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Toward greener and more sustainable freight rail

Comparing freight rail systems and services in the United States and China

ZHENYING SHAO, TIANLIN NIU, JUNHENG YAN

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International Council on Clean Transportation
1500 K Street NW, Suite 650
Washington, DC 20005

communications@theicct.org | www.theicct.org | @TheICCT

EXECUTIVE SUMMARY

China has invested in modal shift strategies—including road-to-railway and road-to-waterway—to address the country's heavy reliance on road shipping along with growing freight activity. As shown by previous ICCT analysis, there is significant potential for China's rail system to be the backbone of freight activity. This report reveals the opportunities and challenges facing China's freight railway in better accommodating the shipping needs of various products, based on a comparison with the freight railway in the United States.

The U.S. rail system, comprised primarily of six privately owned Class I railroad companies, has adapted to become a more efficient and effective freight system. Railway activity—in terms of ton-miles of freight hauled—has increased over 2.5 times in the past 60 years, even though the track length has been reduced by about half. This is reflective of a more efficient network. At the same time, the average hauling length has increased, indicating the critical role of U.S. railway in long-distance shipping. The number of locomotives and freight cars in operation has also decreased while accommodating increased freight activity, indicating higher weight loads on each train. The system has adapted service to meet the decreasing need for shipping bulk products and the increasing demand for intermodal shipping. In addition, the U.S. rail system is required to report its operational and economic information regularly to enable close tracking of performance.

China Railway, a government-owned enterprise, has experienced rapid growth in recent decades, with freight activity increasing almost threefold in the past 30 years. China has made substantial investments in rail infrastructure and rolling stock, resulting in a strong increase in locomotives and railcars, in addition to track length. However, the average hauling length has decreased slightly, possibly due to an improved network resulting from the building of more railyards and stations.

As the rail system in China seeks approaches to improve its overall service and operation, and to reposition itself as the backbone of the freight system, the experiences of the United States could provide valuable insights. The upgrade of infrastructure, facilities, and equipment could be an approach to boost capacity in the rail system, including longer receiving and departure track length and heavier track axle loads. In addition, we identified that China could take proactive measures to upgrade shipping capacity and service, along with assessments of the potential use of intermodal transportation for select high-value commodities. In addition, data collection is essential for establishing a robust foundation for research and policy formulation.

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INTRODUCTION

Freight activity in China has increased significantly over the past decades. The freight system hauled over 50 billion tons of commodities and achieved 23 trillion ton-kilometers of activity in 2022 (Ministry of Transport, 2023). Freight demand is expected to increase 2.3% annually over the next 5 years (Ministry of Transport, 2021a). Trucks have dominated freight transport since 2008, hauling about 70% of total freight (by weight) in 2022 (Ministry of Transport, 2023). The heavy reliance on trucking not only adds burdens on the road system, resulting in increased congestion and safety issues, but also increases carbon and criteria pollutant emissions from diesel-powered heavy-duty vehicles, leading to severe climate, air quality, and public health concerns.

To achieve a green, sustainable freight system, China has invested in modal shift strategies, including road-to-rail and road-to-waterway, aimed at reducing reliance on road shipping (Shao et al., 2022). However, even with the enactment of multiple central and sectoral policies intended to shift freight to rail and waterway, growth in hauling by rail remains slow; most growth has resulted from the transport of heavy, bulk products.

The optimization of China's freight railway—to efficiently transport the increasing demand for higher-value products—remains a complex puzzle yet to be solved. Currently, 50% of the products hauled by rail are coal, while the rest are mostly minerals and petroleum products (National Bureau of Statistics of China, 2022). As China accelerates toward the country's carbon neutrality targets, the demand for coal and other minerals primarily used in heavy manufacturing is poised to decline, paralleled by a rising demand for higher-value commodities.

To help unlock the full potential of China's rail system in hauling higher-value products, this study provides an overview of the development of the freight rail systems in the United States and China. By comparing key elements of the two systems, we aim to identify the opportunities and challenges facing China's freight railway in this transition phase. This work highlights the experiences and lessons learned to provide support for China's railway planning efforts and guide strategic upgrades to the freight system.

This study is part of an ongoing series on advancing the transition toward a greener and more sustainable freight system. Our previous analysis found significant potential for China's rail shipping based on a comparison with the United States on freight market and strategies (Shao et al., 2022). This study provides a deeper comparative analysis focused specifically on freight railways. The experience of the U.S. system in optimizing its infrastructure, equipment, and service could provide relevant information for China's efforts to better position rail in the changing freight market.

The study is based on the most reliable and representative data available, including from the U.S. Bureau of Transportation Statistics (BTS), the U.S. Freight Analysis Framework (FAF), the Association of American Railroads (AAR), China's National Bureau of Statistics Yearbook, and direct communication with key experts. However, data gaps still exist, particularly for China, highlighting a need to prioritize surveys and analysis to help understand freight characteristics and commodity flows.

BACKGROUND

China began promoting the use of railways in 2017 with the initiation of the country's shipping structure strategy (Shao, 2020; Shao et al., 2022). The strategy's initial focus was shifting the transport of heavy, bulk products, specifically coal and iron ore, from trucks to rail. As a first step, coal products were not allowed to be shipped into and out of the ports of Tianjin, Tangshan, and Huangye by truck. In 2018, the State Council, national ministries, local governments, and key enterprises formulated a series of policy documents on transport structure adjustment. The adjustment targeted moving more material by rail and waterway, and more use of intermodal transportation, with the goal of a 10% increase in tonnage shipped by rail by 2025 from the 2020 level (Ministry of Transport, 2021b).

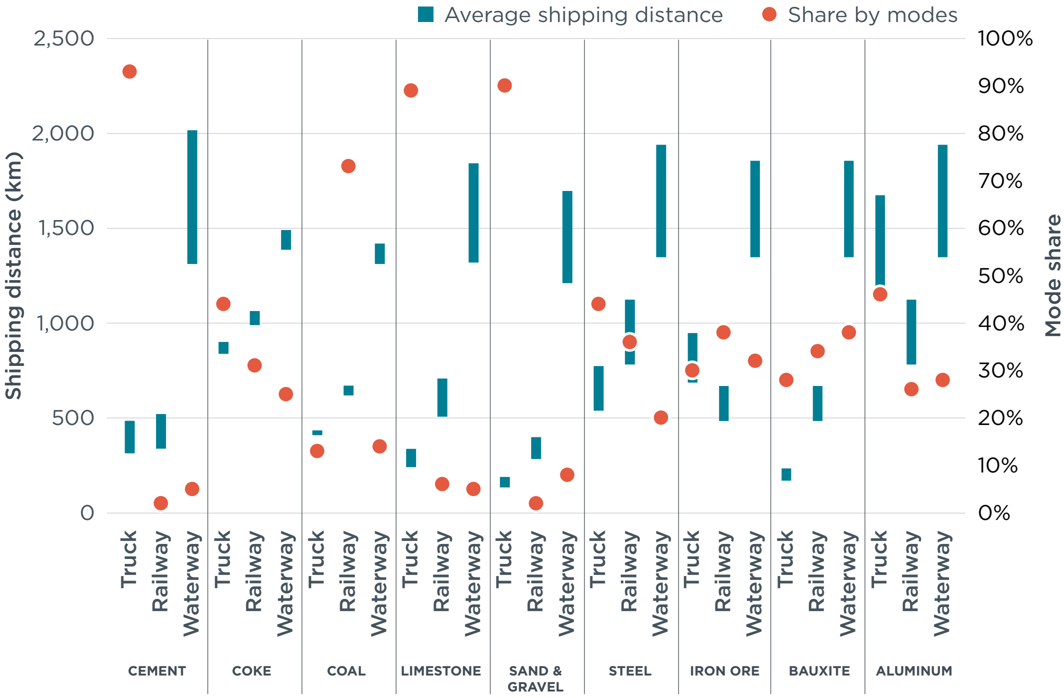
China Railway's Key Shipper Strategy prioritizes the shipping demands of heavy, bulk products. These key shippers handle over 1 million tons of goods or have contracts with over ¥50 million in shipping fares annually. There are currently about 1,000 prioritized shippers, representing about 80% of freight hauled in China's rail system. China Railway offers customized contracts with prioritized services, flexible schedules, and competitive prices in return for a commitment to using the railway.

China Railway has upgraded its network and capacity to accommodate the shipping of heavy, bulk products. For example, the Datong-Qinhuangdao Railway was designed to offer railcars with capacities of up to 80 tons, the maximum capacity the China Railway can carry with a track axle load of 27 tons. The trains also depart at a frequency of every 10–15 minutes to meet the needs of coal shipping (People's Daily, 2010). The government further aimed to build industrial rail spurs connecting major industrial and mining enterprises with annual shipping needs of over 1.5 million tons (National Development and Reform Commission, 2019).

A recent analysis of the freight market identified trucks as the dominant shipping mode for six of the top nine essential bulk products (Chinese Academy of Environmental Planning, 2022). Figure 1 summarizes the mode shares of these products (dots) and average hauling ranges (bars). Transport of coal was the exception, with rail used for more than 70% of shipping needs. For most of the products, trucks were preferred over rail even for longer distances. For iron ore and aluminum, the average shipping distance by rail was even shorter than that of trucks. However, waterway claimed the longest average shipping distances for all products.

Figure 1

Shipping modes for the top nine bulk products in China



Data source: Chinese Academy of Environmental Planning (2022)

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While Figure 1 confirmed the effectiveness of the adjustment in shipping structure strategy, with rail becoming the preferred shipping mode for coal, it highlights that policy measures and strategies are needed to promote rail for the shipment of other goods. The average shipping distance for trucks and railways is somewhat consistent across all commodities, indicating a significant gap in the use of the rail system for long-distance hauling. Trucks carried almost half of all aluminum, for example, at an average shipping distance of over 1,200 km. The average shipping distance of aluminum by rail was between 792 and 1,124 km. Rail had the lowest share among all three shipping modes with 26% of aluminum transported.

While the predominant focus of the rail system is currently the transport of heavy, bulk products, the central government has promoted intermodal shipping for over a decade. The promotion of rail-to-water transport began in 2011, with the launch of six intermodal corridor pilot projects (China Waterborne Transport Research Institute, 2021). Subsequent efforts at the national level have included additional intermodal pilot projects. Recently, the Ministry of Transport announced a goal of reaching an annual growth rate of over 15% for container rail-to-water intermodal shipping between 2021 and 2025 (Ministry of Transport, 2021b).

China has further invested in infrastructure to enhance the efficiency of railway intermodal shipping, including building 18 container hubs, hundreds of logistic centers, and almost 8,500 railway spurs connecting industries, logistics parks, and ports (National Development and Reform Commission, 2016). The government also aims to build industrial rail spurs connecting major ports and new logistics parks (National Development and Reform Commission, 2019). About 127 new rail spurs were built in 2020 to meet this goal, and an additional 166 are planned by 2025 (National

Development and Reform Commission, 2021). However, utilization remains very low for at least one-third of the over 8,800 rail spurs, which span a track length of more than 30,000 km.[1] This poses notable challenges and concerns regarding effective maintenance and operation.

It remains unclear on how rail could better accommodate the shipping needs of various products in the freight system. Information is scarce on the impacts of policies promoting rail for heavy, bulk products and intermodal shipping. It is also uncertain whether rail has fully utilized the capacity to accommodate additional shipping demand from other types of products. However, with the demand for heavy, bulk products expected to be reduced in the future, the rail system also needs to plan for accommodating other goods. Thus, China's rail system is facing the challenges of taking on a larger share of shipping of heavy, bulk products while also setting up a long-term strategy for the evolving shipping market.

COMPARISON OF RAIL SYSTEMS IN THE UNITED STATES AND CHINA

This section provides an overview of the U.S. and China rail systems and compares selected parameters to represent capacity, efficiency, and service quality. The main purpose of the comparison is to understand how U.S. railroads have adapted to become the backbone of the freight system. This section also briefly describes the regulatory bodies in both countries and their respective responsibilities in the rail system, mainly focusing on data reporting and long-term strategy development.

OVERVIEW OF THE U.S. RAIL SYSTEM

Over 620 freight railroad companies operate in the U.S. freight rail system. These railroads are categorized by the Surface Transportation Board into three classes based on revenue; the revenue thresholds change annually to accommodate inflation (Railroad Companies, 2024).[2] Class I includes freight railroads with annual operating revenues above the 2022 threshold of $1.03 billion (Federal Railroad Administration, 2024a). These long-haul railroad companies typically operate with as few stops as possible. Class II, or regional railroads, have 2022 revenues of $46.3 million and $1.03 billion. Class III freight railroads have revenues of less than $46.3 million (Surface Transportation Board, n.d.-b). They typically operate short-haul routes. Class II and Class III railroads provide connections between Class I railroads and customers, performing first- and last-mile delivery by grouping smaller shipments on one train (Genesee & Wyoming Inc., n.d.). In addition to the classes above, switching and terminal railroads operate in ports and industrial areas to transfer freight between larger railroads.

Our analysis focuses on the six Class I railroads in the United States, presented in *Table 1*. Class I railroads account for roughly 70% of U.S. freight rail mileage, over 90% of revenue, and about 40% of long-distance freight activity (Association of American Railroads, n.d.-b). Class I railroads own and maintain more than 140,000 miles (225,000 kilometers) of track across multiple states. BNSF and Union Pacific

1 Estimated based on a survey with China's railway experts.

2 The revenue threshold of the railroad classes was first set in 1992. Class I railroad companies were those with revenue greater than $250 million per year, Class II were those with revenue between $20 million and $250 million per year, and Class III were those with revenue less than $20 million per year. The threshold of revenue changes every year based on inflation.

operate have the most track, mostly west of the Mississippi River. Norfolk Southern and CSX operate on the East Coast. Canadian National connects the Midwestern United States and Canada. Canadian Pacific Kansas City, formed by the merger of Kansas City Southern and Canadian Pacific in 2023, runs from southern Mexico to northwestern Canada.[3] The rail companies, which build and maintain their respective tracks, collaborate through bilateral agreements to perform interchange services to ensure the smooth flow of freight over the entire rail network.

Table 1

Revenue and track miles for the six Class I railroad companies in the United States

Region	Company	Revenue in 2022 (billions)	Track network (thousand miles)
West	**BNSF**	$25.8	~32.5
	Union Pacific	$24.9	~32.1
East	**CSX**	$14.9	~20.0
	Norfolk Southern	$12.7	~19.5
North and South	**National**	$17.1	~19.5
	Canadian Pacific-Kansas City	$6.8	~20.0

Data sources: BNSF Railway Company (2024); Union Pacific (n.d.); CSX Corporation (n.d.); Norfolk Southern Corp. (n.d.); Canadian National Railway Company (n.d.); Canadian Pacific Kansas City (n.d.)

KEY REGULATORY AUTHORITIES

The U.S. freight rail system is regulated at the federal level to ensure efficient, safe, and clean freight movement. The section below lists the major agencies at the federal level responsible for regulatory oversight of the rail system. State-level agencies also often work with railroad companies and federal agencies to ensure the implementation of these policies and measures.

The **Surface Transportation Board (STB)** oversees the economic regulation of the freight rail industry, although many regulatory restraints were removed after the Staggers Rail Act of 1980 (Palley, 2011). This independent federal agency regulates and settles disputes involving rates, construction, mergers, and line sales and abandonment. Adopted in 2016 and implemented in 2017, the United States Rail Service Issues–Performance Data Reporting rule requires Class I railroad companies to file weekly performance reports to the STB (United States Rail Service Issues, 2016). Since then, the STB has collected economic and service data from railroad companies and generated reports, studies, and databases for public access (see Appendix A). The agency also releases cost-related information and contract summaries for agricultural commodities.

The STB collects and releases Carload Waybill Sample data, presenting rail traffic volumes and flows from railway companies with 4,500 or more revenue carloads annually (Surface Transportation Board, n.d.-a). Starting in 2021, railroads are required to report a sample rate of 20%, a considerable increase from the previous sample rate of 2.5% (Waybill Sample Reporting, 2020). The Carload Waybill Sample database provides Class I railroad data on cars, revenues, miles shipped, equipment type and

3 On March 15, 2023, the Surface Transportation Board approved a merger between Canadian Pacific Railway and Kansas City Southern Railway, resulting six Class I railroads.

owner, and shipment size. Because the information in the Carload Waybill Sample contains sensitive shipping and revenue information, STB shares different levels of information and detail with different types of users.[4] In addition, the STB releases a publicly accessible database on an annual basis with anonymized information, which is valuable for various analyses. For more information on the Carload Waybill Sample data, see Appendix C.

The Federal Railroad Administration (FRA) within the U.S. Department of Transportation is the main authority working on safety and network development for both freight and passenger rail. The staff at FRA are responsible for regulations and inspections concerning railroad safety. The agency also works with railroad companies and other stakeholders on network planning and improvement, offering various grants and loans. For example, the recent Bipartisan Infrastructure Law provides FRA with about $102 billion in funding over the next five years to improve the U.S. rail system (Federal Railroad Administration, 2024b). However, most of the funding will support the development of passenger rail instead of freight.

The U.S. Environmental Protection Agency (EPA) has the authority to regulate criteria pollutants and GHG standards for new and remanufactured locomotives. Tailpipe emission standards were first issued in 1998. The latest standard, Tier 4, was adopted in 2008 and implemented in 2015 (U.S. Environmental Protection Agency, 2024). Although the agency does not require the control of in-use GHG emissions, it does require the reporting of these emissions from locomotives in the United States.

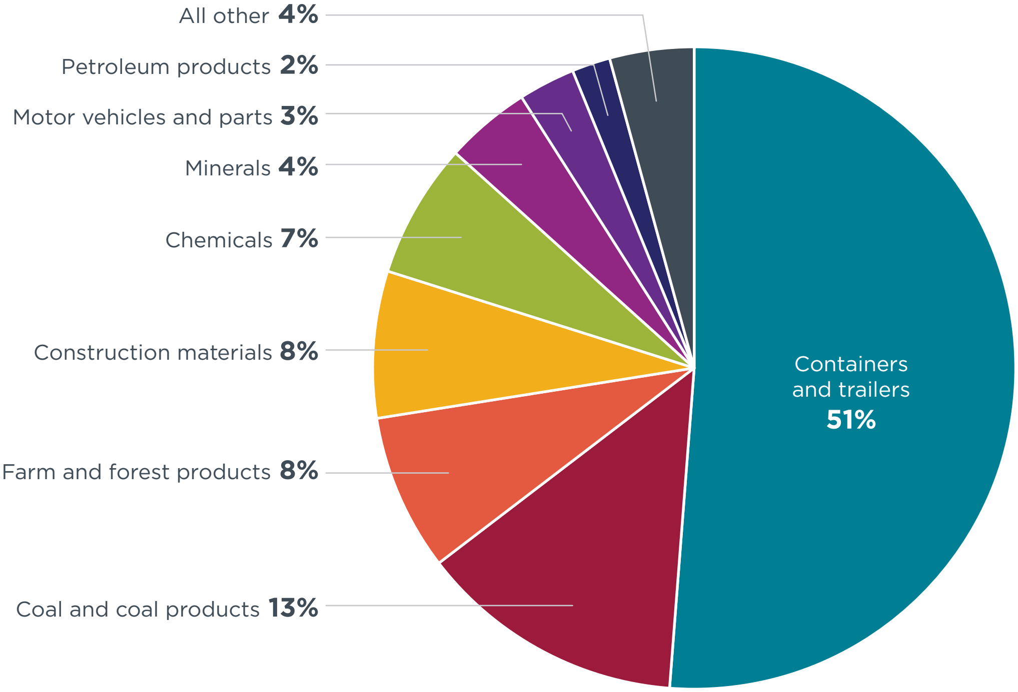
In addition to federal efforts to reduce emissions from new and remanufactured locomotives, some state agencies can regulate the in-use fleet—targeting how the fleet operates in the state—through authority granted by the Clean Air Act, if the state rule is approved by the EPA. For example, the **California Air Resources Board (CARB)** recently adopted an In-Use Locomotive Regulation, which requires switch, industrial, and passenger locomotives built after 2030 and line-haul (Class I) locomotives built after 2035 to operate with zero-emissions in the state (California Air Resources Board, 2023). CARB further set an age limit of 23 years for locomotives operating in California to accelerate the turnover of old diesel engines used in the sector (California Air Resources Board, 2023). Other states could follow California's approach to manage the emissions from locomotives operating within their borders.

FREIGHT SERVICE

The railroad companies, including Class I railroads and short lines, and other rail stakeholders have coordinated to create a competitive freight shipping system over time. About 2.5 trillion ton-km (1.5 trillion ton-miles) was shipped by rail in 2020, accounting for about one-third of U.S. freight activity. The commodities hauled by rail cover a wide variety of types, as shown in Figure 2, including over 3 million carloads of coal, 1.9 million carloads of chemicals (plastics, fibers, drugs, and soaps), 2 million carloads of construction materials (steel, stone, sand, and gravel), 0.8 million carloads of motor vehicles and parts, 2.1 million carloads of farm products, and about 14 million units of container and trailer shipments (electronics, home goods, and clothing) (Union Pacific, 2021). The container and trailer shipments were mostly for intermodal transport, based on the service data from the STB.

4 The five classes of users are defined as: 1) railroads, 2) federal agencies, 3) states, 4) transportation practitioners, consulting firms, and law firms in specific proceedings, and 5) other users.

Figure 2
Freight traffic on U.S. Class I railroads, 2021



Note: Carloads (shown here by type of commodity hauled) accounted for 49% of all freight traffic. Intermodal units (containers and trailers) accounted for 51% of traffic.
Data source: Association of American Railroads (2023)

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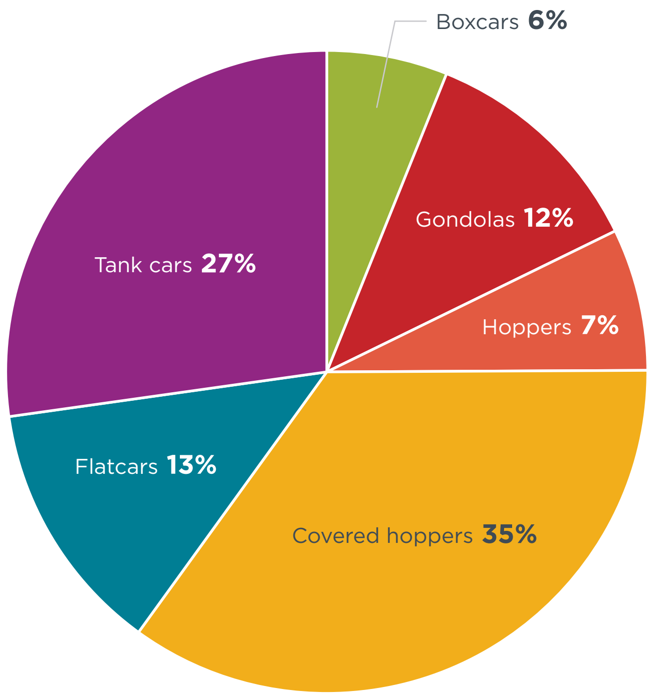
Consistent with the commodities hauled, the approximately 1.6 million railcars in the fleet are mostly covered or uncovered hoppers, tank cars, flatcars, and gondolas, as shown in Figure 3. Hoppers are used mostly for dry bulk commodities, including stone, sand, agricultural products, and coal. Tank cars are typically used for compressed or liquid commodities. Boxcars are for crated or palletized freight, such as paper, packaged goods, and beverages. Flatcars and gondolas carry large commodities, including machinery, tractors, pipe, lumber, and logs. In addition, well cars (not included in Figure 3, about 130,000 in total) haul intermodal containers with a wide variety of goods, such as electronics and refrigerated products.

Figure 3
U.S. Class I railcar fleet, 2019



Data source: Statista Research Department (2023)

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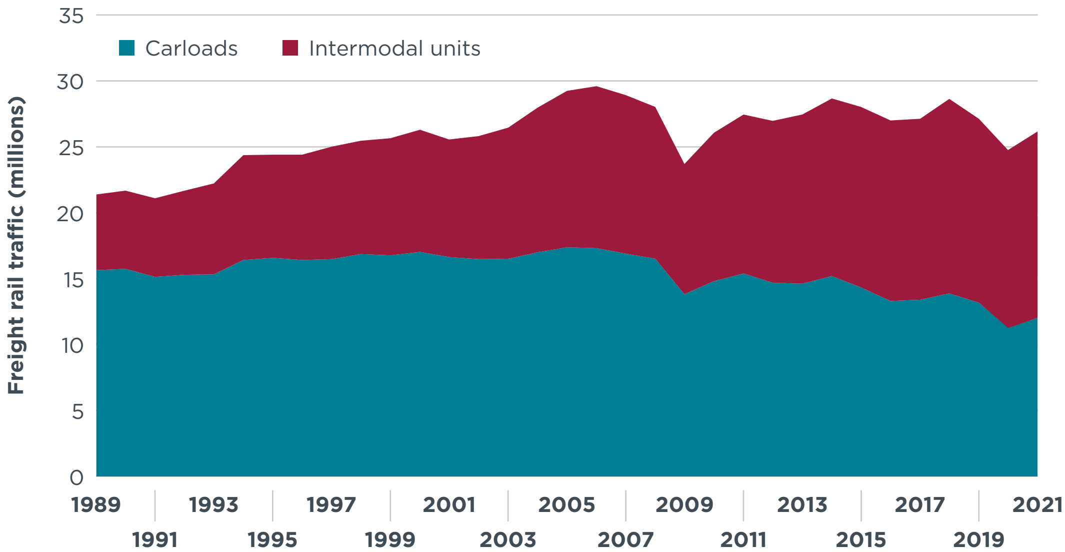
INTERMODAL SHIPPING

One reason for the success of U.S. freight rail development is that the system has adjusted service to accommodate changing shipping needs. This includes embracing intermodal transport to compensate for the reduced demand for heavy, bulk commodities. U.S. rail intermodal volume surged from 5.6 million containers and trailers in 1990, to 9 million in 2000, 11.1 million in 2010, and a record 14.5 million in 2018 before falling slightly to 14.1 in 2021 (Association of American Railroads, 2020). Intermodal volume was 13.5 million units in 2022, accounting for almost 30% of railroad revenue and ranking first in revenue by traffic segment (Association of American Railroads, 2023). In 2021, about half of the freight rail traffic in the U.S. consisted of intermodal units, as shown in Figure 4. These shipping containers hold consumer goods and other miscellaneous products (Federal Railroad Administration, 2020). About half of the intermodal shipping volume was imports or products bound for export. The cost-effectiveness and environmental and social benefits of intermodal shipping have made it the fastest-growing segment in U.S. freight rail transport (Brown & Hatch, 2002).

Figure 4

U.S. Class I railroad traffic by type, 1989–2021



Data source: Bureau of Transportation Statistics (2024)

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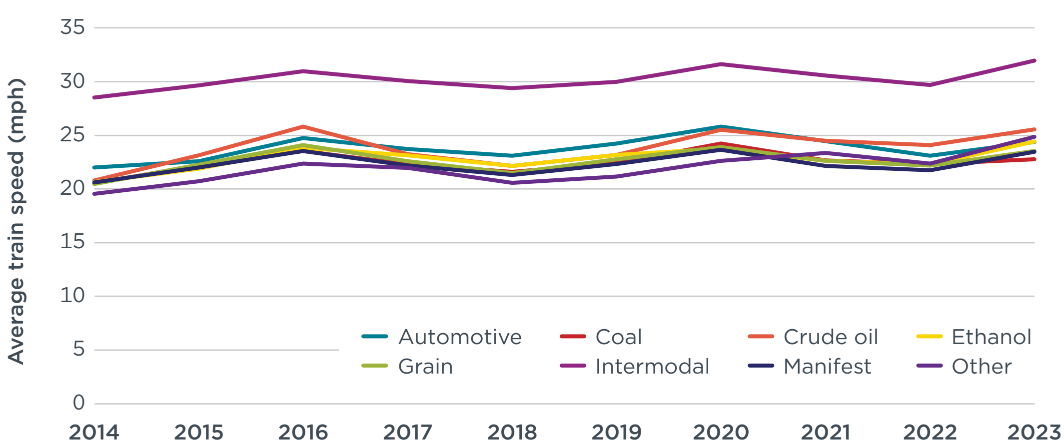
Improvements in facilities and infrastructure have continuously enhanced freight rail capacity and intermodal service (Brown & Hatch, 2002). For example, the higher speed of intermodal transport presents a measure of improved service from railroad companies facing declined shipping needs from coal and other bulk products. The average speed of intermodal trains is over 30 miles per hour to better accommodate time-sensitive, high-value shipping (Figure 5). In contrast, the hauling speeds of other products, including coal, farm products, and motor vehicles, are around 20 to 25 miles per hour. Containers loaded on intermodal trains also normally share the same destinations, making it strategically unnecessary to stop along routes.

Figure 5

Average train speed in the United States by commodity



Data source: U.S. Department of Agriculture (n.d.)

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Federal and state governments have supported U.S. railroads in developing and enhancing intermodal service with intermodal connector projects to improve railway usage and freight efficiency. The Transportation Equity Act for the 21st Century (TEA-21) first highlighted the importance of developing intermodal connectors (Federal Highway Administration, 2017). The Department of Transportation conducted a Freight Intermodal Connectors Study in 2017. The *National Freight Strategic Plan*, released in 2020, includes a focus on improving the U.S. intermodal freight system (U.S. Department of Transportation, 2020). The plan prioritizes federal support for projects that improve intermodal connectivity and enhance freight flows.

Railroad companies have invested in intermodal connectors at about 200 terminals to improve the transfer of containers and trailers between railcars and other modes (Federal Highway Administration, 2020). Railroad companies have also invested in capacity at both rail-to-truck and seaport terminals to enhance intermodal service (American Association of State Highway and Transportation Officials [AASHTO], 2018). In 2020, there were about 200 intermodal container terminals in the United States, accounting for about 10% of all rail terminals (Rodrigue, 2024). Most of them are located close to a railroad's main line to allowing timely and seamless access to maintain rail schedules (Prince, 2013). These terminals tend to be large and located in key economic centers to boost efficiency (International Union of Railways, 2009). About 20 terminals are located on or near seaport docks to enable direct hauling from ports (Rodrigue, 2024). The clearance along the track and loading gauge in the terminal is raised to allow double-stack trains for more efficient container hauling.

Railroad companies have offered diverse solutions and extended connections to accommodate the different needs of heavy bulk products and intermodal shipping. For those shipping many large loads (mostly bulk products), railroad companies collaborate with industry and other stakeholders to build or revitalize spur tracks. For others, mostly involving intermodal shipping and transloading, railway companies work with logistics companies to provide smooth access to the railroads.[5] In addition, investments in rail corridors have enhanced the cost-effectiveness of intermodal transport. These corridors, with raised clearance for double stacking, are normally more than 700 miles long and serve highly congested metropolitan areas and highway routes (Casgar et al., 2003). Although total infrastructure investment could add up to billions of dollars, corridors with sufficient rail volume for full intermodal trains offer economic returns and public benefits.

Railways have closely collaborated with other companies to adapt to the growing needs of just-in-time logistics, including the trucking industry. For example, J.B. Hunt Transport Services Inc., one of the largest trucking companies in the United States, has partnered with BNSF to provide pick-up at rail terminals for first- and last-mile delivery service (We Build Value Digital Magazine, 2020). A similar approach has been applied to equipment management, as many railroads have outsourced railcar management to a third party, particularly flatcars and well cars used for intermodal shipping. The approach standardizes the equipment used and reduces costs for rail companies and shippers (AASHTO, 2018). The approach further paves the way for implementation of double-stack wagons because it does not require investments by individual railroad companies, which doubles container shipping productivity.

5 With transloading, products are loaded from trucks directly to railcars, while with intermodal, products are transferred between trucks and railcars in the same containers or trailers.

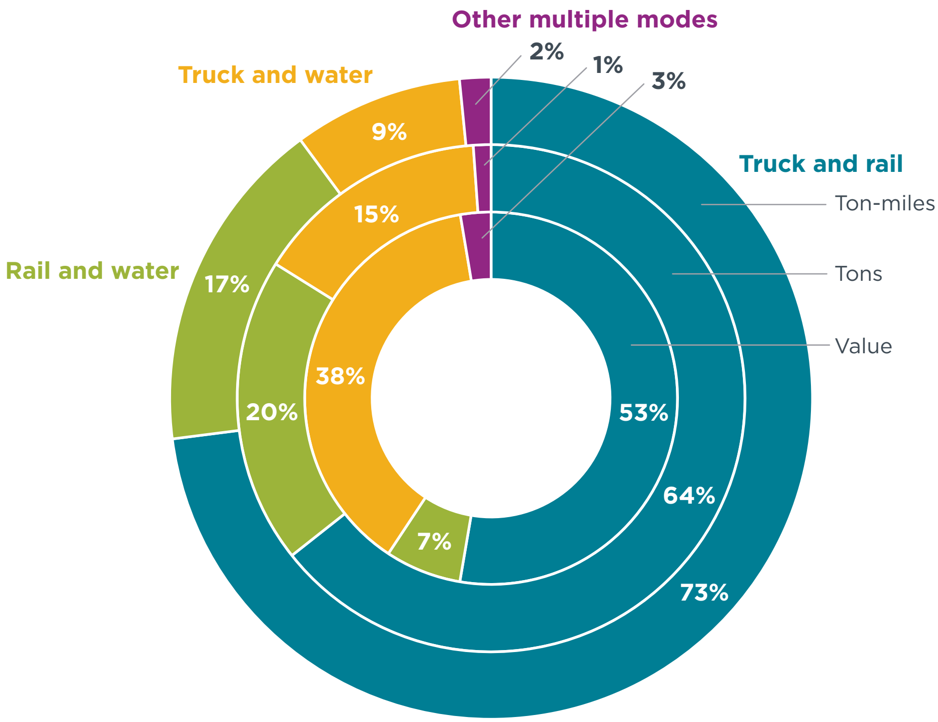
The U.S. freight rail system prioritizes intermodal shipping with enhanced shipping efficiency. Class I railroads treat intermodal shipping as a premium service, offering faster shipping speed compared to other commodities, as shown in Figure 6 (AASHTO, 2018). The average speed of trains performing intermodal shipping reached over 32 miles per hour, around 40%–50% percent higher than other products, and the on-time rates are much higher than those of other services (AASHTO, 2018). As a result, intermodal shipping, particularly for long-haul movement, has become the fastest-growing rail traffic segment over the past 25 years (Association of American Railroads, n.d.-b).

U.S. railway intermodal shipping patterns

Shipping patterns in the United States confirm that rail has increased involvement in intermodal shipping. As shown in Figure 6, truck and rail have contributed to about 53% of the intermodal shipping value, 64% of intermodal shipping weight, and 73% of intermodal shipping tons per mile traveled in 2017, much more than other intermodal approaches. In addition, rail and water also play an important role in intermodal shipping, as rail and water were responsible for almost 40% of the total value and 15% of the weight share in 2017.

Figure 6

U.S. freight activity by type of intermodal shipping, 2017



Data source: Bureau of Transportation Statistics (n.d.)

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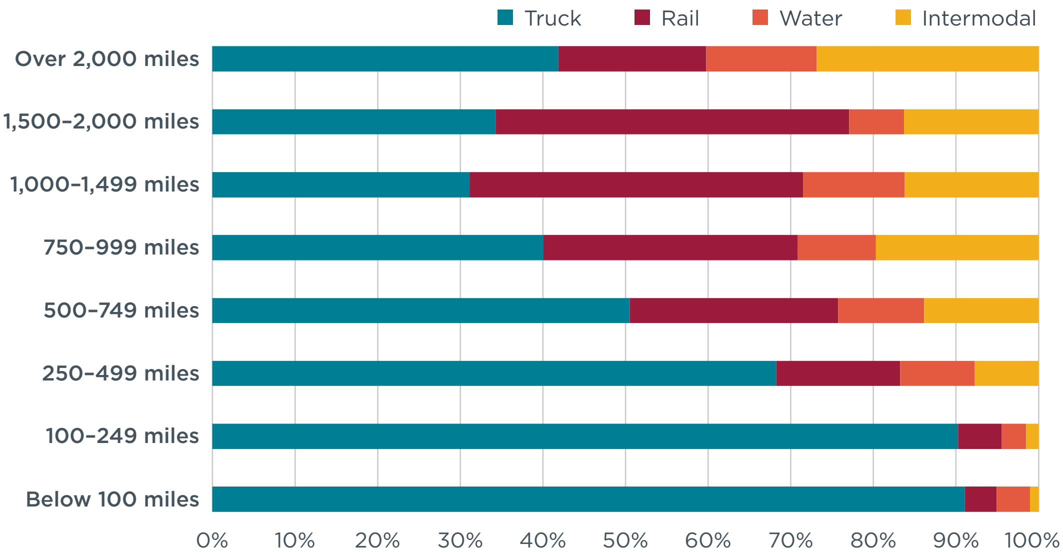
U.S. railroads and intermodal service have become key elements in the freight system, particularly for long-distance shipping. Among all surface shipping modes, rail performs the majority of longer-distance hauling, as indicated in Figure 7. While trucks dominate shorter-distance shipping of less than 250 miles (~402 km), rail leads in shipping for distances over 500 miles (~805 km). Intermodal shipping also has a significant presence, especially for distances of over 2,000 miles (~3,219 km).

Figure 7

Shipping share for different distance bands by mode, 2021



Data source: Oak Ridge National Laboratory (n.d.)

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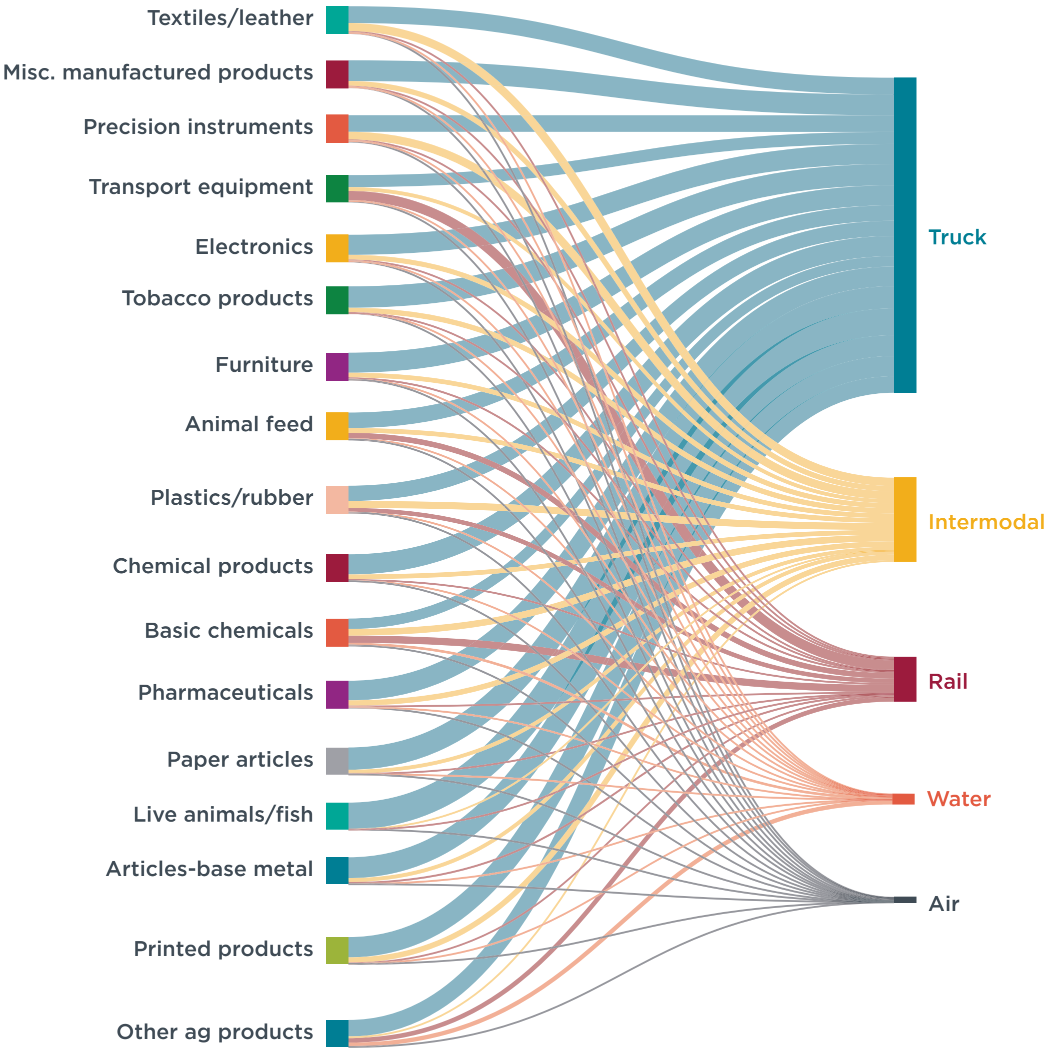
The U.S. rail industry and its intermodal connections have been used for almost all types of commodities, particularly for long-distance hauling. Figure 8 highlights the shipping activity (ton-mile) share by mode for commodities with an average shipping distance of over 500 miles. The commodities are listed in order of average shipping distance, with textiles/leather having the longest shipping distance (~1,064 miles) and other agriculture products having the shortest shipping distance (~505 miles) (Bureau of Transportation Statistics, 2016). Each of the flows represents the percentage share in freight activity (ton-mile) for the product by shipping mode. Although trucking still made up a large share of activity, railroads and intermodal shipping have played a competitive role in higher-value products such as textiles/leather, precision instruments, transport equipment, plastics/rubbers, electronics, and pharmaceuticals.

Figure 8

U.S. shipping patterns for commodities with an average shipping distance of over 500 miles, 2020



Data source: Oak Ridge National Laboratory (n.d.)

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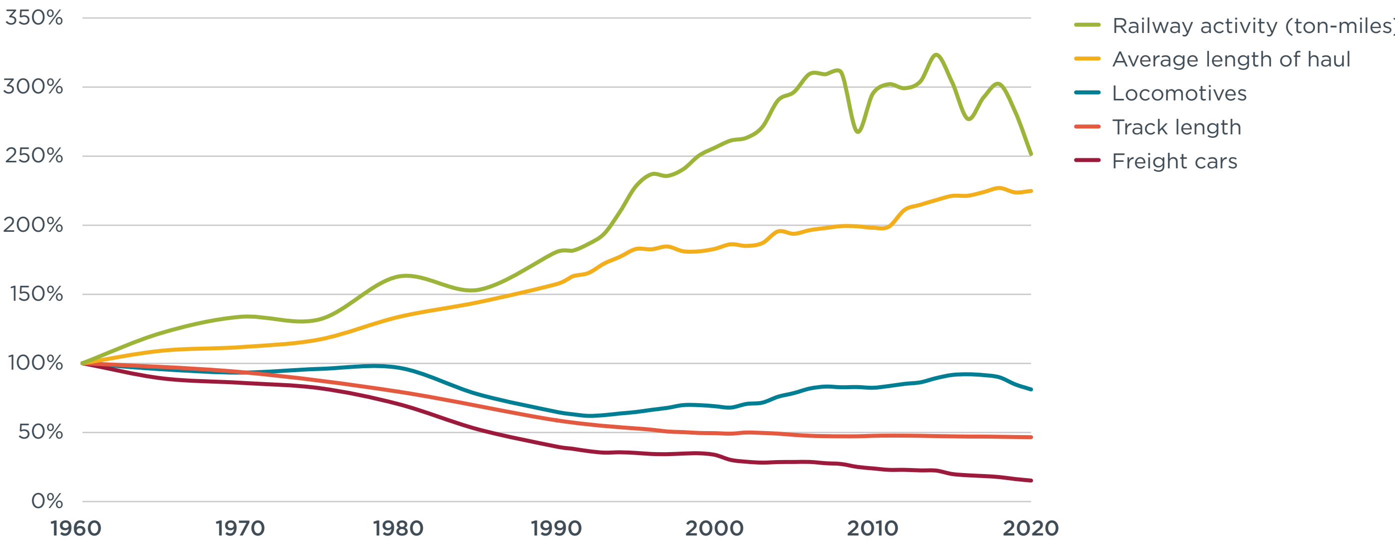
In summary, U.S. railroads have adapted to become more efficient and effective in the freight system. Rail activity has increased over 2.5 times in the past 60 years, with some fluctuations in recent decades, even though total track length has been reduced by about half, illustrating a more efficient network (Figure 9). At the same time, the average hauling distance has increased, indicating the critical role of the U.S. rail network in long-distance shipping. While the number of locomotives and freight cars has decreased, rail ton-miles have been increasing, which indicates more freight weight loaded on each train. In addition, the rail industry has adapted service to meet the decreased shipping need for bulk products and increased intermodal demand.

Figure 9

Evolution of the U.S. freight rail system, 1960–2020



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OVERVIEW OF CHINA'S RAIL SYSTEM

China State Railway Group Co., Ltd. (China Railway) oversees the railway system in China. The company, established with the approval of the State Council, is a state-owned company managed by the central government. China's railways were originally managed by the Ministry of Railways. In 2013, the Ministry of Railways was abolished and its administrative responsibilities for development planning and policy were transferred to the Ministry of Transport with the establishment of the National Railway Administration. Other functions of the former Ministry of Railways were transferred to the newly formed China Railway Corporation. In 2019, China Railway Corporation was restructured and became China State Railway Group Co., Ltd.

China Railway and its regional bureau companies are responsible for planning, operating, and maintaining the rail system, covering locomotives, railcars, tracks, and railyards. China Railway is primarily responsible for daily business management, overall dispatching, coordination and command, construction project management, asset management, financial management, formulation of relevant regulations and measures, and undertaking public welfare transportation tasks stipulated by the state. Each of the 18 regional bureaus oversees an individual operational jurisdiction, and each is responsible for passenger and cargo transportation management, local dispatching and command, local facility maintenance and repair, and other management and business duties.[6] China Railway also runs three specialized transportation companies (container, special cargo, express) and 14 enterprises and institutions engaged in scientific research, survey and design, press and publishing, investment, and other related functions.

In addition to China Railway, there are seven corporate railways that transport bulk materials such as coal. Appendix C provides more information on these corporate railways and their managing companies.

KEY REGULATORY AUTHORITIES

The rail system is regulated mostly by the central government with support from China Railway and local governments.

The **National People's Congress** is a legislative body that does not participate in the direct management and operation of China's railways. The Congress reviewed and adopted The Railway Law of the People's Republic of China, which makes corresponding provisions on the operation, construction, and safety of railways.

The **State Council** manages China Railway directly and is responsible for final research, reviews, and decision-making processes for railway planning and guidance documents; approval of major project construction; and other related administrative duties. For example, the State Council released a set of policies as a shipping structure adjustment strategy with the support of various ministries.

The **National Development and Reform Commission** operates within the State Council, with elevated management responsibilities and status compared to other departments. While the State Council oversees the administrative affairs of the China Railway, the National Development and Reform Commission governs many business functions, including development planning, project approval, and price policies. Thus, the National Development and Reform Commission provides direct guidance and counsel to China Railway, and presents railway plans, projects, and policies to the State Council for final decision-making.

The **National Railway Administration, Ministry of Transport** was formed after railway governance and enterprises were separated. The agency falls under the management of the Ministry of Transport and is tasked with various administrative duties previously handled by the Ministry of Railway. While it does not directly oversee China Railway, the National Railway Administration drafts laws, regulations, and rules for railway supervision and management. Specifically, the agency formulates and implements measures for rail transportation safety, engineering quality safety, and equipment quality safety. The agency also develops policies and measures to regulate the rail transportation and engineering construction markets, along with monitoring and analyzing railway operation conditions and other responsibilities.

The functions of the National Railway Administration are limited and focused on safety and market supervision. China Railway retains key authority in railway supervision and

6 The 18 railway bureaus are: China Railway Harbin Group Co., Ltd.; China Railway Shenyang Group Co., Ltd.; China Railway Beijing Group Co., Ltd.; China Railway Taiyuan Group Co., Ltd.; China Railway Hohhot Group Co., Ltd.; China Railway Zhengzhou Group Co., Ltd.; China Railway Wuhan Group Co., Ltd.; China Railway Xi'an Group Co., Ltd.; China Railway Jinan Group Co., Ltd.; China Railway Shanghai Group Co., Ltd.; China Railway Nanchang Group Co., Ltd.; China Railway Guangzhou Group Co., Ltd.; China Railway Nanning Group Co., Ltd.; China Railway Chengdu Group Co., Ltd.; China Railway Kunming Group Co., Ltd.; China Railway Lanzhou Group Co., Ltd.; China Railway Urumqi Group Co., Ltd.;and China Railway Qinghai-Tibet Group Co., Ltd. Each bureau is responsible for dispatching trains on specific lines within its jurisdiction, while the China Railway Group is responsible for overall dispatching and coordination.

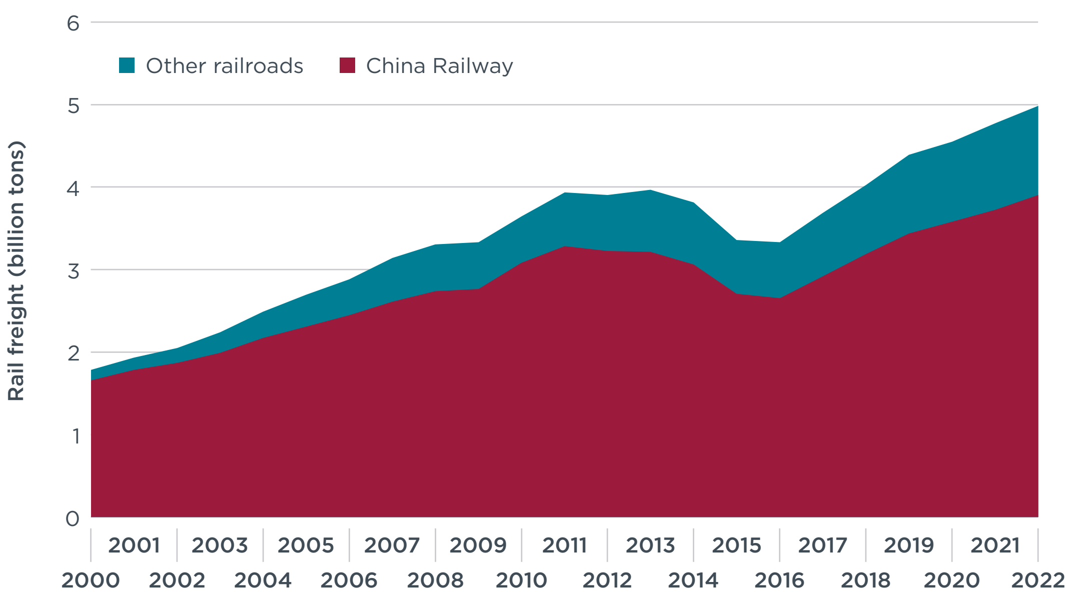
management, including improving and revising rules and regulations on operation, dispatching, maintenance, safety management, construction, and finance.

Local governments and development and reform commissions have the authority to regulate corporate railways operating in their respective regions. China's leading energy and smelting companies have invested in corporate railways to meet their own production and transportation needs. These railways are supervised and managed by the appropriate local governments or local development and reform commissions. However, these trains must comply with the national transportation, loading, and safety standards if they access and use national rail facilities.

FREIGHT SERVICE

China has experienced rapid growth in freight activity over the past decades. The railway carried almost 5 billion tons in 2022 (Figure 10), with over 3.5 trillion ton-km in freight activity. Even with some decline in 2015–2016, an average growth rate of over 5% was achieved annually between 2000 and 2020. The share of corporate railways has also increased over time, accounting for about 22% of the market (by weight) in 2022.

Figure 10
Tons of railway freight in China, 2000–2022



Data source: National Bureau of China (2023)

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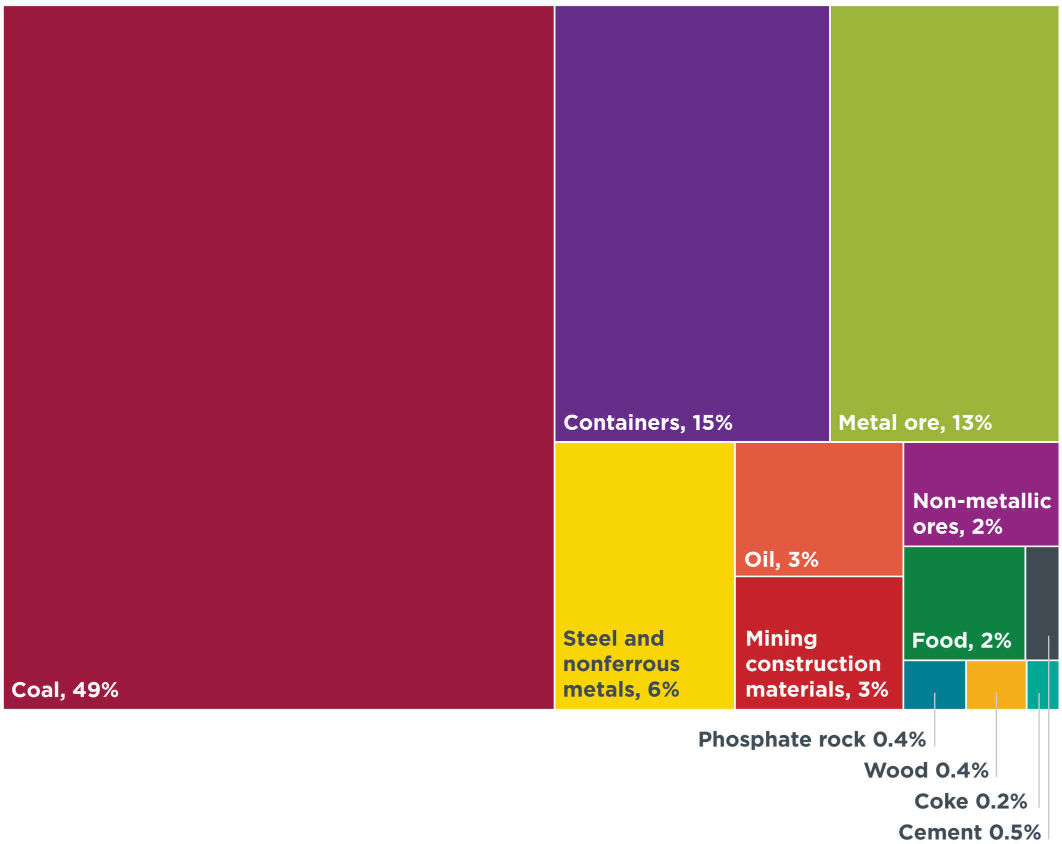
Coal accounted for about half of the commodities by weight hauled by China Railway, playing an important role in the rail market (Figure 11). Other bulk products, including metallic and nonmetallic ores and construction materials, were responsible for another 30% of the products hauled. Containers contributed about 15% of the freight weight, but their share may be higher if tracked by carloads.

Figure 11
Commodities hauled by China Railway by weight, 2022



Data source: National Bureau of China (2023)

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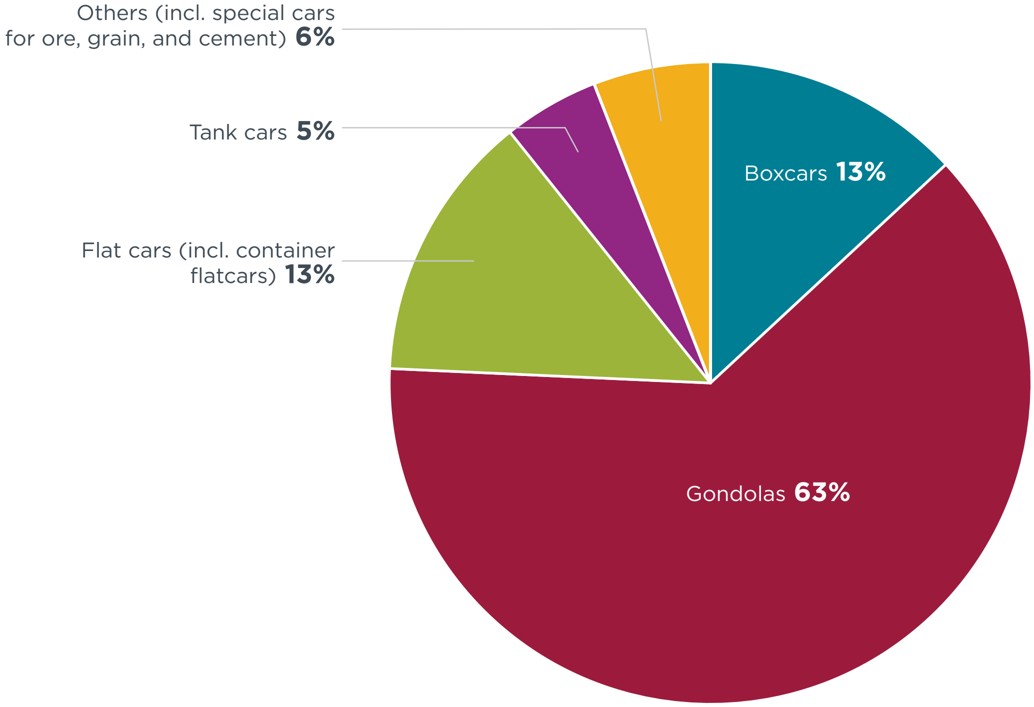
Consistent with the products transported, over 70% of freight cars are designed for hauling heavy products, as shown in Figure 12. Almost 0.9 million railcars were in the fleet as of 2019. Gondolas, which haul heavy bulk commodities such as construction materials, sand, copper, coal, and iron ore, were the majority of railcars. Boxcars, used mostly for crafted or palletized products, and flatcars, including container flatcars for containers (about 42,000 total), each contributed to about 13% of the fleet. Tank cars and other types of cars combined made up about 10% of the fleet.

Figure 12
China railcar fleet, 2019



Data source: China State Railway Group (2023)

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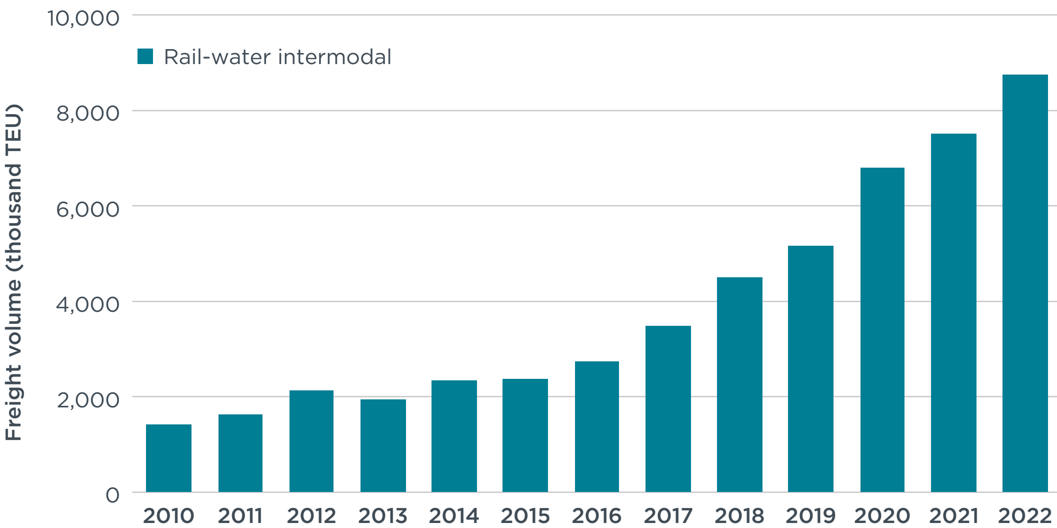
Although the previous charts show that rail transport includes container shipping, information about performance remains uncertain, particularly for intermodal shipping, due to limited or unavailable data and the lack of reporting systems. Rail-water intermodal transport (including sea-rail intermodal) has presented robust growth according to the limited historical data, as shown in Figure 13. However, data on other intermodal modes (e.g., truck-rail, truck-water) remains scarce. There is inconsistency in tracking intermodal transport in the freight system, as China Railway primarily tracks container shipping by twenty-foot equivalent units (TEU), as illustrated in Figure 13.

Figure 13

China rail-water intermodal development, 2010–2022



Data source: Ministry of Transport (2023)

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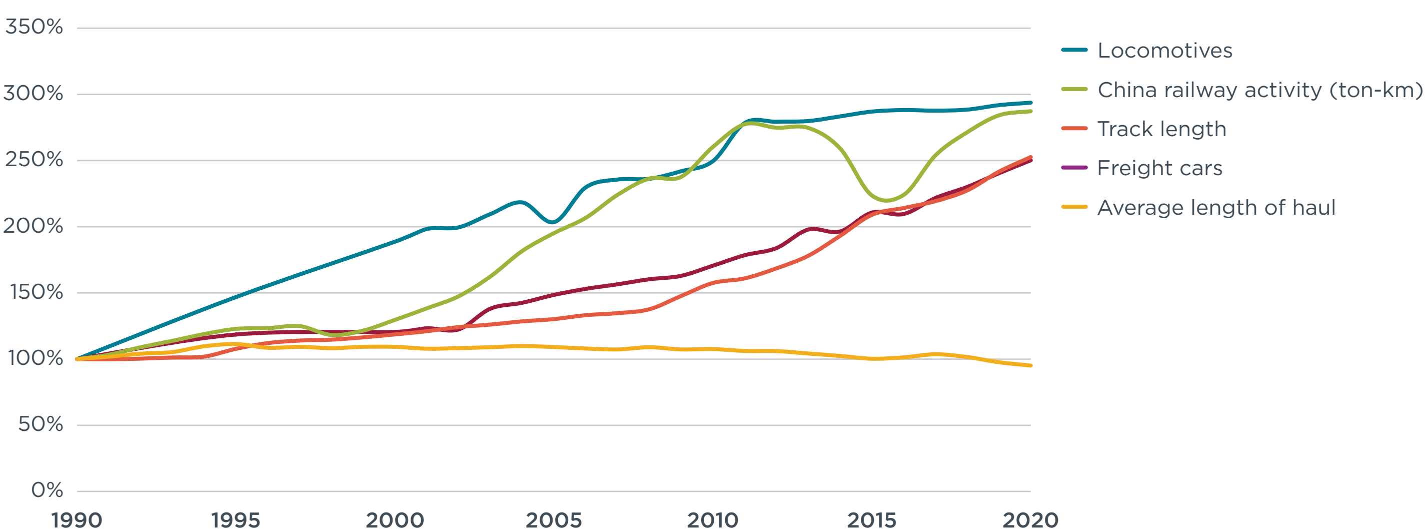
In summary, China Railway has experienced rapid growth in recent decades. Rail freight activity has increased by almost three times in the past 30 years (Figure 14). The decline around 2015 was reversed with the implementation of the shipping structure adjustment strategy, although the increase in activity has recently slowed, possibly due to the Covid lockdown. Meanwhile, China has made substantial investments in rail infrastructure and rolling stock, resulting in a strong increase in locomotives, railcars, and track length. The average hauling distance has decreased slightly, possibly due to the improved network with more railyards and stations built.

Figure 14

Evolution of China Railway, 1990–2020



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KEY INDICATORS DRIVING THE DIFFERENCES BETWEEN RAIL SYSTEMS IN THE U.S. AND CHINA

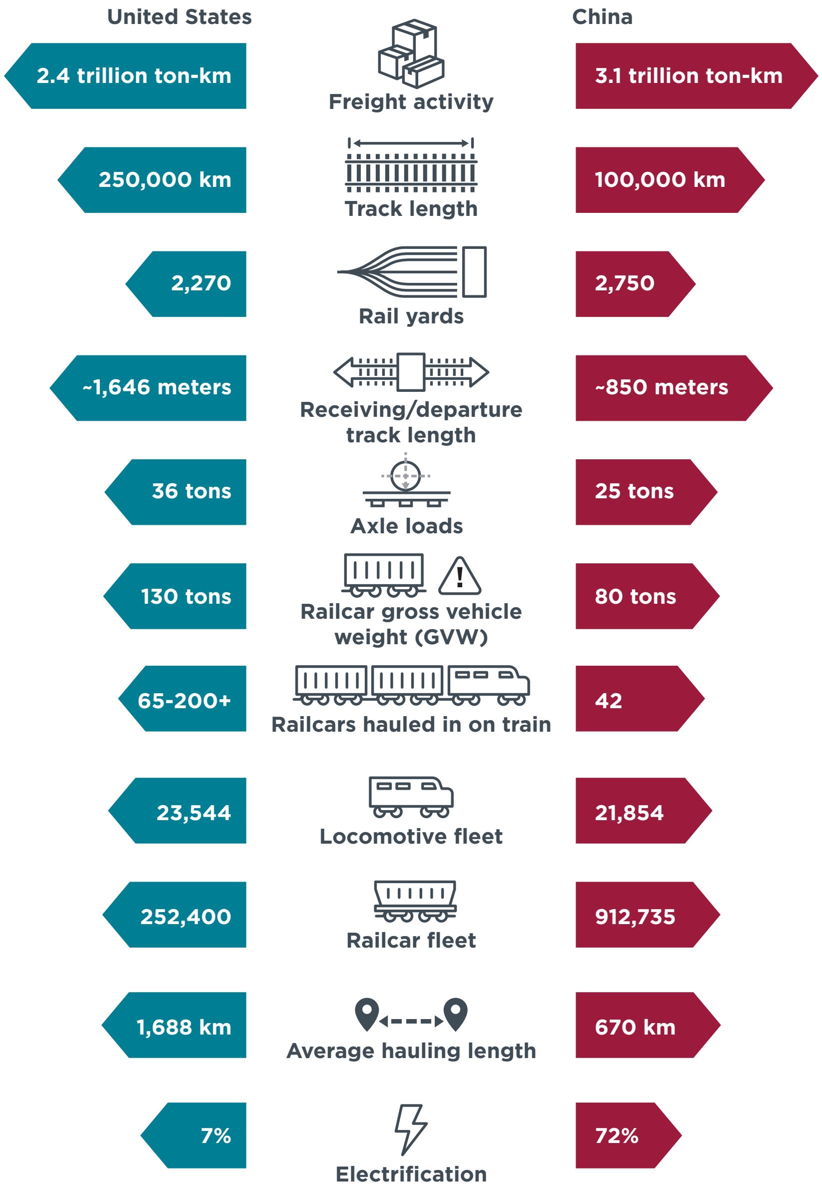
Railways in both the United States and China have witnessed remarkable growth over the past decades and play an important role in their respective freight systems. However, significant differences exist between the two systems. This section compares key parameters of the rail systems in the two countries, spotlighting those elements that could enable China to better utilize rail capacity and upgrade service.

Railway activity in China is higher than that in the United States, with similar or even less infrastructure, which creates challenges in maintaining and increasing service (Figure 15). U.S. railroads were responsible for about 2.4 trillion ton-km of freight activity in 2020, moving about 30% of all freight. China's railways moved about 3 trillion ton-km in 2020, accounting for less than 20% of total freight shipments. Although U.S. freight rail has occupied a larger share of the freight system, China's freight railway has moved more ton-kilometers with lower track lengths, shorter train lengths, and lower train capacity, indicating a much higher frequency of service.[7] In addition, with a similar number of railyards, the average hauling length in China is less than half of that in the United States. Further, it is essential to highlight that more than 70% of China's railways are electrified, resulting in a cleaner and more energy-efficient rail system compared to the United States, which has an electrification share of less than 10%.

7 Track length does not include the distance of double tracks. Over 70% of China's railway tracks are double-tracked, while only 20% of U.S. railway tracks are double-tracked. Double tracks have considerably higher capacity than single tracks, as trains going in opposite directions can pass each other without diverting onto sidings. (Sogin et al, 2013). However, it is beyond this study scope to calculate the equivalent track length with double tracks.

Figure 15

Comparison of U.S. and China rail systems and performance, 2020



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Several key indicators in Figure 16 highlight the difference in infrastructure and railway management in the two countries, suggesting potential avenues for greater operational efficiency within China's freight rail system based on the experiences of the United States.

» The receiving/departure track length is over 1,600 km in the United States, on average, which allows 200 or more railcars to be loaded and unloaded (Safety Advisory, 2023). This significantly increases the railcars in each train to over 200 in the United States, compared to 42 in China.

» The average capacity or gross vehicle weight of railcars in the United States is 286,000 pounds (130 tons). These railcars are supported by 36-ton heavy track axle loads, significantly larger than the average in China. Hence, the railcars and trains in the United States can haul heavier amounts of commodities than those in China.

Receiving/departure track and longer trains

Class I railroads in the United States operate longer trains to increase efficiency (U.S. Government Accountability Office, 2019). Train length has increased over time, reaching a median of 5,400 feet (1,646 m) (Association of American Railroads, n.d.-a). About 10% of trains were longer than 9,800 feet (2,987 m), the share of which has increased over the past decade (U.S. Government Accountability Office, 2019; Association of American Railroads, n.d.-a). Less than 1% of trains were longer than 14,000 feet (4,267 m) (Association of American Railroads, 2024). Although there are concerns regarding safety issues with operating trains over 7,500 feet (2,286 m), there are no regulatory limits on the length of freight trains (Federal Railroad Administration, 2023). Thus, the length of receiving/departure tracks are much longer in the United States to accommodate the longer trains operating in the network.

Many tracks have been extended from 6,100 or 7,400 feet (1,859 or 2,256 m) to about 10,000 feet (3,048 m) to hold the entire train on a single track, reducing or eliminating the demand for car switching (Stagl, 2015). This allows U.S. Class I trains to operate with up to 200 railcars or more attached. For example, the City of Long Beach is planning to extend receiving/departure tracks to 10,000 feet at the port by 2025 to add on-dock capacity for longer train operations (Port of Long Beach, n.d.).

The average receiving/departure tracks in China range between 650 m and 1,050 m. For the Datong-Qinhuangdao Railway, the receiving/departure tracks are 1,700 to 2,800 m to accommodate the large shipping need for coal. However, most of the receiving/departure tracks in China are still shorter than 1,050 m, accommodating up to 42 railcars attached to one train in most cases.

Heavy axle loads and 286,000-lb railcars

The axle load of U.S. tracks was gradually upgraded to 36 tons in the 1990s to enable the use of 286,000-lb railcars. Strengthening tracks to allow larger, heavier cars has been a critical topic concerning the U.S. rail system for improving shipping productivity (Martland, 2013). The maximum axle load, which defines the total weight bearing of tracks, increased from 22 tons in the 1950s to 36 tons in the 1990s to accommodate the need for rapidly growing volumes of coal out of the Powder River Basin in Wyoming (Stone, 1993). The Heavy Axle Load research program undertaken between 1988 and 2000 to understand the limits and benefits of increasing railcar loads confirmed that increasing axle loads to 36 tons to accommodate 286,000 GVW railcars was the most cost-effective option for railways (Martland, 2013).

According to 2019 North American freight car fleet data, 286,000-lb railcars have been widely adopted across the U.S. rail network, accounting for the majority of cars in use. Coal hauling shifted to these larger railcars almost immediately, achieving 100% adoption in a decade (Association of American Railroads, 2020). For intermodal shipping, the adoption rate is about 30%.

In China, the heavy axle loads are set to 25 tons. China's National Railway Administration released and adopted *Heavy Haul Railway Design Specifications* in 2017, allowing upgrades on rail infrastructure to accommodate growing hauling needs (National Railway Administration, 2017). The specifications allow the use of axle loads up to 30 tons for hauling heavier products in the network. So far, most of the upgrades were targeted for coal-hauling needs. For example, the heavy axle loads for Datong-Qinhuangdao Railway were upgraded to 27 tons for larger rail cars, meeting the high shipping needs of coal.

CONCLUSIONS AND RECOMMENDATIONS

This comparison of the China and U.S. freight railways focused on the managing structure, physical infrastructure, and major policy guidance of the two systems. While the network and facilities are relatively similar, notable differences exist in their managing framework. Six private companies oversee the main freight railroads in the United States, so business profit is prioritized. The rail industry has upgraded its infrastructure and facilities, enabling the operation of longer trains and larger railcars to enhance service efficiency. This strategic focus aligns with the growing needs of intermodal shipping, particularly in response to the declining demand for heavy, bulk products in the United States.

As the rail system in China seeks approaches to improve its overall service and operations, and to reposition itself as the backbone of the freight system, the experience of freight rail in the United States could provide valuable insights. The following recommendations could be considered in future efforts to improve China's freight railways.

Proactive measures to plan and invest in shipping capacity and service upgrades could be taken to accommodate the evolving dynamics of the freight market. The experience in the United States indicates that the rail system should consider proactively planning and investing in intermodal transport service due to the expected decrease in shipping demand for heavy, bulk products. Rail companies in the United States have upgraded their services with higher speed and improved efficiency to accommodate intermodal shipping. Although China has initiated efforts to use rail shipping for more types of commodities, additional actions can be taken to ensure service and capacity upgrades meet the shipping needs of the freight market. Collaboration with various industries and companies could enhance understanding and analysis of the gaps in China's rail network with the aim of better serving the freight market.

Assessments of the potential use of intermodal transportation for select high-value commodities could lay the groundwork for subsequent surveys of freight patterns across sectors. The data reporting and collection system in the United States, including the freight flow survey and Carload Waybill Sample, allows for the comprehensive tracking of freight market trends and commodity shipping patterns. Drawing from the intermodal patterns observed in the United States, commodities like textiles/leather, precision instruments, transport equipment, plastics/rubbers, electronics, and pharmaceuticals could be strong candidates for railway intermodal shipping. China could prioritize in-depth analyses of these specific products to identify the opportunities for industry-wide recommendations and policy measures aimed at promoting intermodal shipping. Implementing such practices would serve as a precursor to launching comprehensive freight flow surveys in China, enabling preliminary testing and evaluation before full-scale promotion efforts.

Upgrading of infrastructure, facilities, and equipment could be considered to boost capacity and position the rail sector as the backbone of the freight system. U.S. railroads have undertaken significant investments to modernize the freight system and accommodate market needs. These upgrades include enabling the adoption of longer trains capable of loading more products, improving service efficiency for hauling higher-value products, and improving connectivity to facilitate intermodal shipping. The continuous efforts have solidified U.S. rail as the backbone of the freight system, which could offer valuable insights for increasing the use of China's railways, particularly for long-distance hauling. The upgrading of heavy axle loads and use of bigger rail cars on designated coal shipping lines have proven to be successful in meeting growing hauling demand. Applying improved infrastructure and equipment across the rail network could be considered to increase overall shipping capacity.

Increasing data collection with improved public access could help provide a robust foundation for research and policy formulation. U.S. rail companies are required to report and publish a wide array of operational and financial data, in addition to an industrial statistics survey that offers comprehensive insights into the functioning of the rail system. This wealth of information, along with the open platform, can be used to assess and monitor rail system performance, identify existing bottlenecks, and forecast future shipping requirements for various commodities. Such insights can be invaluable for guiding long-term infrastructure investments and policy formulation. While China has initiated efforts to understand shipping patterns for certain products, more comprehensive data collection could be used to gain a deeper understanding of shipping demand and railway capacity. Insufficient measurement metrics on infrastructure utilization and intermodal shipping can also hinder market development tracking. Additional statistics and analysis could be used to assess how the current rail system serves the freight market and scope plans for future investment and development. Continued efforts in this area can be instrumental in informing strategic decision-making and fostering the development of the railway sector in China.

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APPENDIX A: REQUIREMENTS FOR ECONOMIC DATA AND SERVICE DATA REPORTING

The STB has established detailed requirements for locomotive companies filing information with the agency. The information can be publicly accessed at the STB website.

Economic data

The STB requires Class I railroad companies to submit a wide range of economic information at different time intervals using a standard reporting format. The companies submit an R-1 form containing financial information and operational statistics to the agency annually. Commodity statistics and wage information are reported on a quarterly and annual basis. Revenue, expenses, income, employment and wages, and fuel consumption and costs are reported every quarter, while the average number of employees by job type is reported monthly. Table B1 summarizes the reporting requirements and submission frequency (Surface Transportation Board, n.d.-b).

Table B1

Summary of reporting requirements for Class I railroad companies

Report	Frequency	Main content
R-1 form	Annually	Financial and operating statistics for developing rate of return on net investment for use in revenue adequacy determinations
Cars loaded and terminated	Annually	Number of cars loaded and terminated, by car types
Revenue, earnings, and income	Quarterly	Operating revenues, operating expenses, and income
Condensed balance sheet	Quarterly	Balance for the current and prior year of assets and liabilities, gross capital expenditures, and revenue tons
Commodity statistics	Quarterly and annually	Car loadings and total revenues by commodity codes, for use in developing waybills database
Wages	Quarterly and annually	Number of employees, service hours, compensation, and mileage run by employee group
Fuel cost, consumption, and surcharge	Quarterly	Total fuel cost, fuel consumed, changes of fuel cost, and revenue from fuel surcharges
Employment	Monthly	Average number of employees at midmonth by employee group

Note: Employee group is defined as executives, officials, and staff assistants; professional and administrative; maintenance of way and structures; maintenance of equipment and stores; transportation other than train and engine; and transportation, train and engine.

The STB processes the economic data to monitor the financial health of the freight rail industry and for other regulatory purposes. The public can directly access information such as R-1 reports, revenues and earnings, carloads and volumes, employment and wages, and fuel surcharges for each Class I company. STB reviews information, such as revenue and cost of capital, to determine the class of the railway company, set cost benchmarks, and evaluate revenue for the assessment of reasonable hauling rates.

Service data

As of late 2016, STB requires Class I railway companies to submit service performance data weekly for better real-time visibility into the performance of the railway industry (Surface Transportation Board, n.d.-c). The service performance data provides a standard metric to monitor service conditions and identify regional or national service disruptions. The weekly data from each rail company is released to the public, along with Class I railroad consolidated service information generated by STB. The information can help shippers and other stakeholders plan operations and make informed decisions based on their analysis of performance trends over time.

Performance data shared by Class I railroad companies include:

- System average train speed by train type, and overall system train speed
- Weekly average terminal dwell time and overall system dwell time
- Cars in service by car type

Weekly average dwell time at origin for unit train by train type[8]

- Weekly average number of trains held per day by train type and cause
- Weekly average number of loaded and empty cars not moved in 48 hours or more
- Weekly total grain cars loaded and billed by state and service
- Grain cars: cars ordered, car orders filled, and cars past due
- Grain trains: planned versus performance
- Coal trains: planned versus performance
- Weekly carload origin and destination by commodity

8 A unit train refers to a train hauling a single type of commodity.

APPENDIX B: CARLOAD WAYBILL SAMPLE

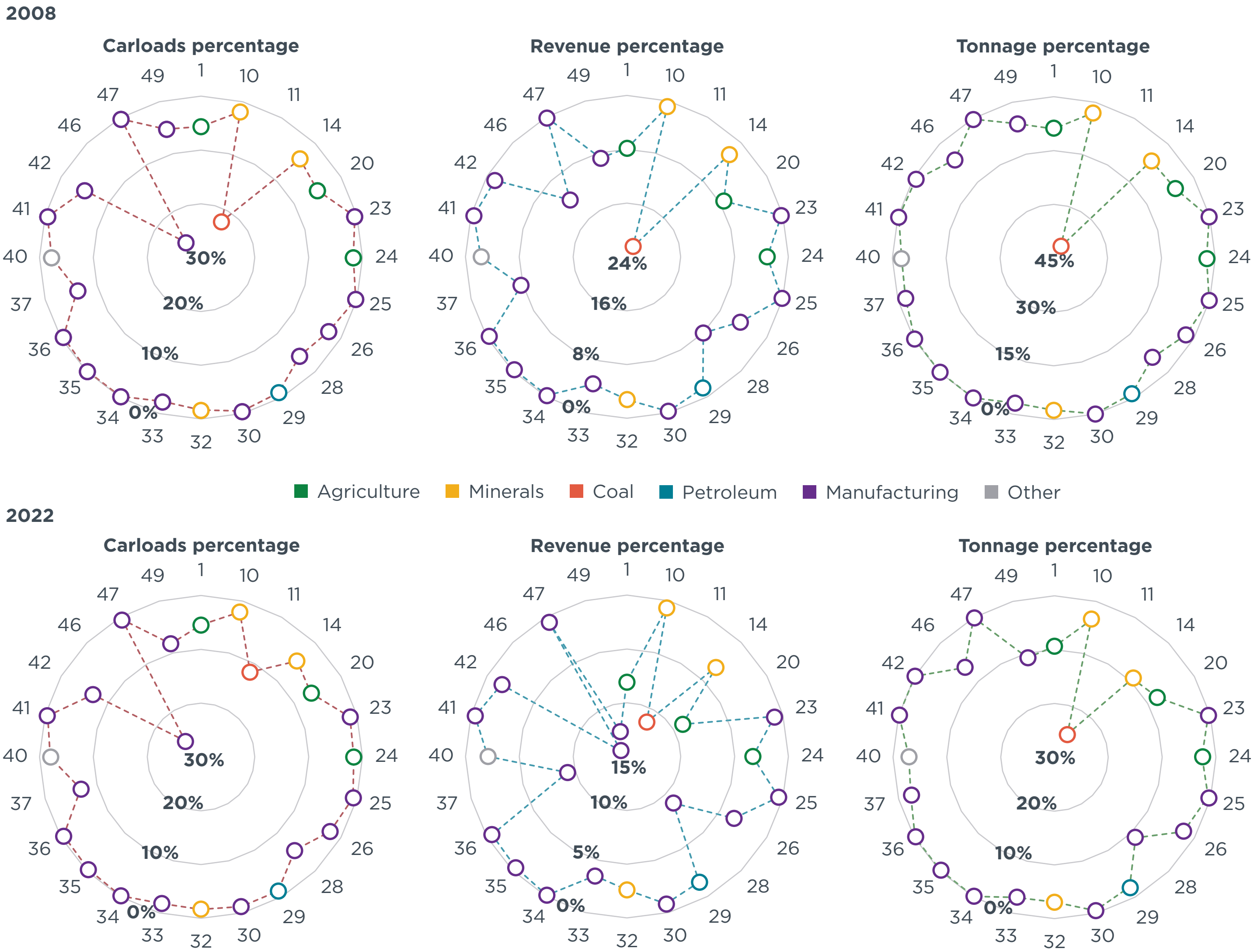
The Carload Waybill Sample can be used for identifying market trends, analyzing commodity shipping patterns, and shaping business strategies (Glauber, 2023).

The U.S. freight rail industry hauls a wide range of goods, covering **agriculture**, **minerals**, **coal**, **petroleum**, and **manufacturing** products. Figure C1 summarizes the carloads, revenue, and tonnage percentage of commodities hauled by U.S. freight railroads in 2008 and 2022. The numbers around the ring correspond to a 2-digit standard transportation commodity classification (STCC) code identifying a category of product, listed below. We categorized the commodity categories by colors to show the associated industry.

The comparison of 2008 and 2022 Carload Waybill Sample data demonstrates the transformative shift within the U.S. rail system in adapting to the decreasing shipping demand for coal products. **Coal** (commodity #11) dominated rail shipping tonnage and revenue in 2008 when the consumption and production peaked, the share of which surpassed other commodities by a wide margin. However, with the decline in coal demand, U.S. railroads began vying for market share in other product categories. **Intermodal shipping** (commodity #46) held the top spot in carload share in 2008, but its revenue share lagged far behind that of coal. In 2022, intermodal shipping had the highest revenue share, despite its carload share remaining consistent with 2008 levels.

Figure B1

Percentage of carloads, revenue, and tonnage by commodity type in the United States, 2008 and 2022



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Standard transportation commodity classification (STCC) code

1	Farm products	32	Clay, concrete, glass or stone products
10	Metallic ores	33	Primary metal products, including galvanized; except coating
11	Coal	34	Fabricated metal products; except ordnance
14	Nonmetallic minerals; except fuels	35	Machinery; except electrical (see major industry group 36)
20	Food or kindred products	36	Electrical machinery, equipment, or supplies
23	Apparel, or other finished textile products or knit apparel	37	Transportation equipment
24	Lumber or wood products; except furniture	40	Waste or scrap materials not identified by producing industries
25	Furniture or fixtures	41	Miscellaneous freight shipments
26	Pulp, paper or allied products	42	Containers, carriers or devices, shipping, returned empty
28	Chemicals or allied products	46	Miscellaneous mixed shipments[a]
29	Petroleum or coal products	47	Small packaged freight shipments
30	Rubber or miscellaneous plastics products	49	Hazardous materials

Note: Includes trade with Mexico and Canada
Data source: Surface Transportation Board (n.d.-a)
[a] Miscellaneous mixed shipments normally refers to intermodal freight composed of shipping containers on flatbed railcars (Bureau of Transportation Statistics, 2012).

The presence of diverse metrics in the Carload Waybill Sample allows a richer and more comprehensive analysis of railroad performance and commodity shipping patterns. For example, the inclusion of the carload metric improves the assessment of **manufacturing commodities** which are usually higher-value products that are not heavy or bulk. The carloads chart indicates **that intermodal shipping** (commodity #46) played a vital role in U.S. freight rail in 2008, even though the tonnage share was negligible at that time. The carload chart further revealed other notable industries, such as **transportation equipment** (commodity #37) and **empty containers** (commodity #42), in U.S. freight rail development.

A similar observation can be made regarding the revenue metric, with which we can identify the most profitable commodities for the railroads. In addition to intermodal, which had highest revenue share of over 14%, **hazardous materials** (commodity #49), **coal** (commodity #11), **transportation equipment** (commodity #37), **chemicals and allied products** (commodity #28), **food and kindred products** (commodity #20), and **farm products** (commodity #1) had revenue shares of more than 8% in 2008 and 2022. These products were not necessarily the ones with the highest shares in weight but were mostly consistent in their percentage of carloads, which indicates the importance of reviewing the rail market by different metrics. In addition, the comparison reveals a widening distribution of revenue sources over time, suggesting that the U.S. railroads have enhanced their service to cater to a broader customer base.

APPENDIX C: CORPORATE RAILWAY COMPANIES IN CHINA

The seven corporate railway companies (introduced below in alphabetical order) in China share about one fifth of the freight rail market (by weight) and are mainly used for meeting the shipping needs of heavy, bulk products.

ANHUI HUAIBEI MINING GROUP

Huaibei Mining (Group) Co., Ltd. is a large-scale enterprise group with diversified operations, mainly producing coal and coal chemical products, generating electric power, and manufacturing construction materials, medicine, and machinery, among many others. Formerly known as Huaibei Mining Bureau, it was restructured into Huaibei Mining (Group) Co., Ltd. in March 1998 and is now directly supervised by the State-owned Assets Supervision and Administration Commission of the People's Government of Anhui Province. The group's internal dedicated railway line spans the cities of Huaibei, Suzhou, and Bozhou, with a total track length of 503 km.

HENAN PINGMEI GROUP

China Pingmei Shenma Energy and Chemical Group Co., Ltd. is a large state-owned company affiliated with the People's Government of Henan Province. The group is headquartered in Pingdingshan City in Henan Province and is the largest producer of coke in the country. The group's mining railway plays a pivotal role in facilitating various transportation activities, including coal transportation, delivery of construction materials to mining sites, and the transportation of raw coal to four coal washing plants and four coking plants within the group. With a total of 28 railway stations spread across the mining area, the railway network spans over 310 km in length, with the main line extending more than 130 km. Serviced by 29 diesel locomotives, 1,716 self-owned trucks of various types, and 16 passenger cars, the railway infrastructure includes advanced large-scale mechanized tamping machines, rescue vehicles, and other road protection and maintenance equipment.

HENAN YONGMEI GROUP

Yongcheng Coal and Electricity Group Co., Ltd. is a large state-owned enterprise in Henan Province. Its industries include coal, chemicals, nonferrous metals, and equipment manufacturing. The Yongmei Special Railway, under construction since 1989, spans a track length of 120 km. It is mainly responsible for coal, local cargo, and commuter passenger transportation for the production mines at the headquarters. The annual railway transport volume is more than 8 million tons.

INNER MONGOLIA YITAI GROUP

Inner Mongolia Yitai Group Co., Ltd. is a prominent energy enterprise, with a core focus on coal production, transportation, and sales. The company currently operates and maintains three main railways: Zhundong Railway (192 km), Huzhun Railway (238 km), and Suancigou Coal Mine Railway Special Line (29 km). The company has three additional railways under construction: Malaysia Railway, Talahao Coal Mine railway line, and Hongqinghe Coal Mine railway line.

JIUQUAN IRON AND STEEL GROUP

Jiuquan Iron and Steel (Group) Co., Ltd. is the fourth steel conglomerate initially planned and constructed by the country. It is also the earliest and largest diversified modern enterprise group in northwestern China, with a focus on black and nonferrous metals. The Logistics Center of Jiuquan Iron and Steel Group Corporation operates more than 800 km of Class C special railways, which are connected to multiple Lanzhou-Xinjiang Railway and Linha Railway stations. The Group owns 55 diesel locomotives and 1,000 C70E gondolas. The company also operates road and rail transport logistics parks in the ports of Xi'an, Lanzhou, Jiayuguan, Urumqi, Ejina, and Ceke, with a total area of 2.64 million square meters.

NATIONAL ENERGY GROUP

National Energy Group (State Energy Investment Group Co., Ltd.) was formed by the merger and reorganization of the China Guodian Corporation and Shenhua Group Co., Ltd. The company, officially established on November 28, 2017, is a state-owned enterprise directly managed by the central government.

National Energy Group inherited the coal transportation network of the former Shenhua Group and owns the Shuohuang, Shenshuo, and Baoshen railways, in addition to other self-operated systems. With an operational mileage spanning 2,408 km, the National Energy Group has a transportation capacity of 483 million tons and is supported by a fleet of over 800 locomotives and more than 50,000 drayage trucks. As such, it stands as the second-largest railway operator in China.

SHAANXI COAL AND CHEMICAL INDUSTRY GROUP

Shaanxi Railway Logistics Group Co., Ltd., a subsidiary of Shaanxi Coal and Chemical Industry Group, is responsible for the construction and operation of the company's branch railways, facilitating the transportation of bulk commodities and materials including coal, chemicals, steel, and cement. The company oversees the management of six holding companies: Jingshen Railway, Hongning Railway, Yuheng Railway, Fenghong Railway, Xiping Logistics, and Shenda Logistics.

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communications@theicct.org

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