

# Case Study

## China Rail

### 1 Introduction

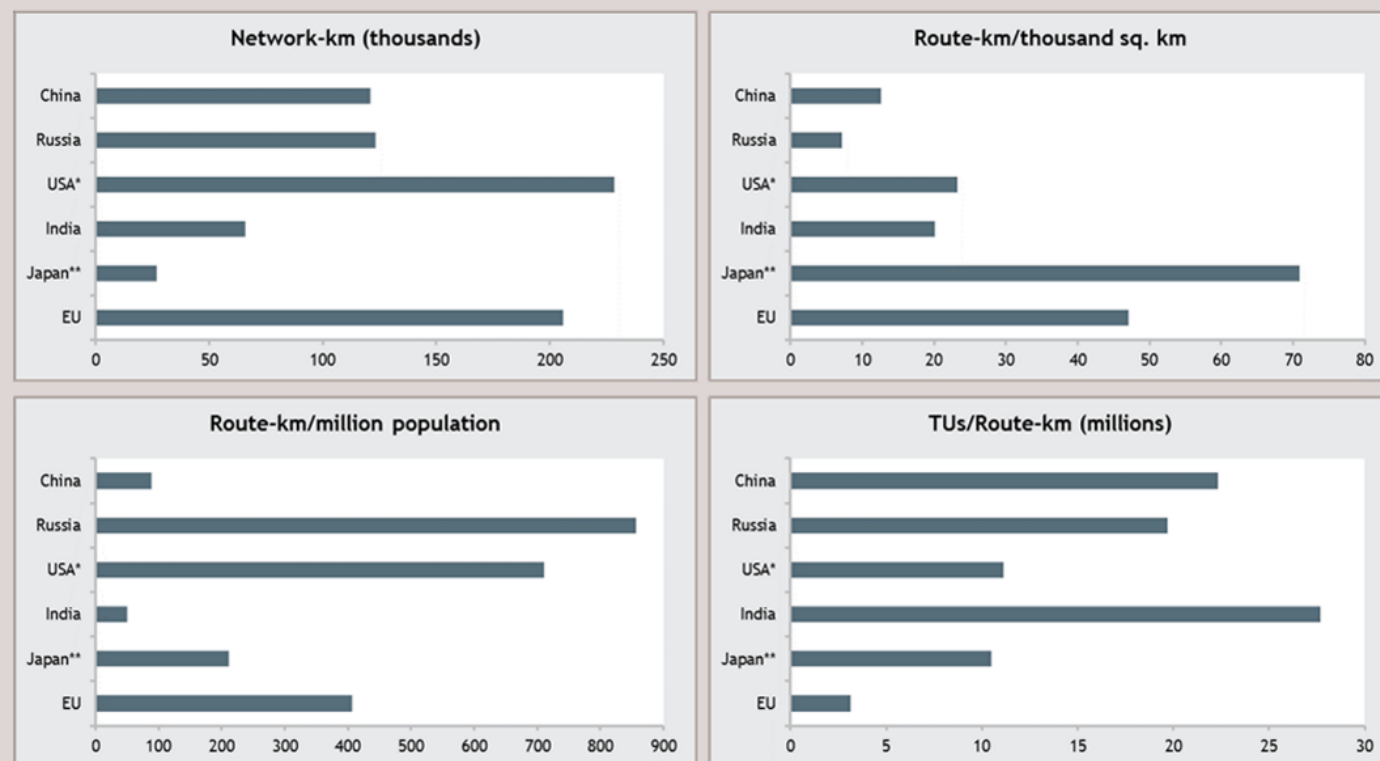
China's is unique in that it is the only country in the world that is going through a rapid rail network expansion, and the scale of the expansion and improvement over the last 30 years is striking.

The reasons are evident in its relatively small but very highly utilized network (Figure 1). In other very large countries such as Argentina, Australia, Brazil, Canada, India, Russia, and the USA, national railway systems had already been formed by the 1950s, when China started its major efforts to build its rail network. In 1949, China had only 22,000 km of poorly maintained and war-damaged railway line, of which less than 1,000 km was double-tracked and none was electrified. Since then, China's Government has expanded its rail network length by more than five-fold and totally transformed quality and capacity of its rail sector. In particular, the high-speed network has undergone extraordinary growth and now accounts for approximately half of all high-speed rail lines in the world.

Railway reform in China differs from many of the case studies presented in this toolkit in the sense that China has adhered to centralized administration and focused on largely state-financed network expansion program as the first priority. China has yet to fully embrace many of the options promoted by the World Bank, such as opening up to private sector participants and investors; allowing freight tariffs to be market-determined; and making a clear separation of regulatory functions from commercial functions. As this case study will show, China has (to various degrees) begun to introduce policies and instruments in relation to each of these best practices.

Perhaps most notably, in 2013, the State Council dissolved the Ministry of Railways (MOR), separating policy and regulatory functions from commercial functions, considered a fundamental best practice for reform. Even after this landmark event, traditional reform strategies, including private sector involvement, are used sparingly as a tool for assisting the country in meeting overall development goals. China's era of rapid development continues in freight and passenger transportation under a heavily centralized structure. However, the sector is not completely monolithic, allowing the participation of joint venture (JV) railways, industrial networks, and local railways. This case study is structured in a manner to highlight China's growth strategy and the remarkable evolution of its railway industry.

**Figure 1** International Railway Network Comparisons 2015



\*2010 data

\*\*Data for multiple railway companies taken from various years (2010-2014)

Source: UIC Railway Statistics 2015; N.B.: Data from the China Statistical Yearbook (used in the remainder of this case) does not correspond with UIC Railway Statistics. UIC Data has been used in this instance in order to cross-compare country data.

Lastly, it must be kept in mind that the period since 2013 has involved contractions in China's overseas markets, and consequently within China. Further, coal demand within China has shrunk as a result of government policy to deal with pollution in the eastern provinces, negatively impacting rail freight volumes. Therefore, various indicators for China's rail sector since 2013 that may show decline should not immediately be taken as an indication of poor performance on the part of China Railway Corporation (CRC), the newly established operator. On the other hand, rail freight operations, particularly for freight, have not shown the same market growth as road and waterway traffic and should thus be monitored closely in the wake of new reform policies and initiatives.

## 2 Railway Industry Framework and Structure

### 2.1 Railway Law

The railway sector is governed by the 1991 Railway Law, which is similar to railway laws in many countries. The law has five main components: (i) sector administration; (ii) commercial arrangements for passenger and freight transport; (iii) planning, construction standards and opening arrangements; (iv) safety and protection; and (v) legal and associated matters. The Law permitted and encompassed four types of railways (Article 2):

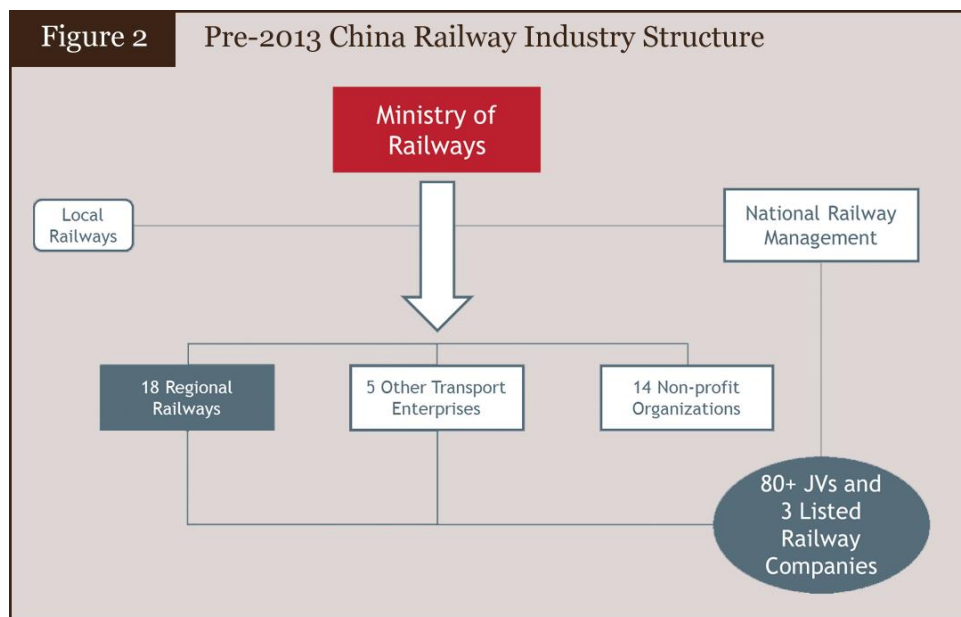
- State railways: administered by the department responsible

- Local railways: administered by local government authorities, which could include provincial governments or city administrations
- Industrial railways: administered by industrial enterprises or other units to provide their own rail transport services
- Private railway sidings: branch railway lines administered by enterprises or other units, connected to another railway line

Article 3 of the 1991 Railway Law requires the relevant government department (MOR to 2013, but MOT since) to implement a centralized and unified traffic control system over the State railway network, and to guide, coordinate, supervise, and assist local and industrial railways and private railway sidings. Article 4 of the Law requires MOR/MOT to develop State railways, and to aid and support local railway development. Article 24 encourages industrial railways to provide public passenger and goods transport services on a commercial basis.

## 2.2 Pre-2013: Ministry of Railways and China Rail

Prior to 2013, MOR supervised the sector, combining strategy, policy and regulatory functions and administering China Rail, the network of infrastructure and transport services operated by the 18 regional rail authorities (RRAs). MOR had overall control of policy, technical standards, planning and investment, finance and system-wide train and rolling stock dispatching, whereas RRAs, many of which are comparable to a large railway in another country, were responsible for daily management of railway infrastructure and delivery of rail transport services. (Figure 2)



During the 1990s, non-core activities of China Rail were separated, including construction, manufacture, telecom, design, education and social activities. Over the next fifteen years, the rail operations staff was reduced by a third, and traffic increased by 60 percent, which more than doubled railway employees' average labor productivity.

In 1999, the Asset Operation Liability System (AOLS) was implemented, and RRAs' managers became accountable for return on capital, output, profitability, and safety. Under AOLS, managers are responsible for managing and increasing assets assigned to them, and incentives are provided to those who exceed agreed performance levels. Each member of RRA management teams, right down to stationmasters, makes an 'incentive deposit' proportionate to his/her rank and must forfeit the deposit if targets and commitments are not met. If managers exceed targets, their deposit is refunded and they get a bonus – up to double the value of the deposit. When AOLS was implemented, RRAs' financial performance improved steadily, as did the overall financial performance of China Rail. In addition, safety improved significantly and accidents declined.

Prior to 2005, each RRA was divided into about five sub-administrations, each with a structure parallel to that of the RRA. In 2005, the secondary level of regional administration was abolished, a major and successful achievement in streamlining corporate management that gave RRAs a direct line of management to depots, stations, and yards, and provided a platform to improve utilization of locomotives and crews, which had often been confined within sub-administration boundaries.

## 2.3 Recent Structural Reform

Leading up to 2013, the National Development and Reform Commission (NDRC) set out three policy principles for the reform of the Chinese railway industry:

- Separate government administration from enterprise management;
- Introduce competition where suitable; and
- Regulate industry more effectively.

In 2013, a rail sector reform was carried out with two major goals:

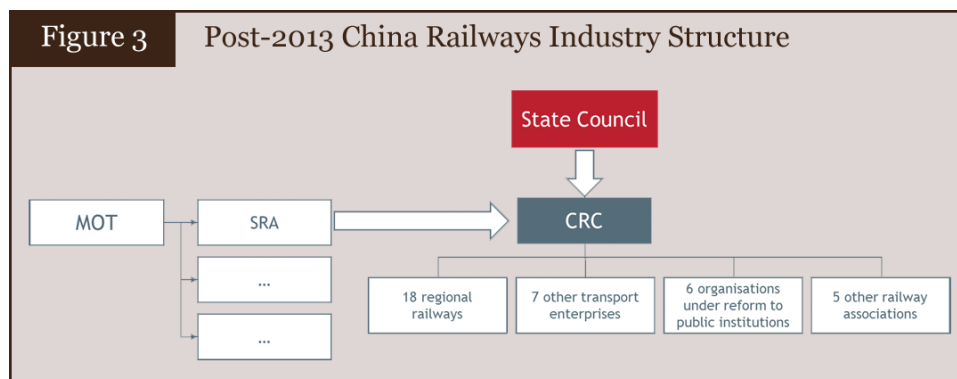
- Maintain a financially sustainable railway in order to achieve the sector's overall development goals; and
- Enhance the rail operator's capability to respond to market competition for both passenger and freight services.

The Government undertook a dramatic restructuring of the railway sector, dissolving MOR and separating the government functions from the operation of the railway. The move confirmed the Government's strategy to separate regulatory and administrative responsibilities from commercial operations, as well as confirming the intent to keep railway assets centralized in China.

On March 14, 2013, the National People's Congress (NPC) passed a restructuring plan that separated the functions of MOR under three distinct entities:

- The Ministry of Transportation (MOT), responsible for overall transport sector planning and development policy;
- The State Railways Administration (SRA), a newly-established body under the MOT responsible for setting technical standards, setting and overseeing safety standards, and monitoring the quality of transport service and construction; and

- China Railway Corporation (CRC)<sup>200</sup>, a newly-established state-owned enterprise responsible for commercial operation of the railway. (Figure 3)



Within CRC, conventional rail network and train operations continue to be organized under the 18 RRAs. CRC also houses seven transport enterprises, such as China Railway Container Transport and Special Cargo Services Company. (Figure 3).

### Box 1 China Railway Corporation

China Railway Corporation (CRC, previously known as China Rail) is the national railway operator of the People's Republic of China. CRC used to be part of the now-defunct MOR (referred to then as China Rail) and in 2013 was converted to an enterprise owned 100% by the State. CRC operates both passenger and freight services, and is responsible for managing the rail network. It is financed solely by the Ministry of Finance (MOF), and reports directly to the State Council.

Since CRC has formal responsibility for governance of the 18 RRAs, the RRAs have no boards of directors or other external supervisory bodies, and each RRA has a Head who reports to CRC. The RRA functional managers report to both the RRA Head and, less directly, to the functional heads at CRC. The RRA organizational structure is similar to and tends to mirror the functional classifications that exist at the Ministry level.

<sup>200</sup> The 2013 reform replaced China Rail with the state-owned enterprise, China Railways Corporation (CRC), which operates the commercial functions of the railway. The terms are in essence interchangeable. However, the reader may wish to note that the main difference (to date) is in the reporting structure. Prior to 2013, China Rail was housed under MOR, and thus reported to the Minister. By separating out the commercial functions and placing them under CRC, the operator now reports directly to the State Council, making the General Manager of CRC a de facto minister-level official. Therefore, at least on paper, the Minister of Transport and the General Manager of CRC hold the same seniority. As the newly established regulator, SRA is housed under MOT, it has yet to be seen how this chain of command will affect regulation of CRC.

(<http://www.railjournal.com/index.php/policy/china-implements-radical-railway-reform.html?channel=000>)

## 2.4 Transport Operations

The now-defunct MOR was responsible for nearly all aspects of railway economic and safety regulation, while the State Council had to approve passenger fares and freight tariffs on State railways. In practice, NDRC administered economic and safety regulation; it regulated and approved China Rail tariffs, and tariffs on new lines, and regulated inter-Provincial JVs. In 2014, MOR's safety and regulatory duties were transferred to SRA under MOT, which is an executive agency of the State Council.

Although the functions of MOT and CRC are now separated, tariffs continue to be guided by NDRC, therefore limiting CRC's ability to operate as a commercially-oriented enterprise. Encouragingly, the current regulatory and institutional environment is favorable for NDRC to open up the industry to market-driven tariff setting. Publications suggest that the State Council and NDRC are indeed considering implementing market-driven freight tariffs, with NDRC at the helm of the reform<sup>201</sup>. However, only time will tell if this shift in policy will occur.

## 3 Rail Sector Growth Strategy

### 3.1 Network Expansion

In the past two decades, China's railway policymakers have continuously faced two immense strategic challenges:

- To increase infrastructure capacity and quality; and
- To reform the industry so it can adapt and thrive in a modern ever-changing market economy.

To meet the infrastructure challenge, China embarked upon the world's biggest program of railway construction since the nineteenth century. In January 2004, the State Council approved in principle the Mid- and Long-Term Railway Development Plan, setting out construction priorities and providing the framework for developing future five-year plans. In 2004, cost estimates for implementing the Plan were RMB 1.7 trillion through 2020 (in 2004 prices)<sup>202</sup>. Already by the end of 2015, the network had reached 121,000 km, with 50 percent of the network double tracked, and over 60 percent electrified. In mid-2016, NDRC released the latest five-year update to the development plan for China's railways, revising its target upward to 175,000 route-km by 2025<sup>203</sup>.

<sup>201</sup> <http://www.scmp.com/business/china-business/article/1402132/heavily-indebted-china-railway-corp-expected-raise-freight>

<sup>202</sup> This was once revised upwards due to the Economic Stimulus Program Government adopted in 2008.

<sup>203</sup> The first update in 2008 also increased the route-km targets for the public rail network to 120,000 km by 2020 (up from 75,000 km in 2005) a figure which was surpassed in 2015.

**Figure 4** Chinese Rail Network Characteristics 1990-2015

	1990	1995	2000	2005	2010	2015
<b>Route-km</b>						
National	53,378	54,616	58,656	62,200	66,239	66,989*
Local	4,522	5,034	4,813	4,775	4,363	**
Joint Venture	N/A	2,738	5,181	8,462	20,577	**
<b>Total</b>	<b>57,899</b>	<b>62,389</b>	<b>68,650</b>	<b>75,438</b>	<b>91,179</b>	<b>120,970</b>
<b>CRC Network*</b>						
Route-km with multiple track	13,024	16,909	21,408	24,497	29,684	64,687
Electrified route-km	6,491	9,703	14,864	19,408	32,717	74,700

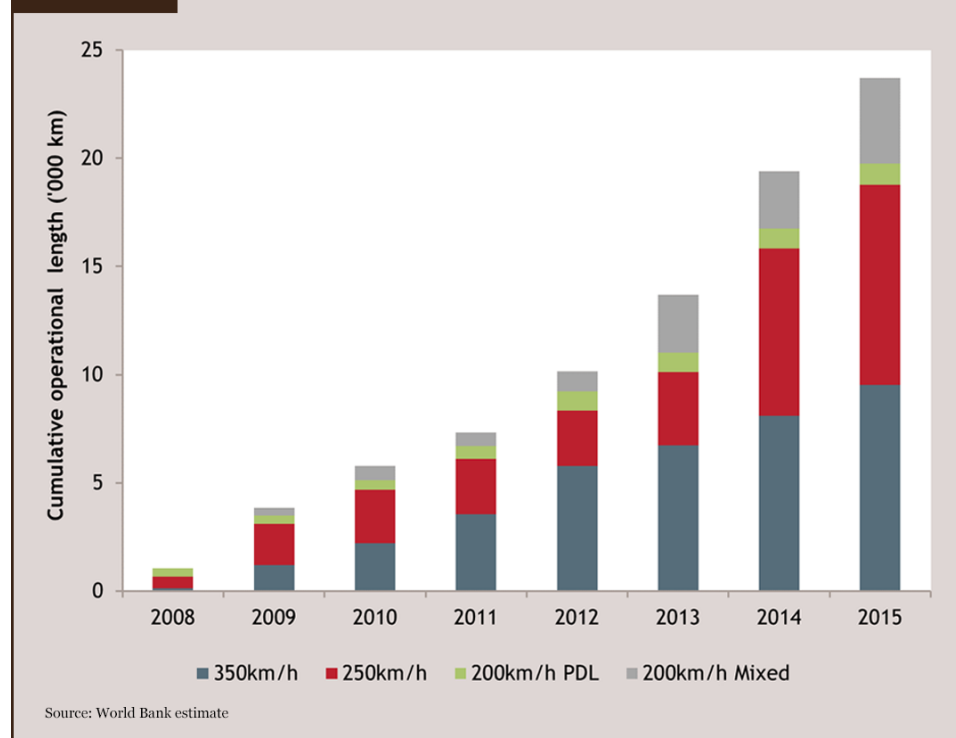
\* 2014 data

\*\* Data not available

+ Almost all new construction since about 2008 has been classified as joint venture rail-ways, even though these are for all practical purposes 'national railways', owned jointly by national and provincial governments. These new joint venture railways are excluded from the 'CRC Network' data in the China Statistical Yearbook (which is presented here). Since 2008, joint venture railways have increased from approximately 10,000 km to about 50,000 km, of which over 20,000 km are double-track electrified high-speed lines.

Source: China Statistical Yearbook, 2016

The program has thus far resulted in considerable growth in high speed rail, ranging from 200 km/h for mixed-use passenger and freight lines (although few freight services are using them) to 350 km/h dedicated passenger lines (Figure 5). The completed network will feature services up to 350km/h based on eight north-south and eight east-west corridors<sup>204</sup>. By 2016, nearly 20,000 km of high speed dedicated passenger lines were completed and most of the main corridors were nearing completion. In late 2016, an updated plan was announced to expand the high speed network to 30,000 km by 2020, which will connect 80 percent of China's major cities.

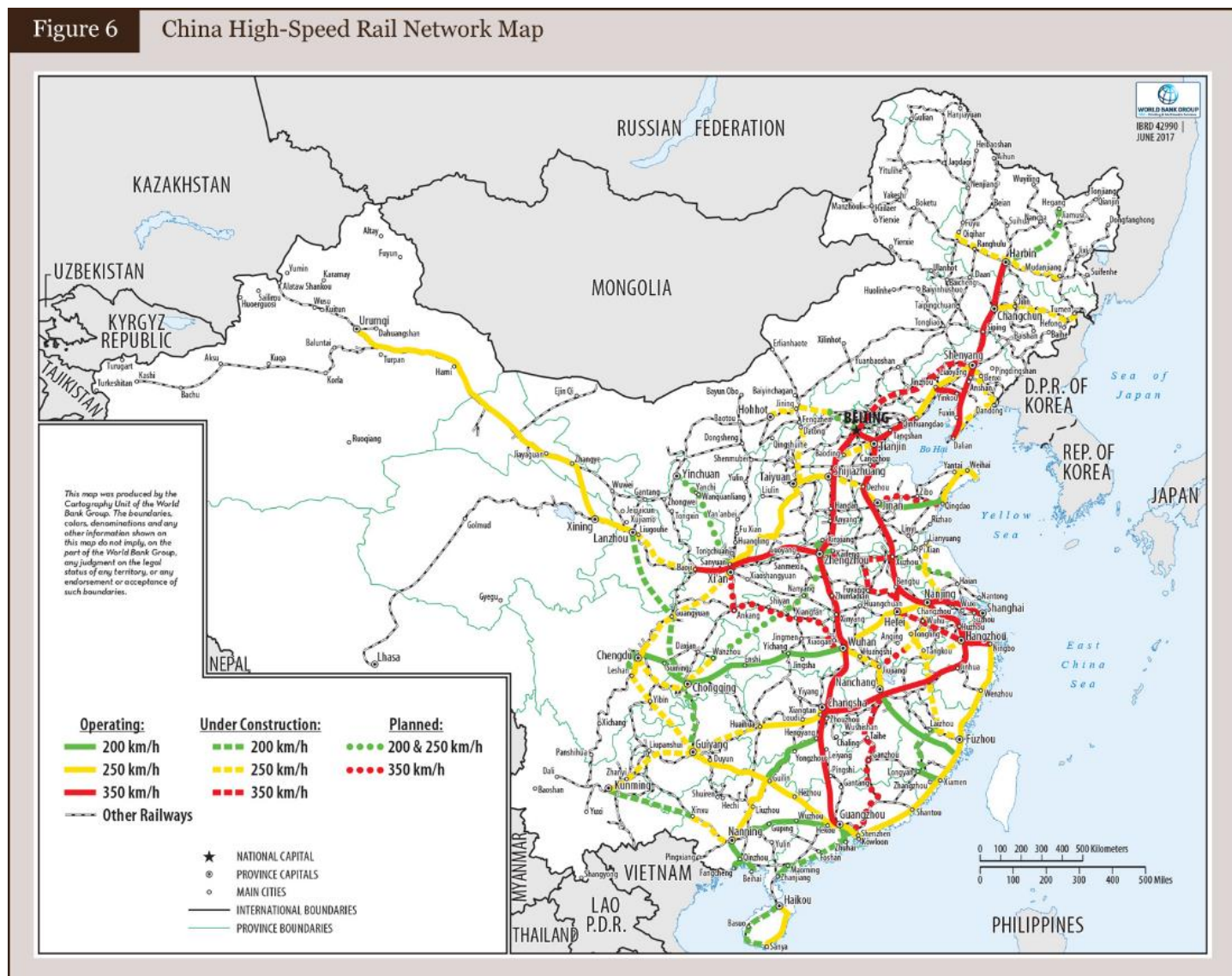
**Figure 5** Growth in High Speed Rail in China 2008-2015


<sup>204</sup> This marks a major expansion compared to the previously published 2008 strategy, which targeted four north-south and four east-west corridors.



The plan also includes 20,000 km of short-distance expansion to the conventional network by 2025. Eight regional intercity systems between major regional cities and towns are already operational. The plan will enhance connectivity within the Bohai Sea area (Tianjin, Beijing, and Qinhuangdao), the Yangtze River Delta (Shanghai, Nanjing, and Hangzhou), and the Pearl River Delta (Hong Kong, Guangzhou, and Shenzhen), as well as improving connections in China's hinterland regions<sup>205</sup>. Twelve new lines are also being constructed for the purpose of improving the rail connectivity of the poorest regions of China, in an effort to foster economic growth.<sup>206</sup>

Figure 6 China High-Speed Rail Network Map



More than ever before, a conducive environment for rail freight transport in China is emerging, although China's supply chain has persistently had low utilization of intermodal transport despite having long-haul routes that are characteristic of suc-

<sup>205</sup> <http://www.chinahighlights.com/travelguide/transportation/china-high-speed-rail.htm>

<sup>206</sup> <http://www.railwaygazette.com/news/infrastructure/single-view/view/chinese-high-speed-network-to-double-in-latest-master-plan.html>



successful rail freight networks. It was anticipated that capacity on the existing network would be freed up by the launch of new dedicated passenger lines, which would in turn accommodate growing freight demand. However, the conventional trains still operate with strong passenger demand, limiting the desired increase in capacity for freight transport.

The separation of CRC from MOT also signals the possibility for CRC to move toward a more commercially-oriented enterprise, which would allow it to have the flexibility to customize its services to customer needs, most notably in tariff setting. Currently, however, regulatory and institutional restrictions limit CRC's ability to operate autonomously.

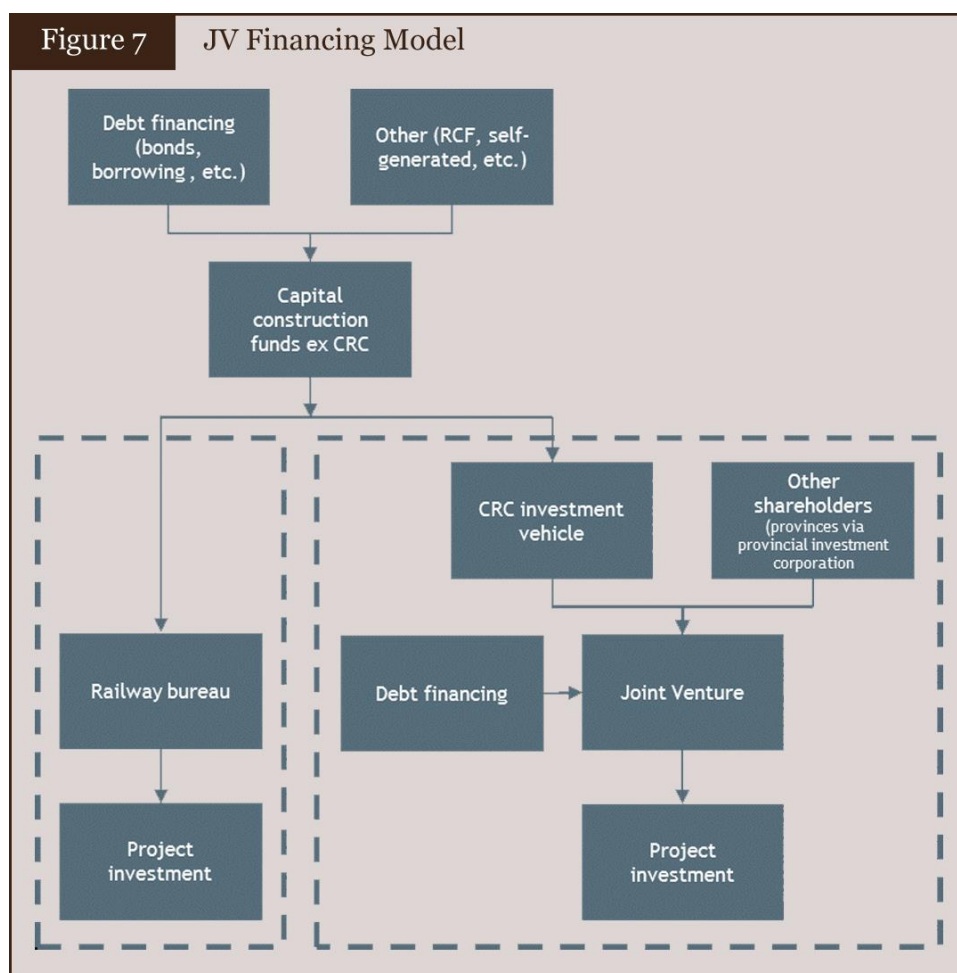
The ongoing revitalization plan for freight services includes high-capacity coal transport corridors, based on China's ten major coalfields, to provide annual coal transport capacity of 2.0 billion tons by 2020. The rail container industry, so far limited with the exception of some larger terminals, will be boosted through upgrading those railway lines with intensive container transport. Some major routes with heavy container traffic are being upgraded to allow double-stack container trains.

Since the early 1990s, the Government has pursued reforms to improve the organization of the railway sector and has slowly begun allowing the industry to introduce new participants. Since 2008, the policy has been that all new and upgraded lines would be done so on a JV basis. Over 80 JV railways have been established with provincial governments, enterprises, and to a minor extent, private investors. The main objective of the JV policy was to reduce the debt accruing to MOR, and the JVs were employed as a mechanism to bring local government funds into the sector. Some 19 JV railways were newly formed to support trunk corridor development. On many low-density lines, some separation and divestment to local management has occurred, with an emphasis on reducing losses.

## 3.2 Sector Overview

### *Joint venture model*

In 2005, China Rail adopted the JV model, which was an important development mechanism for funding new lines. A typical 'new' JV is funded 50:50 by debt and equity. The equity comes from CRC, financed through bonds, and third parties—typically provinces and potential customers—whereas the JV raises the debt from local banks and, to a more limited extent, from International Financial Institutions (IFIs). Provincial equity is often provided in the form of cleared land (and associated resettlement costs), but provinces can also contribute funds, normally through a Provincial Rail Investment Corporation. (Figure 7).



Operation and maintenance of the line is typically contracted to the local railway bureau. There are two models for train operations:

- The JV takes the traffic risk, receives revenue from traffic and pays the local railway bureau to provide train service; or
- The local railway bureau takes the traffic risk, receives revenue from traffic, and pays the JV for track access.

Two successful examples of the JV model are the Daqin and Shuohuang railways. Both are dedicated coal lines, running east-west in northern China. In 1989-92, the Daqin line opened; since then, it has progressively upgraded and improved infrastructure, rolling stock, and operations. In 2006, it was listed on the Shanghai Stock Exchange and by 2007, annual capacity had reached 300 million tons, up from 100 million tons in 1988. The more recently opened JV Shuohuang railway provided a second dedicated line to the Bohai Sea ports. Most of the coal it carries is mined by the Shenhua Company, the principal member of the JV.

The JV model continues to be used for almost all new construction and upgrading projects, despite there being many question marks about how to get the right balance between railway system coordination/integration and protecting the interests of individual JV investors.

### *Attracting private financing*

In 2014, the Government presented a new guideline on the management of a railway development fund to attract private investment into the sector. The China Railway Development Fund will be monitored by CRC, and is scheduled to last for 15 to 20 years, with an option to extend if approved by the State Council. The fund will provide railway investing and financing, and CRC will sign agreements with private investors. Preferred stock holders receive a fixed return on investment, but do not participate in the management of the fund. Seventy percent of the fund is earmarked for railway projects approved by the State Council, while the remaining 30 percent can be invested in other projects, such as land development<sup>207</sup>.

In June 2014, the first round of fundraising for the Railway Development Fund raised RMB 8.2 billion, with investment coming from three of China's "Big Four" state-owned banks, as well as the Fujian province-based Industrial Bank. CRC contributed approximately RMB 75 billion, including approximately RMB 20 billion from the central fiscal budget. Since then, an additional round of funding was raised, and the latest estimate of its registered capital was RMB 188 billion<sup>208</sup>.

Despite significant investment, Chinese media reports indicate that private investors are not very active in the fund. This is due to their discontent with the fact that they are restricted to being preference shareholders, and are thus not permitted to participate in the management of the fund. Further, a Chinese magazine published comments from those in the banking sector, stating that state-owned banks participated under political obligation.

A new policy is also promoting private capital investments into rail projects through public-private partnerships (PPPs). The objective is to alleviate the debt carried by local authorities. In 2016, the Zhejiang government signed the first of such PPP agreements with the Shanghai Fosun High Technology Group Co. Ltd., with an estimated project value of RMB 46.2 billion. The project will connect the cities of Hangzhou and Taizhou.<sup>209</sup>

Focus has also been placed on a policy that encourages development of the land around and above new stations, with generated revenues being used toward paying back railway development.

## 4 Performance of China's Railway Sector

Although MOR in China has recently been dissolved – separating administrative functions (under MOT), and railway operations (under CRC, the state-owned enterprise for railways operation) – the performance of China's railways can still be discussed rather synonymously between the former China Rail and the newly-established CRC. Given time, a comparison study between the former and current structure will be useful to evaluate the impact of separation, particularly if CRC is given the commercial freedom to be operate as a market-oriented enterprise.

<sup>207</sup> [http://www.china.org.cn/business/2014-07/08/content\\_32895952.htm](http://www.china.org.cn/business/2014-07/08/content_32895952.htm)

<sup>208</sup> <http://www.reuters.com/article/chinapacificinsurance-railwayfund-idUSL3N0Z007O20150614>

<sup>209</sup> <http://www.railwaypro.com/wp/china-fosun-to-invest-in-high-speed-rail-ppp-project/>

## 4.1 *Railway Transport Markets*

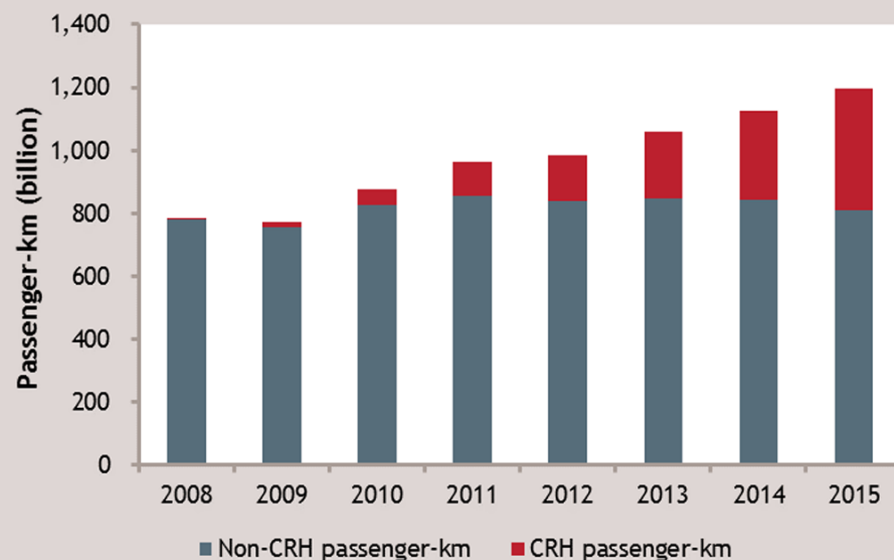
China and its economy are well-suited to railway traffic, which can move massive volumes of people and goods over long distances. China's economy depends heavily upon coal and coke, metal ores, iron and steel, petroleum products, grain, fertilizers and other bulk products that are transported most economically by rail. The average transit distance of CRC freight in 2015 was 707 km, relatively high by world standards. China is the world's second largest freight carrier in net ton-km (after the US Class I system) and the largest passenger carrier in passenger-km. When freight and passenger traffic are taken together, CRC is now the busiest railway in the world.

In addition, China has high population density in settled areas and contains many large cities. Chinese have rising purchasing power, enabling them to travel. The result is some of the largest inter-city passenger flows in the world, creating heavy demand for travel within the larger conurbations. Since 1990, shorter-distance passenger travel has shifted to road transport, in part due to better short- and medium-distance bus services. However, it is also due to a legacy China Rail policy that actively discouraged short-distance passengers in order to free rail capacity for longer-distance travel. A reversal in this policy can be noted by the promotion of the inter-regional networks mentioned earlier, which currently average a city-to-city distance of only 134 km (taking into account operational rail lines).

Since 1990, the average passenger distance traveled has nearly doubled on the national railway system, from 275 km to 472 km in 2015<sup>210</sup>. However, most of the growth occurred before 2000, and the yearly average has been relatively stable over the last decade. Most long-distance travel is by air or by rail and, for trips over 500 km, rail has about two-thirds of the market, but this share has been steadily declining. Overall passenger demand on China Railway has grown at an average of 7.1 percent per year since 2010, and almost all the growth has been on the high speed rail services (CRH) (Figure 8).

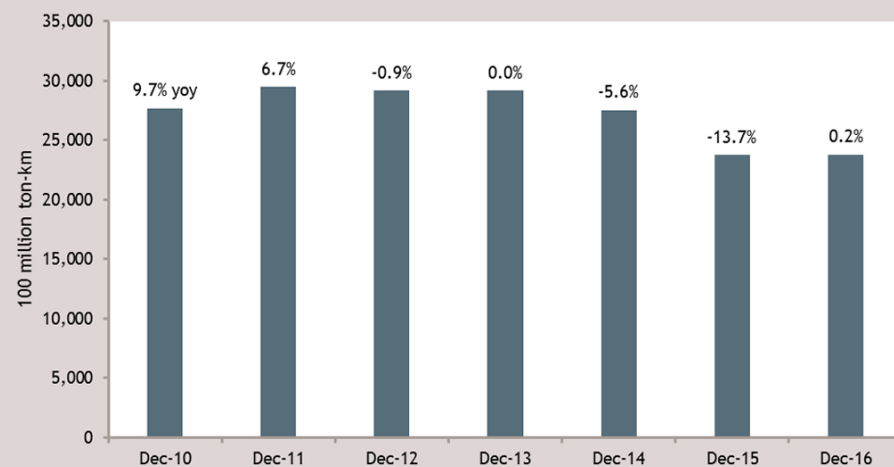
---

<sup>210</sup> China Statistical Yearbook, 2016

**Figure 8** Growth in Passenger Rail Volumes 2008-2015

Source: China Statistical Yearbook, 2016

Meanwhile, freight traffic (ton-km) grew by over 100 percent between 2000 and 2011. However, annual growth then fell below zero percent in 2012. Recently, railway freight volumes have begun to recover, finishing 2016 with an annual growth of 0.2 percent<sup>211, 212</sup>. At the same time, road and waterway freight transport sectors have outpaced China's railway sector substantially. Despite having what should be a naturally favorable position in long-haul transport services, rail has struggled to maintain its market share compared to other modes.

**Figure 9** China Railways Freight Volumes and Growth Rates 2010-2016

Source: National Bureau of Statistics of China

<sup>211</sup> When compared to annual cumulative freight volumes (ton-km) of 2015; National Bureau of Statistics of China

<sup>212</sup> Rail freight volumes experienced a year-on-year decline for 32 consecutive months prior to mid-2016. However, between August and December 2016, year-on-year monthly growth has averaged 10.2 percent.

The lackluster growth in freight rail transport can be attributed to a few major challenges. The Chinese network has been capacity-constrained for several decades, and freight traffic was limited to rail capacity minus the capacity allocated to passenger traffic. The priorities for freight transport were coal and grain, and other traffic was actively discouraged for many years.

Infrastructure planning has not necessarily prioritized the intermodal connectivity of rail for freight transport, either. Particular to container traffic, some blame can also be attributed to China's lack of necessary supply chain infrastructure (on-dock rail capabilities, warehouses, intermodal logistics services, etc.). A recent expansion of Shanghai Port, the world's busiest container terminal, was completed without the inclusion of rail access.

Strict oversight NDRC and MOT maintain on CRC's operations also has made an unfriendly market, regulating rail tariffs and thereby prohibiting CRC from tailoring its customer offerings based on willingness to pay.

Despite the above, the freight rail industry has a positive outlook: conventional rail lines have the potential to be freed up thanks to an expansion in passenger dedicated lines; the ongoing reform at CRC supported by NDRC is a big step toward enabling a competitive environment for rail; and the expansion of intermodal facilities in the country will facilitate inter-modal connectivity.

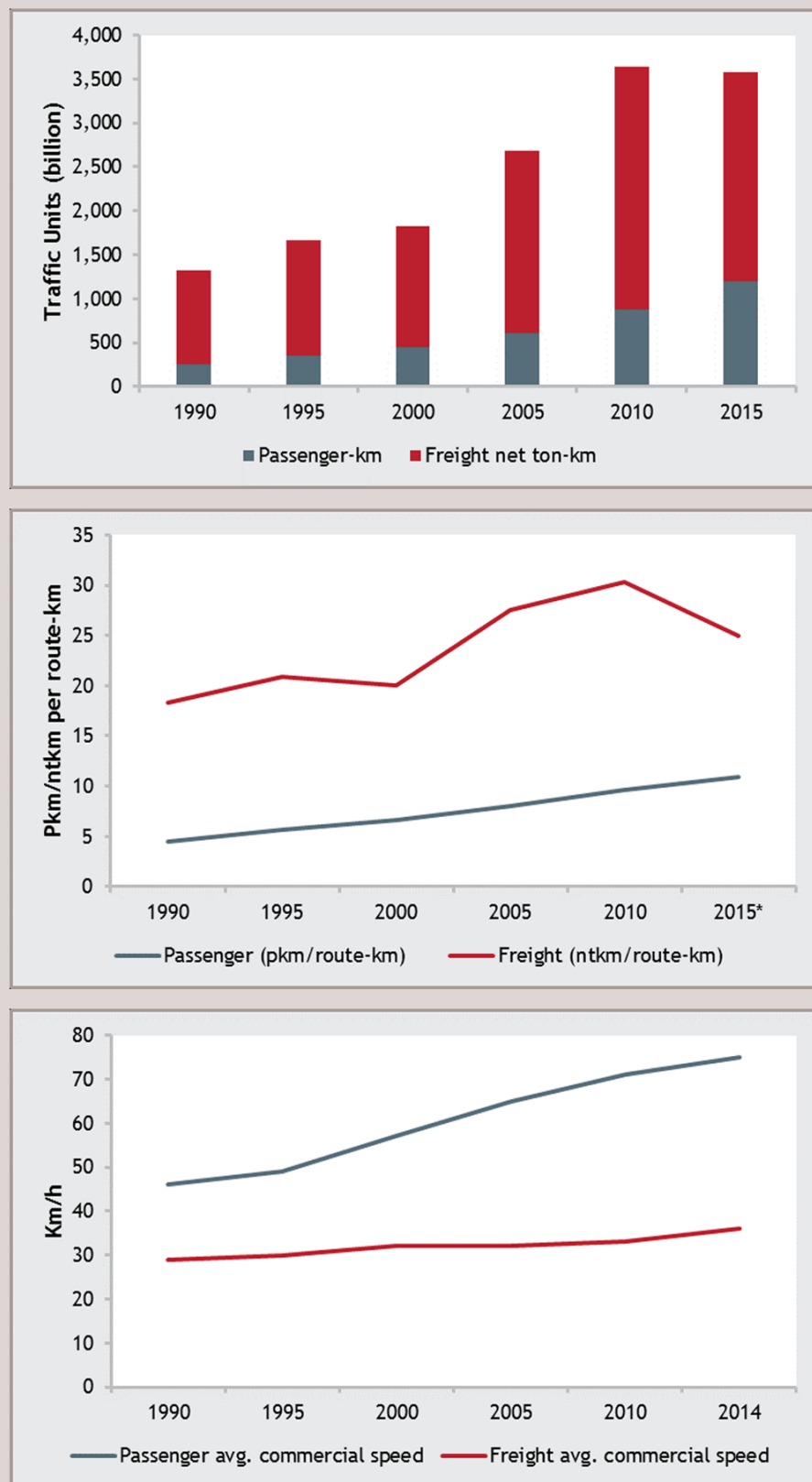
## 4.2 *Transport Operations*

Trends in operational indices, summarized in Figures 10 and 11, are impressive. CRC equipment and labor productivity are among the highest in the world for mixed-use railways.

In aggregate terms, in the two decades since 1990, average passenger speeds have increased by more than 60 percent. In the freight sector, average train size increased by nearly 50 percent, and freight locomotive productivity by over 60 percent.

In 2007, Electric Multiple Unit (EMU) trains operating at 200-250 km/h were introduced on several routes. In August 2008, a 300 km/h EMU train service was inaugurated between Beijing and Tianjin. In January 2010, China's first 350km/h plus high-speed line opened between Wuhan and Guangzhou (961km). Today, over 1330 CRH services are offered daily across the country.



**Figure 10** China Railways Operating Indicators 1990-2015


\*Data presented for 2015 has been estimated, and may also not be directly comparable to previous years due to changes in the method for calculating traffic density in the China Statistical Yearbook since 2013.  
Source: China Statistical Yearbook, 2016

**Figure 11** China Railways Operating Indicators 1990-2014

	1990	1995	2000	2005	2010	2014
<b>Traction</b>						
Electrified track (%)	11.9	15.5	21.7	25.7	35.9	61.7*
<b>Average technical speed (km/h)</b>						
Passenger	57	58	69	74	81	85
Freight	44	44	46	46	48	50
<b>Average commercial speed (km/h)</b>						
Passenger	46	49	57	65	71	75
Freight	29	30	32	32	33	36
Average weight of freight train (gross tons)	2,414	2,597	2,676	3,038	3,467	3,535
Output/day per freight loco (000 gtkm)	860	931	994	1,106	1,350	1,434
Passenger-kms/coach/year (million)	9.6	10.9	12.3	14.5	17.3	N/A
Average freight haul (km)	705	786	771	770	759	722
Average wagon turnaround (days)	4.1	4.5	5.4	4.9	4.5	4.7
<b>Traffic density (system-wide)</b>						
Passenger (mln pkm/route-km)	4.5	5.6	6.6	8	9.6	10.1
Freight (mln ntkm/route-km)	18	20	20	28	30	25
Labor productivity (000 traffic units/staff)	673	749	1,155	1,712	2,298	N/A

Note: Data presented in this figure, as provided by the China Statistical Yearbook, corresponds to what is referred to as the 'National Network' and does not include statistics from the JVs between the national and provincial governments, with the exception of the data for 'Electrified Track' which includes the entire network.

\* Electrified track (%) is provided for 2015 to demonstrate the recent and significant increase. In 2014, it was 33 percent.

Source: China Statistical Yearbook, 2016

Most lines in China carry a mixture of heavy freight and express passenger trains, except for new dedicated high-speed passenger lines and dedicated mineral lines. Typically, such lines operate with headways of seven or eight minutes, and routinely handle the equivalent of 120 pairs of passenger trains daily and up to 180 pairs at peak periods such as Spring Festival, which is close or equal to theoretical capacities.

On the logistics side, in 2012, CRC established a JV under the name YuZinOu with the goal of managing rail freight services between China and Europe. Under the 2013 "One Belt, One Road" program, which focuses on China-Eurasia connectivity, China now moves freight via the China-Europe Railway Express (CR Express). The railway connects China's network of container terminals to more than eight countries, including Germany and most recently the UK. By mid-2016, CRExpress saw 619 outbound trains, and 209 inbound, signaling 150% and 318% growth respectively from the previous year<sup>213</sup>. In 2016, China and the Intergovernmental Organization for International Carriage by Rail (ORIF) also signed a memorandum of understanding to outline areas of future cooperation, including regulations, technical standards, and to promote common CIM/SMGS consignment note for freight between Asia and Europe.

### 4.3 Public Service Obligations

Before the 2013 reform, China Rail had no policy or system of explicit payments for loss-making passenger public service obligations (PSOs). Unlike most national passenger railways, China Rail never built or operated suburban rail networks, which in other countries are a prime area for budgetary support. The Government explicitly views passenger services as both social service and commercial activity, and historically reallocated net revenues across RRAs to ensure financial balance

<sup>213</sup> UNESCAP presentation. "Rail-Based Intermodal Transport in China

Current Status and Challenges." Transport Planning and Research Institute, Ministry of Transport, P. R. China. Bangkok, 30-31 August, 2016. [http://www.unescap.org/sites/default/files/China\\_Rail-Based%20Intermodal%20Transport.pdf](http://www.unescap.org/sites/default/files/China_Rail-Based%20Intermodal%20Transport.pdf)

in each. Meanwhile, the Ministry of Finance (MOF) provided capital contributions to railway line construction in remote regions.

The recent policy changes propose compensation to CRC for its PSOs, with improvements to the cost accounting system in order to create a reasonable compensation mechanism. In the interim, it is the responsibility of the central government to provide subsidies to CRC during the transitional period while the full cost accounting system is being developed and implemented.

#### 4.4 Customer Satisfaction

In the passenger sector, trains are reliable and punctual, and offer superior standards of comfort in the higher service/ticket classes. China introduced a high speed rail network (branded CRH), which is the biggest planned program of passenger rail investment ever in a single country. High speed rail fares are very competitive with other transport modes within China. When looking at the sources of passenger traffic, about one-third of the pre-CRH rail volume (riders from conventional rail) transferred to CRH, which accounts for about half the high speed rail volume. Second-class fares of high speed rail vary between US\$ 0.045 per km at 200-250 km/h and 0.077 at 300-350 km/h<sup>214</sup>. These rates are three to four times higher than conventional express trains, but conventional trains offer far lower levels of service. When compared to average fares in other countries with high speed passenger rail, fares in China are approximately a quarter of the international average.

High speed rail services also compete very effectively with air services over short distances (up to 500 km) because of lower fare, higher reliability, and more frequent services. It is a significant competitor for trips of up to 1,000 km.

However, volumes of traffic, both passenger and freight, are not necessarily an indicator of customer satisfaction. CRC does not regularly monitor customer perceptions of its services. Press reports and anecdotal evidence suggest that the freight business does not always supply enough wagons in a timely manner to meet customer demands, and that general customer responsiveness is below par.

Anecdotal accounts of passenger experiences on the new line connecting Guangzhou to Nanning<sup>215</sup> indicate high levels of satisfaction on several of the new high speed rail lines, making job opportunities more accessible and family trips more frequent. In 2013 and 2015, the World Bank conducted passenger profile surveys of four major lines<sup>216</sup>. A common finding was that respondents would travel less frequently if the high speed lines were not in operation, and that the high speed services continue to attract passengers from bus, air, and private vehicles. Rising incomes have not only spurred people to travel more but also raised demand for

<sup>214</sup> World Bank, “High-Speed Railways in China: A Look at Traffic”. Accessed at: <https://openknowledge.worldbank.org/bitstream/handle/10986/25480/932270BRI0Box30fffc020140final000EN.pdf?sequence=1&isAllowed=y>

<sup>215</sup> World Bank, “Passengers of recently opened Wuzhou-Nanning rail line describe new opportunities”, submitted by Gerald Ollivier, April 6, 2014.

<sup>216</sup> World Bank, “High-Speed Railways in China: An Update on Passenger Profiles” written by Nanyan Zhou, Richard Bullock, Ying Jin, Martha Lawrence and Gerald Ollivier. January 2016, and World Bank, “High-Speed Railways in China: A Look at Traffic” written by Gerald Ollivier, Richard Bullock, Ying Jin and Nanyan Zhou. December 2014.

higher standards of service and convenience. In response, new ticketing systems were implemented to improve the retailing operation, and tickets can now be purchased online. Purchased tickets can be picked up from vending machines in stations.<sup>217</sup>

## 4.5 Financial Performance

Figure 12 shows financial performance indicators<sup>218</sup> for the railway component of MOR-administered and supervised organizations for pre-reform years between 1990 and 2010, and then for CRC in 2015.

The revenue figures in Figure 12 include freight surcharges imposed above basic tariffs to provide capital for new construction through a dedicated railway construction fund (RCF). The surcharge revenue is ear-marked for infrastructure upgrading and not subject to tax.

Government policy, as reflected in tariff regulation, allowed MOR broadly to break even, or make a small surplus, but not to maximize profit. Thus, by design, MOR broke even on its rail operations until 2010 while the RCF was intended to provide construction capex. As high speed trains began operating in 2010, MOR wages were increased sharply: by 100 percent between 2005 and 2010 and by a further 50 percent between 2010 and 2013. Since 2009, CRC has incurred a loss on its rail operations. (Figure 12)

By 2016, CRC had accumulated a high level of a debt and liabilities (RMB 4.14 trillion on an asset base of RMB 6.4 trillion), due largely to borrowing for HSR and other projects.

In an effort to leverage the value of its assets and introduce market-oriented business models to the rail sector, CRC has recently expressed interest in exploring new equity investment mechanisms to increase cash flow from its core and non-core activities, and to consider different financing channels. The World Bank recently published a report for CRC that discussed international best practices and highlighted their relevance for China<sup>219</sup>.

---

<sup>217</sup> Previously, it was not possible to book a return train fare; queuing to buy tickets at stations took hours and sometimes days, which sparked a secondary informal market in tickets.

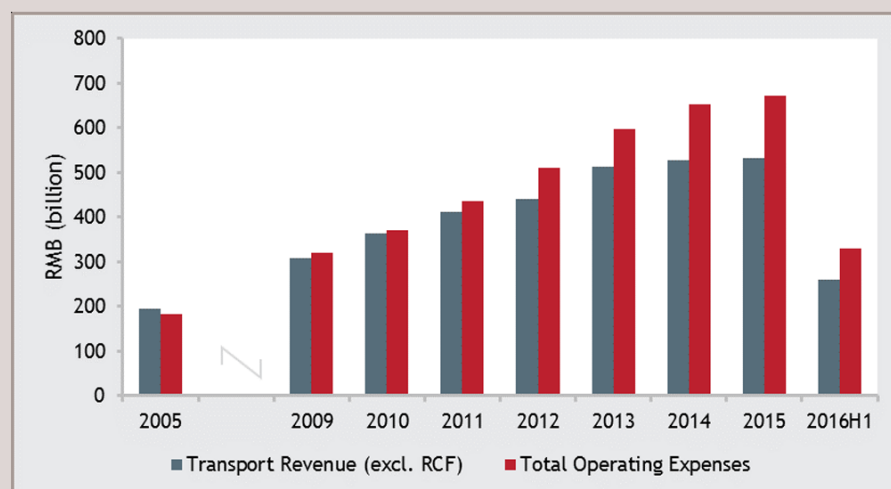
<sup>218</sup> Financial statements do not adhere to international accounting conventions and should be treated with caution. In the early 1990s prices were a mixture of administered and market prices and costs were calculated on a different basis prior to 1999. All figures refer to the railway transport component only of the various organizations. Various reported results for MOR in statistical yearbooks include and sometimes exclude non transport subsidiaries.

<sup>219</sup> See the March 2015 report, “Attracting Capital for Railway Development in China”, by the World Bank. Available at: <https://openknowledge.worldbank.org/handle/10986/23800>

**Figure 12** China Railways Corporation Rail Revenue and Expenditure 1990-2015 (Billion RMB)

	1990	1995	2000	2005	2010	2015
<b>Revenue</b>						
Passenger	11	20	37	62	135	251
Freight (excluding RCF)	27	36	54	110	200	231
Parcels/mail	1	2	4	5	50	56
Other	2	7	16	31	N/A	N/A
Subtotal	41	65	111	207	384	538
RCF	0	35	38	48	65	46
Total Transport Revenues	41	100	149	255	449	584
Business Taxes	2	3	6	12	21	7
Revenues (excl. RCF)	39	62	105	196	363	531
Revenues (incl. RCF)	39	96	143	243	429	577
<b>Expenditures</b>						
Working Expenses	21	57	85	156	299	562
Depreciation	5	7	16	26	71	110
Total Operating Expenses	25	64	101	183	370	672
<b>Profit</b>						
Total Profit after Tax (excl RCF)	14	-3	4	13	-6	-142
Total Profit after Tax (incl RCF)	14	32	43	61	59	-95

Note: Pre-2013 are financial statements for the commercial rail operations of MOR (China Rail); post-2013 are CRC rail operations. Figures exclude any government subsidies



Source: CRC Financial Statements

The study suggests that CRC can: (a) expand its financial sources through organizing and managing its subsidiary entities to maximize their value and the generation of cash; (b) potentially apply PPP concepts through land value capture and integrated land development; (c) capture its right-of-way value through telecommunications services; (d) raise new equity through IPO of profitable and well governed subsidiary entities; and (e) leverage financing from the railway's large fixed asset base.

## 5 Conclusions

### 5.1 Overall Sector

Centralized railway sector administration has been effective in developing China's rail transport industry. First, MOR-administered RRAs execute railway network management and train operation with consistently high discipline and efficiency. Second, for years, MOR has successfully delivered the biggest railway system development program in the world. Even after the 2013 reform, activities remained

centralized within MOR and CRC. A single point (or, more recently, two highly inter-related points) of concentrated responsibility, authority, and financial resources has been critical to managing rapid and comprehensive development of a long-term national program.

China illustrates the benefits of high traffic density for network and service economics and overall financial sustainability. Government policies have achieved some sector governance reforms recommended in this toolkit: (i) the fundamental separation of policy and regulatory functions from commercial functions; (ii) separating non-core functions and ancillary businesses; (iii) improving the commercial responsibilities and incentives for RRAs; (iv) increasing private sector participation, such as the two specialized coal transport companies (Shenhua and Daqin); and (v) creating many joint-venture railways to attract external capital. Nevertheless, to date little capital has been purely private; most came from provincial governments and state-owned enterprises. Competition between railways is not encouraged—either between existing regional railway administrations or between those administrations and new train operating companies. Little business separation has occurred within CRC; regional/functional management structures dominate.

MOT (formerly MOR) has been impressive as policymaker and regulator, embracing and encouraging value-adding railway technologies throughout the industry in construction, maintenance, operations, and management. An equally impressive network of state-sponsored railway institutes, specialist universities, testing facilities, and laboratories provide capacity to adopt international best practice and create custom-designed technologies and processes to solve operating challenges specific to China.

## 5.2 *Notable Management Initiatives*

The supply side of the industry is still heavily state-administered and regulated, but increasingly, all facets of China's transport demand are being shaped by market forces. These include freight and passenger transport types; demand volumes; geographic distribution of demand; and modal allocations of traffic. The Government has long recognized that railways must develop a market-oriented approach to customer service, become more competitive with ever-improving road and air transport, and adopt commercial management principles. In part, railway managers have responded to these pressures within the existing institutional framework. CRC managers have responded to competitive pressures by pursuing some management initiatives described elsewhere in this toolkit. The main initiatives are summarized in Figure 13.



**Figure 13** Selected Examples of Management Approaches Applied in China

Principles	Examples of Application
Market segmentation	Established specialist companies to run some major coal lines and organize rail container services, express small freight and special freight
Labor restructuring	Directly increased railway labor productivity by 6-7 percent annually for last 20 years; extensive training in management and operation of new and locally-adapted rail technologies
Equipment utilization	Continuously improved asset utilization in all classes.
Traffic financial performance	Adopted Traffic Management Information System (TMIS) to provide data that facilitate detailed traffic costing (this is not yet done routinely).
Passenger market pricing	Increased the number of market-based pricing exceptions in the passenger sector, such as for high-speed rail services, though most prices remain heavily regulated.
Efficiency of train operation	Progressively increased average axle load; larger trains; specialized high-capacity wagons; block trains; double-stack container capability.

### 5.3 Future Challenges

The Mid- and Long-Term Railway Development Plan has successfully confronted the challenge of infrastructure development. The Plan involves risks—primarily the risk to CRC's financial sustainability, associated with the debt incurred while developing the high-speed rail network. Demand and supply conditions in China for high speed rail are very favorable. However, as it proceeds, China will need to closely monitor the level of railway debt arising from the program. Payback periods for high speed rail will necessarily be longer term for such 'lumpy' and long-lived assets. China will have to ensure that the scale of support for the high speed passenger network does not result in sacrificing other key elements of the Plan.

Government policy and regulatory functions have now been separated from the commercial functions of railway operating entities. It will be interesting to watch whether CRC is given the regulatory freedom to transition into a more commercially-oriented enterprise and to begin to fully embrace private sector involvement. Developing a more diverse and pluralist railway industry based on market principles implies a need for such institutional reforms. It may be difficult to convince external investors in new rail entities that their rights will be protected and obligations fairly administered if MOT and NDRC control entry to the playing field, set the rules, referee the game, and manage the opposing team. This issue is not straightforward, nor is it a matter just of splitting existing Ministerial functions, although the 2013 reform is certainly a big step in the right direction. In the coming years, the industry will require rigorous policy and institutional analysis that would deliver good sectorial and corporate governance of state railway entities, while maintaining implementation effectiveness for the long-term railway development program.