STAFFER
EUROPEAN RAIL SKILLS ALLIANCE

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Identification of skill needs and occupational profiles from the rail operators and infrastructure managers point of view

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LIST OF ABBREVIATIONS

AI, AR, VR	Artificial Intelligence
AR	Augmented Reality
VR	Virtual Reality
BIM	Building Information Modeling
CEDEFOP	European Centre for the Development of Vocational Training (Centre Européen pour le Développement de la Formation Professionnelle)
CER	Community of European Railway and Infrastructure Companies (Communauté européenne du rail)
CESI	Ecole d'Ingénieurs
CFL	Société Nationale des Chemins de Fer Luxembourgeois
CNAM	Conservatoire national des arts et métiers
CORDIS	Community Research and Development Information Service
DB	Deutsche Bahn AG
EACEA	European Education and Culture Executive Agency
EBA	Eisenbahn-Bundesamt
EQF	European Qualification Framework
ERA	European Union Agency for Railways
ERTMS	European Rail Traffic Management System
ESCO	European Skills, Competences, Qualifications and Occupations
ETCS	European Train Control System
UASHFE	Fachhochschule Erfurt
UASSP	Fachhochschule St. Pölten
FS	Ferrovie dello Stato Italiane
HR	Human Resource
ICT	Information and Communication Technologies
ISCED	International Standard Classification of Education
IŽS	Serbian Railways Infrastructure
MAFEX	Asociación Ferroviaria Española
ÖBB	Österreichische Bundesbahnen-Holding AG
R&D	Research and development

RENFE	Red Nacional de los Ferrocarriles Españoles
RFC	Rail Freight Corridor
IRU	Integrated Railway Undertaking
SBB	Schweizerische Bundesbahnen AG
SNCF	Société nationale des chemins de fer français
UB	University of Belgrade
UNIGE	Università di Genova
wmp	wmp consult – Wilke Maack GmbH
WP	Working Package

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PREFACE

This report is the second delivery in the context of the STAFFER WP 2, "*Identification of current and future skill and competence needs from the operational point of view*": Deliverable D.2.1 addressed the future vision of railways from the perspective of railway operators and infrastructure managers mainly from the angle of relevant technological and other trends, drivers and innovations. The D.2.2 report focuses on future skill and competence requirements in the light of technological and other changes but also from the perspective of cross-border railways and requirements as regards interoperability in the single EU railway market.

As the main source of both D.2.1 and D.2.2 has been the online survey of railway operators and infrastructure managers (carried out in June 2021), both reports should be read in conjunction.

WP 2 is building on a close exchange with WP 1 and its results. However, while WP 2 and its results are structured in a similar way, they are to a large extend different.

This is because WP 2 addresses additional topics and issues. Resulting from the strong interest of the railway operators and infrastructure managers involved in STAFFER[1] as well as a larger group of CER affiliates that participate in regular information meetings.[2] Three aspects have been addressed in WP 2 that in contrast to WP1 specifically considered the perspective of railway operators and infrastructure managers as well as WP 3 (the corresponding WP focusing on the rail supplier industry): Cross-border rail traffic; paying specific attention to European rail freight corridors; and language and communication issues in cross-border railway operation and infrastructure management.

[1] These are: DB, FS, IŽS, ÖBB, PRORAIL, SNCF and CFL as well as CER.
[2] Since the launch of STAFFER, CER organises monthly as well as occasional information meetings in parallel to the general monthly WP meetings. The CER meetings are organised in close cooperation with the WP co-leaders and open to all interested CER affiliates.

1 OBJECTIVES OF WP2 AND TASK 2.2 IN CONTEXT

While WP1 from the general perspective and WP3 from the perspective of the rail supplier industry, WP2 provides a closer look from the perspective of the railway operators and infrastructure managers.

The overall aim of the work package is to identify skill shifts and changes in occupational profiles as impacted by drivers such as trends, technological innovations, and open issues. A further objective was to identify potential fields of action for improvements, namely areas, where HR measures can contribute to more efficiency and effectiveness.

More precisely, WP2 covers two broader issues:

Task 2.1 addresses future visions of the rail sector from the perspective of railway operators and infrastructure managers. This task provides for an overview of the current state, the general key trends (those referred to in WP1, but also trends specific to railway operation and infrastructure management) and current as well as future challenges of railway operation and infrastructure. Beyond the general assessments and evidence, WP2.1 focuses on skill and qualification requirements as well as further issues:

- Cross-border rail traffic, with special references to EU rail freight corridors,
- Language issues and communication issues in cross-border traffic,
- Skill requirements of railway personnel, including trainers and managers (drivers, traffic controllers, conductors, operation managers, infrastructure/corridor managers, control staff and safety personnel) as well as skills and competences of professional profiles affected by digitalisation/big data/cybersecurity, energy, and environmental policies.

While task 2.1 was focusing on main trends and drivers as well as new requirements of railway operation and infrastructure in the transnational context, the key theme of task 2.2 has been the identification of skill needs and occupational profiles in railway operation and infrastructure management.

Tasks 2.1 and 2.2 will feed into WP4 ("*Development of mobility and training programmes*") and WP6 ("*Implementation of training and mobility programmes*"). It will contribute to task 4.4, the development of mobility and training programmes in the field of cross-border railways, communication and language (co-leader DB), and task 6.3, the implementation of cross-European apprentice mobility programmes and work-based internships (co-leader wmp consult), task 6.4, the implementation of cross-European staff mobility programmes and work-based

internships (co-leader DB), and task 6.7, implementing of mobility and training programmes in the field of cross-border railways, communication and language (co-leader DB).

Above that, WP2 should serve as an important basis for further consultation within the CER group of STAFFER partners as regards WP7 ("Development of a long-term strategy and action plan"), namely task 7.1.1 which is about designing a more specific strategy for rail operators and infrastructure managers (co-leader wmp consult).

2 METHODOLOGY AND ACTIVITIES CARRIED OUT

Against the important role of WP2 for STAFFER activities focusing on railway operators and infrastructure managers throughout the whole STAFFER life cycle, tasks 2.1 and 2.2 were implemented by the co-leaders wmp and DB in close cooperation with CER and railway operating and railway infrastructure management STAFFER partners. Different formats of exchange and consultation have proved to be important to fine-tune and agree upon the work plan, methodological tools as well as outcomes: regular meetings with a core team consisting of the DB coordinator and DB staff from different departments(different HR functions, DB training, department on the future of railway jobs), close exchange with the railway partners involved in WP2 as well as regular information meetings for CER affiliates (inside and outside STAFFER) hosted by CER and implemented jointly with the WP2 co-leaders.

Above that, there has been occasional joint meetings and bilateral exchange with educational and research partners, namely TU Dresden, UASSP, UASFHE, Aristotle University of Thessaloniki – School of Civil Engineering, University of Belgrade, CESI as well as UNIGE.

In the context of elaborating the WP2.1 report and with view on exchanging first ideas about key outcomes and follow-up activities in relation to addressing skill needs and future occupational profiles, there has also been an exchange with the co-leader of WP3 (MAFEX).

During the active time of task 2.1, six general meetings of all WP2 partners were implemented to discuss research progress, the methodology and interim as well as pre-final results at the 6th meeting in July 2021.

Based on survey results as well as accompanying activities such as desk research, exchange with experts and focus group meetings (see below), task 2.2 and the corresponding report were implemented during summer 2021.

As regards the implementation of the overall and the specific tasks of WP2, the co-leaders wmp consult and DB as well as the other railway operation/infrastructure management related

STAFFER partners have agreed to apply an integrated approach for tasks 2.1 (Vision Report) and 2.2 (Future skill needs analysis).

In this context, three main themes will be addressed, of which one will address the field of transnational railway operation, language, and communication:

(1) Railway vision – trends, challenges, choices, and related requirements within and outside railway operators and infrastructure managers.

(2) Trends and skill requirements and other needs as regards **interoperability, cross-border corridors, language, and communication**

(3) Skill status-quo analysis and future skills, competence needs and shifts; modernisation of occupational profiles

Whereas all three issues will be addressed in the current WP2.1 report, the subsequent work in task 2.2 and the respective report provide a more in-depth and detailed analysis of skill needs and future occupational profiles in railway operation and infrastructure management. Starting from a larger sample of occupational profiles related to railway operation and infrastructure management as described in the ESCO classification, the partners involved in task 2.2 have identified three occupational profiles that were analysed in more depth:

a) **The occupational profile of train drivers**
b) **Occupational profiles in traffic control centres**
c) **Occupational profiles in railway infrastructure and maintenance, including engineering profiles.**

Against this, WP2 has applied both from the analytical as well as methodological perspective a focused and layered approach that consisted of the elements described in the following subsections.

2.1 Desk research

Desk research and evaluation of existing knowledge and practices: Besides relevant research reports, the co-leaders of WP2 have gathered from EU databases (ERASMUS, CORDIS) as well as from STAFFER partners information on transnational cooperation, mobility, and R&D as well as innovation projects.

Furthermore, and in relation to occupational profiles in railways, an in-depth analysis of the **ESCO database** and identified 30 occupations described by ESCO in terms of skills, competences, and knowledge (see figure 6 and the more detailed discussion in section 3.3). This database will form the basis of further analysis in the context of the future skills analysis that

started already in task 2.1 and will continue during task 2.2 in relation to three focus profiles (train driver, traffic management and control, occupational profiles in maintenance and infrastructure including engineering profiles).

2.2 Thematic focus group(s)

As regards the themes on transnational/cross-border railway operation, rail freight corridors and issues related to language, communication and skill and competence needs of railway personnel in general and of professional profiles affected by digitalisation, it seems to be very important to integrate the expertise of staff/experts in railway undertakings and infrastructure/network managers.

Therefore, a smaller focus group consisting of experts of DB and ÖBB has been formed, focusing on topics such as key HR and other (technical, regulatory, etc.) challenges and barriers in relation to an efficient functioning of rail freight corridors and meeting the objective of achieving a higher modal share of 30% by 2030. The DB and ÖBB focus group consist of corridor managers (RFC 1 and Corridor 9) as well as experts and project representatives involved in pilots and other activities of developing foreign language solutions for communication between different actors involved in transnational railway operation (both rail and freight), for instance infrastructure managers, operators, train drivers and traffic control centre staff.

In the first year of the project, there were 4 meetings of the focus group, addressing issues of rail freight corridors, cross-border communication and (foreign) language needs in cross-border railways (see list of activities in the annex). It is planned that also in forthcoming work packages meetings of the focus group will continue, including also meetings in English language with participants from other countries.

2.3 Online survey

2.3.1 Contents, target groups and structure of the survey

As mentioned above, it is necessary to carry out an in-depth analysis of trends, requirements as well as skills and HR related requirements from the perspective of railway operators and infrastructure managers. An online survey consisting of several thematic sections addressing the topics listed above were circulated. Each survey part addressed experts within railway undertakings and infrastructure managers as well as educational and academic institutions.

Representatives of the following target groups were invited to complete the survey:

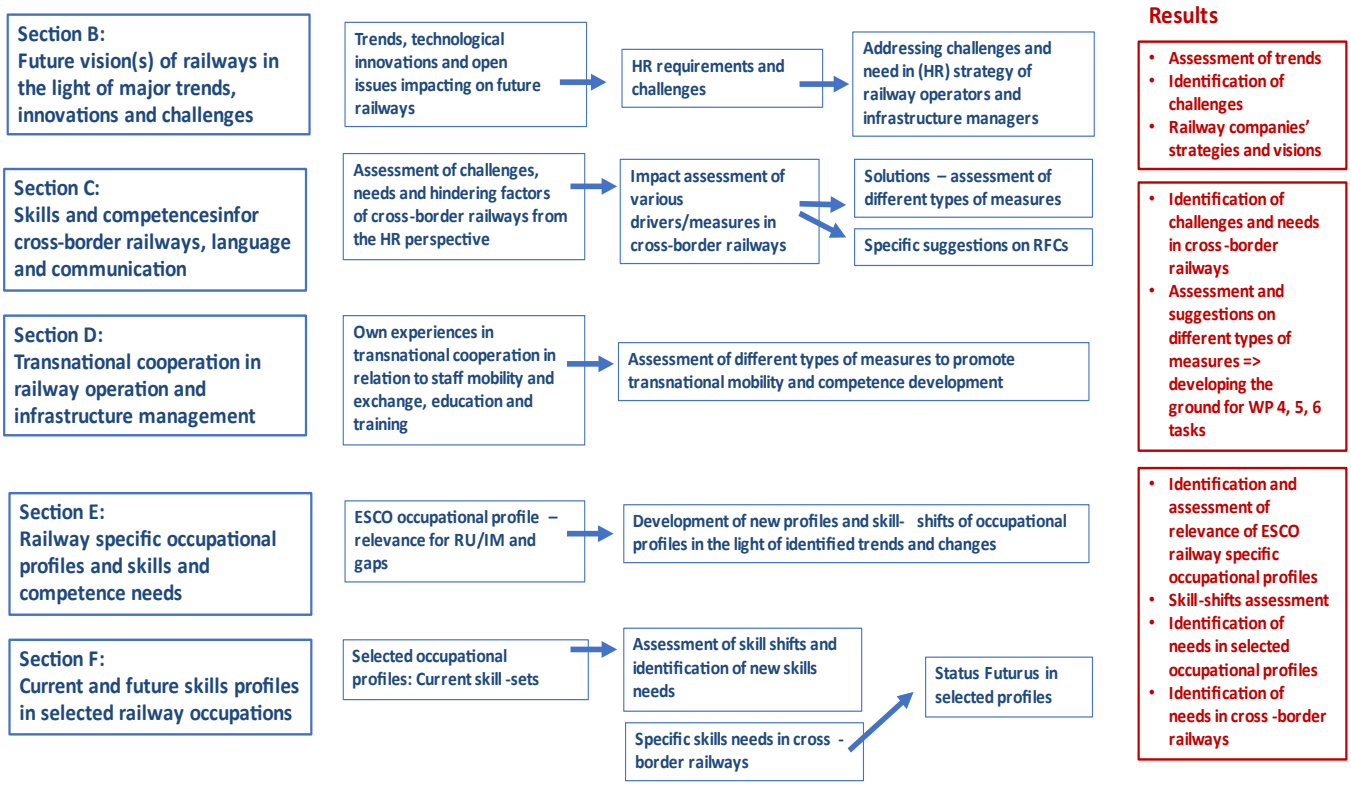
- HR experts
- Experts in relevant business units and functional areas of railway operation and infrastructure management
- Railway related research, education, and training institutions
- Other railway related stakeholders

Information from the survey contributed to both tasks addressed by WP2:

- **Section A** gathering data on the profile of respondents and contact details for follow-up interviews/exchange.
- **Section B** on future vision(s) of railways in the light of major trends, innovations, and challenges.
- **Section C** on skill and competence requirements and solutions for cross-border railways, language, and communication.
- **Section D** on transnational cooperation in railways
- **Section E** on railway specific occupational profiles, skill shifts, and future skill needs across different railway occupations.
- **Section F** aims at a more in-depth analysis of current and future skill requirements in three selected occupational profiles.

The survey logic is illustrated in the following Figure 1.

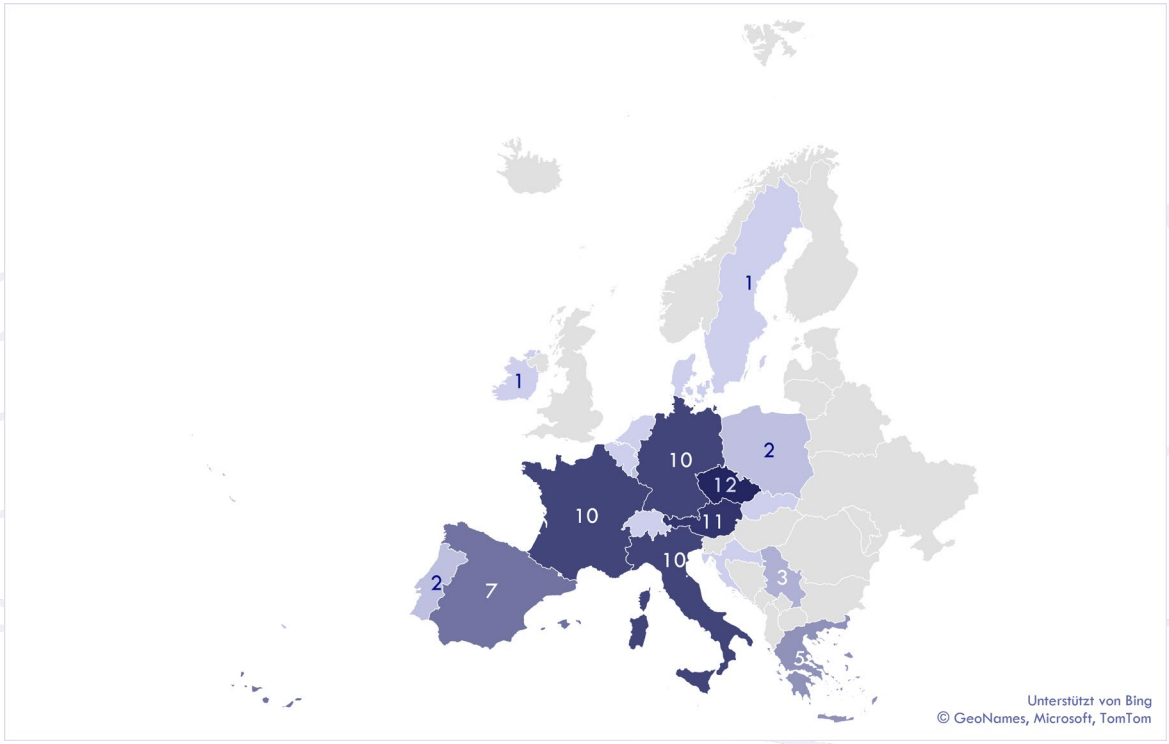
FIGURE 1: ONLINE SURVEY WP2: SURVEY LOGIC



2.3.2 Overview of responses

As of 1 July (when the survey was closed) a total of 19 countries responded to the survey of which 16 are EU Member States (Austria, Belgium, Croatia, Czech Republic, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Slovakia, Spain, Sweden), one is a candidate country (Serbia), and the remaining two are Switzerland and Russia. The number of responses ranged between 1 (Belgium, Croatia, Denmark, Ireland, Netherlands, Slovakia, Sweden, Switzerland and Russia) and 9-12 (Austria, Czech Republic, France, Germany, Italy). For further details see Figure 2 below.

FIGURE 2: SURVEY RESPONSES BY COUNTRY



N=83. Map shows only those countries with responses to the survey, except Russia (1 response).

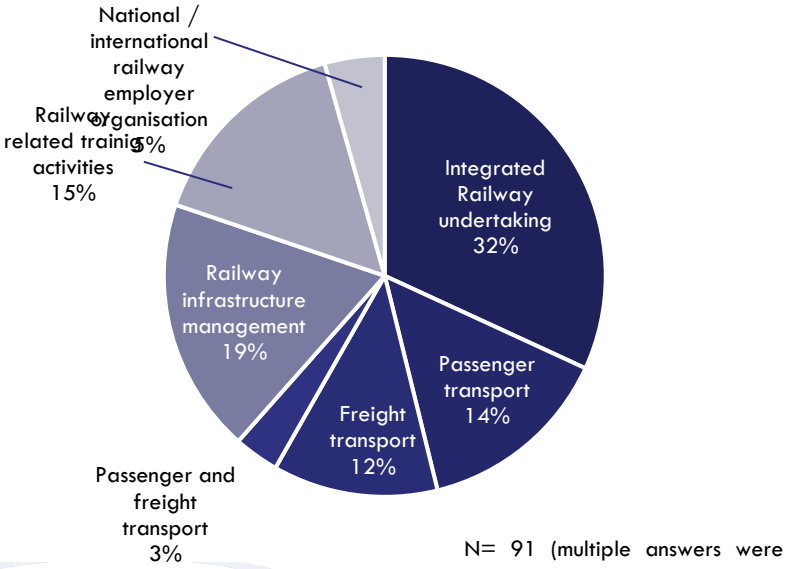
Source: STAFFER Survey of Railway operator and infrastructure managers 2021

More than three quarters (78%) of responses were made by representatives from different areas of railway operation and infrastructure management. In total, 27 railway operating and infrastructure management companies from 18 countries contributed to the survey. Further responses were from educational institutions and academic research (17%) and from railway employer organisations at national and international level (5%).

As regards railway operators and infrastructure management, the survey responses represent a balanced sample of all main domains, i.e. integrated railway companies, rail freight and rail passenger transport as well as infrastructure management (see Figure 3).

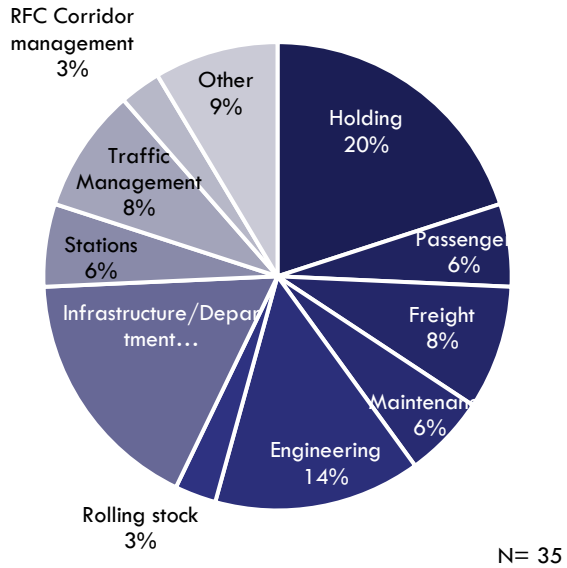
The responses from participants from integrated railway undertakings are spread quite broadly across different functional areas (see Figure 4). Most responses are from functions within the holding of the company (20%) and infrastructure management (19%). Other functional areas are engineering (14%), freight, passenger, maintenance, stations, traffic management, rail freight corridor management, rolling stock as well as areas such as education, training, innovation and research activities. Although the survey is not representative, it reflects different national, corporate, functional, organisational framework conditions as well as characteristics.

FIGURE 3: SURVEY RESPONSES BY TYPE OF ORGANISATION AND ACTIVITY



N= 91 as multiple answers were possible.
Source: STAFFER Survey of Railway operator and infrastructure managers 2021

FIGURE 4: SURVEY RESPONSES BY RAILWAY UNDERTAKINGS AND TYPE OF ACTIVITY



Source: STAFFER Survey of Railway operator and infrastructure managers 2021

2.4 Other activities in WP2

As the updated WP2 action list (see annex) shows, WP2 activities included not only regular meetings of the two co-leaders but also six meetings with CER and affiliated railway operators and infrastructure managers, seven meetings of all WP partners and five meetings of a selected number of experts (from DB and ÖBB) and academic partners on issues of interest, in particular language and communication challenges and needs in cross-border railways, measures to increase efficiency and effectiveness in rail-freight corridors and topics related to new technologies and their impact on railway operation, infrastructure and maintenance such as Building Information Modeling (BIM)[3].

[3] In fact, the meeting on BIM took place after the reporting period, i.e. at the beginning of November but is also included in the action list in the annex because it should be regarded as an activity of WP2 with the aim of developing measures for further STAFFER activities.

3 RAILWAY SPECIFIC OCCUPATIONAL PROFILES: SURVEY RESULTS AS REGARDS EXISTING AND NEW EMERGING OCCUPATIONAL PROFILES

Already in the WP2.1 report we presented a first overview of survey results as regards the relevance of the ESCO classification and railway specific profiles from the perspective of railway operators and infrastructure managers. In the following we will highlight again some key results of the survey and carry out a more in-depth analysis as regards current and future skill and competence needs.

3.1 Relevance of the ESCO classification from the company perspective

As regards the assessments made on ESCO by practitioners and experts, an ambivalent overall picture emerges as regards the adequacy and usefulness:[4] Only one out of three survey respondents indicated to know about the European Classification. Three quarter of those who are aware of ESCO designate it as useful. A further 20% think that it is useful but requires certain improvement.

Around half of the respondents highlighted **deficiencies and problems** of the ESCO classification (profiles are too generic and general; skills and competences are not described sufficiently; some occupations are outdated, train cleaner, mistakes in translation, etc.).

At the same time, another half of the respondents noted that the ESCO classification and the descriptions of occupational profiles, qualifications and competences are useful with view on transparency and the **harmonisation of occupational profiles** in the transnational perspective – as one respondent put it, ESCO "contributes to harmonise rail culture in Europe".

3.2 Railway companies' own experience of occupational profiles

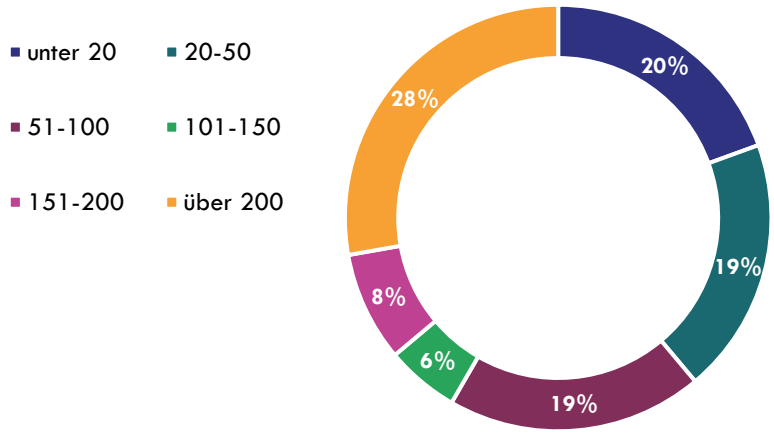
Railway undertakings in practice work with quite different approaches in relation to the description, definition, and differentiation of occupational profiles. This reflects not only

[4] See for detailed comments the WP2.1 report.

company specific requirements but also the differences in national systems of vocational education and training at all EQF levels.

Figure 5 shows that more than 40% of participants in railway undertakings reported in the context of the survey that in their companies more than 100 occupational profiles exist. Of these, nearly 30% stated that there are even more than 200 occupational profiles. By contrast, only 19% of respondents reported that there are less than 20 occupational profiles in place.

FIGURE 5: NUMBER OF OCCUPATIONAL PROFILES RAILWAY UNDERTAKINGS HAVE DEFINED AND DESCRIBED IN THEIR COMPANY



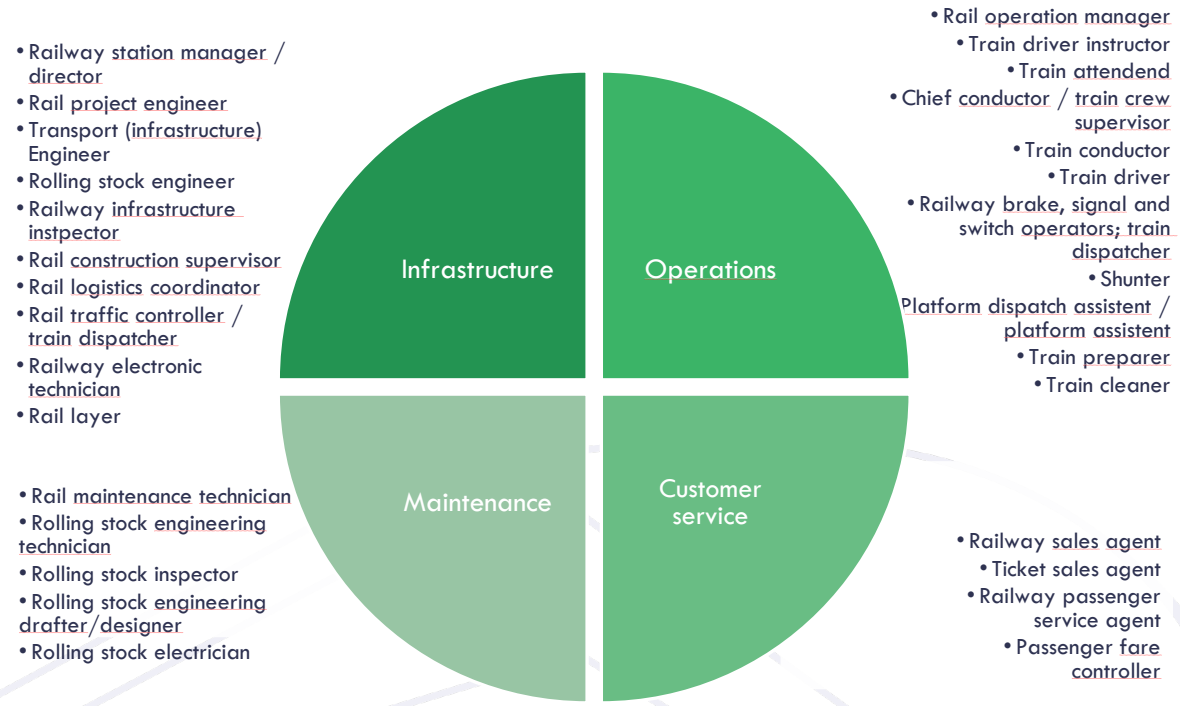
Source: STAFFER Survey of Railway operator and infrastructure managers 2021

This variety of developing and working with occupational profiles illustrates the challenges when developing a more unified or even more harmonised approach of a European classification system.

3.3 ESCO occupational profiles related to railway operation and infrastructure management

In order to identify occupational profiles that are relevant for railway operations and infrastructure management, a total of 30 ESCO profiles have been identified in the context of WP2 in relation to the domains of railway operations (11 profiles), maintenance (5 profiles), infrastructure (10 profiles) and customer services (4 profiles).

FIGURE 6: IN ORDER TO PROMOTE AND FOSTER THE ESTABLISHMENT OF A EUROPEAN RAILWAY AREA AND TRANSNATIONAL MOBILITY IN RAILWAYS, HOW IMPORTANT ARE THE FOLLOWING TYPES?



Source: STAFFER Survey of Railway operator and infrastructure managers 2021

3.4 Relevance of ESCO occupational profiles: More in-depth analysis of survey results

As highlighted already in the WP2.1 report, the survey provided an opportunity to ask railway practitioners and experts about the relevance of such profiles for their own practice in their company and whether such profiles match the company's own classification of occupational profiles, positions and/or functional groups.

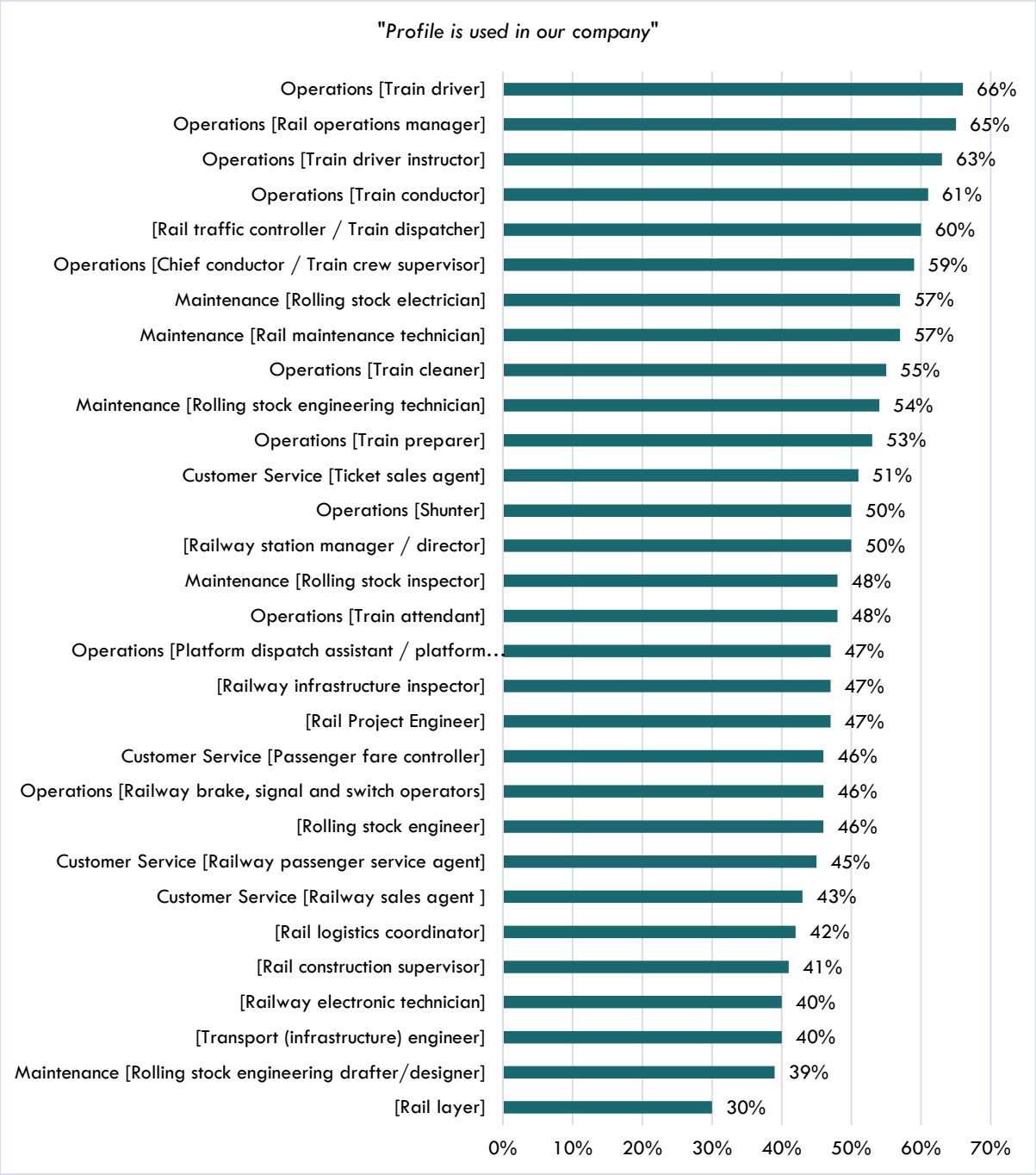
As shown in figure 7 below, there are quite significant differences between the relevance of occupational profiles for company practices, i.e., profiles actually used by the companies:

- The highest shares of ESCO profiles that are coinciding with company profiles can be found in railway operations such as train drivers (66%), rail operations manager (65%), train driver instructor (63%), train conductor (61%) or train dispatcher (60%)
- By contrast, engineering and technical occupations in infrastructure and maintenance such as rolling stock engineering drafter/designer (39%), transport infrastructure engineer (40%), railway electronic technician (40%), rail construction supervisor (41%),

rolling stock engineer (45%), rail project engineer (47%) are profiles that correspond to respective profiles to a much lesser degree.

- Furthermore, from 9% of respondents (regarding occupations such as rail project engineers, rail traffic controller/train dispatcher, railway electronic technician, train driver, shunter, rail maintenance technician) up to 22% (passenger fare controller) stated that the profile is not used in the own company. These profiles are possibly not used because they do not match the profile of the specific activity of the company.

FIGURE 7: RELEVANCE OF ESCO PROFILES FOR RAILWAY UNDERTAKINGS



Source: STAFFER Survey of Railway operator and infrastructure managers 2021

Nearly 80% of survey participants stated that there are occupational profiles that are not included in the ESCO list but are relevant for the railway undertaking in different domains. Such occupations are often ones that also exist in other sectors (research and development engineer, asset, real estate, and facility managers), but also railway specific profiles such as railway design engineer, design engineer in infrastructure and systems, movement inspector.[5] Furthermore, participants referred to occupational profiles in the planning and administration of transport (e. g. at federal or regional authorities planning and contracting passenger services, railway service planners at RU, railway engineers at authorities like EBA, ERA etc. issuing permits for technologies, projects, qualifications ...). These profiles resonate with counterparts at infrastructure managers and railway undertakings as well as suppliers and require similar expertise.

3.5 New occupational profiles developed in the past five years

The WP2 survey also included the question whether new occupational profiles related to railway operation and infrastructure management as well as other relevant domains have been developed during the last 5 years.

As expected, companies have indeed developed new occupational profiles and most of them were established in the context of new digital technologies and new skill and competence requirements related to the overall trend of digitalisation.

New profiles related to **IT, digital technology and new digital services** in railways that have been highlighted by respondents:

- New initial training profile / apprenticeship profile **app development and coding** (with tasks and skills such as programming, coding, and testing of applications or application parts; to document coded computer programs; to install and maintain computer hardware and lines; to develop access to databases; to deal with the wishes of the customers and finding solutions) (ÖBB)
- Profiles related to big data, e.g., **big data analyst** (Competence Center for Railways/Portugal, RENFE)

[5] The following clarification was presented in the response: "*who regulates train traffic; supervises and controls the work of personnel in charge for shunting and the correct composition of the train; plans and monitors the execution of the train traffic plan and gross routing; performs transport, commercial and wagon services; coordinates work with all services in the station and with the operations department; performs tasks and duties within its professional and health capabilities arising from the contracts that the infrastructure manager has with railway undertakings and third parties; performs other tasks.*"

- New profiles in railway education, e.g., **specialists/consultants in digital learning** and technologies such as AI, AR, VR) (Railcenter) or **virtual learning developer** (CFL)
- Profiles in the field of sales and customer relations such as **marketing automation** (RENFE) or **marketing experts** (SBB) and **customer support services** (SBB, ÖBB)
- **Cybersecurity specialists** and/or profiles in physical security of the railway system (RENFE, ÖBB)
- Specialists in the field of **building infrastructure: BIM specialists and managers**[6], **BIM coordinators** (FS Italiane, Italferr) as well as **smart station designers** (FS Italiane)
- New higher education module / subject "**Digitisation in Railways**" and New post-graduate training course: "Digitisation in Railways" (UASFHE)
- Companies also reported that despite no new occupational profiles as such were created, **existing profiles have been adjusted** in order to include new skills, competences and tasks related to digitalisation (e.g., DB); for example, in the field of **production engineering** and **maintenance technology** (SBB)

Besides those that are closely linked to railway related ICT and digitalisation, new occupational profiles have also been developed in the field of management functions such as the profile of a **change manager** and the **digital project manager** (both CFL) or **digital transformation manager** and **innovation programme manager** (RENFE).

Finally, respondents reported also of the development of new occupational profiles in functions and domains that are related to new requirements in the context of liberalisation of the railway market, for example **revenue and yield management** or **competition law experts**.

From the perspective of further activities in STAFFER, these information on new occupational profiles and in particular the strong link to ICT technologies and digital transformation / management of change are important. As described in more depth in section 5.2 and chapter 6.2, they may serve as the basis of developing measures of training, mobility and exchange in field such as railway related engineering in infrastructure and maintenance for example.

[6] The survey participant clarified the profile of a BIM Manager as follows: "He is the reference for the application of BIM standards and methodology throughout the entire process, as well as responsible for Information Management. It is the reference of the BIM Coordinator in the context of the application of BIM processes to the single order. It is the guarantor of the continuity of the BIM process in all its phases, from design to the realisation of the digital as-built. For all activities related to the order (planning, management, control) it acts in agreement with the PM."

4 SKILL SHIFTS IN THE LIGHT OF TECHNOLOGICAL AND OTHER DRIVERS AND TRENDS

4.1 Evidence and results from existing studies

In the context of a study for the Shift2Rail Joint Undertaking, a research study was dedicated to the current skill set of different categories of railway staff, from workers to engineers, railway managers and researchers.[7] As the research evaluated also previous research findings on the topic[8], key results are documented here because they represent the current state of the art.

The following table provides key results of the research as regards the 2012 – 2016 employment development trends of educational attainment and the corresponding skill sets within major professional groups in railways.

Table 2 below shows a clear upskilling tendency visible in all railway jobs towards higher ISCED[9] level. While this relates to most occupational groups, the only group where the share of employment between 2012 and 2016 decreased are service and sales workers, while the upward skill shift has been very strong for senior managers, technicians as well as elementary occupations.

Thus, there is a clear shift across all major occupational groups to higher educational degrees necessary to get recruited and perform a job in the sector.

The research for Shift2Rail on skill shifts has also highlighted significant differences between groups of countries in the skill sets of railway employees:

For this purpose, an analysis of the European Labour Force data was conducted to provide an insight into the developments between four focus countries (Germany, France, Netherlands, and UK), compared to the rest of the countries in Europe.

[7] Dhondt, S. et al. 2019: Socio-economic aspects of human capital: Assessment of the state of play in employment in the railway sector. Human Capital Report Series. TNO for Shift2Rail Joint Undertaking.
[8] These are the following in particular: European Commission (2007), Rail training 2020 - Training needs and offers in the European railway area in the next 10-15 years. Report by Danish Technology Institute. PANTEIA (2015). Analysis of the trends and prospects of jobs and working conditions in transport. SKILLRAIL (2012). Education and Training Actions for high skilled job opportunities in the railway sector, Final Report, November 2012.
[9] ISCED is the reference international classification for organising education programmes and related qualifications by levels and fields. See: http://uis.unesco.org/en/topic/international-standard-classification-education-isced. While, the EQF approach was not designed to classify educational programmes or occupations, but instead focuses on qualifications as learning outcomes in the form of knowledges, skills and competences and only partially implies a hierarchy of educational programmes, there are similarities between EQF and ISCED: A qualification on a higher level in the EQF very likely will correspond to a higher level on the ISCED levels) and a qualification on a lower EQF level will very likely lead to an occupational activity ranked on a lower level in the ISCO skill levels).

TABLE 1: TREND 2012 – 2016: SKILL DISTRIBUTION OF THE RAILWAY WORKFORCE WITHIN DIFFERENT PROFESSIONAL GROUPS

2012-2016: trend	ISCED 0-2	ISCED 3-4	ISCED 5-6
Senior managers	-10%	+5%	+5%
Professional engineers	0%	-1%	+2%
Technicians and associate professionals	-1%	-3%	+4%
Clerical support workers	-1%	-4%	+5%
Service workers and sales workers	-5%	+5%	-3%
Craft and related trades workers	-4%	+2%	+2%
Plant, machine operators and train drivers	-3%	+1%	+1%
Elementary occupations	-3%	-4%	+6%

Source: Dhondt 2019.

The analysis shows quite divergent developments between the two regional selections: The four focus countries show a remarkable stability of employment levels over the total period 2012 – 2016. By contrast, the other countries experienced quite a significant decline in employment of 11%.

Also, the occupational composition is quite different between the two country groups. In the four focus countries, the presence of managers, engineers and technical professionals is 30% higher than in the other group. In this group, the weight of personnel is mainly in service personnel and on-board occupations (train drivers).

When comparing the occupational and educational distributions, the research study shows that the focus countries not only have more personnel in management, engineering, and technical positions, but that this personnel is considerably higher educated (+25% higher). Meanwhile, the personnel in other selected countries shows higher levels of very low educated personnel (+25%).

Thus, the research for the Shift2Rail Joint Undertaking argues that the differences in the educational composition of the two country groups may also indicate there are different degrees of readiness to deal with the technological changes and the general upskilling trend in the context of digitalisation and automation in railways.[10]

Furthermore, several further questions are emerging (that have not been addressed in the Shift2Rail research) that are also relevant for STAFFER activities and in particular in relation to different needs of railway operators and infrastructure managers in terms of railway education and training: Are the differences related to differences in sector-specific and/or company specific framework conditions and a lower demand for managerial and higher qualified staff,

[10] Dhondt, S. et al. 2019: Socio-economic aspects of human capital: Assessment of the state of play in employment in the railway sector. Human Capital Report Series. TNO for Shift2Rail Joint Undertaking, p. 23

for example in engineering? Or are the differences an expression of a mismatch of demand and supply for managers, skilled workers, and engineering talents?

If the latter being the case, what are the reasons for this – deficiencies of the vocational education system, attractiveness of railway jobs, brain drain of well-educated junior professionals, etc.?

4.2 Results of the STAFFER survey

Based on the 30 railway specific occupations in the four main domains of railway operation and infrastructure management, respondents of the survey were asked to assess the skill needs and skill shifts in the light of technological trends and innovations.

The following results should be highlighted (see Figure 8 below for details):

Confirming the results of the generally upskilling trend as described below, only a low share of respondents think that the **current skill set will remain the same** (below 10% of respondents for most occupations, whereby the highest shares are for occupational profiles such as train cleaner, rail layer or shunter).

Minor needs as regards the development of new skills are expected by survey participants for only occupations such as railway sales agent, train conductors, infrastructure inspector or construction supervisors.

This corresponds to few occupations where respondents expect no major needs in terms of new skills that must be added to the occupational profile. Such occupations are those in various **occupational domains with a comparatively low educational and training qualification level**, e.g., train cleaner (only 12% of respondents expect major new skill needs), platform assistant (11%), shunters (12%) or rail layer (14%). Similar low shares of major new skill needs are expected for passenger fare controllers (only 15% expect major new skill needs) and railway sales agents (15%).

As regards occupational profiles with a lower level of qualification and skill needs it should be noted that these results do not mean that digitalisation has no impact on the job and how tasks are carried out. In fact, occupational tasks may already have been strongly affected by new technology (as in the case of ticket sale, controlling or customer services). Furthermore, there are also quantitative impacts, i.e. a reduced demand of jobs in areas that have been digitised already (selling tickets and providing customer information via apps).

By contrast, **technical and engineering occupations** with higher levels of qualification and corresponding EQF levels were highlighted by survey participants as those with major needs for new skills to the added to the respective occupational profile.

FIGURE 8: CONSIDERING THE TECHNOLOGICAL TRENDS AND INNOVATIONS, PLEASE INDICATE PER OCCUPATIONAL PROFILE YOUR ASSESSMENT AS REGARDS SKILL SHIFTS

Source: STAFFER Survey of Railway operator and infrastructure managers 2021

Respondents mentioned the following profiles in particular as occupations that are like to change significantly in the future:

- Rolling stock engineering drafter designer (50% expect major new skill needs)
- Maintenance technician (44%)
- Rolling stock electrician (41%)
- Rolling stock technicians (39%)

Major skill needs are also indicated by high shares of survey participants for **rail operations managers (42%) and rail project engineers (43%).**

An important result of the survey is also that a high share of survey respondents (42%) stated that major new skill requirements and needs are emerging or will emerge in the field of **train driving.**

An even higher share of respondents (45%) thinks that there will be major need in new skills that should be added to the occupational profile of the **rail traffic controller / train dispatcher.**

Overall and as regards future skills development and measures related to employability in railways the survey results raise several issues that will be important to be addressed by railway operating and infrastructure management companies: Which fundamental, general skills will become more important for workers and employees to stay in a job and build a career in specific occupational profiles? Which technical skills will become more important and which transversal, soft skills? From the perspective of railway education and training, which responsibility the vocational education and training system outside and inside railway companies need to play in the future?

Furthermore, the survey results confirm that the decision as highly relevant to select the three occupational profiles of the train driver, profiles in traffic management and control and occupational profiles in maintenance and infrastructure, including engineering occupations.

5 CURRENT AND FUTURE SKILL NEEDS IN SELECTED RAILWAY RELATED OCCUPATIONS

5.1 Current skill set of the job

This section of the survey is a more in-depth analysis of current and emerging future skill needs in selected occupational profiles / occupational groups.

The following three occupational profiles /groups were selected because they are particularly relevant for the STAFFER project in terms of the impact of main trends such as digitalisation and expected changes due to emerging technologies such as automated operation, digital traffic control, disruptive changes in infrastructure and maintenance of rolling stock as well as construction (BIM, digital twins, predictive maintenance, etc.).

A further selection criterion was that the description of the selected occupational profiles in the ESCO classification and correspond to the entire range of relevant EQF levels from 3 to 8, covering vocational school or apprenticeship programmes, technician, bachelor, and master's degrees.

- **Train drivers**
- Occupational profiles in **traffic control centres** (dispatchers, signal box staff, etc.)
- Occupational profiles in **infrastructure and maintenance**, including engineering profiles

Corresponding to the approach that is also used in the CEDEFOP European Skills Survey[11], the STAFFER survey asked participants about the current skill set in three categories and 17 specific skills:

- **8 fundamental skills**: Basic and advanced literacy; basic and advanced numeracy; basic, moderate and advanced ICT; foreign language skills
- **3 technical skills**: Specialised knowledge needed to perform the duties; Knowledge of particular products and services; Ability of operating specialised technical equipment
- **6 transversal skills**: Communication skills; teamworking skills; customer handling skills; problem solving skills; learning skills; planning and organisation skills.

[11] See "Skills, qualifications and jobs in the EU: the making of a perfect match?", p. 68. Available at: https://www.cedefop.europa.eu/en/publications-and-resources/publications/3072.

TABLE 2: DEFINITION OF SKILLS

Skill Category	Skills	Definition
Fundamental	**Basic literacy**	Reading manuals, procedures, letters, or memos.
	Advanced literacy	Writing long documents such as long reports, handbooks, articles, or books.
	Basic numeracy	Calculations using decimals, percentages, or fractions, understanding tables and graphs.
	Advanced numeracy	Calculations using advanced mathematical or statistical procedures.
	Basic ICT	Using a PC, tablet or mobile device for email, internet browsing.
	Moderate ICT	Word-processing, using or creating documents and/or spreadsheets.
	Advanced ICT	Developing software, applications, or programming. use computer syntax or statistical analysis packages.
	Foreign language skills	Using a language other than your mother tongue to perform job duties.
Technical	Specialised knowledge needed to perform the duties Knowledge of particular products and services Ability of operating specialised technical equipment	
Transversal	**Communication skills**	Sharing information with co-workers/clients. Teaching and instructing people. Making speeches or presentations.
	Teamwork skills	Cooperating and interacting with co-workers. Dealing and negotiating with people.
	Customer handling skills	Selling a product/service. Dealing with people. Counselling, advising, or caring for customers or clients.
	Problem solving skills	Thinking of solutions to problems. Spotting and working out the cause of problems.
	Learning skills	Learning and applying new methods and techniques in your job. Adapting to new technology, equipment or materials, engaging in own learning.
	Planning and organisation skills	Planning and setting up plans and managing duties according to plans. Planning the activities of others. Delegating tasks. Organising own or other's work time.

Source: CEDEFOP

5.1.1 Train driver occupational profile

The current skill requirements of train drivers according to the STAFFER survey respondents is characterised by basic to moderate fundamental skills and moderate to higher requirements as regards technical skills. Also, transversal skill requirements are rated as essential or very important by most survey participants.

In relation to **fundamental skills**, Table 2 below shows that most survey respondents regard basic literacy, basic numeracy, and basic ICT skills as essential or very important. The share of respondents who regard those skills as less important is zero. Even around one fifth of respondents think that advanced literacy and numeracy skills are required to perform the job of a train driver.

And quite remarkably, more the 40% of respondents think that foreign language skills are important for train drivers – only 6% regard foreign language skills as less or not important.

TABLE 3: ASSESSMENT OF CURRENT SKILL REQUIREMENTS BY STAFFER SURVEY PARTNERS: TRAIN DRIVER

Skill Category	Skills	Essential / very important	Less important / not important
Fundamental	Basic literacy	74%	0%
	Advanced literacy	21%	18%
	Basic numeracy	68%	0%
	Advanced numeracy	21%	18%
	Basic ICT	61%	0%
	Moderate ICT	38%	3%
	Advanced ICT	10%	19%
	Foreign language skills	42%	6%
Technical	Specialised knowledge needed to perform the duties	74%	3%
	Knowledge of products and services	48%	15%
	Ability of operating specialised technical equipment	71%	0%
Transversal	Communication skills	58%	6%
	Teamwork skills	42%	8%
	Customer handling skills	31%	22%
	Problem solving skills	78%	0%
	Learning skills	64%	0%
	Planning and organisation skills	44%	12%

Source: STAFFER Survey of Railway operator and infrastructure managers 2021

Co-funded by the Erasmus+ Programme of the European Union

Focusing on **technical skills,** ¾ of survey participants regard specialised knowledge as essential or very important to perform the duties. More than 70% of respondents think that the ability of operating specialised technical equipment is either essential or very important skill requirements and nearly 50% of respondents think so as regards the knowledge of particular products and services.

In the field **of transversal skills,** survey participants confirm the already existing experience that train drivers are working in a very demanding environment: Top transversal skill requirements of train drivers according to survey respondents are problem solving skills (78% regard this as essential or very important), learning skills (64%) and communication skills (58%). Also, teamworking skills are assessed as essential or very important by more than 40% of the survey participants. The lowest share of survey respondents rated customer handling skills as essential or very important and around 1/5 of survey respondents regard this skill as less important.

5.1.2 Traffic control centre staff occupational profile

Occupational profiles in traffic control activities are related to different railway-specific occupations in railway infrastructure as well as in operations. Such profiles are also related to different entry qualification levels and/or specialisation. Examples (national language differs here) are rail operation managers, train dispatchers, signal box operators, traffic controllers or logistics coordinators.

Fundamental skills requirements of traffic control staff compared to train drivers are higher in particular when it comes to ICT and numeracy. Around 50% or more of survey respondents regard advanced literacy skills, advanced numeracy and moderate ICT skills as essential or very important to perform the job. Foreign language skill requirements according to survey participants are similar to train drivers (47%).

Apart from such fundamental requirements, also technical skill requirements are rated quite high by survey respondents: Nearly 80% think that specialised knowledge is essential or very important and between 50% and 59% regard as essential or very important the knowledge of particular products and services and the ability of operating with specialised technical equipment.

Finally, transversal skill requirements of traffic control centre staff are markedly higher than in the case of train driving: More than 90% of respondents regard problem solving skills as essential or very important. More than 80% think the same in relation to teamworking and communication skills and around ¾ think so as regards planning and organisation skills. While

more than 60% of survey respondents also think that learning skills are either essential or very important, only around one third of survey respondents think so as regards customer (both in the field of passenger and freight rail transport as well as new emerging customer profiles in the field of door-to-door-mobility solutions) handling skills.

TABLE 4: ASSESSMENT OF SKILLS BY STAFFER SURVEY RESPONDENTS: TRAFFIC CONTROL CENTRE STAFF

Skill Category	Skills	Essential / very important	Less important / not important
Fundamental	Basic literacy	81%	0%
	Advanced literacy	48%	3%
	Basic numeracy	76%	0%
	Advanced numeracy	50%	3%
	Basic ICT	81%	0%
	Moderate ICT	66%	0%
	Advanced ICT	19%	9%
	Foreign language skills	47%	3%
Technical	Specialised knowledge needed to perform the duties	78%	0%
	Knowledge of products and services	52%	6%
	Ability of operating specialised technical equipment	59%	3%
Transversal	Communication skills	82%	0%
	Teamwork skills	83%	0%
	Customer handling skills	37%	6%
	Problem solving skills	94%	0%
	Learning skills	63%	0%
	Planning and organisation skills	74%	0%

Source: STAFFER Survey of Railway operator and infrastructure managers 2021

5.1.3 Infrastructure and maintenance occupational profiles, including engineering profiles

The group of occupational profiles in infrastructure and maintenance is even more diverse than different profiles in traffic control activities. In terms of general qualification requirements profiles range from manual blue-collar jobs in basic functions and EQF level to higher qualified blue- and white-collar occupations such as electricians, drafters, mechanics to academic qualifications in engineering and project engineering and management.

Infrastructure and maintenance occupational profiles are also related to quite different railway domains, e.g., planning, design, and construction of rail infrastructure as well as rolling stock but also bridges, station and other buildings.

To illustrate this diversity, the STAFFER respondents were asked to indicate the specific occupational profile that has been addressed in their response on current and future skill requirements. The following lists those profiles mentioned in this context:

- Most frequently, respondents referred to the occupations of **rolling stock engineers** and **rail transport and infrastructure engineers**
- **Maintenance technicians** and **maintenance engineers** were also mentioned by numerous survey participants
- Further engineering and technician profiles mentioned were the following: **Construction and works engineers, BIM engineers, infrastructure and vehicle maintenance technicians or electricians**
- **Infrastructure project managers (or project owners[12]) or infrastructure managers**
- **Infrastructure inspectors and designers**

Thus, the profiles addressed by respondents in the STAFFER survey tend to be related to higher EQF level requiring academic qualifications or at least technical vocational programmes at the level EQF 3,4 or 5.

Against this but also of course in the light of technological developments related to digitalisation and automation it is not surprising that the survey respondents rate the current fundamental, technical as well as transversal skill requirements as high in most cases and aspects.

In the field of **fundamental skills**, advanced literacy, advanced numeracy as well as at least moderate ICT were regarded as essential or very important by the overwhelming majority of respondents to the survey as the following table shows. Furthermore, more than 50% of the respondents think that foreign language skills are essential or very important for carrying out the respective jobs in infrastructure and maintenance.

Similar high qualification and skill requirements exist in the field of current **technical skills** such as specialised knowledge (regarded as essential or very important by 87% of respondents), the ability to operate specialised technical equipment (86%) or product and service knowledge (65%).

When it comes to **transversal skills**, again skills related to problem solving (94%) were ranked highest by survey respondents. In contrast to the cases of train driving and traffic control, learning skills are rated as the second most important transversal skill by nearly 90% of survey respondents followed by teamworking skills, planning and organisation skills with more than 70%). In contrast to both traffic control centre staff as well as train drivers, communication skills

[12] In French "Maître d'ouvrage"

as well as customer handling skills are regarded as less important for technical and engineering staff in infrastructure and maintenance.

The latter result is somehow surprising when thinking the stronger customer orientation in railway infrastructure as well as rolling stock development and design.

TABLE 5: ASSESSMENT OF SKILLS BY STAFFER SURVEY RESPONDENTS: INFRASTRUCTURE AND MAINTENANCE

Skill Category	Skills	Essential / very important	Less important / not important
Fundamental	Basic literacy	78%	0%
	Advanced literacy	59%	0%
	Basic numeracy	81%	0%
	Advanced numeracy	76%	3%
	Basic ICT	79%	0%
	Moderate ICT	81%	3%
	Advanced ICT	57%	7%
	Foreign language skills	52%	0%
Technical	Specialised knowledge needed to perform the duties	87%	0%
	Knowledge of products and services	65%	4%
	Ability of operating specialised technical equipment	86%	0%
Transversal	Communication skills	57%	3%
	Teamwork skills	74%	3%
	Customer handling skills	29%	13%
	Problem solving skills	94%	0%
	Learning skills	88%	0%
	Planning and organisation skills	72%	6%

Source: STAFFER Survey of Railway operator and infrastructure managers 2021

5.2 Future skills and competence requirements

In the following sections, survey results as regards further skill and competence requirements in view of the three different occupational profiles are presented. Such responses were gathered by participants with an open question asking "*Please indicate skills that in the future will become more important for performing occupational duties and tasks. Please consider both technological change as well as other trends and drivers.*" Survey respondents were able to make comments in two categories: a) *relevant new fundamental (literacy, numeracy, ICT, foreign language) as well as technical skills* and b) *relevant new transversal skills (communication, team-working, etc.)*. The

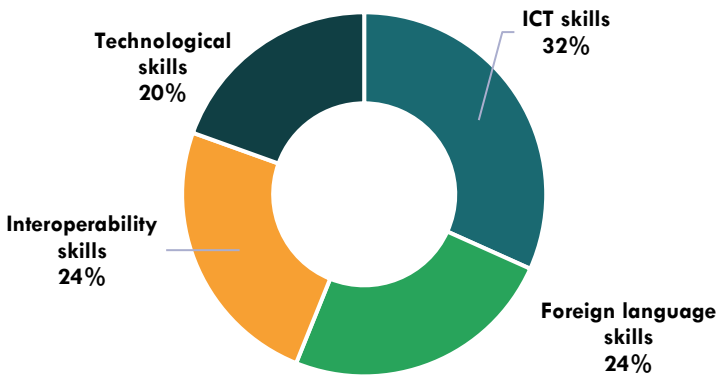
following section summarise results of comments whereby the authors of this report clustered responses according to those skills that were used most often.

5.2.1 Train driver occupational profile

According to survey participants, and not surprising against the current rapid technological change, **ICT skills** as well as **technological skills and competences** will become more important in the future for the job of a train driver. Such skills are needed to master new technologies and tools such as mobile devices and other technological equipment both on-board as well as mobile tools. Survey participants also highlighted that ICT requirements are becoming more complex and require more system thinking of train drivers (see Figure 9).

However, besides technology related skills, around one quarter of the survey participants also highlighted **foreign language skill needs** as becoming more important in the future for the job of the train driver. This indicates the fact that large parts of rail freight transport in Europe already today and even more in the future are cross-border. Furthermore, survey participants seem to also anticipate a future increase in transnational passenger transport in Europe.

FIGURE 9: TRAIN DRIVER: FUNDAMENTAL FUTURE SKILL NEEDS AS HIGHLIGHTED BY SURVEY PARTICIPANTS



Source: STAFFER Survey of Railway operator and infrastructure managers 2021

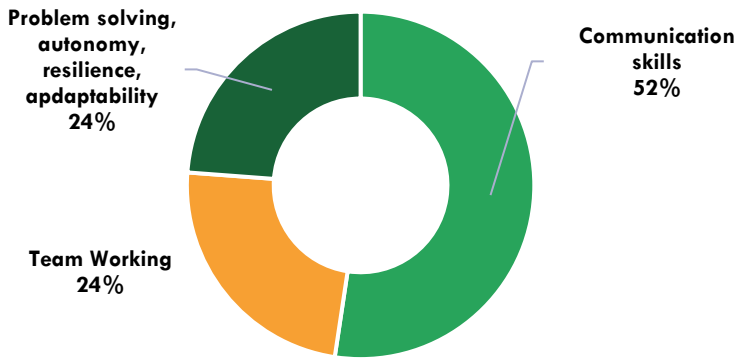
Closely related to the issue of foreign language, a quarter of the participants also highlighted the need of skills, knowledge and competences related to **interoperability**, i.e., the knowledge about European and national systems of traffic security and control, the understanding of regulation in neighbouring countries, etc. Survey participants also highlighted the need that train drivers need to obtain more cross-functional knowledge within railway operation, infrastructure processes and networks.

In view of transversal future skill requirements, survey participants highlighted communication skills as shown in Figure 10. More than 50% of the participants in this context referred to skills related to the handling of new digital communication tools that is likely to substitute or complement oral communication with traffic control centres. Around a quarter of responses referred to new skills in the fields of team-working (collaboration, cooperation) as becoming more important in the future as well as skills such as problem solving, adaptability, dealing with complexity, autonomy, or resilience.

Adaptability, autonomy, dealing with complexity could be summarized as broad definition of resilience. Dealing with complexity could also be categorized as a technical skill.

Add a short definition for these skills or describe how these skills are to be differentiated from each other

FIGURE 10: TRAIN DRIVER: TRANSVERSAL FUTURE SKILL NEEDS AS HIGHLIGHTED BY SURVEY PARTICIPANTS



Source: STAFFER Survey of Railway operator and infrastructure managers 2021

5.2.2 Traffic control centre staff occupational profile

As shown in Figure 11 below, more than 50% of survey participants highlighted a significant **skill shift towards more advanced ICT knowledge** and skills for staff in traffic control centres. This indicates a significant shift from current moderate to advanced skill requirements. Apart from handling new digital technologies, participants also highlighted the need of understanding and obtaining IT system knowledge.

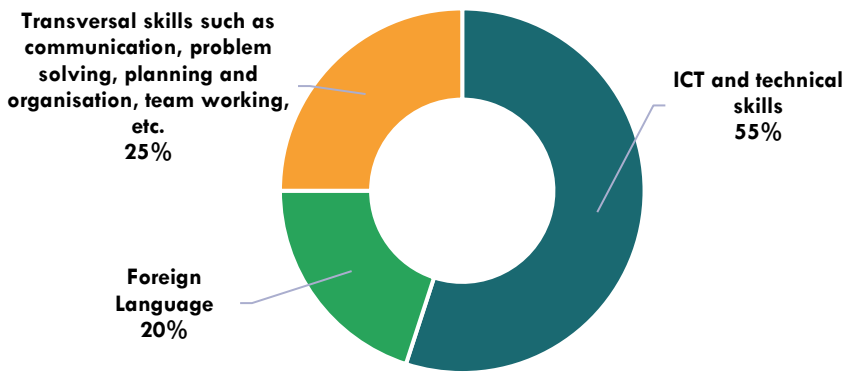
Participants also stressed that the understanding and differentiating of safety systems and related tools and railway system thinking will become more important in the future as well as more advanced literacy, the use of digital communication tools and media as well as working

in 'virtual' environments, including in cross-border constellations. The latter will also require more foreign language skills as the following quote illustrates.

> ***"Knowledge of a foreign language, advanced knowledge in ICT, and of course in reading and calculating; ability to work "virtually"; communication capacity via tools (remote communication) more autonomy and more decision-making because there is an access to more important information / data, management of more complex situations. The place of rules and instructions must be more adapted: we do not strictly apply the rules (strict role of the performer) but we apply them "intelligently" by adapting them, adjusting to the context. Companies need to revise tasks and organization according to this posture of the "intelligent operator" and allow him more autonomy by ensuring his level of technical and non-technical skills."***
> Source: Integrated RU, France
>
> ***Increased communication and technical skills to aid machinists/drivers in critical situations.***
> Source: *Integrated RU, Spain*

The quotes indicates that also transversal skills will become more important in the future. Skills mentioned also by other participants are problem solving, troubleshooting competences, intercultural competences, using technical tools for cross-border communication, team working, coordination, adaptability, agility, collaboration, and communication (including the help of technical tools).

FIGURE 11: STAFF IN TRAFFIC CONTROL CENTRES: FUNDAMENTAL, TECHNICAL AND TRANSVERSAL FUTURE SKILL NEEDS AS HIGHLIGHTED BY SURVEY PARTICIPANTS



Source: STAFFER Survey of Railway operator and infrastructure managers 2021

5.2.3 Infrastructure and maintenance occupational profiles, including engineering profiles

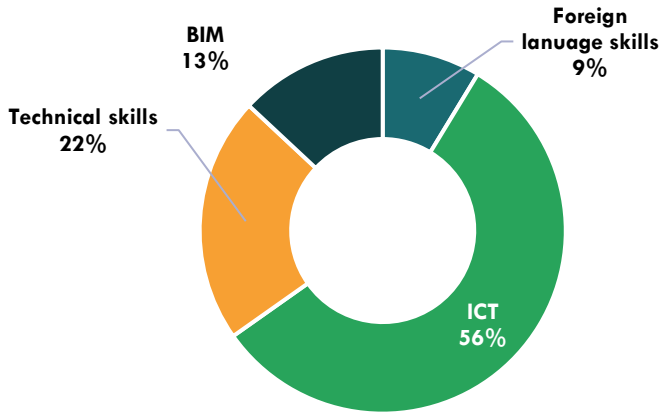
As highlighted above, respondents focused very much on occupational profiles such as engineers, technicians and managerial profiles in infrastructure, construction and rolling stock design, engineering, and maintenance.

The following Figure 12 shows that survey participants overwhelmingly referred to ICT and other technology related skills that will become more important for the respective occupational profiles in infrastructure and maintenance. Advanced ICT skill needs are also related to new

and disruptive technologies such as BIM and systems engineering, augmented and virtual reality skills, digital twins. Participants also highlighted the need of employees and workers to continuously update their knowledge in the rapidly changing ICT and digital technology environment.

In addition, foreign language skills were mentioned by a comparatively small share of respondents. This may be related to the fact that English language skills are already quite well developed in occupations such as engineers.

FIGURE 12: ENIGNEERING PROFILES IN INFRASTRUCTURE AND MAINTENANCE: FUNDAMENTAL FUTURE SKILL NEEDS AS HIGHLIGHTED BY SURVEY PARTICIPANTS



Source: STAFFER Survey of Railway operator and infrastructure managers 2021

Apart from transversal skills that were already highlighted for the other occupational profiles (teamworking, communication, problem solving) survey participants also highlighted skills and competences such as working in transnational teams, planification and organisation skills, continuous and self-learning capacity and skills, project management as well as creativity, adaptability, assertiveness, flexibility, conflict resolution competences and "emotional intelligence."

5.3 New requirements and skill need in cross-border business and processes

5.3.1 Train driver occupational profile

Asked about new requirements and skill need in cross-border business and processes, participants highlighted in relation to the train driver occupational profile skills related to ICT, digitalisation competences and new technologies as well as foreign language skills:

- Using AI tools, e.g., AI translation tools for communication in a foreign language with traffic control centre staff in cross-border railways.
- Basic ICT skills will become a more important entry qualification
- Interoperability knowledge and skills, e.g., on European rules and specificities of other country security and traffic control rules.
- System thinking: Understanding of different European rail systems and related structures and processes.
- ERTMS knowledge.

> ***"New skills are important to implement ERTMS"***
> Source: Railway employer organisations, Sweden
>
> ***"Knowledge of technical particularities of relevant foreign countries; language skills (English); basic knowledge on European rules and regulations including differences of relevant foreign countries."***
> *Source:* Integrated RU, Austria

As regards transversal skills, STAFFER survey participants highlighted the following:

- Continuing education and training, coaching, regular further training courses and learning to learn capacities will become more important in the future, for example on technologies, rolling stock and operating systems
- Ability to continuous learning and openness

5.3.2 Traffic control centre staff occupational profile

With view on traffic control centre staff future skill needs in the context of cross-border railways, participants of the survey highlighted the need to know more about the regulation, processes, and operational practice in other countries along with foreign language skills.

> ***"Increased knowledge of the operation of the administration of the other side of the border."***
> *Source: Integrated RU, Spain.*

Participants also highlighted foreign language needs and requirements; many of them mentioned English language skills as well as foreign language skills in relation to the concrete cross-border situation and along the respective corridors.

As regards transversal skills, participants highlighted particularly the intercultural competences and knowledge about other countries and railway cultures:

> ***"Communication, mutual understanding, harmonization of procedures and signals, sharing of the same representation on situations to be managed, in particular conflict situations, degraded modes and situations."***
> *Source:* Integrated RU, France
>
> ***"Foreign language and knowledge about foreign culture"***
> *Source: Public transport employer organisation, Germany*
>
> ***"Communication, problem solving"***
> *Source: RU, passenger transport, Italy.*

5.3.3 Infrastructure and maintenance occupational profiles, including engineering profiles

From the perspective of cross-border railway operation, staff in infrastructure and maintenance needs to extend the skills and competences basis both on fundamental and technical skills as well as transversal skills.

As highlighted by the Railway Competence Centre in Portugal, the skill base of infrastructure and maintenance staff in general is quite sufficient as regards the national level requirements, but there are challenges and difficulties as regards understanding European rules and regulations.

Participants of the STAFFER survey highlighted the following fundamental future skills:

- Advanced literacy and ICT skills will become more important as well as technological knowledge and foreign language skills (e.g., in the context of increasing international cooperation and globally used technologies and technical solutions).
- Knowledge about European rules and regulation.
- Significant new requirements as regards ICT knowledges and skills for technicians in maintenance.
- For occupational profiles such as design engineer in infrastructure and systems, project managers, infrastructure project managers and infrastructure project owners (*maître d'ouvrage*) as well as construction and works engineers it was highlighted that knowledge about system architecture and systems engineering skill will become more important in the future.
- Knowledge and skills in system architecture and system engineering

- In countries where English language skills is not part of occupational training programme or engineering studies, participants stressed the need to acquire new knowledge and language skills.

A general challenge has been highlighted by an academic and research related STAFFER participant:

> ***"Ensure safety although maintenance is distributed across several companies and countries."***
> *Source: Technical University, Germany.*

As regards transversal skills, participants stressed the following skill needs that will become more important in the future:

- Planning and organisation methodologies that can adapt to increased number of traffic
- Problem solving and critical thinking skills
- Working in international teams and cross-border collaboration and projects
- Capacity to learn and intercultural competences
- Teamwork, cooperation, and cross-culture vision thinking

6 NEEDS FOR CLOSER TRANSNATIONAL COOPERATION IN THE FIELD OF EDUCATION AND TRAINING PROGRAMMES, EXCHANGE, AND MOBILITY

6.1 Survey results

The STAFFER survey of railway operators and infrastructure managers also included the question whether – as regards the specific occupational profile – there should be closer transnational cooperation in the provision of educational programmes and training for train drivers engaged in cross-border railways? If this is regarded as necessary by the survey respondent, he or she was asked to provide the type and contents of such programmes as well as specific target groups.

6.1.1 Train drivers

Most respondents agreed to the need to develop and implement specific training and education measures that target train drivers that are engaged in cross-border railway operation.

> ***Train drivers need to have knowledge of the work/tasks train drivers from other countries. A broader understanding of the tasks train drivers from different countries face, could improve cross-border rail traffic.***
>
> *Source: IRU, Germany.*

As regards the contents of such programmes, survey participants referred to further training measures and programmes that would improve **interoperability skills, foreign language training** as well as programmes that would foster the direct **exchange of knowledge and experience.**

As regards interoperability skills, participants referred to the knowledge of train drivers about different rolling stock equipment, different national security and other rules and procedures in railway operation, traffic control and management as well as network organisation. Such skills according to survey respondents might be organised either for concrete cross-border situations of two countries, along corridors or at a European level.

Education and training of interoperability according to survey participants should be recognised as a further training at the EQF levels of 4, 5 or 6. Survey participants even described such

further training courses and vocational pathways in interoperability very concretely as the following quote illustrates.

> ***Interoperable Driver: After finishing the education/training for national Drivers and doing the job for more than 5 years the Driver is allowed to extend education for Interoperable Driver (voluntary). First step is a repetition of basic English - leading to a certification in B1. The goal is to be confident with the driver's handbook in English. In addition, vehicle- and operations-specific content should be learned. After examination the drivers must acquire the route knowledge for one corridor/destination in Europe which is at maximum 4,5 hours driving time away (goal: at least 1 hour break in the station of reversing). The next goal is to drive at maximum 3 corridors.***
>
> *Source: RU, passenger transport, Austria*

Besides, interoperability skills, survey participants highlighted the need to foster the development of intercultural competences[13] and the transfer of knowledge and experience. According to railway undertakings involved in passenger and freight transport as well as railway infrastructure management companies such knowledge about the concrete working situation and framework conditions of train drivers and traffic management staff in other countries would have a positive impact on the fluency of cross-border rail traffic.

> ***Train drivers need to have knowledge of the work/tasks train drivers from other countries. A broader understanding of the tasks train drivers from different countries face, could improve cross-border rail traffic.***
>
> *Source: RIU, Germany*
>
> ***Machinists of the two border states in joint training on the rules for the other rail traffic management.***
>
> *Source: RU, passenger transport, Spain*

Finally, survey participants highlighted the need of foreign language skills (which could also be combined with education, training, and exchange programmes).

It should be noted that only few respondents referred to a specific language such as English.

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[13] In the ESCO classification intercultural competences are described as "Understand and respect people who are perceived to have different cultural affinities and respond effectively and respectfully to them." Specific skills and competences according to ESCO are amongst others: adapt text culturally; analyse cultural trends; apply intercultural teaching strategies; build rapport with people from different cultural backgrounds; establish communication with foreign cultures; respect cultural preferences; show intercultural awareness; work in an international environment. See: https://ec.europa.eu/esco/portal/skill?uri=http://data.europa.eu/esco/skill/c10d5d87-36cf-42f5-8a12-e560fb5f4af8&conceptLanguage=en&full=true&resetLanguage=true&newLanguage=en&skillFilterIndex=0#&uri=http://data.europa.eu/esco/skill/c10d5d87-36cf-42f5-8a12-e560fb5f4af8#&uri=http://data.europa.eu/esco/skill/c10d5d87-36cf-42f5-8a12-e560fb5f4af8.
It should be mentioned that ESCO does not refer directly to foreign language skills. However, these are highlighted in other reference statements and orientations. For example, in the Conclusions of the European Council on Education, Youth and Culture of 2008, the following is highlighted: "the knowledge, skills and attitudes of particular relevance to intercultural competences are those relating to the following key competences: communication in foreign languages, social and civic competences, and cultural awareness and expression." Available at: https://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/en/educ/100577.pdf.

6.1.2 Staff in control centres

Transnational measures and programmes of skill development for traffic control centre staff involved in cross-border and transnational railway operation according to survey participants is important as it will is regarded as crucial for effective traffic control processes.

> ***"I think that there is a great need to have closer transnational cooperation in the provision of educational programmes and training for traffic control staff engaged in cross-border railways."***
>
> *Source: RIU, Serbia.*

Survey respondents not only referred to training and education programmes (including foreign language courses and communication skills) but the need to promote exchange and mobility of staff across borders, such as work placements in other countries and companies or as highlighted in the following quote, "live my life" measures.

> ***A common training offer for staff is a very effective lever for obtaining maximum efficiency in the management of traffic regulation. But first, it is necessary to ensure the harmonization of procedures in cross-border countries***
> ***This type of program can be part of additional training (after initial training) and continuing education.***
> ***The content of this program:***
> ***Technique:***
> ***- Sharing of local technical specificities in the cross-border region***
> ***- Discussions on blocking points, difficulties (past and potential incidents)***
> ***- Training exercises on simulators***
> ***Non-technical:***
> ***- Communicate effectively***
> ***- Develop the collective***
> ***- Organize regular "cross-border" meetings of the "live my life" type***
>
> *Source; IRU, France*

As regards training, mobility and exchange programmes, participants of the STAFFER survey referred to the need to develop uniform transnational programmes and formats that are offered at EU level for different groups of staff in traffic control management.

Here, participants also commented that skill enhancement and training measures should also contribute to more harmonisation of occupational profiles and (further) training programmes at European level by verification and certification of programmes and diplomas.

At the same time, respondents to the survey suggested also measures targeted at specific cross-border situations.

> ***Staff exchange. Set-up of virtual cross border teams with shared responsibility (KPIs) for specific border crossing.***
>
> *Source: Technical University, Germany*

6.1.3 Infrastructure and maintenance

Survey participants in the context of transnational measures of training, mobility and exchange referred to different occupational profiles, most of them however in the field of engineering, infrastructure project management, supervision, and inspection, thus profiles at an EQF level of 5, 6 or higher.

As regards closer transnational cooperation, survey participants highlighted the general added value of mobility and exchange as well as specific needs in cross-border situation, for example cross-border infrastructure planning or construction and maintenance work that has a direct effect on the other side of the border.

> ***In particular concerning transnational / cross-border projects in the framework of infrastructure/maintenance, language, customer and communication skills are mandatory. Almost all issues concerning infrastructure/maintenance have an international scope. This international scope needs to be taken into account. Example: closing a track in one country, can have influence on the rail transport in other countries.***
>
> *Source: RIU, Germany.*

Other participants highlighted the need of transnational teamworking of engineering staff in cross-border construction and planning projects, to exchange on experience about new technologies such as BIM (Building Information Modeling).

> ***"There should be a closer cooperation in the provision of education programmes and training for staff both in infrastructure engineering and maintenance. For example, in the practice of BIM projects and for the training in model-based systems engineering and architecture, because the competences are rather scarce at the European level in this field."***
>
> *Source: IRU, France*

Transnational cooperation according to participants should also be fostered because of similar needs and challenges in other areas, development of concrete skills and new competences in the context of digitalisation as well as the need to move from mainly national rooted skills and knowledges to an occupational mindset that is more international and European.

In this context, several participants referred to the need to develop formats of training, exchange and staff that deliver knowledge and skills of existing and emerging EU rules and regulation as well as foster transnational cooperation of staff exchange at company level.

> ***"International training about cross-cultural projects, how to manage international projects, trainings for the EU rules, new EU systems, new technologies (BIM, IoT, predictive maintenance…)***
> ***Training and cooperation and exchange programs (students and professionals). Cooperation between national companies."***
>
> *Source: Engineering Training University, France.*

Participants highlighted the need that transnational exchange, mobility and training should provide a concrete added value and contribute to the solving of concrete tasks and needs. Here, participants referred to cross-border infrastructure planning, construction works or EU level rules and requirements in the field of maintenance. In this context it would be interesting to develop further ideas and suggestions on 'service learning' (i.e. combining learning and the assumption of responsibility for the society (service)) by international training, internships and project work.

> ***"Compare national plans and ways of documentation for various ECM (Entity in Charge of Maintenance) roles and vehicles. Understand importance of documentation and control."***
>
> *Source: Technical University, Germany*

What seems to be important in order to achieve a concrete and sustainable impact is the direct involvement of operational staff in transnational measures of exchange and mobility that has similar task and functional profiles.

> ***"Knowledge-sharing meetings and performances by professionals themselves each subject with physical participation of attendees from both border states."***
>
> *Source: RU, passenger transport, Spain*
>
> ***"In particular for engineering with responsibilities in planning future activities."***
>
> *Source: Railway Competence Centre, Portugal*

6.2 Further results: Exchange with experts

The results of the survey of railway operators and infrastructure managers were confirmed strongly by expert group discussions and focus group meetings with railway corridor managers as well as company level experts in model and pilot projects involved in the development of automated/AI supported translation tools and programmes.

In various virtual workshops and meetings that took place between spring and October 2021 with participants from German speaking companies (ÖBB, DB) and higher education institutions (UASSP, UASFHE, TU Dresden) the following key messages emerged as regards rail freight corridors, language and communication:

Key results of the discussions that took place between spring and autumn 2021:

- Skills and knowledges of staff at operational and management level in the field of infrastructure, network planning, traffic control and operation has not been addressed sufficiently in the context of improving the efficiency of cross-border railway operation.

- The lack of understanding of railway systems in other national contexts, differences in national rules, processes and procedures are important barriers and hindering factors as regards cross-border planning and operation in railways.
- In order to improve the situation, measures should not only focus on foreign language training of involved staff but would require communication and joint understanding in a broader sense.
- Language is an important but not the sole aspect to be addressed in this context. Experts and managers of railway undertakings and infrastructure managers involved in cross-border railway have stressed the fact that when it comes to foreign language requirements, simple solutions will not be possible but there are specific needs for specific corridors and cross-border situations as well as specific requirements for concrete groups of staff. AI situations may work for limited and very standardised communication needs in the field of communication between train drivers and traffic control centres but for other groups (dispatchers, network, and traffic planners), higher foreign language requirements are needed as well as a joint working language which in most cases would be English.
- Corridor managers and experts involved in cross-border railway operation have highlighted the need to develop and strengthen European mindsets: Still, railway thinking is very much rooted in national specificities, traditions, rules and procedure and European railway thinking still is regarded as an add-on knowledge of specialists in certain higher management functions. If there is the vision of a single European railway area and the need for harmonisation of regulation and rules, this dominance of national mindsets no longer is sufficient.
- Targeting only senior managers and high-level experts will not be sufficient: A key success factor in this context will be to develop measures and formats that target operational staff involved in cross-border railway operation such as train drivers, dispatchers, and traffic control managers on the ground. In this context rail freight corridor managers have developed already the idea of a Railway Erasmus Scheme that amongst other activities would target exactly these groups of staff.

7 CONCLUSIONS AND OUTLOOK

7.1 Framing of WP2

As highlighted in the chapter on objectives, the focus of WP2 was to analyse how major trends and drivers (technological innovation, open issues and challenges influencing railway operation and infrastructure management in the short- and medium-term perspective) will impact on skill shifts and changes in occupational profiles.

Within WP2 the analysis of future skill needs and the need to adjust occupational profiles was done by a staggered approach: First, a larger group of railway specific occupational profiles was analysed as they are described in the ESCO classification of skills, competences and occupations. As a second step, and as agreed by the partners of WP2 three occupational groups were analysed with a focus on current skill sets, future skills and competence requirements and new skill requirements that are related to cross-border railways and Europeanisation.

Apart from general skill needs and the evolution of occupational profiles in railway operation and infrastructure management as arising from digitalisation and automation, big data, cybersecurity, energy, and environmental policies as well as other impact factors, WP2 had two additional thematic focus areas that are important from the point of view of railway operation and infrastructure management in the European context: First, the issue of cross-border rail traffic, with special references to EU Rail Freight Corridors (RFCs) and second, language and communication issues in cross-border traffic.

Both aspects from the perspective of STAFFER partners from railway operation and infrastructure management deserve a specific attention because they are crucial for transnational railway operation and the implementation of the single European rail area. The assumption is that smooth and efficient functioning of transnational railway operation will also require accompanying measures of skills and competences development, including in the field of (foreign) language and communication.

7.2 Trends and open issues impacting on future skill needs and occupational profiles

The survey of railway operators and infrastructure managers gathered responses from 19 countries and more than 80 company level experts in all domains of railway operation and

infrastructure as well a railway specific academic research and higher education institutions. Responses of survey participants confirmed already existing research evidence that policy choices such as rail market liberalisation, the roll-out of harmonised systems of traffic management, environmental protection, and decarbonisation policies as well as technological drivers and trends such as digitalisation and automation in railways will heavily influence the future of railway in the shorter and medium-term future.

At the same time, survey participants also have highlighted issues as having a strong impact on future railways that are related to core STAFFER activities and objectives such as common language solutions in international railway communication or stronger European cooperation in railway operation and infrastructure management. Also issues that are related of efficiency in railway operation such as punctuality, attractiveness to customers and smart door-to-door mobility solutions were named as having a strong impact on the European railway system of the future.

This correlates with the assessment that amongst the various technological innovations that are affecting future railway operation and infrastructure management, the ERTMS and ETCS deployment is ranked as the most important issue impacting on railway operation within the next five years.

7.3 Skill shift and future skill needs

An important result of the survey has been that the railway operation and infrastructure system of the future will become more complex and demanding from the perspective of individual workers and employees across all occupational profiles. This means that skill requirements both in the field of fundamental, technological, and soft skills will increase and there will be the need of upskilling and continuous refreshment of the skill base in most occupations, but in those occupations in particular that already today require a higher qualification (EQF level 4 or higher) such as rolling stock engineering design, rail infrastructure project management or maintenance technicians and engineering.

The more in-depth analysis of three occupational profiles has shown that in all three profiles, ICT and technological skills will become more important in the future. However, survey respondents and experts have also highlighted the need to improve transversal skills such as problem solving, handling emergencies, team-working and communication skills.

A key result of the analysis has been that ‘quality’ becomes more important than quantity: Driven by digitalisation (for example IT based analysis of data and faults), basic functions and

operations ('quantity') become less important, while at the same time, the quality becomes more important. Thus, **quality and continuous improvements will become the main sources of maintaining and developing competitiveness in railways.**

This also relates to the development of future occupational profiles and requirements in the context of cross-border railways: WP2 has shown that apart from fundamental skills such as foreign language skills, transversal and soft skills are important, namely cross-border railway system understanding, intercultural competences and further skills that can be subsumed as **'Mindsets'.**

7.4 Stronger transnational cooperation and the need to develop European mindsets

A key result of the STAFFER survey amongst railway operators and infrastructure managers is the strong message that there is a need of stronger transnational cooperation in the field of education and training but also in cross-border railways and along railway corridors.

Measures that were regarded by the largest shares of participants as having an important impact are the development of common European training modules for operational and infrastructure management staff involved in cross-border railways and targeted measures of staff development, exchange and mobility in the cross-border and transnational context.

When it comes to language in cross-border railways, also large shares of the survey respondents indicated the need to develop foreign language skills and establish English as the common language in transnational railways.

Such assessments were concretised by input provided during WP2 in the context of focus group discussions and exchange with experts about ways to address barriers and hindering factors of efficiency in cross-border railway operation and rail freight corridors. According to experts the situation is complex and solutions – for example in the field of foreign language skill requirement or digital translation tools supported by artificial intelligence – need to consider the specificity of requirements and needs of different categories of staff (train drivers, staff in cross-border traffic control, dispatcher, network planners).

An important result of the consultation with experts (that will continue also in the context of further railway operation and infrastructure related tasks and work packages) was however, that there is a strong need to develop transnational mobility, exchange and training programmes for staff directly involved in cross-border operations: train drivers and their

instructors, staff involved in cross-border traffic management and control. This is important not only because existing transnational cooperation and networking focusses on higher management staff groups and operational staff so far has not been targeted.

The clear need to engage more in transnational cooperation, exchange, and training according to stakeholders would also be important to develop and strengthen European mindsets.[14] The clear message in this context was that the vision of a European rail area will only become reality if those involved at executive, managerial as well as operational level will develop European mindsets and related skills in the field of intercultural knowledge and competences.

Besides staff directly involved in cross-border railways, the in-depth analysis in the context of task 2.2 and the exchange with experts in railway infrastructure and maintenance on future skill needs also confirmed the need not only to invest more in the acquisition of new technical skills but also invest more in the development of new mindsets that also include intercultural competences, openness, and the engagement in stronger transnational cooperation with companies in other countries.

7.5 Development of mobility and training programmes in the field of cross-border railways, communication, and language

This overview of results shows that WP2 has already gathered a remarkable number of ideas and requirements for the development of more concrete measures and programmes of exchange and training in the context of following work packages and in particular task 4.4:

The exchange with company level experts and thematic focus groups (e.g. cross-border corridors, foreign language requirements and solutions) should continue and extended by the involvement of further STAFFER partners in order to further sharpen ideas and the development of measures that would provide a concrete added value for the selected occupational profiles of train drivers and traffic control centre staff. As regards operational staff groups such exchange should target particularly train drivers and traffic control centre staff.

In the field of railway infrastructure and maintenance, the STAFFER survey as well as exchange at the expert level has also identified a strong interest to engage in transnational exchange of knowledge, experience, and skill needs, in particular on new emerging technologies such as BIM

[14] The term mindset and the need to develop new mindsets in the light of digitalisation, changes in work as well as in the context of Euorpeanisation was used quite often by survey responsendents as well as input from experts to the focus and expert group meetings in WP2. Therefore, there is a need to further discussion of this concept in later WPs (i.e. via focus group discussion, further surveys, etc.).

(Building Information Modeling) and related issues, including new occupational profiles. Also here, it is suggested that activities of exchange and cooperation in transnational focus groups should continue throughout the STAFFER lifecycle.

7.6 Outlook

WP2 took a closer look at cooperation in the context of the three occupational profiles and in relation to transnational measures of exchange, mobility and training. There have been gathered manifold suggestions of the development of common training modules, staff exchange, engagement in pilot-type cross-border cooperation and other measures that would be useful from the perspective of a broad variety of companies engaged in railway operation and infrastructure management. One interesting suggestion in this context was the idea of "Railway Erasmus Scheme" that would combine different formats exchange, mobility and training. The main objective of such measures eventually is to facilitate, reduce barriers and increase efficiency in cross-border railway operation but also to contribute to mindsets that facilitate the European rail area and more harmonisation in railway related vocational education and training.

Thus, from the perspective of railway operation and infrastructure management and the results achieved in WP2, there are plenty of ideas as regards topics, measures and formats developed further in WP4, validated in the context of WP5 and implemented in WP6.

Issues and questions that need to be addressed include the following in particular:

- Short, medium and long-term strategies and accompanying measures as regards cross-border railways (regarding different needs of language training, intercultural communication and other skills, interoperability, other aspects) targeting staff involved in operation (train drivers) and cross-order traffic management, control, and planning.
- Qualitative vs. quantitative changes in job profiles and topics/contents and formats of education and training that might be developed at transnational or European level.
- Develop a better understanding of "European mindsets" in railways (discussion and exchange with experts, further research) and how to foster them, for example by railway-specific Erasmus schemes.

8 ANNEX

8.1 Updated action list WP2

No	Activity / Meeting	Who	Involved partners	Date	Status
1	Gathering comments from WP2 railway operators and infrastructure partners on expectations and suggestions regarding concrete outcomes and topics addressed	wmp/DB	Railway operators and CER	Nov-Dec 20	Completed
2	Desk research and repository of transnational R&D projects relevant to the WP	wmp	all partners / CER	15. Mar 21	Completed
3	Providing input to WP1 survey	CER STAFFER partners	WP1 co-leaders	Jan/Feb 21	Completed
4	CER STAFFER Info Meeting	wmp/DB/ CER	CER STAFFER partners and other affiliates	21. Jan 21	Completed
5	1st WP2 General Meeting - Presentation of WP2 and first concretisation of work plan and timeline	wmp/DB	all partners	28. Jan 21	Completed
6	Concretisation and discussion of methodological approach of WP2	wmp/DB	Railway operators and CER	11. Feb 21	Completed
7	2nd WP2 General Meeting: Presentation concretisation of work plan and timeline, including survey concept	wmp/DB	all partners	25. Feb 21	Completed
8	Presentation and discussion of results and planning with CER STAFFER Info Meeting	wmp/DB/ CER	CER Staffer partners and other affiliates	10 Mar 21	Completed
9	Focus Group Rail Freight Corridors /railway language and communication	wmp/DB	German speaking railways and academic STAFFER partners	12 Mar 21	Completed
10	3rd WP2 General Meeting	wmp/DB	WP2 partners	30 Mar 21	Completed
11	Concretisation of methodology of desk research evaluation, interviews, focus groups and survey	wmp/DB	all partners	25 Mar 21	Completed
12	Evaluation project repository, ESCO database analysis, survey / interview contents development	wmp	STAFFER partners and CER Team	March - May 21	Completed
13	Focus Group Rail Freight Corridors /railway language and communication	wmp/DB	German speaking railways and academic STAFFER partners	15. Apr 21	Completed
14	CER STAFFER Info Meeting: WP2 and WP4 planning, exchange on WP1, RFC focus group results and planning, online survey, expert interviews, adjusted work planning	wmp/DB/ CER	CER Staffer partners and other affiliates	22. Apr 21	Completed
15	4th WP2 General Meeting	wmp/DB	WP2 partners	29. Apr 21	Completed
16	Focus / expert group language & communication	wmp/DB	German speaking railways and academic partners	5 or 6 May 21	Completed

No	Activity / Meeting	Who	Involved partners	Date	Status
17	CER STAFFER Info Meeting: Finalisation of the survey, interview progress/reports, results of desk research, etc.	wmp/DB	CER Staffer partners and other affiliates	19 May 21	Completed
18	5th WP2 General Meeting: Presentation of the survey, reports on other progress	wmp/DB	WP2 partners	27. May 21	Completed
19	Launch of WP2 survey	wmp/DB	WP2 partners and external stakeholders	01. Jun 21	Completed
20	WP2 Survey: Deadline for provision of responses	wmp/DB	WP2 partners and external stakeholders	15. Jun 21(extended until 1 July)	Completed
21	Evaluation of survey results, elaborating draft WP2.1 report	wmp	WP2 partners	June / July 21	Completed
22	CER STAFFER Info Meeting: Survey results presentation and draft WP2.1 report	wmp/DB	CER Staffer partners and other affiliates	24. Jun 21	Completed
23	6th WP2 General Meeting: Presentation of the survey results and WP2.1 final draft report	wmp/DB	WP2 partners	01. Jul 21	Completed
24	Coordination meeting with WP4	DB/wmp	CESI	1 Jul 21	Completed
25	Exchange with WP3 co-leader	wmp	wmp / Mafex	14 Jul 21	Completed
26	Delivery of WP2.1 report to UNIGE	wmp/DB	STAFFER coordination	15. Jul 21	Completed
27	Planning workshop WP 2.2	DB/wmp	DB, wmp, FH Erfurt and St. Pölten, TU Dresden	15/16 July 21	Completed
28	WP2,3,4,5 co-leaders meeting	DB/wmp	UNIGE, DB, wmp, MAFEX, Siemens Mobility, University of Belgrade, FH Erfurt	28 Jul 21	Completed
29	Workshop WP2.2 – key elements and findings of the report	DB/wmp	DB, wmp	11 Aug 21	Completed
30	WP2.2 exchange on draft texts of the report	DB/wmp	DB, wmp	6 Sep 21	Completed
31	Input for conceptual framework employability / WP5	FH Erfurt	DB, wmp, FH Erfurt, University of Belgrade	8 Sep 21	Completed
32	Workshop with WP4.2	CESI	CESI, wmp, DB, Siemens Mobility, UNIGE	9 Sep 21	Completed
33	Exchange on WP4.4	DB	DB, wmp	16 Sep 21	Completed
34	WP2,3,4,5 co-leaders meeting	DB/wmp	UNIGE, DB, wmp, MAFEX, Siemens Mobility, University of Belgrade, FH Erfurt	17 Sep	Completed
35	WP2.2 and WP4.2 exchange	CESI	wmp and CESI	21 Sep	Completed
36	Workshop WP 2.2 and discussion with experts on occupational profiles, communication, language	DB	wmp, ÖBB, FH Erfurt, FH St Pölten	22-23 Sep 21	Completed

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No	Activity / Meeting	Who	Involved partners	Date	Status
37	WP2,3,4,5 co-leaders meeting	DB/wmp	UNIGE, DB, wmp, MAFEX, Siemens Mobility, University of Belgrade, FH Erfurt	4 Oct 21	Completed
38	WP2.2 planning meeting	DB/wmp	DB, wmp, ÖBB	14 Oct 21	Completed
39	WP2.2, WP4.4 planning and working meeting	DB/wmp	DB, wmp, ÖBB	18 Oct 21	Completed
40	RFC expert/focus group	DB/wmp	DB, ÖBB, wmp	19 Oct 21	Completed
41	CER Info Meeting	DB/wmp	CER Staffer partners and other affiliates	20 Oct 21	Completed
42	WP2.2 – finalisation of report	DB/wmp	DB, wmp	28-29 Oct 21	Completed
43	Delivery of WP2.2 report to UNIGE	DB/wmp	STAFFER coordination	03 Nov 21	Completed
44	7th and final WP2 meeting	wmp/DB	WP2 partners	09 Nov 21	Completed
45	Meeting of WP co-leaders with STAFFER partners and experts of SNCF (SNCF Reseau and *Université* de l'*Ingénierie,* (Udl) on BIM (Building Information Modeling) and its impact on different domains of railways.	wmp/DB	SNCF, ÖBB, Udl	10 Nov 21	Completed