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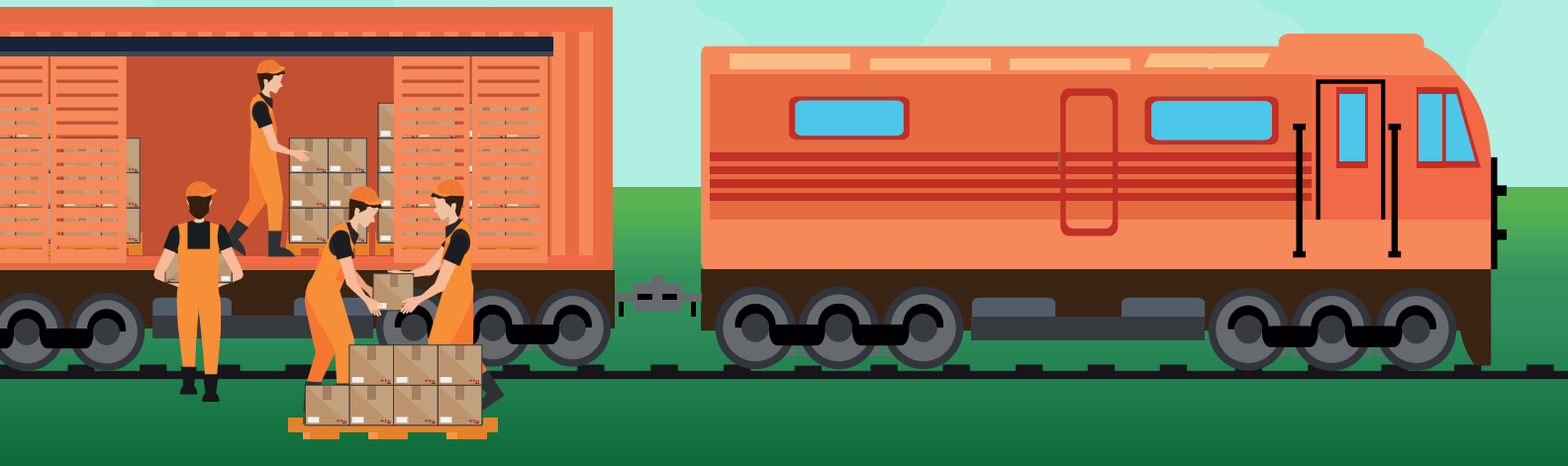
SUSTAINABLE ENERGY FOUNDATION

MOVING TOWARDS A LOW-CARBON TRANSPORT FUTURE

Increasing **Rail Share** in Freight Transport in India

Working Report – Automobile



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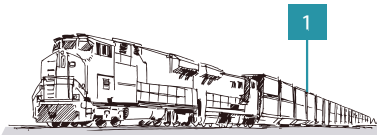

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About Shakti: Shakti Sustainable Energy Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that support energy efficiency, renewable energy and sustainable mobility.

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AUTOMOBILE

The Global Automobile Industry

Automobile production takes place in a handful of countries around the world. In 2017, global production of motor vehicles, excluding two-wheelers, three-wheelers, and tractors, stood at about 97 million units, a significant jump from 87 million units in 2013, recording a compound annual growth rate (CAGR) of 2.7% (OICA, 2018). The motor vehicle sales also increased at a CAGR of about 3.2% during the same period.

China is the largest producer of motor vehicles, accounting for about one-fourth of the global production, by producing 24.4 million units of motor vehicles in 2017. It was followed by Japan, which produced about 8 million units of motor vehicles during the same year. India ranked sixth in terms of production of motor vehicles (OICA, 2018).[2]

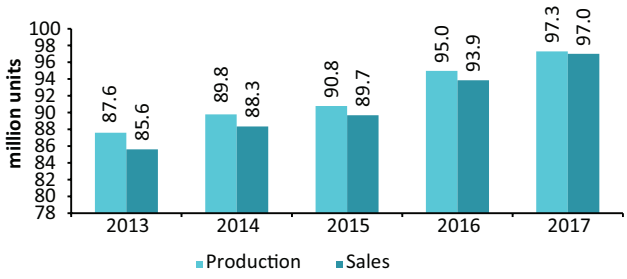

Figure 1: Global Production and Sales of Motor Vehicles (passenger cars, light vehicles, HCVs, and buses) (2013–2017)
Note: Numbers are for calendar years
Source: International Organization of Motor Vehicle Manufacturers (OICA)

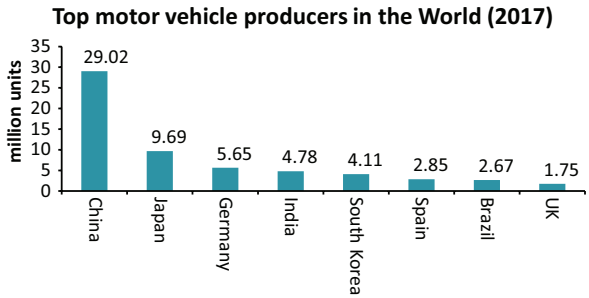

Figure 2: Top Motor Vehicle Producers in the World (2017)
Note: Includes passenger cars, light vehicles, buses, and HCVs; Source: OICA

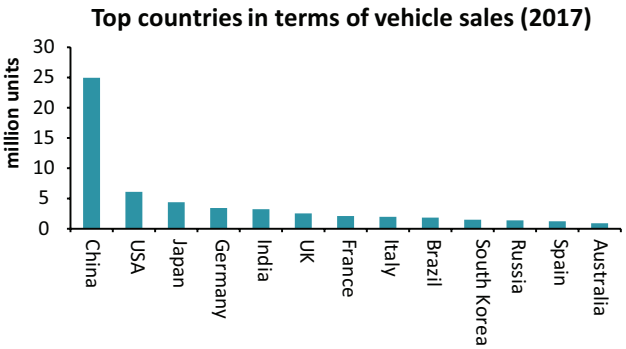

Figure 3: Top Countries by Sale of Passenger Cars (2017); Source: OICA
Note: Motor vehicles, as reported by OICA, include passenger cars, light motor vehicles, buses, and heavy commercial vehicles.

Rising income and increasing affordability has resulted in a massive increase in car ownership. China recorded the highest volume of motor vehicle sales during 2017 at 25 million units, followed by the USA, Japan, and Germany with 6.1, 4.4, 3.4 million units, respectively. India ranked fifth in terms of volume of motor vehicles sold during 2017 (OICA, 2018).[3]

Automobile Sector in India

Production, Sales, and Exports

The Indian auto industry is one of the largest in the world with an annual production of about 29 million vehicles in 2017–18 (SIAM, 2018)[4]. Buoyed by rapidly increasing disposable incomes driving the demand for automobiles, the industry is also one of the fastest growing industrial sectors in India reporting CAGR of 8% between 2013–14 and 2017–18. The automobile industry also accounts for over 7.1% of the country's GDP, making it a major economic driver in India's growth story (IBEF, 2016).

[1] *Note: Motor vehicles, as reported by OICA, include passenger cars, light motor vehicles, buses and heavy commercial vehicles.*

[2] *http://www.oica.net/production-statistics/*

http://www.oica.net/wp-content/uploads/total-sales-march-2018.jpg (last accessed on June 5, 2018)

[3] *http://www.oica.net/category/sales-statistics/*

[4] *http://www.siamindia.com/statistics.aspx?mpgid=8&pgidtrail=13 (last accessed on June 5, 2018)*

This is also an economy which has a growing middle class and one of the largest youth populations in the world. Coupled with the fact that there is a large unmet demand for mobility across the country, this industry is expected to see a large growth in the near to distant future. During 2017–18, the industry sold 25 million vehicles also making it a very large market for automobiles.[5] As of 2017–18, around 30% of the small cars sold globally were manufactured in India and the country also exported about 4 million vehicles in the same year.

Production, Sales and Exports of Vehicles in India (units)

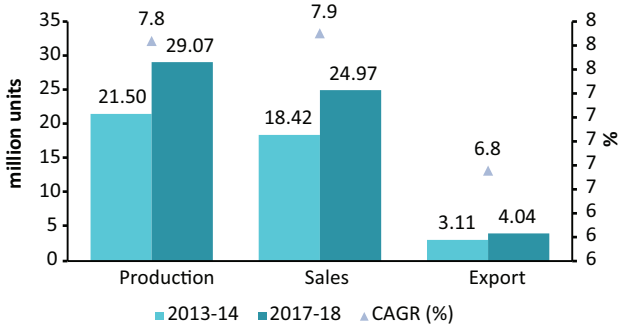

Figure 4 : Trends in Automobile Production, Sales and Exports (2013-14 and 2017-18)
Source: SIAM 2017-18

Owing to its significant contribution to the economy, the automobile industry is also being given boost under the Make in India initiative of the union government. The new Automotive Mission Plan 2016–2026 envisages a growth of nearly 3.5 to 4 times from the current value of USD 74 billion to USD 260-300 billion, contributing about 12% of the economy by 2026. The plan also envisions scaling up of exports to 35%–40% of the overall output in the next decade (AMP 2016-2026).[6]

Category-wise Analysis

The Indian automobile industry is largely dominated by two wheelers, constituting 80% of the total vehicles produced in the country in 2017–18 (SIAM, 2018). As a matter of fact, the Indian automobile industry is increasingly being recognized as one of the core industrial sectors of the Indian economy.

Production share of different vehicle classes -2017-18

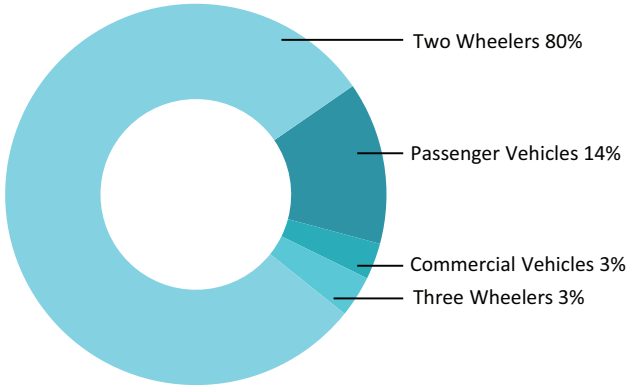

Figure 5: Category-wise share in total automobile production 2017-18
Source: SIAM 2017-18

Focus on Passenger Cars

Globally recognized as one of the largest 'small car' markets, India has also recently started producing a large number of larger-sized vehicles in the utility-vehicle segment (KPMG, 2012) with a growth of about 50% in the SUV segment over the last few years (IBEF, 2016). However, fuelled by an increasing middle class demand, the country would still predominantly produce 'small cars' over the next decade. The rural market, so long mostly untapped for passenger cars, is also gradually opening up and becoming accessible. In addition, the progressively reducing life of vehicles is also adding to the overall domestic demands for passenger vehicles, further fuelling the industry.

If we focus on the passenger car segment; India has about 23 cars per 1,000 population as of 2015 (MoRTH, 2014-15). This number is expected to increase to 35 cars

Production and sales of passenger vehicles in India

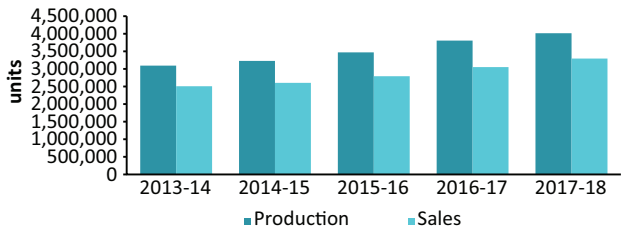

Figure 6: Production and sales of passenger vehicles in India (2013-14 to 2017-18)
Source: SIAM Statistical Profile 2017-18

[5] *http://www.siamindia.com/statistics.aspx?mpgid=8&pgidtrail=14 (last accessed on June 5, 2018)*
[6] *http://www.siamindia.com/uploads/filemanager/47AUTOMOTIVEMISSIONPLAN.pdf (last accessed on October 5, 2017)*

per 1,000 population by 2025, at a CAGR of 4.9% (TERI, 2014).

From largely being a controlled industry till the economic liberalization 25 years ago, the automobile industry has undergone a sea change. The automobile manufacturers have progressively continued to diversify their product offerings to meet the ever-increasing consumer demands, while also addressing the continuous needs of regulation. A large number of automobile technology and fuel variants (such as CNG, LPG, hybrids, and electric) are being offered for the same models and the choice basket for the user is on the rise with higher levels of customization (E&Y, 2012).

In the last 15 years or so, the production of passenger vehicles in India has more than tripled from 1.2 million units annually in 2004–05 to 4 million units in 2017–18. During the last five years, the production of passenger vehicles increased at a CAGR of 7% from 3.1 million units in 2013–14 to 4 million units in 2017–18. The sales on the other hand increased from 2.5 million units in 2013–14 to 3.3 million units in 2017–18 at a CAGR of 7%.

The industry estimates suggest that by 2026, passenger vehicle production volumes would increase to about 9.4–13.4 million units, commercial vehicles to 2.0–3.9 million units, two wheelers to 50.6–55.5 million units, and tractors to 1.5–1.7 million units[7]. In order to cater to the movement of such a huge volume of automobiles, the demand for truck trailers are also expected to increase significantly (from 16,000 in 2014–15 to 96,000 in 2025–26), in a scenario where the railways continue to play a very small role.

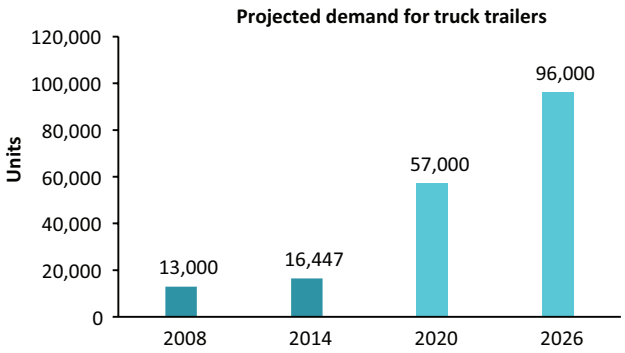

Figure 7: Estimated demand for truck trailers
Source: Maruti and ICRA

Export of passenger vehicles

While the domestic demand will continue to grow, given the availability of skilled labour and conducive market environment, the Indian auto industry is also expected to become a large exporter of cars in the near future, supplying to markets in Africa, eastern Europe and south-east Asia (E&Y, 2012). Even currently, of the total vehicles exported, passenger cars formed about 22% of the total automobile exports from India (2016-17), which grew at a CAGR of 6% between 2013–14 and 2017–18.

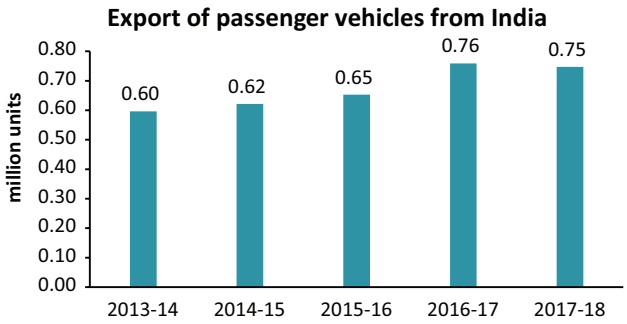

Figure 8: Export of passenger vehicles from India (units) (2013-14 to 2017-18)
Source: (SIAM, 2018)

Production Strategy

To meet this increasing market demand, the manufacturers are also evolving their production strategies at a fast pace. Lagging behind is the infrastructure requirement to aid the auto industry's expansion. Consequently, in the absence of well-established transport linkages, the industry is planning multi-plant strategies and clustering around established or future demand centres to have greater control of their supply chains and product deliveries (KPMG, 2012). Increasing urbanization would imply that a large number of such clusters which are already around the major urban centres would be expanded further and new, smaller, and more specialized delivery linked clusters would emerge closer to the point of final sale. Companies that plan to set up manufacturing base in India prefer location close to ports for easier shipment.

While these trends would continue to reduce the conventional demands for mobility for the industry, which currently transports the complete vehicle unit, it

[7] *http://auto.economictimes.indiatimes.com/news/industry/automotive-mission-plan-2016-26-unveiled-here-are-the-key-highlights/48772090*

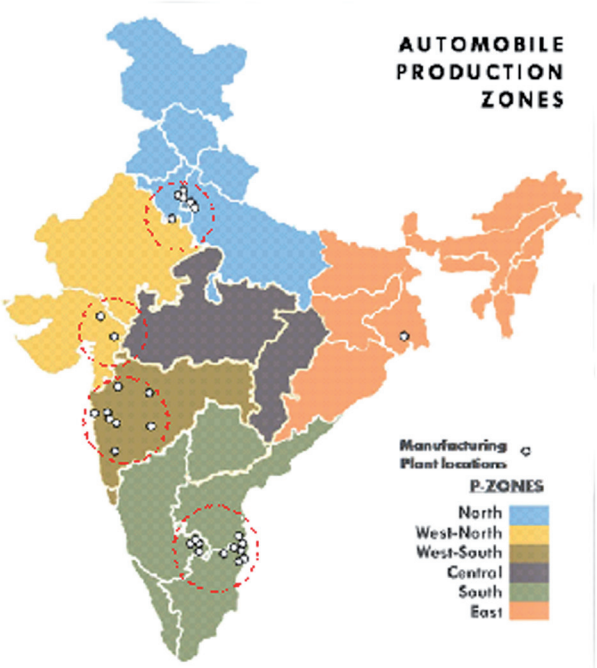

Figure 9: Passenger vehicle production clusters in India

would increase the demands for the movement of semi-finished vehicle units from mother-plants to finishing-plants. Such modular manufacturing processes would require much more streamlined and time-bound supply chain arrangements. Railways, roadways or waterways which would form the backbone of such impending future mobility needs of the automobile industry would therefore need to be reliable and cost-efficient to become a mode of choice. If the Railways aim to capture such kinds of traffic, it would require these to be futuristic while also addressing the current needs of the industry. In the current setting, almost all vehicle categories, while produced in a handful of locations in the country, are sold and operated across India or are exported through designated ports which too should move on rails.

Given the bulky nature and long distance of travel, all categories of vehicles such as two wheelers, three wheelers, four-wheelers, and commercial vehicles should ideally move on railways. The current analysis, however, limits itself to the study of passenger vehicles only. Currently beyond the scope of this exercise, it must however also be highlighted that given the size and growth of the two-wheeler volumes, the Railways should also focus to encourage the movement of two wheelers onto rail.

Production clusters

One of the characteristic features of automobile manufacturing establishments' all over the world is that these industries are more efficient while operating in clusters. Meeting the demand for such large volumes of vehicles, as required in India, would also require a large number of manufacturing clusters strewn across the country.

As shown in Figure 9, the zones of automobile production (specifically passenger cars) are concentrated in the northern, southern, and western states of India.

Car manufacturers

In the case of four-wheeler passenger vehicles, India is well recognized as a country that is a leader in the small cars segment (cars less than 1,500 cc) with a recent introduction of multi-utility vehicle (MUV) and sport-utility vehicle (SUV) segments. The two companies, Maruti Suzuki and Hyundai Motors have 60% of the market share in terms of production of passenger vehicles (PVs) in 2017–18. Ford India stands third, followed by Mahindra & Mahindra and Tata Motors. Others players, such as Honda, Volkswagen, General Motors, Toyota Kirloskar, and Nissan are also amongst the major car producers. Most of these companies have one or two production facilities spread across a handful of automobile clusters.

For instance, Maruti's main plant is located in the north Indian state of Haryana while the primary Hyundai plant is located in south of India near Chennai. Currently, General Motors manufacture vehicles from its two facilities—Halol in Gujarat and Talegaon in Maharashtra. Other companies, such as Mahindra & Mahindra and Tata Motors have multiple plants spread across a region, with each plant specializing in the production of particular types of vehicles or models. For instance, out of the six plants of Tata Motors, only its plant in Sanand (Gujarat) manufactures the model Tata Nano which is sold not only in India but all across the globe. These plant locations create a unique case for movement of automobiles from plants to consumption/sale centres by railways.

[8]*Passenger vehicles refer to and comprise of "Passenger Cars", "Utility Vehicles" and "Vans".*

In addition to these established plants, a large number of manufacturers such as Maruti Suzuki, General Motors, Isuzu Motors, Chrysler, Mercedes Benz, and BMW are planning to expand or create new production facilities in the near future. As per industry sources, Maruti is setting up a new facility at Sanand in Gujarat and will start production from there early next year. General Motors is also planning to expand their production facilities in Maharashtra, with an upcoming plant in Pune.

Company-wise share in total production of PVs

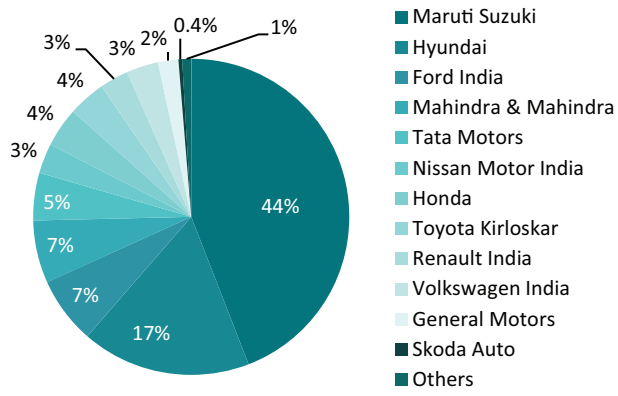

Figure 10: Company-wise share in total production of passenger vehicles (2017–18)
Source: SIAM -2018

Production Zone Classifications

These passenger vehicle manufacturing centres can be apportioned into various zones based on the state/location of these plants. While the plants in the northern cluster around the National Capital Region (NCR) could be classified as the Northern Zone, the plants in the western states of Maharashtra and Gujarat could be classified into a Western-South and Western-North Zone respectively. Figure 11 highlights the various zones wherein the different passenger vehicle plants in India have been classified for the purpose of analysis. Based on this, Maharashtra emerges as the state with the largest number of plants, followed by Tamil Nadu and Karnataka.[9]

Each of these states are further classified into five different zones (as shown in Figure 11) recognized as the zones of production for each of the different manufacturers.

Based on this zonal classification, the West–South zone, comprising of the states of Maharashtra and Goa have the largest number of plants (14), followed by the Southern (12) and Northern (6) zones. In terms of volumes of production, the North zone (marked in the blue circle) produces the largest number of vehicles (48.6%)

Table 1: Company-wise number of passenger vehicles produced during 2013–14 and 2017–18 (no. of passenger vehicles)

	2013–14	2017–18	CAGR (%)
Maruti Suzuki	11,53,596	17,68,488	11%
Hyundai	6,19,889	6,93,530	3%
Ford India	1,34,199	2,73,568	19%
Mahindra & Mahindra	2,60,253	2,57,268	0%
Tata Motors	2,03,782	1,95,182	-1%
Nissan Motors India	1,53,181	1,22,653	-5%
Honda	1,35,073	1,61,884	5%
Toyota Kirloskar	1,54,260	1,53,653	0%
Renault India	72,044	1,16,718	13%
Volkswagen India	88,906	1,31,557	10%
General Motors	78,428	83,742	2%
Skoda Auto	14,900	15,371	1%
Others	75,222	36,759	-16%

Source: SIAM 2017

[9] Location of some company plants could not be classified and has been noted as "N.A." However, most of these manufacturers have a very small share of the total production basket.

followed by the Southern (27.5%) and two Western zones combined (22%). The Southern and Western zones are also the industry centres for automotive parts. In addition, there are also certain automobile companies which do not have production facilities in India but import their vehicles. The Central and Eastern zones do not, however, have any significant passenger vehicle production facilities.

Going forward, the production capacity of PVs is expected to increase significantly in line with the projected three time increase in production of PVs under the Automotive Mission Plan 2016–2026. The emerging Sanand–Hansalpur–Vithalpur cluster is expected to gain a significant market share in terms of available production capacity in the country. This region will cater to the domestic consumption/sale market as well as export-oriented production.

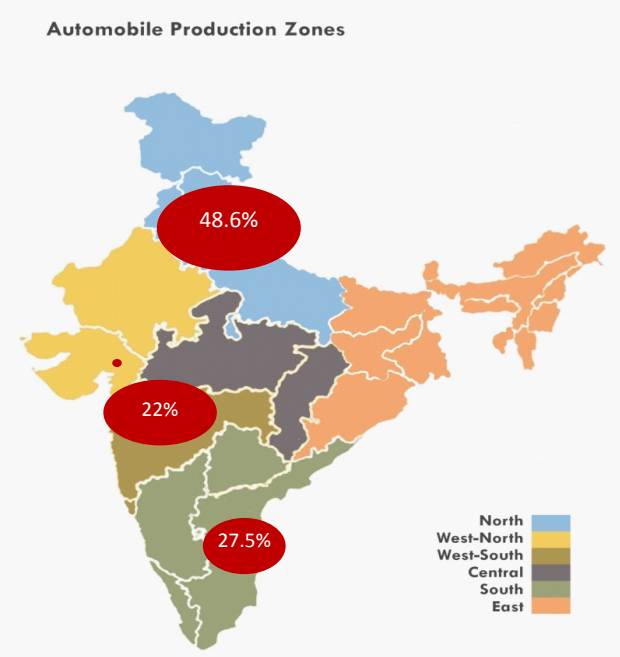

Figure 11: Passenger Vehicle Production Zones & Estimated Production Shares as of 2014–15
Source: Compiled from data from SIAM and Vahan Database

Sale of passenger vehicles

Echoing the production trends in the automobile industry, the overall sales of passenger vehicles (PVs) in the country have seen a decline and then an increase over the last few years, hovering around the 3 million vehicle mark annually. However, as has already been explained, this is also a category of vehicles which is expected to see a rapid growth in the near future due to its current low levels of penetration. Domestic sales of passenger vehicles are expected to grow to 9.4 to 13.4 million by 2026 at a CAGR of 12.39% between 2015 and 2026 (AMP 2016-26).

As in the case of vehicle production, the sales of passenger vehicles are also dominated by Maruti Suzuki, with 50% share in the overall vehicle sales, followed by Hyundai with around 16% share (SIAM Statistical Profile 2017-18). On the export front, Hyundai accounts for the highest share, closely followed by Ford India. Both these original equipment manufacturers (OEMs) have manufacturing units located close to the port locations (Hyundai in Chennai area and Ford in Chennai and Sanand area).

However, unlike in the case of production, which takes place in a few clusters as explained in the earlier section, the sales of passenger vehicles takes place pan-India

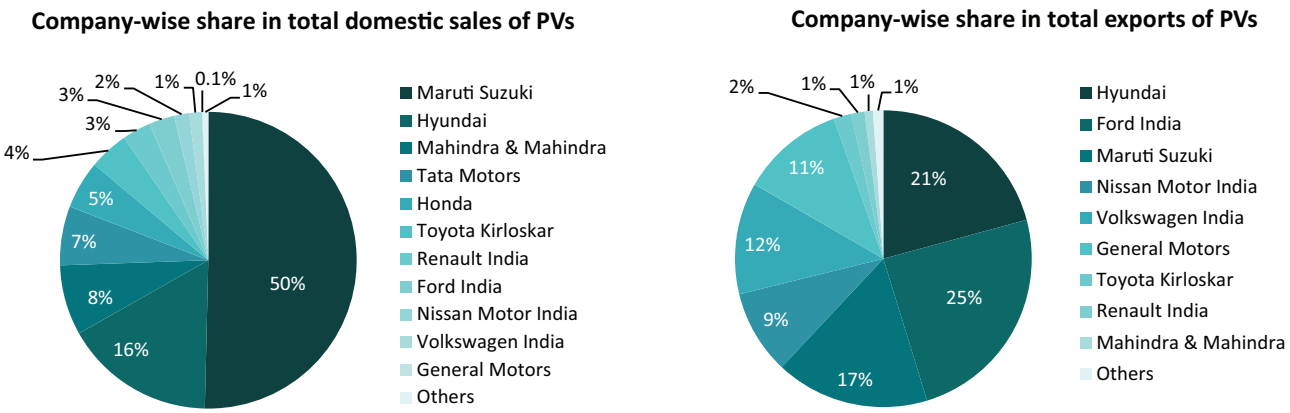

Figure 12: Company-wise share in total domestic sales and exports of passenger vehicles (2017–18)
Source: SIAM, 2018

Table 2: Company-wise number of passenger vehicles sold and exported (2017–18)

Manufacturer	Domestic Sales			Manufacturer	Exports		
	2013–14	2017–18	CAGR (%)		2013–14	2017–18	CAGR (%)
Maruti Suzuki	10,53,689	16,43,467	12%	Hyundai	2,33,260	1,53,942	-10%
Hyundai	3,80,253	5,36,241	9%	Ford India	48,106	1,81,148	39%
Mahindra & Mahindra	2,54,344	2,48,859	-1%	Maruti Suzuki	1,01,352	1,23,903	5%
Tata Motors	1,98,812	2,10,200	1%	Nissan Motor India	1,16,314	67,829	-13%
Honda	1,34,339	1,70,026	6%	Volkswagen India	33,330	90,382	28%
Toyota Kirloskar	1,28,811	1,40,645	2%	General Motors	4	83,140	1101%
Renault India	57,368	1,02,222	16%	Toyota Kirloskar	27,276	14,389	-15%
Ford India	84,469	90,061	2%	Renault India	16,800	10,707	-11%
Nissan Motor India	38,024	52,796	9%	Mahindra & Mahindra	7,605	6,770	-3%
Volkswagen India	52,528	45,329	-4%	Others	12,095	8,340	-9%
General Motors	80,890	2,500	-58%				
Others	39,967	20,004	-16%				

Source: SIAM, 2016-17

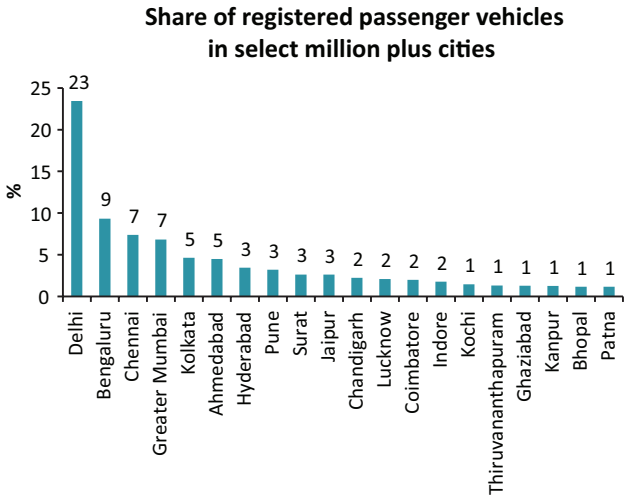

Figure 13: Passenger Vehicle Registrations in Million Plus Cities of India as of 2014-15
Source: MoRTH

with heavy concentration of sales in certain states and urban agglomerations[10]. Once sold, the vehicles are registered as per the state of their sale. Although quite similar in terms of trends, there is minor variation in the year on year total sales numbers and registration figures due to inventory and dealership stocks.

The vehicle registration trends show that passenger vehicles are spread across the different states with higher densities in certain states as compared to others. The top 15 states accounted for almost 90% of the total vehicle registrations in the country, with the top 6 states, Maharashtra, Delhi, Gujarat, Tamil Nadu, Karnataka, and Kerala accounting for about 56% of the total vehicle registrations in 2014–15.

Even within these states, it is the large urban agglomerations that have the highest density of

[10]*Data pertaining to sales of passenger vehicles by different manufacturers across different states is closely guarded and not available in the public domain due to competition considerations.*

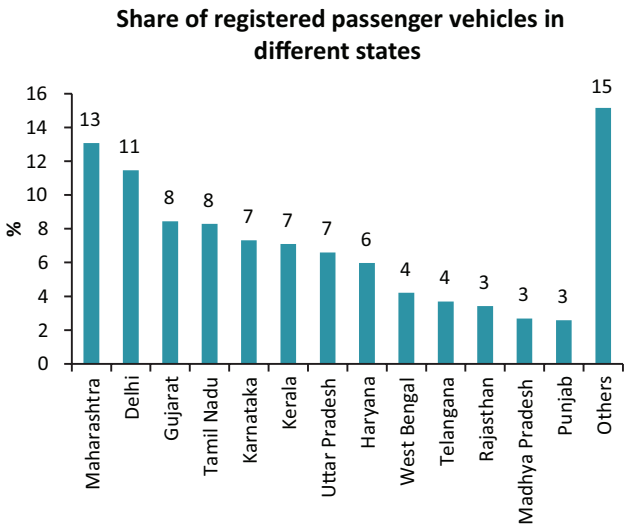

Figure 14: State-wise share of registered passenger vehicles
Source: MoRTH, 2014-15

passenger cars. As of 2016, the top 20 million plus cities in India accounted for over 84% of the total passenger vehicle registrations in the country. Delhi accounts for the largest number of passenger vehicle registrations in the country (2.73 M) followed by other large cities such as Bengaluru (1.09 M), Chennai (0.86 M), Mumbai (0.8 M), and Kolkata (0.54 M) (MoRTH, 2014-15). A large number of factors, such as levels of per capita incomes, demand for personalized mobility, availability of public transport and road infrastructure, etc., lead to such variations in the demand for passenger vehicles in cities.

With increasing rates of urbanization, the demand for passenger vehicles in these urban centres is going to grow across the existing and other upcoming urban agglomerations. The demand for transport links to connect automobile manufacturing hubs to these locations is consequently also going to rise. A mapping of manufacturing and consumption/sale zones for passenger vehicles along with the demand volumes would help identify the requirement for such links. Once identified, given the volumes and frequencies, the links could then be associated to a particular mode based on the efficiency of the mode's operation for meeting the demands.

Sale Zones

Like in the case of production zones as highlighted in the previous section, if a zonal apportionment study is conducted for passenger vehicles based on the state of their registration, a mapping of inter-zonal production zone to consumption/sale zone could be possible. Plotting the passenger vehicle registration data form the VAHAN Database of the Ministry of Road Transport and Highways (MoRTH), Government of India, gives an interesting insight with regard to the state-wise and zone-wise mapping of vehicle sale.

A zone-wise analysis of the regional sales in India in 2014–15 indicates that the North Zone dominated the registrations of passenger vehicles with about 37.7% of the total registrations reported in India, followed by 21.9% in South Zone, 14.1% in the West North, 11.6% in the West-South, and 8.1% in the East Zone. The Central Zone only had 6.2% of the total passenger vehicle registrations recorded in the VAHAN system. There has not been any significant change in these rankings over the last few years.

Mapping production and domestic sale zones

Mapping of the production and sale zones highlights an interesting pattern in the flows of passenger vehicle movement. The North Zone dominates the passenger vehicle market both in terms of production and sale.

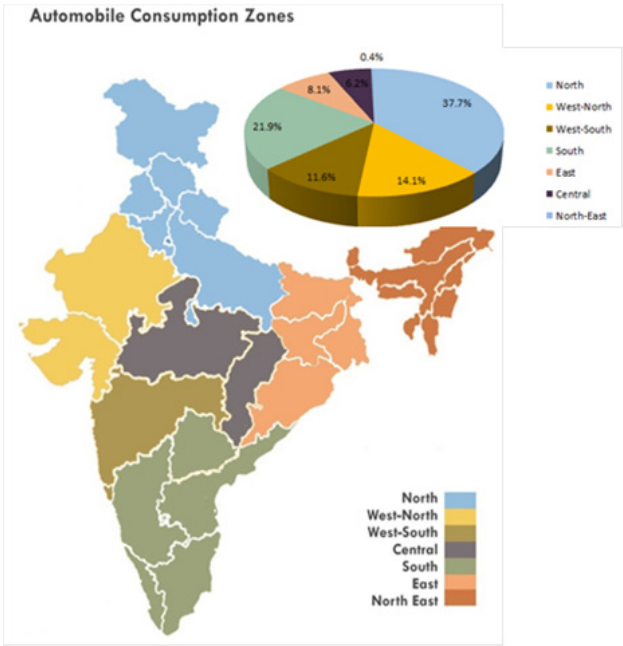

Figure 15: Passenger Vehicle Sale zones and estimated registration shares as of 2014–15
Source: (MoRTH, 2016)

Table 3: Mapping of movement from production to sale zones

Production Zones	Sale Zones									
	2014-15	Prod. share	Central	East	North	North East	South	West North	West South	Total
	North	49%	5%	2%	19%	0%	10%	7%	6%	49%
	West-North	3%	0%	0%	1%	0%	1%	0%	0%	3%
	West-South	19%	1%	2%	6%	0%	5%	2%	2%	19%
	South	27%	0%	2%	11%	0%	6%	4%	3%	27%
	East	0%	0%	0%	0%	0%	0%	0%	0%	0%
	N.A.	2%	0%	1%	0%	0%	0%	0%	0%	2%
Total										**100%**

Source: Analysis based on SIAM and Vahan Database data

As of 2014–15, the North Zone was the largest producer of passenger vehicles (~49%) accounting for sale of 38% of its produce and shipping out the remaining to the other zones. The largest recipient of vehicles from the North Zone was the South Zone, which received 20% of the North Zone's produce. The South Zone, also the second largest automobile producing zone, reported sale of only 22% of its produce and shipped out the remaining 78%. The highest recipient of the South Zone's produce was the North Zone (42%). In addition, both the North and South Zones sent about 15% of their production to the West–North Zone and about 12% each to the West–South Zone. The third-largest (19%) passenger vehicle production zone was the West–South Zone comprising of plants located in the state of Maharashtra. About 34% of the West–South Zone's production went to the North Zone, followed by 27% to the South Zone. Around 13% of its produce went to the West–North Zone and 11% was sold internally within the West–South Zone.

These movement patterns clearly outline the nature of transport demand for moving these vehicles from points of production to places of end consumption. Given that the largest volumes of passenger vehicles are also moving the longest distances, this clearly creates an opportunity for a bulk transport mode, such as the Railways, to ensure efficient movement.

Table 4: Top 10 Inter-Zone Movements in 2014–15 (P-Zone to C-Zone)

Production zone	Sale zone	2014–15	% of Total inter-zonal movement
South	North	325,248	16.1%
North	South	272,239	13.5%
North	West-North	197,071	9.8%
West-South	North	179,837	8.9%
North	West-South	165,124	8.2%
North	Central	144,645	7.2%
West-South	South	142,686	7.1%
South	West-North	119,884	5.9%
South	West-South	92,405	4.6%
West-South	West-North	69,974	3.5%

Source: CRIS

Average distances and volumes of movement

Analysis of the transport flows between various origin and destination zones for passenger vehicles in India throws up certain corridors for movement of these

vehicles. Given the large volumes of traffic generated in the North, nearly all the top corridors of movement are linked to the North or the South.

The top four corridors/circuits are as follows:

1. North–South–North
2. North–West South–North
3. North–West North–North
4. West South–South–West South

The distances between the major originating and destination cities for these transport circuits are nearly in excess of 1,000 km, making these movements ideal for efficient bulk transport modes such as the Railways. A closer inspection of the volumes of vehicles moved across the North–South–North circuit gives an indication of the kind of transportation required.

North–South–North Movement Circuit

If Gurgaon[12] is assumed to be the centroid of the automobile movement originating out of the Northern Zone and if Bengaluru and Chennai, are considered to be the destinations in the Southern Zone, it is easy to see the long distances that these vehicles have to traverse from the North Zone plants to these cities.

As of 2014–15, about 270,000 passenger vehicles were moved from the Northern Zone to the Southern Zone. One of the largest movements from the North to the South is from Gurugram to Bengaluru, a distance of 2,324 km. If 25% of the movement was to the city of Bengaluru, [13]then it would imply a movement of about ~68,000 vehicles across a distance of over 2,300 km per year to Bengaluru alone. If completely moved on road, such volumes would have required the use of over 11,500 truck trips with an average capacity of 6 cars per truck just to Bengaluru alone. On the contrary, if the same volumes were to be shipped by rail, it would take only about 210 BCACBM rake trips carrying on an average about 320 cars per trip.

The largest inter-zone movement (16.1%) happens from the South to the North Zone with most of the South Zone's traffic originating from the Chennai region, and most of the sale in the Northern Zone taking place in the NCR. This is again a long lead movement of about 2,212 km. If 50% of the traffic between these zone pairs as of 2014–15 originated in Chennai, and were to come to NCR, it would imply a requirement of about 27,000 trucks if moved completely on road or about 500 train trips if moved entirely on rail. This gives both the road and rail-based transport modes huge opportunities to provide mobility to the automobile industry.

Table 5: Distance between Major Auto Producing and Consuming Cities

	Gurgaon	Bengaluru	Chennai	Ahmedabad	Mumbai	Pune	Kolkata
Gurgaon	×	2,324	2,212	833	1,324	1,495	1,459
Bengaluru	2,324	×	357	1,589	1,193	927	1,943
Chennai	2,212	357	×	1,723	1,258	1,092	1,645
Ahmedabad	833	1,589	1,723	×	491	631	2,047
Mumbai	1,324	1,193	1,258	491	×	166	1,964
Pune	1,495	927	1,092	631	166	×	2,019
Kolkata	1,459	1,943	1,645	2,047	1,964	2,019	×

Source: (RBS, 2015)

[11]North Zone: Jammu& Kashmir, Himachal Pradesh, Haryana, Punjab, Uttar Pradesh, Uttarakhand, Delhi (UT), Chandigarh (UT)

West-North Zone: Rajasthan, Gujarat

West-South: Maharashtra, Goa, Dadra and Nagar Haveli (UT), Daman and Diu (UT)

Central: Madhya Pradesh, Chhattisgarh

South Zone: Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Kerala, Pondicherry (UT), Lakshadweep (UT)

East Zone: Andaman & Nicobar Islands, Bihar, Jharkhand, Odisha, West Bengal

North-East Zone: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim (Data from VAHAN for the NE zone appears to be incomplete, with Manipur and Nagaland not reporting passenger vehicle numbers)

[12] Most of the Northern Zone passenger vehicle production happens in Haryana, around Gurgaon.

[13]The exact volume of passenger vehicles moved to Bengaluru is currently not available.

If these movement flows starting from the North to the South and then back to the North were converted into a complete circuit, then empty return trips could also be avoided for both road and rail. While the volumes of traffic and the distances involved warrant the use of rail-based efficient transport modes for this kind of bulk movement, currently, the rail-based movement for passenger vehicles continues to be limited.

The following section scopes the current mobility that is being provided by the Railways in meeting this kind of demand.

Movement of Automobiles by Railways

The share of railways in automotive logistics is on the higher side in the USA due to the well-developed/ connected rail system. In China, however, the share of rail in automobile transportation is relatively on the lower side at 7% (Zeng Tao, et. al., 2013). The share of coastal shipping in automotive logistics on the other hand is on the higher side at 8% in 2013.[14] For countries such as South Korea and Japan, which are net exporters of automobile, road transportation continues to dominate as the manufacturing locations are close to the ports.

In the Indian context, the share of railways in automotive transportation is around 4% (overall) and less than 2% in terms of movement of passenger cars. As seen earlier, while the automobile production happens in a handful of clusters in North, West, and South of the country, the points of final sale of these vehicles are all across the length and breadth of the country. This requires extensive movement of automobiles from production hubs to the points of final sale. The vehicles produced are moved over long distances, of over 2,000 km, to meet the growing demands for cars. Going into the future, while the patterns of movement might change, the demand for such kind of mobility would only keep rising further. Majority of this kind of long lead movement should ideally happen in railways, the most sustainable mode of surface transport.

Recognizing this, the Railways have, over the last few years, taken up several initiatives to encourage the use of rail for automobile transport. However, there has only been a lukewarm impact of such policies and which have only marginally increased the movement of automobiles by rail. The benefit of the smaller share of railways in automobile transportation has almost entirely been captured by the much more fragmented, yet flexible and market responsive road freight transport sector. Road transport, unlike the Railways, has been much quicker in being able to adapt to the changing patterns of the automobile industry's needs and demands. As a result today, more than 95% of the automobile freight movement happens on road, on road trailers, and trucks (Automotive Logistics, 2015).

The Railways have been transporting various kinds of automobiles for several decades. Not only does the Indian Railways (IR) move passenger vehicles and other four-wheelers, but they also move two and three wheelers, tractors, and in some cases trucks using the roll-on-roll-off (Ro-Ro) facilities. The Indian Railways also moves automotive parts and other materials for the automobile industry.

In terms of rakes, in total, the Railways moved about 456 automobile rakes in 2014–15 which was up from 430 rakes moved in the previous year. The largest volume of these rakes was used to move passenger vehicles, followed by those used for moving tractors and then two and three-wheelers.

There is also a large variation in the types of rakes used for railway movement of automobiles in India. They range from passenger coaches converted to auto-wagons, to flat open wagons, to flexi deck-covered wagons. For the movement of passenger vehicles alone, there are about four different types of rakes used in Indian Railways. Table 6 gives an overview of the different types of wagons currently being used in India.

BCACBM wagons which are flexi deck auto wagon rakes with ramp are largest in number, carrying almost 73% of the total traffic. This is followed by old passenger wagons modified to carry cars (NMG) at 14% and the bi-level auto car carriers BCACM at 10%.

[14] *https://ac.els-cdn.com/S1877042813021745/1-s2.0-S1877042813021745-main.pdf?_tid=0bc3361c-ba2c-11e7-be2b-00000aacb360&acdnat=1509008580_21012db379ab5bad004b5bedd1f50eb4*

Table 6 : Types of rakes used and stock availability (as of July 2018)

Type	Ownership	Characteristics	Availability of stock (No. of rakes)	Standard composition (No. of wagons/ rake)	Carrying Capacity (No. of small cars/rake)
NMG	Railways	Old passenger wagons modified to carry cars	20	25	125
BCACM	Railways	Bi level Auto Car Carrier Modified with sliding roof and a ramp	2	45	270
BCACBM	Private	Flexi deck auto wagon rakes with ramp	17 (3 by Maruti and 14 by APL Vascor)	27	318
BCCNR	Railways	Closed wagons with center discharge, air braked	1	30	125

Source: Indian Railways

Table 7: Number of rakes loaded and number of cars transported between 2012–13 and 2016–17

Type of wagon	2012–13	2013–14	2014–15	2015–16	2016–17
Number of rakes loaded					
NMG	184	177	151	142	149
BCACBM	0	2	73	208	296
BCACM	63	44	51	49	49
BCCNR*	17	8	3	14	32
Grand Total	264	231	278	413	526
Number of cars transported					
NMG	21,896	21,063	17,969	16,898	17,731
BCACBM	-	636	23,214	66,144	94,128
BCACM	17,010	11,880	13,770	13,230	13,230
BCCNR*	2,125	1,000	375	1,750	4,000
Grand Total	**41,031**	**34,579**	**55,328**	**98,022**	**1,29,089**

**Mostly used for tractor movement; Source: Railway Board*

When compared against the demand for automobile wagons across different circuits as shown in the previous section, the total number of rakes used in 2016–17 clearly highlights the very limited share of movement currently taking place on the Railways. The South to North movement alone would have required in the range of 500 rake-load (of BCACBM) movements to meet the demands for 2015–16 as compared to a total 526 rake load movement in 2016-17. When converted into number of vehicles transported on these rakes, it is estimated that only about 129,000 passenger vehicles would have been transported on Railways (compared to the 3.2 million vehicles produced) in 2016–17. This is an abysmally low figure and indicates the large untapped potential for moving automobile traffic through railways.

When this railway traffic flow data is further analysed, it is seen that most of the traffic as of now is taking place between a handful of origin-destination pairs of stations. Most of these movement flows are aligned with

the origin-destination zones for aggregate passenger vehicle movement as identified in the previous section. Corresponding with the total movement flow requirement as identified in the previous section, the largest volumes of automobile traffic in Railways take place between the North and South Zones. The traffic is mostly moving between the Northern cluster around the NCR and the Southern Cluster around Chennai. Other large movement streams seem to be between the Northern Cluster and the western port in Mundra, and between the Southern Cluster to regions in North East of India.

The top five origin destination pairs of stations generated about 50% of the rake movements in 2015–16. The maximum movements seem to be originating from Gurugram in Haryana, with a reported 83 rakes originating from this station alone. This traffic mostly goes to Karnataka, Gujarat, Telangana, Maharashtra, and West Bengal.

High movement OD pairs on Railways

The top 5 OD pairs comprise almost 50% of the total movement (413 rakes) between stations, as per 2015–16 statistics.

The maximum rakes carrying automobiles hail from the Gurugram station in Haryana, indicating a high outward movement of passenger vehicles for sale in the south. As per the 2015–16 statistics, 83 rake loads were moved out of the Gurugram station which accounts for nearly 20% of the total number of rake loads moved in that year carrying passenger vehicles. Figure 17 provides information regarding the important destinations and the total number of rakes moved from Gurugram to each of these destinations.

Other than Gurugram in Haryana, Melpakkam, Tiruvalllur, and Kathuwas were the other major passenger vehicle loading locations as of 2015–16. Given that the distances moved from these locations were all long lead movements, they also generated a significant amount of the traffic in terms of net-tonne km moved in the same year.

While automobiles have the typical characteristics required for movement by railways, such as long leads and high volumes, the movement of cars by rail requires high precision logistics which are currently limited in India. Realizing that the Indian Railways and their fully-owned subsidiary, Container Corporation of India (CONCOR), have few facilities to handle such

Table 8 : Top 5 OD pairs in terms of no. of rakes moved (2014–16)

Originating station name (State)	Destination station name (State)	Distance (Km)	No. of Rakes 2014–15	No. of Rakes 2015–16	Type of rakes
Gurugram (Haryana)	Nidvanda (Karnataka)	2,355	62	50	BCACBM, NMG, BCACM
Gurugram (Haryana)	Mundra Port (Gujarat)	1,066	40	33	BCACM, BCACBM
Tiruvallur (Tamil Nadu)	Chang Sari (Assam)	2,628.28	51	29	NMG, BCCNR
M/S Greenfield PFT of CONCOR Neemrana Served By Kathuwas (Rajasthan)	Melpakkam (Tamil Nadu)	2,289	20	24	BCACBM
Melpakkam (Tamil Nadu)	M/S Greenfield Pft Of Concor Neemrana Served By Kathuwas (Rajasthan)	2,289.27	22	22	BCACBM

Source: Railway Data

Figure 16: Desire line diagram for top 5 O-D pairs for year (2015–16)
Source: TERI Analysis 2016

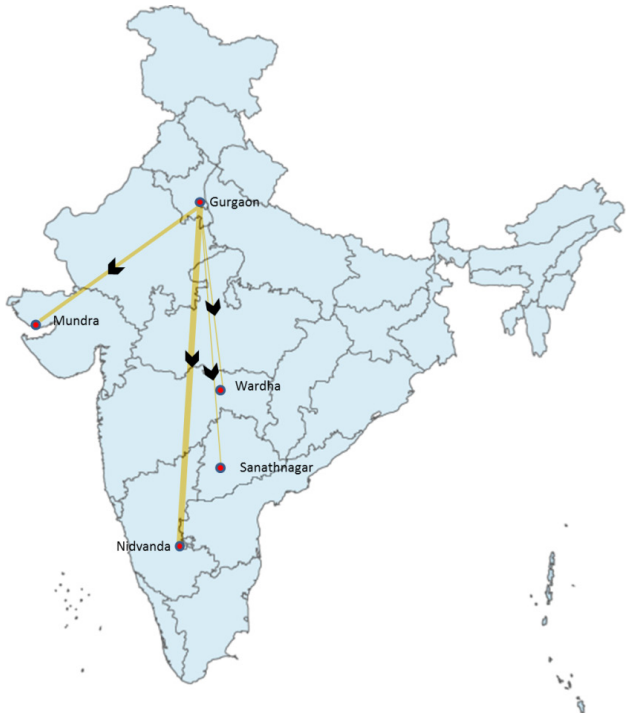

Figure 17: Total Movement from Gurgaon station and Important Destinations (2015-16)

Table 9 : Total Movement from Gurgaon station and important destinations (2014–16)

Originating station (State)	Destination state name (State)	Distance (Kms)	No. of rakes 2014-2015	No. of rakes 2015-2016	Type of rakes
Gurgaon (Haryana)	Mundra port (Gujarat)	1,066	40	33	BCACM, BCACBM
	Nidvanda (Karnataka)	2,355	62	50	BCACBM, NMG, BCACM
	Sanathnagar new goods complex (Telangana)	1,706	11	4	NMG
	Wardha Jn. (Maharashtra)	1,200	8	3	NMG, BCACBM

Source: Railway Data

traffic the Ministry of Railways (MoR), Government of India, to incentivize the use railways by the automobile manufacturing companies, have also floated the idea of Automobile Freight Train Operators (AFTO). In this manner, the MoR have opened the market for railway logistics for automobiles to private participants in 2013, hoping that private service providers would be able to deliver the high service qualities required by this sector. However, only two private players have come forward till date to acquire the AFTO licenses. As a result of the lack of facilities and limited supply side efforts to garner this traffic, the volume of automobile traffic moved on rail has remained dismally low.

Initiatives by the Indian Railways to Encourage Auto Movement

Ever since the mass production of passenger vehicles in India was started in 1982, there was a constant and increasing need for transportation of automobiles and

passenger vehicles in India. Railways responded to this need with NMG wagons. These coaches were old passenger coaches which were no longer in service converted into wagons for carrying automobiles. Special rates were also devised for transportation of automobiles using these NMG wagons.

With the economic liberalization of 1991, as more automobile companies started production in different parts of the country, the need for mobility of automobiles also continued to increase exponentially.

The NMG design was however recognized as not very efficient since it carried only about 125 small passenger vehicles and had design issues with regards to loading and unloading. Given such limitations, the Indian Railways realized that the growing industry demands could not be met with the existing designs. Due to capacity and financial constraints in operating NMGs, a need was realised to induct special purpose wagons for transportation of automobiles by rail in India. This resulted in the Railways developing the BCACM wagons for transporting automobiles in the year 2008. However, due to the size constraints, these wagons were only suited to carry small cars (mainly from Maruti). While two double decker BCACM rakes developed from flats were inducted in the IR network, the production for these wagons was halted, given their extremely heavy weights and size limitations.

This was followed by the Railways introducing the AFTO policy in 2010. On similar lines as the Container Train Operator (CTO) and Special Freight Train Operator (SFTO) schemes, the AFTO policy invited private parties to invest in special purpose wagons for carrying automobiles and also operate their own wagons with IR locomotive power. The first version of the AFTO policy received a very poor response from the industry. To address this issue, the Railways revised the policy in 2013. The revised AFTO policy is described in detail in the subsequent section.

Post the revision in the AFTO policy, two companies from the industry responded by applying for AFTO licenses and introducing new and upgraded BCACBM wagons for movement of automobiles. These wagons were developed by the Indian Railways and had a 20% more capacity (318 cars) as compared to the previous double decker BCACM designs. The BCACBM wagons are picking up additional traffic, but the total numbers of such rakes still remain limited to meet the ever increasing demands for auto transportation.

In parallel to the AFTO policy in 2010, the Railways also launched 'Development of Automobile and Ancillary Hub' policy to facilitate end to end logistics for automobiles. However, this policy has not made any significant impact towards encouraging private participation in the end to end vehicle logistics process. Other schemes, such as the Private Freight Terminal Scheme (2010) and the Participative Models in Rail connectivity and Capacity Augmentation Projects Scheme, could also be seen by the industry as efforts by the Railways in encouraging more movement on rail.

Other than these efforts, the Railways have also recently introduced an initiative called SAMVAD to encourage a more open and informal dialogue with the automobile industry.

Automobile Freight Train Operator (AFTO) Policy

Evolution of the policy

With a special focus on increasing the share of railways in transportation of automobiles, one of the fastest growing industries in the country, the Ministry of Railways (MoR) introduced a new scheme known as the Automobile Freight Train Operator (AFTO) in 2010. This initial policy announced by MoR invited private entities, including logistics service providers and road transporters, to induct and operate special purpose wagons to run on the IR network and offered rebate on freight rates in return. At the time of the announcement of this policy, automobiles were being transported using traditional wagons (such as NMG, BCCNR, BRN, etc.) run by the Indian Railways. Some of these wagons, especially NMG wagons which are nothing but converted passenger coaches, are one of the main wagons used to transport automobiles in the country. However, these traditional wagon designs are not quite efficient designs for carrying automobiles. With growing demands and industry needs, a need was therefore felt to bring in 'auto carriers with suitable design and higher throughput' to promote bulk

transportation of automobiles from production clusters to sale/consumption centres.

As per the AFTO policy, the Railways offered 15% rebate on freight rates for every rake loaded. The rebate was offered on the base freight rate as applicable at the time of booking and would be granted for a period of 20 years or till the recovery of the cost, whichever is earlier. In case of high capacity wagons inducted by the operator, an additional freight rebate of 2% (charged at the applicable base freight rate) was granted for every 10% increase in throughput per train. The scheme, however, failed to derive a suitable response from the private investors, especially due to ambiguity in the policy clauses. For instance, it was not clear if the 'existing freight rates' on which rebate was offered, referred to the rates applicable for NMG rakes or BCACM rakes or others. The private investors therefore perceived the policy as an unpredictable and unfeasible proposition.

The Railways, failing to attract private investors, reviewed and launched the revised policy in 2013. As per the new AFTO scheme, private entities could induct special wagons to run on the IR network and avail freight rebates in return which were now built into the freight rates offered by the Railways, that is, the operators would have to pay discounted haulage charges to IR for using its infrastructure. IR reserved the right to change these charges in the future. As per the policy, the operators could carry automobile traffic which includes finished passenger cars, two/three wheeler automobile units, mini trucks, tractors, chassis, shells of cars or automobiles moved in completely knocked down (CKD) condition.

The policy also allows operators to run trains over the IR network, provided the Railway terminal is open for automobile booking and the private terminal is also willing to handle automobile traffic. No NOC is, therefore, required for the routes from Zonal Railways. However, as per industry sources, some Railways/Divisions insist on route notification. Therefore, to start a new service on a sector, the operators have to seek permission from the Railway Board.

Issues with the AFTO Policy

Three key issues were pointed out with the AFTO policy that the operators or the parties who were interested to get into the sector had pointed out. These included (1) As per the AFTO policy, the operators shall pay only the haulage charges as notified by the MoR from time to time. Separate rates were applicable for running loaded and empty rakes and the freight is charged depending on the composition of train load; (2) The operators after a fully-loaded run with automobiles were permitted to back load the wagons with automobile verticals (which includes auto ancillaries and auto spare parts) at per wagon load rates for BCACBM. However, the automobile industry reports that movement of auto spare parts in the country is largely in the same direction as automobiles. Therefore, automobiles and ancillaries should be allowed to move together and should not be restricted to a move after a fully loaded rake; (3) The AFTO policy also specified that the private operator who is interested in running trains should make a minimum investment for 3 rakes.

All these issues have now been resolved through IR efforts insofar as IR undertook a number of steps in the last one year to increase the loading of automobiles through railways. These are enumerated as follows:

- In October 2017, IR made revisions to the AFTO policy related to registration fee and minimum rake requirement. Registration fee has been reduced from Rs 5 crore to Rs 3 crore; and private players are now required to procure only 1 rake instead of 3 to operate as an AFTO operator.
- In April 2018, IR also allowed handling of automobile from all container terminals and allowed loading automobile and auto spares in privately-owned wagons in different directions to reduce empty runs.
- Around 28 routes have been notified for operation of BCACBM rakes.

Suggestions related to AFTO

- There should not be any restrictions on the kind of automobile or automobile parts moved using Indian Railways under the policy.
- The clause related to registration fee should be done away with. Since the private players are investing in the rolling stock, the need to pay registration fee should be waived off .
- Further, any terminal which has facilities for handling automobile traffic should be allowed on a cost-

plus basis. In such a case, the operator should be allowed to add infrastructure required for handling automobiles.

Policy impact and Response from the industry

In response to the AFTO 2013 policy, only two private parties have come forward and registered themselves under the scheme till date. These include Maruti Suzuki and APL Logistics Vascor Automotive Pvt Ltd. The two parties have inducted a total of 11 rakes so far; with Maruti owning 3 rakes and 8 rakes belonging to APL Logistics. Maruti Suzuki started operations for 3 rakes in March 2014. Out of these, 2 rakes are in operation from Gurugram (NR) to Nidvanda (SWR). Industry sources suggest that as of 2016, Maruti is also expected to induct more rakes and initiate services from Gurugram to Wardha (CR) and Gurugram to Chitpur (ER).

In September 2014, APL Logistics started operations of its 3 rakes wherein 2 rakes are in operation between Melpakkam (SR) to Kathuwas (NWR); APL added 2 more rakes which are being operated between Melpakkam (SR) and Chang Sari (ER). As per APL, it plans to run at least 15 rakes by 2018–19.

With the liberalization of the AFTO policy, more private players are expected to start operations for automobile movement through Indian Railways. As of July 2018, three more private operators were approved by IR to operate under the AFTO Policy and are expected to start operation by end 2018. The three new operators are IVC Logistics (approved to operate 6 rakes), Joshi Kanoike Transport and Infrastructure Pvt. Ltd (3 rakes), and Transport Corporation of India (6 rakes).

Development of Automobile and Ancillary Hub, 2010

Following the AFTO policy in 2010, the Railways also launched a policy for development of automobile and ancillary hub to facilitate end to end logistics. The idea was to provide opportunities to automobile manufacturers to ensure bulk transportation by rail and secondary distribution to consuming/sale centres in the immediate catchment areas from such hubs. This arrangement would also allow the manufacturers to conduct aggregation of automobiles at these hubs, so as to offer full rake load to railways that would further lead to improved rail coefficient of automobiles.

Under the policy, the Railways would provide surplus railway land for the development of hub on an extendable lease agreement initially for a period of 7 years (extendable every year). The facility shall be developed around the area where rail terminal exists and facilities for loading/unloading operations would be provided by the railways. The hub would be a common user facility for general use of the automobile industry, without any exclusive right to the licensee.

Walajabad Auto Hub on Southern Railway: [16] The Indian Railways inaugurated a rail auto hub at Walajabad near Chennai, Tamil Nadu, in March 2016. The facility is located is one of the major automobile producing hubs where players, such as Hyundai, Ford, Nissan-Renault, BMW, and Daimler are based. It is India's first common user auto hub facility provided by the Indian Railways. The salient features of the rail auto hub at Walajabad include:

Total area: 5,030 sq. m

Total capacity: 300 four wheelers

Road connectivity: 4/6 lanes between production and sale centres

However, the response from the industry has been lukewarm in terms of loading automobiles from the Walajabad auto hub. According to the Indian Railways, very few rakes were loaded from the Walajabad hub and of these all were NMG rakes. The lack of interest from the rake operators to load BCACBM rakes from the Walajabad hub and instead preferring Melpakkam and even Tiruvallur as the originating stations indicates the lack of coordination between the Railways and the private operators in developing automobile hubs.

The key reasons for the low utilization of available facility include lack of space around the unloading point and the lack of electrified rail track connecting from Walajabad to the mainline.

According to data made available by the Indian Railways, the number of indents raised for rakes from Walajabad

[16] *http://www.sr.indianrailways.gov.in/cris//uploads/files/1481280352410-commercial-auto-hub.pdf*

Table 10: Number of rakes loaded from Walajabad auto hub (2016–17)

Terminal/hub	NMG	BCACBM
Walajabad	9	-
Melpakkam		121
Tiruvallur	57	-

Source: Railway Board

auto hub during the month of December 2017 was only 4 and that too for NMG rakes while loading was only conducted for 2 NMG rakes.

Recommendations related to Automobile and Ancillary Hub policy

- Lease agreement should be valid for longer period of time, instead of just 7 years. This will give long-term plan perspective to the private operators.
- Development of auto hubs by railways should be done in consultation with the users/private operators.
- Single user should be permitted to develop railway land with clause of co-use on payment of the agreed fee.
- Transit time should be reduced between plant and port to make it competitive to the road transport
- Long term tariff contract could be signed between Indian Railways and manufacturers/3PL operators to ensure certainty in policy and tariff rates.

Private Freight Terminal (PFT), 2010

To enable rapid development of a network of freight handling terminals with private investments, MoR introduced the PFT scheme in 2010. The main intent was to provide efficient and cost-effective logistics services with warehousing solution to end users.

PFTs (green or brownfield) were to be set up only on private land. However, for rail connectivity, railway land could be offered as per extant rule under the policy. PFTs were also permitted to handle all kinds of parcel traffic and containers. All types of wagons and parcel vans, including privately-owned wagons, are permitted to be dealt at PFTs, unless otherwise notified by the MoR.

Under the policy, PFTs could also provide various logistics-related services, such as warehousing facilities, value added services like palletization, labelling, processing of goods with adequate inter-modal facility and convenience centre, etc. As discussed earlier, changes are required in the usage of railway terminals/sidings for allowing operators to augment and use such facilities.

PFT licences for operating PFTs are offered by the MoR with an application fee of Rs 10 lakh (earlier Rs 1 cr) and security deposit of an equal amount to ensure timely commissioning of the PFT. PFTs are also permitted to develop and provide value added logistics related services and charge for the same from customers. These licenses are offered for the period of 20 years, with an extension possibility of another 10 years. Additional extension for this license would be permitted on the basis of extant policy at the time of such extension.

Issues and Challenges Limiting Movement on Railways

While the Railways have initiated many policies with the aim to increase the passenger vehicle movement on rail, it has resulted in limited conversion in terms of traffic share. A large number of factors have been responsible for making the Railways relatively unviable compared to other modes, primarily road. These issues could be broadly classified into issues related to policies and their interpretations, freight rates, both fixed and variable infrastructure, and operations.

Freight-related issues

Although the automobile industry generates a high value product (passenger vehicles), the margins of their operations are extremely thin. As a result, the industry is extremely sensitive to transit costs which often determine the final margin of their profits.

Rail freight often uncompetitive with road rates

Currently the dominant mode of transport for automobiles, the road-based car carriers, not only

Box 1: Participative Models in Rail Connectivity and Capacity Augmentation Projects

This policy is another effort on part of the MoR to accelerate the development of fixed rail infrastructure through promoting private investments in the sector. The policy proposes multiple models of participative investments for its existing shelf of projects and also new projects.

1. Non-Government Railway Model: Applicable to first and last mile connectivity projects at either end of the rail transportation chain providing connectivity to ports, large mines, logistics parks or other similar industries/ cluster of industries which are handling goods traffic for multiple consignors or consignees
2. JV Model for operationally necessary/ bankable sanctioned/to be sanctioned Railway projects: Applicable for bankable new line and Gauge Conversion projects, either sanctioned or proposed to be sanctioned, having clearly identifiable stakeholders either as user of the line or utilities, such as ports, mines, exporters, plants, and the state governments.
3. Railway Projects on BOT awarded through Competitive Bidding: Applicable to the sanctioned Railway projects where it is not possible to identify a stakeholder or strategic investor who can take a lead in making investment in the project line. The projects under this model will generally be long rail corridors carrying traffic generated from various streams. These will be sandwiched sanctioned new line and gauge conversion projects or dedicated freight corridors. In the absence of strategic investor, selection of investors will be done through competitive bidding process. The concessionaire so selected will design, build, finance, maintain, and transfer the railway line at the end of concession period.
4. Capacity Augmentation (Doubling/Third line/Fourth line, etc.) with funding provided by customers: This model addresses doubling/ multiple line projects where some customers are beneficiaries of the capacity addition and may be interested in funding the project for expeditious completion/commissioning.
5. Capacity Augmentation (Doubling/Third-line/Fourth line, etc.): This model is applicable to sanctioned doubling, third line and fourth line projects where it may not be possible to find funding from any specific user.
6. State government cost sharing: This model also allows for a cost sharing arrangement for infrastructure development by Railways with state governments across India. State governments, depending on the importance of a state level infrastructure, could invest in the development of the infrastructure under this scheme, which the Railways could eventually develop and operate.

provide end to end transport for automobiles from manufacturing plants to dealership locations, but they also provide these services at extremely competitive prices. This is a result of the trucking industry being highly fragmented, with a large number of players in a near perfectly competitive market. Since the trucking industry is also not guided by any particular regulations for pricing, they are also highly flexible in terms of the pricing they offer to the automobile industry; this is a huge advantage of road transport over rail. The trucking industry can therefore peg their pricing with the prices of diesel and transfer any savings arising out of declining diesel prices directly to the industry. The Railways, which is more rigid in their pricing methodology is comparatively inflexible.

As per the Central Motor Vehicle Regulations (CMVR), car carriers are stipulated to have a maximum length of 18 m, with a height limit of 4.75 m. Most of the car carriers were fabricated to be around 22 m with different drawback facilities to increase their carrying capacities, illegally. The minimum specifications that the car carriers follow is of 18.75 m allowing them to carry about 8–9 small cars or 6 sedans (Chawla, 2016). Even with penalties in the range of 15% of operating costs, the non-standard designs of the car carriers and the lack of adequate enforcement of the CMVR make the road-based transport more competitive than rail in terms of costing of movement per car. However, majority of the car carriers have now reduced the length of their fleet to adhere to the recent rule (i.e. maximum length of 18.75 m).

Transportation of passenger vehicles by rail: In the case of transportation of automobiles through railways, a number of components play a significant role in deciding the total cost of transportation of the automobile freight. Following are different components of the cost of transportation through railways:

- Direct cost of transportation per car: This cost also includes the cost incurred on the account of insurance, damage, and delay deliveries which amount to 0.5% of direct cost.
- First mile transportation charges from factory to terminal
- Terminal access charges at the origin station
- Terminal access charges at the destination station
- Last mile transportation charges from terminal to the dealer
- Terminal handling charges at origin and destination stations
- Depreciation per car
- Interest per car

An analysis of the costing for Chennai–Delhi section indicates that besides the direct cost of transportation of cars, cost incurred on the account of last mile transport from terminal to dealer is highest (about 11%), followed by cost component of first mile transportation charges from factory to terminal (about 10%).

Transportation of passenger vehicles by road: As mentioned earlier, the cost of transportation of automobile freight resonates with the diesel prices. For example, in April 2015, the prices of diesel declined by 5% which resulted in a 2.3% reduction in the overall cost of transportation. Similarly in August 2015, a 2.5% fall in fuel prices resulted in 1% reduction in the overall cost. However, in April 2016, a 2% increase in diesel prices resulted in a 2.4% increase in the cost of transportation.

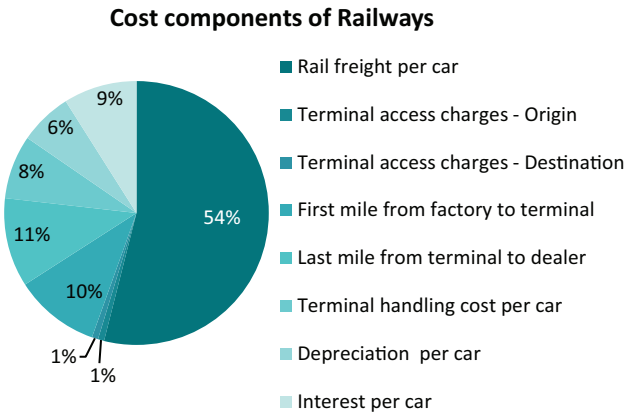

Figure 18: Cost components of rail transportation of passenger cars
Source: Industry sources

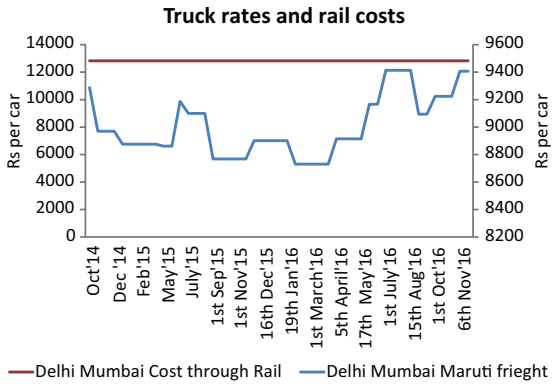

Figure 19: Trend in truck rates and rail costs for Chennai-Delhi route
Source: Industry sources

Comparison – Railways vs. Road

Table 11 shows a comparison between the rates of transportation of car via road and via rail. The rates for railways has been taken from freight marketing circular No. 2010/TC(FM)/25/4pt-1 , dated 21-05-2013. It should be noted that till date, the rates for BCACBM have not changed since 2013.

Figures 21 and 22 show the transportation of automobile freight through railways and roadways. The figures on the arrows show the percentage of total cost spent for the

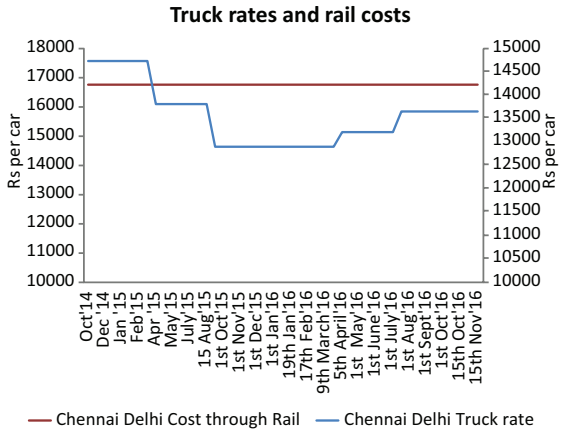

Figure 20: Trend in truck rates and rail costs for Mumbai-Delhi route
Source: Industry sources

particular activity. As can be seen in the figures, in case of railways, about 21% of the total cost is used for first and last mile connectivity from factory to terminal and again from terminal to the dealer. Also, it should be noted that the cost advantages on account of reducing fuel prices does not affect the cost of the transport though rail. It is because of these reasons that road transport becomes more competitive in terms of pricing.

Price elasticity of demand of customers not considered

As mentioned earlier, the automobile industry is extremely price sensitive and operates on extremely thin margins of profitability. Sometimes these margins of profitability are as low as Rs 1,000 to Rs 2,000. The Railways while planning their pricing strategies for automobile transport needs to therefore maintain cognizance of the price elasticity of the market for different kinds of vehicles originating from various locations. The Railways should also transfer some of the benefits and savings arising out of fuel price reductions or efficiencies in operations, etc., to the industry to attract them onto rail.

The Railways need to, therefore, restructure the pricing methodology currently being used for setting rates for automobile transport. IR should ideally customize freight rates based on light or heavy cargo and determine the pricing based on fuel prices and prices of competition/ road transport. In case of automobile industry, the important criteria while determining the pricing should be the type or quality of vehicle being transported, along with the locations from where such transport is taking place.

Table11: Cost of transporting a passenger car by rail vis-à-vis road (Factory to Dealer)

Stretch name	Rate per car - ROAD (Rs)	Rate per car - RAIL (Rs)	Percentage Difference (%)
Chennai–Delhi (2251–2300 km slab)	15,848	16,761	5.8
Delhi–Mumbai (1301–1350 km slab)	10,000	12,824	28.2
Chennai–Sanand (1751–1800 km slab)	14,093	14,963	6.2

Note: The cost of transporting cars by rail includes costs related last mile and first mile movement, terminal charges, etc.
Source: Industry sources

Infrastructure (Rolling stock and terminals)*

In terms of infrastructure, the key features of automobile transportation on rail are terminal space requirements for loading and unloading, technology and logistics planning for handling and movement, and dedicated rolling stock with high rates of utilization.

Rolling stock

The current rolling stocks available in India for

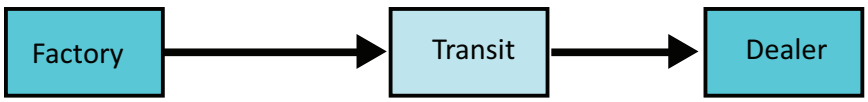

Figure 21: Flow diagrams of different activities for the transportation of automobiles through road

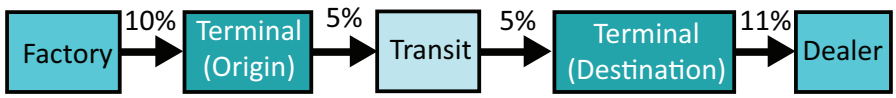

Figure 22: Flow diagrams of different activities for the transportation of automobiles through rail

automobile transport are suboptimal for movement of either passenger vehicles or two-wheelers. Even the ones which are available are few in number and inadequate compared to the high demand. The NMG rakes, which are the most abundant types of rakes currently available, can carry only 125 small vehicles. BCACBM rakes are only operated by the two private operators—Maruti and APL Vascor.

- The maximum moving dimensions of the high-capacity auto rakes available are also not optimized to increase efficiency in loading.
- The other challenge in moving dimensions is the OHE lines, the height of wagons restrict in adding a third level in each wagon.

As per industry sources, the more recently inducted BCACBM wagons are not very robust and have already started showing signs of wear. Given that the private wagon design market is very nascent, even if improved and more optimal designs exist with the industry, the turnaround time for design approvals from RDSO takes an extremely long time and involves a complex back and forth application process. The industry is therefore weary of submitting improved designs for approval from the Railways given the large capital costs incurred in the approval process and final procurements.

Terminal facilities

The handling of automobiles during its transportation requires space in terms of terminal facilities and technology in terms of logistic software for planning and mechanization for loading and unloading. The current terminal facilities for handing automobiles are extremely limited, with just a handful of facilities across the country. Also, the facility of loading and unloading from both the ends is limited to very few terminals (namely CMLK).

Operations

Other than issues with policy, freight rates, and infrastructure availability, there are also some limitations in terms of operations that restrict the auto industry from moving on rail.

Time-sensitive industry

The automobile industry is extremely time sensitive in terms of delivery times. Given that the distances involved are often over 1,500 km from plants to dealerships and road transport becoming increasingly uncertain due to congestion, the Indian Railways has a huge potential for providing the automobile industry time-bound travel options for auto transport. The Indian Railways started with the time guaranteed service for select routes. However, the performance, so far, has not been good.

Following are the two routes on which time table automobile freight trains are running:

1. Gurgaon (GGN) – Nidvanda (NDV)
2. Melpakkam (MLPM) – Kathuwas (CMLK)

1. GGN–NDV and NDV-GGN performance analysis:

GGN-NDV: It was seen that the average running time increased from 83 hrs 40 min in July 2016 to 111 hrs in August 2017. The highest average running time was seen in July 2017 at 121 hours. The targeted transit time for the operation was 70 hours.

NDV-GGN: It was seen that the average running time increased from low of 71 hrs in September 2016 to the highest in 110 hrs in February 2017. The targeted transit time for the operation was 70 hours.

2. MLPM-CMLK and CMLK-MLPM performance analysis:

CMLK-MLPM: It was seen that the average running time increased from 73 hrs 10 min in July 2016 to the highest transit time of 133 hrs 20 min in March 2017. The targeted transit time for the operation was 66 hours.

MLPM-CMLK: It was seen that the average running time increased from a low of 66 hrs 20 min in August 2016 to a maximum average transit time of 107 hrs and 20 min during December 2016. The targeted transit time for the operation was 67.50 hours.

Transit time comparison between Rail and Road

In terms of transit time, the Indian Railways does not hold any significant advantage over road transport. TERI analysed two OD pairs for transit time comparison—Chennai–Delhi and Delhi–Mumbai (refer Table 12). It is

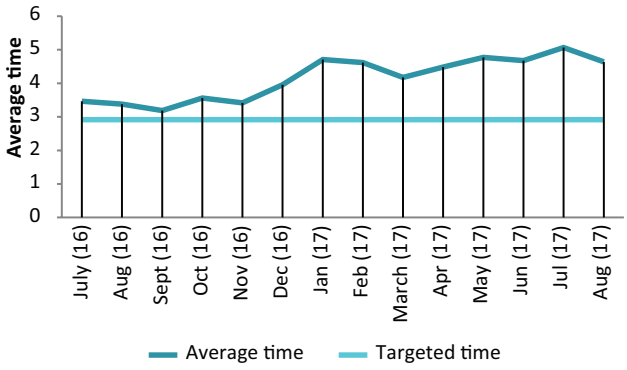

Figure 23: Running status of Gurgaon-Nidvanda trains
Source: Indian Railways

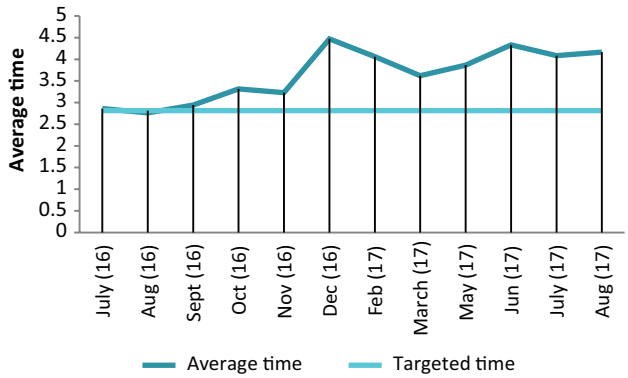

Figure 26: Running status of Melpakkam-Kathuwas trains
Source: Indian Railways

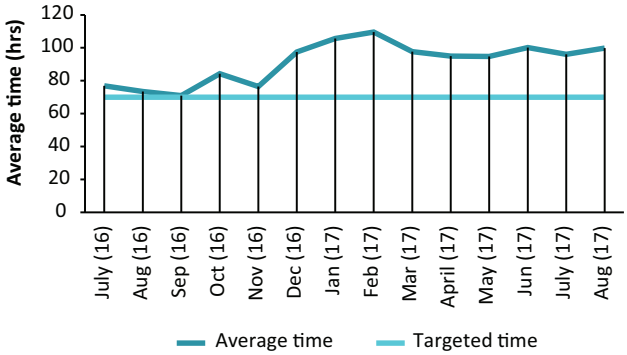

Figure 24: Running status of Nidvanda-Gurgaon trains
Source: Indian Railways

Table12: Comparison of transit time for transporting passenger cars by rail vis-à-vis road (Factory to Dealer)

Stretch name	Transit time – ROAD (days)	Transit time – RAIL* (days)
Chennai–Delhi	approx. 9 days	8–9
Delhi–Mumbai	5–6	6–7

*Note: *Including time taken for moving cars during first mile (from plant gate to rail terminal) and last mile (from unloading terminal to dealer)*
Source: Industry sources

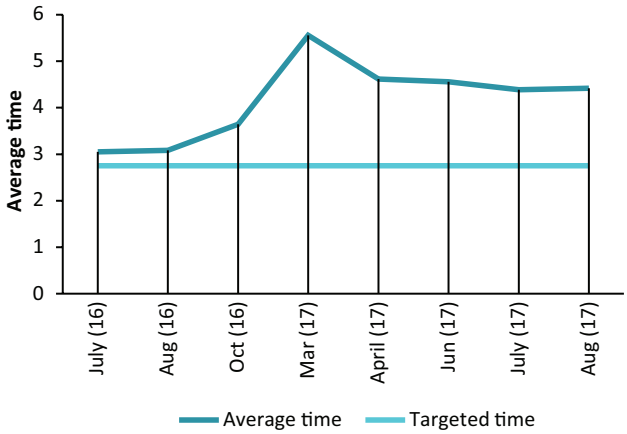

Figure 25: Running status of Kathuwas-Melpakkam trains
Source: Indian Railways

seen that it takes 8–9 days for automobile consignment from Chennai plant to reach the dealer in Delhi using railways, while it takes about 9 days for truck trailers to move finished products from factory to dealer. For the rail movement between Chennai and Delhi, it takes about 1–2 days for pick up, 1 day for rake positioning/ loading, 4 days for rail transit, and about 1–2 days for delivery to the dealers – total of 8–9 days.

Flexibility in operations to reduce empty trips

The current AFTO policy gives automobile transporters differential rates for loaded and empty direction movements on the two legs of their origin-destination circuit. This kind of inflexibility results in costlier transportation of goods via railways, as there was an extra cost component due to empty home base trip for a given OD pair.

Movement of Two-wheelers by IR—Current Issues and Recommendations

Two-wheelers are primarily carried using the NMG type wagon. IR handled 80 rakes of two-wheelers during 2017–18 as compared to only 40 during 2013–14. Consequently, IR witnessed a rapid increase in the number of two-wheelers loaded to touch 102,190 in 2017–18. However, comparing it with the production level, the percentage of two-wheelers carried by IR is still at a very low level of less than 1%, indicating that the majority movement is still preferred through road transport.

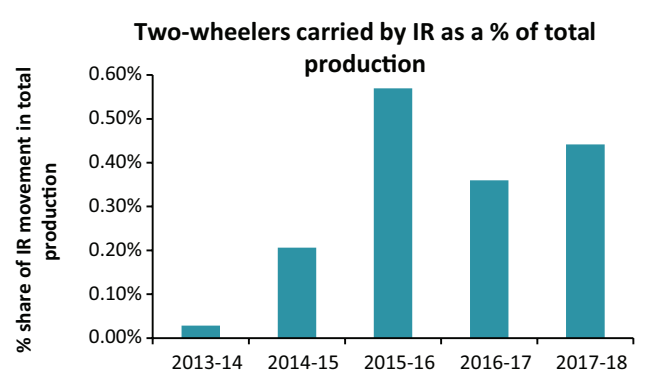

Figure 27: IR's share in the movement of two-wheelers in total production
Source: IR and SIAM

Like Passenger Vehicle (car) movement, two-wheeler movement also faces issues while being transported through Indian Railways. Some of these issues are common to the four-wheeler segment highlighted in this section—related transit time, freight rates, and terminal facilities. Besides, the use of rolling stock currently in service (NMG wagons) and the loading/unloading of two-wheelers, thereof, is a cumbersome and time taking exercise. Currently, side loading to two-wheelers onto customized NMG wagons equipped with side doors is limited. In the current scenario, two-wheelers are wheeled into the wagons manually, which takes significant amount of time and man-hours. The possible way out is the induction of improved wagons with features, such as gradual roof profile, and cantilever decks with side opening doors for easy loading/unloading.

Provide secure transport

Railways do not take any liability for mishaps that happen to goods in transit. Given that automobiles are high value items and wagons are not secured using locks or seals during transit, there have been instances of robberies and thefts on auto trains. As a result the transporters have started taking insurance for the transportation of the automobiles, this in turn add to the total cost transportation of railways which is equivalent to about 0.5% of the total direct cost of transportation of cars.

Suggested Recommendations to Indian Railways

Some of the recommendations for the issues listed above are enumerated as follows:

Policy

Recommendations for Immediate Implementation

- Changes related to AFTO policy

  With the objective of improving efficiency and enhancing acceptability of railways as a mode of transport by the private operator, the policy should be relooked. The policy guidelines that hinder private participation should be changed or eliminated. For instance, the guidelines related to registration fee, minimum rake holding of the private operator, maintenance-related clause, etc., should be relaxed or revaluated. Further, the definition of circuit should be clearly mentioned in the AFTO policy.

- Incentive schemes to attract more traffic on the railways

  Indian Railways need to develop certain incentive schemes to attract more traffic to railways. For example, at the end of first quarter of Year 1, the total freight tendered by business associate should be compared with freight tendered in the same quarter of previous year (Year 0). Based on this, percent increase/decrease in freight carried should be calculated and therefore,

the incentive amount can be decided. For instance, if there is a revenue increase of 25%, a rebate of 7.5% can be offered in the rail freight. This rebate amount will be adjusted in the next quarter and at the beginning of the next quarter, the sequence begins again.

Freight related

Freight rates should be revised at regular intervals in consultation with the industry. These revisions should be implemented after studying the impacts/benefits of the revision.

Recommendations for Immediate Implementation

- **Nature of freight rates for movement of automobiles**

  Freight rates should be revised at regular intervals in consultation with industry as well as keeping a close eye on the rates offered by the road transporters. These revisions should be implemented after studying the impacts/benefits of the revision and also cost to the consumers. Also, the pricing mechanism should be linked to the value of the goods that are being transported and should not be based upon GTKMs (gross tonne per km).

- **Rail freight often uncompetitive with road rates**

  At present, the transportation of cars via roads is 5% cheaper as compared to the railways. The Railways need to develop a plan and pricing mechanism that addresses the issue of additional cost incurred on account of last mile connectivity, which is about 11% of the total cost incurred for the transportation of cars via railways, inadequate fleet utilization, etc. In addition, the railways should also ensure that the policies that are formed are implemented on the ground.

- **Price elasticity of demand of customers not considered**

  The Railways should develop strategies that facilitate the transfer of some of the benefits and savings arising out of fuel price reductions or efficiencies in operations, etc., to the industry to attract them onto rail. The Railways therefore, need to restructure the pricing methodology currently being used for setting rates for automobile transport. The Indian Railways should ideally customize freight rates based on light or heavy cargo and determine the pricing based on fuel prices and the price of competition. In case of the automobile industry, the important criteria while determining the pricing should be the type or quality of vehicle being transported, along with the locations from where such transport is taking place.

Infrastructure (Rolling stock and terminals)*

It was seen that the railways need to bring more efficiently designed, faster, and more robust rolling stock for the movement of automobiles to encourage the industry to shift from road to rail. IR needs to undertake an assessment and compare the advantages and disadvantages of a universal wagon design as compared to customized rote/vehicle specific wagons.

Rolling stock

Recommendations for Immediate Implementation

- **Use of higher capacity wagons**

  Between June 2016 and August 2017, 302 trips of BCACBM rakes were made to transport automobiles carrying about a lakh vehicles. Although, BCACBM have a higher capacity as compared to NMG, a substantial amount of transport is still being conducted through NMG. Indian railways need to mandate/encourage the use of higher capacity of wagons, eventually leading to lower cost per unit of vehicle. In addition, delivery of rakes to the operators should be made on a priority basis by the manufacturers.

- **Optimize the design of wagons**

  Optimization in wagon length: The Indian Railways need to redesign the wagons by making them longer or shorter to optimize the space utilisation. For example, if the wagon length was either reduced to 20.5 m or increased to 24.5 m, then either an additional wagon could be added to the rake or two additional vehicles could be transported per wagon respectively.

  Optimization in wagon height: Automobile designs have shifted towards production of taller cars. SUVs are generally 1800 mm tall; the Scorpio and Bolero are over 1900 mm in height. In order to utilize the capacity of the wagons, all these vehicles need to be paired with some vehicle on the top deck. This is not possible in the existing wagon design. For example, if

a SUV of height 1800 mm were to be loaded on the bottom deck of the BCACBM, a space of only 1360 mm is left on the top deck which is inadequate to accommodate any automobile. Thus, it was seen that additional 350 mm in height will enable most models to be accommodated. If the wagons were taller by 350 mm, more space would be available on the top deck to accommodate additional vehicles. This would require an automobile wagon to be 4655 mm in height instead of 4305 mm at present.

Terminal facilities

Medium Term Recommendations

- **Development of dedicated auto handling terminals**

  The Railways need to make a conscious push towards encouraging the development of private automobile terminal facilities across the country by giving adequate incentives to the industry in terms of freight booking advantages or land for connectivity. To start with, these terminals could have basic facilities—secure perimeter, parking space as per the number of trains handled, loading/unloading ramps, and space for staff.

  In addition, special wharfage rule should be applicable specifically for handling automobiles at rail terminals. Demurrage concession should also be given as the logistics demand of the product from the terminal varies across the country. Therefore, careful analysis and consultation with the operators should be undertaken by the Indian Railways while fixing demurrage conditions/charges.

  Schemes, such as the PFT, should be tailor made to enable the development of automobile transit terminals in proximal locations to either point of manufacturing or close to high consumption/sale regions. These terminals should take a cue from economies, such as the US and Europe, as to how to design and plan for auto parks. With increasing volumes, India should also start planning for rail connected pre-delivery inspection (PDI) and final fabrication enabled parks across the country.

- **Planning rail infrastructure facilities to cater to the emerging production hub of Sanand, Gujarat**

  As discussed earlier, Sanand is expected to emerge as one of the key production hubs in the country, which would cater to both domestic and export markets. It is therefore suggested that rail infrastructure facilities (rail line, terminal, etc.) be looked at by the Indian Railways. Adequate planning is required in terms of providing facilities and catering to the automobile manufacturers in transporting the finished products from plant to dealers.

Operations

Other than issues with policy, freight rates, and infrastructure availability, there are also certain limitations in terms of operations that restrict the auto industry from moving on rail. Some of the recommendations focussing on this issue have been discussed as follows:

Recommendations for Immediate Implementation

- **Time-sensitive industry**

  As mentioned earlier in the report, the automobile industry is an extremely time-sensitive industry and the freight trains used to transport the automobiles are suffering major delays. Hence, the Railways need to not only introduce more realistic time-tabled train operations for automobile transport but also have to stick to the times that it sets before itself. The Railways need to define dedicated paths for auto trains and ensure that the logistic companies involved provide seamless first and last mile connectivity options so as to limit the chances of bottlenecks at either end of movement. The overall speeds of movement of auto trains need to be increased. The industry suggests that the railways should increase their speeds for auto transport by another 10–15 km per hour in comparison to the current speeds offered by the Railways. Providing such time-bound train services would impart the Railways a major competitive advantage over roadways.

- **Flexibility in operations to reduce empty trips**

  Flexibility in circuit operations: As mentioned earlier in the report, it is possible to have triangular movement circuits to reduce empty flows of auto rakes. This kind of flexibility with well-defined freight charge for loaded running and a defined freight rate for empty running would allow operators to increase their efficiencies in

loading and also run trains for triangular circuits (such as Gurugram–Bengaluru–Chennai–Gurugram or even longer journeys such as Chennai–Chang Sari–Delhi–Bengaluru–Chennai). All policies should therefore encourage reductions in empty trips. The objective should be to maximize the loading of automobiles per rake.

Maintenance check points: In addition to permitting such movements across different longer circuits, there is a need to increase maintenance check-points. Currently, wagons need to undergo maintenance checks after completing 6,000 km runs. To encourage increased running, the Railways should also increase the number of locations for such scheduled checks to increase higher utilization of rakes.

- **Provide secure transport**

  The Railways have started providing Railway Protection Force personnel (at cost) to the auto transporters based on availability. Such a practice should be ensured for all loaded trains as an added service for automobile transport to encourage a road to rail shift.

ANNEXURE 1

NMG loading and unloading points (July 2018)

Gurgaon (GGN)	Amausi (AMS)
Hoshiarpur (HSX)	Delhi Cantt.(DEC)
Chandigarh (CDG)	Fatuha (FUT)
Jwalapur (JWP)	Sarai (SAI)
M/S Sanjvik Terminal Pvt. Ltd. (MSTB)	Kankariya (KKF)
Haldi Road (HLDO)	Chinchvad (CCH)
Mandidip (MDDP)	Warangal (WL)
Sanand (SAU)	Reddipalem (REP)
Jogeshwari (JOS)	Sanatnagar (SNF)
Butibori (BTBR)	Aurangabad (AWB)
Chinchavad (CCH)	Changari (CGS)
Aurangabad (AWB)	Salem (SA)
Rachagunneri (RCG)	Tiruvallur (TRI)
Tiruvallur (TRI)	Ernakulam (ERM)
Vadippatti (VDP)	Nidvanda (NDV)
Dodballapur (DBU)	Bidadi (BID)
Hosur (HSRA)	Changari (CGS)
Kadakola (KDO)	Changari (CGS)
Bidadi (BID)	Changari (CGS)

ANNEXURE 1

Approved routes for BCACBM rake operation (July 2018)

Melpakkam (MLPM)	Kathuwas (CMLK)/ NWR,
	Fatuah (FUT)/ECR,
	Kalamboli (KLMI)/ CR,
	Sanand (SAU)/ WR,
	Jakhvada (CWCJ)/ WR,
	Khurja (ARIK)/ NCR,
	Nivanda (NDV)/ SWR,
	Khapari (PCPK)/ CR,
	Dankuni (DKAI)/ER,
	Talit (TIT)/ER,
	Rangapani (RNI)/NFR,
	Changari (CGS)/NFR,
	Nagalpalle (CMCN)/SCR

Changsari (CGS)	Khurja (ARIK)

Detroj	Changari (CGS),
	Pen/CR,
	Nidvanda (NDV)
	Rangapani(RNI)

Kathuwas (CMLK)	Nidvanda (NDV)
	Nagalpalle (CMCN)
	Jakhvada (CMCJ)
	Sanand (SAU)
	Changsari (CGS)
	Pipavav
	Pen
	Dankuni (DKAI)
	Tali (TIT)
	Rangapani (RNI)
	Kalamboli (KLMI)
	Khapri (PCPK)

Gurugram	Changari (CGS),
	Detroj (DTJ)/WR,
	Pen/CR,
	Nidvanda (NDV)
	Rangapani (RNI)