

Industry Research Report on Infrastructure
sector in India
(Water, Waste water, Roads and Railways)

Submitted to
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Table of Contents

1. Economic Outlook	6
1.1 Global Economy outlook.....	6
1.2 Indian Economy Outlook	7
1.3 Investment Trend in infrastructure	10
1.4 Industrial Growth.....	11
1.5 Consumer Price Index (CPI)	12
1.6 Concluding Remarks	14
2. Infrastructure industry in India.....	16
3. Water supply and Waste Water management.....	18
3.1 Overview.....	18
3.2 Regulatory framework for water and waste water Industry in India	22
3.3 Key trends in the water supply and waste water management system in India	24
3.4 Key growth drivers in the water supply and waste water treatment industry.....	25
3.5 Key Risks and challenges in the water supply and waste water industry	27
3.6 Government Initiatives for water supply and waste water management	28
3.7 Recent events in water supply and waste water management	36
3.8 Outlook.....	37
4. Roads and Highway Industry	38
4.1 Overview	38
4.2 Institutional framework for Roads at Central level	39
4.3 National Highways Development Project (NHDP)	40
4.4 NHAI – Authority in Charge for National Highways.....	40
4.5 Policy framework for the infrastructure sector	43
4.6 National Highway.....	46
4.6.1 Electric Toll collection.....	47
4.6.2 Key growth drivers of the sector	47
4.6.3 Key budget announcements for road sector in FY23.....	49
4.6.4 Government Initiatives for Development of Road Infrastructure.....	49
4.6.5 Key trends in Roads sector	52
4.6.6 Recent events in Roads and Highways sector	52
4.6.7 PPP models	53
4.6.8 Major challenges faced by the roads sector	54
4.6.9 Outlook	55
5. Railway and Metro.....	57
5.1 Railways	57
5.2 Metro	62
5.3 Government regulations and initiatives.....	66
5.4 Recent events in Railways sector	67
5.5 Key trends in Railways sector	67
5.6 Opportunities in National Infrastructure Policy for the Railways	68
5.7 PPP in Railways	69
5.8 Key growth drivers.....	70
5.9 Major challenges.....	71

6. Overview of raw material used in Infrastructure industry	73
7. Competitor analysis of key listed players.....	85
8. Overview of Order book.....	89
9. Annexure.....	91

List of Charts

Chart 1: Global Growth Outlook Projections (Real GDP, Y-o-Y change in %)	6
Chart 2: GDP growth trend comparison - India and China (Real GDP, Y-o-Y change in %).....	7
Chart 3: Growth in Per Capita GDP, Income and Final Consumption (Y-o-Y growth in %).....	10
Chart 4: Gross Fixed Capital Formation (GFCF) as % of GDP (At constant prices):	11
Chart 5: Y-o-Y growth in IIP (in %).....	12
Chart 6: Retail Price Inflation in terms of index numbers and Y-o-Y Growth in % (Base: 2011-12=100) .	12
Chart 7: Core CPI (Y-o-Y Growth in %)	14
Chart 8: Rural Households given tap water connections (cumulative)	20
Chart 9: Sewage generation and treatment capacities (MLD)	21
Chart 10: Number of HouseHolds with tap water connection	29
Chart 11: Decrease in water borne disease.....	32
Chart 12: Schools provided with tap water supply	33
Chart 13: Length of Highway constructed in India.....	46
Chart 14: Rate of Highway construction per day	46
Chart 15: FASTag Toll Collection continues to rise.....	47
Chart 16: Road Projects Awarded and Constructed	48
Chart 17: Budget Allocation for the Ministry of Road Transport and Highways	49
Chart 18: Phasing Under NMP	56
Chart 19: Passenger Traffic	58
Chart 20: Freight Traffic	59
Chart 21: Metro Passenger Traffic.....	64
Chart 22: Sector-wise break-up of capital expenditure of ₹111 Trillion during fiscal 2020-25.....	68
Chart 23: Movement in Raw material prices.....	71
Chart 24:Cement production (MT).....	73
Chart 25: Cement consumption (MT).....	74
Chart 26: International Coal Prices.....	75
Chart 27: Average Sales Price of Limestone	75
Chart 28: Cement Consumption Estimates	76
Chart 29: India's finished steel production and consumption.....	77
Chart 30: Domestic average finished steel prices	78

Table 31: Consumption of finished steel products (in '000 tonnes)	79
Table 32: Domestic average price of Poly Vinyl Chloride	81
Table 33: Performance Indicators for steel pipes and tubes industry (in '000 tonnes).....	81
Chart 34: Price movement of crude oil	84

List of Tables

Table 1: RBI's GDP Growth Outlook (Y-o-Y %)	8
Table 2: Sectoral Growth (Y-o-Y % Growth) - at Constant Prices	8
Table 3: Component wise retail inflation (Y-o-Y growth in %).....	13
Table 4: Breakup of Road Network.....	38
Table 5: Completion status of NHDP Phases December 2020	40
Table 6: NHA Source of Funds (Rs. Billion)	41
Table 7: NHA Application of Funds (Rs. Billion)	41
Table 8: Details of metro link being built/under construction (as on August, 2022)	65

1. Economic Outlook

1.1 Global Economy outlook

As per the International Monetary Fund (IMF)'s World Economic Outlook growth projections released in January 2023, global economic growth estimate for CY22 slashed to 3.4% citing disruptions due to the Russia-Ukraine conflict and higher-than-expected inflation worldwide. The CY23 is projected to slow down further to 2.9% mainly due to tightening global financial conditions, expectations of steeper interest rate hikes by major central banks to fight inflation, a sharper slowdown in China and spillover effects from the war in Ukraine with gas supplies from Russia to Europe tightening. The CY24 is projected to pick up by 3.1% with expected gradual recovery from the effects of the war in Ukraine and subsiding of inflation. For the next 5 years, the IMF projects world economy growth between 2.6%-3.3% on year on year (Y-o-Y) basis.

IMF revises the GDP growth outlook considering uncertainties relating to global inflation

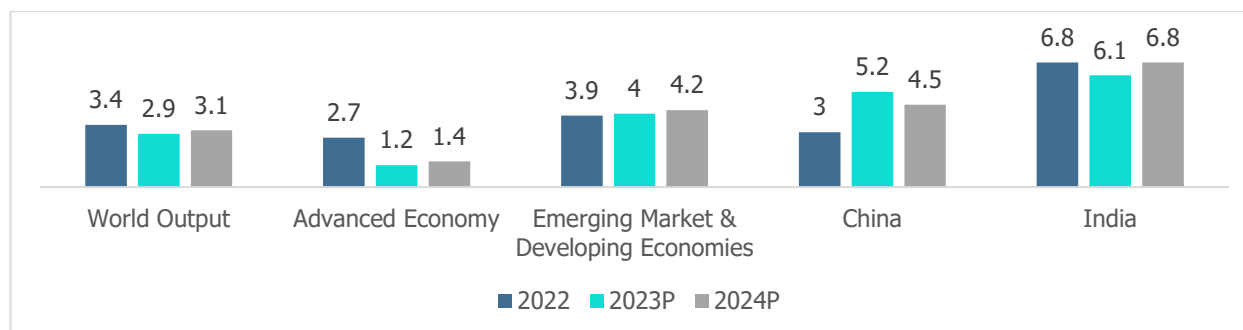
Advanced Economies Group

For the major Advanced economies group, the GDP growth is estimated to be 2.7% in CY22 which further projected to be declined to 1.2% in CY23. This forecast of low growth reflects rise in central bank to fight inflation and the war in Ukraine. About 90% of advanced economies are projected to see decline in growth in CY23. This growth is expected to rebound in CY24 and projected to be 1.4% in CY24.

One of the major countries from this group is United States. The growth for United States is estimated to be 2% for CY22. Whereas, growth for CY23 and CY24 is projected at 1.4% and 1% respectively. This is reflective of declining real disposable income impacting consumer demand with higher interest rates taking toll on spending.

Recovery in tourism related services and industrial production in Italy and Spain, Russian gas supply cuts, tighter financial conditions, with rapidly rising policy rate growth for CY22 in Euro Area is estimated to be 3.5%. However, the boost from reopening of economy after pandemic appears to be fading. For CY23 and CY24, the growth is projected at 0.7% and 1.6% respectively. With inflation at about 10% or above in several euro area countries and the United Kingdom, household budgets remain stretched. The accelerated pace of rate increases by the Bank of England and the European Central Bank is tightening financial conditions and cooling demand in the housing sector and beyond.

Chart 1: Global Growth Outlook Projections (Real GDP, Y-o-Y change in %)



Notes: P-Projection

*For India, data and forecasts are presented on a fiscal year basis and GDP from 2011 onward is based on GDP at market prices with fiscal year 2011/12 as a base year.

Source: IMF – World Economic Outlook, October-2022

Emerging market and developing economies group

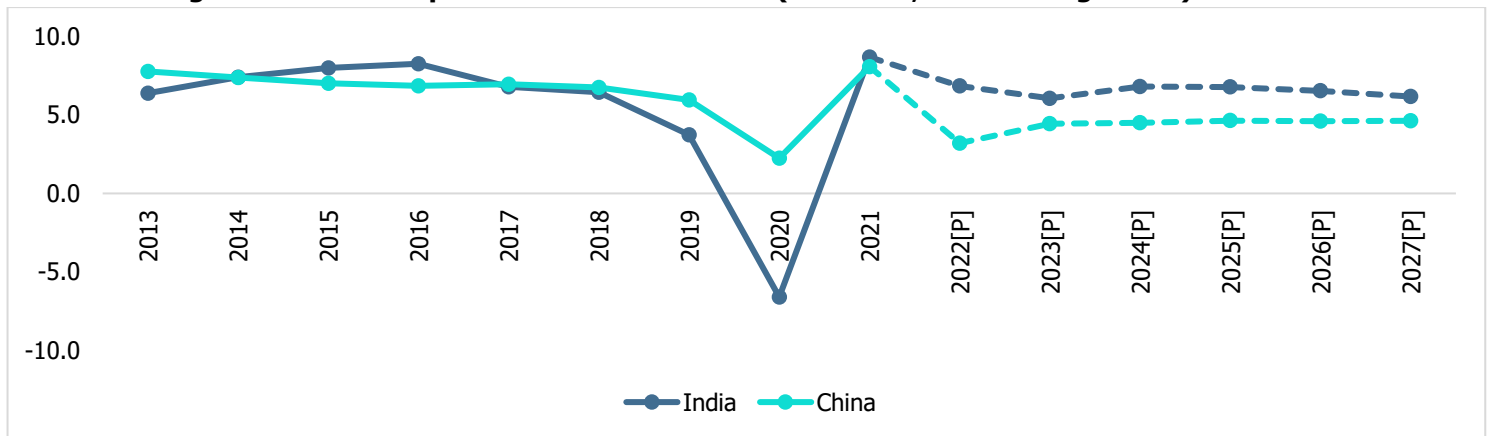
For the Emerging market and developing economies group, GDP growth is estimated to rise modestly to 3.9% in CY22 with further projected growth of 4.0% in CY23 and 4.2% in CY24. Growth is expected to pick up in China with the full reopening in CY23 with 5.2%. Overall, the expected growth in CY24 is mainly on account of anticipated gradual recovery.

The estimates for India's GDP growth have been made at 6.8% in CY22. While, projection for CY23 stands at 6.1% and 6.8% for CY24 with resilient domestic demand despite external headwinds.

India to remain fastest growing economy transcending China

Despite of the turmoil in last two-three years, India bears good tidings for becoming USD 5 trillion economy by CY27. According to the IMF dataset on Gross Domestic Product (GDP) at current prices for India, the current GDP is estimated to be at USD 3.5 trillion for CY22 and projected to be at USD 5.5 trillion by CY27. The expected GDP growth rate of India for coming years is almost double as that of world economy.

Chart 2: GDP growth trend comparison - India and China (Real GDP, Y-o-Y change in %)



P- Projections; Source: IMF, World Economic Outlook Database (October 2022)

Besides this, India stands out as the fastest growing economy amongst the major economies. Outshining the growth rate of China, the Indian economy is expected to grow at more than 6% rate in the period of CY23-CY27.

Indian economy is paving its way towards becoming largest economy in the world. Currently, India is the third largest economy globally in terms of Purchasing Power Parity (PPP) with ~7% share in global economy with China [~18%] on the top and United states [~15%] being second. Purchasing Power Parity is an economy performance indicator denoting price of an average basket of goods and services that a household needs for livelihood in each country. In spite of the pandemic and the geo-political tensions in Europe, India has been one of the major contributors to world economic growth.

1.2 Indian Economy Outlook

Resilience to external shocks remains critical for near-term outlook

In broader sense, the pandemic resulted to 6.6% of negative growth for the Indian economy in FY21. The Indian economy bounced back strongly in Q1FY22 with 20.1% y-o-y growth due to lower base effect. The easing of lockdowns and restrictions across states since June coupled with the decline in Covid-19 cases and higher vaccination rate facilitated higher economic activity as reflected in the GDP for the Q2FY22, which grew annually by 8.4%. The dip in Q3FY22 of 5.4% can be attributed to the fading base effect. India's economy recorded modest growth of 4.1% in Q4FY22, down from 5.4% in the previous

quarter. The economy was hit by the third wave of Covid-19 pandemic during the quarter. Global supply bottlenecks due to the Russia-Ukraine dispute and higher input costs slowed down the pace of recovery in the last quarter. Overall, India is expected to have witnessed 8.7% growth in FY22.

In Q1FY23, India recorded 13.5% growth in GDP which can largely be attributed better performance by agriculture and services sectors. Following to this double-digit growth, Q2FY23 witnessed 6.3% growth. This slowdown in growth compared to the previous quarter can be accounted to the normalization of the base and a contraction in the manufacturing sector's output. Prospectively, the announcements in the Union Budget 2022-23 on boosting public infrastructure through enhanced capital expenditure are expected to augment growth and crowd in private investment through large multiplier effects in FY23. However, heightened inflationary pressures and resultant policy tightening may pose risk to the growth potential.

GDP growth outlook

Table 1: RBI's GDP Growth Outlook (Y-o-Y %)

FY23 (complete year)	FY24 (complete year)	Q1FY24	Q2FY24	Q3FY24	Q4FY24
6.8	6.4	7.8	6.2	6.0	5.8

Source: RBI press release dated December 21, 2022

With stronger prospects for agricultural and allied activities, rural demand is likely to boost. The rebound in contact-intensive sectors and discretionary spending is expected to support urban consumption. Strong credit growth, resilient financial markets, and the Government's continued thrust on capital spending and infrastructure create a congenial environment for investment. On the other hand, external demand is likely to be dented by a slowdown in global activity, with adverse implications for exports.

Taking all these factors into consideration, in February 2023, the RBI in its bi-monthly monetary policy meeting estimated the real GDP growth to be at 6.4% for FY24.

Gross Value Added (GVA)

Gross value added (GVA) is the measure of the value of goods and services produced in an economy. GVA gives a picture of supply side whereas GDP represents consumption.

Industry and Services sector leading the recovery charge

- The gap between GDP and GVA growth has turned positive in FY22 (after a gap of two years) as a result of robust tax collections. Of the three major sector heads, service sector has been fastest growing sector in the last 5 years.

Table 2: Sectoral Growth (Y-o-Y % Growth) - at Constant Prices

At constant Prices	FY18	FY19	FY20	FY21	FY22	FY23 (AE)	Q1FY23	Q2FY23
Agriculture, forestry & fishing	6.6	2.1	5.5	3.3	3.0	3.5	4.5	4.6
Industry	5.9	5.3	-1.4	-3.3	10.3	4.1	8.6	-0.8
Mining & quarrying	-5.6	-0.8	-1.5	-8.6	11.5	2.4	6.5	-2.8

At constant Prices	FY18	FY19	FY20	FY21	FY22	FY23 (AE)	Q1FY23	Q2FY23
Manufacturing	7.5	5.4	-2.9	-0.6	9.9	1.6	4.8	-4.3
Electricity, gas, water supply & other utility services	10.6	7.9	2.2	-3.6	7.5	9.0	14.7	5.6
Construction	5.2	6.5	1.2	-7.3	11.5	9.1	16.8	6.6
Services	6.3	7.2	6.3	-7.8	8.4	9.1	17.6	9.3
Trade, hotels, transport, communication & broadcasting	10.3	7.2	5.9	-20.2	11.1	13.7	25.7	14.7
Financial, real estate & professional services	1.8	7.0	6.7	2.2	4.2	6.4	9.2	7.2
Public administration, defence and other services	8.3	7.5	6.3	-5.5	12.6	7.9	26.3	6.5
GVA at Basic Price	6.2	5.8	3.8	-4.8	8.1	6.7	12.7	5.6
At constant Prices	FY18	FY19	FY20	FY21	FY22	FY23 (AE)	Q1FY23	Q2FY23
Agriculture, forestry & fishing	6.6	2.1	5.5	3.3	3.0	3.5	4.5	4.6
Industry	5.9	5.3	-1.4	-3.3	10.3	4.1	8.6	-0.8
Mining & quarrying	-5.6	-0.8	-1.5	-8.6	11.5	2.4	6.5	-2.8
Manufacturing	7.5	5.4	-2.9	-0.6	9.9	1.6	4.8	-4.3
Electricity, gas, water supply & other utility services	10.6	7.9	2.2	-3.6	7.5	9.0	14.7	5.6
Construction	5.2	6.5	1.2	-7.3	11.5	9.1	16.8	6.6
Services	6.3	7.2	6.3	-7.8	8.4	9.1	17.6	9.3
Trade, hotels, transport, communication & broadcasting	10.3	7.2	5.9	-20.2	11.1	13.7	25.7	14.7
Financial, real estate & professional services	1.8	7.0	6.7	2.2	4.2	6.4	9.2	7.2
Public administration, defence and other services	8.3	7.5	6.3	-5.5	12.6	7.9	26.3	6.5
GVA at Basic Price	6.2	5.8	3.8	-4.8	8.1	6.7	12.7	5.6
At constant Prices	FY18	FY19	FY20	FY21	FY22	FY23 (AE)	Q1FY23	Q2FY23
Agriculture, forestry & fishing	6.6	2.1	5.5	3.3	3.0	3.5	4.5	4.6
Industry	5.9	5.3	-1.4	-3.3	10.3	4.1	8.6	-0.8
Mining & quarrying	-5.6	-0.8	-1.5	-8.6	11.5	2.4	6.5	-2.8
Manufacturing	7.5	5.4	-2.9	-0.6	9.9	1.6	4.8	-4.3
Electricity, gas, water supply & other utility services	10.6	7.9	2.2	-3.6	7.5	9.0	14.7	5.6
Construction	5.2	6.5	1.2	-7.3	11.5	9.1	16.8	6.6
Services	6.3	7.2	6.3	-7.8	8.4	9.1	17.6	9.3
Trade, hotels, transport, communication & broadcasting	10.3	7.2	5.9	-20.2	11.1	13.7	25.7	14.7

At constant Prices	FY18	FY19	FY20	FY21	FY22	FY23 (AE)	Q1FY23	Q2FY23
Financial, real estate & professional services	1.8	7.0	6.7	2.2	4.2	6.4	9.2	7.2
Public administration, defence and other services	8.3	7.5	6.3	-5.5	12.6	7.9	26.3	6.5
GVA at Basic Price	6.2	5.8	3.8	-4.8	8.1	6.7	12.7	5.6

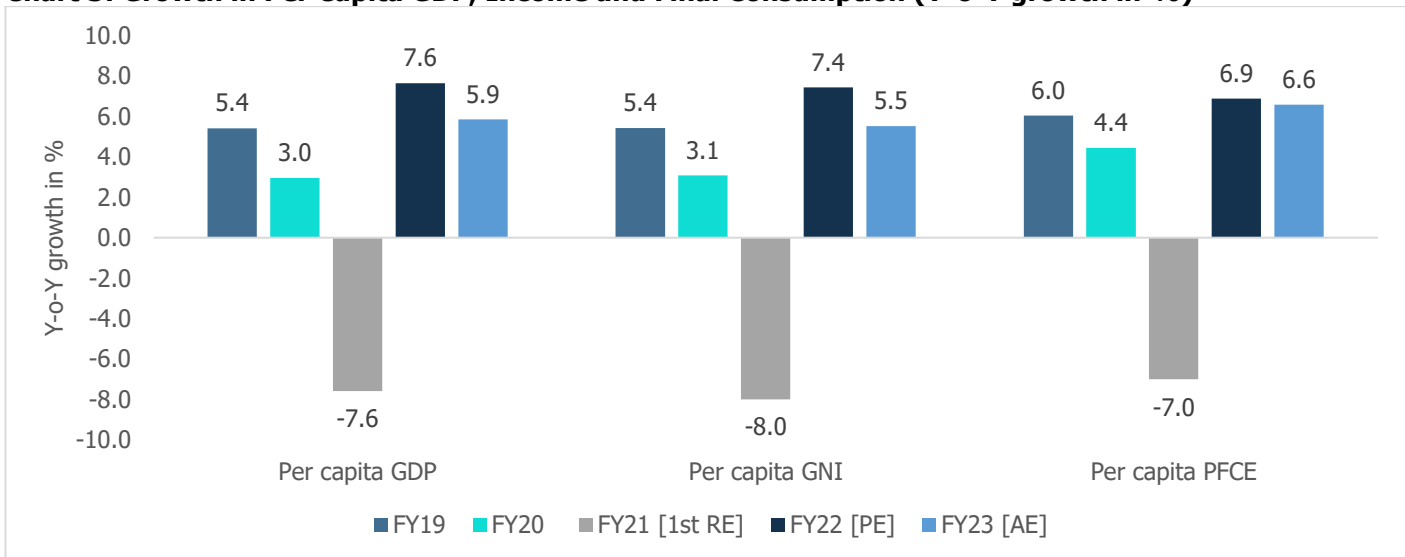
Source: MOSPI

Per Capita GDP, Income and Final Consumption

India has a population of about 1.3 Billion with a young demographic profile. (Source: MOSPI). The advantages associated with this demographic profile are better economic growth, rapid industrialization and urbanization.

GDP per capita is a measure of a country's economic output per person. FY21 witnessed a significant slowdown due to the pandemic and FY22 witnessed recover. For the FY23, GDP per capita is estimated to grow by 5.9%. The Gross National Income ("GNI") is also estimated to increase by 5.5% in FY23. The per capita private final consumption expenditure ("PFCE"), that represents consumer spending, is likely to increase by 6.6% in FY23. Majorly, the FY23 reflects normalization in per capita growth.

Chart 3: Growth in Per Capita GDP, Income and Final Consumption (Y-o-Y growth in %)

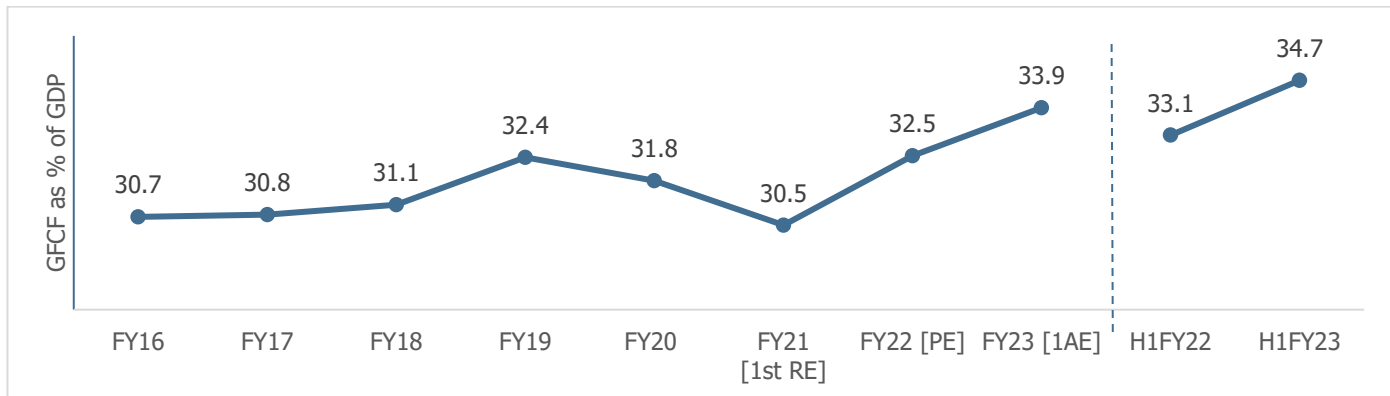


Source: MOSPI

1.3 Investment Trend in infrastructure

Gross Fixed Capital Formation (GFCF) which is a measure of the net increase in physical asset, is estimated to have made an improvement in FY22. As a proportion of GDP, it is estimated to be at 32.5%, which is the second highest level in 7 years (since FY15). In FY23, the ratio of investment (GFCE) to GDP inched up to its highest in the last decade with 33.9% as per the advanced estimate released.

Chart 4: Gross Fixed Capital Formation (GFCF) as % of GDP (At constant prices):



PE: Provisional Estimates, RE: Revised Estimate, AE: Advanced Estimate; Source: MOSPI

Overall, support of public investment in infrastructure is likely to gain traction from the ethos of Atmanirbhar Bharat.

1.4 Industrial Growth

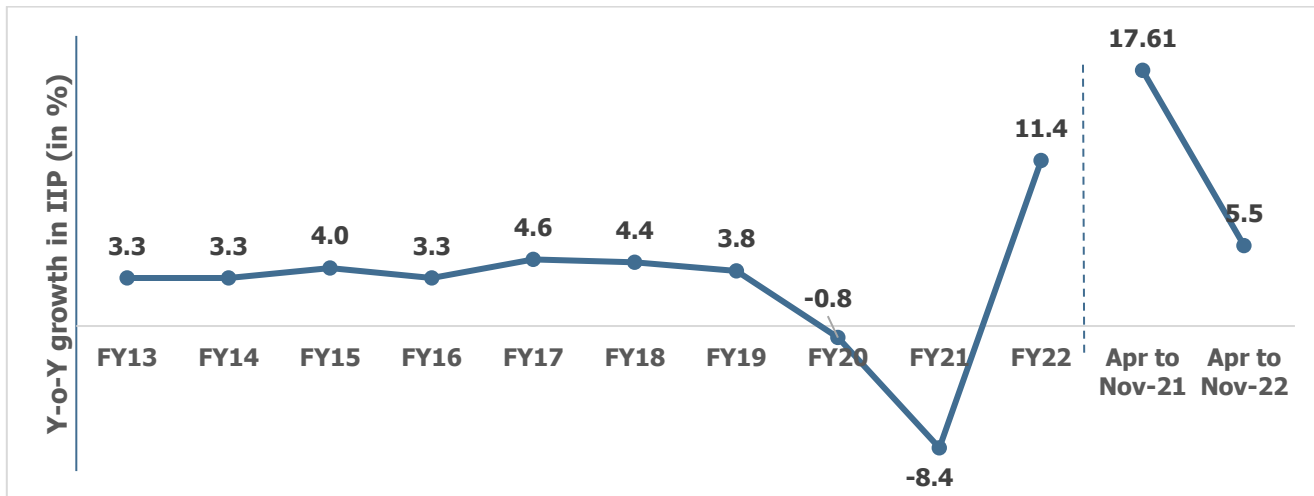
Improved core sector and capital goods sector helps in IIP pickup

Index of Industrial Production (IIP) is an index to track manufacturing activity in an economy.

On a cumulative basis, IIP grew by 11.4% in FY22. However, this high growth is mainly backed by a low base of FY21. FY22 IIP was higher by 2.0% when compared with the pre-pandemic level of FY20, indicating that while economic recovery is underway, it is still very nascent.

Moreover, in this current year, IIP registered 5.5% growth for the cumulative period April – November 2022. This growth is supported by favorable base and momentum effect. Going ahead, it will be critical for the current growth momentum in the industrial sector to be maintained. In the environment of global slowdown, maintaining growth in Industrial output will depend on the resilience and momentum of domestic demand recovery. Healthy credit growth and moderating inflation in the economy is likely to be supportive of domestic consumption demand in the months to come. Pick up in the investment demand is also expected to be supportive of segments like capital goods and infrastructure. However, industrial sector might feel the pinch of global slowdown as reflected by contraction in the export dependent sectors.

Chart 5: Y-o-Y growth in IIP (in %)



Source: MOSPI

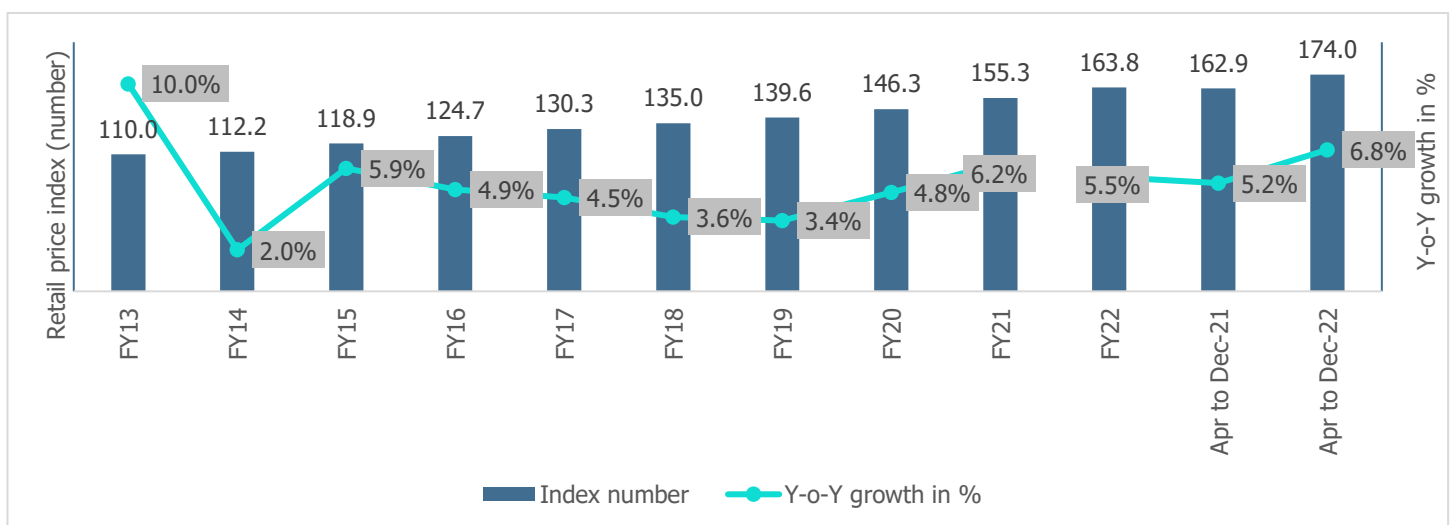
Going ahead, moderating inflation in the economy is likely to be supportive of domestic demand in the months to come. Easing of global commodity prices is also expected to aid the manufacturing sector in the coming quarter by reducing the input cost.

1.5 Consumer Price Index (CPI)

CPI continues to remain uncomfortably high

Inflation has reappeared as a global issue in both advanced and emerging economies. India's retail price inflation stood at 5.5% in FY22 which is within the targeted tolerance band of 6%. The consumer inflation started to upswing from October 2021 onwards. As per the monthly numbers, the inflation rate reached the tolerance level of 6% in January 2022. Following this, the month of March 2022 registered 6.9% rate.

Chart 6: Retail Price Inflation in terms of index numbers and Y-o-Y Growth in % (Base: 2011-12=100)



Source: MOSPI

Consecutively, during the cumulative period of April 2022 – December 2022, the inflation rate remained above the RBI's tolerance level, surpassing the band of 6.8%. The retail inflation eased low of 5.7% in December 2022 retreating back into the RBI's tolerance band for the second consecutive month after 5.9% in previous month. The moderation in inflation, primarily in food inflation is comforting but it is mostly led by vegetables which are susceptible to weather fluctuations.

The CPI is primarily factored in by RBI while preparing their bi-monthly monetary policy. At the bi-monthly meeting held in December 2022, RBI projected inflation to be at 6.7% for FY23. For the Q3FY23 projections were made at 6.6% and for Q4FY23 at 5.9%. Entering into FY24, CPI inflation for Q1FY24 is projected at 5% and for Q2FY24 at 5.4%.

Table 3: Component wise retail inflation (Y-o-Y growth in %)

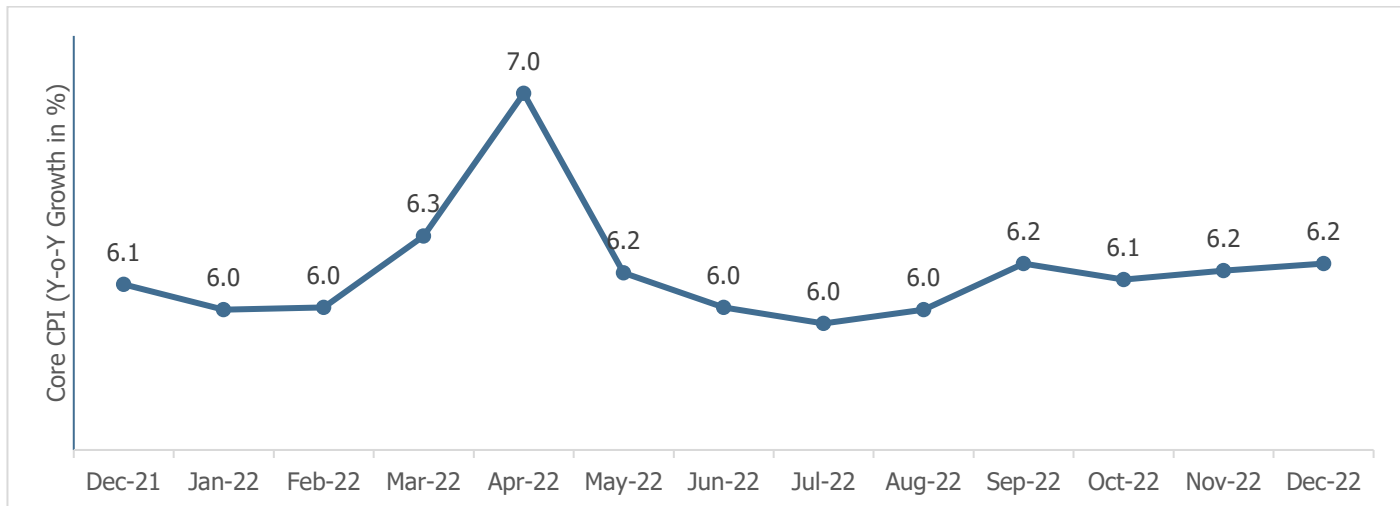
	Food and Beverages	Pan, tobacco and intoxicants	Clothing & footwear	Housing	Fuel & light	Miscellaneous
Weight	45.9	2.4	6.5	10.1	6.8	28.3
Dec-21	4.5	3.2	8.3	8.6	8.3	6.7
Jan-22	5.6	2.5	8.8	9.5	8.8	6.5
Feb-22	5.9	2.4	8.6	10.1	8.9	6.5
Mar-22	7.4	2.9	9.1	11.3	9.4	7.0
Apr-22	8.1	2.7	9.5	12.1	9.9	8.0
May-22	7.8	1.2	8.5	10.7	8.9	6.8
June-22	7.6	1.8	9.2	11.9	9.5	6.3
July-22	6.7	1.8	9.5	11.9	9.9	5.9
Aug-22	7.6	1.7	9.6	11.9	9.9	6.0
Sep-22	8.4	1.9	9.9	12.2	10.2	6.1
Oct-22	7.0	1.9	9.8	12.1	10.2	5.9
Nov-22	5.1	2.1	9.6	11.9	9.8	6.0
Dec-22	4.6	2.6	9.2	11.5	9.6	6.2

Source: MOSPI, CareEdge Research

Core CPI

Core inflation (which excludes volatile components, such as food and energy prices) eased out but was still close to the 6.2% mark, indicating that inflation has become broad-based.

Chart 7: Core CPI (Y-o-Y Growth in %)



Source: MOSPI and CareEdge Research

RBI tightening the monetary policy to tame inflation

RBI hiked its policy repo rate by 35 basis points (bps) to 6.25% in a meeting held between 5-7 December 2022. RBI maintained the liquidity adjustment facility (LAF) corridor by adjusting the standing deposit facility (SDF) rate at 6.00% as the floor and the marginal standing facility (MSF) at the upper end of the band at 6.50%.

RBI continued to maintain its stance as accommodative.

The consecutive rate hike by the RBI has come against the backdrop of intensifying inflationary pressures in the global and domestic economies. With the US dollar index appreciation to a two decade high in July 2022, both advanced and emerging economies witnessed weakening of their currencies against the US dollar. RBI foresees this could lead to imported inflationary pressure. With domestic economic activities gaining traction, RBI has shifted gear to prioritize controlling inflation. RBI continues to remain focused on withdrawal of accommodation to ensure that inflation remains within the target going forward, while supporting growth.

1.6 Concluding Remarks

Despite the global growth uncertainties, Indian economy is relatively better placed. The major headwinds to economic growth are escalating geopolitical tensions, volatility in global commodity prices and shortages of key inputs. However, the bright spots for the economy are continued healthy demand, support from Government capital expenditure and improving business confidence. Various high-frequency growth indicators including purchasing managers index, auto sales, bank credit, GST collections have shown improvement in the first few months of FY23.

Despite high food and fuel inflation pressure, the normalizing employment situation after the opening up of economy is expected to improve and provide support to consumption expenditure.

Public investment is expected to exhibit healthy growth as the Government has budgeted for strong capital expenditure in FY23. The private sector's intent to invest is also showing improvement as per the data on new investment projects announced. However, the volatility in commodity prices and the economic uncertainties emanating from global turbulence is likely to slow down the pick-up in the private capex and investment cycle.

Among sectors, the industrial segment is expected to be negatively impacted due to high input prices. Nonetheless, with flagship programmes like 'Make in India' and the Production Linked Incentive (PLI) schemes, the Government is continuing to provide the support to boost the industrial sector. Service sector are expected to see a bounce back in FY23 with good economic revival and growth. However, in the services sector, some segments like Information Technology would feel the pinch of slowdown in the US and European economy.

2. Infrastructure industry in India

Infrastructure sector is a key driver for the Indian economy. The sector is highly responsible for propelling India's overall development and enjoys intense focus from the Government for initiating policies that would ensure time-bound creation of world class infrastructure in the country. Infrastructure sector includes power, bridges, dams, roads, and urban infrastructure. In other words, infrastructure sector acts as a catalyst for India's economic growth as it drives the growth of the allied sectors like townships, housing, built-up infrastructure and construction development projects.

In order to become a US\$ 5 trillion economy by 2025, infrastructure development is the need of the hour. The Government has launched the National Infrastructure Pipeline (NIP) combined with other initiatives such as 'Make in India' and the production-linked incentives (PLI) scheme to augment the growth of infrastructure sector. Historically, more than 80% of the country's infrastructure spending has gone towards funding for transportation, electricity and water & irrigation. Centre's share in NIP is 39% whereas, State and Private sector's share is 39% and 22% respectively.

Under NIP, investment in Energy sector will be ₹25,000 Billion, ₹20,000 Billion in Roads, ₹16,000 Billion in Irrigation, rural, agriculture and food processing, ₹16,000 Billion in Mobility, ₹14,000 Billion in Railways, ₹3,200 Billion in Digital Infrastructure and ₹2,500 Billion in Ports & Airports.

While these sectors still remain the key focus, the Government has also started to focus on other sectors as India's environment and demographics are evolving. There is a need for enhanced and improved delivery across the whole infrastructure range, from housing to water and sanitation services to digital and transportation demands, which will assure economic growth, increase quality of life and boost sectoral competitiveness.

Some recent investments & Government initiatives in the Infrastructure sector in India:

- In June 2022, Minister of Road Transport and Highways (MoRTH), launched 15 national highway projects worth ₹13.58 Billion in Patna and Hajipur, Bihar
- MoRTH, launched 19 National Highway projects in Rajasthan and Haryana in March 2022, investing a total of ₹14.07 Billion
- The Asian Development Bank (ADB) approved a loan in November 2021 for US\$ 250 Million to support the National Industrial Corridor Development Program (NICDP). This is a portion of the US\$ 500 Million loan for constructing 11 industrial corridors connecting 17 states
- With the launch of the "Infrastructure for the Resilient Island States" initiative in November 2021, India will have a significant opportunity to improve the lives of other vulnerable nations around the globe
- Dubai and the Indian Government signed a contract in October 2021 to build infrastructure in Jammu and Kashmir, including industrial parks, IT towers, multipurpose towers, logistics centres, medical colleges, and specialized hospitals
- Road construction was accelerated in FY22 as a result of Government initiatives like the NIP, National Monetization Pipeline and Bharatmala Pariyojana
- For reform-based and result-linked fresh electricity distribution, the Government declared ₹ 3,059.84 Billion scheme over the next five years

- The Mega Investment Textiles Parks (MITRA) scheme was introduced to create seven textile parks over three years and world-class infrastructure for the textile industry
- The Ministry of Railways intends to monetize a number of assets, including the Eastern and Western Dedicated Freight Corridors once they have been put into service, the introduction of 150 modern rakes via public private partnership (PPP), station renovation via PPP, railway land parcels, multifunctional complexes (MFC), railway colonies, hill railways, and stadiums

3. Water supply and Waste Water management

3.1 Overview

India is the world's second most populous country with 1.39 Billion people. Out of this, 65% of the population lives in rural areas and 35% are connected to the urban centres according to United Nations (2019). The metropolitan cities of the country are seeing major expansion as a result of economic expansions and reforms. This expansion in urban population is unsustainable without efficient planning of cities and provision of utility services especially clean and affordable water. Water allocation in cities is usually done from common pool with multiple sectoral demand.

India has a challenge of serving 18% of the world population with 4% of the world's fresh water resources. Currently, India stores less than one-tenth of the annual rainfall and is designated to be a water stressed nation. Disproportionate use of water for agricultural use, excessive ground water pumping and deficient monsoon in the last couple of years make the demand-supply balance more critical. India is facing water crisis with around 50% population experiencing high-to-extreme water shortage, as per NITI Aayog.

The average water available per capita annually depends on the region's hydro-meteorological and geological factors. The per capita water availability in the country is reducing due to increasing population. The annual per-capita water availability is less than 1,700 cubic meters and is expected to fall to 1,367 cubic meters by 2031 according to "Reassessment of Water Availability in India using Space Inputs (2019)." As per a report by Dynamic Ground Water Resource Assessment 2022, out of 7,089 assessment units which includes blocks, talukas, mandals, watersheds, firkas in the country, 1,006 units have been categorized as 'Over-exploited'.

It is expected that by 2050, about 1,450 km³ of water will be required out of which approx. 75% will be used in agriculture, ~7% for drinking water, ~4% in industries, ~9% for energy generation. However, because of growing urbanization, the need for drinking water will take precedence from the rural water requirements. Many of the cities are situated by the bank of rivers from where the fresh water is consumed by the population and the waste water is disposed back into the river, thus causing contamination of the water source and irrigation water. This has raised serious challenges for urban wastewater management, planning and treatment.

According to the Central Pollution Control Board (CPCB), the estimated wastewater generation was almost 39,600 Million liters per day (MLD) in rural regions, while in urban regions it was estimated to be 72,368 MLD for the year 2020-21. The estimated volume in the urban cities is almost double than that of the rural regions because of the availability of more water for sanitation which has improved the standard of living.

Water supply management

With increasing population of the country, the need for water and its management is ever increasing. Water availability is projected to become a major concern in the future. In addition to that, the damage to water resources done by pollution is yet another concern. Releasing industrial waste, discharge of untreated or partly treated municipal waste water through drains, discharge of industrial effluent, improper solid waste management, illegal ground water abstraction, encroachments in flood plains/ river banks, deforestation, improper water shade management and non-maintenance of e-flows and agriculture run off etc. are some of the major reasons for pollution of water bodies. The Government of India (GoI) has come up with various schemes that emphasizes on water conservation and restoration. As a result, the number of polluted river stretches has reduced from 351 in 2018 to 311 in 2022 and improvement in water quality has been observed in 180 out of 351 Polluted River Stretches (PRS) during the year 2018. As per a report by Ministry of Jal Shakti, assessment of water quality over the years discloses that in the year 2015, 70% of rivers monitored were identified as polluted, whereas in the year 2022 only 46% of rivers monitored are identified as polluted. The water requirement is only estimated to grow higher in the coming years.

Market size for water requirement for different uses (in Billion Cubic Meters) in coming years:

Sr No.	Uses	Scenario (2025)	Scenario (2050)
1	Irrigation	611	807
2	Domestic	62	111
3	Industries	67	81
4	Power	33	70
5	Others	70	111
	Total	843	1,180

Source: CareEdge Research

Providing clean drinking water is the main focus of the Government. Over the years, the drinking water quality has become a major concern in the rural areas.

Central Water Commission (CWC) periodically assesses country's overall water resources and it has accorded water supply for drinking purpose as the top most priority under water allocation.

To address the present and future food and water security concerns, the GoI has been implementing various schemes. Following are some of the priority areas, focusing on water resources development, that have been identified by the GoI:

- Improving the overall water use efficiency in irrigation and drinking water supply system
- Adoption of piped distribution system in place of open canal system to reduce the conveyance water loss
- Command area development by implementing more micro irrigation system and participatory irrigation management
- Dam safety, dam rehabilitation and performance improvement
- Repair, renovation and restoration of existing water bodies for irrigation, drinking water supply, cultural activities, etc.
- Improving the rural drinking water supply system and sanitation

Impact of COVID – 19

COVID – 19 restated the importance of sanitation and water availability to the world. It made the need for water management more prominent than it was before the pandemic.

The Government has in the past five years introduced a number of schemes to streamline water supply and waste water management. However, COVID - 19 impacted the construction activities across sectors due to labor shortage and material shortage. With the support of the Government, majority sectors were able to sail through the tough times.

Although, it was challenging for the department to ensure testing of water sources during COVID-19, 12,000 Self-Employed Mechanics (SEMs) & more than 11,000 members of women Self-Help Groups (SHGs) were trained & provided with 7,000 Field Test Kits to act as water warriors. COVID - 19 did slowdown the speed of the project execution; however, the execution pace has picked up since fiscal 2023.

In Dam Rehabilitation and Improvement Project, due to the COVID - 19 pandemic, Ministry of Jal Shakti initiated some urgent actions to facilitate the partner agencies to compensate for the loss of time and complete the ongoing rehabilitation activities. The Scheme was extended by additional nine months i.e. up to March 31, 2021. Also, the loan amount of US\$ 101 Million

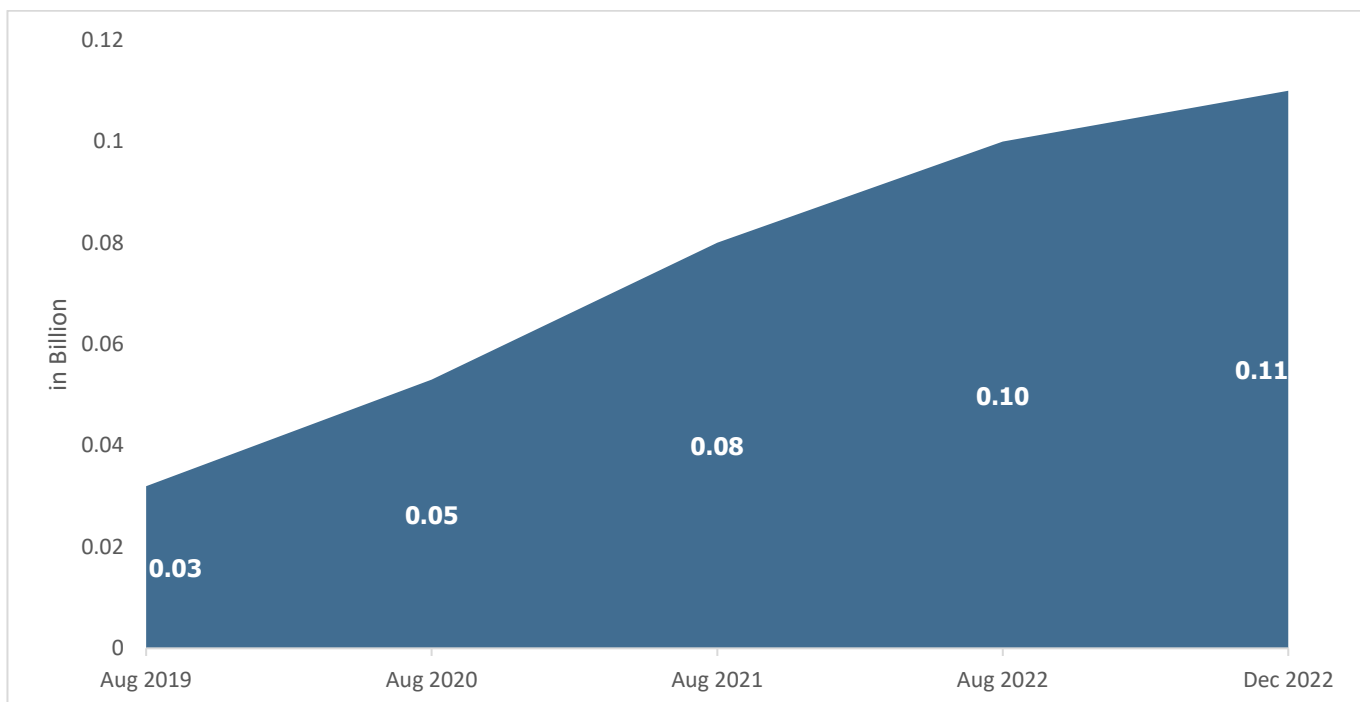
was surrendered in 2020 to avoid the commitment charges on undisbursed loan amount. Phase I of project closed successfully on March 31, 2021.

After the successful implementation of Jal Shakti Abhiyan in 2019, Ministry of Jal Shakti planned to take up the Jal Shakti Abhiyan-II (JSA-II), covering all blocks of all districts of the country but it could not be taken up due to COVID - 19 pandemic imposed restrictions. However, to keep its continuity, National Water Mission, launched a campaign "Catch the Rain" with the tag line "Catch the rain, where it falls, when it falls" to nudge the states and all stakeholders to create Rain Water Harvesting Structures (RWHS) suitable to the climatic conditions.

Key performance indicators for water supply management in India:

The GoI in partnership with States is implementing Jal Jeevan Mission (JJM). At the time of the announcement of the JJM, only 17% of the households were reported to have tap connections. However, as on December 31, 2022, post implementation of the JJM, 55% of the households are reported to have tap water supply in their homes.

Chart 8: Rural Households given tap water connections (cumulative)



Source – Jal Jeevan Mission, CareEdge Research

Some States and Union territories have even achieved 100% tap water connections in the rural households.

List of State / Union Territories (UTs) Rural Households with 100% tap water supply:

- Andaman & Nicobar Islands
- Dadra & Nagar Haveli and Daman & Diu
- Goa
- Gujarat
- Haryana
- Puducherry
- Telangana

Water supply management traction:

- All 0.23 Million rural households of Goa & 0.08 households of Dadra & Nagar Haveli and Daman & Diu have access to potable water through tap connection
- As of December 2022, 0.87 Million (84.83%) schools and 0.90 Million (80.79%) Anganwadi Centers across India have been provided with potable tap water supply for drinking & cooking mid-day meals and hand washing. The remaining States/ UTs are working hard to provide tap connections in schools and Anganwadi centers so that children get access to safe water
- 0.51 Million Village Water & Sanitation Committee/Paani Samitis have been formed, and 0.50 Million Village Action Plans (VAPs) have been developed for sustained drinking water supply management

Urban Waste Generation and Treatment

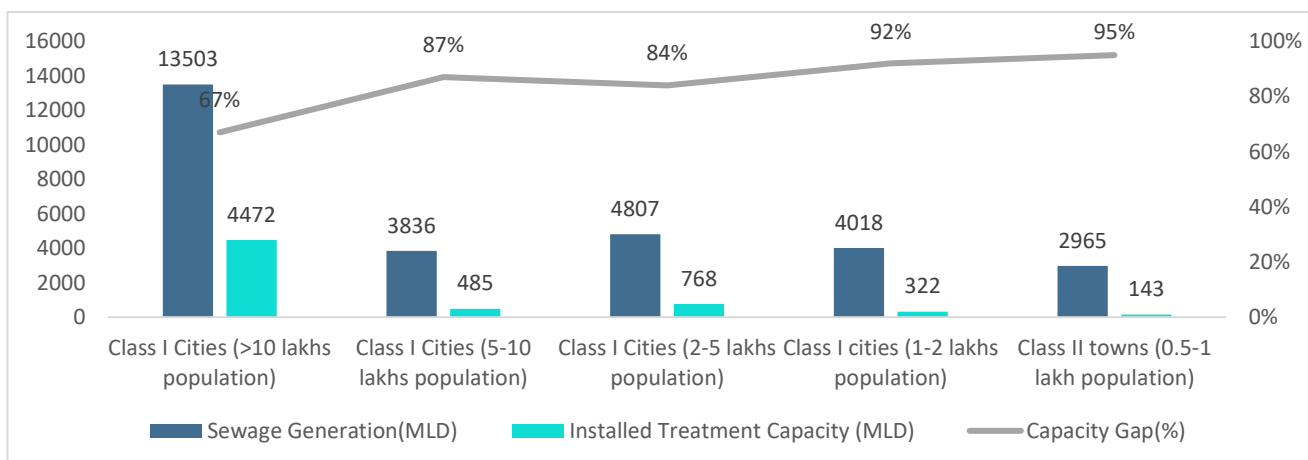
In India, the sewage generation in the urban region was 72,368 Million Litres per Day (MLD) for the year 2020-21, while the installed sewage treatment capacity is 31,841 MLD. The operational capacity is 26,869 MLD, which is very low than the load generation.

As per a Niti Aayog report, as of August 2022, of the total sewage generation only 28% i.e. 20,236 MLD was treated which implies that 72% of the waste water is left untreated and is disposed in the various water bodies like river, lakes or underground water. Some capacity additions like 4,827 MLD sewage treatment have been proposed but a gap between the waste water generation and treatment of 35,700 MLD i.e. 49% still remains.

Additionally, as per the CPCB (2021) in the city-scale assessments, the wastewater generation from Class I cities and Class II towns (as per the 2001 census) is estimated as 29,129 MLD, and under the assumption of a 30% decadal increase in urban population, it is expected to be 33,212 MLD at the current time. Against this, the existing capacity of sewage treatment is only 6,190 MLD. There is still a 79% (22,939 MLD) capacity gap between sewage generation and existing sewage treatment capacity. Another 1,742.6 MLD wastewater treatment capacity is being planned or built. Even with this added to the current capacity, there is still a sewage treatment capacity shortfall of 21,196 MLD.

Key performance indicator for the water sewage sector:

Chart 9: Sewage generation and treatment capacities (MLD)



Source- Central Pollution Control Board, 2022

Note- Performance of 115 sewage treatment plants studied by Central Pollution Control Board

3.2 Regulatory framework for water and waste water Industry in India

The management of water and waste water has been highly fragmented in India. The first ever National Water Policy (NWP) in India was set up in 1987. Currently the NWP - 2012 is in effect in India. But to address the present challenges in water sector, revision of NWP has been envisaged and a drafting committee was constituted to revise the NWP.

The Ministry of Water Resources assumes a nodal role as regards to all matters concerning India's water resources.

The Central Ground Water Board (CGWB), a subordinate office of the Ministry of Water Resources, GoI, is the National Apex Agency entrusted with the responsibilities of providing scientific inputs for management, exploration, monitoring, assessment, augmentation and regulation of ground water resources of the country. CGWB was established in 1970 by renaming the Exploratory Tube Wells Organization under the Ministry of Agriculture, GoI. It was merged with the Ground Water Wing of the Geological Survey of India during 1972.

Department of Water Resources, River Development and Ganga Rejuvenation now "Ministry of Jal Shakti"/ "Jal Shakti Mantralaya" has two departments i.e. department of Water Resources, River Development and Ganga Rejuvenation (Jal Sansadhan, Nadi Vikas Aur Ganga Sanrakshan Vibhag) and Department of Drinking Water and Sanitation (Peya Jal Aur Swachhata Vibhag).

As per Ministry of Jal Shakti's publication, water being a State subject, steps for augmentation, conservation and efficient management of water resources are primarily undertaken by the respective State Governments. In order to supplement the efforts of the State Governments, the Central Government provides technical and financial assistance to them through various schemes and programmes.

The GoI along with the States is implementing Jal Jeevan Mission – Har Ghar Jal. This program aims at providing potable water in adequate quantity of prescribed quality on regular and long-term basis to every rural household, through tap water connection, by 2024 with an estimated outlay of ₹3,600 Billion. The water sources inter alia include groundwater, surface water (river, reservoir, lake, pond, springs, etc.) and rain water stored in small tanks.

The work assigned to the Department of Water Resources, River Development and Ganga Rejuvenation is:

General:

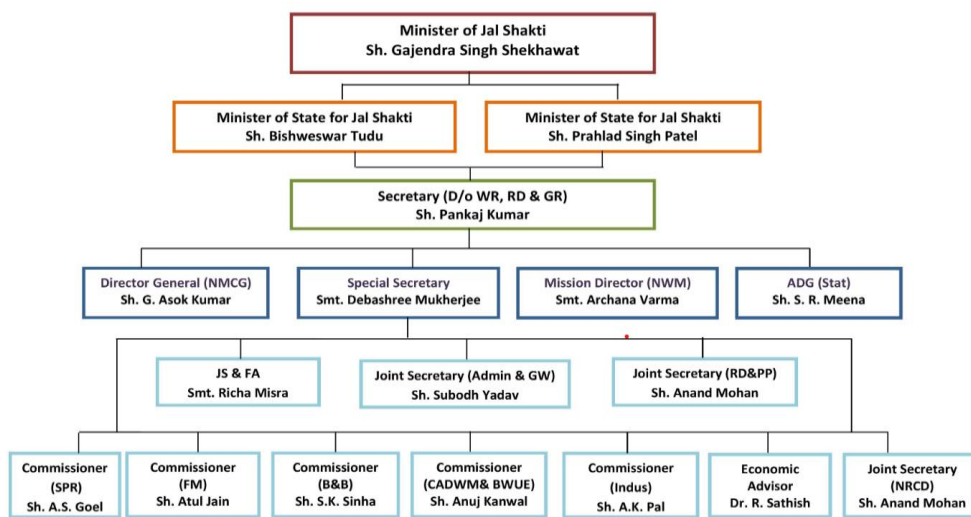
- Development, conservation and management of water as a national resource; overall national perspective of water planning and coordination in relation to diverse uses of water and interlinking of rivers;
- General Policy, technical assistance, research and development training and all matters relating to irrigation, including multi-purpose, major, medium, minor and emergency irrigation works, hydraulic structures for navigation and hydro-power, tube wells and groundwater exploration and exploitation, protection and preservation of ground water resources, conjunctive use of surface and ground water, irrigation for agricultural purposes, water management, command area development, management of reservoirs and reservoir sedimentation, flood (control) management, drainage, drought proofing, water logging and sea erosion problems, dam safety;
- Regulation and development of Inter-State rivers and river valleys. Implementation of Awards of Tribunals through Schemes, River Boards;
- Water laws, legislation;

- Water quality assessment;
- Cadre control and management of the Central Water Engineering Services;
- Conservation, development, management and abatement of pollution of rivers

International:

- Commissions and conferences relating to water resources development and management, drainage and flood control;
- Matters relating to rivers common to India and neighbouring countries, the Joint Rivers Commission with Bangladesh, the Indus Waters Treaty 1960, the Permanent Indus Commission;
- Bilateral and external assistance and cooperation programmes in the field of water resources development

Organization chart:



Source: Department of Water Resources, River Development & Ganga Rejuvenation, CareEdge Research

Atal Mission for Rejuvenation and Urban Transformation (AMRUT):

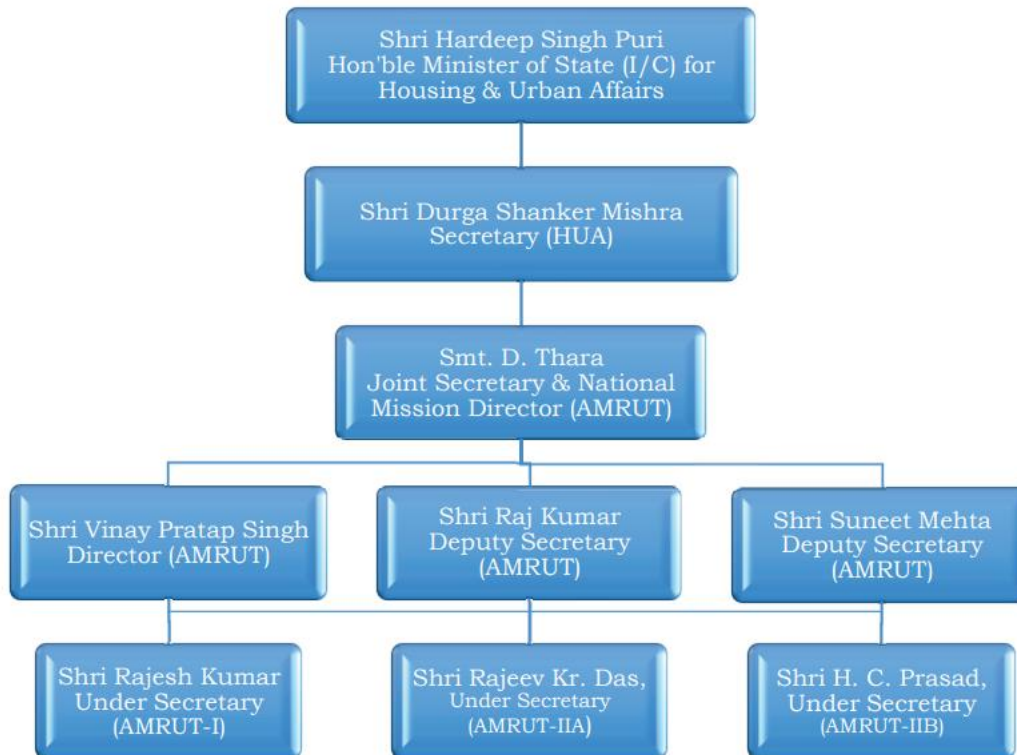
The mission of AMRUT is providing basic services (e.g. water supply, sewerage, urban transport) to households and build amenities in cities which will improve the quality of life for all, especially the poor and the disadvantaged which is a national priority.

Its mission components include:

- Decentralised, networked underground sewerage systems, including augmentation of existing sewerage systems and sewage treatment plants
- Rehabilitation of old sewerage system and treatment plants
- Recycling of water for beneficial purposes and reuse of waste water

Organization chart:

Organisational Chart for AMRUT as on 09.12.2019



Source: AMRUT, CareEdge Research

3.3 Key trends in the water supply and waste water management system in India

Increase in schemes introduced by Government: In recent times, there has been an increased number of schemes introduced by the Government towards improving water supply as well as water sewage infrastructure in India. Schemes like JJM, Jal Shakti, Atal Bhujal Yojana have been set up in the last 7 years. In FY24 Budget, allocation for JJM/National Drinking Water Mission has increased to ₹700 Billion, an increase of 27.3% from ₹550 Billion in FY23.

Emergence of new sources of water: Techniques like rain water harvesting, treated waste water are gaining momentum due to growing demand of water. These techniques are acting as soon as they can reduce pressure on fresh surface water.

Focus on improving water efficiency: A new initiative 'Support for Irrigation Modernization Program' to improve water efficiency, increase crop water productivity has been taken up by the Department of Water Resources.

Use of technology in water and waste water management: Use of technology in various sectors is increasing day by day. Similarly, use of technology in water supply and waste water management is expected to increase for data collection, to keep a record of water treatment, sanction disposal and project mapping.

Increased private participation: The participation of the private players who are providing water availability 24x7 is increasing. These players are setting up recycling facilities, sewage treatment plants to support increased supply of water.

3.4 Key growth drivers in the water supply and waste water treatment industry

Use of technologies and innovative waste water treatments play an important role in improving urban sanitation and enhancing water security. The usage of treated waste water is still an issue in India despite the known benefits of waste water treatment and information about reuse technologies.

Key drivers for water supply management:

- **Mission on making water available to all**

The focus of the GoI in the past few years has been to make potable water available to all the households in the country. For the same reason, a number of schemes have been established by the GoI. The per capita water availability in the country is decreasing due to increasing population. As per a NITI Aayog report, India is facing water crisis with around 50% population experiencing high-to-extreme water shortage.

The Government has introduced schemes like 'Jal Jeevan Mission' to execute the mission of providing safe and adequate water to all. Under JJM, the tap connections in rural households have increased to 55% as of December 2022.

- **Focus on improving water availability**

Based on the study of "Reassessment of Water Availability in India using Space Inputs" (CWC, 2019), the average annual per capita water availability for the year 2031 has been assessed as 1,367 cubic meters. The Government is coming up with measures to improve availability of water by building and maintaining natural resources of water. Below schemes have been set up by the GoI to tackle the declining availability of water:

- Atal Bhujal Yojana (Atal Jal): Sustainable groundwater management
- Jal Shakti Abhiyan: "Jal Shakti Abhiyan: Catch the Rain" focuses on creating Rainwater Harvesting Structures

The thrust areas for these schemes will be rain water harvesting, rejuvenation of water bodies.

On the other hand, the Department of Water Resources and other schemes aim to ensure maintenance and efficient use of water resources to match the continuously growing demand of water.

- **Rejuvenation of urban water bodies**

Water bodies in urban areas such as lakes, ponds, step-wells, and baolis have traditionally served the function of meeting water requirements of various needs like washing, agriculture or religious/cultural purposes. Surface water bodies and traditional water harvesting structures in numerous cities have either dried up, or disappeared due to encroachment, dumping of garbage, and entry of untreated sewage. These water bodies can store water and recharge ground water if revived thus helping in meeting the increased requirement of water.

Key drivers for waste water treatment:

- **Central Government policies push for waste water treatment and use**

Under the National Sanitation Policy, waste water treatment and reuse of water to enhance alternative water supplies and conservation is promoted. Initiatives like National Lake Conservation Plan, National Wetland Conservation Program are introduced to help identify lakes and wetlands across the country for undertaking conservation, waste water treatment, pollution abatement, education and awareness creation etc.

Central Government has also implemented National River Conservation Plan for abatement of pollution across stretches of various rivers and undertaking conservation plan, sewage systems construction, sewage treatment plant construction, electric crematoria and river front development.

Financial assistance for treatment plants installation are also provided to small scale industries. Apart from this, the Central Government has also issued directions for zero liquid discharge implementation.

- **Development plans to clean River Ganga and improve wastewater treatment and management**

The GoI has launched two flagship programs for cleaning River Ganga i.e., Ganga Action Plan (GAP) (1985) and Namami Gange Programme (2014). The Government has also initiated sectoral plans like Swachh Bharat Mission, AMRUT, Smart City initiatives etc. to improve unsewered and sewer sanitation. Under these initiatives, the State Government, municipal and private sector applicants are given grants and subsidies for the construction of sewage treatment plants and water treatment plants.

- **Agricultural water reuse**

Low quality water is not conventionally used in agricultural production. The two sources of non-conventional water (NCW) are – waste water used for domestic, municipal and industrial and saline water from underground, drainage or surface sources. But many countries are using the NCW sources for agricultural uses as the fresh water sources are limited. The NCW is primarily treated and blended with other water to produce the desired quality and quantity. In India, under Ganga Action Plan - I, the objective was to improve the water quality along with diversion and treatment of domestic sewage and industrial waste. If not properly treated the low-quality irrigation water might cause severe water and soil contamination. To tackle this, India needs water treatment plants with advanced technology and increased volume across the country.

- **Industrial water reuse**

The industrial water can be recycled and reused by processing the waste water produced. Various methods are used to perform this depending upon the quality of the waste water requirements, space constraints, and budget. Benefit of this, is reduction of fresh water cost and reduction in the water footprint. The operational and sustainability of the industries can also be improved with improved water treatment process and production capacity.

3.5 Key Risks and challenges in the water supply and waste water industry

Water Supply:

- **Regulatory challenges:**

Under water supply management, permits and finance are key elements for setting up the project. Different projects might need different permits along with financial sanctions which follow a regulatory process. The process can become time consuming due to delayed submissions, incomplete information, revised project plans. The unexpected changes could lead to extended timelines and delay the project timelines. Also, receiving funds required for implementation and execution of projects takes time, which leads to project execution delay.

- **Financial challenges:**

When the draft for a water supply project is presented, an estimated cost of the project is presented to the authorities as well. The project cost estimates typically get revised as the design gets more specific or the design gets updated due to additions made in the project. Based on the draft design, the authorities sanction the budgeted amount which may get revised due to factors like inflation, change in material cost, economic changes or even inaccurate estimations. These unexpected changes lead to revised project cost which need approval from the authorities again or in some cases the additional construction cost may have to be borne by the construction company assigned.

- **Environmental challenges**

Climate change is affecting the environment in a major way. It is impacting rainfall patterns, causing floods and may also lead to long term decline in naturally available sources like groundwater storage. Groundwater availability is closely linked to food security as it has played a vital role in increasing agricultural production over the years. Groundwater contributes nearly 62% in irrigation, 85% in rural water supply and 50% in urban water supply. Even though Groundwater is replenishable but its availability is non-uniform as it is dependent on rainfall. The over exploited groundwater sources are a major challenge as it is a key water supply source for agriculture.

Waste water management:

- **Institutional Challenges**

The Urban Local Bodies (ULBs) are responsible for domestic waste water management and treatment. However, there is a lack of planning capacity and project implementation. According to the audit report of Comptroller and Audit General (CAG 2017), there was a shortage of man power in the municipalities for waste water collection, treatment and revenue collection which affected delivery of citizen services. It also exposed deficiencies in planning, financial management, implementation, and monitoring of various projects. Similarly, the CAG performance audit (2016) in the state of Jharkhand found that none of the sampled ULBs had a sewage network. In the absence of the same, around 175 MLD of untreated waste water is discharged into open drains polluting nearby water bodies.

The current institutional, legal and policy mechanisms for management and treatment of waste water and control of water pollution in the country is not sufficient to address the looming crisis.

- **Economic Challenges**

The gap between the sewage generation and present treatment capacity is very large in all the classes of cities and towns due to increasing population and urbanization in India. It is difficult for smaller cities and towns in finding necessary resources to set water treatment plants considering high capital expenditure and operation and maintenance cost. Community participation in operation and maintenance is suggested to improve the economic viability of Sewage Treatment Plants (STP). Private sector waste water treatment investments are difficult in India due to high capital investments and unpredictable revenue stream.

- **Technical Challenges**

There is an overdependence in India on older technologies for waste water treatment due to its high cost. This results in more repair work and less efficiencies of these plants. These limitations lead to poor performance of the plants and adulteration of sewage and water bodies. The conventional centralized waste water treatment plants are designed to remove only Nitrogen, Biological Oxygen Demand and Phosphorous but with rapid urbanization and changing type of contaminants, technologically advanced plants are needed to be setup to deal with them.

Apart from this the land requirement for STP plants is a big challenge. In urban areas land availability is a big issue due to limited land availability and high cost.

- **Social Challenges**

Social acceptance of treated waste water is a big challenge due to fear and disgust when it comes to reuse. Recycled water is unlikely to be used as drinking water when compared to its use in irrigation etc. The negative attitude towards this has also stemmed from concerns like health risk and aesthetic aspects like colour, odour, taste and cultural and religious background of consumers.

Identifying and obtaining of sites for plant setup is another challenge due to people not preferring to live near these plants. This is because of the reasons like health risks, aesthetic impacts and factors like land depreciation. Solutions like underground plant setup can help eliminate the above stated factors but involves a huge capital expenditure. Also, buffer zones are limited to solid wastes. Conventional systems in India suffers operational costs, management costs, demand of treated water and decentralized systems.

3.6 Government Initiatives for water supply and waste water management

Water supply

Jal Jeevan Mission - 'Har Ghar Jal'

JJM is a Central Government initiative undertaken by Ministry of JAL SHAKTI. It aims to ensure piped water access to every household in India. The initiative was launched on 15th August 2019 by the Prime Minister of India.

The program is implemented in partnership with States to assure tap water supply in adequate quantity, prescribed quality, adequate pressure, on a regular and long-term basis in all rural households and public institutions, which includes anganwadi, schools, ashramshalas, public/ community health centres, sub-centres, wellness centres, community centres, gram panchayat buildings, etc., by the year 2024.

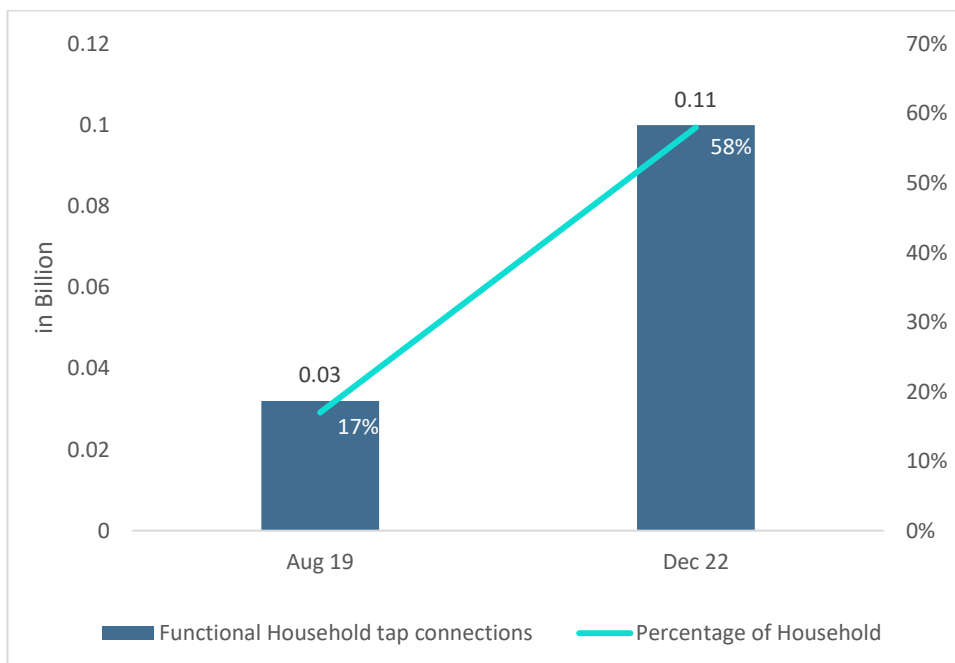
Under JJM, 30% weightage was assigned for difficult terrains which inter alia include areas under Desert Development Programme (DDP) and Drought Prone Area Programme (DPAP) while allocating the fund, to prioritize the coverage in these areas. Further, provisions have been made in the operational guidelines for planning and implementation of bulk water

transfer from long distances and regional water supply schemes for ensuring tap water supply in drought-prone & water-scarce areas/ areas with inadequate rainfall or dependable ground water sources. In addition, provisions have also been made for source recharging, viz. dedicated bore well recharge structures, rain water recharge, rejuvenation of existing water bodies, etc., in convergence with other schemes such as the Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGA), Integrated Watershed Management Programme (IWMP), 15th Finance Commission tied grants to Rural Local Bodies (RLB)/ Panchayat Raj Institutions (PRI), State schemes, Corporate Social Responsibility funds, etc.

For villages in water-scarce areas, in order to save the precious fresh water, states are also being encouraged to plan new water supply scheme with dual piped water supply system, i.e. supply of fresh water in one and treated grey/ waste water in another pipe for non-potable/ gardening/ toilet flushing use. Moreover, the households in these areas are to be encouraged to use the faucet aerators that save a significant amount of water, in multiple taps that they may be using inside their house.

Functional Household tap connection under Jal Jeevan Mission:

Chart 10: Number of HouseHolds with tap water connection



Source: Jal Jeevan Mission, CareEdge Research

The total number of households in India as on October 2022 were 191.5 Million out of which over 110.2 Million households have received tap water connection as of December 2022.

Funds allocated for Jal Jeevan Mission:

The estimated cost of the mission is ₹3,600 Billion. The Central and State have a share of ₹2,080 Billion and ₹1,520 Billion, respectively of the total cost.

The 15th Finance Commission has identified water supply and sanitation as a national priority and allocated funds of ₹2,360 Billion to Rural Local Bodies/Panchayat Raj Institutions (RLBs/PRI) for the period 2021-22 to 2025-26. Accordingly, 60% of the fund, i.e., ₹1,420 Billion provided as Tied Grants are meant to be utilized exclusively for the drinking water, rainwater harvesting and sanitation & maintenance of open-defecation free (ODF) village. This huge investment in rural areas across the country is accelerating economic activities and boosting the rural economy, as well as creating employment opportunities

in villages. This is a progressive step to ensure that villages have potable water supply with improved sanitation for transforming the villages into '**Water Sanitation and Hygiene (WASH) enlightened**' villages.

In 2022-23, the GoI has released ₹229.75 Billion to 21 eligible States for the implementation of JJM. In FY24 Budget, the allocation for JJM has increased to ₹700 Billion, an increase of 27% from ₹550 Billion in FY23.

The Central funds are released by the GoI based on the utilization of available Central funds and matching State share. For online monitoring, Integrated Management Information System (IMIS) and JJM–Dashboard have been put in place. Provision has also been made for transparent online financial management through Public Financial Management System (PFMS).

The details of Central funds allocated, funds drawn, and funds utilization reported in the year 2019-20, 2020-21, 2021-22, and 2022-23 under JJM is as below:

Fund allocation for Jal Jeevan Mission: (in ₹Billion)

Year	Central				Utilization under state share
	Opening balance	Funds allocated	Funds drawn by State/UT	Reported Utilization	
2019-20	24.36	111.39	99.52	59.99	40.67
2020-21	64.32	230.33	109.18	125.42	78.03
2021-22	48.13	923.08	400.10	255.16	185.33
2022-23	193.19	1,007.90	229.75	265.44	184.19

Mission as stated by Jal Jeevan Mission program:

Jal Jeevan Mission is to assist, empower and facilitate:

- States/ UTs to plan participatory rural water supply strategy for ensuring potable drinking water security on long-term basis to every rural household and public institution, viz. GP building, School, Anganwadi centre, Health centre, wellness centres, etc.
- States/ UTs for creation of water supply infrastructure so that every rural household has Functional Tap Connection (FHTC) by 2024 and water in adequate quantity of prescribed quality is made available on regular basis
- States/ UTs to plan for their drinking water security
- Gram Panchayats (GP)/ rural communities to plan, implement, manage, own, operate and maintain their own in-village water supply systems
- States/ UTs to develop robust institutions having focus on service delivery and financial sustainability of the sector by promoting utility approach
- Capacity building of the stakeholders and create awareness in community on significance of water for improvement in quality of life
- In making provision and mobilization of financial assistance to States/ UTs for implementation of the mission

Objectives of Jal Jeevan Mission:

The broad objectives of the mission are:

- To provide Functional Household tap connection (FHTC) to every rural household
- To prioritize provision of FHTCs in quality affected areas, villages in drought prone and desert areas, Sansad Adarsh Gram Yojana (SAGY) villages, etc.

- To provide functional tap connection to Schools, Anganwadi centres, GP buildings, Health centres, wellness centres and community buildings
- To monitor functionality of tap connections
- To promote and ensure voluntary ownership among local community by way of contribution in cash, kind and/ or labour and voluntary labour (shramdaan)
- To assist in ensuring sustainability of water supply system, i.e. water source, water supply infrastructure, and funds for regular O&M
- To empower and develop human resource in the sector such that the demand of construction, plumbing, electrical, water quality management, water treatment, catchment protection, O&M, etc. are taken care of in short and long term
- To bring awareness on various aspects and significance of safe drinking water and involvement of stakeholders in manner that make water everyone's business

Components under Jal Jeevan Mission:

The following components are supported under JJM:

- Development of in-village piped water supply infrastructure to provide tap water connection to every rural household
- Development of reliable drinking water sources and/ or augmentation of existing sources to provide long-term sustainability of water supply system
- Wherever necessary, bulk water transfer, treatment plants and distribution network to cater to every rural household
- Technological interventions for removal of contaminants where water quality is an issue
- Retrofitting of completed and ongoing schemes to provide FHTCs at minimum service level of 55 litres per capita per day (lpcd)
- Greywater management
- Support activities, i.e. IEC, HRD, training, development of utilities, water quality laboratories, water quality testing & surveillance, R&D, knowledge centre, capacity building of communities, etc.
- Any other unforeseen challenges/ issues emerging due to natural disasters/ calamities which affect the goal of FHTC to every household by 2024, as per guidelines of Ministry of Finance on Flexi Funds

Achievements under JJM:

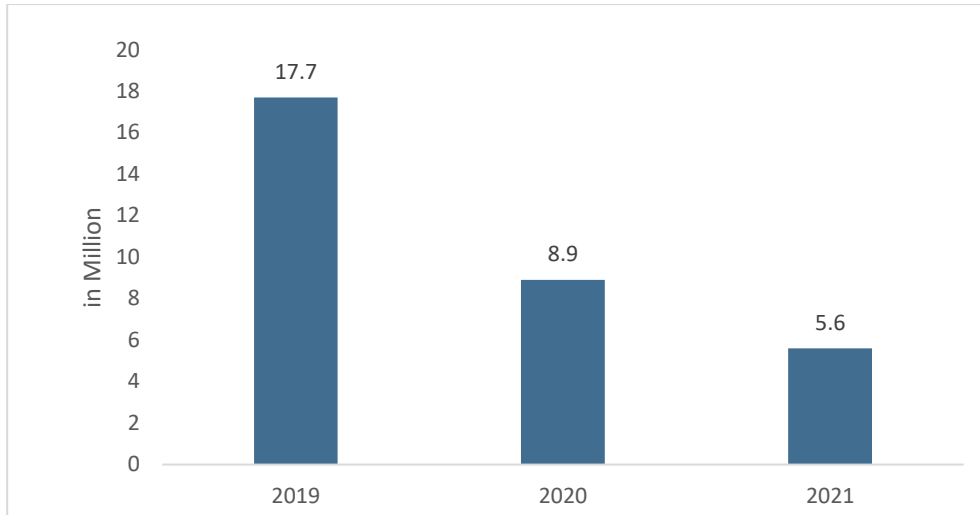
- 0.07 Billion new connections have been installed under the program from August 2019 to August 2022
- Direct support of USD 18.94 Billion has been added under the 15th Finance Commission for 5 years from 2021-2026
- 0.86 Million schools, 0.89 Million anganwadi centres and 0.04 Million public institutions have been connected to water supply
- 0.50 Million village water and sanitation committees with at least 50% women have been formed under the community engagement
- There has been an increase of 504% in FHTC in 117 remote and backward districts from 2.43 Million to 14.69 Million between Aug 2019 and May 2022
- 2,038 water testing labs have been opened for testing the water samples and 1 Million women have been trained to use the test kits

Unique features of Jal Jeevan Mission:

Partnerships: The JJM strives to build partnerships and work together with various institutions/ individuals to achieve long-term drinking water security for all. For this purpose, 212 Voluntary Organizations (VOs), Non-Governmental Organizations (NGOs), Social service & charity organizations, and professionals/ individuals already working in the field of water are recognized as 'Sector Partners' in this ambitious program to address the challenges holistically.

Reduction in water borne diseases: The mission has managed to bring down the water borne diseases in the country. As per the National Centre for Disease Control (NCDC) report, due to availability of safe and potable drinking water in every rural household, the water-borne diseases have reduced drastically.

Chart 11: Decrease in water borne disease



Source: Jal Jeevan Mission, CareEdge Research

Use of technology: JJM is focusing on using various technologies for the community-led implementation of:

- source sustainability measures such as aquifer recharge, rainwater harvesting, increased storage capacity of water bodies, reservoirs, de-silting, etc. to improve the lifespan of water supply systems
- water budgeting and audits
- operation and maintenance
- grey water management
- water quality monitoring and surveillance
- pre-positioned emergency water supply kits to provide transitional services in camps
- solar based water supply schemes using solar energy which are steps intended to reduce the carbon footprints
- technologies like Internet of Things (IoT) for Supervisory Control and Data Acquisition (SCADA), remote sensing & Geographic Information System (GIS), design software have been used in building climate resilience through water accounting, water quality control, water use efficiency, water resource planning, and impact assessment. IoT Pilots are being implemented in 118 villages in 14 States/UTs. 25 innovative projects related to water are recommended by Technical Committee for water treatment, water quality & monitoring, IoT-based battery vehicles, and software for the hydraulic design of water treatment plants in rural India.

Reducing Non – revenue water: The community - led water audits and water security planning is crucial to reduce the real and apparent losses in the water supply distribution system and non-revenue water.

Measures like IoT-based technology, water metering, installation of flow control valves in water connection, water budgeting, community surveillance, water conservation measures and convergence with various water-related programs, etc. are being taken up to further strengthen the water supply management for all.

Status of tap water connections provided under JJM:

Households:

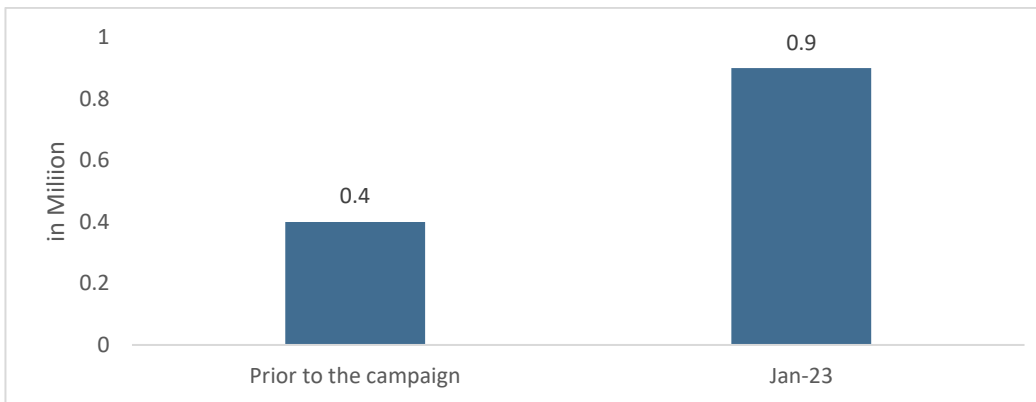
State/UTs with 100% tap water connection (in Million):

State/UT	Remaining households as on 15/8/2019	Progress till date	Progress %
Goa	0.06	0.06	100%
A&N Islands	0.03	0.03	100%
D&NH and D&D	0.09	0.09	100%
Haryana	1.27	1.27	100%
Gujarat	2.60	2.60	100%
Puducherry	0.02	0.02	100%
Telangana	3.83	3.83	100%

Source: Jal Jeevan Mission, CareEdge Research

Schools:

Chart 12: Schools provided with tap water supply



Source: Jal Jeevan Mission, CareEdge Research

Schools with 100% water supply:

State/UT	Total schools	Schools with tap water supply	Schools with tap water supply (%)
Andaman & Nicobar Islands	368	368	100%
Dadra & Nagar Haveli and Daman & Diu	411	411	100%
Goa	1,098	1,098	100%
Kerala	10,877	10,877	100%
Lakshadweep	33	33	100%
Puducherry	390	390	100%

Source: Jal Jeevan Mission, CareEdge Research

Atal Bhujal Yojana

Atal Bhujal Yojana was launched in 2019 to undertake community-led sustainable ground water management of the stressed areas identified. It was launched to strengthen institutional framework and monitoring ground water data and improve planning and implementation of the water management interventions.

It is a Scheme of the GOI aided by the World Bank with an outlay of ₹60 Billion. and is implemented to focus on community participation and sustain ground water level in identified water stressed areas during five-year duration. The schemes currently are taken up in seven states of Haryana, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh.

It is the world's largest community-led ground water management program which is helping villagers understand the water availability and usage pattern in their areas.

Jal Sakti Abhiyan (JSA)

Jal Sakti Abhiyan - I was launched in the year 2019 in the stressed districts of the country to promote conservation of water, water resource management, implementing rain water harvesting, renovation of traditional water bodies, reuse of water, recharging water body structures, watershed development and afforestation. The actual expenditure from MGNREGS fund was ₹ 180.66 Billion.

JSA is expanded to 'Jal Sakti Abhiyan: Catch the Rain' to cover all the blocks of the districts across the country to focus on –

- 1) Rainwater harvesting & water conservation
- 2) Enumerating, geo tagging & making inventory of all water bodies
- 3) Setting up Jal Shakti Kendras
- 4) Afforestation
- 5) Generation of awareness

The progress of the Jal Shakti Abhiyan: Catch the Rain campaign of 2021 as uploaded on the portal from 22.3.2021 to 28.03.2022 are as follows: -

- Water Conservation & Rainwater Harvesting Structures: 1.62 Million
- Renovation of Traditional Water Bodies: 0.30 Million
- Reuse and Recharge Structures: 0.83 Million
- Watershed Development: 1.92 Million
- Intensive Afforestation: 367.57 Million
- and Training Programmes/ Kisan Melas: 0.04 Million

The above details include completed as well as ongoing works. Actual expenditure from MGNREGS fund was ₹ 656.66 Billion. States/UTs have also been directed to utilize their own resources.

Water Vision@2047

'Water Vision@2047' conference was held in Bhopal on 6th January,2023 under the Ministry of Jal Sakti. In this conference different ways of increasing water availability and efficient utilization of water resources and their development was discussed. Challenges of water conservation, increasing population, climate change, rapid industrialization and urbanisation, and economic boom which will lead to increase in demand of water were discussed. It was also stated that the harvestable component of water resources is to be surpassed and planning is to be done towards 2047 to achieve the water conservation goals were discussed.

Water quality was also discussed and the vision was set to creating over 2,000 water quality testing laboratories, training 4 lakh women for using Field Testing Kits to testing water using Internet of Things based on sensor.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

The Atal Mission for Rejuvenation and Urban Transformation was launched in June 2015 under GoI. It is the first focused national water mission and was launched in 500 cities and covers 60% of the urban population. In the Budget of FY24, the allocation to AMRUT has increased from ₹153 Billion to ₹160 Billion.

The program focuses on basic urban infrastructure in water supply system and access to potable water for every household.

Universal coverage of water supply is the priority under the Mission, under which 2.28 Million tap connections have been provided. The total plan size of all State Annual Action Plan (SAAPs) was ₹776.40 Billion. out of which ₹390.11 Billion i.e. 50% has been allocated to water supply.

Waste water management:

Jawaharlal Nehru National Urban Renewal Mission

This scheme was launched in December 2005 and is the largest national urban initiative to encourage reforms and fast track planned development of 63 identified cities. The focus is improving efficiencies of the urban infrastructure and services. It consists of two sub-missions - Urban Infrastructure & Governance and Basic Services to the Urban Poor.

It focuses on many aspects of urbanization like redevelopment, water supply, sewage and solid waste management, urban transport including roads, high ways, metro projects, parking lots, heritage area development, prevention of soil erosion, preservation of water bodies etc.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

The Atal Mission for Rejuvenation and Urban Transformation was launched in June 2015 under the GoI. It is the first focused national water mission and was launched in 500 cities and covered 60% of the urban population.

Under the program, 883 sewerage & septage management projects which amounts to ₹340.81 Billion. have been taken up out of which 370 projects costing ₹82.58 Billion. have been completed till date. In the Budget FY24, the allocation to AMRUT has increased from ₹153 Billion to ₹160 Billion.

Namami Gange programme

It is an integrated Conservation Mission approved as 'Flagship Programme' by the Union Government in June 2014 with budget outlay of ₹200 Billion to accomplish the twin objectives of:

- i. effective abatement of pollution
- ii. conservation and rejuvenation of National River Ganga

The Programme has main objectives of Sewerage Treatment Infrastructure, River Surface Cleaning, Afforestation, Industrial Effluent Monitoring, etc. For conservation of rivers, the Ministry of Jal Sakti has been supplementing efforts with the states and Union Territories by providing financial and technical assistance for abatement of pollution under the programme. The National River Conservation Plan has so far covered polluted stretches of 34 rivers across 77 towns and sanctioned cost of ₹ 59.61 Billion. and created a sewage treatment capacity of 2,677 Million litres per day.

Under the Namami Gange programme, so far, a total of 352 projects have been sanctioned. 157 sewage treatment projects of 4.90 Billion litres per day, sewer network of 5,212 kms have been taken up with a sanctioned amount of ₹304.58 Billion. for all projects.

Swachh Bharat Mission (Urban)

Swachh Bharat Mission (SBM) (Urban) was launched by GoI with the vision of ensuring hygiene, waste management and sanitation across the country in 2019. The SBM (Urban) was implemented under the Ministry of Housing and Urban Affairs. The key focus area under this are eliminating open defecation, eradication of manual scavenging by converting insanitary toilets to sanitary, solid waste manager, behavioural change, general sanitation awareness etc.

Under Swachh Bharat Mission (Urban) 2.0 launched on October, 2021 an amount of ₹158.83 Billion. has been allocated to states and union territories for waste water management including setup of sewage treatment plants and faecal sludge treatment plants.

3.7 Recent events in water supply and waste water management

Interlinking of rivers (Eastern Rajasthan Canal Project (ERCP) with the Parbati-Kalisindh-Chambal link)

National Perspective Plan (NPP) for development of water resources was formulated by the GoI in the year 1980. 30 link projects (16 under Peninsular Component & 14 under Himalayan Component) have been identified under NPP. National Water Development Agency (NWDA) has been entrusted with the work of inter-linking of rivers under NPP.

Looking at the scarce water availability in the State of Rajasthan, the Special Committee for Interlinking of Rivers (SCILR) in its 20th meeting held in December, 2022 in New Delhi has approved the proposal of integration of the Eastern Rajasthan Canal Project (ERCP) with the Parbati-Kalisindh-Chambal link (a link under NPP) and the Modified Parbati-Kalisindh-Chambal (PKC), duly integrated with ERCP, to be a part of NPP of interlinking of rivers in the country. The project envisages mitigating the water needs, particularly the drinking water needs, in 13 districts of Rajasthan and 7 districts of Madhya Pradesh.

Namami Gange Mission II approved with a budgetary outlay of ₹225 Billion till 2026:

Namami Gange Programme which was launched in June 2014 for a period up to 31st March, 2021 with the objective to rejuvenate River Ganga and its tributaries with a budgetary outlay of ₹200 Billion has been further approved with a budgetary outlay ₹220 Billion till 2026 inter alia including projects for existing liabilities (₹112.25 Billion) and new projects/interventions (₹112.75 Billion).

Under the programme, a comprehensive set of interventions such as waste water treatment, solid waste management, river front management (Ghats and crematoria development), e-flow, afforestation, biodiversity conservation and Public Participation etc. have been taken up for rejuvenation of river Ganga and its tributaries. The increased budgetary outlay will help the programme to achieve its goal of waste water treatment significantly.

3.8 Outlook

About 35% of the Indian population lives in urban centers according to census 2011 and the number is expected to go up rapidly leading to the increase of demand of fresh water. The generation of waste water is double in cities as compared to rural India because of availability of more water in urban cities due to increased living standards and the urbanization pace.

Rapid urbanization has also added pressure on the food and fresh water requirement. This is also responsible for consuming large water quantities and discharging the waste water back into the source. Due to increase of use of water for various household, industrial and agricultural purposes, waste water management and treatment is very important. Of the total sewage generated in FY21 only 28% i.e. 20,236 MLD was treated which implies that 72% of the waste water is left untreated and is disposed in the various water bodies like river, lakes or underground water. This is a huge opportunity of development in this sector.

4. Roads and Highway Industry

4.1 Overview

Robust infrastructure is an essential sign of a developing nation. Development of roads, bridges, airports and railways is crucial for economic development of the country. Out of all modes of transport, road is the only mode which has ability of last mile connectivity.

Transportation of freight as well as passengers by road is one of the most cost-effective mode. With a total 6.37 Million kilometers (kms) of road network, India ranks second in the world after USA. This road network supports movement of 60% of freight traffic in the country and 87% of the total India's passenger traffic. The Indian road network comprises of National Highways, Expressways, State Highways, Major District Roads, Other District Roads and Village Roads. To get the country in fast forward mode, development of National Highways has been key focus area, however state highways, district and rural roads continue to be large part of overall road network.

Table 4: Breakup of Road Network

	Million kms	%
National Highways	0.14	2%
State Highways	0.17	3%
Other Roads	6.06	95%
Total	6.37	100%

Source: MoRTH & CareEdge Research

With improvement in road connectivity over the years between cities, towns and villages, transportation by way of road has gradually increased over the years. Development and maintenance of roads in India is undertaken by various agencies of both Central and State Governments. The primary agency responsible for the development and maintenance of National highways is the Ministry of Road Transport & Highways (MoRTH) and it executes the same through the agency of National Highways Authority of India Ltd (NHAI), National Highway Infrastructure Development Corporation Ltd (NHIDCL) and State PWDs & Border Roads Organizations etc.

India's road infrastructure has seen consistent improvement in the last few years. Connectivity has improved and road transportation has become a focus of rapid development. Roads are providing better access to services, ease of transportation and movement to people. Recognizing the significance of a reliable and swift road network in the country and the role it plays in influencing its economic development, the MoRTH has taken up the responsibility of building quality roads and highways across the country. As per MoRTH, road transport emerged as the dominant segment in India's transportation sector with a share of 4.5% in India's GDP in FY06.

Road construction trends in recent years also gives optimism of achieving high targets during next few years in spite the sector badly hit by the COVID - 19 pandemic and partial lockdown at various states across India. Sector has clearly shown focus on Bharatmala Pariyojana with added emphasis on multimodal integration, road safety, increasing use of Information Technology applications, augmentation of existing funding sources and emphasis on green initiatives.

Impact of COVID – 19

The Road transport acted as the backbone of the country in difficult pandemic times. It was an enabler of smooth movement of essential goods to various parts of the country.

On the other hand, due to COVID – 19 pandemic, the constructing activities took a temporary halt throughout the country. The awarding activity slowed down leading to halt in construction. Construction moved slowly in first half of FY21 and picked up in the latter half of the year. The rate of construction activity dropped to 28km per day in FY20 when in the last month lockdown was imposed. However, this rate picked up in FY21 when the lockdown impositions were lifted in a phased manner from the construction activities. As per the Ministry of Road Transport and Highways, a presentation was made showing the works being carried during the lockdown period. It was stated that 1,315 projects covering 49,238 kms worth ₹5,896.48 Billion were under progress, of which 819 projects covering 30,301 kms costing about ₹3,062.5 Billion were delayed. It also showed State-specific issues like pending land acquisition, environment clearance etc. which had been delaying the project implementation.

However, the impact of COVID – 19 was reversed by the Government's relentless focus on infrastructure spending which boosted a sharp growth in highway construction in FY21.

4.2 Institutional framework for Roads at Central level

MoRTH, an apex organization under the Central Government, is entrusted with the task of formulating and administering, in consultation with other Central Ministries/Departments, State Governments/UT Administrations, organizations and individuals, policies for road transport, national highways and transport research with a view to increasing the mobility and efficiency of the road transport system in the country. The Ministry has two wings:

- **Roads wing** responsible for development and maintenance of National Highways in the country
- **Transport wing** responsible for matter relating Road Transport.

Main Responsibilities of Road wing are:

- Planning, development and maintenance of National Highways in the country
- Extend technical and financial support to State Governments for the development of state roads and the roads of inter-state connectivity and economic importance
- Evolve standard specifications for roads and bridges in the country
- Serve as a repository of technical knowledge on roads and bridges

Main Responsibilities of Transport Wings are:

- Motor Vehicle legislation
- Administration of the Motor Vehicles Act, 1988
- Taxation of motor vehicles
- Compulsory insurance of motor vehicles
- Administration of the Road Transport Corporations Act, 1950
- Promotion of Transport co-operatives in the field of motor transport
- Evolves road safety standards in the form of a National Policy on Road Safety and by preparing and implementing the Annual Road Safety Plan
- Collects, compiles and analyses road accident statistics and takes steps for developing a Road Safety Culture in the country by involving the members of public and organizing various awareness campaigns
- Provides grants-in-aid to Non-Governmental Organizations in accordance with the laid down guidelines

Various institutes with responsibilities make the functioning of MoRTH smooth. An autonomous body **National Highways Authority of India (NHAI)** is responsible for development and maintenance of National Highways. **National Academy of Highway Engineers** (formerly National Institute of Training for Highway Engineers) is for sharing of knowledge and pooling of experience on the entire range of subjects dealing with the construction and maintenance of roads; bridges; tunnels and road transportation including technology, equipment, research, planning, finance, taxation, organization and all connected policy issues. A fully owned company of MoRTH, **National Highways and Infrastructure Development Corporation (NHIDCL)** is responsible for promoting, surveying, establishing, designing, building, operating, maintenance and upgradation of National Highways and Strategic Roads including interconnecting roads in parts of the country which share international boundaries with neighboring countries.

4.3 National Highways Development Project (NHDP)

NHDP was launched in 1999-2000 to achieve a turn-around in the road sector in phased manner. Under First and second phase, four laning of 6,359 km and 6,359 km was approved on 12th January 2000 and 18th December 2003 at the cost of ₹ 303 Billion and ₹343.39 Billion respectively. These two phases comprise of Golden Quadrilateral (GQ), North-South and East-West Corridors (NS-EW), Port Connectivity and other projects. The GQ (5,846 km) connects the four major cities of Delhi, Mumbai, Chennai and Kolkata. The NS-EW Corridors (7,300 km) connect Srinagar in the North to Kanyakumari in the South, including a spur from Salem to Kochi and Silchar in the East to Porbandar in the West. Under third phase, upgradation of 12,109 km was approved on 12th April 2007 at the estimated cost of ₹806.26 Billion. Under fourth phase, upgradation/strengthening of 20,000 km of national highways to 2 lanes with paved shoulders on EPC/ BOT (Toll/Annuity) basis was approved on 18th June 2008. Under fifth phase, six laning of 6,500 km of national highways comprising 5,700 km of Golden Quadrilateral and balance 800 km of other sections were approved on 5th October 2006 at the cost of ₹412.1 Billion. Under sixth phase, construction of 1000 km of expressways with full access control on new alignments at a cost of ₹166.8 Billion was approved in November 2006. Under seventh phase, construction of ring roads, bypasses, grade separators, flyovers, elevated roads and tunnels at a cost of ₹166.8 Billion were approved in December 2007. Below table explains the status of completion of various phases of NHDP, which have been subsumed under the umbrella programme of Bharatmala Pariyojana, Phase-I:

Table 5: Completion status of NHDP Phases December 2020

NHDP Phases	Length completed up to 31.12.2020 in km
I+II+III+IV: GQ, Port connection & Up-gradation with 2/4/6-laning / North-South & East West Corridor	38,685
V: 6-laning of GQ and High-density corridor	4,088
VI: Expressways	219
VII: Ring Roads, Bypasses and flyovers and other structures	181

Source: MoRTH

4.4 NHAI – Authority in Charge for National Highways

National Highway Authority of India (NHAI), is the authority responsible for the development of National Highways in India. It came into existence by passing of the National Highway Authority of India Act 1988. It was formed with the vision to meet the need of provision and maintenance of National Highway networks to global standards. Its mission is to develop, maintain and manage National Highways vested in it by the Government, to collect fees on National Highways, regulate and control the plying of vehicles on National Highways for its proper management, to develop and provide consultancy and construction services in India and abroad and carry on research activities in relation to the development, maintenance and management of highways or any other facilities there at, to advise the Central Government on matters relating to highways, to assist on

such terms and conditions as may be mutually agreed upon, any State Government in the formulation and implementation of schemes for highway development. It has tried to achieve its mission by bringing innovative ways of construction so as to increase private participation.

NHAI receives its funding through:

- Government support in form of capital base, cess funds, additional budgetary support, capital grant, maintenance grant, ploughing back of toll revenue and Toll Operate & Transfer (TOT) proceeds;
- Loan from multilateral agencies;
- Market borrowings;
- Borrowing from International market through Masala Bonds by Inaugural International Debt offering;
- Asset Monetization through InvIT.

Table 6: NHAI Source of Funds (Rs. Billion)

Sources of Funds	FY19-20	FY20-21
Receipts of Cess	110.91	238.83
Plough Back of Toll Revenue	106.00	115.00
Plough Back TOT Remittance	50.00	72.62
Additional Budgetary Support	10.00	28.00
Capital Grant (JICA &WB)	1.57	1.00
Capital Gain Tax Exemption Bonds	44.51	34.27
Taxable Bonds	495.36	458.03
Loan from National Small Saving Fund	100.00	-
Term loan from SBI	110.00	158.50
Other Sources/Working capital Changes	3.80	136.15
Utilisation of opening balance	8.47	11.11
Total	1,040.65	1,253.50

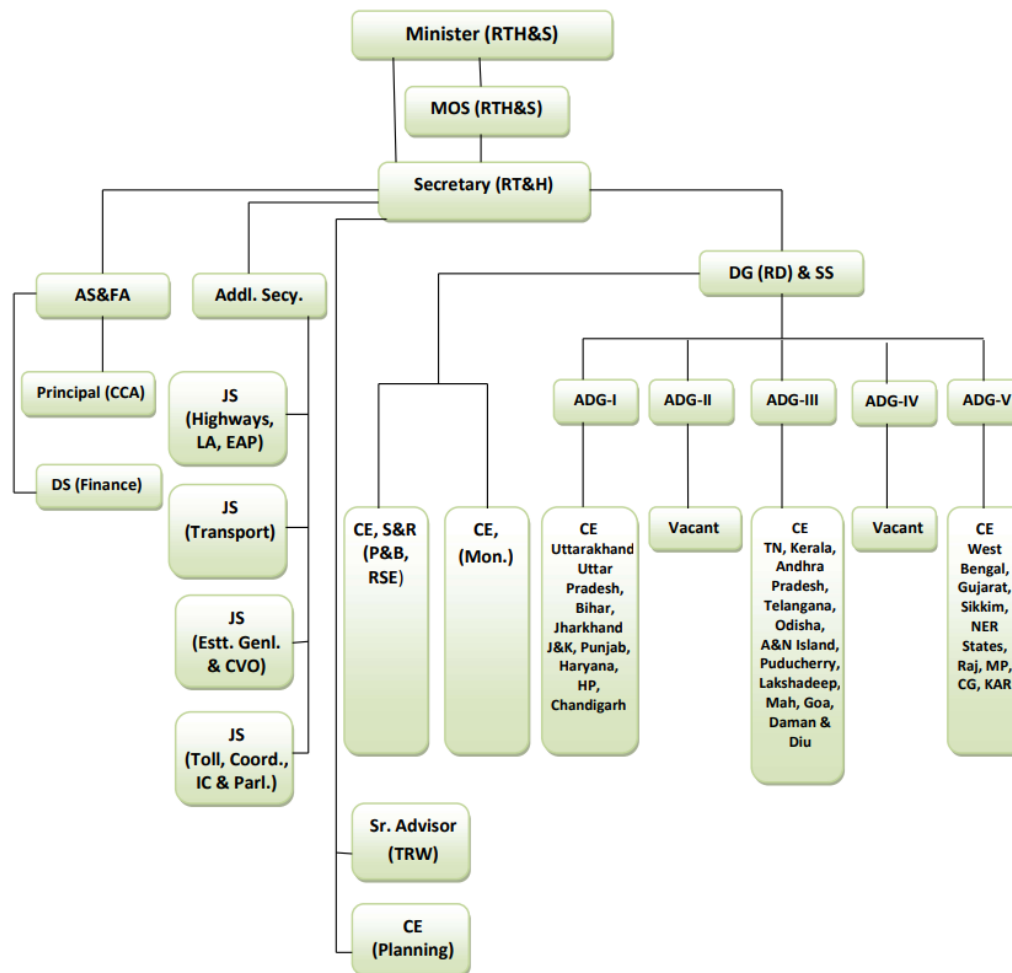
Source: NHAI

Table 7: NHAI Application of Funds (Rs. Billion)

Application of Funds	FY19-20	FY20-21
Land Acquisition	285.42	358.58
Project Expenditure	497.85	614.84
Repayment of Loans and Interest thereon	194.20	256.33
Other Outflow	63.19	23.75
Total	1,040.65	1,253.50

Source: NHAI

Organisation Chart of MoRTH:



Note: - The matters relating to Vigilance, Land Acquisition, International Cooperation and Parliament shall be submitted directly to Secretary (RT&H) by the concerned Joint Secretary

Institutional framework for Roads at State level

- 1) Gujarat: Road and Building (R&B) department is a governing body in the State of Gujarat and it is responsible for all activities pertaining to planning, construction and maintenance of all categories of roads and all Government owned buildings in Gujarat. These activities constitute a vital component of developmental work in the state.
- 2) Maharashtra: Public Work Department (PWD) is the authority that is responsible for the development of roads and highways construction and maintenance of roads, bridges, and Government buildings in the state of Maharashtra. The PWD also acts as the technical advisor to the state Government.
- 3) Uttar Pradesh: PWD is the authority that is responsible for the development of roads and highway construction and maintenance of roads, bridges, and Government buildings in the state of Uttar Pradesh. The PWD undertakes the maintenance of national highways passing through Uttar Pradesh which are not covered by the National Highways Authority for which funds are provided by the GoI. UP State Bridge Corporation, U.P. Rajkiya Nirman Nigam Ltd and U.P. State Highway Authority are the corporation and authorities working under UP PWD.

- 4) Madhya Pradesh: PWD is the authority whose main activities are construction, upgradation and maintenance of National Highways, Major District Roads, Other District Roads, Village Roads and Construction of Bridges, Fly Overs and ROB's in the State. The total length of Road network in PWD is about 61,616 kms. The Public Works Department and Project Implementation Unit (PWD PIU) undertakes construction of buildings in the State in Project mode. PWD is Nodal Agency for e- registration of contractors of all works department in the State.

4.5 Policy framework for the infrastructure sector

NITI Aayog had brought in the National Program and Project Management Policy Framework, which introduced sweeping reforms in the way infrastructure projects were executed in India, an action plan to:

1. Adopt a program and project management approach to infra development.
2. Institutionalize and promote the profession of program and project management and build a workforce of such professionals.
3. Enhance institutional capacity and capability of professionals.

Major functions of the Infrastructure Policy & Planning Division are:

- Matters relating to the Harmonized List of Infrastructure sub-sectors.
- All policy related issues in infrastructure sectors including those concerning road, ports, shipping, railways, inland water transport, urban development, power, new and renewable energy, railways and telecommunication sector referred to Department of Economic Affairs by the Administrative Ministries concerned.
- Examination of proposals requiring the approval of Expenditure Finance Committee (EFC) / Press Information Bureau (PIB) / Cabinet Committee on Economic Affairs (CCEA) / Committee of Secretaries (COS) / Competition Commission of India (CCI) in above sectors for viability and justification. In addition, all matters relating to Delhi Mumbai Industrial Corridor Trust and Delhi Mumbai Industry Corridor Development Corporation (DMICDC).
- Matters relating to infrastructure financing and promotion of investments in infrastructure sectors and credit enhancement.
- All International interface on infrastructure policy issues and infrastructure financing.
- Matters relating to the Infrastructure and Investment Working Group (IIWG) of G-20.
- All policy related issues pertaining to energy sector, viz., Petroleum & Natural Gas, Coal, Atomic Energy and New & Renewable Energy.
- Examination of proposals for grant of viability gap funding (VGF) under the National Clean Energy Fund (NCEF), matters relating to OPEC Fund for International Development (OFID) and Committee on Allocation of Natural Resources (CANR).
- Policy matters related to Public Private Partnerships (PPPs). The Public Private Partnership (PPP) Cell is responsible for matters concerning Public Private Partnerships, including policy, schemes and programmes and all other matters relating to mainstreaming PPPs.
- Matters and proposals relating to the scheme for Financial support to Public Private Partnerships in Infrastructure [Viability Gap Funding (VGF)] Scheme and the India Infrastructure Project Development Fund.

These major functions were further allocated Subject/Section wise Work

1. Infrastructure (policy) Cell:

- All policy related issues in infrastructure sector including those concerning roads, ports, shipping, railways, inland water transport, urban development, power and telecommunication sector referred to the Department of Economic Affairs (DEA) by the concerned administrative Ministries or identified and examined by DEA.
- Examination of proposals in above sectors requiring the approval of EFC/PIB/CCEA/COS/CCI for their viability and justification.
- Sectoral Charge – Ministry of Road Transport & Highways, Ministry of Shipping including Ports and Inland Water Transport, Ministry of Urban Development, Ministry of Railways, Ministry of Civil Aviation, Department of Telecommunication, Department of Post.
- All matters relating to Roads projects (PPP and non-PPP) including EFC/State Finance Commission (SFC) / Public Private Partnership Appraisal Committee (PPPAC) and Environmental Information (EI) / Environmental Clearance (EC) under the GoI VGF Scheme.
- Matters relating to Delhi Mumbai Industrial Corridor Trust and DMICDC.
- Development of Smart Cities.
- Atal Mission for Rejuvenation & Urban Transformation (AMRUT).
- Institutional Mechanism (IM) for Harmonized Master List of Infrastructure Sub-sectors.
- Telecom Commission.
- National Highway Authority of India.
- External charge – China, South Korea and North Korea.
- India Korea Macro-economic and Financial Dialogue, and
- India – China Financial Dialogue.

2. Infrastructure Finance Section:

- Matters related to infrastructure financing and promotion of investments in infrastructure sectors.
- Matters relating to Infrastructure Debt Funds (IDFs), Real Estate Investment Trusts (REITs)/Infrastructure Investment Trust InvITs, Tax Free Bonds, Municipal Bonds and other instruments meant for infrastructure financing and credit enhancements.
- All international interfaces on infrastructure financing (other than PPPs).
- Model Tripartite Agreements (MTA) for sectors such as Road, Ports, etc.
- External charge- Bahrain, Oman, Saudi Arabia, Qatar, Kuwait, UAE, Yemen, Israel, Jordan and Lebanon.

- Matters relating to Infrastructure and Investment Working Group (IIWG) of G-20.
- India-Saudi Joint Investment Fund, Indo-Israeli R & D Fund.
- Examination of proposals in above sectors requiring the approval of EFC/PIB/CCEA/COS/CCI for their viability and justification.
- All policy matters relating to Project Monitoring Group (PMG).
- India Saudi Arabia Joint Commission for Technical and Economic Cooperation.
- Matters relating to meetings of Board of Directors of ONGC-Videsh Limited (OVL), IIFCL and IRFC as Government nominee on the Board of Directors.
- Coordination and general matters pertaining to the Division.

3. Public Private Partnership (PPP) Cell

- Matters relating to appraisal and approval of Central sector PPP projects, as per the Cabinet approved "Compendium of Guidelines for Central Sector PPPs" and the delegation of powers assigned from time to time except those in Road Sector.
- Matters and proposals relating to clearance by Public Private Partnership Appraisal Committee (PPPAC) except those in Road Sector.
- Matters and proposals relating to the scheme for Financial support to Public Private Partnerships in Infrastructure Viability Gap Funding (VGF) Scheme except those in Road Sector.
- Matters and proposals relating to the scheme for India Infrastructure Project Development Fund (IIPDF).
- Developing Multi-pronged and innovative interventions and support mechanisms for facilitating PPPs in the country, including Technical Assistance and programmes from bilateral/multilateral agencies on mainstreaming PPPs and support to State and local Governments.
- Managing training programs, strategies, exposures for capacity building for PPPs and other matters relating to institution building for mainstreaming PPPs.
- All International interfaces on PPPs & other matters concerning PPPs.

4.6 National Highway

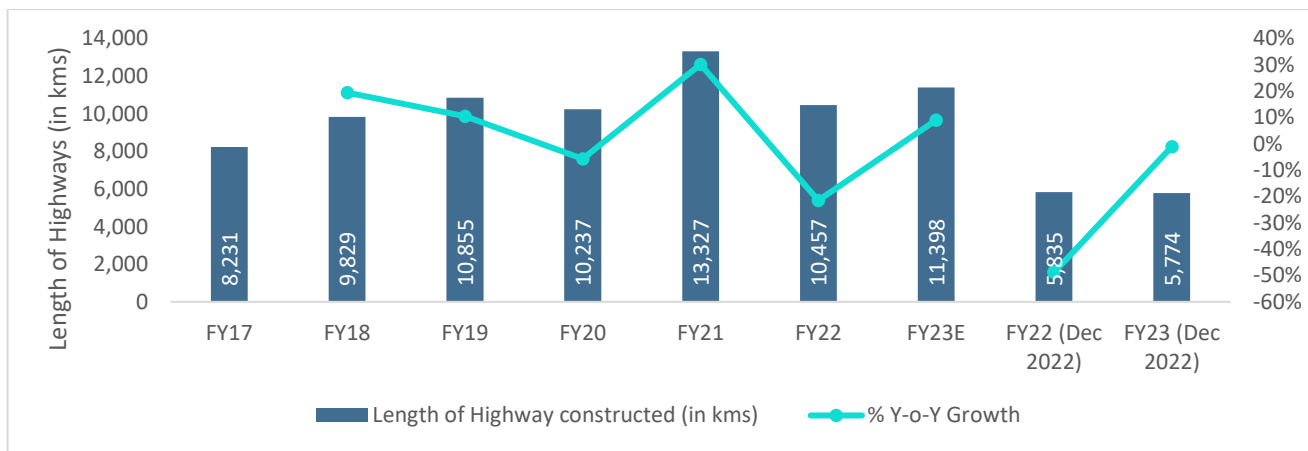
Recovery Mode on – Highway construction pace returned to pre COVID - 19 level

Total Highways Construction in India grew at a CAGR of 13% between FY16-FY21. Despite the challenges amid COVID - 19, the Government’s relentless focus on infrastructure spending, boosted a sharp growth in highway construction in FY21. After a slow growth in the first half of FY21, the pace of highway construction picked up in the second half of FY21, in which the February and March 2021 registered a record high construction at a pace of over 70 kms a day.

In FY22, the pace of project award and construction slowed down by 21.54% after record highway construction in FY21. The pace did not pick up in H1FY23 as well, where the projects awarded declined by 11.2% and construction declined by 6.9% as compared to the previous financial year. Till the month of September 2022, 3,559 Kms of highways were constructed and 4,092 kms were awarded. The slowdown in construction can be attributed to the slowdown in awarding activity. However, construction activity in H2FY23 is expected to be robust backed by various Government initiatives such as Gati Shakti, Bharatmala Pariyojana, National Infrastructure Pipeline and change in the Model Concession Agreement (MCA) of the Hybrid Annual Model (HAM) of road project implementation.

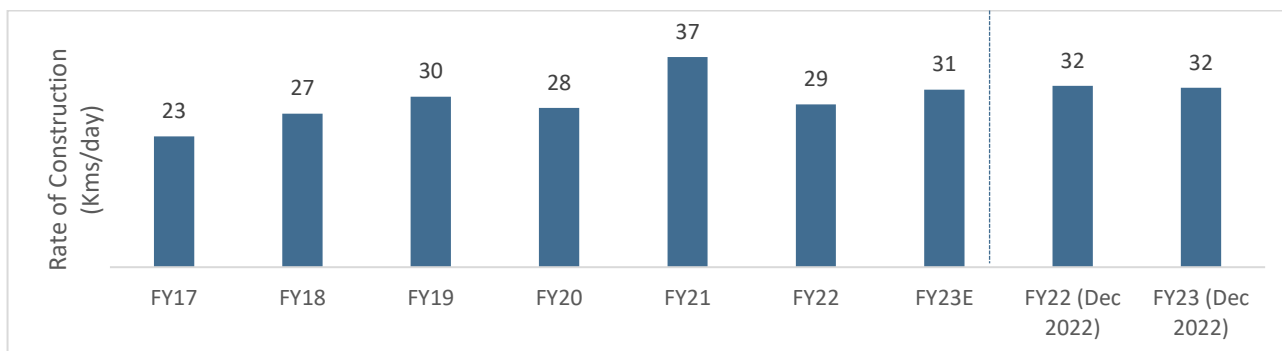
Key performance indicator for national highways:

Chart 13: Length of Highway constructed in India



Source: MoRTH & CareEdge Research

Chart 14: Rate of Highway construction per day



Source: MoRTH & CareEdge Research

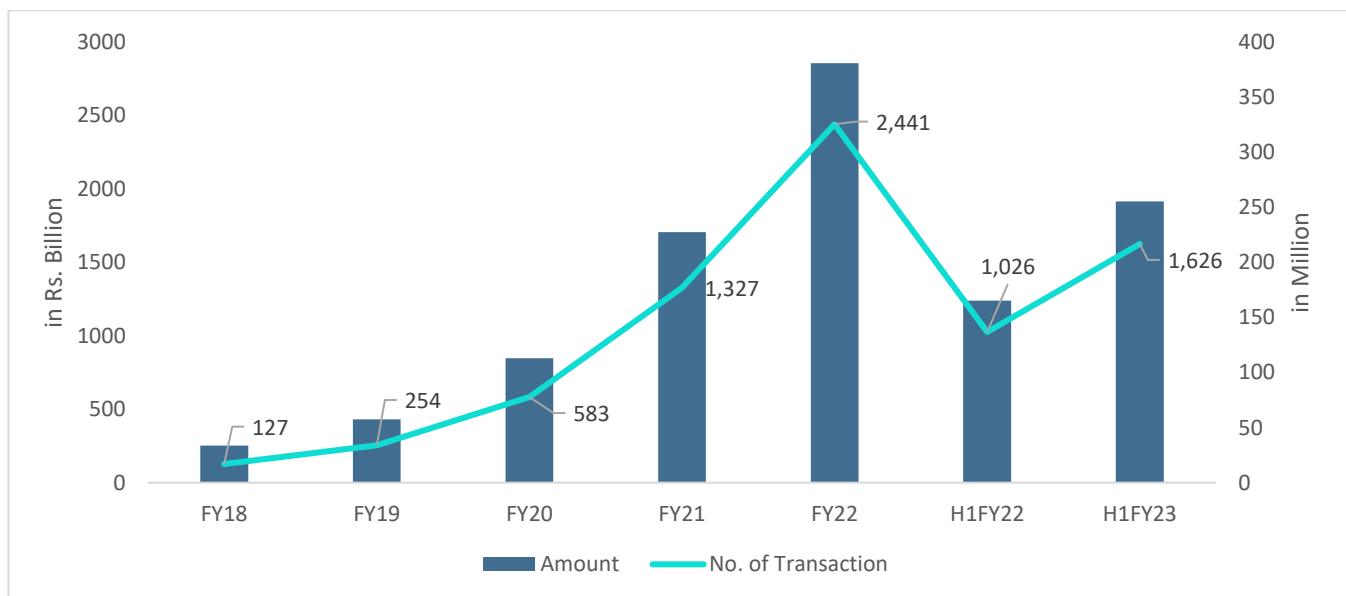
4.6.1 Electric Toll collection

FASTag is proving an effective and time saving mode of Toll Collection

Electronic toll collections have soared since the introduction of FASTag. FASTag toll collection for the H1FY23 stood at ₹ 255.43 Billion from ₹1,626 Million transactions compared to ₹165.41 Billion from ₹1,026 Million transaction in H1FY22 a growth of 54% YoY, making it highest ever collection. The record high transaction and toll collections come on the back of declaration of all lanes on national highway as FASTag lane, increased economic and transportation activities across India especially during the festive season.

FASTag comes as a part of the GoI's initiative to enhance digital transactions across various sectors in the country. It was first introduced in India in 2014 and was made mandatory from February 2021. It has transformed the way toll tax is collected in the country. It is a Radio Frequency Identification (RFID) technology enabled card that allows drivers to pay their toll tax electronically at the toll booth reducing long vehicle queues and waiting times and at the same time saving time and fuel.

Chart 15: FASTag Toll Collection continues to rise



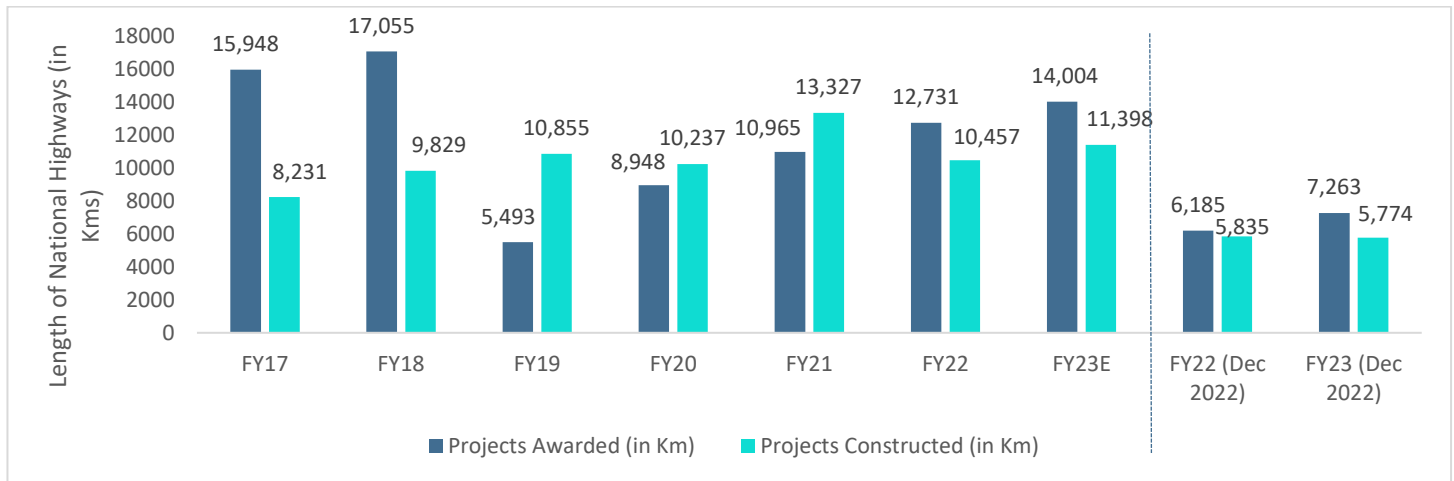
Source: National Payments Corporation of India

4.6.2 Key growth drivers of the sector

Firing the fuel that lead to achieve pre COVID - 19 levels

National Highways Projects awarded continue strong pace. The national highways project has witnessed decline in projects awarded due to lower participation from private players. However, with increased focus towards EPC and HAM models, the pace of awards of NH projects grew at a strong pace of 32% CAGR over the past 4 years (Refer chart below). Strong execution of projects was witnessed in FY22, albeit lower than FY21 as it was impacted with reinforcement of lockdown and extended monsoons. However, project execution is expected to continue its momentum in FY23 on back of higher awarding activity and also various Government initiatives such as Gati Shakti, Bharatmala Pariyojana, National Infrastructure Pipeline and change in the Model Concession Agreement (MCA) of the Hybrid Annual Model (HAM) of road project implementation.

Chart 16: Road Projects Awarded and Constructed



Source: MoRTH & CareEdge Research

Government's infrastructure focuses to support growth in the medium term

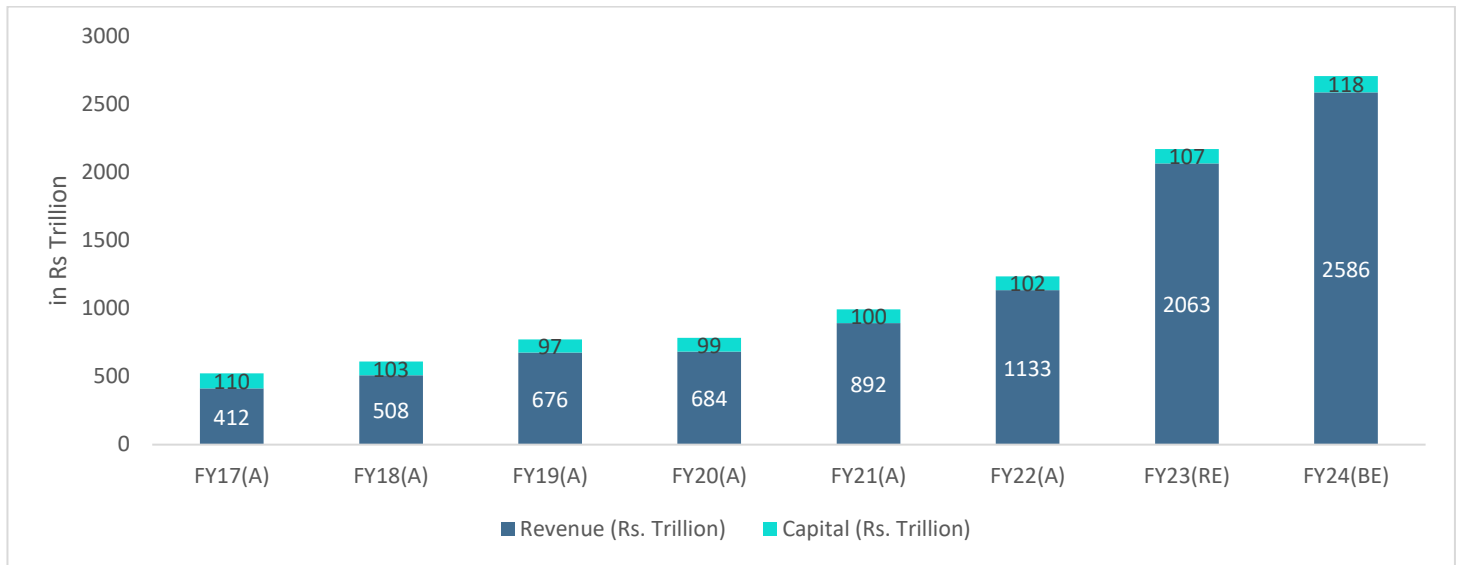
Road construction is amongst the critical sub-segments of infrastructure development, economic growth as well as for employment creation. Infrastructure has been a major focus of the Government currently.

In the Union budget 2022-23, the Government budgeted to incur higher expenditure towards road construction. Wherein, the Central Government made the highest ever outlay of ₹1,990 Billion (compared to the estimated expenditure of ₹1,310 Billion for 2021-22).

Overall, the Union Budget for 2023-24 depicted higher focus on infrastructure. The budget plan aims for multi-modal logistics facilities and connectivity systems under the PM Gati Shakti. For infra push, financial assistance of ₹1,300 Billion interest free loans for 50 years has been allocated to states from the Centre. Through this, the Government is planning to generate employment opportunities and augurs well for the Roads sector.

In addition, ₹111 Trillion of investments have been projected in infrastructure projects for FY20-FY25 by the Task Force on National Infrastructure Pipeline (NIP), with ~18% of the targeted investment expected to be made in the road sector in India. Also, under the recently announced Asset Monetization Pipeline, around ₹1,600 Billion are to be monetized through roads.

Chart 17: Budget Allocation for the Ministry of Road Transport and Highways



Source: Demand for Grants 2022-23, MoRTH

RE – Revised Estimates

BE – Budgeted Estimates

4.6.3 Key budget announcements for road sector in FY23

The 2023-24 budget by the Government highlights the impetus for growth by focusing on big public investment for modern infrastructure, which shall be guided by PM Gati Shakti and benefited by the synergy of multi-modal approach.

- It's a step towards economic growth as well as sustainable development and is driven by seven engines, namely, Roads, Railways, Airports, Ports, Mass Transport, Waterways, and Logistics Infrastructure.
- 100 critical transport infrastructure projects have been identified at an investment of ₹75,000 crore including ₹15,000 crore from private players.
- For the urban infrastructure in Tier – II and Tier – III cities, a corpus of Rs. 10,000 crore per annum has been set aside via establishment of Urban Infrastructure Development Fund.

4.6.4 Government Initiatives for Development of Road Infrastructure

GoI has introduced a number of policy initiatives to ensure an enabling environment for various stakeholders involved.

The initiatives are broadly categorized as follows:

1. Development Initiatives by Government of India

- **Bharatmala Pariyojana**

MoRTH has envisaged an ambitious highway development program Bharatmala Pariyojana which includes the development of 65,000 km of national highways. The key objective of the programme is to optimize the efficiency of freight and passenger

movement – this would be achieved by bridging critical infrastructure gaps through the development of Greenfield expressways, economic corridors, inter-corridors and feeder routes. Under Phase-I of Bharatmala Pariyojana, the MoRTH has approved implementation of 34,800 km of National highways in 5 years with outlay of ₹5,350 Billion. NHA has been mandated the development of about 27,500 km of National Highways under Bharatmala Pariyojana Phase-I.

- **Connectivity in LWE Area**

The Government has approved a scheme for development of about 1,177 km of NHs and 4,276 km of State Roads in Left Wing Extremism (LWE) affected areas as a Special Project with an estimated cost of about ₹73 Billion. The detailed estimates for 5,422 km length have been sanctioned at an estimated cost of ₹86.74 Billion. Development in 4,792 km length has been completed up to March, 2019 and cumulative expenditure incurred so far is ₹73.15 Billion.

- **Char Dham Pariyojana**

MoRTH has taken up separate programme for connectivity Improvement for Char-Dham (Kedarnath, Badrinath, Yamunothri & Gangotri) in Uttarakhand. Out of total 53 civil works covering the entire length of 889 km under Char Dham project, 40 civil works of total project cost amounting to ₹94.74 Billion (including cost of pre-construction works amounting to ₹4.91 Billion) in a length of 673 km has been sanctioned.

- **Special Accelerated Road Development Programme (SARDP) including Arunachal Pradesh Package**

The Scheme has been envisaged to be taken up under three phases. First phase - improvement of about 4,099 km length of roads (3,014 km of NH and 1,085 km of State roads). Out of these, 3,213 km roads have been approved for execution and balance 886 km has been approved 'In-Principle'. 3,333 km of length has been awarded and 2,101 km of roads have been completed till March, 2019. The SARDP-North East first phase is expected to be completed by 2023-24. Second phase of SARDP-NE - improvement of 3,723 km of roads (2,210 km NHs and 1,513 km of State roads) and shall be taken up after completion of first phase.

The Arunachal Pradesh Package for Road & Highways involving development of about 2,319 km length of road (2,205 km of NHs & 114 km of State / General Staff / Strategic Roads) has also been approved by the Government. Projects on 776 km are to be taken up on BOT (Annuity) mode and the remaining are to be developed on EPC mode / Item Rate Contract as per MoRTH's extant policy. Projects of 2,047 km length have been awarded and 928 km of road has been completed till March, 2019. The entire Arunachal Pradesh package is targeted for completion by 2023-24. An amount of about ₹303.15 Million has been spent in SARDP including Arunachal Pradesh Package.

- **State Public Works Department (PWD) and Border Road Organization (BRO)**

An amount of about ₹249.29 Billion was earmarked during the year 2021-22, for the development of NH entrusted to State PWDs. States have spent ₹ 191.57 Billion till 31st December 2021. An amount of about ₹4.33 Billion was earmarked during the year 2021-22, for the development of NH entrusted to BRO. BRO has spent ₹1.79 Billion till 31st December 2021. An amount of about ₹9.11 Billion was earmarked during the year 2021-22, for the maintenance of NH entrusted to State PWDs. States have spent ₹2.10 Billion till 31st December 2021. An amount of about ₹1.70 Billion has been earmarked during the year 2021-22, for the maintenance of NH entrusted to BRO. BRO has spent ₹0.69 Billion till 31st December 2021.

- **FDI Investment in Roads and Highways**

Government has permitted 100% FDI investment in roads and highways projects by direct route. This has attracted many international institutes to invest in projects. Some of the investments are as follows:

- Australia-based Macquarie Infrastructure and Real Assets' second pan-Asian infrastructure fund, Macquarie Asia Infrastructure Fund 2 (MAIF 2), in association with Ashoka Buildcon, has bagged contract for the first bundle of nine highway stretches measuring 680 km in Andhra Pradesh and Gujarat

- Canada Pension Plan Investment Board (CPPIB) and Allianz Capital Partners (ACP) acting as anchor investors in India's first private infrastructure investment trust, namely, IndInfravit Trust, which is sponsored by L&T Infrastructure Development Projects Ltd (L&T IDPL). Under this, CPPIB's investment of Canadian \$200 Million fetched it 30% of IndInfravit units with ACP and L&T IDPL accounting for 25% and 15%, respectively. The remaining units were subscribed by other institutional investors

2. Various Operational Initiatives to smoothen construction

Process streamlining is being increasingly taken up by MoRTH to ensure smooth appraisal and approval of road sector projects. Some of the major steps for process streamlining are:

- **Mode of Delivery:** MoRTH is empowered by a Cabinet Committee on Economic Affairs (CCEA) decision on mode of delivery of projects.
- **Increased threshold for project appraisal and approval:** MoRTH was authorized through a CCEA decision to appraise and approve projects up to ₹100 Billion.

In addition to this many technological initiatives have been adopted by MoRTH to aid the execution and operation of a road projects. Some of technological initiatives are:

- **Use of Bhoomirashi:** MoRTH has corroborated with the National Informatics Centre, to create Bhoomirashi, a web portal which digitizes the cumbersome land acquisition process and also helps in processing notifications relating to land acquisition process and also helps in processing notifications relating to land acquisition online. Processing time, which was earlier two or three months, has come down to one to two weeks now
- **E-procurement System:** NHAI is using the e-procurement portal for tendering of all kinds of goods and services. This has led to greater transparency. The system currently in use by NHAI is the Central Public Procurement Portal by National Informatics Centre (NIC)
- **Bidder Information Management System (BIMS):** BIMS aims to simplify the qualification process of bidders for road construction contracts. This helps in faster evaluation of technical information provided by the bidders
- **Interlinked between various platforms:** The two IT initiatives Bhoomirashi and BIMS, have now been integrated with the Public Financial Management System (PFMS). PFMS allows for the compensation amount to be paid to the concerned person directly rather than being deposited with CALA (Competent Authority for Land Acquisition)
- **mVahan:** mVahan has been envisaged as a convenient mobile solution for managing various VAHAN services by Department Officers at the RTOs and other stakeholders like dealers. The current version, facilitates a number of processes including automation of Vehicle Inspection and Fitness, facilitation of documents uploads by Dealer/RTO during vehicle registration and other services like processing requests for change of address etc. The Government is further working to expand to cover the full range of RTO operations

3. Revival of languishing projects:

Projects which were languishing for a number of years have been attempted to be revived with the help of number of policy measures taken by the Government. Some of the policy measures have been discussed below:

- **100% equity divestment two years post Commercial Operation Date (COD)** – The policy enables private developers to take out their entire equity and exit all operational BOT projects two years from commercial operation date
- **Premium deferment in stressed projects** – The policy permits rescheduling of premium committed by concessionaires during bid stage for awarded projects
- **Rationalized compensation to concessionaires for languishing NH projects in BOT mode for delays not attributable to concessionaires** – The policy enables extension of concession period for languishing BOT projects to the extent of delay provided. The original operation period remains unchanged
- **One-time fund infusion** – The policy enables revival and physical completion of languishing BOT projects that have achieved at least 50% physical progress, through one-time fund infusion by NHAI, subject to adequate due diligence on a case to case basis

4. Amicable dispute resolution:

To enable time-bound resolution in an affordable manner, efforts have been made by NHAI for dispute resolution through the established mechanism of alternate dispute resolution through the three-tier stage of.

- 3-CGM committee
- Independent Settlement Advisory Committee (ISAC) and
- Executive Committee/Board of NHAI for Settlement of disputes

In 2017, NHAI established Conciliation through Committee of Independent Experts (CCIE). Further, Society of Affordable Redressal of Disputes (SAROD) was formed in 2013 by NHAI to reduce cost and time overruns due to the arbitration process and for fast dispute redressal. The main objectives of SAROD were to reduce cost due to the arbitration process and pendency of disputes, efficient disposal of disputes and to develop experts for the arbitration process 347 arbitrators have already been empaneled.

4.6.5 Key trends in Roads sector

Robust demand of automobiles: The overall domestic sales in 9MFY23 grew by 12% compared to 9MFY22. The growth has been primarily driven by the commercial vehicle and passenger vehicle segment, especially the utility vehicles sub-segment under passenger vehicles. This growth of automobiles is a major push for road development in the country.

Huge investments by Government: In the Union budget 2023-24, the Government budgeted to incur higher expenditure towards road construction (approximately 2,700 Billion). The Central Government made an outlay of ₹1,990 Billion in 2022-23 (compared to the estimated expenditure of ₹1,310 Billion for 2021-22).

Development of economic corridors: Corridors like Bharatmala Pariyojana help in integrating the economic corridors which facilitate larger connectedness between economically important production and consumption centers.

4.6.6 Recent events in Roads and Highways sector

New project for National Highways inaugurated in Maharashtra: Foundation stone for 5 National Highway projects of 212 km length at Nanded worth ₹15.75 Billion, 3 National Highway projects worth ₹10.58 Billion and 75 km length at Parbhani, and National Highway project worth ₹10.37 Billion are laid at Hingoli. This project will help in improving connectivity of Marathwada region with Telangana and Karnataka.

NHAI to explore use of Phosphur – Gypsum in highway construction: Keeping its commitment to encourage use of waste material to build ecologically sustainable National Highway Infrastructure, NHAI along with Department of Fertilizers, Ministry of Chemicals & Fertilizers is going to take up field trials on NHAI projects for use of Phosphor-Gypsum in National Highway construction to achieve a circular economy in the use of Gypsum. The fertilizer company and CRRRI have been asked to take up field trials on an NHAI project to evaluate performance of Phosphor-Gypsum on a National Highway and to generate confidence among various stakeholders on use of Phosphor-Gypsum waste material in Highway construction.

Joint projects with Japan to be undertaken for digital transformation: The Indo-Japan Joint Working Group (JWG) to function together for providing best road infrastructure for commuters and freight movement and helping India achieve its sustainable transport goals. The joint projects will be undertaken for a massive digital transformation in the areas of Intelligent Transport Systems (ITS), and eco-friendly mobility.

4.6.7 PPP models

To boost Private participation, Government has come up with various models

Overview

Connectivity has been priority of the Government and making last mile connectivity, road is the best and cheapest way of increasing connectivity. Construction of roads in every corner of the country by only Government agency is difficult as it will increase time and cost both. To achieve complete connectivity by way of roads, Government partnered with the private players and it came to be known as Public Private Partnership (PPP). Initially, PPP road projects broadly fell in one of the two categories of toll or annuity. However private sector participation gradually subdued post 2012 due to various issues including aggressive bidding and over-leveraged balance sheet of developers, shortcomings in project preparation activities and land acquisition issues. To attract PPP participation in the road sector, Government introduced the Hybrid Annuity Model (HAM). It focused on proper allocation of risk among partners. Further, operational asset monetization model has gained prominence recently with the advent of the Toll-Operate-Transfer (TOT). Other asset monetization options like use of Infrastructure Investment Trusts (InvIT) and Securitization of toll revenue are also in various stages of implementation.

Key types of PPP models in India

- **Build Operate and Transfer (BOT)**
This is a simple and conventional PPP model where the private partner is responsible to design, build, operate (during the concession period) and transfer back the facility to the public sector. Role of the private sector partner is to bring the finance for the project and take the responsibility to construct and maintain it. In return, the public sector will allow it to collect revenue from the users by way of toll.
- **BOT (Annuity)**
In the BOT (Annuity) mode, the private partner is responsible for building, operating and transferring the road at the end of the agreement period to the public sector. The toll collection is however undertaken by the Government agency and the payment is made on semi-annual basis to the private players.
- **Engineering, Procurement and Construction (EPC)**
In the EPC mode, the cost is completely borne by the public sector - Government. Public sector invites bids for engineering knowledge from the private players. Procurement of raw material and construction costs are met by the public player. The private sector's participation is minimum and is limited to the provision of engineering expertise.

- **Management Contract**

Here, the private promoter has the responsibility for a full range of investment, operation and maintenance functions. He has the authority to make daily management decisions under a profit sharing or fixed-fee arrangement. Variants include basic management for fee contract, management contract with performance incentives, management and finance contract with some rehabilitation and expansion.

- **Lease Contract**

In this approach, the Government gives a concession to a private entity to build a facility (and possibly design it as well), own the facility, lease the facility to the public sector and then at the end of the lease period transfer the ownership of the facility to the Government. Usually, the private partner in such cases would require an assurance in terms of tariff levels, increases over term of lease and compensation and review mechanism in case the tariff levels do not meet the estimates.

- **Service contract**

In this approach, the private promoter performs a particular operational or maintenance function for a fee over a specified period of time. In addition, there are modes such as TOT and Operate-Maintain-Transfer (OMT) for monetizing future toll earnings of completed projects.

- **Hybrid Annuity Model (HAM)**

Due to subdued private participation in the bidding process, the Government opted for advance version of the Hybrid Annuity Model (HAM) in FY2017. It was introduced when private players were piling on debt and banks were fearing on providing additional loan as major of the projects were failing. Major BOT project had proven to be bad choice as there the main assumption for the returns was traffic, if there was no enough traffic as assumed the whole project would turn into fund trap for private players. But in case of HAM, it is a mix of BOT (Annuity) and EPC models. This model safeguards the interest of both the parties i.e., Government and private entity. During the construction period, the private entity is provided 40% grant of the bid project cost by the Government in five equal instalments depending on the physical progress of the project. The remaining 60% of the bid project cost is to be borne by private entity through debt and equity. The Government generates its revenue from the project by way of toll collection. This model has been very successful as the burden of financing of private players has reduced. In the first year of its implementation, ₹ 280 Billion of projects were awarded by the NHA of which 50% of the projects were under HAM. HAM has not only brought back private participation but it has also safeguarded the banks as the fund disbursed to private players are backed by the Government annuity payments i.e. the traffic risk is taken care by Government itself, private players are only responsible for building the project and there is no role in road's ownership, toll collection or maintenance.

4.6.8 Major challenges faced by the roads sector

Despite Governments continues support by way of Finance and tweaking PPP models many challenges still persist for the sector

- **Land Acquisitions:** Post Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2003, many land owners demand for higher compensation and refuse to hand over possession of their land. With the Act coming into effect, cost of land has increased and in some case land cost is higher than the project cost.
- **Mismatch between project cashflows and debt repayment tenure:** Revenue from large infrastructure projects is spread over 20-30 years whereas the loan for the same project is for the period of 10-15 years. This results into cashflow

mismatches in the initial years of operations till the project stabilizes and also overall tenure mismatch between project cashflows and debt repayment, thereby resulting in private players to fund cashflow mismatches from their own sources.

- **Projects Delays Impact on Financial Institutions:** As debt is on a rise due to push for road projects, many projects get stuck or get delayed, turning the loans into NPAs which leads to contraction in the lending capacity of the banks.
- **Financial Stress:** Due to failed BOT projects on account of lower than estimated traffic or delays in project completion due to approvals/ land acquisition, private players have come under financial stress due to significantly leveraged balance sheets in anticipation of high levels of project revenue growth. Due to slowdown in economic activity on account of COVID - 19, revenue realization has also been much lower than anticipated.
- **Highly stressed Loan portfolios:** With lower than anticipated revenues, the private players' debt servicing capacity has been impacted. To mitigate the risk of failure of company, restructuring of loan has been opted by the private players. Restructuring of loans for the first time does not impact asset classification but subsequent restructuring leads to NPA recognition in the books of financial institutions.

4.6.9 Outlook

Connectivity has always been the backbone of any economy as it not only reduces the overall cost of logistics but also reduces the overall cost of production. To achieve last mile connectivity, roads and highways pave the way as they are cost effective way of connectivity. Over the years budgetary allocation has been increased from ₹520 Billion in FY17 to ₹ 1,820 Billion in FY23 proving the Government's high focus on infrastructure sector. India has second largest road network in world with 6.37 Million kilometers of roads and highways of which 5% falls under Highways. For better connectivity and faster movement of goods, Government is expanding 2 lane highways to 4 lanes and 4 lanes to 6 lanes. Government has also identified border areas for better connectivity and have launched various projects. This sector has higher opportunities as the connectivity of ports and other key locations such as consumption centres, metros, Tier-2 cities and strategic importance is still under developed.

To achieve the complete connectivity, private player participation is must and to attract the investment of private players, Government has brought in several Public-Private Partnership (PPP) models which has attracted significant investment over the past decade. Of all the PPP models, HAM has proven to be successful. It has given favorable condition for the participation of private players. Government is looking forward to bring in more projects under HAM followed by EPC. Lower participation for private players has at some point hampered the overall development of roads and highway sector. Issues of delay in project completion, due to land unavailability has been dealt by NHAI's decision to allot project, post completion of 90% of land acquisition. Also, to ease the burden of debt and avoid NPAs in books of private players & banks, Government has allowed 100% FDI in the sector and also allowed asset monetisation for private players post construction is complete.

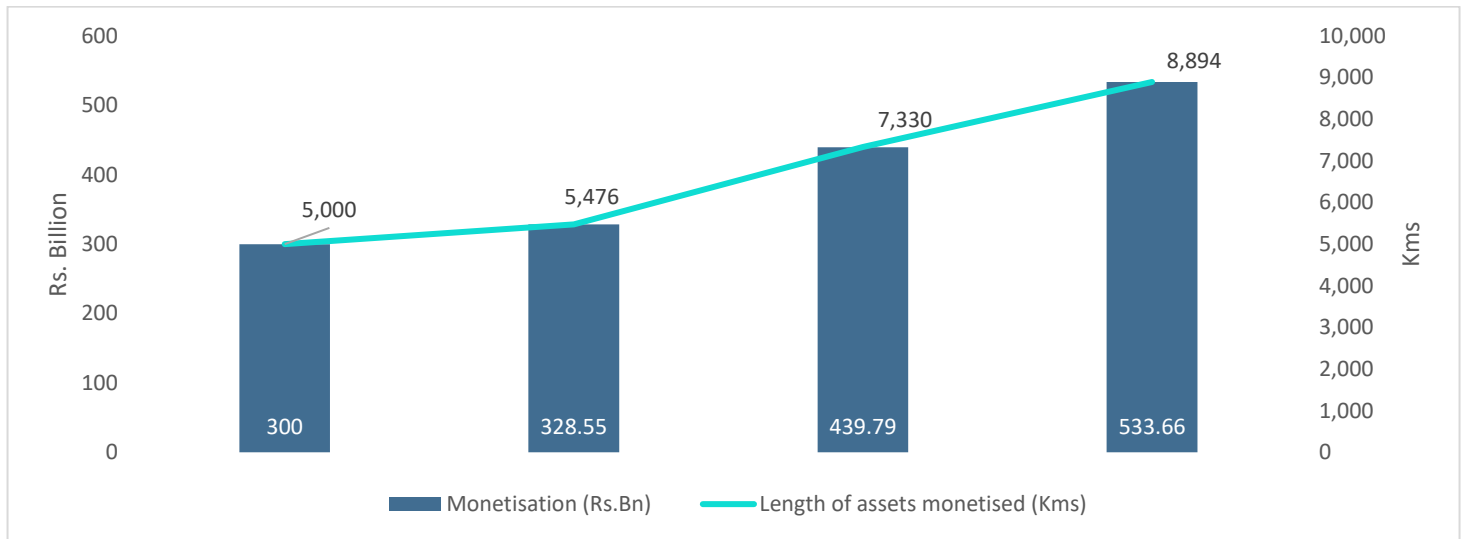
Further to set a clear view of development, Government has set up National Infrastructure Pipeline. Under the National Infrastructure Pipeline (NIP), 18% of the ₹111 Trillion investment targeted over FY20-FY25 is expected to be made in the roads sector. Majority of it is targeted towards improving road length and safety features. A total of 1815 national highway projects spanning 87,612 kms and 5 expressway projects spanning 2,142 kms have been identified under the pipeline with a capital expenditure of ₹ 13,800 Billion over the fiscals 2020 to 2025. Delhi-Mumbai expressway and Chennai-Bengaluru Expressway have been identified as the marquee projects.

To finance the NIP, several innovative financial avenues would have to be looked at such as asset monetization, increased implementation of de-risked models such as Hybrid Annuity Model (HAM) and introduction of investment platforms such as Infrastructure Investment Trusts (InvITs) apart from monetization planned through the National Monetization Plan (NMP).

National Monetization Plan

The National Monetization Plan (NMP) announced by the Government has identified the road sector having the maximum potential at 1,602 Billion which constitutes 27% share in the overall NMP. Around 26,700 km of road assets are to be monetized under NMP which makes around 20% of the total asset length. The chart below shows the phasing planned under NMP.

Chart 18: Phasing Under NMP



Source: National Monetization Pipeline, Volume II

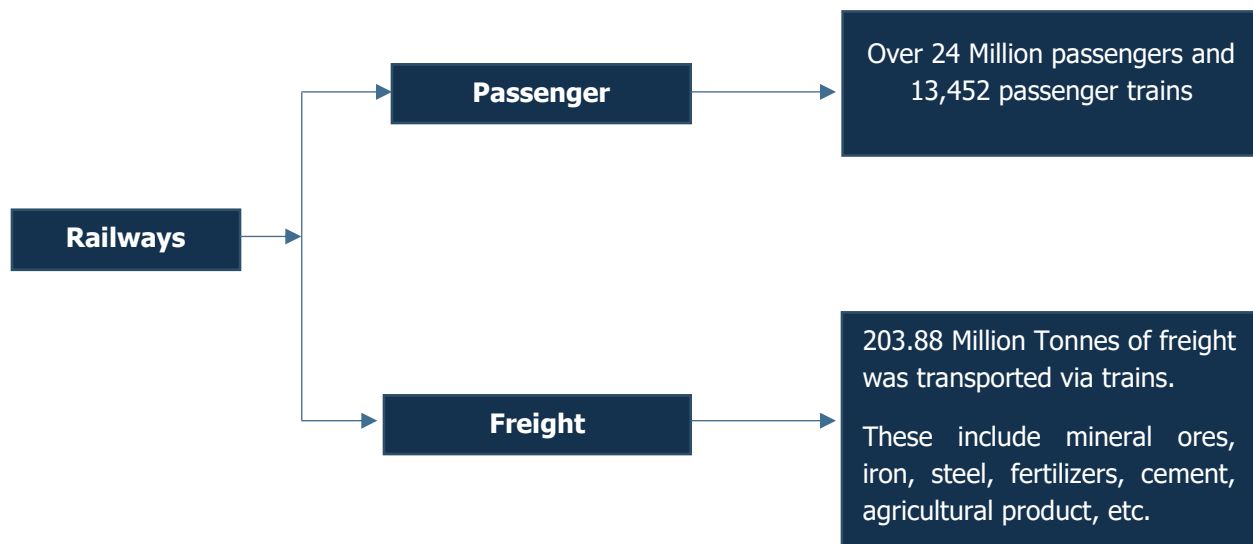
NHAI announced InvIT as a mode to monetize road projects under NMP. The InvIT will initially have a portfolio of five operating toll roads with an aggregate length of 390 kilometers. These roads are located across the states of Gujarat, Karnataka, Rajasthan, Maharashtra, Andhra Pradesh, Madhya Pradesh and Telangana. NHAI's first InvIT raised more than ₹50 Billion in November 2021 and second InvIT raised ₹15 Billion in October 2022. TOT projects covered under InvITs are Kota, Kothakota - Kurnool Project Highway, Chittorgarh Kota Project Highway, Maharashtra Belgaum Project Highway, Abu Road Swaroopganj Project Highway and Palanpur Abu Road Project Highway. InvITs are instruments like mutual funds, designed to pool money from investors and invest the amount in assets that will provide cash flow over a period of time. The Government plans to add more national highways to the InvIT portfolio as the long-term revenue generating assets such as toll roads provide stable and long-term yields under the InvIT structure. With InvIT coming into picture, burden on budget will be lowered as financing will be take care by InvIT. This will not only result in reducing debt of NHAI but also have access to additional funds for the new projects.

5. Railway and Metro

5.1 Railways

The Indian Railways is the largest rail network in the World and is a regulated body under GoI and is the backbone of the Indian economy. It is also the fourth largest national railway system in the world. It consists of a total track length of over 0.12 Million km with over 0.07 Million km route consisting of more than 7,000 stations. Indian railways run about 9,000 freight trains and 13,500 passenger trains carrying a total passenger count of over 24 Million passengers and more than 203 Million tonnes of freight. It is also the largest employer in India and contributes to about 1.5% of the GDP as it supports about 45% share of the modal freight of India. It is the driver of India's economic growth and is considered safe, viable and environment friendly mode of transport in India. The Railways operations can be divided into passenger and Freight segments. The Government has proposed a 70% Y-o-Y increase in budgetary allocation of ₹2,400 Billion to Railways in Budget FY24.

Owing to customer centric approach and business development units backed by strong policies, the Railways achieved 1,400 Million Tonne (Mn Tonnes) Freight loading mark for the first time in FY22. The originating Freight Loading of the Indian Railways stood at 1,418 Million Tonnes in FY22 as compared to 1,233 Million Tonnes in FY21.



The reasons for the same are improvement in passenger earnings which happened by introduction of new trains and special trains or premium special trains etc. by increase in freight earnings like rationalizing merry-go-round policy, reducing distance in mini rakes etc., by leasing of parcel space to private parties and by liberalization of parcel policy.

Apart from this, Indian railways is also considering to explore areas like changing coaches' compositions, having additional streams by monetizing traffic on digital booking on IRCTC.

Passenger Earnings

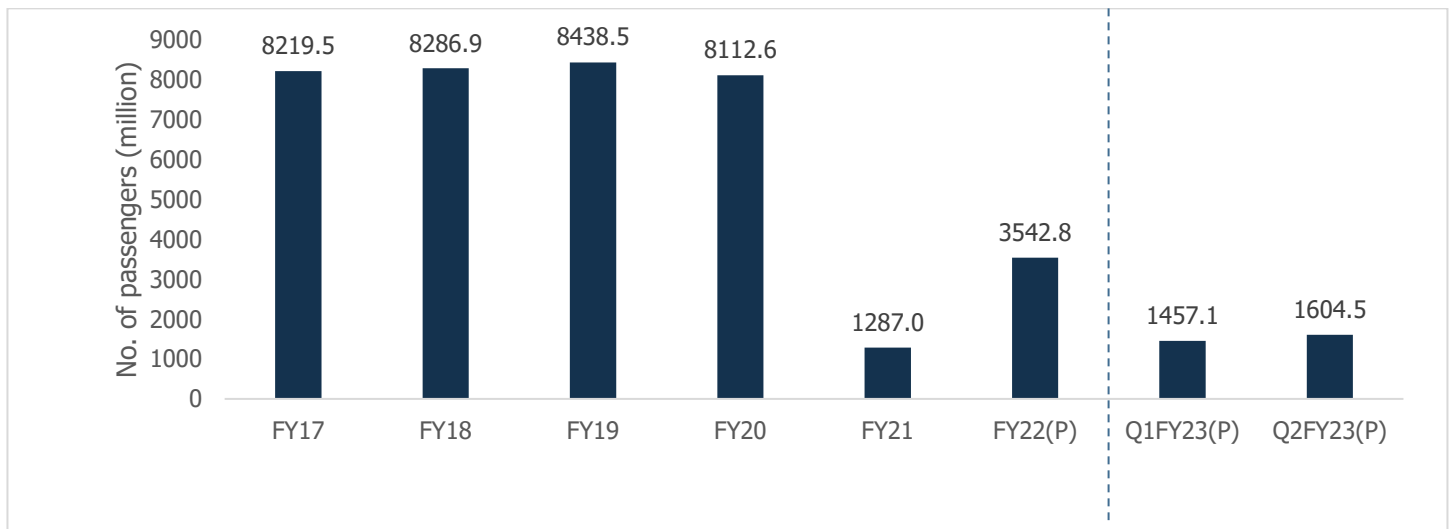
Train travel is the preferred means of transport for long-distance travel for majority of Indians. Passenger traffic is broadly divided into two categories i.e. suburban and non-suburban traffic. Suburban trains usually cover small distances like 150 km and carries the passenger within the cities whereas non-suburban trains cover larger distances and covers inter cities or states. Majority of the revenue i.e. 94% comes from non-suburban trains. In FY22, there was a 61% growth in passenger

revenue y-o-y, according to the provisional reports, and it was majorly because of low base effect due to the lockdown in COVID - 19 pandemic.

The year 2020-21 ended with an excess of earning over expenditure to the tune of ₹25.47 Billion. In H1FY23, the passenger traffic has already reached 3,062 Million and is expected to cross pre-covid level in the coming years. The increase in the demand for passenger trains is supported by return of normalcy after the blow of pandemic, urbanization, improving income standards, etc.

Key performance indicators for the railways sector:

Chart 19: Passenger Traffic



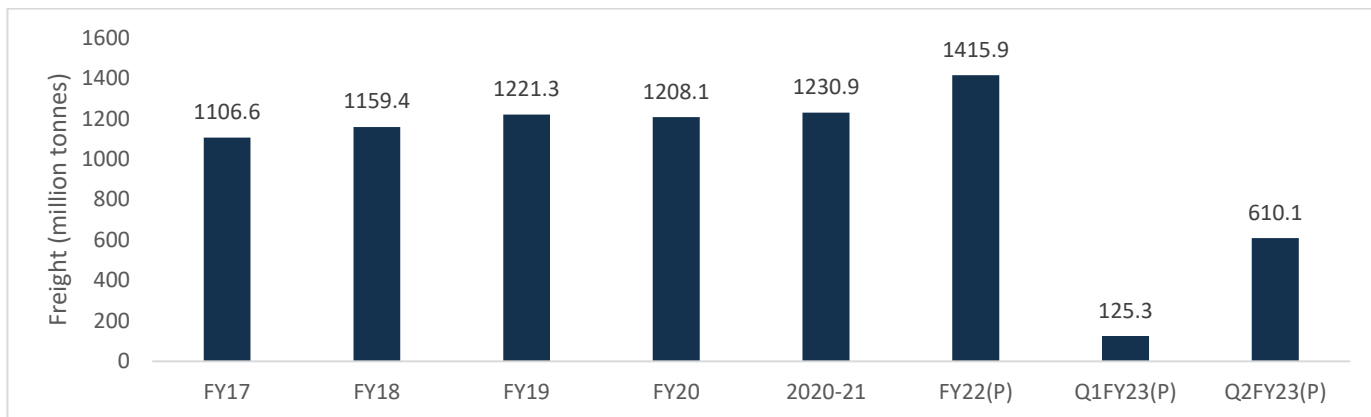
Source- Ministry of Railways, CareEdge Research

Note- P: Provisional

Freight Traffic

The freight traffic in India mainly consists of 9 commodities - coal, steel, iron ore, food grains, petroleum products, amongst others. It is a key revenue generator in the railway segment and accounts for about 70-75% of the total revenue in FY22. Despite the passenger traffic being lower than the pre-covid levels, the freight traffic was 15% higher in FY22 and 17% higher than FY21. This is mainly because the transport of commodities not being much effected by the COVID - 19. Railway freight traffic stood at 735.4 Million Tonnes in H1FY23, an increase of 11% as compared to H1FY22. The growth is led by incremental loading of coal, cement and clinker. The Government is also heavily investing in rail infrastructure to improve freight transport. Due to favorable policy measures and increasing private participation increase in freight traffic is expected in medium to long term.

Chart 20: Freight Traffic



Source- Ministry of Railways, CareEdge Research

Note- P: Provisional

Current Handling Capacity

The freight loading during the period April – October FY22 was 855.63 Million Tonnes as against last year’s loading of 786.2 Million Tonnes registering growth of 9% over last year loading. Railways have earned ₹923.45 Billion in FY22 as compared to ₹789.21 Billion last year which is a growth of 17% y-o-y. Freight revenue of ₹133.53 Billion has been achieved in October 22 as against ₹123.13 Billion freight earnings in October 2021, thereby showing an improvement of 8% over last year.

The Mantra, “Hungry for Cargo” has been followed by the Indian Railways owing to which sustained efforts have been made to improve the ease of doing business and to improve the service delivery at competitive prices. This has resulted into new conventional and non-conventional commodity streams traffic coming to railways. Strong policy making and customer centric approach has helped Railways to achieve this landmark.

Commodity wise the Railways has achieved an incremental loading of 6.8 Million Tonnes in Coal, followed by 1.2 Million Tonnes in Iron Ore and 1.22 Million Tonnes in balance other goods, 0.4 Million Tonnes in Cement & Clinker and 0.3 Million Tonnes in Fertilizers in FY23. Apart from this, increase in automobile loading has also improved the freight traffic in FY23 and 2712 rakes have been loaded in FY23 till September as compared to 1,575 rakes during the same period of last year, thereby showing a growth of 72.2%. The freight ecosystem is also expected to grow from the present level of 4,700 Million Tonnes to 8,200 Million Tonnes by 2030. Currently, railway capacity is barely able to carry 1,220 Million Tonnes which is around 26-27% of the modal share.

The sustained efforts of Indian Railways to increase supply of Coal to Power houses, in close coordination with Ministries of Power and Coal, has again been one of the key features of the freight performance in the month of September. The loading of Coal (both domestic and imported) to Power Houses has increased by 6.2 Million Tonnes in September 2022, with 42 Million Tonnes coal being moved to Power houses as against 35.8 Million Tonnes last year, i.e. a growth of 17.3%. Cumulatively, in the first Half of the year, Indian Railways has loaded more than 64.53 Million Tonnes extra coal to Power Houses as compared to same period of last year, showing a growth of more than 29.3%.

Capacity Expansion Plans and Investments in Railway sector

Being the third largest network in the world under single management and over 68,000 route kms, Indian Railways is known to provide safe, efficient, competitive transport system. On an average 1,835 new track km per year has been added via new-line and multi-tracking projects during the period of 2014 to 2021. Indian Railways is adopting new technology such as KAVACH, Vande Bharat trains and redevelopment of stations to have safe and better journey experience for the passengers.

CAPEX has been increased substantially from an average of ₹459.80 Billion during 2009-2014 to ₹ 2,150.58 Billion during FY22. Indian Railways is also targeting for 100% electrification of its network by December 2023. In addition to the above, projects connecting difficult terrain such as Rishikesh - Karnaprayag line is also laid down to connect all capitals of north east states. Further, a number of infrastructure development initiatives are taken under the National Rail Plan (NRP) prepared by Indian Railways.

The National Rail Plan is the road map for capacity expansion of the railway network by 2030 to cater to growth up to 2050. It has been incorporated to take care of the demand and expectation of passengers and also increase the modal share of railways in freight to 40-45% from the present level of 26-27%. The target of 40-45% modal share for railways is necessary from the perspective of sustainability and also from the national commitments made globally for reducing emission levels.

Government regulations and initiatives

PM- Gati Shakti

PM Gati-Shakti is a national master plan for multi-modal connectivity across the country. It is a digital platform to bring 16 ministries including railways, roadways together with an integrated plan to coordinate the implementation of infrastructure connectivity projects.

Under PM-Gati shakti, the concept of 'One Station- One product' is to be popularized to help the local businesses and supply chain. About 2,000 km of network will be brought under Kavach as a part of Atmanirbhar Bharat. Kavach is an indigenous world-class technology for safety and capacity augmentation in 2022-23.

Under this scheme, a total of 400 new-generation Vande Bharat Trains with greater energy efficiencies and passenger experience are to be developed and manufactured and 100 cargo terminals for multimodal facilities are to be setup in the next three years as stated by the Finance Minister in February 2022.

National Rail Plan

Indian Railways prepared a National Rail Plan for India-2030. This plan is to make railway system future ready by 2030. The plan will be aimed to formulate strategies based on operational capacities and commercial policy initiatives to improve the modal share of the railways to 45% in freight.

As per the National Rail Plan, the freight ecosystem is expected to grow from the present level of 4,700 Million Tonnes to 8,200 Million Tonnes by 2030. Currently, railway capacity is barely able to carry 1,220 Million Tonnes which is around 26-27% of the modal share. The Plan provides a pipeline of projects, which on completion will increase railway capacity to capture 45% of freight traffic. Since the railways is already having a large number of sanctioned projects that need to be completed before taking up new projects, it has been planned to increase railway capacity in two surges. The first surge is to be provided by the Vision 2024 plan to prioritize and complete sanctioned projects so that railway capacity does not fall far behind the targeted modal share, such that by the time capacity is finally created, the traffic would have shifted to another mode. To prevent further diversion from modal share, railway capacity enhancing projects have been categorized as Super Critical and Critical. These projects are focused at increasing capacity on routes that serve major mineral, industrial hubs along with ports and major consumption centers.

Dedicated Freight Corridor (DFC)

Dedicated Freight Corridor Corp. of India Ltd. (DFCCIL) is building two freight corridors namely Eastern Freight Corridor from Ludhiana to Dankuni (1,856 km), and Western Freight Corridor from Dadri to Jawaharlal Nehru Port (1,504 km), at a total cost of ₹ 810 Billion. DFCCIL is a special purpose vehicle for implementing the DFC project under the administrative control of Ministry of Railways.

Total length of the DFC is 28,243 kms and the total estimated cost is US\$ 11.66 Billion as on September 2019. The financial progress stands at 63.6% and physical progress stands 67.5%. The eastern wing of the DFC is funded by the World Bank and western wing is being financed by the Japanese International Cooperation Agency. The Japanese International Cooperation Agency has granted ₹ 85.53 Billion (US\$ 1,167.68 Million) for phase 1 of the DFC. The World Bank granted loan of US\$ 1,100 Million for EDFC-2 and sanctioned loan of US\$ 650 Million for EDFC-3 in October, 2016.

Currently, new links New DDU to New Sonnapur (137 Km) section, New Rooma to New Sujatpur section (130 km) and New Kanpur to New Bhimsen (28.18km) have been sanctioned in the calendar year of 2022.

Regulatory Framework for Railways

The Ministry of Railways is the apex organization for Railways. Apart from its functions as the top Railway executive body for the administration, technical supervision and direction of the Railways, the Railway Board function, also, as a Ministry of the GoI exercises all the powers of Central Government in relation to the Railways.

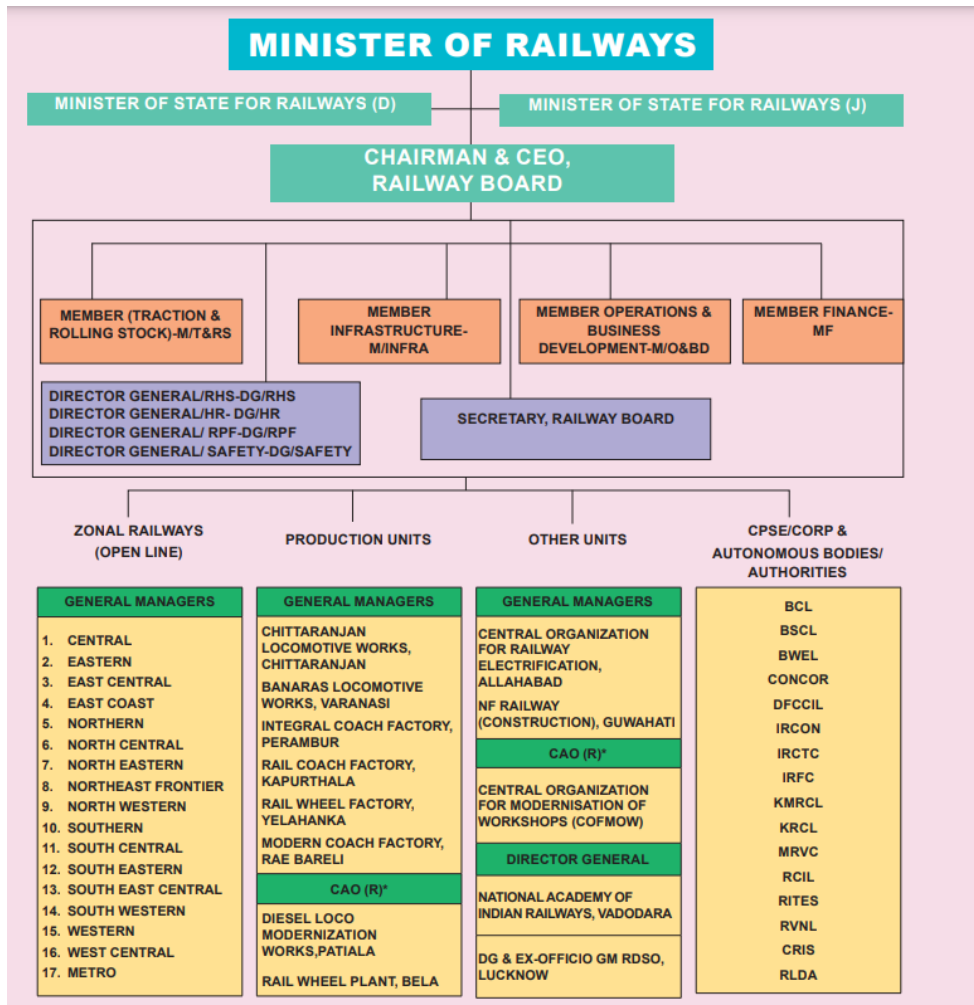
The Mission of Indian Railways is

- Protect and safeguard railway passengers, passenger area and railway property.
- Ensure the safety, security and boost the confidence of the traveling public in the Indian Railways.

The Objectives are:

- Carry on an unrelenting fight against criminals in protecting railway passengers, passenger area and railway property.
- Facilitate passenger-travel and security by removing all anti-social elements from trains, railway premises and passenger area.
- Remain vigilant to prevent trafficking in women and children and take appropriate action to rehabilitate destitute children found in Railway areas.
- Co-operate with other departments of the Railways in improving the efficiency and image of the Indian Railways.
- Act as a bridge between the Government Railway Police/local police and the Railway administration.
- Adopt proactively all modern technology, best human rights practices, management techniques and special measures for protection of female and elderly passengers and children, in the pursuit of these objectives.

The organization chart of Railways is as given below:



5.2 Metro

Overview

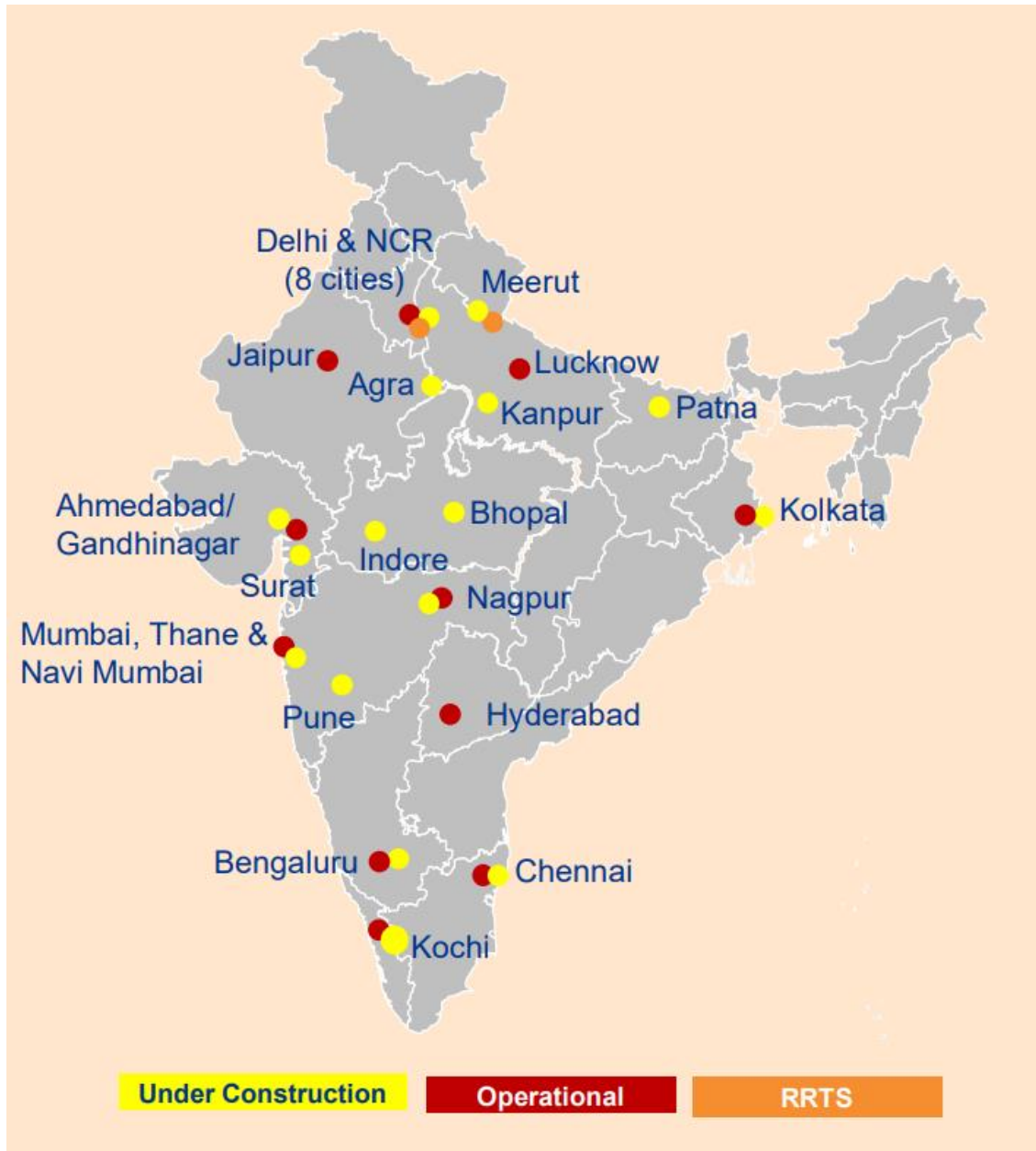
Cities play an important role in growth of the country and urbanization plays an important role in it. It is estimated that more than 50% of India's population will be living in cities by 2050. Most cities in India are expanding at a rapid pace and the steady growth of urban population demands new innovative transit systems, which will be the future of mobility in cities across India.

The sustainable development of all urban cities is dependent on the physical, social and institutional infrastructure. Transport is a very important component of urban infrastructure. The rapidly growing urban population requires a systematic and efficiently planned city with comprehensive mobility plans, optimal land use and proper transport while ensuring factors like road safety, efficient transport systems, promotion of non-motorized systems like cycle tracks and walkways.

Urban rail transit is an effective and popular mode of transport in the urban cities. It plays an important role in intracity transportation. Urban rail transit is made up of rapid transit, metro, monorail, trams and suburban rail.

The Metro Rail policy was formed in consultation with various metro rail corporations, State Governments, Central Ministries, domain experts and was launched in September, 2017 for enhancing the feasibility of metro rail projects from economic, social and environmental perspective. The policy is focused approach towards the selection and implementation of metro rail projects to maximize the overall mobility of the city and cost minimization. The policy aims to evolve metro projects from being just transportation projects to transformational projects.

Following is the current stages and location of various metro project across India.



Source: Ministry of Housing and Urban Affairs

To improve the mobility of smaller, rail-based mass transit system are opted as solution, Government has introduced low cost transit options for tier-2 cities, namely MetroLite and MetroNeo.

MetroLite

Standard specifications for Light Urban Rail Transit System named "MetroLite" have been issued by the Ministry in July, 2019. This system is a solution for Peak Hour Peak Direction Traffic (PHPDT) up to 15,000 passenger and can be developed at about 40% cost of conventional metro system due to its lighter civil structure, low axle load, smaller stations with basic amenities, requirement of low power rated electrical equipment, etc. Low construction, operation, and maintenance costs makes MetroLite financially sustainable for Tier-2 cities and peripheral areas of big cities.

MetroNeo

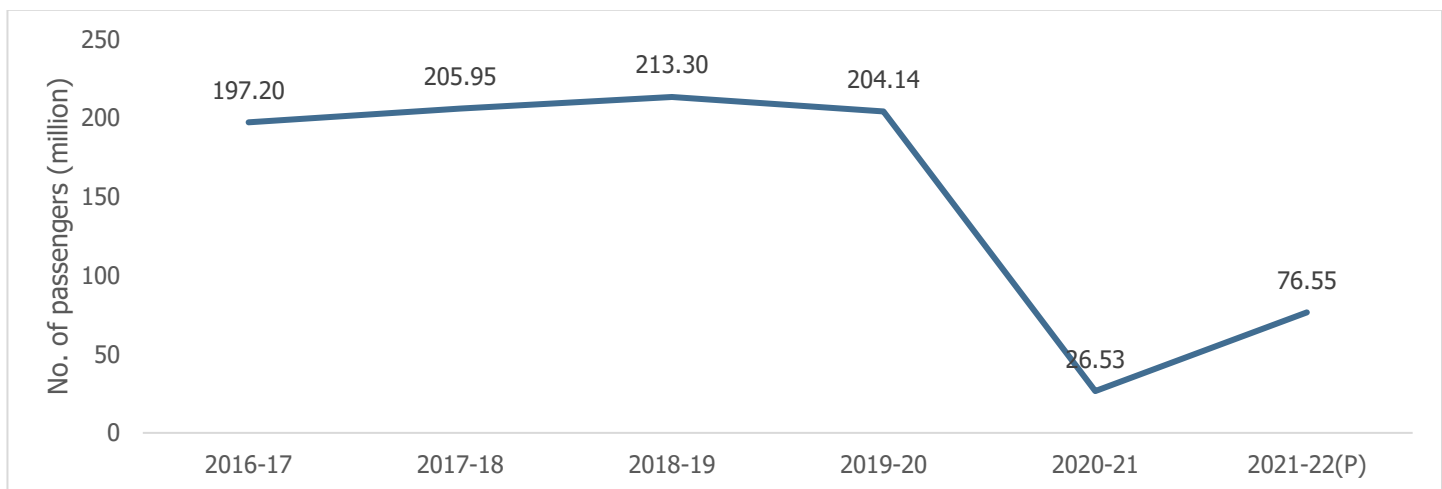
Standard specifications for Rubber Tyre Electric Coaches Powered by Overhead Traction System with exclusive right of way named MetroNeo have been issued in November, 2020. This mass rapid transit system is suitable for Tier-2 cities with PHPDT upto 8,000 and can be developed at a cost of about 25% of conventional metro system.

Key performance indicator for the Metro sector:

Passengers Traffic

Urban transport is an integral part of development of cities. Metros were introduced to increase mobility, reduce traffic and to introduce an affordable and quick means of transport to the passengers. The passenger traffic has peaked at 213.3 Million in FY19 from 197.20 Million in FY17, registering a growth rate of 8% before being hit by the pandemic. The COVID – 19 led lockdowns led to a decline in footfalls by 87% in FY21. The revenue from metro rail network also took a great hit because of absence of any freight transport in this sector. The passenger traffic stands at 76.55 Million in FY22, and is expected to grow at steady space with increase in urban population and major development policies in the metro sector in various part of the country.

Chart 21: Metro Passenger Traffic



Source- Ministry of Railways, CareEdge Research

Note- P: Provisional

Capacity Expansion Plans and Investments in Metro rail segment

A total of 548 kms of metro rail network has been laid and are in operation in the country since 2014. Urban transport is an integral part of the development of the cities and various states and union territory Governments are responsible to build and develop the infrastructure of the cities. As per the Metro Rail Policy, 2017, the state/union territory Government can ask

for financial assistance from the Central Government for the proposed metro construction. An amount of ₹888.69 Billion has been released by Government of India from 2014 till date in form of equity, subordinate debt, grants, gap funding etc. Below are the details of metro rail network being built/ under construction across the country with the sanctioned costs/ fun allocated.

Table 8: Details of metro link being built/under construction (as on August, 2022)

Cities Covered	Total Length (Kms)	Under Construction Length (Kms)	Sanctioned Cost (₹Bn.)
Delhi	67.23	67.23	258.90
Patna	32.51	32.51	133.65
Bangalore	130.29	116.67	411.93
Ahmedabad, Gandhi Nagar	64.21	57.71	161.57
Surat	40.35	40.35	120.20
Bhopal	27.87	27.87	69.41
Indore	31.55	31.55	75.00
Kanpur	32.38	23.38	110.76
Agra	29.40	29.40	83.79
Mumbai	191.42	170.69	870.41
Nagpur	38.21	12.12	86.80
Pune	56.61	44.61	175.44
Kochi	13.20	13.20	26.67
Chennai	118.90	118.90	632.46
Kolkata	85.16	85.16	23.16
Delhi, Ghaziabad, Meerut	82.15	82.15	302.74

Source- Press Information Bureau (PIB), Ministry of Housing & Urban Affairs

A total length of 1,041.45 kms of metro rail network is being sanctioned across 15 cities, under which 953.50 kms is under construction and a sum of ₹3,542.95 Billion. is sanctioned for the same. Apart from this, stretch of 663.29 kms is proposed to the Central Government across 18 projects.

COVID – 19 impact on Railway and Metro:

Public transport was one of the most severely impacted sectors during the COVID – 19 period. The public transport services were brought to a standstill due to the onset of COVID – 19 in March 2019 till the Government resumed it in phases only for individuals working in essential services departments. It can be observed that the passenger traffic in railway reduced from 8,438.5 Million in FY19 to 8,112.6 Million in FY20 to 1,287 Million in FY21. Similarly, in metro the passenger traffic reduced from 213.3 Million in FY19 to 204.1 Million in FY20 to 26.53 Million in FY21.

On the other hand, railways played a crucial role during the pandemic in helping people as well as businesses in the country. The freight traffic of the railways declined by merely 1% as railways formed part of essential service to keep the goods/agricultural produce moving in the country.

The lockdown had put both the lives and livelihoods of Millions of migrants on hold. A great many number of them urgently wanted to get back to their homes and villages. The Ministry of Home Affairs ordered the Ministry of Railways to arrange an emergency unique train service in coordination with individual State Governments and Shramik Special train was flagged off by the Government.

The railways were also successful in turning around the negative situation to their benefit. The Indian Railway took advantage of the opportunity of availability of traffic blocks due to reduced train operations during lockdown period and succeeded in completing over 350 critical and long pending major bridge & track works. These works had major bearing on safety and operational efficiency. Some of these works were pending for several years as sufficient traffic blocks could not be made available under normal working conditions due to high density of traffic.

5.3 Government regulations and initiatives

Metro Rail Policy

This policy was formed in consultation with the various metro rail corporation, State Governments, Central Ministries and domain experts. It was launched in September 2017 for enhancing and ascertaining feasibility of the metro rail projects from economic, social and environmental perspective. This policy is made to approach towards the selection and implementation of metro projects and maximize overall benefits and reduce cost. It also acts like a guide for states and union territories for preparing comprehensive proposals for planning and implementing the metro rail systems.

At present, 27 cities in the country are on metro map with metro system of about 742 km operational in 19 cities namely Delhi & 7 NCR cities, Bangalore, Hyderabad, Kolkata, Chennai, Jaipur, Kochi, Lucknow, Kanpur, Mumbai, Ahmedabad and Nagpur.

About 1037 km of metro rail projects, including 82 km Delhi-Meerut Regional Rapid Transit System (RRTS) corridor, are under construction in various cities namely Delhi and NCR, Bangalore, Kolkata, Chennai, Kochi, Mumbai, Nagpur, Ahmedabad, Gandhi Nagar, Pune, Kanpur, Agra, Bhopal, Indore, Patna, Surat and Meerut.

Jawaharlal Nehru National Urban Renewal Mission

This was launched in December, 2005 and is the largest national urban initiative to encourage reforms and fast track planned development of 63 identified cities. The focus is on improving efficiencies of the urban infrastructure and services. It consists of two sub-missions- Urban Infrastructure & Governance and Basic Services to the Urban Poor.

It focuses on many aspects of urbanization like redevelopment, water supply, sewage and solid waste management, urban transport including roads, high ways, metro projects, parking lots, heritage area development, prevention of soil erosion, preservation of water bodies etc.

Outlook

Railways - The Indian railways saw exceptional performance in FY22 with respect to both passenger and freight revenue. To continue the trend the Indian Government has taken various steps to improve the numbers further and have launched various programs like "Hungry for Cargo", concession on railway freight, introduction of Kisan Rail, opening of export traffic to Bangladesh for automobiles, parcels and containers, setting up of business development units etc. Apart from this the Government has allocated plans to build more Vande Bharat trains by FY24. The Government is also focusing on building the Dedicated Freight Corridor, redeveloping many stations, India's first Bullet Train Project, India's first Underwater Rail system, Semi High-speed trains which will be an export bid as well and India's highest Railway Arch Bridge.

The Government has planned huge capex addition and capacity expansion under National Rail Plan. Under this the freight ecosystem is expected to grow from the present level of 4,700 MT to 8,200 MT by 2030 and is aimed to formulate strategies based on operational capacities and commercial policy initiatives to improve the modal share of the railways to 45% in freight.

Metro - The Indian Metro system is attracting many new projects. Metro has been operational in 15 cities across India and have huge under construction projects. Under the Metro Rail Policy, an amount of ₹888.69 Billion has been released till date

by Government of India. Apart from this, a sum of ₹3,542.95 Billion has been sanctioned for the various metro projects across the country.

Metro is a very important mode of transport in the urban cities and is widely used by the citizen as source of transport. The Government is spending a huge amount as assistance to the State/Union Territories Government for metro construction. Tenders have been rolled out for players for metro construction.

5.4 Recent events in Railways sector

Indian railways plan to run 35 hydrogen trains under 'Hydrogen for Heritage'

Indian Railways has envisaged to run 35 Hydrogen trains under "Hydrogen for Heritage" at an estimated cost of ₹0.8 Billion per train and ground infrastructure of ₹0.7 Billion per route on various heritage/hill routes.

Additionally, the Railways has also awarded a pilot project for retro fitment of Hydrogen Fuel cell on existing Diesel Electric Multiple Unit (DEMU) rake along with ground infrastructure at the cost of ₹1.12 Billion which is planned to be run on Jind – Sonipat section of Northern Railway. The first field trials of the first prototype on Jind –Sonipat section of Northern Railway are expected to commence in 2023-2024.

The use of Hydrogen as fuel will provide greater benefits in the green transportation technology space and support zero carbon emission goals.

Indian Railways and India Posts launch 'Rail Post Gati Shakti Express Cargo Service'

This is an initiative of partnership between Indian Railways and India Posts to provide seamless logistics for the services sector in the country which is in compliance with the Budget Announcement of FY 2022-23 and it has been started in February 2023, on the four sectors - Delhi to Kolkata, Bangalore to Guwahati, Surat to Muzaffarpur and Hyderabad to Hazrat Nizamuddin. However, a total of 15 sectors have been planned to be covered in the first phase.

The highlights of this service are total logistic Service: Pick-up and delivery at customer premises, palletization - transportation through covered and sealed boxes, semi-mechanized handling, time tabled service, insurance at 0.05% of the declared value of the cargo for loss, damage and deterioration, Integrated Parcel Way Bill.

5.5 Key trends in Railways sector

Improving passenger experience: Increasing urbanization along with rising income is driving demand for passenger travel. To provide improved experience to the passengers, the Railways are trying to introduce new features and trains with better services.

Net zero carbon emission: Indian Railways has planned to gradually reduce its carbon footprint and become Net Zero Carbon Emitter by 2030. It will attempt to reduce its carbon footprint primarily through sourcing of its energy requirements from renewable energy sources. By the year 2029-30, expected requirement of installation of renewable capacity would be about 30 GW. Indian Railways has installed 142 MW solar rooftop capacity and 103.4 MW of Wind energy till August, 2022.

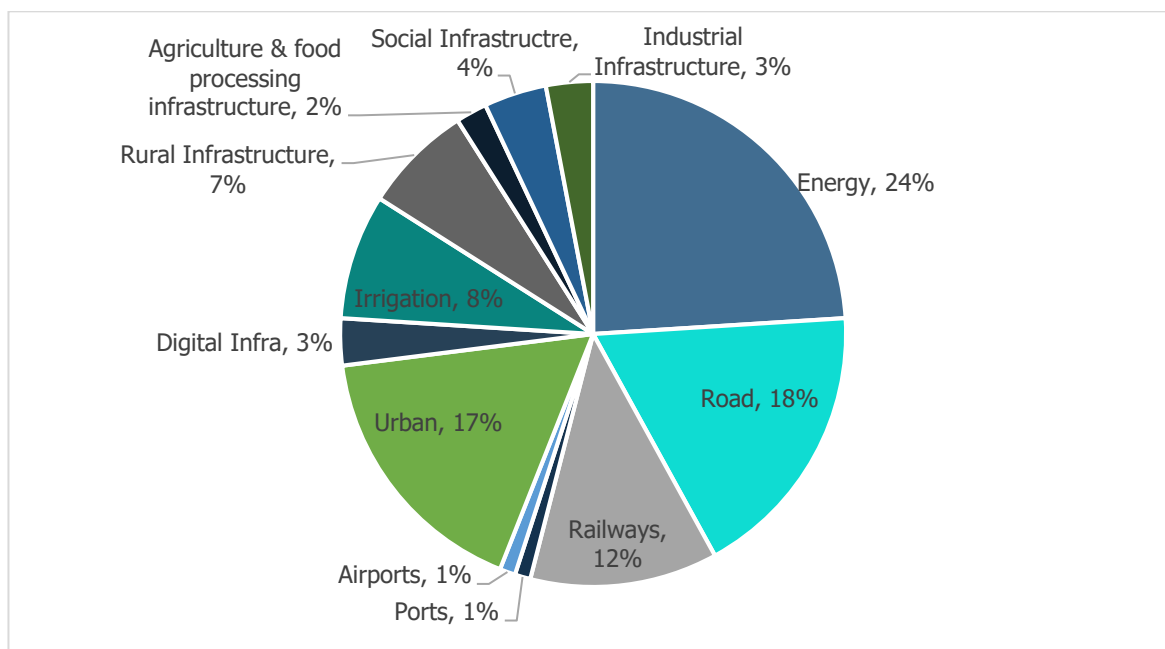
Electrification: Indian Railways has embarked upon an ambitious plan of electrification of its complete Broad-Gauge network which would not only result in a better fuel energy usage resulting in increased throughput, reduced fuel expenditure but also savings in precious foreign exchange.

5.6 Opportunities in National Infrastructure Policy for the Railways

Before the onset of the pandemic the GoI had unveiled the National Infrastructure Policy (NIP) covering various sectors and regions indicating that it is relying on an 'infrastructure creation' led revival of the country's economy. The NIP which covered rural and urban infrastructure entailed investments to the tune of ₹111 Trillion to be undertaken by the Central Government, State Governments and the private sector during FY20-25. This in turn is expected to offer significant opportunities to construction players in India.

In order to achieve the GDP of USD 5 trillion by FY25, India needs to spend about USD 1.4 trillion over these years on infrastructure. During FYs 2008-17, India invested about USD 1.1 trillion on infrastructure. However, the challenge is to step up infrastructure investment substantially. Keeping this objective in view, National Infrastructure Pipeline (NIP) was launched with projected infrastructure investment of around ₹111 Trillion (USD 1.5 trillion) during FY 2020-2025 to provide world-class infrastructure across the country, and improve the quality of life for all citizens. It also envisages to improve project preparation and attract investment, both domestic and foreign in infrastructure. NIP was launched with 6,835 projects, which has expanded to over 9,000 projects covering 34 infrastructure sub-sectors.

Chart 22: Sector-wise break-up of capital expenditure of ₹111 Trillion during fiscal 2020-25



Source: NIP

During the fiscals 2020 to 2025, sectors such as energy (24%), roads (18%), urban (17%), and railways (12%) amount to around 70% of the projected capital expenditure in infrastructure in India. NIP has involved all the stakeholders for a coordinated approach to infrastructure creation in India to boost short-term as well as the potential GDP growth.

Further, the number of projects and the total cost as per NIP for different sectors are as follows:

Sector	No. of projects	Value of projects (₹ Billion)
Roads & bridges	3,564.00	400.20
Railways	679.00	208.36
Power and others	325.00	153.80
Urban Infra	227.00	115.13

Source: Department of Economic Affairs

5.7 PPP in Railways

For the faster & safe movement of passenger and increase stake in freight transport from 17% to 45%, Indian Railways has planned huge investment by 2030 which is estimated to be around ₹ 50,000 Billion will be capital investment required for network expansion and capacity augmentation, rolling stock induction and other modernization works to enable better delivery of passenger and freight services and to improve its modal share in transport. To bridge the gap in capital funding and to induct modern technologies and improve efficiencies, Indian Railways has planned to use Public Private Partnership (PPP) model for few initiatives.

PPP model was allowed in areas such as Suburban Corridors, Mass Rapid Transport System, High-Speed Trains, Dedicated Freight Lines, Rolling Stock, Train Sets, Locomotives, etc., Railway Electrification, Signalling Systems, Freight and Passengers Terminals, Industrial Parks.

The policy provides following five PPP models for implementation of various types of rail-connectivity and capacity augmentation projects:

- Non-Government Private Line Model
- Joint Venture (JV) model
- Build, Operate and Transfer (BOT) model
- Capacity augmentation with funding provided by customers
- Capacity augmentation through annuity model

As per the guidelines, three of these models (private line, JV and customer funded) involve participation of strategic investors/customers and two others (BOT and Annuity models) are pure PPP models.

Through the above five models, Railways aims to mobilise substantial investments through various Projects/Schemes like Port Connectivity Projects, Private Freight Terminals (PFT), Private Container Operations, Liberalised Wagon Investment Scheme (LWIS), Wagon Leasing Scheme (WLS), Automobile Freight Train Operator Scheme (AFTO), Special Freight Train Operator Scheme (SFTO), Redevelopment of Stations and Locomotive Manufacturing Unit.

Ministry of Railways (MoR) had invited applications for investment and induction of modern rakes over select routes through Public Private Partnership (PPP) to provide world class services to the passengers. Accordingly, MoR had issued 12 Requests for Qualification (RFQs) on 1st July, 2020 for operation of passenger trains over approximately 109 origin-destination pairs (divided into 12 clusters) through PPP on Design, Build, Finance and Operate ("DBFO") basis.

In addition, the Government also announced a PPP model for station redevelopment. Under this move, 400 stations have been identified for redevelopment which envisages an investment opportunity of nearly ₹ 1,000 Billion. These development plans would improve participation of private players in the railway sector over the longer term.

5.8 Key growth drivers

Railways:

Rising passenger travel: The vast network of Railways is used by Millions of Indians to travel, whether local or leisure. Railways are well connected to travel for pilgrimage, business or vacations. In reserved passenger segment, the total approximate numbers of passengers booked during the period 1st April 2022 to 31st December 2022 is 0.6 Billion as compared to 0.6 Billion during the same period in 2021, showing an increase of 6%. The rising population is only leading towards increased passenger travel in future.

Push to Freight business: Indian railways play a major role in freight movement in the country. The railways are well connected and offer competitive pricing. According to a report by Ministry of Railways, following the Mantra, "Hungry For Cargo", Indian Railways has made continuous efforts to improve the ease of doing business as well as improve the service delivery at competitive prices which has resulted in new traffic coming to railways from both conventional and non-conventional commodity streams. The Indian Railways on a cumulative basis from April - December 22, achieved the freight loading of 1,109.38 MT as against 1,029.96 MT for the same period in 2021, an improvement of 8% over last year loading.

Use of digital technology: Automatic trains are being introduced with modern technology to make the travelling experience better and distance shorter. As per Ministry of Railways, in order to increase line capacity to run more trains on existing High-Density Routes of Indian Railways, Automatic Block Signalling (ABS) is a cost-effective solution. Indian Railways has been rolling out Automatic Block signalling on a mission mode. With implementation of Automatic Signalling, increase in capacity will accrue resulting in more train services becoming possible.

Electronic Interlocking are being adopted on a large scale to derive benefits of digital technologies in train operation and to enhance safety.

Initiatives to promote tourism: With introduction of new routes and special trains, the Government is also providing EMI options to the passengers. For the Ayodhya to Janakpur train – 'Bharat Gaurav Deluxe AC Tourist Train', the Railways is providing with an attractive as well as affordable package, IRCTC has tied up with Paytm and Razorpay payment gateways for providing EMI payment option for breaking the total payment in small amount EMIs. Users can avail the EMI payment option for making payment in 3, 6, 9, 12, 18 or 24-month EMIs. These EMI payment options can be made through Debit/Credit Cards.

Metro:

Infrastructure development: Infrastructure development plays a very crucial role in economic development of the country. Metros in urban areas not only facilitate easy and quick movement of people but also have a positive impact on the economic growth and quality of life. This results in increased income and provides various benefits to the society, like helping in decongestion and reducing travel time in the city.

Urbanization: India is in the process of transitioning from mostly rural to a quasi-urban country. This offers great opportunity for leveraging the benefits of urbanization with robust system in place. There is immense scope in infrastructure development of many Indian cities and towns with the help of technology and planning. There is a need for smooth, hassle free and fast transportation system. The increased population in the cities, along with the increasing working population is driving the demand for alternate transport sources like Metro rail. These projects provide high capacity public transit and considering the rapid urbanization and the imminent need for enhancing mobility in cities, metro rail is becoming a very favorable transport option.

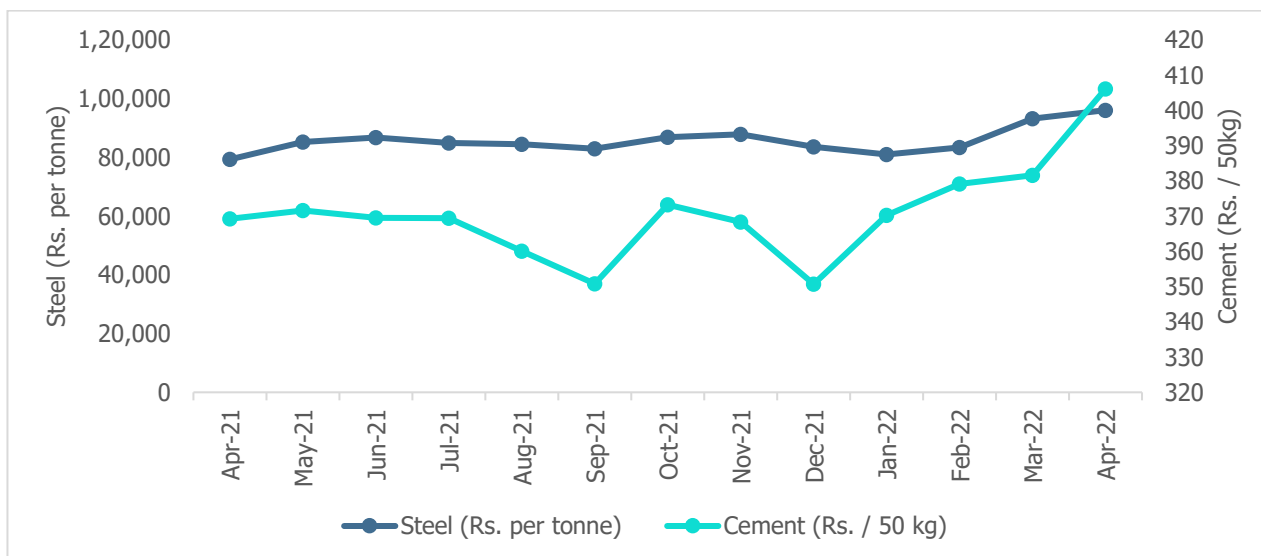
Government support: Most of the metro rail projects are financed by the Central Government in partnership with the State Governments. On the other hand, some have been funded by the State Governments either on their own or with private partnership. As per the Metro Rail policy, the existing 50:50 Joint Venture model that is predominantly the major model available for the financing and organization structure was started with Delhi Metro Rail Corporation and later followed in other metros like Mumbai Line-3, Chennai, Bangalore, Nagpur, Lucknow, Kochi and Ahmedabad.

Decreasing vehicular traffic and pollution: Metros help in reduction in traffic congestion, road and parking cost, transport cost and per-capita traffic accidents. One of the major benefit of Metros is that it helps in substantial reduction in per capita pollution emission bringing down various chronic diseases; hence, results in huge public health benefits.

5.9 Major challenges

Changes in raw material prices: The rising cost of steel and cement, two major raw materials that are consumed in railways and metro industry saw a sharp rise during the second half of FY21. Any variation in the prices of raw materials during the construction period of the project has a direct impact on total cost of the project. The average domestic steel prices surged 26% y-o-y in FY21. In FY22 as well, the average price of domestic steel and cement increased by 45% and 8% respectively. Here, increased international steel prices led to significantly higher export volumes, which in turn led to an increase in domestic steel prices. Whereas, the rise in cement prices was primarily on account of rising input and fuel costs pressure due to geopolitical tensions. The volatile commodity prices are expected to impact margins of construction players.

Chart 23: Movement in Raw material prices



Source: CMIE

Land acquisition issues: Cities are densely populated and to plant a new railway or metro line, a large chunk of land is to be acquired. This land may belong to slums, construction companies or even business owners. Land acquisition gives rise to major resettlement and rehabilitation issues especially in the metro cities. The issues related to land can go up to years and lead to project delays. A detailed survey is done by the agencies to determine the people affected in that area due to the upcoming project. Additionally, the rehabilitation cost may also add up to the project cost for the railway/metro project.

Operational inefficiencies: The railway and metro projects are large scale operations. These projects require a lot of approvals from different authorities. Lack of clarity, delays in submission, incorrect or inefficient data can lead to delays in the project.

Inaccurate Data: Data collection and analysis related to traffic forecast, demand forecast, expected ridership plays a very crucial role in finalizing a project. Incorrect data for a project can lead to a huge losses and enormous loss of resources and time. Over estimation of projects can lead to over sizing of the asset whereas, under sizing of the infrastructure resources.

6. Overview of raw material used in Infrastructure industry

Cement industry

Overview

Cement is manufactured from limestone and other materials and is mainly used as concrete in construction of infrastructure such as houses, roads, airports etc. According to US Geological Survey – Mineral Commodity Summaries – Cement, the world consumes over 4 Billion tons of cement annually.

Cement industry forms part of the core industrial sectors in the country and in terms of production, India is the second largest producer of the cement. For a developing and transitioning economy such as India, cement as a commodity holds significant value given the immense infrastructure requirements of a growing and urbanizing country, as well as its contributions by way of direct and indirect employment. The GoI has time and again emphasized its focus on infrastructure development with the announcement of several schemes such as Housing for All and NIP to name a few schemes. Growth in the cement industry is indicative of the overall growth in the economy.

Even though India is the 2nd largest producer of cement in the world, the market is highly underpenetrated. The per capita consumption of cement is only between 200-250 kg/per capita compared to the world average of 500-550 kg/per capita.

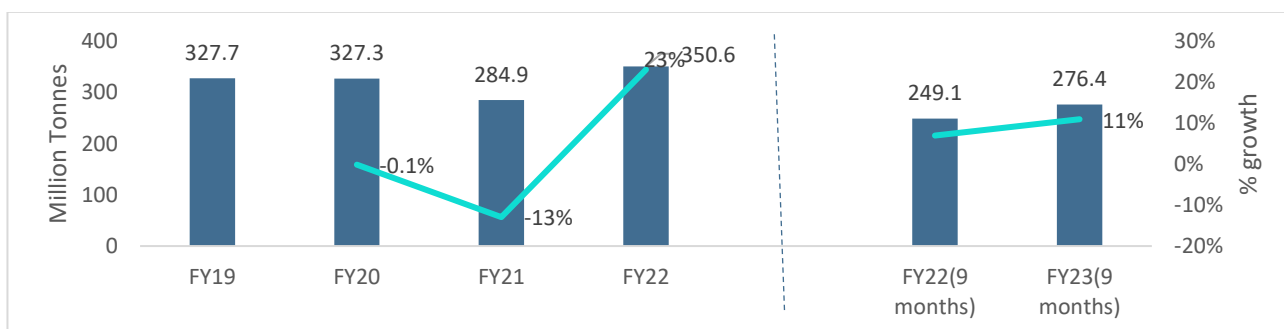
Trend in production

In FY22, production of cement at 350.6 Million tonnes (MT) surpassed the pre-pandemic levels, growing by 23% as compared with 285 MT of cement produced in FY21 aided by a low base of FY21 and pent up demand from the previous years.

In YTD FY23 (April 2022 to December 2022), there was an 11% increase in production on a year-on-year basis to 276.4 MT driven by increase in Government push for infrastructure development especially in the rural segment, urban housing and construction activities like metros, highways, smart cities etc. in different regions of India.

There is a cyclical trend in the cement production/consumption where-in the same is low during April to October mainly on account of monsoons and picks up subsequently over November to March as the monsoons subside and construction activity increases across the country. As a result, the production declines in the 1st and 2nd quarter of any financial year compared to previous half year, but it soon picks up after the festive season and usually see a significant growth in 3rd and 4th quarters of a financial year.

Chart 24: Cement production (MT)



Source: CMIE

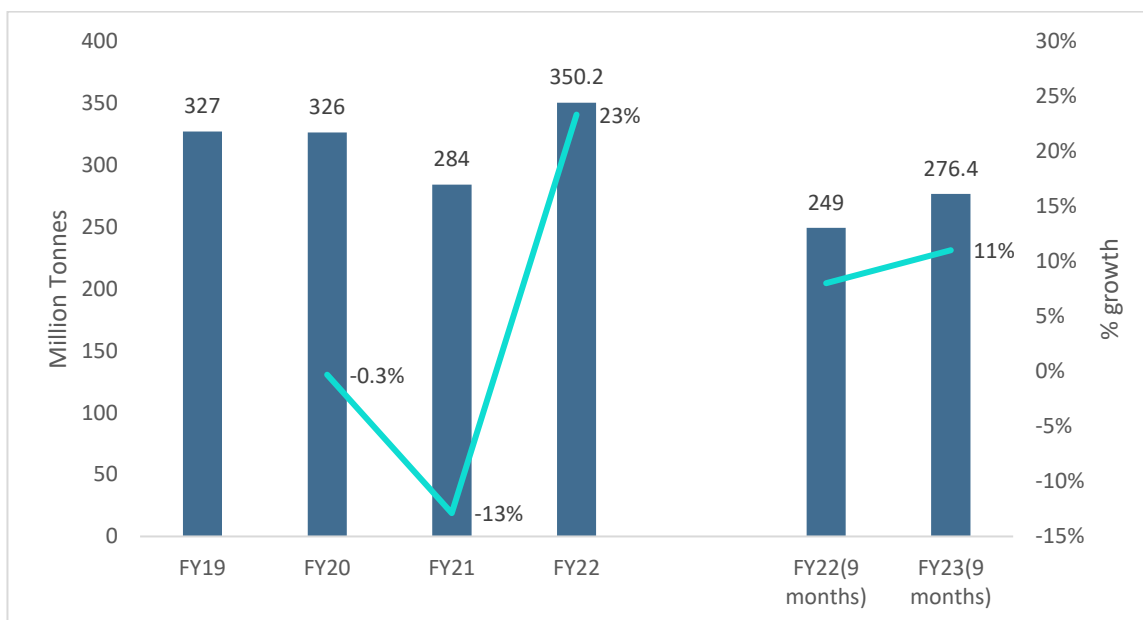
Cement consumption:

There was a major decline in cement consumption in FY21 to 284 MT (13% y-o-y), which can be attributed to the challenging environment witnessed by the industry on account of Covid-19 pandemic outbreak. The end user industries of cement such as real estate sector and infrastructure sectors were severely impacted. The persisting liquidity crunch in the sector worsened, and restrictions imposed by the Government to arrest the spread of Covid-19 led to many developers postponing completion of their projects. The industry had to also grapple with issues such as reverse migration and disruption in supply chain.

In FY22, after opening of the economy, the real estate industry is demonstrating signs of recovery. Reopening of the property markets in India has led to increase in buyers. The second half of FY22 saw improvements in the real estate capital flow even with emergence of Omicron though not to the pre-Covid levels. The cement consumption stood at 350.2 MT in FY22 and continued to increase backed by growth in demand from end user industries such as construction of public infrastructure and real estate. The demand continued in FY23 and have seen a growth of 11% riding on the back of fast paced construction of roads, railways and other infrastructure projects across the country.

In FY23 (April 2022 to December 2022), there was an 11% increase in consumption on a year-on-year basis to 276.4 Million Tonnes due to increased demand and increase in infrastructure activity across India

Chart 25: Cement consumption (MT)



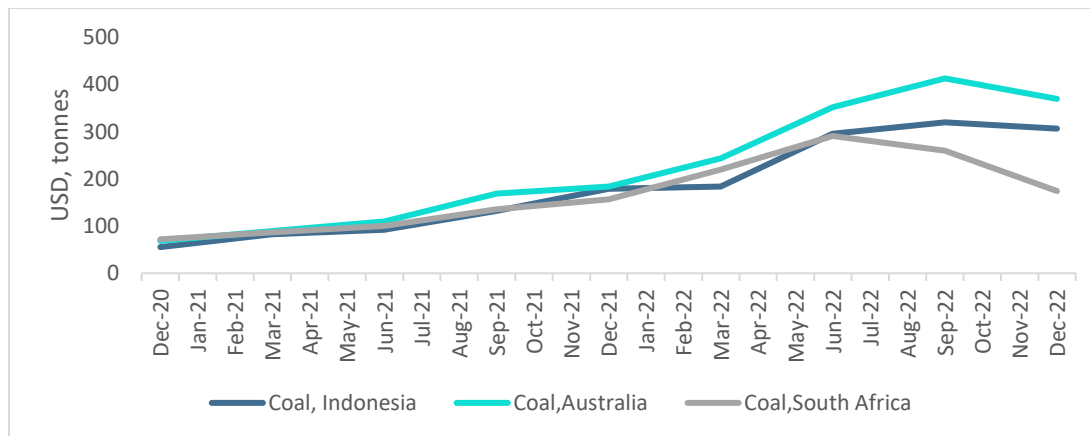
Source: CMIE

Prices:

Global coal prices have been on an upward trajectory since November 2021 due to the geopolitical tensions between Russia and Ukraine. For the quarter ending September 2022, the Australian, Indonesian and South African coal prices surged by a staggering 144%, 142% and 139% y-o-y, respectively, after which the prices started to decline due to soft global demand. CareEdge Research expects coal prices to gradually cool off in the near-medium term.

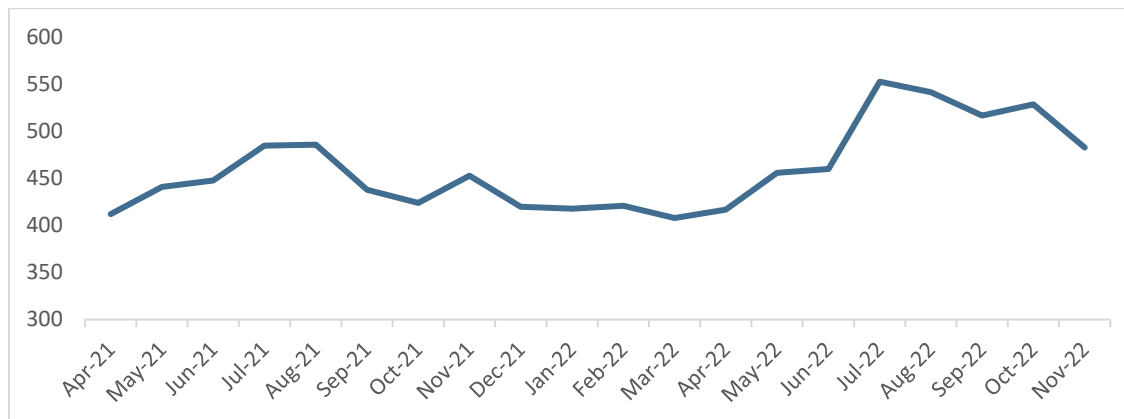
Despite the onset of softening raw materials costs like limestone due to increased production in Q2FY23, the price of limestone is still higher by 21% q-o-q and 14% y-o-y. The power and fuel prices which includes coal, pet coke etc. are estimated to increase 310- 320 per MT in FY23 i.e. almost double the price as compared to FY22.

Chart 26: International Coal Prices



Source: CMIE, CareEdge Research

Chart 27: Average Sales Price of Limestone



Source: CMIE, CareEdge Research

Outlook:

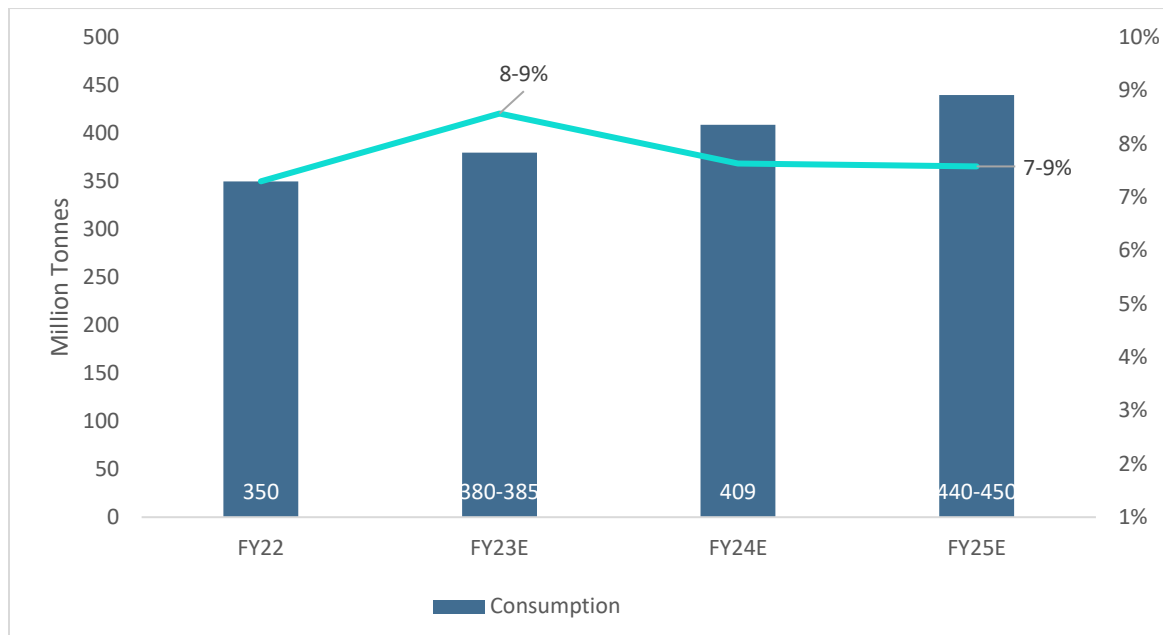
Production:

The cement demand is expected to grow by 8-9% y-o-y to 380-385 MT in FY23 to driven by increase in Government push for infrastructure development especially in the rural segment, urban housing growth and constructions like metros, NHAI, Smart cities etc. in different regions of India. The Central Government is expected to continue its infrastructure focus in FY24 as it is the pre-election year. The capex announced under 2023-24 (Budget Estimate) at ₹1,000 Billion are almost 3 times of the capital expenditure in FY2019-20 and is focused towards development of highways, internal road connectivity and railways.

The Government has launched the smart city project and increased the allocation to the PM Awas Yojana budget allocation for FY24 by 66%. The private capex is also expected to pick up in the coming years with the support of rising domestic demand and policies like the PLI scheme announced by the Government for 13 manufacturing sectors.

Increase in spending on infrastructure and real estate, and low per capita consumption of cement in India augurs well for the cement industry. The domestic cement volumes are expected to grow to 440-450 MT by FY25 year-end with Central and Eastern regions witnessing higher traction.

Chart 28: Cement Consumption Estimates



Source: CMIE, CareEdge Research

E- Estimates

The long-term outlook for the cement industry remains stable and is expected to be driven by infrastructure impetus provided by the Government as evident under the continuously growing budgetary support. Several schemes have been announced aimed at development and improvement of public Infrastructure - roads, highways, metros and railways, airports, ports, logistics Infrastructure etc. including PM Gati Shakti, National Infrastructure Pipeline (NIP), Urban Rejuvenation Mission: AMRUT and Smart Cities Mission to name a few. Further, the Government scheme Pradhan Mantri Awas Yojana (PMAY) aimed at affordable housing is likely to drive low cost housing segment.

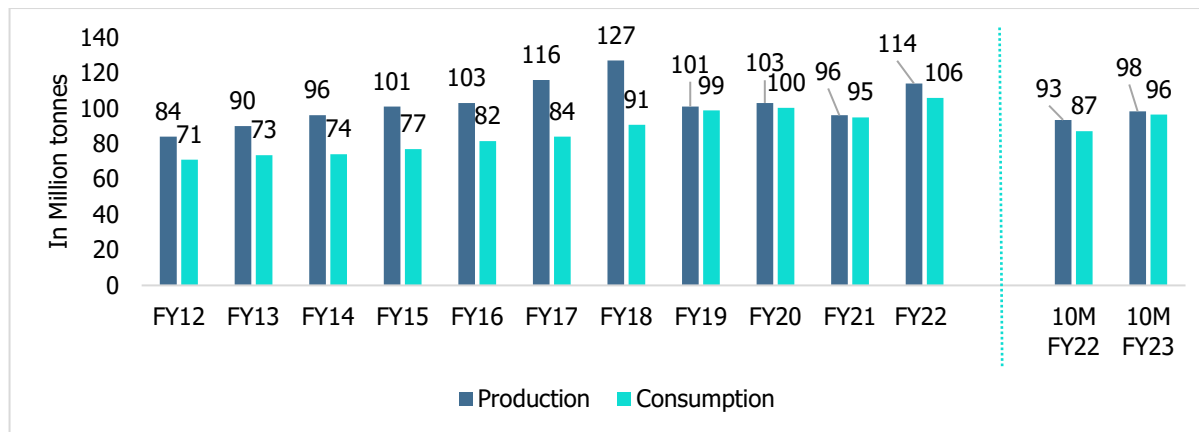
Steel industry

India is the second largest steel producer in the world. The Indian steel sector has been able to grow over the year due to domestic availability of raw material such as iron ore and cost-effective labor.

Trend in India's finished steel production and consumption

In the last 11 years, finished steel production increased at a CAGR of 3.1% from 84 MT in FY12 to 114 MT in FY22. The growth in production is backed by a rise in domestic steel consumption on account of growing economic activities in the country like increase in infrastructure and construction spending by the Government, improved automobile and consumer durable demand among others. During these years, finished steel consumption in India has increased at a CAGR of 4.1% from 71 MT in FY12 to 106 MT in FY22.

Chart 29: India's finished steel production and consumption



Source: CMIE

Note: 10M period refers to April to January for FY22 & FY23

The domestic steel production was at its highest at 114 Million tonnes in FY22 up from 96 Million tonnes in FY21, an increase of 19% y-o-y. India's steel consumption was at 106 Million tonnes in FY22, up from 95 Million tonnes in FY21, an increase of 11% y-o-y on account of increased consumption by the Government on developing infrastructure as well as the resumption of real estate and construction activities.

The rebound in domestic production, continuous investment in infrastructure and policy support by the Government has increased the industry production and consumption of finished steel by 5% and 11%, respectively, on a y-o-y basis during 10M FY23 (April-January).

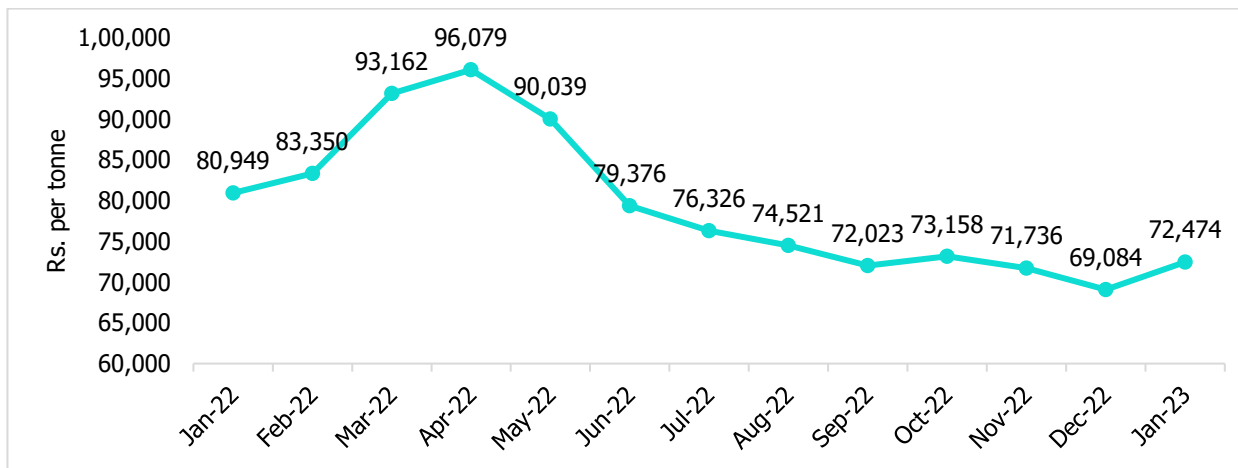
Trend in domestic Steel Prices

The average domestic finished steel prices peaked at ₹96,079 per tonne in April 2022. After a sharp uptick, it started to witness a downward trend and declined to ₹69,084 per tonne in December 2022, a decline of 17% on a y-o-y basis. The export duty imposed on a range of finished steel products resulted in lower exports which caused a build-up in domestic inventories. Moreover, the prices of iron ore have softened by about 31% to ₹4,100 per tonne in December 2022 as compared to ₹5,965 per tonne in May 2022, due to increased domestic supply in light of a hike in duty on iron ore exports to 50% since May 2022. These factors in turn resulted in a decline in domestic steel prices.

Following the reduction in export duty on iron ore in November 2022, domestic prices are expected to witness a rise. In January 2023, NMDC hiked the prices for iron ore lumps and fines to ₹4,300 per tonne and ₹3,410 per tonne from ₹4,100 per tonne and ₹2,910 per tonne, respectively. This increase in input costs will make steel products costly.

The domestic steel prices are expected to directionally follow the global prices and are expected to remain range-bound due to continued strong domestic demand and increase in input prices.

Chart 30: Domestic average finished steel prices



Source: CMIE

Outlook

The demand for steel is mainly driven by sectors like construction, real estate, railways, automobiles, capital goods and consumer durables among others. In addition, Government spending on infrastructure is expected to augur well for the sector. The thrust towards infrastructure projects is majorly contributing to the rise in steel demand in the domestic market.

CareEdge Research estimates India's steel production to be in a range of 117-119 Million tonnes, a growth rate of 3-5% and consumption growth rate is expected to be healthy at 10-12% in FY23. Improving activities in the construction sector along with an uptick in the real estate and automobile sector is expected to boost the demand for steel products in the industry. The automobile sector which observed a growth of 23.7% in sales during 9M FY23 also indicates the growing demand for steel. To serve the increasing domestic demand, the production will also observe a growth along with the consumption.

Considering the pre-election year (2023), the Government is likely to increase the investments both at the state and central level and this is expected to augur well for the domestic steel demand.

Some of the key budgetary announcements which reflect the same are:

- An increase in allocation of capex towards infrastructure from ₹7,500 Billion to ₹10,000 Billion in Union Budget 2023-24.
- The capital outlay of ₹2,400 Billion for Indian Railways.
- 100 transport infrastructure projects.
- Approval of Production Linked Incentive (PLI) Scheme for specialty steel.
- Pradhan Mantri Awas Yojana (PMAY) scheme (to provide affordable housing to the urban poor), an increase to ₹795.90 Billion from ₹480 Billion.
- Jal Jeevan Mission (to provide safe and adequate drinking water to all the rural households), an increase of ₹100 Billion towards the scheme.

As per the National Steel Policy 2017, the target of Government is to achieve crude steel production of 300 MT by 2030-31 from 145-155 MT currently.

During 10M FY23, exports have witnessed a de-growth as compared to FY22. This is mainly because of the announcement made by Government in May 2022, on imposing export duties which made steel exports from India expensive and affected demand from countries outside. However, in November 2022, the Government has withdrawn the export duty on steel products, iron ore lumps and fines (less than 58% iron content) and iron pellets, while the export duty of iron ore lumps and fines (more than 58% iron content) has been reduced from 50% to 30%. The reversal of the export duty hike is expected to boost the Indian exports of steel products with the full impact expected by early-FY24.

International steel prices are expected to remain range-bound due to high input costs, primarily iron ore and coking coal, and the ongoing geopolitical crisis. Domestic prices are also expected to trend in-line with global prices supported by healthy domestic demand.

Steel pipes and tubes

Overview

India is one of the largest manufacturers of steel pipes in the world which is one of the most important sub-industries of the Indian Steel Sector. It contributes around 8% of India's steel consumption and is valued around ₹600 Billion.

The industry is further divided into two segments- Electric Resistant Welded (ERW) and Submerged Arc Welded and Seamless (S&S). Construction, Railways, Oil & gas, agriculture, real estate are some of the key consumers of steel pipes and tubes.

Types of Steel products

Long products

Long products are typically supplied in straight length/cut length barring wire rods which are normally supplied in irregularly wound coils. These finished steel products are normally produced by hot rolling/forging of bloom/billets/pencil ingots into usable shapes or sizes. This segment includes products like bars, rods, angles and rail sections.

Flat products

These are finished steel products that are produced from slabs/thin slabs in rolling mills using flat rolls. These are supplied in Hot Rolled (HR), Cold Rolled (CR) or in coated condition depending upon the requirement. Types of flat products are plates, sheets and strips.

Table 31: Consumption of finished steel products (in '000 tonnes)

Particulars	Long Products			Flat Products	
	Bars & Rods	Steel Structural	Railway Materials	HR Coils	Plates
FY18	33,387	8,230	1,208	14,547	5,184
FY19	35,828	8,335	1,426	14,942	5,601
FY20	39,718	7,180	1,849	40,632	4,681
FY21	39,696	6,546	1,548	36,635	4,242
FY22	44,595	7,067	1,419	40,445	4,650
FY23(April-Jan)	40,399	6,541	1,262	37,272	4,014

Source - CMIE

Types of pipes:

Galvanised Iron Pipes

Galvanised Iron pipes are manufactured using mild steel strips of low carbon steel coils. The process involves coating with pipes with zinc. This process is called galvanization. This process makes the pipe corrosion resistant, long lasting and highly protected.

Galvanised pipes are majorly used for the purpose of distribution of treated or raw water in various regions. The pipes are sturdy, durable and resistant to abrasion and dust. They are also cheap and light in weight.

Application - Water & Sewage pipes, Electric poles, Hand pumps, Irrigation, Oil and gas transmissions, etc.

Polyvinyl Chloride Pipes (PVC pipes)

PVC pipes are manufactured by extrusion of raw material PVC. They are made by combining additives like plasticizers with chlorinated hydrocarbon polymer to make is more resilient and malleable. PVC pipes are light weight and hence are easy to install and transport. These pipes are usually used in water and sewage purposes and are very durable, recyclable and corrosion resistant. The smooth surface of the PVC pipes ensures smooth and faster flow of water due to lower friction as compared to the pipes made from cast iron or concrete.

Application - Water supply, plumbing, electrical insulation, agricultural irrigation, etc.

Unplasticized Polyvinyl Chloride Pipe (UPVC pipes)

UPVC pipes are manufactured without using additional plasticizing polymers. Due to this the pipes have more rigid consistency than PVC pipes. UPVC pipes are resistant to corrosion and function well with wide range of temperatures and operational pressures.

These pipes are low maintenance and low-cost product mostly used for water supply to households, hospitals, hotels etc. or for supply of salt water in industries or production lines.

Application - Distribution of portable water, water transfer in bathrooms, kitchen, laboratories, etc.

Chlorinated Polyvinyl Chloride (CPVC pipes)

CPVC pipe is manufactured by adding chlorine to PVC. This process increases the resistance and lifespan of the product. CPVC excels in flexibility and temperature handling. It is used to create commercial or industrial grade pipes for liquid distribution as well as the fittings to secure them.

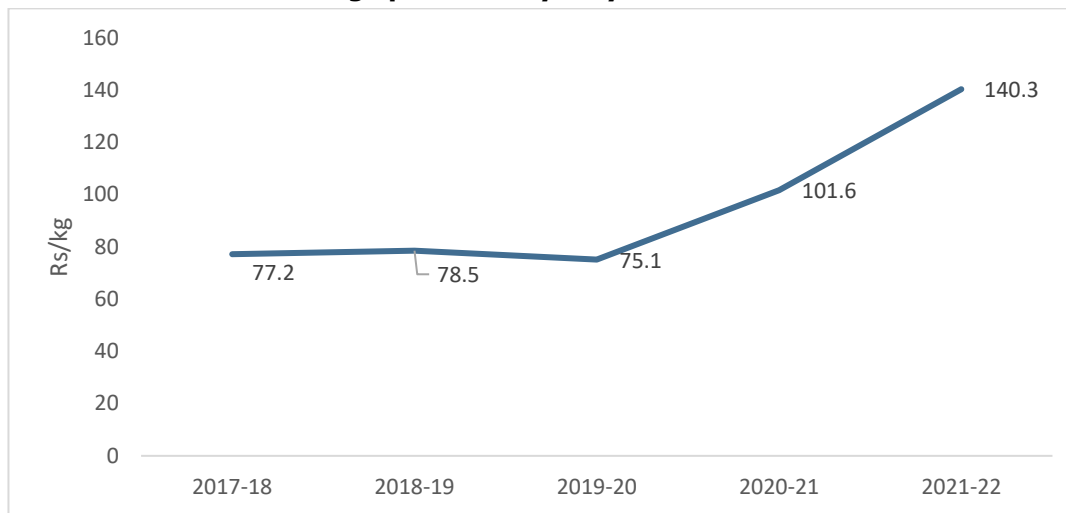
Application - Plumbing application in factories where chemical and heat resistance matters.

Trend of poly Vinyl Chloride (PVC) in India:

PVC is derived from two materials - salt and oil. The other additives used in PVC materials include lubricants and heat stabilizers. Its compatibility with different kinds of additives makes it a highly versatile polymer.

The prices of PVC are dependent on oil as it is one of its key material. The hike in price of PVC in 2022 was on account of increased crude oil prices. Further, demand from construction industry also impacts the PVC prices. PVC is the raw material for majority of pipes used in construction industry mainly used for water and sewage pipes.

Table 32: Domestic average price of Poly Vinyl Chloride



Source: CMIE

Review

The steel pipes and tubes industry has witnessed growth of around 24% in production and 25% in consumption on a y-o-y basis during the 9M FY23 (April - December). Around 5,681 thousand tonnes of steel tubes and pipes were produced in the 9M FY23 whereas 5,097 thousand tonnes were produced during the same period in the previous year. This growth is on account of the factors such as improvement in construction activities, continuous investment in infrastructure and policy support by the Government.

During FY22, the production of steel pipes and tubes increased by 7.1% to 6,321 thousand tonnes backed by a growth in domestic consumption and export market. Recovery in economic activities after the second wave of Covid-19 pandemic improved the domestic consumption by 4.1% to 5,633 thousand tonnes.

Table 33: Performance Indicators for steel pipes and tubes industry (in '000 tonnes)

Particulars	FY21	FY22	Y-O-Y	9M FY22	9M FY23	Y-O-Y
Production	5,901	6,321	7.1%	4,584	5,681	23.9%
Consumption	5,413	5,633	4.1%	4,082	5,097	24.9%

Source: CMIE

Note: 9M period refers to April to December for FY22 & FY23

Outlook

The outlook for steel pipes and tubes is expected to remain stable backed by rising demand with high economic activities and continuous investment by the Government in infrastructure of the country including real estate, water, oil & gas infrastructure.

The trend for affordable housing is picking up in India along with an increase in urban infrastructure as Government plans to set up 100 new airports by 2024 under Ude Desh ka Aam Naagrik (UDAN) scheme. Additionally, 100 transport infrastructure projects have been announced in the latest budget 2023-24. Moreover, there has been increase in allocation

towards Pradhan Mantri Awas Yojana (PMAY) scheme (to provide affordable housing to the urban poor) to ₹795.90 Billion from ₹480 Billion.

The Government has been taking various initiatives to reach new markets. On 15th August, 2019 the Government had launched "Jal Jeevan Mission" programme with an aim to provide safe and adequate drinking water through individual household tap connections by 2024 to all households in rural India. This programme has already achieved in providing tap connections to nearly 58% rural households in 3.5 years now and is still likely to improve demand for steel pipes for distribution of water because of its non-corrosion and non-rusting characteristics. This, in turn, will support safe and sustainable drinking water to households through individual household tap connection by 2024. The mission has always seen a consistent allocation in budget every year. In the Union budget 2023-24, the allocation has increased to around ₹700 Billion.

It is expected that an increase in the length of Natural Gas pipelines by 2024-2025 will contribute towards expansion of steel pipe production. The natural gas sector that already has seen the announcement of 'One nation, one gas grid' initiative will attract new investments in India's natural gas infrastructure. It is expected that the gas pipeline network which has already crossed 22,000 km currently, will reach to 35,000 km in the coming 4-5 years. The efforts of moving towards the gas-based economy along with implementation of city gas distribution networks is expected to augment the demand for pipes going forward. Along with this, the increase in CNG stations, bio-refineries, bio plants etc. will support the infrastructure for gas.

Further, the usage of steel pipes and tubes will also be supported by demand from domestic water infrastructure, oil exploration and transportation, construction, real estate, railways (capital outlay of ₹2,400 Billion), irrigation and infrastructure.

Bitumen

Overview

Bitumen is produced through distillation of crude oil and is known for waterproofing and adhesive properties. It is widely used in construction industry, mainly for roads and highways. After the earthwork, bituminous or flexible pavement is made up of five layers as follows:

- Dense bituminous macadam (DBM): It consists of coarse aggregates and bitumen and is suitable for all pavement layers and for all traffic conditions. It also provides a good quality smooth surface and improved skid resistance. The purpose of this layer is to provide strength to the road and coarse surface which can hold fine aggregates laid on the top layer. The thickness of this layer varies but is always greater than or equal to the top layer which is the bituminous concrete. As bitumen is the key constituent in this layer, it makes DBM costlier.
- Bituminous concrete (BC): It is the top most layer in the flexible pavement and consists of fine aggregates and bitumen. Depending on the design of the pavement, the thickness also accordingly varies. This layer has a higher proportion of bitumen as compared to DBM. Hence, it is the most expensive layer of flexible pavement.
- Sub-grade: It forms the bottom layer of flexible pavement and involves levelling the ground surface. The materials used in levelling the ground surface are aggregates of soil, rocks and clays. The thickness of this layer is highest. Sub-grade accounts for about 5% of the total cost in constructing a road.
- Granular sub-base (GSB): After the sub-grade, GSB layer is laid. It consists of stones, soil, sand, small size metals, etc. The main purpose of this layer is to provide strength to the road and bear the load of the traffic. GSB accounts for 12% of the total cost of constructing a bituminous road.

- Wet mix macadam (WMM): WMM is laid over GSB. In this layer, various materials like moorum, stones, dust and sand are cohered using some water and bitumen. WMM accounts for 13% of the total cost of constructing a bituminous road.

Bitumen derivatives market in India

Bitumen derivatives are broadly classified into modified bitumen and emulsions. Additives or blends of additives are added to manufacture derivatives. There are various bitumen derivatives available in the market which are mentioned below.

Modified bitumen: A bituminous binder whose performance properties are enhanced with the use of additives. The examples of additives are polymers, crumb rubber, Sulphur, polyphosphoric acid.

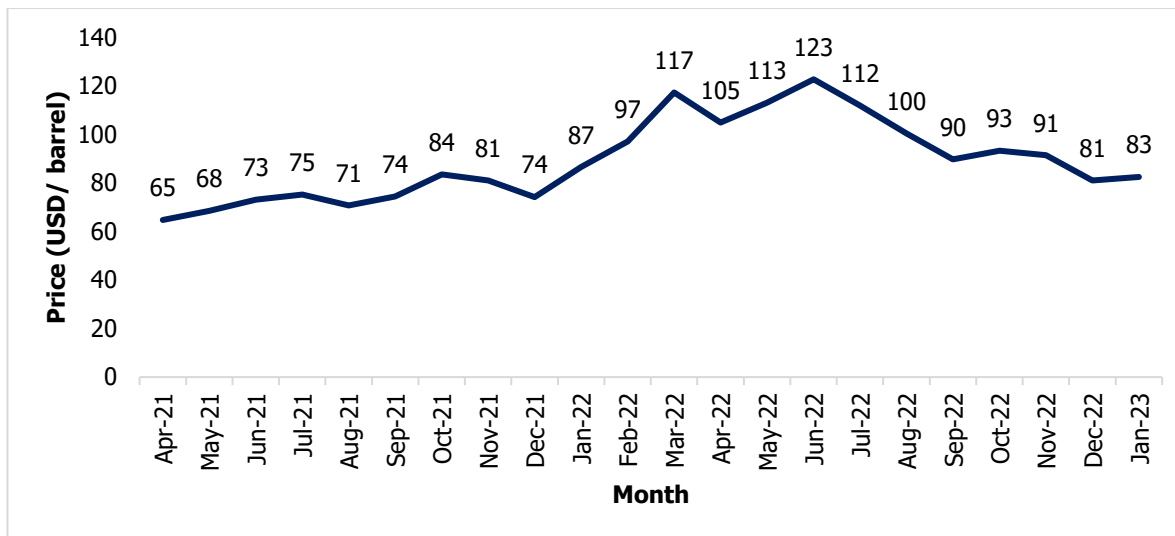
- Polymer modified bitumen (PMB): PMBs serve to improve bitumen's elasticity, rigidity, durability and water resistance. It also possesses less temperature sensitivity and is crucial for pavement application because the material does not lose its original form irrespective the temperature.
- Crumb rubber modified bitumen (CRUMB): Crumb rubber modified bitumen consists of crumb rubber modifier and the chosen bitumen grade. The modifier strengthens the binder from the occurrence of any deformation when trying to change/maintain temperature. CRMB increases the life of the road by 1.5-2 times.
- Natural rubber modified bitumen: The adoption of rubber in construction ensures reduced cost of construction and as the rubber is recycled it also minimizes the environmental pollution to an extent. It is also used for increasing the longevity of the roads.
- Emulsion: It is a free-flowing liquid at ambient temperature. Bitumen emulsions are of two types – cationic and anionic, it depends on the emulsifier which is employed.
- Slow setting emulsion is one of the most stable type of emulsion and is used in dense graded aggregate bases, slurry seals. It sets very slowly and hence is suitable for being mixed with aggregates of high surface area.
- Rapid setting emulsion sets quickly when in contact with aggregates, therefore it finds its use in low surface of roads, mainly in chip seals and surface dressing.

Price trend of crude oil

Bitumen is a by-product of crude oil and is produced through distillation of crude oil. Hence, bitumen follows the trend of crude oil.

In the early half of FY21, the crude oil sector witnessed huge volatility in terms of prices due to lockdown and travel restrictions in different parts of the world. Global crude oil prices fell to new lows as Covid-19 induced lockdowns resulted in sharp fall in demand. However, the crude prices gradually started recovering since H2FY21 with the reduction of mobility restrictions and opening of economy.

Chart 34: Price movement of crude oil



Source: CMIE

The ban in purchase of Russian oil by USA and UK amid Russia Ukraine tensions significantly increased the price of crude oil with the benchmarks trading above \$100 towards the end of FY22. The price was passed on to the consumers which increased the cost of goods and services, leading to high inflation. However, the crude oil prices are now cooling down after reaching all-time high in June.

Outlook

On account of pent up demand from last year and the new projects launching this year, the consumption and demand for bitumen is expected to increase. However, the availability and supply of bitumen is expected to be lower despite steady domestic production and imports.

Due to bitumen’s properties such as water resistance and viscosity, its usage is also increasing in paints, coatings, inks and dyes. This is also one of the factors propelling the bitumen market growth.

7. Competitor analysis of key listed players

For peer comparison, CARE Edge has considered infrastructure companies operating under various business segments similar to Vishnu Prakash R Punglia Limited (VPRP Ltd). However, it may be noted that these peers are not exclusive to the segments under which they are mentioned. They do operate under other segments as well.

Companies considered for comparison under water supply and waste water treatment

Amounts in ₹ Millions

Particulars	NCC Ltd	ITD Cementation India Ltd	Hindustan Construction Company Ltd	PNC Infratech Ltd
FY2023	Consolidated			
Net Sales	1,55,534.1	50,909.1	98,565.9	79,560.8
Y-o-Y Growth (%)	39.6%	33.7%	-7.6%	10.4%
Net Sales 6 Year CAGR (%)	9.5%	16.3%	0.0%	23.4%
EBITDA	17,907.8	13,726.8	11,882.4	25,431.6
Y-o-Y Growth (%)	39.8%	33.5%	-33.0%	3.8%
EBITDA Margin (%)	11.5%	27%	12.1%	32%
EBIT Margin (%)	8.1%	5.6%	4.6%	16.9%
PBT	8,848.5	1,838.8	-890.8	9,574.6
PBT Margin (%)	5.7%	3.6%	-0.9%	12.0%
PAT	6,462.1	1,247.3	-265.9	6,584.5
PAT 6 Year CAGR (%)	59.3%	6.2%	-45.2%	33.1%
Net Margin (%)	4.2%	2.5%	-0.3%	8.3%
ROE (%)	10.5%	10.1%	3.7%	15.4%
ROCE (%)	17.6%	14.6%	9.8%	12.8%
Asset Turnover (times)	0.9	1.0	0.7	0.6
Current Ratio (times)	1.3	1.0	1.1	1.7
Total Debt/Equity (times)	0.2	0.6	-7.4	1.5
Interest Coverage (times)	2.4	1.7	0.4	2.9
Debtors Days	67.1	61.0	79.1	40.5
Inventory Days	34.9	55.1	22.7	45.1
Payable Days	134	128.1	141.0	43.6
Net Working Capital Days	-32	-11.9	-39.2	42.0
Total Debt/EBITDA (times)	0.5	0.5	4.5	2.5

Companies considered for comparison under railway sector

Particulars	Rail Vikas Nigam Ltd	KEC International Ltd	Ircon International Ltd
FY2023	Consolidated		
Net Sales	2,02,815.7	1,72,817.1	1,03,679.3
Y-o-Y Growth (%)	4.6%	25.8%	40.5%
Net Sales 6 Year CAGR (%)	22.8%	12.4%	22.5%
EBITDA	13,708.7	23,046.3	7,529.7
Y-o-Y Growth (%)	7.5%	13.8%	17.6%
EBITDA Margin (%)	6.8%	13.3%	7.3%
EBIT Margin (%)	6.0%	3.9%	5.8%
PBT	17,981.5	1,609.8	8,910.0
PBT Margin (%)	8.9%	0.9%	8.6%
PAT	14,205.5	1,760.3	7,652.3
PAT 6 Year CAGR (%)	24.5%	-8.7%	12.5%
Net Margin (%)	7.0%	1.0%	7.4%
ROE (%)	19.4%	4.7%	14.7%
ROCE (%)	8.9%	9.6%	8.9%
Asset Turnover (times)	1.1	0.9	0.7
Current Ratio (times)	2.0	1.1	1.5
Total Debt/Equity (times)	0.9	0.8	0.3
Interest Coverage (times)	2.1	1.2	5.0
Debtors Days	17.2	126.7	27.4
Inventory Days	1.1	29.5	9.6
Payable Days	8.2	204.1	36.3
Net Working Capital Days	10.0	-47.9	0.7
Total Debt/EBITDA (times)	4.7	1.4	2

Companies considered for comparison under road construction sector

Particulars	GR Infraprojects Ltd	H.G. Infra Engineering Ltd	KNR Construction Ltd	IRB Infrastructure Developers Ltd
FY2023	Consolidated			
Net Sales	94,815.1	46,220.1	40,623.6	64,016.4
Y-o-Y Growth (%)	12.1%	23.2%	12.7%	10.3%
Net Sales 6 Year CAGR (%)	19.4%	27.9%	15.9%	1.5%
EBITDA	27,336.1	9,696.2	12,561.5	35,599.9
Y-o-Y Growth (%)	44.2%	29.0%	1.9%	13.5%
EBITDA Margin (%)	28.8%	21.0%	30.9%	55.6%
EBIT Margin (%)	24.3%	17.3%	18.1%	37.4%
PBT	19,523.4	6,634.5	6,820.6	11,839.6
PBT Margin (%)	20.6%	14.4%	16.8%	18.5%
PAT	14,544.3	4,931.9	4,402.4	8,270.2
PAT 6 Year CAGR (%)	16.3%	44.8%	30.1%	2.4%
Net Margin (%)	15.3%	10.7%	10.8%	12.9%
ROE (%)	23.2%	25.7%	16.0%	6.2%
ROCE (%)	19.3%	20.9%	21.7%	8.0%
Asset Turnover (times)	0.7	0.9	0.9	0.1
Current Ratio (times)	2.6	1.7	2.0	1.6
Total Debt/Equity (times)	0.9	1.0	0.2	1.3
Interest Coverage (times)	5.2	5.2	4.8	1.6
Debtors Days	19.6	53.8	54.9	74.9
Inventory Days	57.0	22.2	32.0	45.1
Payable Days	47.6	61.1	48.2	64.6
Net Working Capital Days	29.0	15.0	38.7	55.4
Total Debt/EBITDA (times)	2.1	2.0	0.5	4.7

Other companies considered for comparison

Particulars	Larsen & Toubro Ltd	Dilip Buildcon Ltd	J Kumar Infraprojects Ltd
FY2023	Standalone	Consolidated	Standalone
Net Sales	11,05,009.8	1,06,436.5	42,031.4
Y-o-Y Growth (%)	9.4%	11.3%	19.2%
Net Sales 6 Year CAGR (%)	9.0%	12.3%	17.4%
EBITDA	1,18,084.3	11,912.1	6,532.2
Y-o-Y Growth (%)	-1.9%	12.5%	16.1%
EBITDA Margin (%)	10.7%	11.2%	15.5%
EBIT Margin (%)	7.2%	5.2%	10.5%
PBT	98,327.0	1,034.2	3,735.7
PBT Margin (%)	8.9%	1.0%	8.9%
PAT	78,489.7	-13.9	2,743.9
PAT 6 Year CAGR (%)	6.3%	NA	16.9%
Net Margin (%)	7.1%	0.0%	6.5%
ROE (%)	11.0%	0.0%	11.7%
ROCE (%)	9.4%	5.2%	15.5%
Asset Turnover (times)	0.6	0.7	1.0
Current Ratio (times)	1.4	1.2	1.6
Total Debt/Equity (times)	0.2	1.7	0.2
Interest Coverage (times)	3.7	0.6	4.5
Debtors Days	114.8	40.2	88.1
Inventory Days	13.3	134.5	42.7
Payable Days	176	105.2	67.7
Net Working Capital Days	-48	69.5	63.1
Total Debt/EBITDA (times)	1.1	5.6	0.8

CAGR : Compounded Annual Growth Rate

PBT: Profit Before Tax

EBIT: Earnings Before Interest and Tax

EBITDA: Earnings Before Interest Tax Depreciation and Amortisation

ROE : Return on Equity

ROCE: Return on Capital Employed

8. Overview of Order book

For key players operating in water supply and waste water treatment:

Company	Order book (in Millions) as of 30th September 2022	% of order book from water and waste water treatment	Sectors/Segments in which they operate
NCC Ltd	400,200	20%	Building, Road, Water & Environment, Electrical, Irrigation, Mining, Others
ITD Cementation India Ltd	217,131	12%	Urban Infrastructure, MRTS and Airports, Highway, Bridges and Flyovers, Maritime Structures, Industrial Structures and Buildings, Hydro, Dams, Tunnels and Irrigation, Water and Waste Water, Foundation and Specialist Engineering
Hindustan Construction Company Ltd	137,840	42%	Transport, Hydro, Water, Nuclear & Special
PNC Infratech Ltd	192,610	39%	Road Projects, Water & Canal Projects, New HAM Projects, Other Projects

For key players operating in Railway sector:

Company	Order book (in Millions) as of 30th September 2022	% of order book from railway sector	Sectors/Segments in which they operate
Rail Vikas Nigam Ltd	550,000	100%	New Line, Metro Projects, Gauge Conversion, Business Development, Doubling, Other (Bridge Construction, etc), Workshop, Railway Electrification

KEC International Ltd	275,690	18%	T&D, Civil, Railways, Cables, Oil & Gas, Smart Infra
Ircon International Ltd	400,200	76.8%	Railways, Highways, Others

For key players operating in road sector:

Company	Order book (in Millions) as of 30th September 2022	% of order book from road sector	Sectors/Segments in which they operate
GR Infraprojects Ltd	156,299	94%	EPC, HAM, Railways, Transmission, others
H.G. Infra Engineering Ltd	108,516	100%	Road projects
KNR Constructions Ltd	80,415	74%	Road projects, Other Road projects, Irrigation projects
IRB Infrastructure Developers Ltd	109,000	100%	Road projects

For other key players in the industry:

Company	Order book (in Millions) as of 30th September 2022	Sectors/Segments in which they operate
Larsen & Toubro Ltd	3,724,000	Infrastructure, Energy, Hi-Tech manufacturing, Others
Dilip Buildcon Ltd	263,375	Water supply, Road & highways, Metro, Irrigation, Tunnel, Mining, Airport, Special bridges
J Kumar Infraprojects Ltd	114,390	Metro, Flyover, Bridges, Roads & Tunnels, Water, Civils & Others

9. Annexure

Abbreviations:

ABS: Automatic Block Signalling	MGNREGA: Mahatma Gandhi National Rural Employment Guarantee Act
ACP: Allianz Capital Partners	MLD: Million Litres Per Day
ADB: Asian Development Bank	MoR: Ministry of Railways
AFTO: Automobile Freight Train Operator Scheme	MoRTH: Ministry of Road Transport and Highways
AMRUT: Atal Mission for Rejuvenation and Urban Transformation	MSF: Marginal Standing Facility
BC: Bituminous concrete	MTS: Model Tripartite Agreements
BIMS: Bidder Information Management System	NCDC: National Centre for Disease Control
BRO: Border Road Organization	NCEF: National Clean Energy Fund
CAG: Comptroller and Audit General	NCW: Non Conventional Water
CALA: Competent Authority for Land Acquisition	NGO: Non-Governmental Organizations
CANR: Committee on Allocation of Natural Resources	NHAI: National Highways Authority of India
CCEA: Cabinet Committee on Economic Affairs	NHDP: National Highways Development Project
CCI: Competition Commission of India	NHIDCL: National Highway Infrastructure Development Corporation Ltd
CCIE: Committee of Independent Experts	NIC: National Informatics Centre
CGWB: Central Ground Water Board	NICDP: National Industrial Corridor Development Program
COS: Committee of Secretaries	NIP: National Infrastructure Pipeline
CPCB: Central Pollution Control Board	NMDC: National Mineral Development Corporation
CPI: Consumer Price Index	NMP: National Monetization Plan
CPPIB: Canada Pension Plan Investment Board	NPA: Non-Performing Asset
CPVC: Chlorinated Polyvinyl Chloride	NPP: National Perspective Plan
CRUMB: Crumb Rubber Modified Bitumen	NRP: National Railway Plan
CWC: Central Water Commission	NS – EW: North - South and East – West corridor
DBFO: Design, Build, Finance and Operate	NWDA: National Water Development Agency
DBM: Dense Bituminous macadam	NWP: National Water Policy
DDP: Desert Development Plan	ODF: Open Defecation Free
DEA: Department of Economic Affairs	OFID: OPEC Fund for International Development
DEMU: Diesel Electric Multiple Unit	OMT: Operate – Maintain – Transfer
DFC: Dedicated Freight Corridor	PFCE: Private Final Consumption Expenditure
DFCCIL: Dedicated Freight Corridor Corporation of Indian Ltd	PFMS: Public Financial Management System
DMICDC: Delhi Mumbai Industry Corridor Development Corporation	PFT: Private Freight Terminals
DPAP: Drought Prone Area Programme	PHPDT: Peak Hour Peak Direction Traffic
EC: Environment Clearance	PIB: Press Information Bureau
EFC: Expenditure Finance Committee	PIU: Project Implementation Unit
EI: Environmental Information	PKC: Prabati - Kalisindh – Chambal

EPC: Engineering, Procurement and Construction	PLI: Production Linked Incentive
ERCP: Eastern Rajasthan Canal Project	PMAY: Pradhan Mantri Awas Yojana
ERW: Electric Resistant Welded	PMB: Polymer Modified Bitumen
FHTC: Functional Household Tap Connection	PMG: Project Monitoring Group
GAP: Ganga Action Plan	PPP: Public Private Partnership
GDP: Gross Domestic Product	PPP: Purchasing Power Parity
GFCF: Gross Fixed Capital Formation	PPPAC: Public Private Partnership Appraisal Committee
GIS: Geographic Information System	PRI: Panchayat Raj Institutions
GNI: Gross National Income	PRS: Polluted River Stretches
GoI: Government of India	PVC: Polyvinyl Chloride
GP: Gram Panchayat	PWD: Public Works Department
GQ: Golden Quadrilateral	REIT: Real Estate Investment Trusts
GSB: Granular sub – base	RFID: Radio Frequency Identification
GVA: Gross Value Added	RLB: Rural Local Bodies
HAM: Hybrid Annuity Model	RRTS: Regional Rapid Transit System
IDFs: Infrastructure Debt Funds	RWHS: Rain Water Harvesting Structures
IIFCL: India Infrastructure Finance Company Ltd	S&S: Submerged Arc Welded and Seamless
IIP: Index of Industrial Production	SAAP: State Annual Action Plan
IIPDF: India Infrastructure Project Development Fund	SAGY: Sansad Adarsh Gram Yojana
IIWG: Infrastructure and Investment Working Group	SARDP: Special Accelerated Road Development Programme
IM: Institutional Mechanism	SAROD: Society of Affordable Redressal of Disputes
IMF: International Monetary Fund	SBM: Swachh Bharat Mission
IMIS: Integrated Management Information System	SCADA: Supervisory Control and Data Acquisition
InvITs: Infrastructure Investment Trusts	SCILR: Special Committee for Interlinking of Rivers
IoT: Internet of Things	SDF: Standing Deposit Facility
IRCTC: Indian Railway Catering and Tourism Corporation	SEMs: Self Employed Mechanics
IRFC: Indian Railway Finance Corporation	SFC: State Finance Commission
ISAC: Independent Settlement Advisory Committee	SFTO: Special Freight Train Operator Scheme
ITS: Intelligent Transport System	SHGs: Self Help Groups
IWMP: Integrated Watershed Management Programme	STP: Sewage Treatment Plant
JJM: Jal Jeevan Mission	TOT: Toll Operate and Transfer
JSA – II: Jal Shakti Abhiyan II	UDAN: Ude Desh ka Aam Naagrik
JWG: Joint Working Group	ULBs: Urban Local Bodies
LAF: Liquidity Adjustment Facility	UPVC: Unplasticized Polyvinyl Chloride
LPCD: Litres Per Capita per Day	VGf: Viability Gap Funding
LWIS: Liberalised Wagon Investment Scheme	VO: Voluntary Organizations

MCA: Model Concession Agreement	WASH: Water Sanitation and Hygiene enlightened
MFC: MultiFunctional Complexes	WLS: Wagon Leasing Scheme

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