

An LRT system is a medium capacity mode of mass rapid transit (MRT) that lies between high-capacity metro rail systems and low-capacity bus services which has so far been not explored in India. However, in July 2019, the Ministry of Housing and Urban Affairs (MoHUA) issued specifications to promote the development of a light urban rail transit system (Metrolite) in urban areas.

MetroLite is a low-cost, low-capacity system intended for 5,000 – 15,000 peak hour peak direction traffic (PHPTD), fully-elevated rapid transit system that offers metro-level of comfort, safety, convenience at 40 % less cost than conventional metro. MetroLite is currently being planned in Jammu & Kashmir, Gorakhpur, and Coimbatore.

MetroNeo is a rubber-tired electric coach powered by an overhead traction system running on a dedicated road-slab. It is intended for smaller cities with upto 8,000 PHPTD and offers comfort, safety, convenience at much less cost than conventional metro. It is currently being planned in Nashik, Warangal, and Dehradun.

With the upcoming light rail project in the capital, the concept will gain momentum in the rest of the country as well.

Monorail

Monorails were first introduced in the country in 2014 in Mumbai. The first phase of 8.26 km of the monorail project from Chembur to Wadala was commissioned in 2014 while the second phase, from Wadala to Gadge Maharaj Chowk was commissioned in March 2019. The entire Chembur Wadala Jacob Circle monorail network stretches over 19.5 km and is the third longest monorail network in the world. The network has the capacity to carry about 200,000 commuters daily and it has lower maintenance costs. However, due to the limited number of suppliers, the future of monorails does not seem as promising.

Tramways

Another very popular and old means of urban transit is trams operating only in Kolkata. Trams are important cost-effective means of public transport. In May 2019, Kolkata's trams underwent a makeover with the aim of combining old-world charm with comfort (air conditioners etc.). The transformation of trams at a cost of Rs 25 million, has opened up the path for the revival of this long forgotten mode of transit.

4.6 Specific supply opportunities for Austrian companies

- Chrome rails and switches
- Optical fiber systems and hardware
- Computer controlled locomotive systems for express trains
- Special vehicles
- Track construction and maintenance
- Technologies for the construction of earthquake-proof railway bridges
- Devices for securing and testing railway bridges
- Geotextiles for railway line renewal
- Railway communication systems (GSMR)
- Escalators and lifts
- Control and security systems
- Access control systems
- Fire retardant material
- Fire alarm and extinguishing equipment
- Tunnel construction
- Civil engineering services.

5. STRENGTHS AND WEAKNESSES OF THE SECTOR

5.1 COVID 19 and Indian Railways

The three waves of COVID-19 saw all economies bear the impact of the COVID-19 pandemic, which was also reflected on the transportation sector, including Indian Railways. Rail freight which had already begun to show signs of marginal decline in the third quarter of 2019-2020 due to the deceleration of growth in core sectors of the economy. The economic impact of this pandemic shall linger much longer than the pandemic itself.

Railways have demonstrated agility and ingenuity to meet new requirements that arose due to COVID-19. It has played a crucial part by stepping up the transportation of goods – such as foodgrains, milk and dairy products, farm produce, medicines etc.; aggregating small parcels and operating parcel cargo trains; transporting critical medical equipment and Personal Protection Equipment (PPE).

Although revenues in 2020-21 were adversely impacted by the pandemic, Indian Railways continued to push ahead with important projects to enable the building of capacity and efficiencies. In July 22, Indian Railways resumed the operation of remaining 500 passenger trains which were stopped in early 2020 to check the spread of Covid-19.

5.2. Strengths and Problems

It is very difficult to gain a foothold in this sector without an Indian partner. Dealing with government agencies requires insider knowledge and regular and persistent on-site follow-up.

Purchase decisions are usually made on the price and not on the quality, maintenance and repair costs are often not taken into account. With metro projects, this situation is a little better.

The path from product launch to sale is long and arduous. Pre-qualification as a potential supplier of goods or services for Indian Railways is the first hurdle. All products must be approved by the RDSO (Research Design & Standards Organization), i.e., suppliers must present their offer to RDSO Lucknow with precise specification of technical specifications and, during this, provide samples for the tests at their own expense and install them at the test points. The testing process can take between six and twelve months.

6. TRADE FAIRS

IREE 2023

International Railway Equipment Exhibition 12.10. – 14.10.2023

New Delhi

W www.ireeindia.com

InnoRail India 2022

International Exhibition & Conference on Innovations in Rail Transportation 17.11. – 19.11.2022

Lucknow

W www.cii.in

Traffic Infratech Expo

16 -18 November 2022

Mumbai

<https://trafficinfratechexpo.com>

India Warehousing Show

14 -16 June 2023

New Delhi

<https://www.indiawarehousingshow.com>

India Warehousing and Logistics Show

1 – 3 December 2022

Mumbai

<https://www.indiawlshow.com>

7. SOURCES

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The Metro Rail Guy: <https://themetrorailguy.com/metro-rail-projects-in-india/>

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