

## **Analysis of further training and development opportunities in the rail sector (summary)**

**Eike Hartmann, Gabriel Specht, Tanja Riotte, Maximilian Wipperfürth, Elisabeth Meilhammer**

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German Centre for  
Rail Traffic Research at the



Federal Railway Authority

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of the German Centre  
for Rail Traffic Research

Report 19 (2022)

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# Analysis of further training and development opportunities in the rail sector

Summary

by

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# Abstract

Against the backdrop of the German government's climate goals and the Rail Transport Master Plan target of doubling the number of railroad passengers by 2030, it can be assumed that there will be an increase in the need for qualified specialists in the rail sector. This development will augment the already severe shortage of skilled workers in many areas of the rail sector. Furthermore, due to technological developments and new regulations, there is a constant need for further training. This need for qualification can be covered by the training of specialists at universities, initial training within the framework of the German dual training system, the continuous further training of employees in the sector, and the qualification of lateral entrants through retraining.

The following study is the first to provide a comprehensive overview of further training and development in the German rail sector. A combination of various primary data sources was used for the analysis: web research on further training opportunities, analyses of job advertisements, surveys, and expert interviews. The study was conducted from June to December 2021 by market research service provider Statista in collaboration with Prof. Dr. Elisabeth Meilhammer.

Findings showed that advanced training courses, i. e., further training measures for employees already working in the relevant field, account for 75 % of all courses offered. Retraining, i. e., further training measures which qualify lateral entrants for a new professional profile, account for the remaining 25 %. Due to the significant difference in the duration of the courses, an analysis of the offered course days reveals a contrasting image: Over 90 % of all course days offered were within the context of retraining, with retraining as a train driver accounting for 56 % of all course days.

There are few major players among further training providers. The three biggest providers – DB Training, Learning & Consulting, dispo-Tf Education GmbH and the Verband Deutscher Eisenbahnfachschulen [Association of German Railway Schools] (VDEF) – offer 69 % of all available courses. Moreover, some providers have a strong focus on specific areas. Providers that offer further training courses and, at the same time, operate in the field of employee leasing typically focus on retraining related to the professional profiles that are in high demand in the labor market, i. e., train drivers, special-purpose vehicle drivers, managing functions in rail operations, and customer support.

Companies in the rail sector that require further training services see shortages in the availability of suitable offers in many areas. A limiting factor for the expansion of offers is the availability of qualified trainers. In terms of quality, however, most companies are satisfied with external course offers. Key recommendations for optimizing the further training market include stronger cooperation among providers, the bundling of scarce trainer resources, increased training of trainers, and the establishment of information and exchange platforms. This would result in greater transparency regarding the partially fragmented supply and demand, allowing for the creation of more courses.

# 1 Aim and scope of the study

Against the backdrop of the German government's climate goals and the Rail Transport Master Plan<sup>1</sup> target of doubling the number of railroad passengers by 2030, the rail sector is likely to become even more important in the future, and, consequently, the need for qualified specialists will also increase. The experts interviewed as part of the study shared this opinion. At the same time, new regulations, and technological developments, such as increasing digitalization, are generating more demand for further training of new and existing employees in the rail sector.

The following study aims at providing a comprehensive and structured overview of further training and development opportunities in the rail sector in Germany. Another study commissioned by the German Centre for Rail Traffic Research (DZSF) examines the training of specialists at universities<sup>2</sup>. 2019 was chosen as the reference year for the data that was collected in interviews as part of the present study to exclude the impact of the COVID-19 pandemic.

The term "further training" encompasses both retraining and professional development courses, and the latter, in turn, can be divided into refresher training and career advancement training. Further training is therefore used as an umbrella term in this study. In some cases, a distinction has been made between retraining and advanced training. Advanced training refers to professional development courses for employees that already work in the relevant position. Meanwhile, retraining refers to further training measures that typically take longer and qualify lateral entrants for a new professional profile.

The study focuses on rail-specific needs for further training, i. e., providing specific skills that are required in the rail sector. In contrast, areas which require skills that are almost identical to those required in other industries were not analysed. This line of demarcation was established during the expert interviews with representatives from further training institutions and companies operating in the rail sector. Based on this, the needs for further training were divided into 11 sections to structure the analysis (see Table 1). Furthermore, the focus of the study lies in specialist skills. Cross-disciplinary social, methodological, and personal skills (so-called "key skills") were not analysed.

In the present study, "special-purpose vehicle drivers" include drivers of railroad excavators and switchyard engine drivers, for example. In the field of rail operations, a distinction has been made between managing functions, such as railroad chief operating managers or traffic controllers, and executing functions, such as switchers or car inspectors. "Infrastructure and track construction" comprises jobs such as master track builders, switch mechanics, and construction supervisors. When it comes to "logistics / forwarding services", this study only analyses rail-specific further training, such as further training on the handling of dangerous goods in rail transportation. Meanwhile, "other areas of further training" comprises rail-specific further training that cannot be clearly classified as belonging to one of the other areas of further training. This includes professional development courses to qualify as a fire warden with a focus on the rail sector as well as rail-specific language or IT courses.

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<sup>1</sup> BMDV (2021). Masterplan Schienenverkehr [Rail Transport Master Plan]. Available at: <https://www.bmdv.de/MasterplanSchienenverkehr>. Accessed on December 23, 2021

<sup>2</sup> Büker, T., Nießen, N., Stoll, F., Schindler, C., & Jagodzinski, N. (2022). Analyse der Hochschulausbildung im Schienenverkehrssektor, *Berichte des Deutschen Zentrums für Schienenverkehrsforschung*, 18, doi: 10.48755/dzsf.220002.01

TABLE 1: ANALYSED AREAS OF FURTHER TRAINING IN THE RAIL SECTOR

<b>#</b>	<b>Area of further training</b>
1	Retraining as a train driver (lateral entry)
2	Trained train drivers (advanced training)
3	Special-purpose vehicle drivers
4	Customer support
5	Managing functions in rail operations
6	Executing functions in rail operations
7	Infrastructure and track construction
8	Security / safety officers
9	Vehicle engineering and maintenance
10	Logistics / forwarding services
11	Other areas of further training

## 2 Methodological approach to data collection

Five primary research approaches were combined to carry out the research project. This was done to get the desired structured overview of supply and demand for further training services (see Figure 1). Data collection and interviews were conducted over a period of four months in the second half of 2021.

The supply side includes both further training offered by training providers, typically commercial ones, and internal further training, which is primarily offered by companies to their own employees. Based on an extensive and detailed analysis of the areas of further training shown in Table 1, a needs analysis was carried out that focused on both quantitative and qualitative needs. This also involved analysing shortages and their underlying reasons, e. g., why course offers in the field of further training cannot meet demand. Subsequently, recommendations for action were derived based on the analysis and results.

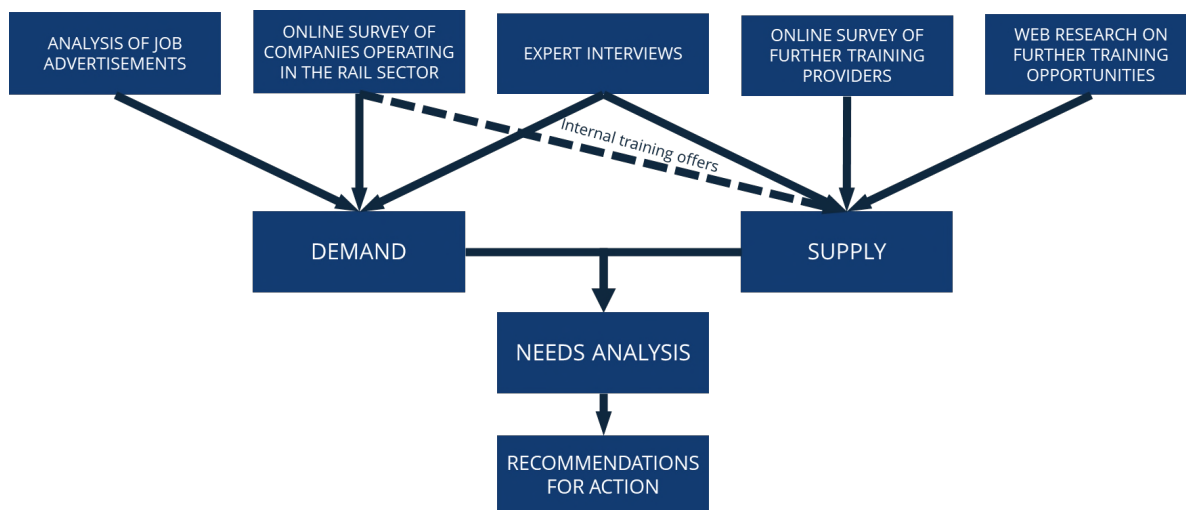


Figure 1: Schematic representation of the methodological approach

In total, 8,540 job advertisements relating to the rail sector were identified on the job portals of the Federal Employment Agency and Stepstone. These were then analysed in a structured way, regarding professional profiles and the level of qualification required from applicants, among others.

Moreover, an online survey of companies operating in the rail sector was conducted, which was distributed via different disseminators, such as industrial associations. Subsequently, 48 companies were willing to participate. The survey included questions on the needs for further training; the range and extent of internal training offers, which are primarily geared toward the company’s own employees; how frequently they used external training offers and how satisfied they were with them; their opinion on the framework conditions; and expected future developments. Individual analyses were carried out for the eleven areas of further training if at least five companies stated they had training needs in the relevant field. Since many companies in the rail sector have internal training opportunities, the online survey also provided insights into these types of offers.

As another part of the study, a total of 13 expert interviews were carried out. Of these, eleven were conducted with representatives from companies operating in the rail sector, who were surveyed on the needs for further training, internal offers, and their take on the current state of the further training market. In addition, two representatives from further training providers were interviewed on further training offers and their assessment of the market.

Furthermore, data was collected by carrying out an online survey of further training providers. After being approached directly about the survey, 28 further training providers (about a quarter of identified providers in Germany) agreed to participate. The survey included questions on the courses offered, the characteristics of course participants, the balance between supply and demand regarding further training services, their opinion on the framework conditions, and expected future developments. Individual analyses were carried out for eleven areas of further training if at least five companies stated they had further training offers in the relevant field.

The study also involved extensive research on information about providers and courses offered in the field of rail-specific further training that was available online. Particular attention was paid to the providers' external representation, such as their web presence and information material for potential course participants. These were analysed in detail. Based on this, 109 relevant further training providers and 5,441 courses offered were identified, and the latter was assessed in a structured way – in terms of course duration, content, and costs, among other things. This analysis provides a snapshot of the information available on the internet at the time of the study. It is worth noting that there are considerable differences between providers when it comes to how far in advance information on courses is provided, i. e., whether they only display courses that are to be held in the following weeks or whether they also show courses that are to be held significantly further in the future, for example. The level of detail of the information provided about their courses varies, ranging from a clear presentation of all courses on offer, including detailed information on individual courses, to a rough description of the areas covered by the relevant provider without any information on individual courses. Some providers also offer courses that are customized to the individual needs of requesters. The data collected thus only represents a portion of the total further training market, namely all the courses for which information was available online at an individual course level at the time of research

### 3 Analysis and results

#### 3.1 Analysis of the demand for further training

The shortage of skilled workers poses a great challenge for the rail sector. In general, 92 % of the companies participating in the online survey stated that it was very difficult or rather difficult to recruit enough qualified people in the labor market to cover their needs in at least one of the professional profiles considered in this study. For every professional profile examined in this study, at least half of the railroad industry representatives reported difficulties in finding qualified personnel (see Figure 2). For special-purpose vehicle drivers, train drivers, and employees in the areas of “vehicle engineering and maintenance”, “infrastructure and track construction”, and “managing functions in rail operations”, the rate was even higher, with more than 80 % of respondents choosing either “very difficult” or “rather difficult.”

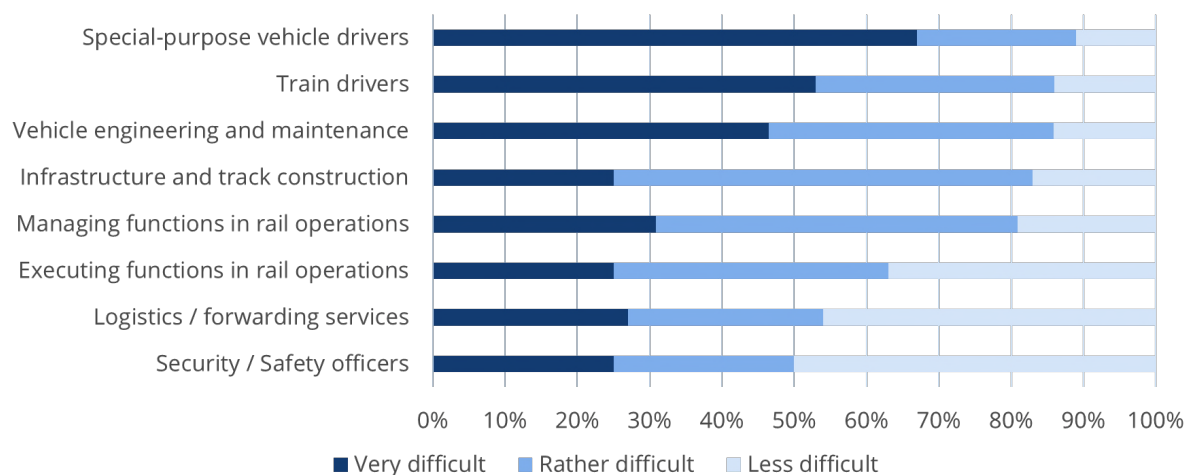


Figure 2: Difficulty levels in meeting the needs for qualified personnel in the labor market reported by companies

In parallel to the survey, an analysis of job advertisements in the rail sector was conducted to better understand the framework conditions for further training. Findings show that specialists in the field of “infrastructure and track construction” are particularly in high demand. In addition, more than 50 % were targeted at university graduates. Of these, many were engineers and IT specialist positions. This demand for university graduates is significantly higher than the share of employees currently working in rail sector with a university degree. A considerable proportion of job advertisements were also specifically aimed at lateral entrants, especially when it came to “security / safety officers”, “customer support”, “executing functions in rail operations”, and train drivers.

It is therefore not surprising that a sizable proportion of the respondents from the rail sector said that retraining was an important measure for tackling the shortage of skilled workers. Retraining was named as the most applied measure for four out of five areas particularly affected by the shortage of skilled workers (“Special-purpose vehicle drivers”, “Train drivers”, “Infrastructure and track construction”, and “Managing functions in rail operations”).

When addressing the annual number of further training days<sup>3</sup> per employee, the survey of companies in the rail sector focused on 2019. Across all areas of further training, the average number of days is at similarly high levels as those in the sector of corporate service providers, which includes areas such as transportation and storage and therefore also the rail sector. In comparison to the industrial sector, the need for further training is higher in the rail sector. The reference values for the sectors were taken from the IW Survey of Further Training, conducted by the German Economic Institute<sup>4</sup>, which also refers to 2019. The average numbers varied across the analysed areas of further training in the rail sector: While security / safety officers attended an average of 1.9 days/year of further training, the number of days for special-purpose vehicle drivers was much higher, with 3.8 days/year (see Figure 3). Retraining that lasts more than several months was excluded from these numbers.

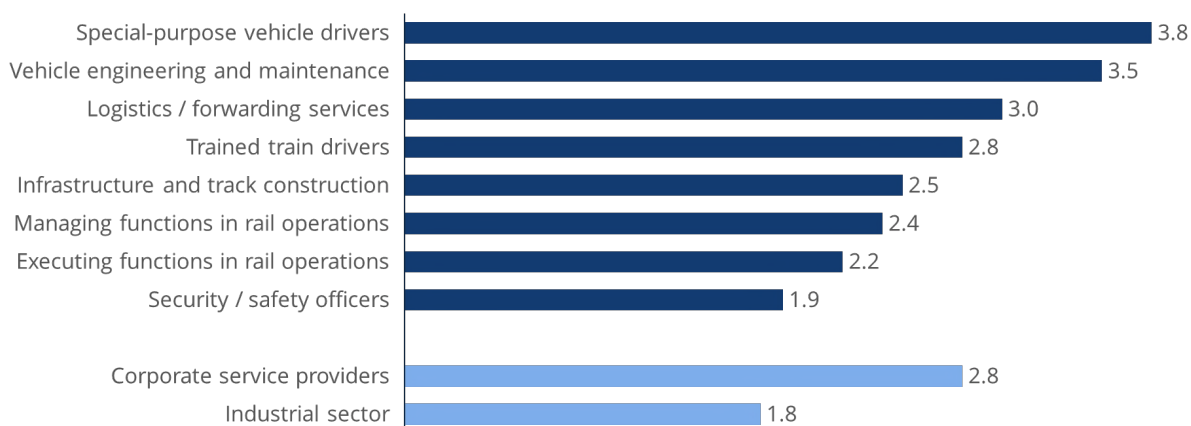


Figure 3: Average number of further training days per employee in 2019 by area of training, based on a survey of 1,340 companies as part of the IW Survey of Further Training 2020 (Source: Seyda & Placke, 2020)

When addressing the need for further training, companies in the rail sector use both internal training and offers from external providers. Further training that is primarily geared toward the company’s own employees but conducted by external trainers is considered as internal training. Smaller companies were particularly dependent on external trainers when it came to internal training programs. In companies with fewer than 50 employees, for example, external trainers carried out 75 % of the requested trainer days<sup>5</sup>. Furthermore, it is worth noting that larger companies in particular also allow external participants to attend their internal courses for further training. Thus, 80 % of the companies with more than 250 employees reported that at least some of their internal courses were generally also available to participants outside of the company.

The level of demand that is met by internal and external further training offers varies across the different areas of further training. The area of “Managing functions in rail operations,” for instance, is highly dependent on external offers as more than 50 % of the companies surveyed are exclusively using external offers to meet their demand (see Figure 4). In contrast, some areas, such as advanced training

<sup>3</sup> “Further training days” refers to the number of days on which employees are not performing their usual duties for the purpose of participating in further training.

<sup>4</sup> Seyda, S., Placke, B (2020). IW-Trends 4/2020. IW-Weiterbildungserhebung 2020: Weiterbildung auf Wachstumskurs. Vierteljahresschrift zur empirischen Wirtschaftsforschung, 47 (4). Institut der deutschen Wirtschaft Köln e. V.

<sup>5</sup> A “trainer day” is defined as all-day employment of a trainer in a training course.

for already trained train drivers, “Retraining as a train driver,” and further training for special-purpose vehicle drivers, rarely only rely on external course offers. Instead, most companies use a combination of internal and external further training courses.

There are only minor differences between companies of various sizes when it comes to how they meet demand. In fact, across all the analysed size clusters, most of the companies surveyed use both internal and external course offers. Approximately 10 % of the companies exclusively use internal offers to meet their demand. A similar percentage of companies with more than 250 employees exclusively use external offers and therefore offer no internal further training. Among smaller companies, the proportion is somewhat larger: Between one quarter and one third of them exclusively use external offers.

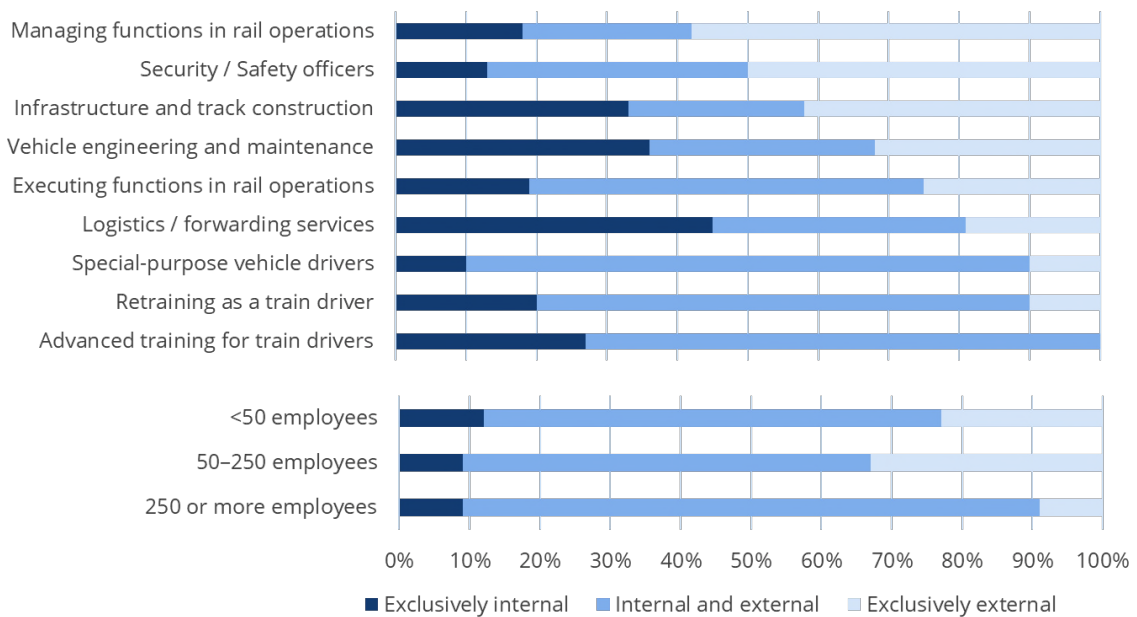


Figure 4: Coverage of further training needs through internal and external course offers

The most mentioned reasons for meeting further training needs internally are cost benefits, the possibility of having a strong focus on company-relevant content and on the company’s own quality standards, as well as the lack of external course offers. In contrast, the main reason for using external offers is not having enough employees who need further training.

### 3.2 Analysis of further training offers

As previously noted, the demand for further training is met through internal course offers, which are primarily geared toward the company’s own employees, and external course offers, which are generally provided by commercial providers. The following section presents research findings taken from information available online about rail-specific further training courses on offer and their providers.

A total of 5,441 further training offers were identified (see Figure 5). Of those, three quarters were advanced training courses, and one quarter were for retraining. In terms of the areas for further training, “Infrastructure and track construction” is the largest with 24 % of all courses, followed by “Other areas of further training” with 17 %. This area includes courses that cannot be clearly attributed to one specific professional profile. It also comprises preparatory courses for retraining, including contents such as

“Learn to learn” as well as “German courses for those entering the workforce”. In this specific area of further training, approximately 100 courses were identified that were specifically aimed at new target groups, such as refugees, to counteract the serious shortage of skilled workers.

Advanced training courses, which mostly last only a few days, dominate nearly all areas of further training. When it comes to further training for special-purpose vehicle drivers, however, retraining plays a significant role. For train drivers, a distinction has been made between retraining and advanced training by using two separate categories, which can be seen in Figure 5.

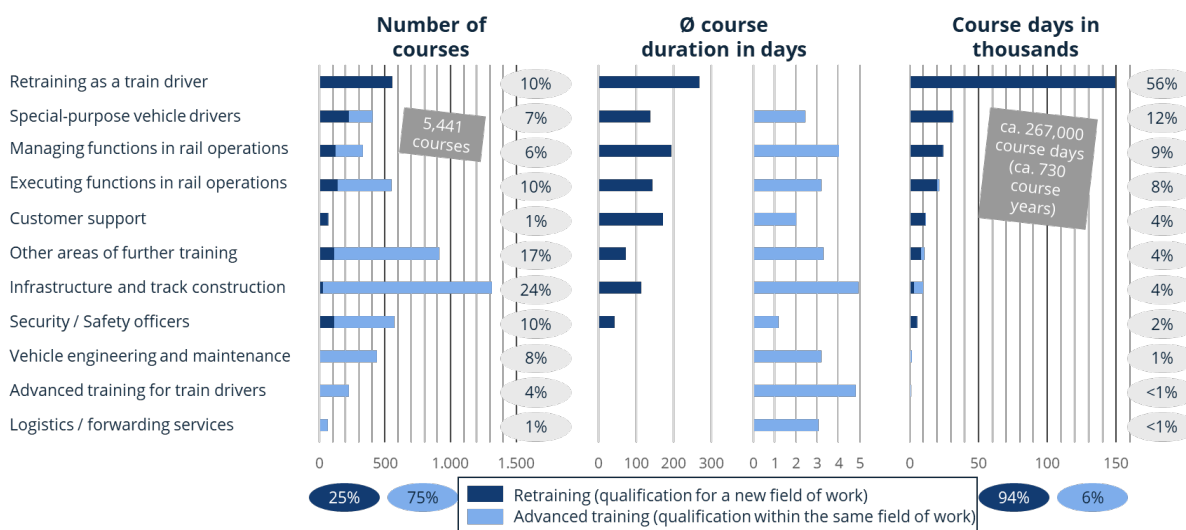


Figure 5: Number of identified further training courses and their duration

Typically, retraining lasts for several months and in some cases for more than a year. Due to this significantly longer duration of these courses, 94% of the offered courses days take place in the form of retraining. Retraining as a train driver stands out as 56% of the courses offered focus on this qualification. The total number of course days, amounting to approximately 267,000, were calculated by multiplying the number of all identified courses by their duration in days. The number of participants was not taken into account here. When adding up the number of days that course participants spent on training, the total number of course days were significantly higher because courses are usually offered for groups.

The course duration is also the most important factor when it comes to determining the price of the offered courses. The courses for retraining as a train driver, which, on average, are the longest in duration, are also the most expensive ones, with an average price of approximately €25,000 per participant. In contrast, advanced training courses, with an average duration of two to five days in most areas of further training, cost around €1,000. However, at approximately €200 to €500 per participant per course day, the prices for advanced training courses are significantly higher than those for longer retraining courses, which cost between €50 and €150 per course day.

Overall, a large proportion of the courses on offer are provided by a small number of major providers. The three biggest providers – DB Training, Learning & Consulting, dispo-Tf Education GmbH and the Verband Deutscher Eisenbahnfachschulen [Association of German Railway Schools] (VDEF) – offer 69% of all available courses. The 84 smallest providers, each offering fewer than 50 courses according to internet research, represent 77 % of all providers but offer only 13 % of all courses. Medium-sized providers, offering between 50 and 499 courses, account for the remaining 18 % of all courses.

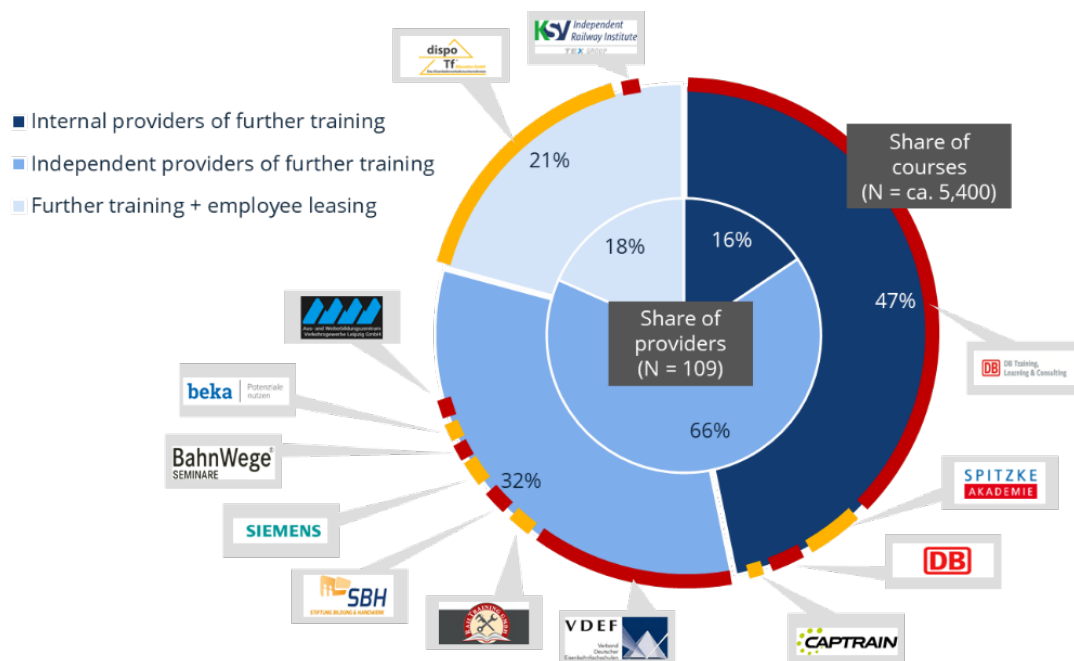


Figure 6: Further training offers by provider business model

In addition to size, the providers were also categorized by their business model. As such, this study differentiates between three types of providers: (i) internal providers of further training, (ii) independent providers of further training, and (iii) companies that provide further training services and, at the same time, operate in the field of employee leasing. Each identified provider was assigned to one of these three categories based on the information available on their company websites (see Figure 6).

Providers were categorized as “Internal providers” of further training if they are part of a company that is also engaged in other business activities in the rail sector. In addition, their services are predominantly offered to meet their company’s own needs, but they also market at least a portion of their offers externally. Examples include DB Training, Learning & Consulting, a further training provider of the DB Group, and the Spitzke Akademie, a further training provider of the Spitzke Group. These types of providers account for 47 % of all the courses that were identified during the research process of this study.

Providers were categorized as “Independent external providers” of further training if they predominantly operated as education and training service providers. VDEF and Rail Training GmbH belong to this category, for example. Furthermore, independent external providers also include providers of further training whose training offers supplement other business activities in the rail sector outside of rail operations. These activities include the production of rolling stock, the production of systems and components of the railroad infrastructure, and certification services. Examples of this type of provider are the Siemens Mobility Academy or TÜV NORD Bildung gGmbH. Providers belonging to this category offer 32 % of all courses.

Companies that offer further training courses and, at the same time, operate in the field of employee leasing usually combine both activities. They typically focus on retraining course participants to qualify them for professional profiles that are in high demand. These participants then have the opportunity, or in some cases even the obligation, to stay at the company, and are subsequently placed with clients that have staffing needs. This type of provider accounts for 21 % of all courses, with the largest provider of this category being dispo-Tf Education GmbH.

An analysis of the courses offered in terms of the providers’ business model reveals that internal providers of further training have a large focus on the areas of “Security / safety officers”, “Infrastructure and track construction”, and “Other areas of further training” as they dominate in these areas and account for more than 50 % of all offered courses (see Figure 7). The share of independent providers of further training is particularly high in the areas of “Logistics / forwarding services”, “Vehicle engineering and maintenance”, and “Executing functions in rail operations”. Companies that offer further training and, at the same time, operate in the field of employee leasing are predominant in the areas of “Customer support”, “Advanced training for train drivers”, “Managing functions in rail operations”, and “Retraining as a train driver”. When looking at the absolute numbers, these providers also offer a large proportion of the courses in the area of “Special-purpose vehicle drivers”. However, internal providers also offer many courses in this field.

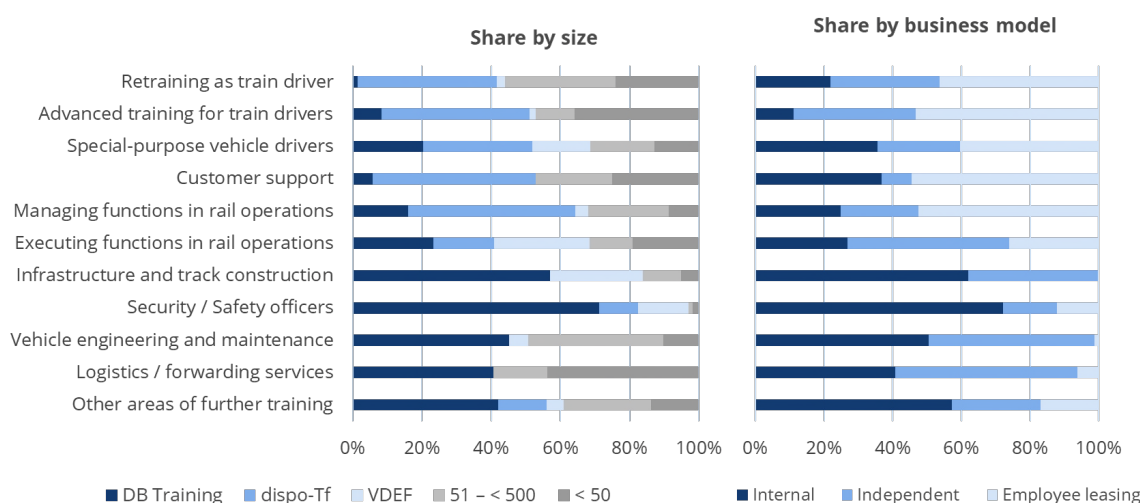


Figure 7: Further training offers by size and business model of the providers

An analysis of the offered course programs in terms of the size of the providers reveals that the market is fairly fragmented in the areas of “Logistics / forwarding services”, “Retraining as a train driver” and “Vehicle engineering and maintenance”. It also shows that small and medium-sized providers offer a relatively large proportion of the available courses. The areas of “Security / safety officers” and “Infrastructure and track construction”, however, are strongly dominated by the three largest providers, DB Training, Learning & Consulting, dispo-Tf Education GmbH, and VDEF.

### 3.3 Needs analysis

The companies operating in the rail sector that were surveyed observed shortages when it came to the availability of suitable offers for further training in sufficient quantity and quality. This was especially the case for special-purpose vehicle driver courses but also in the areas of “Logistics / forwarding services”, “Vehicle engineering and maintenance”, and “Executing functions in rail operations”.

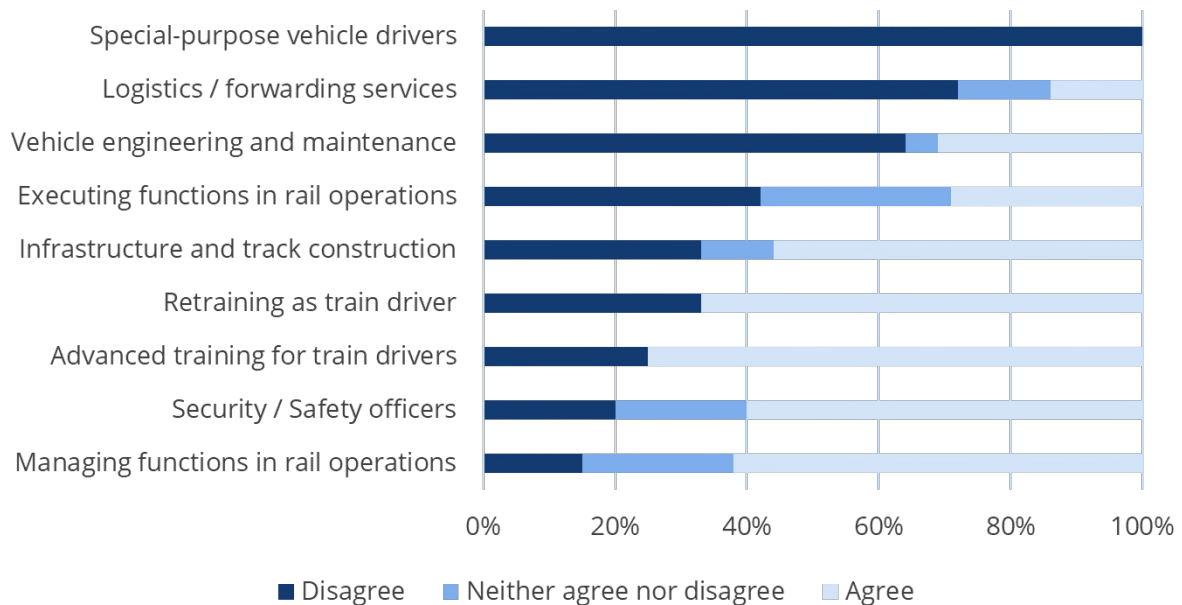


Figure 8: Degree to which companies agree that suitable offers for further training are available in sufficient quantity and quality

The providers of further training surveyed cited the shortage of qualified trainers as the main reason for not being able to meet the existing demand, for example when it came to courses on executing functions in rail operations. In other areas, however, providers noticed somewhat of an oversupply of further training courses. This was particularly true for the areas of “Retraining as a train driver” and “Advanced training for train drivers”. According to the interviewed providers, the main reasons for not being able to utilize existing training capacities was the difficulty in reaching potential course participants through advertising as well as the generally low number of people interested in attending the courses on offer.

The companies were also surveyed on the quality of the offered further training courses. Across all company sizes, more than 80 % of respondents were either satisfied or very satisfied with the external offers they had used (see Figure 8). The few companies that were not satisfied or not fully satisfied criticized the quality of the course contents or the scarcity of courses.

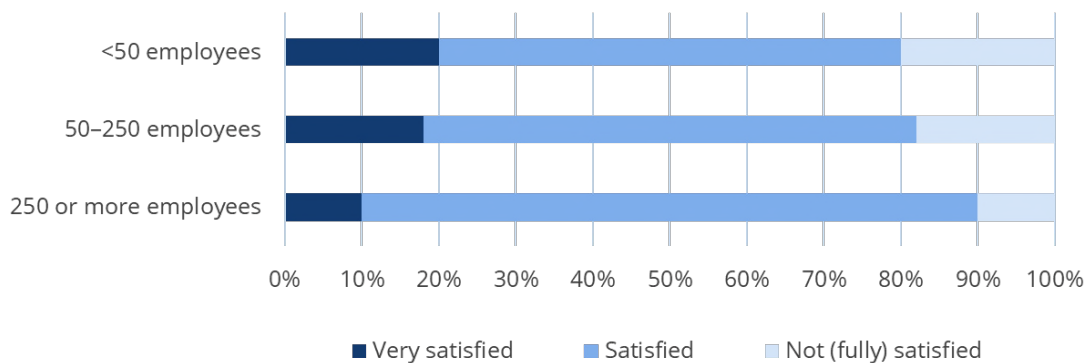


Figure 9: Satisfaction with the external further training offers that companies took part in

However, an analysis of the quality assurance measures, or rather the systems implemented by the providers that are indicative of a high degree of professionalization, reveals that there is still potential to improve quality management. This is particularly true for internal offers of further training in smaller companies (see Figure 10). Only about 30 % of the companies with fewer than 50 employees carry out standardized course evaluations for certain courses that are part of their internal further training programs. Among larger external training providers with more than 500 trainer days per year, 40 % evaluate all their courses and approximately 50 % evaluate at least part of their courses. A similar situation can be observed for the guidelines regarding the teaching concept for trainers, the application of learning management systems (LMS) for course management, and the application of learning content management systems (LCMS), i. e., systems that are used for adding content-related changes to the course contents quickly, if, for example, regulatory guidelines have been modified. From the data analysed, it can be concluded that external providers tend to have a higher degree of professionalization. Moreover, the bigger the company, the higher the degree of professionalization, for both internal and external providers.

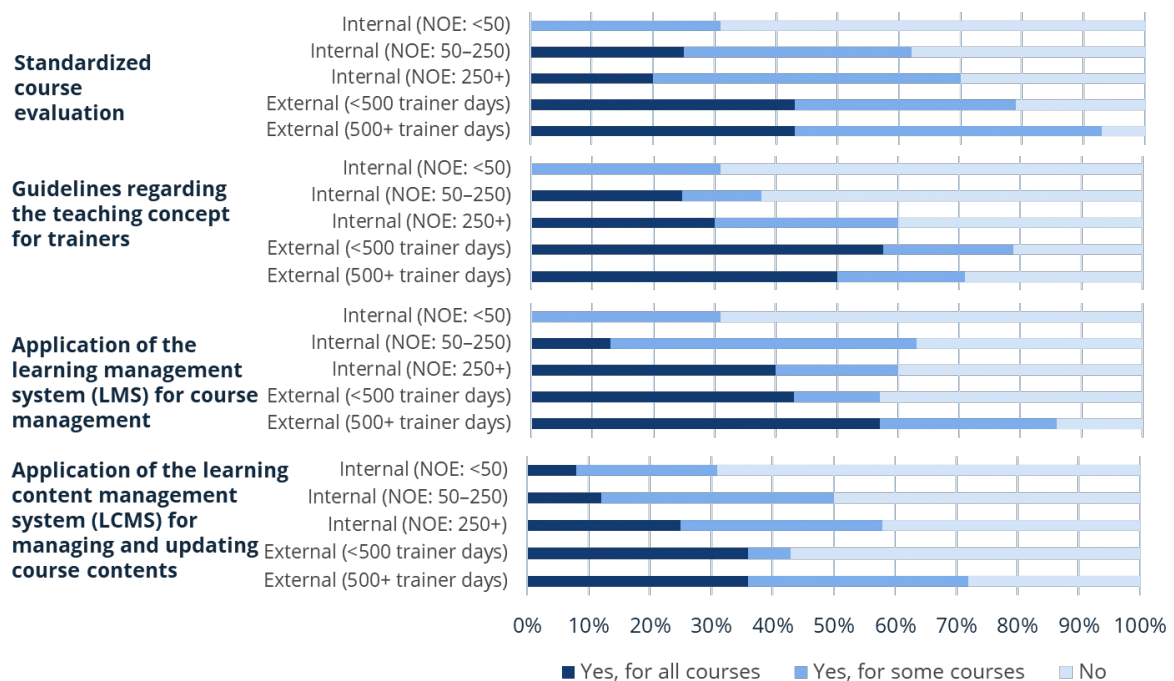


Figure 10: Use of quality assurance measures for the offered courses by further training providers (NOE = number of employees)

## 4 Recommendations for action and outlook

Further training is an important factor for the qualification of new and current workers in the rail sector, particularly within the context of the current acute shortage of skilled workers, the expected increase in the need for skilled workers due to climate and traffic policy goals, and the continuously developing technological and regulatory framework. Based on the qualitative interviews and the collected data, recommendations for action were derived to better address the identified needs (see Figure 11).

In general, it should be noted that all measures for the improvement of the further training market should be considered against the backdrop of the major shortage of skilled workers. An essential course of action must therefore be the recruitment of new skilled workers for the rail sector, and the further training sector can make a positive contribution by expanding pre-qualification measures. Examples of this would be industry-specific language courses or preparation courses for retraining in the rail sector; however, it is the companies within the rail sector that have the responsibility here. Numerous supporting measures have been agreed upon in the Rail Transport Master Plan. These include increased training and job advertisements through the Federal Ministry for Digital and Transport as part of the communication campaign for the “Deutschlandtakt” or through an annual “rail day.” The latter is organized by the Federal Government, states, and regional authorities as well as associations and companies in the rail sector, during which numerous events take place.

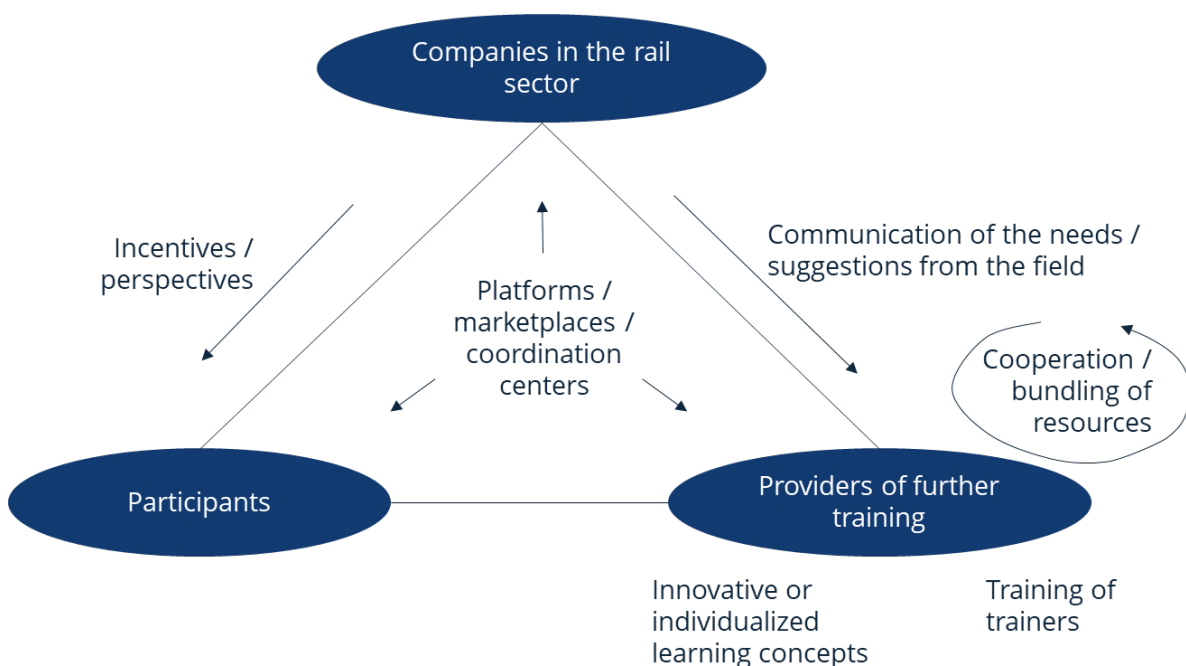


Figure 11: Key recommendations for action to be taken by relevant stakeholders

It is the providers that have some levers that they can use when it comes to the issue of scarce resources, an example being increased cooperation. Currently, around half of the providers already cooperate with competitors to pool together scarce training resources. However, according to the

interviewed experts, there is still potential for further expansion in cooperation. There is also potential regarding increased training of trainers and a stronger use of innovative and/or individualized learning concepts for the improvement of course offerings.

Moreover, companies within the rail sector are also able to positively influence further training offerings, particularly when working together with other relevant stakeholders. According to the interviewed experts, clearer and more long-term communication with providers regarding future needs for further training would give providers more planning security in the development of their offerings. This would lead to more suitable quantitative and qualitative offers. In addition, companies in this sector can take inspiration from actual practice to make their courses more relevant. Another measure which was suggested in the expert interviews was increasing motivation to partake in further training. Companies can achieve this by creating incentives for current and potential future employees and clearly showcasing the career perspectives that can come from partaking in the courses.

Exchange platforms and marketplaces or coordination centers can also offer positive contributions in many areas. Information regarding courses, available spots, and further training needs can be bundled on a central platform, for example, to increase transparency about the somewhat fragmented supply and demand, thus improving market efficiency and allowing for the provision of more courses. Such a platform could also become a central point of reference for interested participants to inform themselves about available further training opportunities.

Further suggestions refer to the expansion of quality assurance instruments, such as a standardized course evaluation. When it comes to internal further training, smaller businesses in particular have not yet implemented this kind of evaluation on a large scale. To further the implementation of such instruments, a branch-specific quality seal could be developed, which would require certain quality assurance measures, training of trainers, and/or technical equipment.

The recommendations for action presented here represent a selection of the measures developed within the study regarding the course participants, companies in the rail sector, and further training providers. These recommendations for action were classified in terms of their expected effectiveness and feasibility. This assessment should be verified and further developed in the appropriate discussion platforms or in in-depth studies.

Furthermore, this study contributes to addressing the challenges posed by the shortage of skilled workers and to the initiation of suitable mitigation measures. To this end, the findings of this study should be linked together with the finalized study of the DZSF on the employment impact of the rail sector<sup>6</sup> as well as the study “Analysis of higher education in the German rail sector,” which was commissioned by the DZSF in parallel to the present study.

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<sup>6</sup> Böttger, C.; Maenning, W.; Hartmann, E.; Barsch K.; Waldmann, L.; Specht, G.; Brockmann, L. (2021): Economic significance of the German rail sector on employment impact. In: Berichte des Deutschen Zentrums für Schienenverkehrsforschung (14/2021), DZSF, Dresden.

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