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## FREIGHT RAIL TRANSPORT IN JAPAN – NOT LESS EXCITING THAN PASSENGER ONES

### *NÁKLADNÁ ŽELEZNIČNÁ DOPRAVA V JAPONSKU – NIE MENEJ VZRUŠUJÚCA AKO OSOBNÁ*

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#### 1 INTRODUCTION

Japanese National Railways (JNR) has been privatized in 1987. As Kurosaki [45] stated, during the era of JNR, it accumulated heavy debts, especially in the freight operating area as railways in Japan are passenger-dominated. The conglomerate of Japanese domestic railway operators consists of 6 passenger companies and the seventh one is dedicated to freight operations and transport. Passenger rail transport companies are divided regionally and certainly operate passengers' trains only. These companies are Hokkaido Railway Company (JR Hokkaido), East Japan Railway Company (JR East), West Japan Railway Company (JR West), Central Japan Railway Company (JR Tokai), Shikoku Railway Company (JR Shikoku), Kyushu Railway Company (JR Kyushu) and additionally Shinkansen Holding Corporation for high-speed rail transport [40]. By the way, it also includes the Railway Communication Company, Rail Information Systems Company, Railway Technical Research Institute, and Japanese National Railways Settlement Corporation [41]. Each of these transportation companies has in disposal their infrastructure and facilities in contrast to Japan Freight Railway Company (JR Freight), the company which operates freight transport. According to [45], JR Freight forms a vertically separated structure, while all the JR passenger companies comprise a vertically integrated structure. JR Freight consists of 6 branches: Kyushu, Kansai, Tokai, Kanto, Tohoku, Hokkaido [40]. JR Freight rents infrastructure from other companies [45], which makes freight transport dependent on time windows between passengers' transport (more information related to that topic is mentioned hereafter). It does not have own its tracks; however, it has in disposal its own stations, yards, and facilities for freight trains. JR Freight, as many other companies in Japan (e.g. Shizutetsu, Suzuyo – sample companies are mentioned after discussions on the topic during grant in Japan with Prof. Koichi Shintani – private correspondence) is carrying about several different kinds of business, i.e. freight services, warehousing, car park operation, advertising, indemnity and other non-life insurance agency services, vehicle services, general civil engineering and construction design, project execution and management, incidental and related business operations [39]. It is also worth mentioning that Railway Business Act in Japan provides three different classes of railway business in Japan [45]. Class 1 states for enterprises providing rail passenger and/or freight services

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while holding their rail infrastructure. Class 2 states for enterprises that provide rail passenger and/or freight services using rail infrastructure owned by another organization. And Class 3 states for enterprises that own infrastructure only for renting it to an enterprise of Class 2. JR Freight is an example of Class 2 [45]. Currently, major players in Japanese freight rail transport are [49]: foremostly JR Freight as the most well-known and recognizable operator, together with Nippon Express Co., Ltd., Kamigumi Co., Ltd., AZ-COM Maruwa Holdings Co., Ltd., Yusen Logistics Co., Ltd., and others.

## 2 WHAT CAN BE FOUND IN RESEARCH LITERATURE?

Certain key indicators of the Japanese railway market are as follows. Japanese rail track gauge is 1067 mm. The rail track operation length in 2014 was 8,166.8 km [50] and it slightly decreased to 7,959 km in 2018 [41]. In 2018 [41], 426 trains run per day with train-kilometers c.a. 189,000 km/day (approx. 200,000 km/day in 2015 according to [50]), with the total volume of traffic: 42,628,000 tons (43,816,000 tons in 2014 [3]) and ton-kilometers performance as 21,400,000,000 ton-km/year (20,700,000,000 ton-km/year in 2015) – more data are given in **TABLE 1** and **TABLE 2**. This number of freight trains is currently equal to a number of container trains (425 items), whereas in general 737 freight trains run across the country on average [49]. In 2014 only 5% (c.a. 10,000,000,000 ton-kilometers – please, compare it with **TABLE 2**, where data are slightly different) of freight share were operated by rail transport mode (therefore, it was more than doubled in last years) whereas 50% (215,000,000,000 ton-kilometers) were operated by road transport and 45% (c.a. 180,000,000,000 ton-kilometers) by domestic shipping [50]. It has slightly changed since 2008 when 4% of freight was operated by rail transport mode and 58.7% by road mode of transport (Japan Railway Construction, Transport and Technology Agency 2008).

Freight transport in Japan in 2015 was operated by 243 stations which include 116 stations for container handling [50]. The rolling stock in 2015 consisted of 617 locomotives (2018: 574 locomotives [39]) and 7,551 freight cars including 42 cars for freight EMUs (2018: the same quantity [39]). A number of containers held by JRF was 66,900 containers (2018: 67,369 of JR Freight and 17,851 private containers [39]). It has changed a year later downsized to 61,398 of JR Freight 17,753 private containers, which might be reasoned by the fact that in February 2018 it has been announced that 2,600 mm-high containers (Class20) have become the general-purpose container size [40].

As mentioned in [50], the maximum train length in Japan is 540 m (which equals up to 26 freight cars and a locomotive). This is confirmed by the research observation of freight trains by the author who applied the methodology of non-participating observation altogether with filming and in-situ counting during his long-period stay in Japan in 2019-2020. Selected examples are as follows:

- January 23rd, 2020, after 3:30 pm in relation Tokyo–Shizuoka, trains have run that consisted of 22 freight intermodal cars with containers and 3 tank cars,
- January 25th, 2020, after 10:00 am in relation Tokyo–Shizuoka, trains have run that consisted of 19 freight intermodal cars for with containers and 1 tank car and 2 empty cars,
- January 26th, 2020, 7:26 pm in relation Shizuoka–Tokyo (in Mishima), trains have run that consisted of 20 freight intermodal cars with containers and 6 empty cars,
- February 8th, 2020, c.a. 9:00 am in relation Shizuoka–Tokyo (in Shizuoka), trains have run that consisted of 23 freight intermodal cars with containers,
- January 26th, 2020, c.a. 8:00 pm in relation Shizuoka–Tokyo (in Shizuoka), trains have run that consisted of 5 freight intermodal cars with containers and 18 empty cars,
- The capacity of a freight train per train is about 650 tons for the longest 26-car train (equivalent to 65 10-ton trucks [7]).

In the Japanese railway operation system, transits and operations related to railway mode of transport are mostly realized during the nights [50] – it is 90%. The main reason is that during the day passenger transport is prioritized. Moreover, as it was mentioned before railway freight operators do not possess their own track infrastructure – they borrow it from passengers' operators. An example timetable of Tokaido Line, given in [50], presented that from 0:00 am to 5:00 am all trains are freight trains (timetables in Japan are rarely changed, therefore it is assumed as still actual information). Local passenger trains are not operated in that time window. Nishimura [50] mentioned that the frequency of freight runs between 01:30 am and 2:30 am is every 5 minutes. In Japan, long-distance rail freight is a healthy niche market. It is used especially for paper, chemicals, other industrial products, and foodstuffs. Containers represent two-thirds of the transported goods (in tons). Intermodal rail transport in Japan mostly uses 12-ft containers standardized by Japan Railway [11]. The regular operation concern short freight train of 1,300 ton that consists of train 26 cars. However, specialized trains such as Toyota Longpass Express are operated as well. The distance it runs is 900 kilometers between Nagoya (Aichi Prefecture) and Morioka (Iwate Prefecture) and it certainly transports auto parts, typically by 40 items of 10-ton truckloads.

**TABLE 1** Freight Tonnage carried (in thousands) – based on [29], unless otherwise specified: <sup>a)</sup> [50], <sup>b)</sup> [23], <sup>c)</sup> [3], <sup>d)</sup> [33], <sup>e)</sup> [36], <sup>f)</sup> [37], <sup>g)</sup> [38], <sup>h)</sup> [48], <sup>i)</sup> [27], <sup>k)</sup> [26], <sup>l)</sup> [4], <sup>m)</sup> [49]; N/A – not analyzed, no data found up-to-date; approximated values are as such due to the fact that these were analyzed based on graphs without detailed specifications.

**TAB. 1** Prepravovaná nákladná tonáž (v tisícoch) – na základe [29], pokiaľ nie je uvedené inak: <sup>a)</sup> [50], <sup>b)</sup> [23], <sup>c)</sup> [3], <sup>d)</sup> [33], <sup>e)</sup> [36], <sup>f)</sup> [37], <sup>g)</sup> [38], <sup>h)</sup> [48], <sup>i)</sup> [27], <sup>k)</sup> [26], <sup>l)</sup> [4], <sup>m)</sup> [49]; N/A – neanalyzované, neboli nájdené žiadne aktuálne údaje; približné hodnoty sú ako také spôsobené tým, že boli analyzované na základe grafov bez podrobných špecifikácií.

| Year | Railway transport     | JR Freight <sup>a)</sup> | Year | Railway transport                              | JR Freight <sup>a)</sup> |
|------|-----------------------|--------------------------|------|--|--------------------------|
| 1965 | 243,000 <sup>h)</sup> | N/A                      | 2010 | 43,628   | 30,987                   |
| 1980 | 162,827 <sup>g)</sup> | 117,896 <sup>g)</sup>    | 2010 | 43,628   | 30,987                   |
| 1985 | 96,285 <sup>f)</sup>  | 65,497 <sup>f)</sup>     | 2011 | 39,098 <sup>c)</sup>                           | Approx. 28,000           |
| 1987 | 81,869 <sup>c)</sup>  | 56,280 <sup>l)</sup>     | 2012 | 42,847 <sup>c)</sup>                           | Approx. 28,000           |
| 1990 | 86,619 <sup>d)</sup>  | 58,400 <sup>e)</sup>     | 2013 | 43,487 <sup>c)</sup>                           | Approx. 31,000           |
| 1995 | 76,932 <sup>d)</sup>  | 51,456 <sup>e)</sup>     | 2014 | 43,816 <sup>c)</sup>                           | 30,300                   |
| 1999 | 59,058 <sup>c)</sup>  | 39,500 <sup>b)</sup>     | 2015 | 43,210   | 30,780 <sup>l)</sup>     |
| 2000 | 59,274 <sup>d)</sup>  | 39,620 <sup>e)</sup>     | 2016 | 44,089   | 30,940 <sup>l)</sup>     |
| 2004 | 52,528 <sup>c)</sup>  | 37,056                   | 2017 | 45,170   | 31,640 <sup>l)</sup>     |
| 2005 | 52,473                | 36,864 <sup>e)</sup>     | 2018 | 42,628 <sup>c)</sup>                           | 29,220 <sup>l)</sup>     |
| 2006 | 51 872 <sup>e)</sup>  | Approx. 36,800           | 2019 | 42,660 <sup>l)</sup>                           | 29,540 <sup>l)</sup>     |
| 2007 | 51,013 <sup>c)</sup>  | 36,199                   | 2020 | 39,124 <sup>k)</sup> /<br>42,660 <sup>m)</sup> | 26,990 <sup>l)</sup>     |
| 2008 | 48,645 <sup>c)</sup>  | Approx. 33,000           | 2021 | 38,910 <sup>m)</sup>                           | N/A                      |
| 2009 | 39,219 <sup>c)</sup>  | Approx. 31,000           | 2022 | 39,000 <sup>m)</sup>                           | N/A                      |

Trucks and especially ships have become more efficient in operating on freight and are now transporting larger volumes of commodities over longer distances to the detriment of rail freight [23]. It is still actual, as an island country, Japan, with its versatility surrounded by seas, can rely on water transport.

Japanese freight rail transport is rarely considered in research publications. Therefore, the author decided to prepare a compilation of the data whenever possible. The aim: data completion and presentation for future comparisons with various worldwide markets.

### 3 FANTASTIC RAIL TRANSPORT DATA AND HOW TO FIND THEM?

As can be observed in previous sections, data related to freight rail transport are not often published by researchers. Therefore, it was decided to develop a set of proper, historical data for several characteristics of rail freight transport in Japan.

**TABLE 2** Ton-kilometers carried (in millions) – based on: [29], unless otherwise specified: <sup>a)</sup> [50], <sup>b)</sup> [23], <sup>c)</sup> [47], <sup>d)</sup> [3], <sup>e)</sup> [2], <sup>f)</sup> [51], <sup>g)</sup> [36], <sup>h)</sup> [38], <sup>i)</sup> [52], <sup>k)</sup> [43], <sup>l)</sup> [40], <sup>m)</sup> [49], <sup>n)</sup> [4], <sup>o)</sup> [6] – given as <number of container + number of carloads>; N/A – not analyzed, no data found.

**TAB. 2** Prepravené tonokilometre (v miliónoch) – na základe: [29], pokiaľ nie je uvedené inak: <sup>a)</sup> [50], <sup>b)</sup> [23], <sup>c)</sup> [47], <sup>d)</sup> [3], <sup>e)</sup> [2], <sup>f)</sup> [51], <sup>g)</sup> [36], <sup>h)</sup> [38], <sup>i)</sup> [52], <sup>k)</sup> [43], <sup>l)</sup> [40], <sup>m)</sup> [49], <sup>n)</sup> [4], <sup>o)</sup> [6] – uvádza sa ako <počet kontajnerov + počet vozňov>; N/A – neanalyzované, nenašli sa žiadne údaje

| Year | Railway transport    | JR Freight <sup>a)</sup>                   | Year | Railway transport                                    | JR Freight <sup>a)</sup>       |
|------|----------------------|--|------|--|--------------------------------|
| 1980 | 37,428 <sup>i)</sup> | 36,688 <sup>l)</sup>                       | 009  | 20,562 <sup>c)</sup>                                 | 20,404 <sup>c)</sup>           |
| 1985 | 22,134 <sup>b)</sup> | 21,410 <sup>l)</sup>                       | 010  | 20,398   | 20,228 <sup>c)</sup>           |
| 1990 | 27,287 <sup>b)</sup> | 26,728 <sup>h)</sup>                       | 011  | 19,998 <sup>c)</sup>                                 | 19,800/19,852 <sup>c)</sup>    |
| 1995 | 25,146 <sup>b)</sup> | 24,702 <sup>h)</sup>                       | 012  | 20,471 <sup>c)</sup>                                 | 20,151 <sup>c)</sup>           |
| 1998 | 22,959 <sup>b)</sup> | N/A  | 013  | 21,071 <sup>c)</sup>                                 | 20,732 <sup>c)</sup>           |
| 1999 | 25,101 <sup>c)</sup> | 22,300 <sup>b)</sup> /24,702 <sup>c)</sup> | 014  | 21029 <sup>g)</sup> /21,102 <sup>d)</sup>            | 22,000                         |
| 2000 | 22,136 <sup>c)</sup> | 21,855 <sup>c)</sup>                       | 015  | 21,519   | N/A                            |
| 2001 | 22,193 <sup>c)</sup> | 21,907 <sup>c)</sup>                       | 016  | 21,265   | N/A                            |
| 2002 | 22,131 <sup>c)</sup> | 21,860 <sup>c)</sup>                       | 017  | 21,663<br>19,970 + 1,700 <sup>m)</sup>               | N/A                            |
| 2003 | 22,794 <sup>c)</sup> | 22,565 <sup>c)</sup>                       | 018  | 19,369 <sup>j)</sup><br>17,720 + 1,640 <sup>m)</sup> | 21,400<br>19,000 <sup>o)</sup> |
| 2004 | 22,476 <sup>c)</sup> | 22,264 <sup>c)</sup>                       | 019  | 19,993 <sup>j)</sup><br>18,380 + 1,610 <sup>m)</sup> | N/A                            |
| 2005 | 22,813               | 22,601 <sup>c)</sup>                       | 020  | 18,340<br>16,830 + 1,500 <sup>m)</sup>               | 18,000 <sup>l)</sup>           |
| 2006 | 23,192 <sup>c)</sup> | 22,985                                     | 021  | 16,540 + 1,500 <sup>m)</sup>                         | 17,700 <sup>n)</sup>           |
| 2007 | 23,334 <sup>c)</sup> | 23,140                                     | 022  | N/A  | N/A                            |
| 2008 | 22,256 <sup>c)</sup> | 22,100/22,081 <sup>c)</sup>                |      |  |                                |

**TABLE 3** Freight train-kilometers and rolling stock-kilometers (in thousands) – based on: [29], unless otherwise specified: <sup>a)</sup> [30], <sup>b)</sup> [32], <sup>c)</sup> [33], <sup>d)</sup> [34], <sup>e)</sup> [35], <sup>f)</sup> [37], <sup>g)</sup> [38], <sup>h)</sup> [28], <sup>i)</sup> [26]; N/A – not analyzed, no data found.

**TAB. 3** Nákladné vlakokilometre a vozňokilometre (v tisícoch) – na základe: [29], ak nie je uvedené inak: <sup>a)</sup> [30], <sup>b)</sup> [32], <sup>c)</sup> [33], <sup>d)</sup> [34], <sup>e)</sup> [35], <sup>f)</sup> [37], <sup>g)</sup> [38], <sup>h)</sup> [28], <sup>i)</sup> [26]; N/A – neanalyzované, nenašli sa žiadne údaje.

| Year | Freight train-kilometers | Freight rolling stock-kilometers | Year | Freight train-kilometers | Freight rolling stock-kilometers |
|------|--------------------------|----------------------------------|------|--------------------------|----------------------------------|
| 1980 | 145,714 <sup>h)</sup>    | 2,188,584 <sup>h)</sup>          | 011  | 67,828 <sup>c)</sup>     | 1,037,718 <sup>c)</sup>          |
| 1985 | 97,206 <sup>g)</sup>     | 1,190,771 <sup>g)</sup>          | 012  | 68,395 <sup>c)</sup>     | 1,048,589 <sup>c)</sup>          |
| 1990 | 94,927 <sup>c)</sup>     | 1,483,303 <sup>c)</sup>          | 013  | 68,547 <sup>b)</sup>     | 1,090,030 <sup>b)</sup>          |
| 1995 | 90,523 <sup>c)</sup>     | 1,342,041 <sup>c)</sup>          | 014  | 67,171                   | 1,095,489                        |
| 2000 | 77,839 <sup>c)</sup>     | 1,161,992 <sup>c)</sup>          | 015  | 67,098                   | 1,108,776                        |
| 2005 | 83,690 <sup>a)</sup>     | 1,189,912 <sup>a)</sup>          | 016  | 65,157                   | 1,078,201                        |
| 2006 | 77,388 <sup>f)</sup>     | 1,289,141 <sup>f)</sup>          | 017  | 64,018                   | 1,095,467                        |

| Year | Freight train-kilometers | Freight rolling stock-kilometers | Year | Freight train-kilometers | Freight rolling stock-kilometers |
|------|--------------------------|----------------------------------|------|--------------------------|----------------------------------|
| 2007 | 74,950 <sup>e)</sup>     | 1,200,424 <sup>e)</sup>          | 018  | 59,192 <sup>i)</sup>     | 971,144 <sup>i)</sup>            |
| 2008 | 74,599 <sup>e)</sup>     | 1,167,420 <sup>e)</sup>          | 019  | 61,745 <sup>i)</sup>     | 1,020,833 <sup>i)</sup>          |
| 2009 | 71,036 <sup>d)</sup>     | 1,080,080 <sup>d)</sup>          | 020  | 59,341 <sup>j)</sup>     | 949,464 <sup>j)</sup>            |
| 2010 | 69,663                   | 1,066,710                        | 021  | N/A                      | N/A                              |
| 2011 | 67,828 <sup>c)</sup>     | 1,037,718 <sup>c)</sup>          | 022  | N/A                      | N/A                              |

These characteristics are as follows: freight tonnage carried given in **TABLE 1**, ton-kilometers given in **TABLE 2**, freight train-kilometers and rolling stock-kilometers given in **TABLE 3**, freight revenue given in **TABLE 4**, infrastructure investment and maintenance investment given in **TABLE 5**. It was not always possible to find accurate data, hence the gaps in tables appeared.

**TABLE 4** Freight revenue (100 million yen) – based on: [29], unless otherwise specified: <sup>a)</sup> [23], <sup>b)</sup> [24], <sup>c)</sup> [20], <sup>d)</sup> [12], <sup>e)</sup> [16], <sup>f)</sup> [15], <sup>g)</sup> [14], <sup>h)</sup> [22], <sup>i)</sup> [30], <sup>j)</sup> [32], <sup>k)</sup> [33], <sup>l)</sup> [34], <sup>m)</sup> [35], <sup>n)</sup> [36], <sup>o)</sup> [55], <sup>p)</sup> [56], <sup>q)</sup> [28], <sup>r)</sup> [26]; N/A – not analyzed, no data found.

**TAB. 4** Výnosy z prepravy (100 miliónov jenov) – na základe: [29], pokiaľ nie je uvedené inak: <sup>a)</sup> [23], <sup>b)</sup> [24], <sup>c)</sup> [20], <sup>d)</sup> [12], <sup>e)</sup> [16], <sup>f)</sup> [15], <sup>g)</sup> [14], <sup>h)</sup> [22], <sup>i)</sup> [30], <sup>j)</sup> [32], <sup>k)</sup> [33], <sup>l)</sup> [34], <sup>m)</sup> [35], <sup>n)</sup> [36], <sup>o)</sup> [55], <sup>p)</sup> [56], <sup>q)</sup> [28], <sup>r)</sup> [26]; N/A – neanalyzované, nenašli sa žiadne údaje

| Year | Railway transport   | JRFreight                                      | Year | Railway transport   | JRFreight                                      |
|------|---------------------|--|------|---------------------|--|
| 1987 | 1,715 <sup>h)</sup> | Approx. 950 <sup>b)</sup>                      | 2008 | 1,316 <sup>m)</sup> | 1,615 <sup>e)</sup>                            |
| 1990 | 2,028 <sup>k)</sup> | 1,860 <sup>k)</sup>                            | 2009 | 1,225 <sup>l)</sup> | 1,522 <sup>e)</sup>                            |
| 1992 | N/A                 | Approx. 1,500 <sup>b)</sup>                    | 2010 | 1,215               | 1,152/1,536 <sup>f)</sup>                      |
| 1995 | 1,856 <sup>k)</sup> | 1,711 <sup>k)</sup>                            | 2011 | 1,185 <sup>k)</sup> | 1,529 <sup>f)</sup>                            |
| 1997 | N/A                 | Approx. 1,450 <sup>b)</sup>                    | 2012 | 1,187 <sup>k)</sup> | Approx. 1,200 <sup>b)</sup>                    |
| 1999 | N/A                 | 1,644 <sup>a)</sup>                            | 2013 | 1,210 <sup>j)</sup> | 1,145 <sup>j)</sup>                            |
| 2000 | 1,415 <sup>k)</sup> | 1,315 <sup>k)</sup>                            | 2014 | 1,211 <sup>i)</sup> | 1,146 <sup>j)/Approx. 1,250<sup>b)</sup></sup> |
| 2001 | N/A                 | 1,607 <sup>c)</sup>                            | 2015 | 1,247               | 1,183  |
| 2002 | N/A                 | 1,574 <sup>c)/Approx. 1,400<sup>b)</sup></sup> | 2016 | 1,252               | 1,187  |
| 2003 | N/A                 | 1,657 <sup>c)</sup>                            | 2017 | 1,297 <sup>q)</sup> | 1,227 <sup>d)</sup>                            |
| 2004 | N/A                 | 1,616 <sup>c)</sup>                            | 2018 | 1,247 <sup>r)</sup> | 1,136 <sup>d)</sup>                            |
| 2005 | 1,345 <sup>i)</sup> | 1,269 <sup>i)/1,647<sup>c)</sup></sup>         | 2019 | 1,335 <sup>r)</sup> | 1,239 <sup>r)</sup>                            |
| 2006 | 1,365 <sup>n)</sup> | 1,291 <sup>n)/1,637<sup>e)</sup></sup>         | 2020 | N/A                 | N/A  |
| 2007 | 1,382 <sup>m)</sup> | 1,671 <sup>e)</sup>                            | 2021 | N/A                 | N/A  |
| 2008 | 1,316 <sup>m)</sup> | 1,615 <sup>e)</sup>                            | 2022 | N/A                 | N/A  |

**TABLE 5** Infrastructure investment and maintenance – based on [51], unless otherwise specified: <sup>a)</sup> approx. based on [44], <sup>b)</sup> based on [53], it can be stated that maintenance cost is almost constant, however, data given in these references concern all the maintenance costs not only infrastructural ones; N/A – not analyzed, no data found up-to-date.

**TAB. 5** Investície a údržba infraštruktúry – na základe [51], ak nie je uvedené inak: <sup>a)</sup> cca. na základe [44], <sup>b)</sup> na základe [53] možno konštatovať, že náklady na údržbu sú takmer konštantné, avšak údaje uvedené v týchto referenciách sa týkajú všetkých nákladov na údržbu, nielen na infraštruktúru; N/A – neanalyzované, neboli nájdené aktuálne údaje

| Year | Infrastructure investment | Infrastructure maintenance <sup>b)</sup> | Year | Infrastructure investment | Infrastructure maintenance <sup>b)</sup> |
|------|---------------------------|--|------|---------------------------|--|
| 1994 | 8,001,923,101             | N/A                                      | 2009 | 9,601,945,141             | N/A                                      |

| Year | Infrastructure investment | Infrastructure maintenance <sup>b)</sup> | Year | Infrastructure investment | Infrastructure maintenance <sup>b)</sup> |
|------|---------------------------|--|------|---------------------------|--|
| 1995 | 8,456,340,090             | N/A                                      | 2010 | 11,305,885,029            | N/A                                      |
| 1996 | 7,522,380,694             | N/A                                      | 2011 | 10,208,813,812            | N/A                                      |
| 1997 | 6,198,278,849             | N/A                                      | 2012 | 11,803,122,282            | N/A                                      |
| 1998 | 6,186,887,287             | N/A                                      | 2013 | 9,192,030,123             | 2,550,000,000 <sup>a)</sup>              |
| 1999 | 8,308,133,793             | N/A                                      | 2014 | 8,644,266,433             | N/A                                      |
| 2000 | 10,146,000,000            | N/A                                      | 2015 | 8,880,164,753             | N/A                                      |
| 2001 | 9,586,956,887             | N/A                                      | 2016 | 9,174,734,997             | N/A                                      |
| 2002 | 9,085,073,599             | N/A                                      | 2017 | 10,391,224,715            | N/A                                      |
| 2003 | 7,522,860,701             | N/A                                      | 2018 | 10,466,421,217            | N/A                                      |
| 2004 | 6,214,676,346             | N/A                                      | 2019 | 10,541,617,718            | N/A                                      |
| 2005 | 6,050,438,950             | N/A                                      | 2020 | 10,616,814,220            | N/A                                      |
| 2006 | 6,738,741,816             | N/A                                      | 2021 | N/A                       | N/A                                      |
| 2007 | 6,882,796,271             | N/A                                      | 2022 | N/A                       | N/A                                      |
| 2008 | 7,369,257,130             | N/A                                      |      |                           |  |

### 3 CONCLUSIONS

Japan is a country with high concentrations of mountainous terrain, which makes the construction and maintenance of infrastructure more expensive and allocated mainly at the islands' borders. On the other hand, freight container transport is proceeded mainly by coast shipping. Although the rail transport network is highly developed, the scale of freight transport by rail branch is not so common due to the demanding load of passenger rail transport. The study on freight rail data enabled to obtain the following results, assumptions, and speculations:

- In many cases, empty containers are returned by trains from locations to which the goods were delivered by coastal shipping; consequently, using foldable containers should be considered so that more of them could be carried on the 26-wagon long trains,
- Data has been collected for future comparisons with other countries however, there are still gaps in the collected data – therefore it is advisable to continue with the collection of archival data and await for current data to be collected – the latter may be updated with the publication of the next Japanese Statistical Yearbooks (nevertheless, it should be noted that sometimes data are published with from two to three years delay),
- There is still an observed lack of references and certain statistics related to rail freight transport in Japan – organizing, cataloguing, and grouping data is time-consuming and requires further intensive research and analysis, not only of scientific publications, but above all of websites, reports of railway operators and domestic authorities,
- Objective for further work: further analyses to address the issue of transport optimization and simulation of foldable containers.

### References

[1] Agency of Natural Resources and Energy, 2020: <https://www.enecho.meti.go.jp/about/whitepaper/2013html/2-1-2.html>, accessed March 22<sup>nd</sup>, 2020. [2] Aratani, T., Sato, K., 2018: Possibility of intermodal freight transport using ferry and RORO ships in Japan, Scientific Journals of the Maritime University of Szczecin, 54, 126, 95-102. [3] CEIC, 2020: <https://www.ceicdata.com/en/japan/railway-statistics/railway-freight-tonnage-carried>, accessed February 19<sup>th</sup>, 2020. [4] CSR, 2022: JR Freight, CSR Report 2022, [www.jr-](http://www.jr-)

freight.co.jp/files/私たちについて/CSR・IR情報/csr\_jr\_rep2022\_rev.pdf, accessed June 4<sup>th</sup>, 2023. [5] **CSR, 2021:** JR Freight, CSR Report 2021, [www.jrfreight.co.jp/files/私たちについて/CSR・IR情報/csr\\_jr\\_rep2021\\_H.pdf](http://www.jrfreight.co.jp/files/私たちについて/CSR・IR情報/csr_jr_rep2021_H.pdf), accessed June 4<sup>th</sup>, 2023. [6] **CSR, 2020:** JR Freight, CSR Report 2020, [www.jrfreight.co.jp/files/私たちについて/CSR・IR情報/img\\_01\\_01.pdf](http://www.jrfreight.co.jp/files/私たちについて/CSR・IR情報/img_01_01.pdf) accessed June 4<sup>th</sup>, 2023. [7] **CSR, 2018:** JR Freight, CSR Report 2018, <https://t.ly/3sv9>, accessed February 19<sup>th</sup>, 2020. [8] **CSR, 2017:** JR Freight, CSR Report 2016-2017, <https://t.ly/p-HoP>, accessed February 19<sup>th</sup>, 2020. [9] **CSR, 2015:** JR Freight, CSR Report 2015, <https://t.ly/x8QT>, accessed February 19<sup>th</sup>, 2020. [10] **CSR, 2014:** JR Freight, CSR Report 2014, <https://t.ly/J7sZ>, accessed February 19<sup>th</sup>, 2020. [11] **Diziaina, D., Taniguchi, E., Dablanc, L., 2014:** Urban Logistics by Rail and Waterways in France and Japan, *Procedia - Social and Behavioral Sciences* 125, pp. 159–170. [12] **ESR, 2019:** JR Freight, Environment and Social Report 2019, <https://t.ly/CbWa>, accessed February 19<sup>th</sup>, 2020. [13] **ESR, 2013:** JR Freight, Environment and Social Report 2013, <https://t.ly/m4yc>, accessed February 19<sup>th</sup>, 2020. [14] **ESR, 2012:** JR Freight, Environment and Social Report 2012, <https://t.ly/b2l7>, accessed February 19<sup>th</sup>, 2020. [15] **ESR, 2011:** JR Freight, Environment and Social Report 2011, <https://t.ly/O8l6b>, accessed February 19<sup>th</sup>, 2020. [16] **ESR, 2010:** JR Freight, Environment and Social Report 2010, <https://t.ly/v6tmj>, accessed February 19<sup>th</sup>, 2020. [17] **ESR, 2009:** JR Freight, Environment and Social Report 2009, [https://www.jrfreight.co.jp/assets/files/csr\\_pdf\\_07.pdf](https://www.jrfreight.co.jp/assets/files/csr_pdf_07.pdf), accessed February 19<sup>th</sup>, 2020. [18] **ESR, 2008:** JR Freight, Environment and Social Report 2008, [https://www.jrfreight.co.jp/assets/files/csr\\_pdf\\_08.pdf](https://www.jrfreight.co.jp/assets/files/csr_pdf_08.pdf), accessed February 19<sup>th</sup>, 2020. [19] **ESR, 2007:** JR Freight, Environment and Social Report 2007, [https://www.jrfreight.co.jp/assets/files/csr\\_pdf\\_09.pdf](https://www.jrfreight.co.jp/assets/files/csr_pdf_09.pdf), accessed February 19<sup>th</sup>, 2020. [20] **ESR, 2006:** JR Freight, Environment and Social Report 2006, [https://www.jrfreight.co.jp/assets/files/csr\\_pdf\\_10.pdf](https://www.jrfreight.co.jp/assets/files/csr_pdf_10.pdf), accessed February 19<sup>th</sup>, 2020. [21] **Global Infrastructure Outlook, 2020:** <https://outlook.gihub.org/countries/Japan>, accessed March 21<sup>st</sup>, 2020 [22] **Imashiro, M., Ishikawa, T.:** The Privatisation of Japanese National Railways: Railway Management, Market and Policy, Bloomsbury: London, UK 2012. [23] **Iwasa, K., 2001:** Rail Freight in Japan—The Situation Today and Challenges for Tomorrow, *Japan Railway & Transport Review* 26, pp. 8-17. [24] **Ishikawa, T., 2017:** 貨物駅改良による鉄道貨物輸送の効率化とその評価 (Improvement of rail freight transportation by improvement of freight station and its evaluation) <https://tinyurl.com/mr3cmn4e>, accessed February 25<sup>th</sup>, 2020. [25] **Japan Federation of Transport Associations, 2017:** Understand the benefits and mechanisms. Railway container transportation. Guidebook, [http://www.t-renmei.or.jp/reference/leaflet/pdf/2017-\\_butsuryu.pdf](http://www.t-renmei.or.jp/reference/leaflet/pdf/2017-_butsuryu.pdf), accessed February 25<sup>th</sup>, 2020. [26] **Japan Statistical Yearbook, 2023:** Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. <https://www.stat.go.jp/english/data/nenkan/72nenkan/index.html>, accessed June 3<sup>rd</sup>, 2023. [27] **Japan Statistical Yearbook, 2022:** Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. <https://tinyurl.com/4vdhed8d>, accessed June 3<sup>rd</sup>, 2023. [28] **Japan Statistical Yearbook, 2021:** Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. <https://tinyurl.com/3ae9yuft>, accessed June 3<sup>rd</sup>, 2023. [29] **Japan Statistical Yearbook, 2020:** Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. <https://www.stat.go.jp/english/data/nenkan/69nenkan/1431-13.html>, accessed February 25<sup>th</sup>, 2020. [30] **Japan Statistical Yearbook, 2019:** Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. [31] **Japan Statistical Yearbook, 2018:** Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. [32] **Japan Statistical Yearbook, 2017:** Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. [33] **Japan Statistical Yearbook, 2016:** Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. [34] **Japan Statistical Yearbook, 2015:** Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. [35] **Japan Statistical Yearbook, 2014:** Statistics Bureau, Ministry of Internal Affairs and

Communications, Japan. [36] **Japan Statistical Yearbook, 2013**: Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. [37] **Japan Statistical Yearbook, 2012**: Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. [38] **Japan Statistical Yearbook, 2011**: Statistics Bureau, Ministry of Internal Affairs and Communications, Japan. [39] **JRFreight, 2020**: <https://www.jrfreight.co.jp/en/corporate-overview>, accessed February 25<sup>th</sup>, 2020. [40] **JRFreight, 2021**: <https://www.jrfreight.co.jp/en/corporate-overview>, accessed June 4<sup>th</sup>, 2023. [41] **Kim, C. J., Huang, M. C.**, 2019: The Privatization of Japan Railways and Japan Post: Why, How, and Now. ADBI Working Paper 1039. Tokyo: Asian Development Bank Institute. <https://t.ly/Bo3Y>, accessed February 19<sup>th</sup>, 2020. [42] **Knoema, 2020**: <https://tinyurl.com/vup7xdhd>, accessed March 5<sup>th</sup>, 2020. [43] **Knoema, 2023**: <https://tinyurl.com/mr2wc42m>, accessed June 3<sup>rd</sup>, 2023. [44] **Koshiichi, I.**, 2014: Maintenance Issues for Railway Facilities and Future Prospects in Maintenance, JR EAST Technical Review-No.29, pp. 5-8. [45] **Kurosaki, F.**, 2018: A study of vertical separation in Japanese passenger railways, Case Studies on Transport Policy, Volume 6, Issue 3, pp. 391-399. [46] **Lyckle, G.**, 2016: The Railway Market in Japan, EU-Japan Centre for Industrial Cooperation - Office in the EU, [www.EUbusinessinJapan.eu](http://www.EUbusinessinJapan.eu), accessed February 25<sup>th</sup>, 2020. [47] **Ministry of Land, Infrastructure, Transport and Tourism Railway, 2015**: Japan Railways in figures (2015 数字でみる鉄道 (バックナンバー)), Transport Policy Research Organization, 292 p. [48] **Mizoguchi, M. 2000**: The Rolling Stock Manufacturing Industry in Japan, <https://tinyurl.com/yezahrhb>, accessed March 24<sup>th</sup>, 2020. [49] **MordorIntelligence, 2023**: Japan rail freight transport market size & share analysis - growth trends & forecasts (2023 - 2028), <https://tinyurl.com/3j6n5rsc>, accessed June 6<sup>th</sup>, 2023. [50] **Nishimura, K., 2015**: Freight Rail Overview & Freight Management in JAPAN. Japan Freight Railway Company, <https://tinyurl.com/2ajvesvu>, accessed February 19<sup>th</sup>, 2020. [51] **OECD, 2020**: Freight transport (indicator). <https://tinyurl.com/43wnvbcw>, accessed March 3<sup>rd</sup>, 2020. [52] **OECD, 2021**: <https://tinyurl.com/mwwuhtdr>, accessed March 3<sup>rd</sup>, 2020. [53] **Takikawa, M.**, 2016: Innovation in Railway Maintenance utilizing Information and Communication Technology (Smart Maintenance Initiative), Japan Railway & Transport Review No. 67, pp. 22-35. [54] **Tanaka, K.**, 2010: Transport Costs, Distance, and Time: Evidence from the Japanese Census of Logistics, Institute of Developing Economies, IDE Discussion Paper No. 241, JETRO, pp. 1-32. <https://bit.ly/2QzQqF2> accessed March 21<sup>st</sup>, 2020. [55] **TDB, 2019**: Teikoku DataBank, Ltd., Special plan: Shikoku area Road freight forwarding business. Top 20 companies with the highest revenues Performance survey (FY2018), <https://tinyurl.com/3j3cyhb6>, accessed March 21<sup>st</sup>, 2020. [56] **TDB, 2017**: Teikoku DataBank, Ltd., Special project: Survey on the actual conditions of management of road freight carriers, <https://tinyurl.com/yc52kcb>, accessed March 21<sup>st</sup>, 2020. [57] **Zhongyuan, S.**, 2014: Energy Conservation Policies in Transport Sector in Japan, Energy Conservation Group The Institute of Energy Economics, JAPAN (IEEJ), Beijing, October 20, 2014, <https://tinyurl.com/243zuenh>, accessed March 22<sup>nd</sup>, 2020.



### Summary

*Japanese National Railways has been privatized in 1987. In the era of JNR, it accumulated heavy debts, especially in the freight operating area as railways in Japan are passenger-dominated. The conglomerate of Japanese domestic railway operators consists of 6 passenger companies and the seventh one is dedicated to freight operations and transport. This paper is related to the study of freight rail transport which is rarely of researchers' interest. The following data were collected and are given within the paper: freight tonnage,*



*ton-kilometers, freight train-kilometers and rolling stock-kilometers, freight revenue and infrastructure investment together with maintenance investment.*

### **Resumé**

*Japonské národné železnice boli sprivatizované v roku 1987. V ére JNR nahromadili veľké dlhy, najmä v oblasti nákladnej dopravy, keďže železnice v Japonsku ovládajú cestujúci. Konglomerát japonských domácich železničných operátorov pozostáva zo 6 osobných spoločností a siedma sa venuje nákladnej doprave a doprave. Tento článok súvisí so štúdiom nákladnej železničnej dopravy, o ktorú sa výskumníci len zriedkavo zaujímajú. Nasledujúce údaje boli zozbierané a sú uvedené v dokumente: tonáž nákladu, tonokilometre, vlakové kilometre a kilometre vozového parku, príjmy z nákladnej dopravy a investície do infraštruktúry spolu s investíciami do údržby.*



