



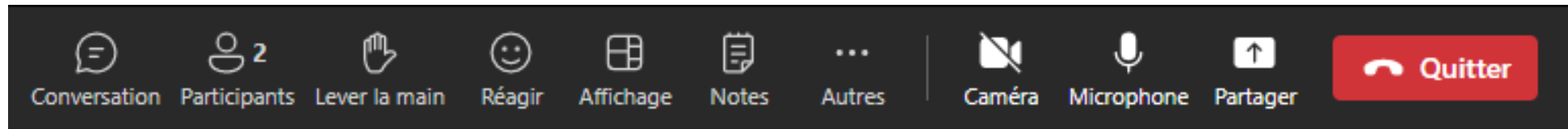
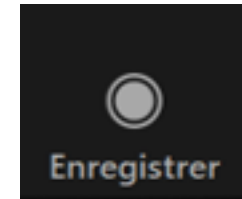
# EUROPE'S RAIL SYSTEM PILLAR

## WEBINAR n°1

**FDFTO - FULL DIGITAL FREIGHT  
TRAIN OPERATIONS ENABLED BY  
THE DIGITAL AUTOMATIC  
COUPLER DAC**

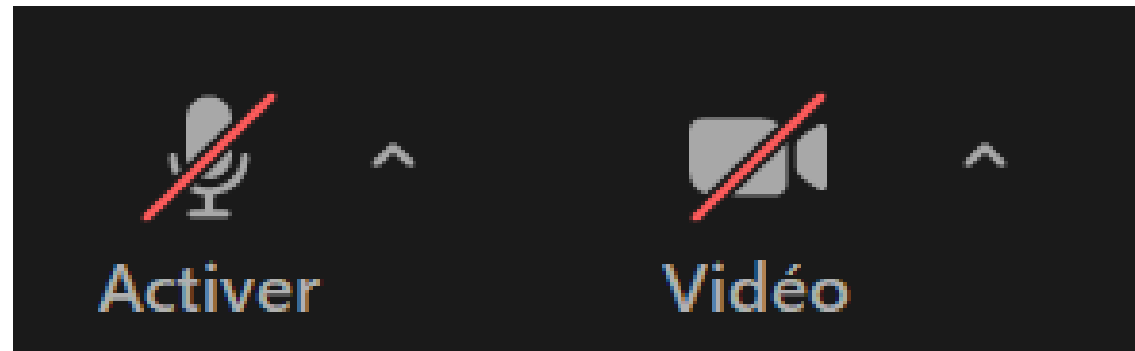
# Webinar Guidelines

The meeting is recorded, the link for “replay “ will be made available after the session,  
also this presentation support



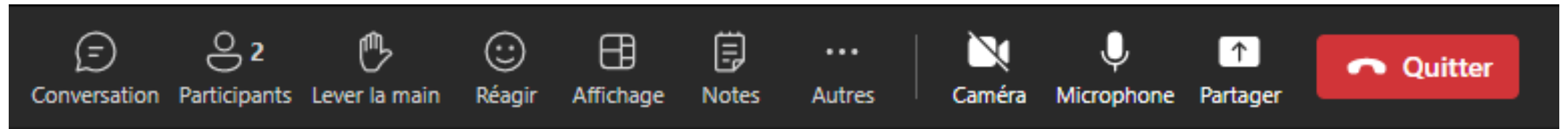
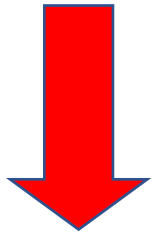
# Webinar Guidelines

Please make sure to keep your microphone and video off during the webinar



# Webinar Guidelines

Please use the chat tab to write a message if necessary



# Objectives of the webinar

## Introducing D2.1 Preliminary Operational Procedures

*In cooperation with EU-Rail Flagship Project 5 Sounding Board EDDP-European DAC Delivery Programme*

The focus of this webinar is just referencing to the **harmonised operational procedures**, one of the preconditions to enable the use of **new technology uniformly** on the one hand, and on the other to keep the **complexity** of FDFTO requirements **as low as possible**

During the webinar, the **preliminary Target Operational Procedures** will be explained in terms of general content and structure. This will **enable all interested parties** to examine them and to provide **further input to the DAC** related activities with **operational standards UE**.



Courtesy of DAC4EU



# Agenda of the webinar

## Introducing D2.1 Preliminary Operational Procedures

10:00 - 12:30

- Introduction (Mr Javier Ibáñez de Yrigoyen)  
Senior Programme Manager EU-Rail – 10 min
- Context and opening (Mr Jens Engelmann)  
EDDP Programme Co-Manager – 15min
- Preliminary Operational Procedures presentation (Mr Andreas Haller)  
EU-Rail TRANS4M-R Lead of System Architecture – 100 min
- Next steps/outlook (Mr Frédéric Hénon)  
EU-RAIL System Pillar lead of task 4 & "Harmonisation of FDFTO Operations" – 10min
- Conclusion (Mr Jens Engelmann)  
EDDP Programme Co-Manager – 5 min



# Introduction



DELIVER AN  
**INTEGRATED  
EUROPEAN RAILWAY  
NETWORK BY DESIGN**



DEVELOP A **UNIFIED  
OPERATIONAL  
CONCEPT AND A  
FUNCTIONAL SYSTEM  
ARCHITECTURE** FOR  
INTEGRATED EUROPEAN  
RAIL TRAFFIC AND  
CCS/AUTOMATION



DELIVER A  
**SUSTAINABLE AND  
RESILIENT RAIL SYSTEM**



DELIVER A  
**COMPETITIVE, GREEN  
RAIL FREIGHT FULLY  
INTEGRATED INTO THE  
LOGISTICS VALUE CHAIN**



DEVELOP A **STRONG  
AND GLOBALLY  
COMPETITIVE  
EUROPEAN RAIL  
INDUSTRY**

# EUROPE'S RAIL: ONE INTEGRATED R&I PROGRAMME

## SYSTEM PILLAR

OPERATIONAL  
CONCEPTS

FUNCTIONAL  
SYSTEM  
ARCHITECTURE

**A SINGLE COORDINATING  
BODY FOR THE WHOLE  
SECTOR EVOLUTION**

OPEN  
INTERFACES TO  
OTHER  
TRANSPORT  
MODES AND  
BUSINESSES

SYSTEM  
REQUIREMENT  
SPECIFICATIONS

## INNOVATION PILLAR

*TECHNOLOGICAL AND  
OPERATIONAL SOLUTIONS  
FOR SERVICES OF FUTURE*

FLAGSHIP  
PROJECTS

LARGE-SCALE  
DEMONSTRATIONS

EXPLORATORY AND  
FUNDAMENTAL R&I

1

**EUROPEAN RAIL  
TRAFFIC AND  
MOBILITY  
MANAGEMENT**

Manage and improve rail traffic at  
EU level

Adjust rail traffic management in  
function of the mobility demand

2

**DIGITALISATION &  
AUTOMATION IN  
TRAIN OPERATIONS**

ATO implementation

Digital train operations

3

**SUSTAINABLE AND  
DIGITAL ASSETS**

Integrated assets testing &  
life-cycle framework

Zero-emission, silent rail system

4

**COMPETITIVE,  
DIGITAL, GREEN  
RAIL FREIGHT**

New digital customer interaction &  
innovative rail freight services

Multimodal and rail freight  
innovation integration

5

**REGIONAL RAIL  
SERVICES IN LOW  
DENSITY AREAS**

New system approach to regional  
rail services in low density areas

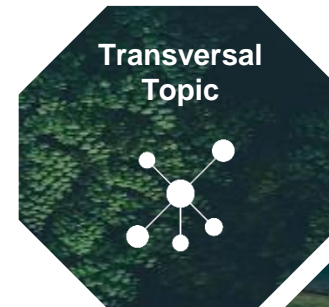
## DEPLOYMENT GROUP

FUTURE SOLUTIONS DEPLOYED IN A COORDINATED AND CONSISTENT WAY AT EUROPEAN LEVEL, TAKING INTO ACCOUNT ALTERNATIVE ROLLOUT SCENARIOS, BEHAVIOURAL AND ORGANISATIONAL CHANGES, SYNERGIES WITH OTHER MODES OF TRANSPORT



## Network management planning and control & Mobility Management in a multimodal environment

Network management planning and control (new processes and automation for decision support) & rail management in a multimodal environment (real-time demand-driven operations, including demand from other transport modes)



## Digital Enablers

Provide Digital Twins Design toolbox for design as well as for validation, verification and test + a Federated dataspace where all digital elements of the system can play together in a coherent and interoperable way

## Digital & Automated up to Autonomous Train Operations

Digital "Automated & Autonomous" Train Operations building upon the next gen Automatic Train Control based on ERTMS + enhancements on TCMS for integration at the on-board level



## Innovation on new approaches for guided transport modes

Explore non-traditional and emerging flexible and/or high-speed guided transport systems, as well as to create opportunities for innovators to bring forward ideas for shaping those future systems

## Intelligent & Integrated asset management

Knowledge from the digital transformation will feed back into the design, construction, manufacturing as well as into operation and maintenance processes.



## + Exploratory Research and other activities



## Regional rail services / Innovative rail services to revitalise capillary lines

Decreasing cost while offering a high quality of service and operational safety + increase customer satisfaction and attractiveness

## A sustainable and green rail system

Innovative solutions and services based on leading edge technologies to minimize the overall energy consumption and environmental impact of the railway system



## Sustainable Competitive Digital Green Rail Freight Services

Digitalization and automation of operational functions (e.g. DAC) and processes as well as increasing the efficiency of the immaterial (information/data) layer of transport in logistic



**Call:** HORIZON-ER-JU-2022-FA5-01

**Topic:** Sustainable Competitive Digital Green Rail Freight Services

**Type of action:** Horizon JU Innovation Action (IA)

**Call deadline:** 23 June 2022

**Info letter sent:** 5 August 2022

**Proposed Starting date:** 01 July 2022

**Duration:** 45 months

**Maximum JU contribution:** 40,599,047.39 EUR

**Reporting periods:** 4

**Coordinator:** Deutsche Bahn AG (DB)

**Number of participants:** 71



Subject to the grant agreement conclusion, 2023 will mark the first steps of the first EU-Rail FP5, notably focusing on two work-streams and delivering the following by 2025:

## **WS1 Full digital Freight Train Operations with DAC as enabler for full digital freight train operation**

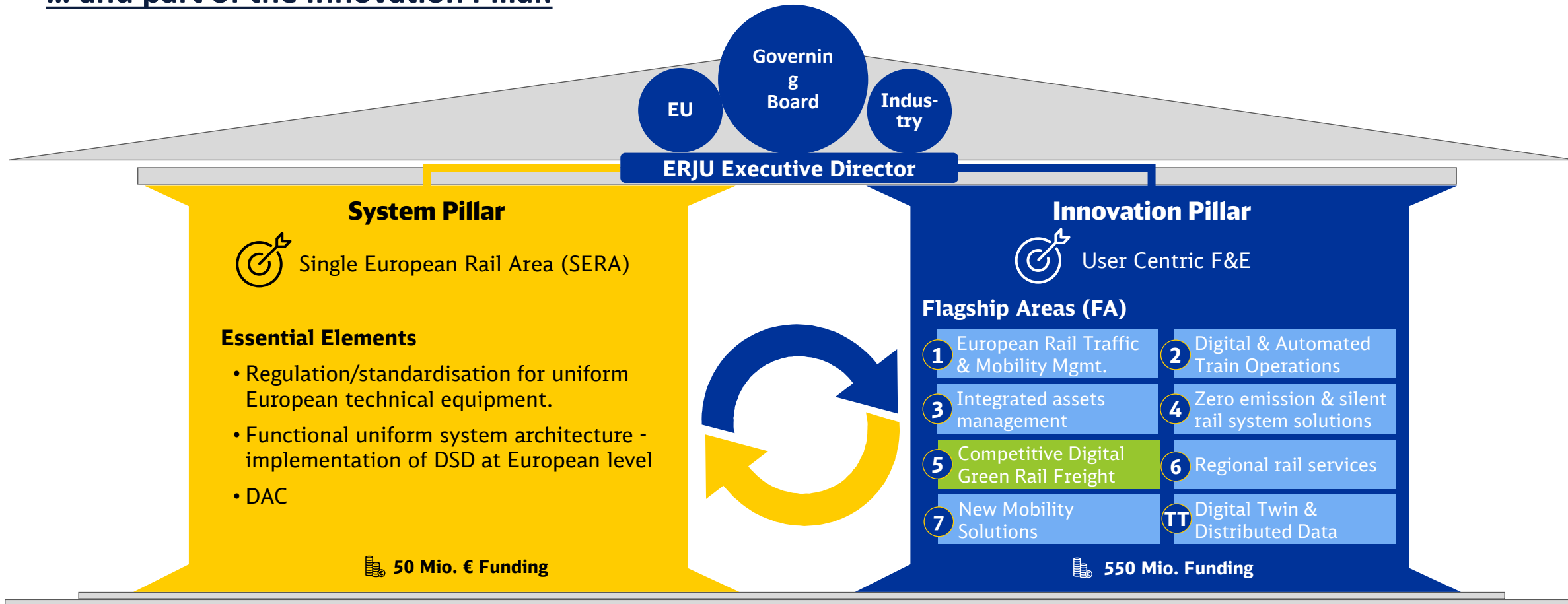
- **European full digital freight train operations (TRL 8-9):** Large-scale demonstrator showing full digital freight train operations based on DAC Type 4 (incl. energy supply & data/communication solution and Type 5 upgradability **(and TRL 7 technical solutions)**)
- **European full digital freight train operations (TRL 8 – some functionalities at lower TRL):** Demonstration of Yard automation equipment, wagon identity system allowing automated shunting, video gates and way side check points with visual recognition and AI tools for yard automation.

## **WS2 Seamless Freight: with easy access and reliable (intermodal) transport service offering digital solutions.**

Deliver by 2025 at least the following:

- **Seamless freight corridor (TRL 5-8)** The comprehensive innovations for planning and operation of cross-border freight trains should be demonstrated on (parts of) two European corridors.
- **Seamless customer freight (TRL5-8)** Seamless planning, management and booking of multimodal rail-based transport integrating multi-actors, should be demonstrated integrating rail in modern supply chains.

... and part of the Innovation Pillar.



WHAT ?

**16 technical enablers will be developed, tested and demonstrated**



**1**

Interoperable DAC  
Type 5 ready

**2**

Dev. of DAC-  
enabled train  
functions

**3**

Prep. for  
additional DAC  
train functions

**4**

Autonomous  
Shunting  
Operations

**5**

Multi-source data  
fusion (TS+OB)

**6**

Interface for  
hand-over:  
main-line → yards

**7**

DAC for  
T3000 wagons

**8**

Specs for int.  
cross-border time-  
table planning

**9**

Models for int.  
cross-border time-  
table planning

**10**

Dynamic  
Yard Management  
System

**11**

AI-based  
prediction of ETA

**12**

Railway  
Checkpoints at  
borders

**13**

Multi-country  
driver concepts

**14**

Transport  
planners with  
easy booking

**15**

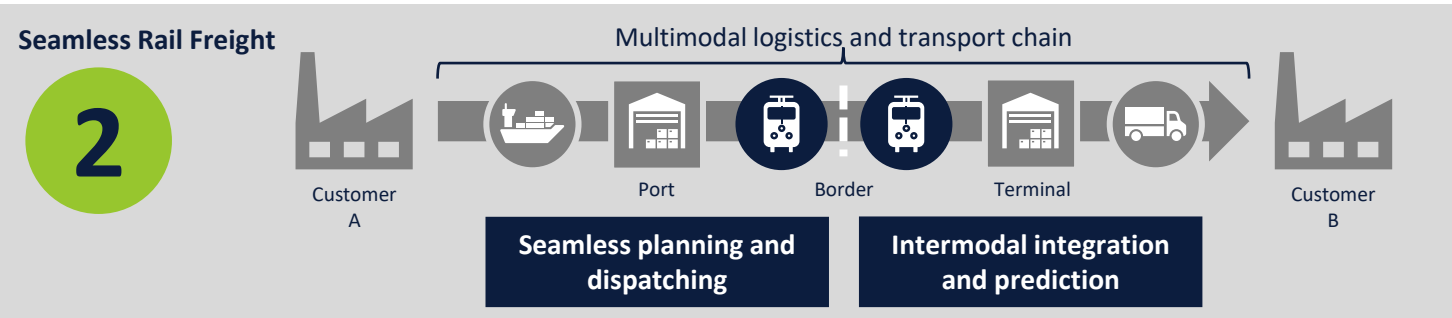
Framework  
for seamless data  
exchange

**16**

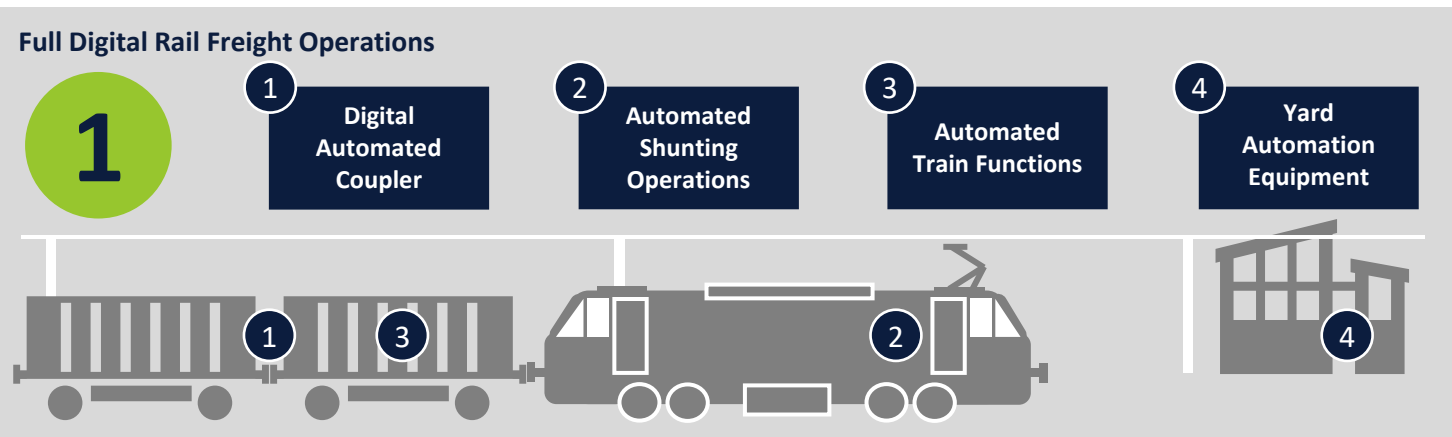
Platform of  
platforms f. seam-  
less experience

HOW ?

...working in two clusters/workstreams...



Cluster 1 enables Cluster 2



# Context and opening

EDDP, ERJU, FP5



# European DAC Delivery Programme

enabled by Europe's Rail

## EDDP Programme Management

**Mark Topal-Gökceli  
(ÖBB)**



**Jens Engelmann  
(railiable)**



- Mark Topal-Gökceli
- Jens Engelmann
- Giorgio Travaini
- Javier Ibáñez de Yrigoyen

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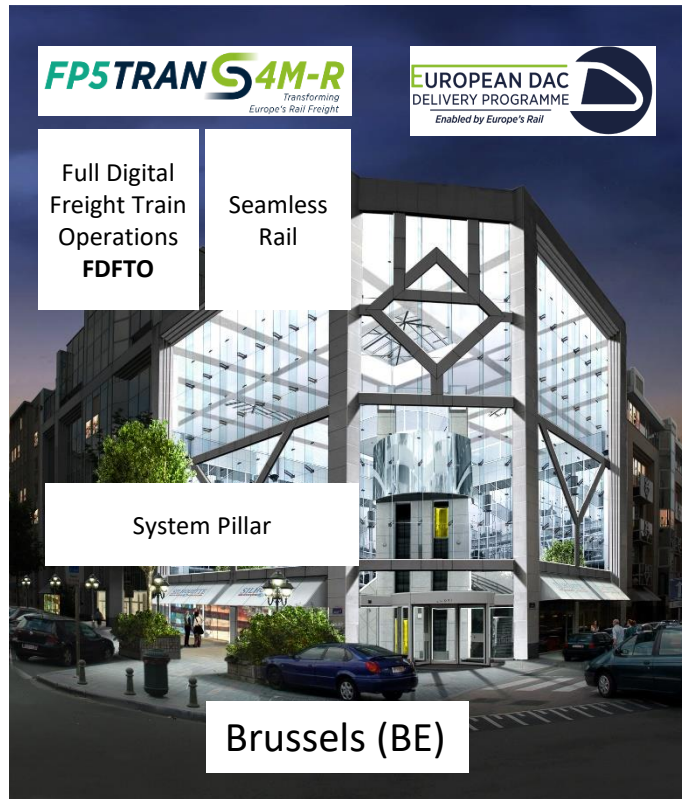
More information: <https://rail-research.europa.eu/european-dac-delivery-programme/>



# The different DAC actors and how they are connected



# The different DAC-related EU actors involved



Europe's Rail JU  
Flagship Project 5

EDDP

development/follow-up of migration roadmap, sector-wide coordination, risk management, prep. of decision-making



EC/ERA

Europe's Rail  
System Pillar

ESOs

FP 5 DFDTO  
sounding boards



Technology  
(mirroring & sector feedback)



Operational  
Procedures  
(mirroring & sector feedback)

## DAC migration roadmap

11 actions



Fleet Analyses  
& rtf Engineering  
(rtf readiness)



Retrofit  
capacity plan  
(workshops, work-  
force, components)



Funding &  
Financing plan



development of  
efficient & suitable  
authorisation  
process &  
requirements



CBA  
(updates)



operational  
procedures  
standardisation  
(plan & execution)



GENELEC



Executing  
European  
standardisation



Infrastructural  
& IT adaptations



Retrofitting plan  
(traffic & customer  
sidings analysis,  
operational plan)



Investment plan  
& procurement  
framework plan



TSI revision



Placing into service plan  
(safety, workforce  
training, rulebooks etc.)

Other regulatory &  
legal framework  
plans

Technical  
harmonisation:  
preparing TSI  
revision & driving  
EU standardisation

alignment of  
rail & DAC system  
architecture



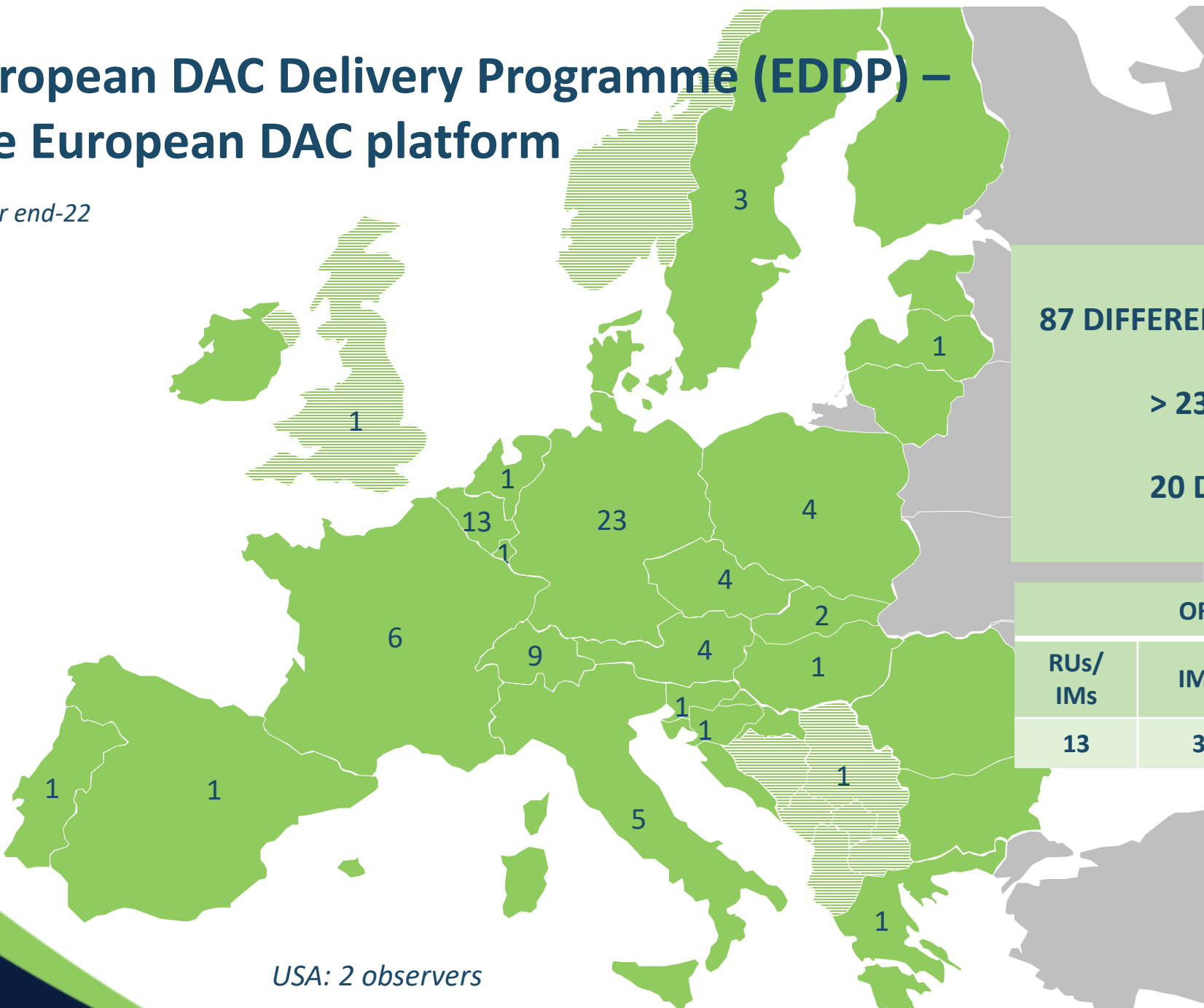
DAC/"Full Digital  
Freight Train  
Operations"

target operat. proc.  
functional requ'mts  
system architecture  
tech. development  
testing & demos  
tech. specification  
authoris. dossiers



# European DAC Delivery Programme (EDDP) – the European DAC platform

*as per end-22*



**87 DIFFERENT ORGANISATIONS (06/22)**

**> 235 PARTICIPANTS**

**20 DIFFERENT COUNTRIES**

**ORGANISATIONS BY TYPE**

RUs/ IMs	IMs	WKs	INDU- STRY	OTHER
13	3	16	20	36

*w/o US, UK*

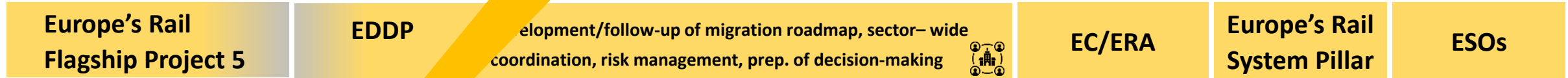
*USA: 2 observers*

# EDDP Governance – Programme Board



# All DAC-related activities

Here operations and technology are developed



FP5TRAN54M-R  
*Transforming Europe's Rail Freight*

FP 5 DFDTO  
sounding boards

## DAC migration roadmap

11 actions




DAC/"Full Digital Freight Train Operations"

target operat. proc.  
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Technology  
(mirroring & sector feedback)



Operational Procedures  
(mirroring & sector feedback)

 Fleet Analyses & rtf Engineering (rtf readiness)	 Retrofit capacity plan (workshops, workforce, components)	 Funding & Financing plan	 development of efficient & suitable authorisation process & requirements
		 CBA (updates)	
 Infrastructural & IT adaptations	 Retrofitting plan (traffic & customer sidings analysis, operational plan)	 Investment plan & procurement framework plan	 TSI revision
 Placing into service plan (safety, workforce training, rulebooks etc.)		 Other regulatory & legal framework plans	

operational procedures standardisation (plan & execution)

Technical harmonisation: preparing TSI revision & driving EU standardisation

alignment of rail & DAC system architecture



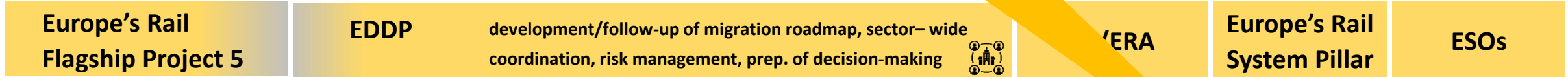
CENELEC




Executing European standardisation

# All DAC-related activities


Here later the ope procedures will be standardised Europe-wide



**FP 5 DFDTO sounding boards**












**Technology (mirroring & sector feedback)**



**Operational Procedures (mirroring & sector feedback)**

**DAC migration roadmap** 11 actions

 <p><b>Fleet Analyses &amp; rtf Engineering (rtf readiness)</b></p>	 <p><b>Retrofit capacity plan (workshops, workforce, components)</b></p>	 <p><b>Funding &amp; Financing plan</b></p> <p> <b>CBA (updates)</b></p>	 <p>development of efficient &amp; suitable authorisation process &amp; requirements</p>
 <p><b>Infrastructural &amp; IT adaptations</b></p>	 <p><b>Retrofitting plan (traffic &amp; customer sidings analysis, operational plan)</b></p>	 <p><b>Investment plan &amp; procurement framework plan</b></p> <p><b>Other regulatory &amp; legal framework plans</b></p>	 <p><b>TSI revision</b></p>

**operational procedures standardisation (plan & execution)**

**Technical harmonisation: preparing TSI revision & driving EU standardisation**

**alignment of rail & DAC system architecture**

**DAC/"Full Digital Freight Train Operations"**

target operat. proc.  
functional requ'mts  
system architecture  
tech. development  
testing & demos  
tech. specification  
authoris. dossiers

**Executing European standardisation**








# All DAC-related activities

<b>Europe's Rail Flagship Project 5</b>	<b>EDDP «neo»</b> development/follow-up of migration roadmap, sector-wide coordination, risk management, prep. of decision-making	<b>EC/ERA</b>	<b>Europe's Rail System Pillar</b>	<b>ESOs</b>
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**FP5TRAN54M-R**  
*Transforming Europe's Rail Freight*

**FP 5 DFDTO sounding boards**



**Technology (mirroring & sector feedback)**

**DAC migration roadmap** 11 actions

 <p><b>Fleet Analyses</b> (of engineering business)</p>	 <p><b>Retrofit capacity plan</b> (workshops, workforce, components)</p>	 <p><b>Funding &amp; Financing plan</b></p>
 <p><b>Infrastructural &amp; IT adaptations</b></p>	 <p><b>Retrofitting plan</b> (traffic &amp; customer sidings analysis, operational plan)</p>	 <p><b>CBA (updates)</b></p>
 <p><b>Placing into service plan</b> (safety, workforce training, rulebooks etc.)</p>		 <p><b>Investment plan &amp; procurement framework plan</b></p>

Here we are today



**Operational Procedures (mirroring & sector feedback)**



**DAC/"Full Digital Freight Train Operations"**

target operat. proc.  
functional requ'mts  
system architecture  
tech. development  
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development of efficient & suitable authorisation process & requirements



**TSI revision**



operational procedures standardisation (plan & execution)

Technical harmonisation: preparing TSI revision & driving EU standardisation

alignment of rail & DAC system architecture



**CENELEC**



Executing European standardisation

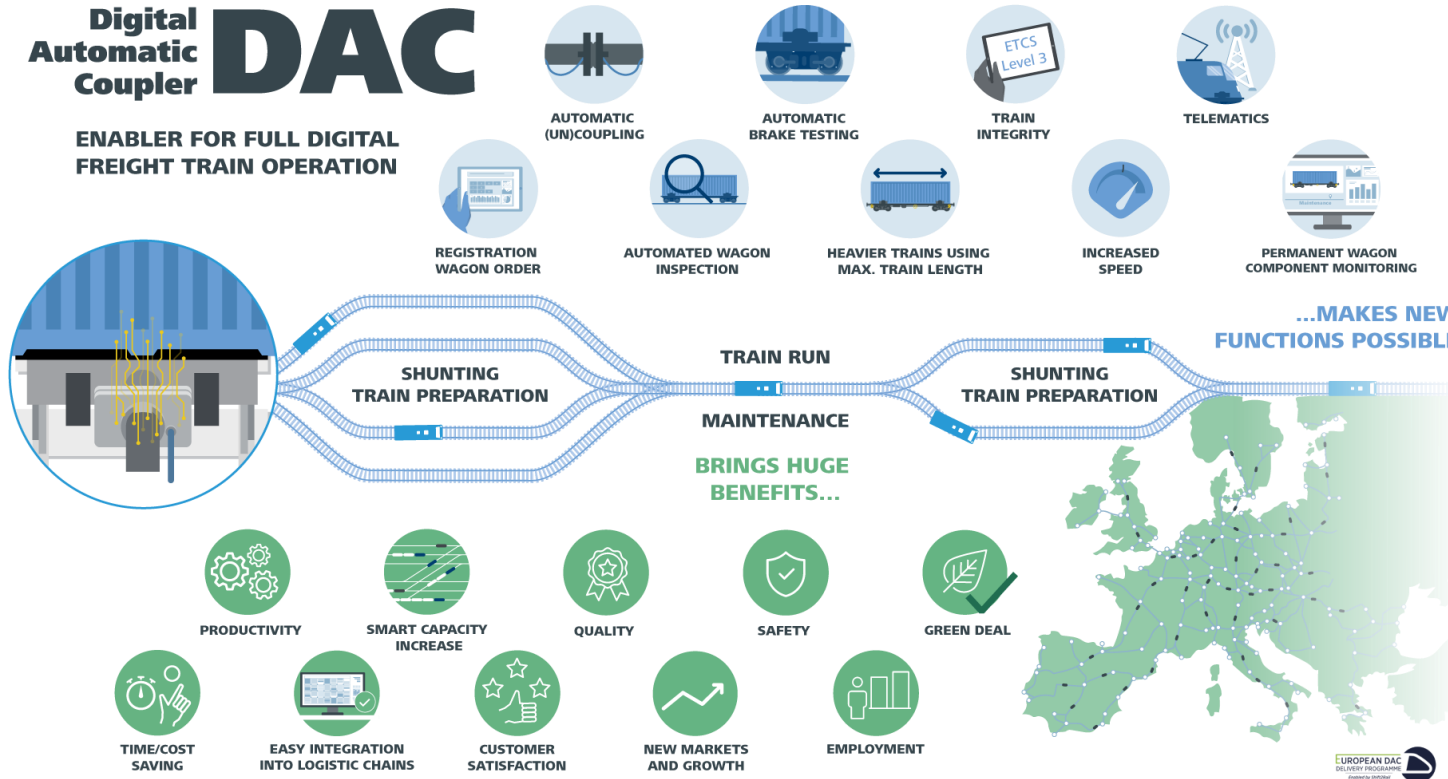


# DAC use cases

# DAC for Full Digital Freight Train Operations

## Digital Automatic Coupler DAC

ENABLER FOR FULL DIGITAL FREIGHT TRAIN OPERATION



- › DAC is more than just a coupler
- › DAC is a key and unique enabler for numerous applications
- › DAC is not a stand-alone technology but the backbone for “full digital freight train operations” to achieve the ambitious transformation in European rail freight
- › This will allow the DAC to enable even more use cases and to generate a max. possible benefit

EUROPEAN DAC DELIVERY PROGRAMME  
Enabled by Shift2Rail



“Scharfenberg” latch-type design selected for future Europe-wide Digital Automatic Coupling (DAC) standard coupler head





# Use cases: DAC Core system and DAC applications (Full Digital Freight Train Operations)

benefits =  
gains in the  
processes  
(time,  
system time,  
cost savings,  
capacity,  
reliability,  
quality,  
safety)  
  
+ induced  
modal shift

## DAC Core system



- › Automated coupling & manual uncoupling and digital backbone
- › Recording of train composition
- › Automatic (remote) uncoupling
- › Heavier & longer trains (within existing infra limitations)
- › Increased payload
- › Increased speed via improved longitudinal forces

## DAC shunting



- › Automated parking brake
- › Draining of auxiliary air tanks
- › Automated air valve
- › Rear view camera for train driver
- › Proximity detection
- › Sound signals when train in motion

## DAC train preparation



- › Automatic brake test & calculation of brake capacity
- › Automated technical wagon inspection

## DAC train run



- › Tail light (train integrity prior OTI function)
- › Train end device (intermediate solution?)
- › Vital on train integrity (OTI), enabling ETCS L3 moving block operations
- › Increased speed via better braking performance
- › Multiple loco traction and trains up to 1500m
- › Derailment detection

## DAC telematics

### (wagon & goods monitoring)



- › Predictive / preventive maintenance
- › detection of cargo condition
- › Cargo surveillance, intrusion alarm
- › Wagon data & loading information on mobile device

## DAC loading & unloading



- › Automatic loading/unloading processes (replacement of hydr/pneum components, electro-mechanical actuators for bridge plates, automated cargo securing, heating elements for defrosting, ...) via ext. energy supply
- › illumination for worker's safety & interior

# Introduction of D2.1

Motivation, Background, History, Methodology, Delimitation



## Ing. Andreas Haller (M.Sc.)

Lead Architect Intelligent Freight Train & Digital Automated Coupling  
Digital Automatic Coupling Project (L.CBX)

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DB Cargo AG

Caroline-Michaelis-Straße 5-11, 10115 Berlin

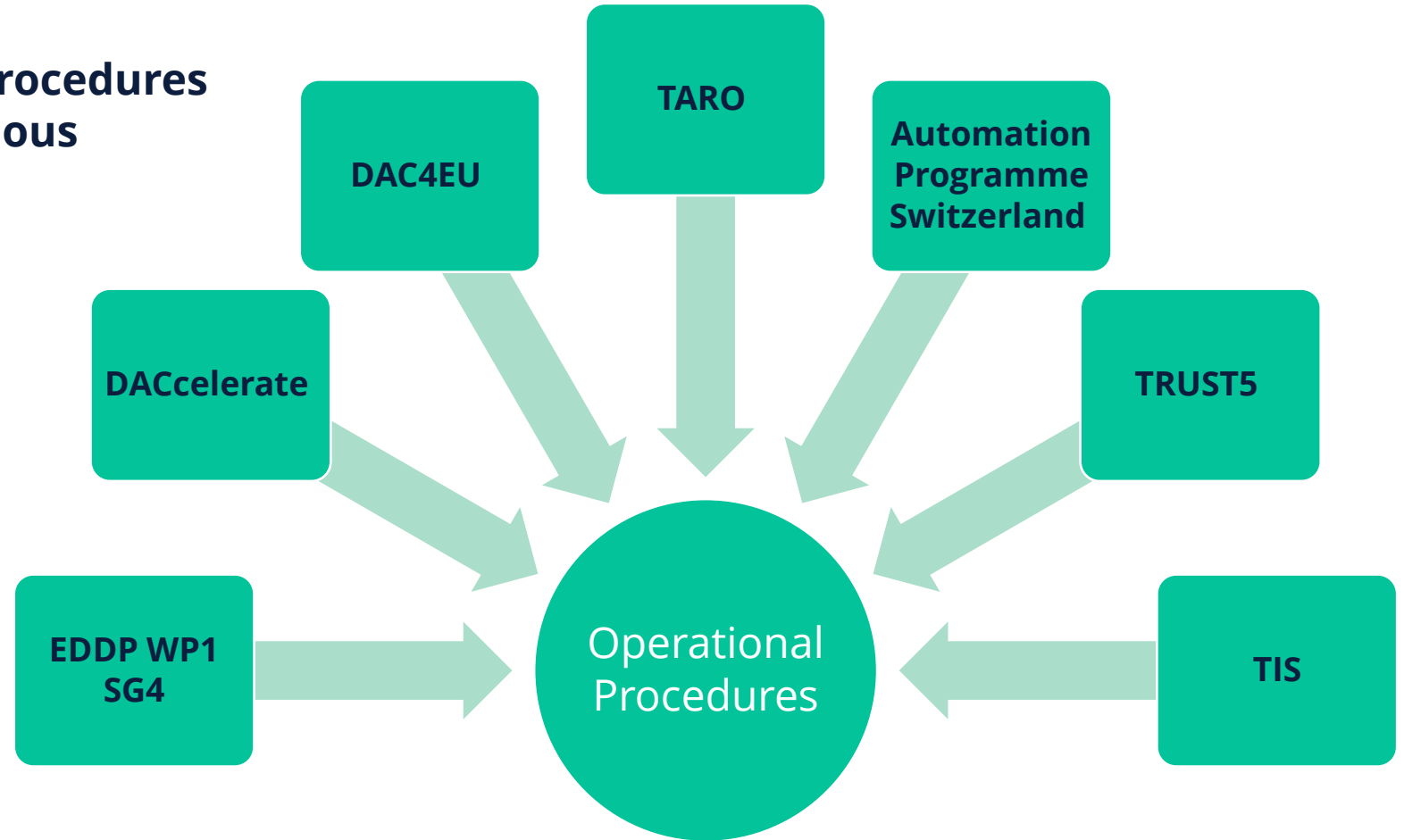
Mobil: +49 152 374 052 79

Mail: [andreas.an.haller@deutschebahn.com](mailto:andreas.an.haller@deutschebahn.com)

The objective of this document is to provide the **first agreed throughout Europe target operational procedures for rail freight.**

The procedures will define the basis for the development of the innovations for WP3-WP12. It describes the **target of full automation of the freight sector**, as well as a subset based on the agreed technical enablers in FP5-TRANS4M-R.

**D2.1 Preliminary Operational Procedures have used the results from various projects, initiatives as input.**





The CoreTeam

Andreas Haller



Manfred Stobrave



Stefan Zebracki



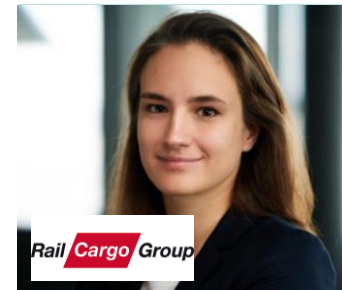
Anton Vogel



Lisa Ruiz



Barbara Lunzer



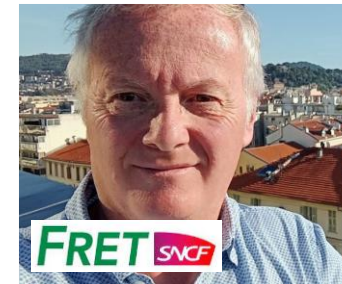
Manuel Rapold



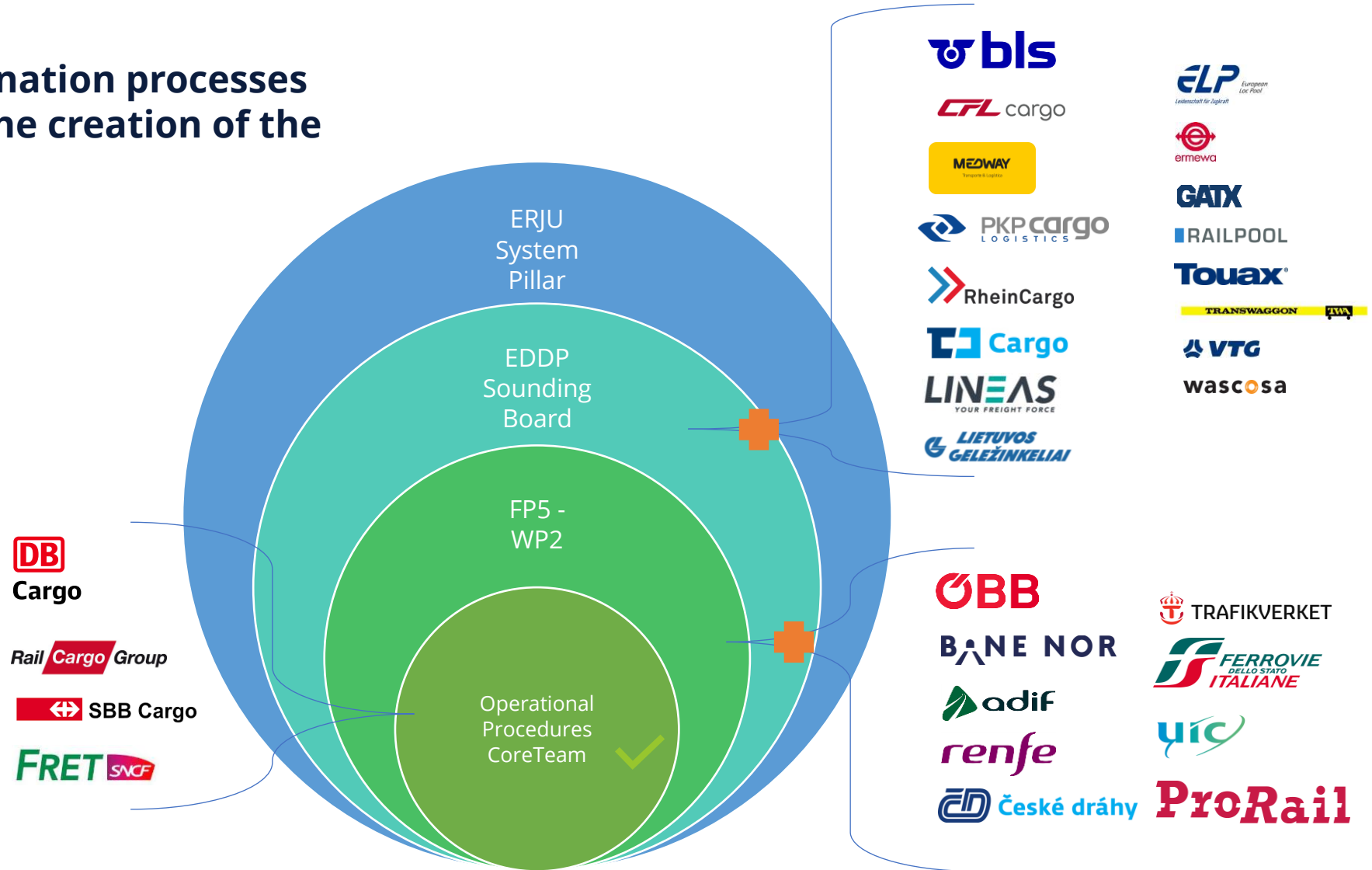
Aldo Smania



Patrick Lefevre



Intensive coordination processes already during the creation of the document



- **Disruption/error process**

Disruptive processes often introduce a high level of intricacy, involving multiple variables and uncertainties that can complicate the analysis and interpretation of results. Due to the inherent complexity, there are no disruption processes considered in this document.

- **Migration**

The document does not cover any migration scenarios. These scenarios are subject of other initiatives. However, the document could be a base for the development of migration scenarios.

- **Border traffic/handover between countries and/or infrastructures**

Handover between RUs or at border stations are not directly considered, as these processes are the responsibility of the RUs. However, the individual process steps should be included in the processes, whereas the order of the steps may vary.

- **Existing operational processes (Signaller, ETCS, ...)**

Existing processes without impact of Full Digital Freight Train are not part of the document.

- **IT interfaces only in a generic view**  
Not known at this time, this topic is partially addressed in other working packages within ER JU.
- **Maintenance processes**  
Only the operative shunting processes in the workshop are taken into account (supply/discharge). The maintenance/repair processes of the vehicle or components are not considered.
- **Consist functions**  
Train functions may be accompanied by consist functions, which are not described in this document.

# Preliminary Operational Procedures

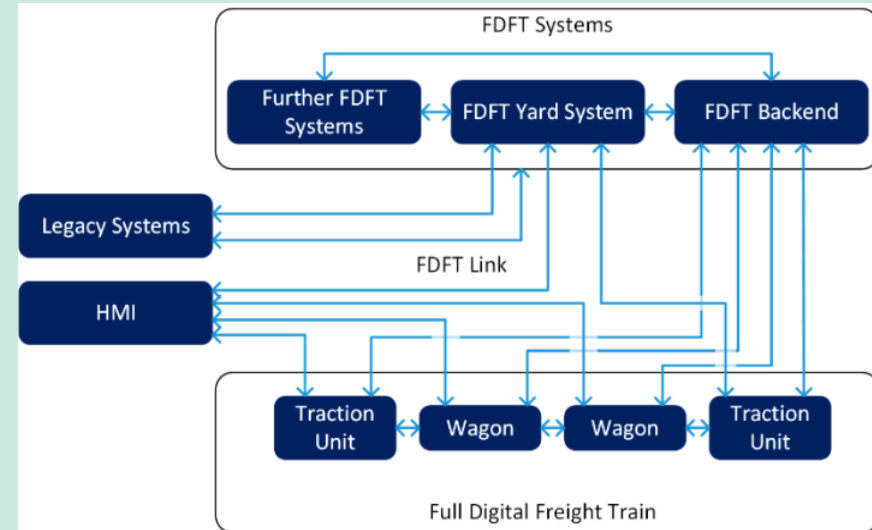
## Terms and Actors

General:

- The abbreviation "FDFT" in front of descriptions means that they must be newly developed.
- The abbreviation "Legacy" in front of descriptions means that they already exist and are in use.

Definition	Description
FDFT Function	Function that does not exist today and <b>needs to be developed to achieve the target state.</b>
FDFT function Prevent Coupling	<ul style="list-style-type: none"><li>• While the function is <b>activated</b>, the DAC coupler head must <b>not allow coupling.</b></li><li>• Note: This function is required at all levels of DAC, even if the technical solution may be different.</li></ul>

Definition	Description
FDFT System	<ul style="list-style-type: none"> <li>Systems that do not exist today and need <b>to be developed to achieve the target state.</b></li> </ul>
FDFT Wagon Base System	<ul style="list-style-type: none"> <li>system on <b>each wagon</b>, which <b>controls wagon components</b> (e.g. DAC coupler heads, wagon wide power control system, battery management system, brake system, sensors).</li> <li>can communicate via FDFT Link (network) e.g. with the Traction Unit, FDFT Backend (if available), landside systems, with Personnel by using a Mobile HMI</li> </ul>
FDFT Link	<ul style="list-style-type: none"> <li><b>Enables communication between FDFT Systems</b></li> <li>connection can be physical or wireless.</li> </ul>



Definition	Description
FDFT mode Train Run	<ul style="list-style-type: none"> <li>• Coupled DAC coupler heads of Train <b>cannot be commanded to uncouple</b> &amp; first and last DAC coupler heads of Train must have FDFT function Prevent Coupling deactivated</li> <li>• Power supply over DAC coupler heads can be enabled by Traction Unit.</li> <li>• An <b>operational train</b> run is carried out in FDFT mode Train Run.</li> <li>• Current state of discussion: Automated Parking Brake cannot be activated</li> </ul>
FDFT mode Shunting (note: not ETCS Shunting Mode)	<ul style="list-style-type: none"> <li>• <b>Allows electrical uncoupling</b> of DAC coupler heads, electrical activation of function prevent coupling and activation of Automated Parking Brake.</li> <li>• <b>Uncoupled: no harmful electrical power</b> on DAC coupler head is present, especially on electrical contacts.</li> <li>• <b>Uncoupling:</b> electrical connections of DAC coupler head must be <b>free of harmful electrical power or current</b></li> <li>• <b>Coupling: harmful electrical power and current</b> is only <b>applied after successful mechanical coupling</b> of both DAC coupler heads including electrical coupler.</li> </ul>

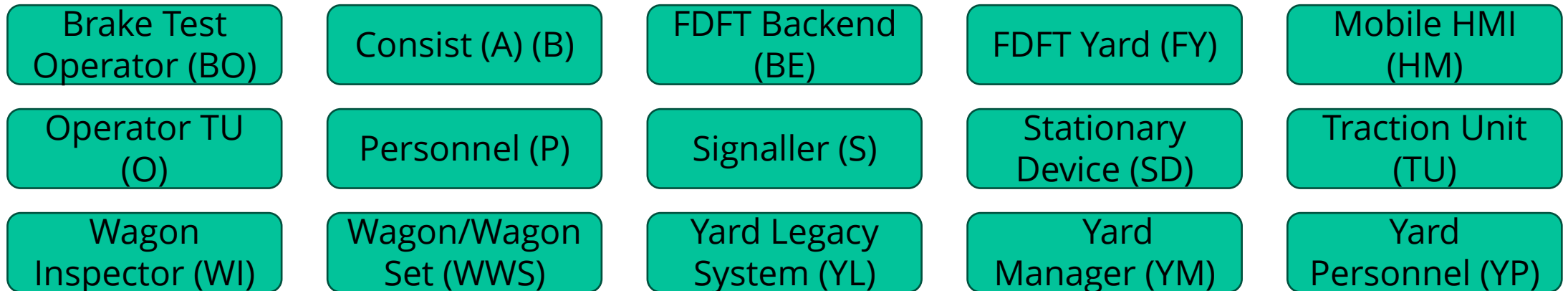


Today existing	Description
Service Brake	<ul style="list-style-type: none"> <li>• <b>braking system used today</b> on freight trains (<b>compressed air brake</b>)</li> <li>• slows down the vehicles by lowering the air in the main brake pipe or</li> <li>• secures vehicles against rolling away for short periods of parking.</li> </ul>
Legacy braking means to secure wagon(s) against rolling away	<ul style="list-style-type: none"> <li>• braking means like <b>drag shoe, hand brake</b>, track brake, etc.</li> </ul>
"New" Definition	Description
Automated Parking Brake	<p>An <b>automated</b> parking brake <b>secures the wagon(s) against rolling away</b>. Activation of applying and releasing is done via the FDFT link</p>
Controllable Brake	<p>Can be <b>one or more systems</b> covering the following functions:</p> <ol style="list-style-type: none"> <li>1) <b>Securing the wagon(s) against rolling away</b>. This function can be realised on the one hand by the Automated Parking Brake (especially longer parking periods) or by the service brake (shorter parking periods, depending on national regulations).</li> <li>2) <b>Targeted braking of the wagon(s)</b> to a <b>certain speed or standstill</b>, which takes place after the wagon (set) has separated from the traction unit (e.g. braking of the wagon(s) after hump shunting/fly shunting).</li> </ol>

Definition	Description
Coupling Point of Shunting Composition/Wagon Set	Identifies the future <b>connection between two DAC coupler heads planned for coupling.</b>
Uncoupling Point of Shunting Composition/Wagon Set	Identifies the <b>connection between two DAC coupler heads planned for uncoupling.</b>

You can find more definitions in Deliverable 2.1 Chapter 6.

- In the processes, actors are used as the executing entity
- They are kept general so that the processes can be applied to various infrastructures as well as different RUs
- How to read the document will be presented later



Actor	Description
Brake Test Operator (BO)	On site personnel <b>performing</b> the <b>brake test</b> .
Consist (A) (B)	A consist is the <b>smallest railway rolling stock entity</b> for operation (e.g. wagon, traction unit, ...), containing one <b>CCU</b> (Central Control Unit) <b>representing one node</b> on DAC network. It can be a traction unit, single wagon as a fixed set of single vehicles (segments) which are not disconnected while operation. A consist own a <b>unique vehicle identification number</b> .
FDFT Backend (BE)	Collection of <b>new FDFT functions</b> on land side. Receives, supplies, and stores Consist Data (e.g. Wagon Target Track Data, Traction Unit Status Data, Wagon Set Data and Additional Wagon Data). FDFT Backend provides and receives data to and from other systems (FDFT Yard, Traction Unit, etc.) FDFT Backend <b>initiates different functions</b> , e.g. coupling and uncoupling processes, in Target State.

Actor	Description
FDFT Yard (FY)	FDFT Yard is infrastructure based and <b>controls</b> all infrastructure elements in its area. FDFT Yard <b>provides current state</b> of infrastructure <b>to FDFT Backend</b> if available. The interfaces between FDFT Backend and FDFT Yard will be defined in a later step.
Mobile HMI (HM)	(Locally) (remote) device for <b>personnel</b> to <b>interact with FDFT Systems</b> . Connection to FDFT Systems can be wireless and physical, even to FDFT Wagon Base System. For example, personnel can connect the Mobile HMI to a wagon in a wagon set and retrieve Wagon Status Data and Wagon Set Data of the entire Wagon Set.
Operator TU (O)	Personnel (remotely) controlling Traction Unit(s).
Personnel (P)	<b>Only for subprocesses.</b> Refers to the originating swim lane actor in the main process. E.g. if subprocess activity was on the Yard Manager swim lane, Personnel refers to Yard Manager in the subprocess context.

Actor	Description
Signaller (S)	Performer in charge of the route <b>setting of trains/shunting movements</b> and of issuing instructions to Operator of Traction Unit (see TSI OPE).
Stationary Device (SD)	<b>Infrastructure-sided device</b> that provides air for (automated) brake test and measurement data (e.g. air pressure). For <b>target processes</b> : <b>Power and data are also supplied</b> and connected. Over this device, a connection between Wagon(s) to FDFT Backend or Legacy Systems is possible.

Actor	Description
Traction Unit (TU)	<p>A Traction Unit with DAC coupler heads that <b>supplies traction power</b> and moves itself and coupled vehicles. This also includes multiple traction units moving together.</p> <ul style="list-style-type: none"> <li>• The DAC coupler heads can also be <b>hybrid couplers</b> (is able to operate with screw couplers and DAC)</li> <li>• A Traction Unit can also have Distributed Power System functionalities</li> <li>• <b>ATO</b> (Automatic Train Operation) and <b>ASO</b> (Automated Shunting Operations) systems can be applied</li> <li>• A Traction Unit <b>can be equipped with FDFT functionalities</b>, e.g. allows retrieving Wagon Status Data or Wagon Set Data and can initiate FDFT Wagon Base System's functions, like secure against rolling away, bleeding, etc.</li> <li>• An <b>unpowered</b> Traction Unit is considered and behaves <b>like a wagon</b> with FDFT Wagon Base System</li> <li>• Traction Units can be main line locomotives, shunting locomotives, shunting devices, two-way vehicles, etc.</li> <li>• The traction unit (TU) <b>supplies the electrical energy</b> for all the wagons in a train, <b>if technical available</b></li> <li>• User Interface is available</li> </ul>

Actor	Description
Wagon Inspector (WI)	On site personnel <b>performing technical inspection</b> of wagon(s).
Wagon/Wagon Set (WWS)	<p>Wagon: Single physical freight Wagon equipped with <b>DAC coupler head at each end.</b></p> <p>Wagon(s) permanently coupled (just one UIC Number) together should behave like a single wagon and cannot be uncoupled.</p> <p>Wagon Set: Wagon(s) coupled together by DAC coupler heads.</p>
Yard Legacy System (YL)	Today's technical systems used in yard operations.



Actor	Description
Yard Manager (YM)	Personnel responsible for operation of shunting yards.
Yard Personnel (YP)	On site personnel needed for <b>shunting operations</b> , e.g. for uncoupling / coupling rolling stock, for securing rolling stock and any <b>other activities</b> that <b>require human intervention</b> in shunting operation.

# Preliminary Operational Procedures

## General Assumptions and Premises

- The present design of the Preliminary Operational Procedures reflects the current status of the discussion on operational procedures within the sector and specifically within FP5- TRANS4M-R
- Design premises  
These Operational Procedures are designed as processes for universal usage in Europe, so by definition generic. It is not target of these processes, to define the detailed individual processes of each RU, Wagon keepers, but it should serve as a foundation for the individual adaptations on locations and/or local rules, to be done by each and every company.
- The following has been excluded from this study:
  - Disruption/error process
  - Migration
  - Border traffic/handover between countries and/or infrastructures
  - Existing operational processes (Signaller, ETCS, ...)
  - IT interfaces only in a generic view
  - Maintenance processes
  - Consist functions

## Definition of DAC hardware level and FDFT Functions

- The general and DAC level specific definitions of the hardware and the functions which are being developed in ER JU FP5-TRANS4M-R project are listed below.
- The general assumption is that DAC 4 is upgradeable to DAC 5.
- Note:  
Alignment process for allocation for functions to DAC level is still ongoing; updated version will be available in D3.1 System Requirement Specification FDFT.

### FDFT Hardware General

- mechanical coupler
- electrical coupler
- power and data lines, battery, CCU, emergency release
- Hardware of Functions (e.g. sensors, ...)

### FDFT Hardware DAC Level specific

- DAC 4:
  - lever on wagon side
- DAC 4.5:
  - electrical actuator
  - push button on wagon side
- DAC 5:
  - electrical actuator

- FDFT Functions are partially described in the document, but are considered / developed in detail in other WPs
- Train Functions: → are needed to automatize and accelerate the train operation especially in shunting mode.
  - are controlled or monitored by the leading consist of the composition or an FDFT System.
  - users can be: a locomotive driver / Personnel / an ATO system (Automatic Train Operation) or a train protection system of the leading consist or an FDFT System.

For all train functions a validated train composition is needed as precondition to execute train functions in a safe and correct manner.

## FDFT Functions General

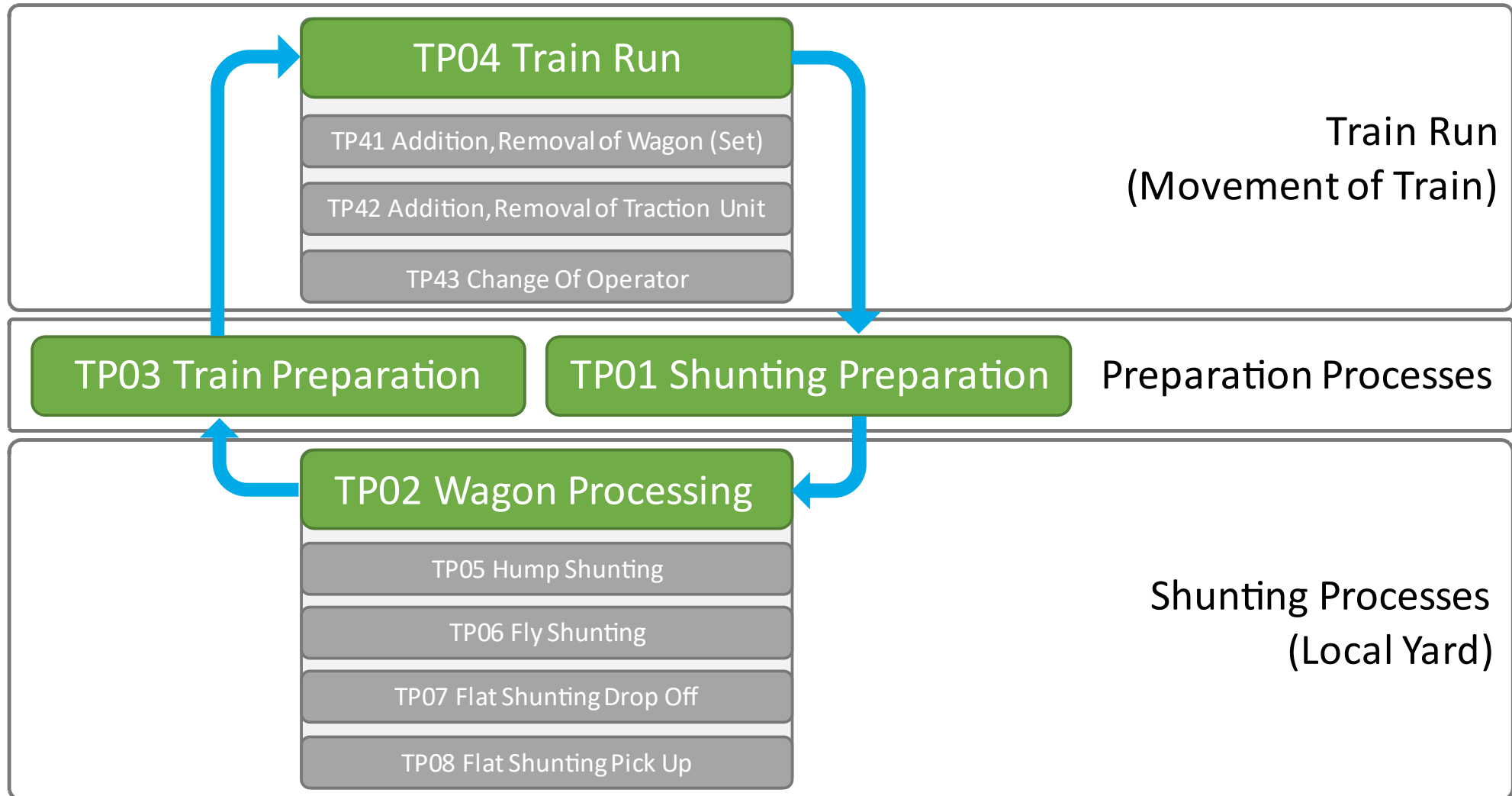
- coupling
- uncoupling
- prevent coupling
- train composition detection
- train integrity monitoring
- train length determination
- automated brake test
- automated parking brake
- ep-brake
- distributed power system
- air management

- **Differences between Target Process and Semi-Automated Process**
  - The target process represents fully automated operation.
  - Processes that are only partially automated, are called semi-automated processes.
  - Possible reasons:
    - the technical development is not yet ready
    - certain areas (e.g. customer siding) are not (yet) fully equipped
  - Therefore, a differentiation is made between the “Target State”, which represents the fully automated operations (Target Processes) and the “Semi-Automated State” (Semiautomated processes).
- **Differences between Target Process and ER JU Process**
  - Within the framework of ER JU FP5-TRANS4M-R, not all developments that can represent the target state are carried out.  
For this reason, semi-automated processes, called "ER JU Process", are defined in this document, which represents the status that can be achieved after developments in ER JU FP5-TRANS4M-R have been completed (Technical Enabler)
  - Most dominantly no development of European FDFT Backend

# Preliminary Operational Procedures

How to read the document

# Process overview with four main processes





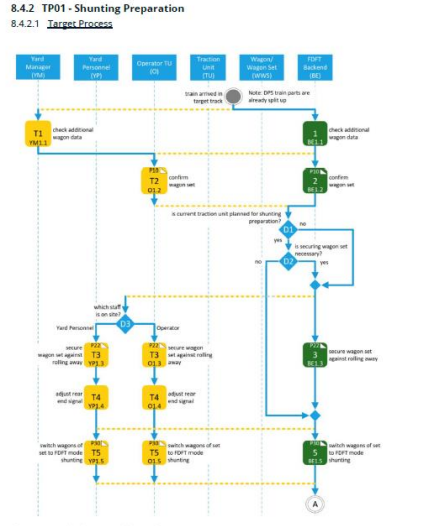
- TP01 Shunting Preparation
- TP02 Wagon Processing
- TP03 Train Preparation
- TP04 Train Run

- TP05 Hump Shunting
- TP06 Fly Shunting
- TP07 Flat Shunting Drop Off
- TP08 Flat Shunting Pick Up
- TP09 Automated Brake Test
- TP10 Confirm Wagon Set
- TP11 Technical Wagon Inspection
- TP41 Addition, Removal of Wagon (Set)
- TP42 Addition, Removal of Traction Unit
- TP43 Change of Operator

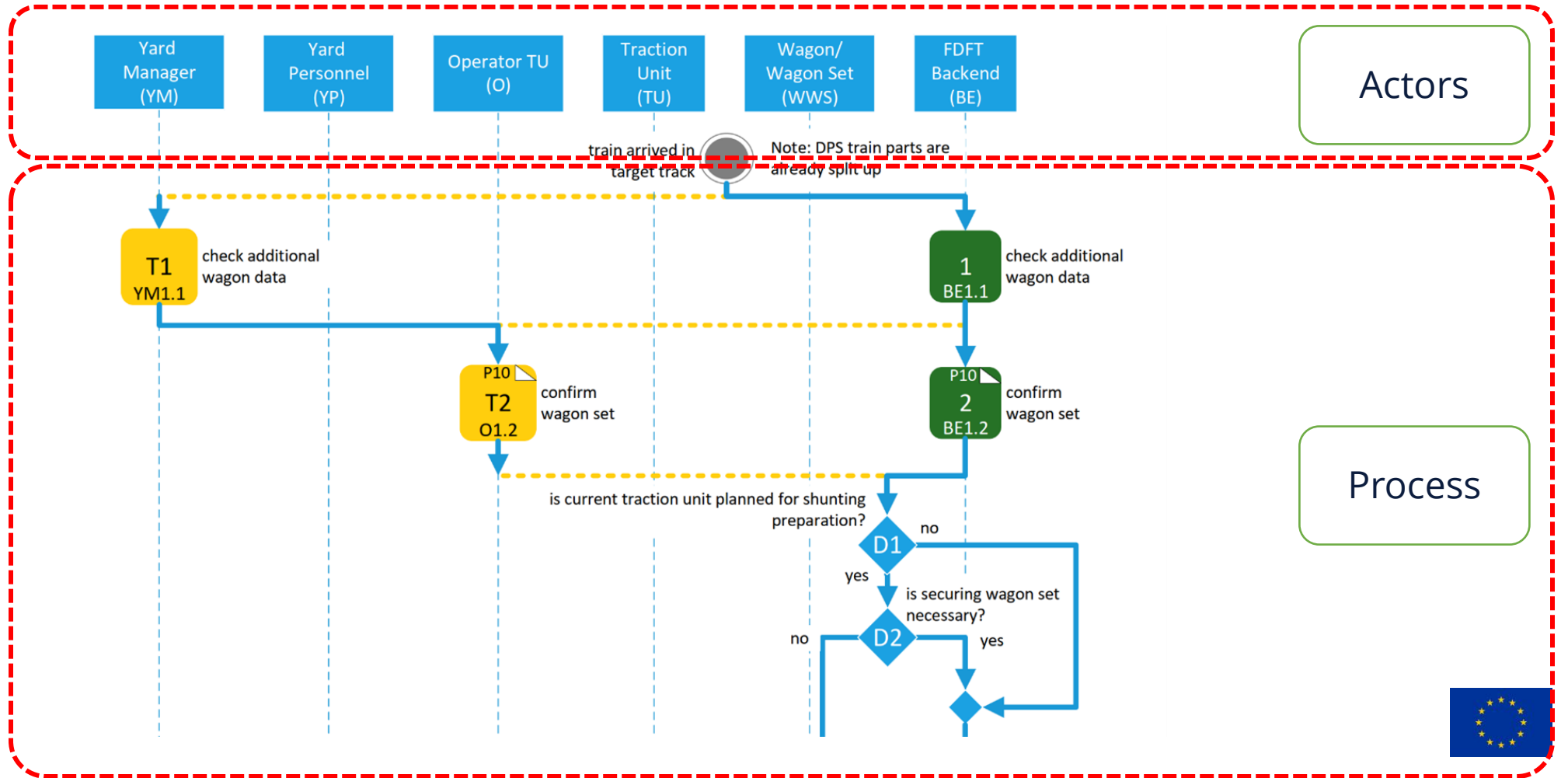
- TP20 Uncouple
- TP21 Couple
- TP22 Secure Wagon (Set) Against Rolling Away
- TP23 Remove, Release braking means
- TP24 Bleeding
- TP25 Apply Parking Brake
- TP26 Release Parking Brake
- TP30 Switch to FDFT mode Shunting
- TP31 Switch to FDFT mode Train Run
- TP32 Composition Detection

## 8.4.2 TP01 - Shunting Preparation

### 8.4.2.1 Target Process



D2.1 | PU | V1.0 | Submitted 55 | 317 FP5-TRANS4M-R | GA-101102009





actor with swimlane of process



Target State activity



Semi-automated State activity



This activity is not executed within ERJU processes.



subprocess indicator with white flag at top right corner and referenced process id



activity with operational necessity



start/end of activity flow path



decision



end of decision paths



direction of activity flow



direction of information flow



information interface connection point



branch/join of sequence-independent flow



branch/join of semi-automated activity flows

train arrived in target track

Note: DPS train parts are already split up

T1  
YM1.1

check additional wagon data

1  
BE1.1

check additional wagon data

P10  
T2  
O1.2

confirm wagon set

P10  
2  
BE1.2

confirm wagon set

is current traction unit planned for shunting preparation?

D1

yes

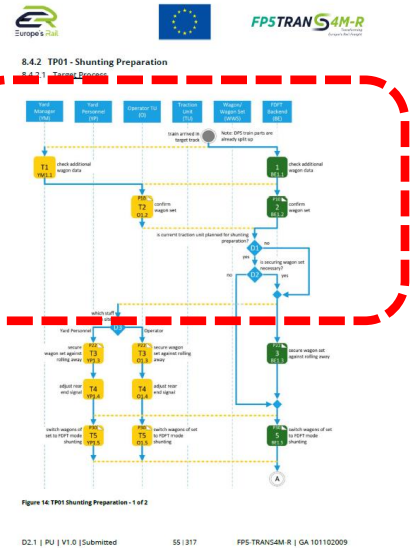
is securing wagon set necessary?

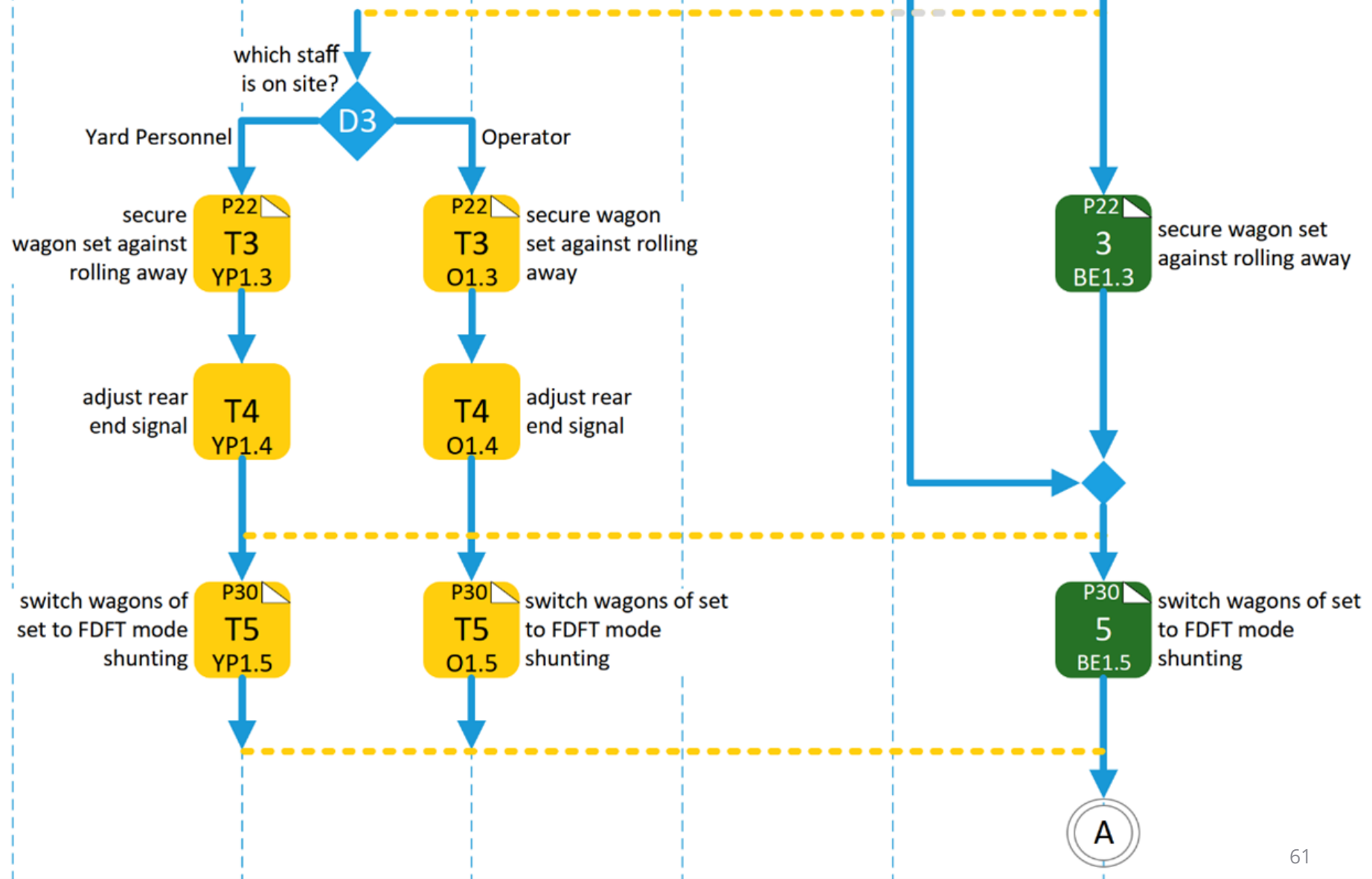
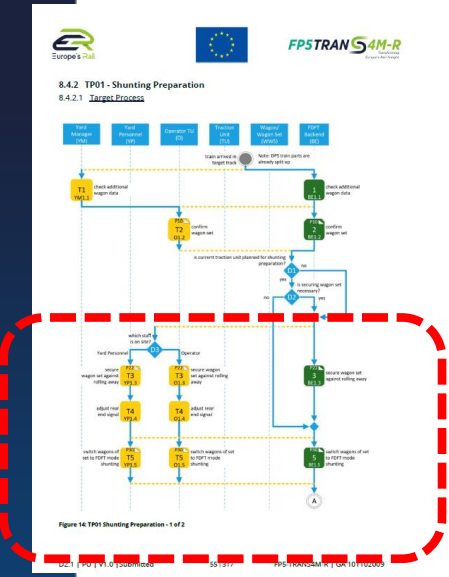
no

yes

no

yes





8.4.2 TP01 - Shunting Preparation  
8.4.2.1 Target Process

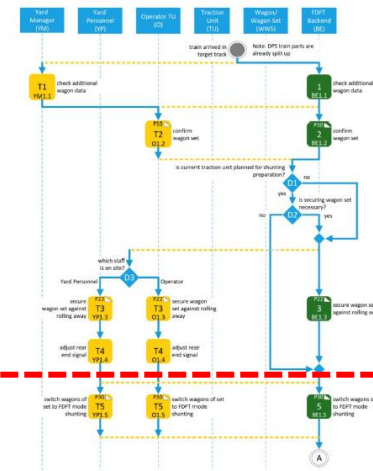
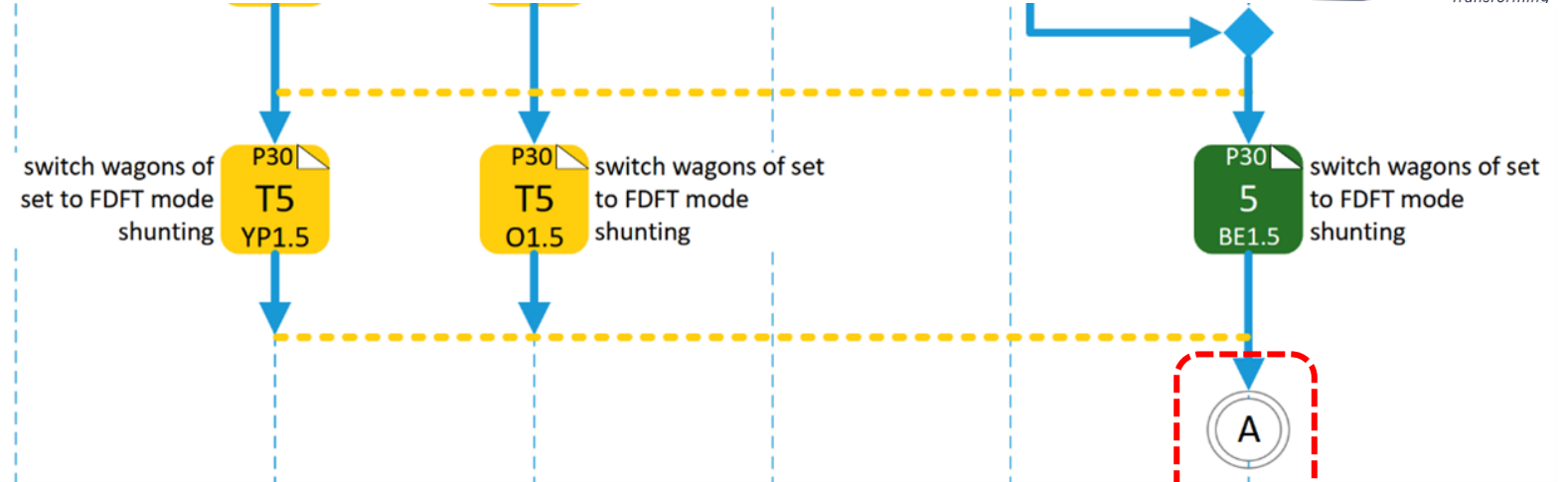


Figure 14: TP01 Shunting Preparation - 1 of 2



Yard Manager (YM)

Yard Personnel (YP)

Operator TU (O)

Traction Unit (TU)

Wagon/Wagon Set (WWS)

FDFE Backend (BE)

is an action required to ensure rolling capability?

no

yes

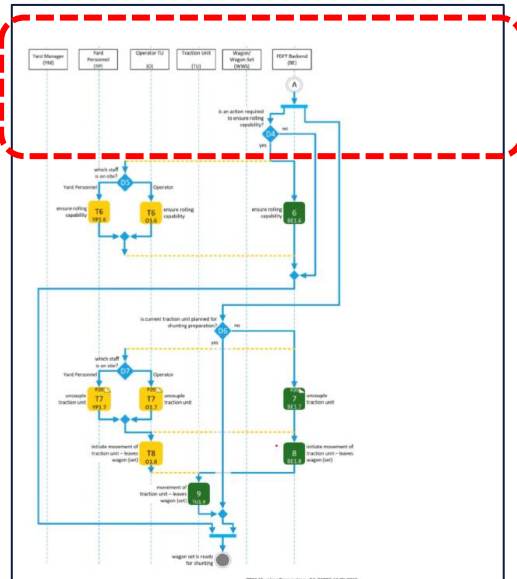
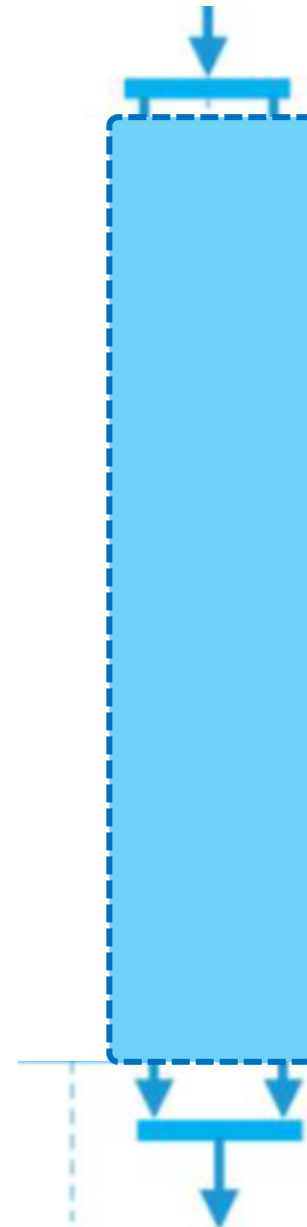
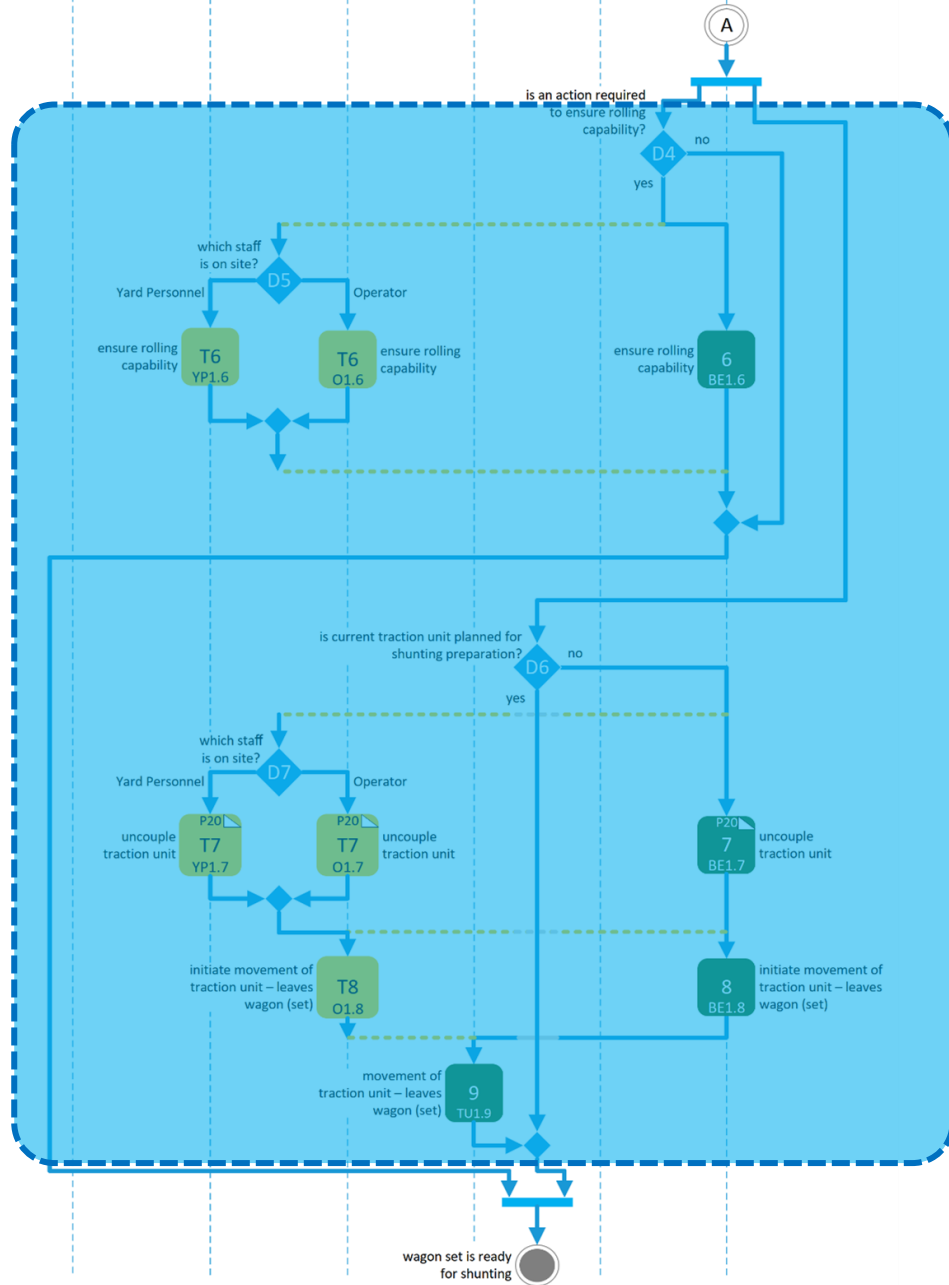


Figure 15: TP01 Shunting Preparation - 2 of 2

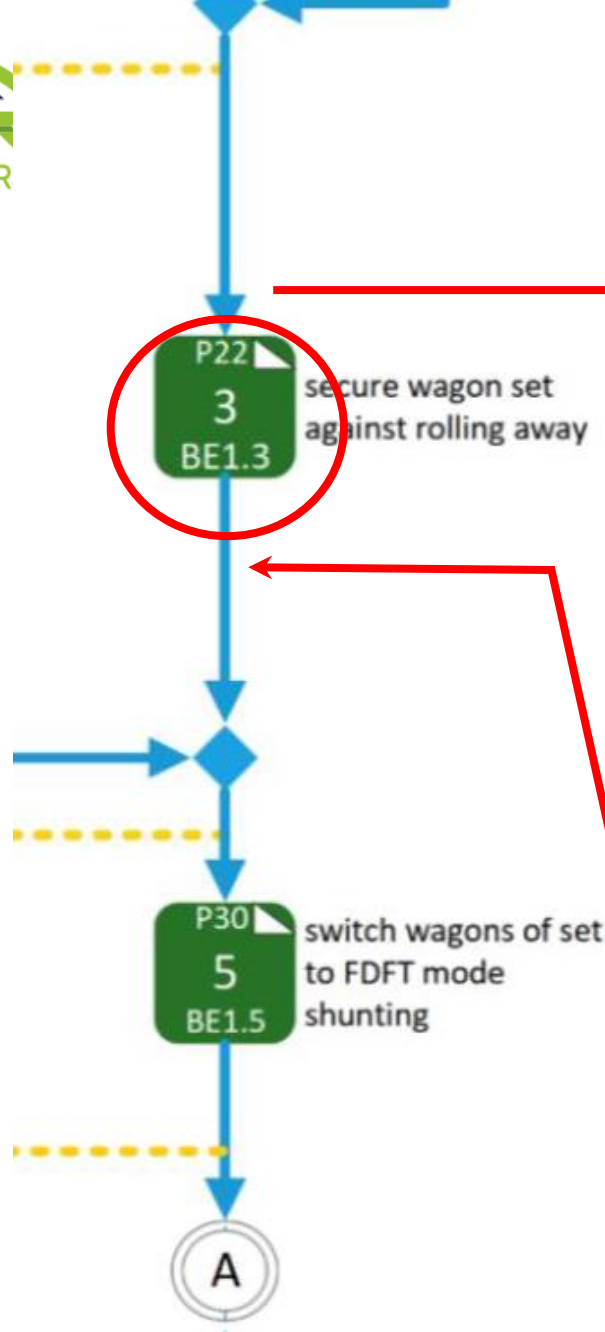


start  
sequence-independent flow

sequence-independent flow

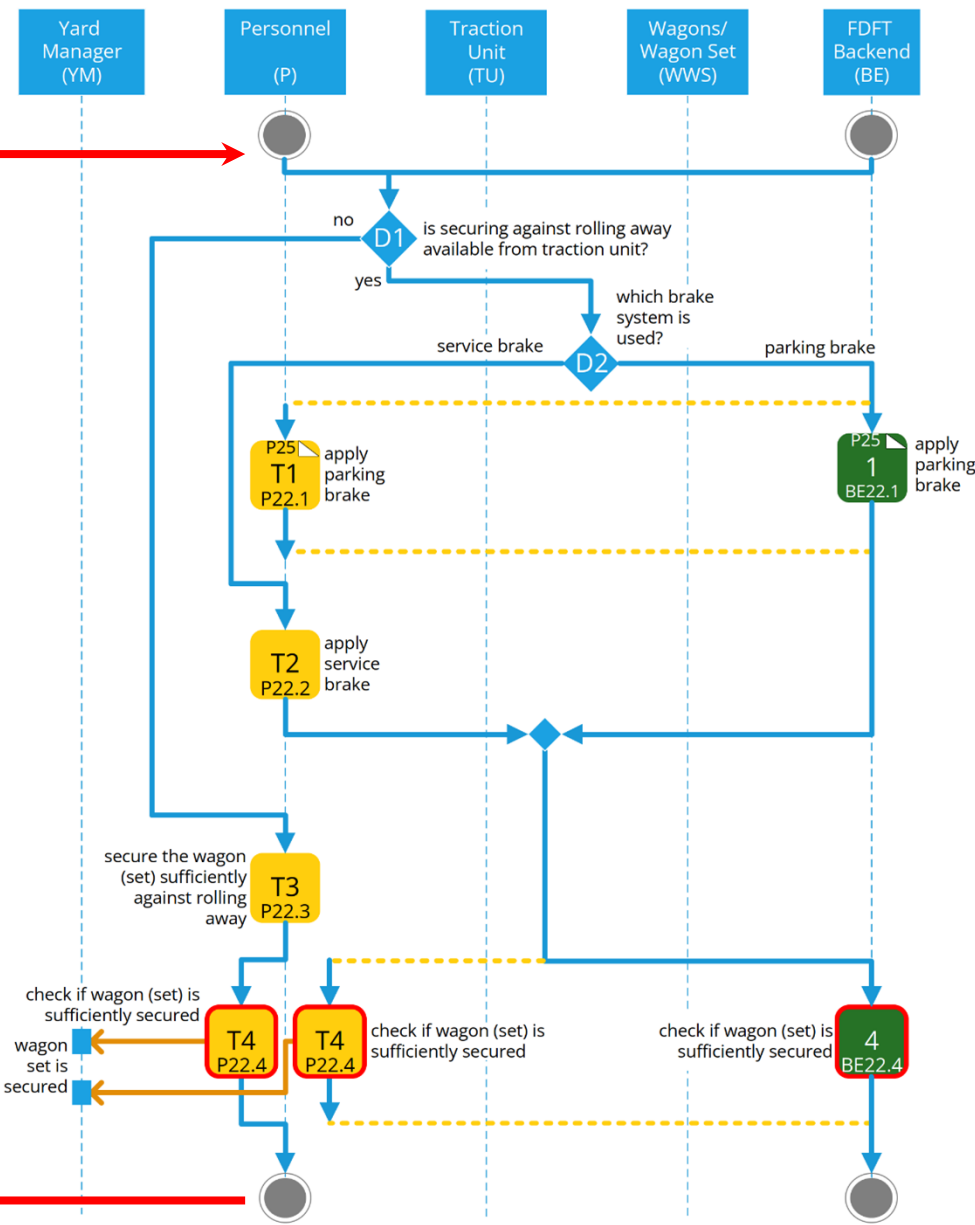
end  
sequence-independent flow





### 8.4.15 TP22 - Secure Wagon (Set) Against Rolling Away

#### 8.4.15.1 Target Process





## IDx.y

Activity	<i>Short description of containing task(s)</i>
Precondition	<ul style="list-style-type: none"> <li>▪ <i>conditions that must be fulfilled to begin the overall process</i></li> </ul>
Conditions	<ul style="list-style-type: none"> <li>▪ <i>conditions that must be fulfilled to start the activity without degradation. If not, a reference to an alternative degraded activity is given here or is indicated by a dotted yellow line in the process diagram</i></li> </ul>
Tasks	<ul style="list-style-type: none"> <li>▪ <i>description of tasks to be done in activity</i></li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ <i>additional information to understand the context of the tasks</i></li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ <i>additional reason for activity in process context</i></li> </ul>
Postcondition	<ul style="list-style-type: none"> <li>▪ <i>states or information that must be reached/fulfilled/sent/received after finishing the scenario or activity</i></li> </ul>

ID	
Decision	<i>Short description of decision</i>
Branch 1	<ul style="list-style-type: none"> <li>▪ <i>First option of branching according to decision</i></li> </ul>
Branch 2	<ul style="list-style-type: none"> <li>▪ <i>Second option of branching according to decision</i></li> </ul>
...	<ul style="list-style-type: none"> <li>▪ <i>Further options if necessary</i></li> </ul>
Remarks	<ul style="list-style-type: none"> <li>▪ <i>additional information to understand the context of the decision</i></li> </ul>
Rationale	<ul style="list-style-type: none"> <li>▪ <i>additional reason for condition in process context</i></li> </ul>

# Next Steps / Outlook



# Next Steps / Outlook

## Scheme for the elaboration of EU Harmonised Operation Procedures and second set of Ops Concepts (Syt.Pillar Task4/WP1)

- Questionnaire “on-line” will be addressed to all participants right after this Webinar n°1, to collect feedback  
==> mid-october 2023
- System Pillar/Task 4 will analyse and elaborate conclusions, with an evaluation, and handover to FP5  
==> mid-november 2023
- FP5/WP2 will provide a next revision v2.0, including first review-comments, improvements  
==> planned release: 31/12/2023

➔ Syst.Pillar/Task 4 to implement a "mirror group" in the frame of the next step ahead

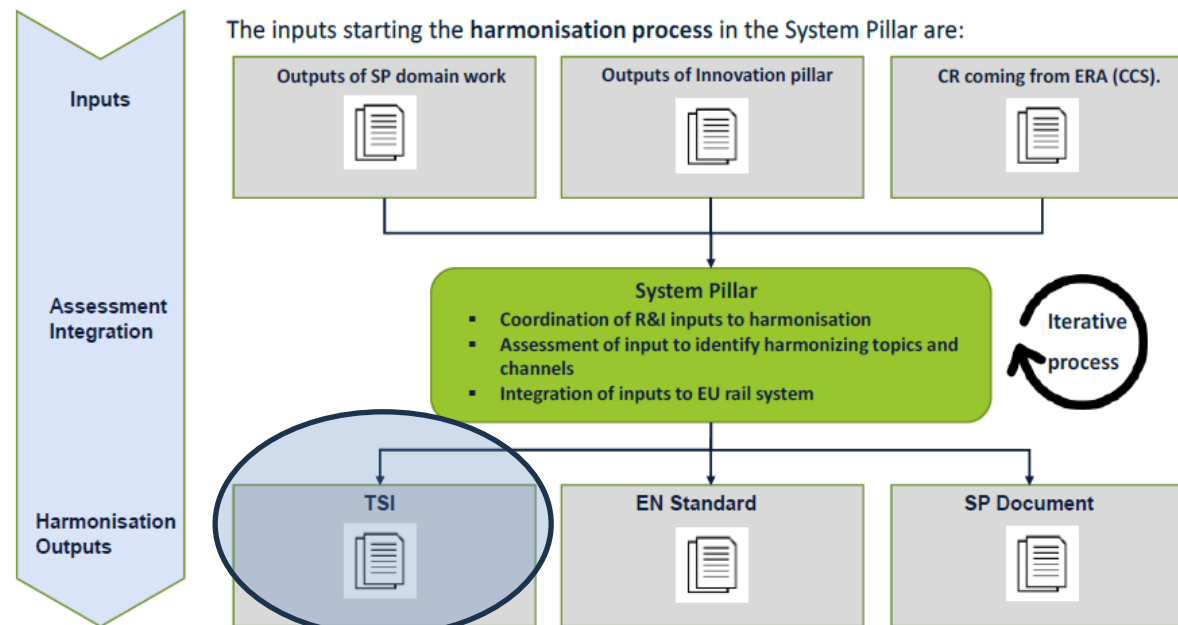


# Next Steps / Outlook

## Elaboration of EU Harmonised Operation Procedures (FDFTO Rule Book) – based on results of Task4/WP1 and mature final input from FP5/WP2

Writing of the FDFTO Rule Book based on sector feedback and final mature input from FP5: 2nd evolution of FDFTO Rule Book draft

- 1st evolution of FDFTO Rule Book draft – 06/2024
- Collect and evaluate feedback via mirror group(s) until 09/2024
- 2nd edition of FDFTO Rule Book (pre-final deliverable of EU-Rail) - 12/2024



# Conclusion

### General:

- The operational procedures are harmonised within FP5, but not yet finished and will be further improved
- ERJU processes describe a subset of the overall requirements
- These processes are the basis for UseCases, SystemArchitecture, SystemRequirements, UserRequirements, ...

### D2.1

### Preliminary Operational Procedures

<b>Project acronym:</b>	FP5-TRANS4M-R
<b>Starting date:</b>	2022-07-01
<b>Duration (in months):</b>	45
<b>Call (part) identifier:</b>	HORIZON-ER-JU-2022-01 (Topic: HORIZON-ER-JU-2022-FA5-01)
<b>Grant agreement no:</b>	GA 101102009
<b>Due date of deliverable:</b>	Month 10
<b>Actual submission date:</b>	2023-06-30
<b>Responsible/Author:</b>	Andreas Haller, DB
<b>Dissemination level:</b>	PU
<b>Deliverable Type:</b>	Report
<b>Doc Version &amp; Status:</b>	V1.0   Submitted

Reviewed: (Yes/No)



Your participation is key !

Please review and comment the document !

# FP5 Partners





# FP5 TRAN 4M-R

*Transforming  
Europe's Rail Freight*

## Introducing D2.1 Preliminary Operational Procedures

Online, 13.09.2023



The project is supported by the Europe's Rail Joint Undertaking and its members.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Europe's Rail Joint Undertaking. Neither the European Union nor the granting authority can be held responsible for them.





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- While some activities among competitors are both legal and beneficial to the industry, group activities of competitors are inherently suspect under the antitrust/ competition laws of the countries in which our companies do business.
- Agreements between or among competitors need not be formal to raise questions under antitrust laws. They may include any kind of understanding, formal or informal, secretive or public, under which each of the participants can reasonably expect that another will follow a particular course of action or conduct. Each of the participants in this initiative is responsible for seeing that topics which may give an appearance of an agreement that would violate the antitrust laws are not discussed. It is the responsibility of each participant in the first instance to avoid raising improper subjects for discussion, notably such as those identified below.
- It is the sole purpose of any meeting of this initiative to provide a forum for expression of various points of view on topics
  - (i) that are strictly related to the purpose or the execution of the initiative,
  - (ii) that need to be discussed among the participants of the initiative,
  - (iii) that are duly mentioned in the agenda of this meeting and
  - (iv) that are extensively described in the minutes of the meeting.
- Participants are strongly encouraged to adhere to the agenda. Under no circumstances shall this meeting be used as a means for competing companies to reach any understanding, expressed or implied, which restricts or tends to restrict competition, or in any way impairs or tends to impair the ability of members to exercise independent business judgment regarding matters affecting competition.
- As a general rule, participants may not exchange any information about any business secret of their respective companies. In particular, participants must avoid any agreement or exchange of information on topics on the following non-exhaustive list:
  1. Prices, including calculation methodologies, surcharges, fees, rebates, conditions, freight rates, marketing terms, and pricing policies in general;
  2. any kind of market allocation, such as the allocation of territories, routes, product markets, customers, suppliers, and tenders;
  3. production planning; marketing or investment plans; capacities; levels of production or sales; customer base; customer relationships; margins; costs in general; product development; specific R&D projects;
  4. standards setting (when its purpose is to limit the availability and selection of products, limit competition, restrict entry into an industry, inhibit innovation or inhibit the ability of competitors to compete);
  5. codes of ethics administered in a way that could inhibit or restrict competition;
  6. group boycotts;
  7. validity of patents;
  8. ongoing litigations.



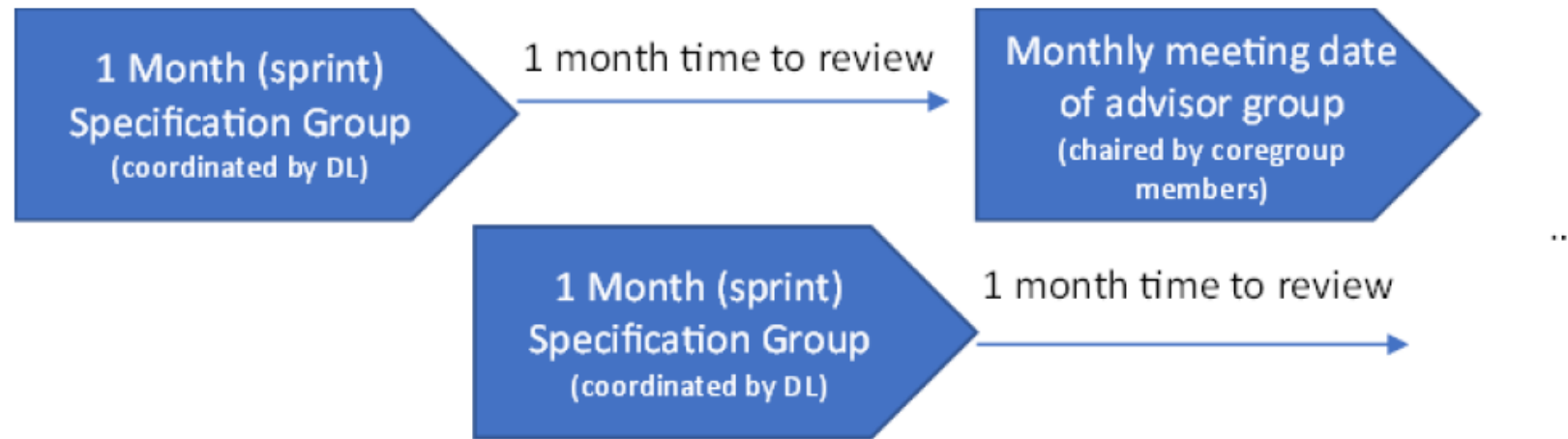
## Introducing D2.1 Preliminary Operational Procedures

10:00 - 12:30

- Introduction (Mr Javier Ibáñez de Yrigoyen) – 15min
- Context and opening (Mr Engelmann) – 15min
- Preliminary Target Operational Procedures presentation (Mr Haller) – 100 min
- Next steps/outlook (Mr Hénon) – 15min
- Conclusion (Mr Engelmann) – 5 min

# Basic Workflow / Team

System Pillar Task 4 will industrialize the specification process within their specification groups. This process implies avoiding iterative dialogues by employing direct moderation. The generic repeating workflow of all mission-critical activities shall have this form



Sprint durations are to waiting periods. The advisor group meetings shall be open for participants of technical bodies and are on fixed days on every month, hosted by the Core Group Convenors.

The mirror groups (larger) will be involved at least every 6 months for reviewing and commenting the results.



# Basic Workflow / Team

FP5 / WP2 will provide a next document version v2.0

- including first review-comments, improvements
- planned release: 31.12.23

Design of disruption/error process

- planned start in Q1/2024
  
- Intensifying work regarding interfaces IT

