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FOSTER RAIL

Future of Surface Transport Research Rail

Coordination and Support Action

Grant Agreement No 605734

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Deliverable D5.3

Report from "pre-requirements and implementation groups"

| WP | 5 | Fostering innovation and partnerships: ERRAC and SHIFT ² RAIL |
|------|-----|---|
| Task | 5.2 | Innovation Packages (IPs) requirement specifications and R&D coordination |

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¹ Dissemination level: PU = Public, PP = Restricted to other programme participants (including the JU), RE = Restricted to a group specified by the consortium (including the JU), CO = Confidential, only for members of the consortium (including the JU)

² Nature of the deliverable: \mathbf{R} = Report, \mathbf{P} = Prototype, \mathbf{D} = Demonstrator, \mathbf{O} = Other

Table of Content

| Exec | utive Summary | 3 |
|------|---|---|
| Desc | ription of Deliverable | 4 |
| 2.1 | Restructuring, contribution received, current status and finalisation | 4 |
| 2.2 | Briefing note describing the role of the committee | 5 |
| 2.3 | Four matrixes | 6 |
| | Desc 2.1 2.2 | Executive Summary Description of Deliverable 2.1 Restructuring, contribution received, current status and finalisation 2.2 Briefing note describing the role of the committee 2.3 Four matrixes |

1. Executive Summary

FOSTER-RAIL is a EU coordination and support action project under the 7th Framework Programme designated to support ERRAC (European Rail Research Advisory Council) in defining research needs for their strategies and programmes in order to realise the objectives of the Europe 2020 strategy.

The Foster Rail Work Package 5 (WP5) "Fostering innovation and partnerships: ERRAC and SHIFT²RAIL" relies on the implementation of the proposed joint undertaking for research, development and innovation for rail (under the acronym: SHIFT²RAIL). One objective of the WP5 was to create/manage under the ERRAC umbrella the so-called "pre-system requirements and implementation groups" of the future SHIFT²RAIL to embrace the business needs for the entire sector.

The purpose of this deliverable is to describe the activities carried out within WP5 associated to the task 5.2 "Innovation Packages (IPs) requirement specifications and R&D coordination". The main objective of this task was to provide a framework under which the creation of "system pre-requirements groups" for each SHIFT²RAIL Innovation Package could be established.

Within the proposal for establishing the initiative known as "SHIFT²RAIL", the need to establish the business needs of the sector and how they lead to future functional requirements of the system to be taken into account in the Research & Innovation planned within SHIFT²RAIL and Horizon 2020 is an important step.

A first introduction of this deliverable was provided with the deliverable D5.2 "Report from pre-requirements and implementation groups", while this deliverable represents the summary of all the pre-requirements actions that ended with the meeting held on 19th September 2014. All those actions will continue within the proper working groups of the Joint Undertaking SHIFT²RAIL (e.g. User Requirements Working Groups, Implementation and Deployment Working Groups, System Integration Working Groups). Moreover in order to preserve this important backup initial work, a cooperation tool to store the data has been created (please refer to the deliverable D5.7 "Internal platform communication").

The deliverable D5.3 describes:

- The organisation of the Work Package 5 partners to address the setting-up of the pre-requirements and implementation groups: Restructuring, contribution received, current status and finalization;
- The role of the committee created under Work Package 5;
- The four matrixes delivered by Work Package 5

2. Description of Deliverable

2.1 Restructuring, contribution received, current status and finalisation

It was decided to combine the Foster Rail WP5 task 5.2 "Innovation Packages (IPS) requirement specifications and R&D coordination" with the SHIFT²RAIL preparation phase. Therefore Foster Rail WP5.2 partners have organised combined meetings with the promoters leading the SHIFT²RAIL preparatory phase. This combined group was named **SHIFT²RAILextended system group**.

The reason for this internal restructuration comes from the fact that the initially foreseen "pre-requirement groups, one per each IP" was impossible implement by UIC and UITP, due to the lack of experts availability from their members, interest or for some others reasons (e.g. internal association organisation).

The WP5.2 partners considered therefore important to try to activate the work that the task 5.2 was supposed to produce with the incorporation of the WP5.2 and the UNIFE coordinated initiative SHIFT²RAIL preparatory phase, where the involved companies were actually meeting and working.

The meetings in May 2014 and September 2014 were therefore attended not only by UNIFE, UIC and UITP but also by the Operators and Infrastructure Managers involved in SHIFT²RAIL, as well as by the IP coordinators.

Input was received from the following stakeholders:

- CAF provided a feedback on the TCMS example of functional requirements that SNCF provided during the previous phase
- Thales provided as well an example for the High Speed matrix requirement
- Ferrovie dello Stato (FS) provided an entire fill in of the four matrix with functional requirements

The FS full documentation allowed the discussion to continue but the difficulty in agreeing on a level of functional requirement to be provided become evident.

UIC suggested simplifying the exercise for the mainline part providing the Challenge2050 document and Rail technical Europe document as a basis for the exercise.

Given the impossibility for the mainline operators – even if driven by motivated companies – to reach a common interpretation on the level of the input required as EU input, it was agreed to collect all the input knowing that it will serve as a basis for the future SHIFT²RAIL Joint Undertaking work, which should allow for a good amount of flexibility as the EU users will have different level of requirements, also based on different TDs.

UITP requested UNIFE a specific format explaining the TD, so that their members could complete the four matrix. Unfortunately also on UITP members' side no input from the members was received.

On the meeting on 19 September 2014 it was suggested to hold the meetings and the deliverable at the current status, giving the high work load that some companies will have in responding to the call for SHIFT²RAIL Associated Members. In addition the European Commission is setting up the SHIFT²RAIL structure and it is expected a continuation of this work under the official framework of the SHIFT²RAIL Joint Undertaking.

The European Commission agreed to finalise the deliverable as it stands, reporting what has been and has not been achieved compared to the objectives reported on previous deliverable – in particular the fill in of the Excel file of pre-requirements per SPD(markets)/IP/TD

2.2 Briefing note describing the role of the committee

Within the proposal for establishing the initiative known as "SHIFT²RAIL", the need to establish the business needs of the sector and how they lead to future functional requirements of the system to be taken into account in the Research & Innovation activities planned within SHIFT²RAIL and Horizon 2020, is an important step.

Ensuring the involvement of the operators and users of the rail system is essential as these stakeholders will be operating and in some cases maintaining the solutions that the industrial companies, involved in SHIFT²RAIL, will as a result integrate into the products that they place on the European and worldwide markets.

These steps have a three phase cycle of: **requirements** (the inception – at high level for the SHIFT²RAIL proposal, and in details for the annual technical programme once SHIFT²RAIL will be running), **quality assurance** (the during, once SHIFT²RAIL will be running) and **implementation** (the conclusion, once SHIFT²RAIL is running, of the system level testing of the innovations created in the IPs) with this latter also taking the form of a collective appraisal of the results, leading to the specification of new voluntary interface standards and, in some cases, changes to existing standards and regulations that support the overall objective of system interoperability.

This work has been started within the structure of the FOSTER RAIL project, which will put in place a framework that can act as a catalyst for the work that will need to be undertaken for the duration of the SHIFT²RAIL programme.

In FOSTER RAIL, it was planned to establish a structure of "Pre-Requirements Groups" for each of the technical areas addressed by the SHIFT²RAIL proposal – one group for each of the "Innovation Programmes".

Involving the European region of the UIC (incorporating the ROC contribution of both CER and EIM), UNIFE and UITP as well as the interested members of those associations, it is anticipated to structure this framework as follows:

→ LEADERSHIP and INVOLVED STAKEHOLDERS

- UIC will lead the management of this process and the creation of the working groups
- UNIFE and UITP will play a significant role in the development of this activity and in causing it to happen
- These associations and their interested members will be invited to nominate experts to participate in the work

→ SCOPE

The Pre-Requirements Groups will develop and deliver the following activities:

- An outline work programme to enable the development of the functional requirements
- Determine the business needs which can be input to the SHIFT²RAIL Innovation Programmes
- Determine those that will not be part of the SHIFT²RAIL initiative and which will be helpful to the FOSTERRAIL route mapping activity and implementation of the previous ERRAC roadmaps
- Play a key role in delivering the functional requirements for the SHIFT²RAIL Innovation Programmes so as to better focus their proposal for research and innovation activities
- Establish the first ideas of a quality assurance framework for the SHIFT²RAIL work programme. This being to ensure that the functional requirements that are fed into the SHIFT²RAIL Innovation Programmes Research & Innovation activities and that the assessed KPIs will reflect the added value to business of rail transport.

→ SHIFT²RAIL

It should be noted that once the SHIFT²RAIL programme is started, these "Pre-Requirements Groups" will then become "Requirements and Implementation Groups" and will be responsible for the following activities: • Ensuring that the business needs of the European rail operating community (Railway Undertakings)

Page 5 of 10

and Infrastructure Managers) are identified and made available to the relevant innovation programmes for the refinement of the annual working programme (in terms of operational and maintenance requirements)

- Creation and management of an impact management tool able to check in a continuous manner throughout the duration of SHIFT²RAIL, the progress made towards the accomplishment of the measurable objectives (KPIs) and compliance with the operational and maintenance requirements
- Establishment and management of a standardisation plan thus ensuring that the deliverables for the innovation program and the key interfaces with other systems and sub-system are identified and developed
- Contribution to the development of standards (e.g. interface standardisation) and suggestions for changes in European regulations, TSIs and European Standards, on the basis of pre-standard documents that these groups will produce.
- Collaboration with other system groups and with the ad hoc working parties created within SHIFT²RAIL for the management of the interfaces between the sub-systems concerned

2.3 Four matrixes

Here below the example (draft) of High Speed coming from the input of one participant. Similar matrixes are available for the Regional, Urban/suburban and Freigth case scenario. All input can be downloaded on the cooperation tool, given that it is still in its draft form – no validation by the group – it is not the final deliverable as intended in the proposal.

| HIGH SPEED/MAINLINE | | | | | | | | |
|---------------------|--------------------|---------|--|--------------------|--|----------|--|--|
| SPD | Objectives | Targets | KPIs | Target/indicator % | System requirements | Links SR | | |
| | System Capacity | 70% | Passengers per Metre of Train Length | 35 | 600-650 passengers for 200 m train with comfort similar to actual | | | |
| | | | double the train running in Increased Line Occupancy 65 infrastructure. Lower track access cha 40% | | | | | |
| | System Reliability | 30 | Reduction in the number of In-service failures per million kms in a specific subsystem affecting operation | 60 | reduction to 25 % of actual values | | | |
| IIGH SPEED/MAINLINE | System renability | 50 | Increased reliability through the better design, implemention and monitoring of infrastructure | 40 | | | | |
| IIGH SPEED/MAINLINE | | 23% | Reduction in capital costs (infrastructure) | 15 | | | | |
| | | | Reduction in capital costs (Rolling Stock | | reduction of 20% of actual cost of rolling stock and 50% of LCC | | | |
| | LCC | | Reduction in maintenance costs (infrastructure) | 30 | | | | |
| | | | Reduction in maintenance costs (Rolling Stock) | | reduction of 40% of actual cost of rolling stock maintenance | | | |
| | | | Reduction in Energy consumption | 10 | Reduction of 20% of actual cost of energy | | | |

| HIGH CAPACITY TRAINS | PROGRAMME 1 | | | | | |
|--------------------------------------|---|--------------------|---|-----------------------|--|----------------|
| HIGH SPEED/MAINLINE | | | | | F | 1 00000 |
| TD | Description | Targets | KPIs | Improvement indicator | Functional Requirements | LINKS FR |
| | | | | | Increase of space available for passenger (600-650 ir 200 m train) | |
| | | Question Question | ngers per Metre of Train | x | 200 11 10 11 | |
| | More efficient and lighter traction | System Capacity | | | | |
| | drives using the new generation of | | ncreased Line Occupanc | × | braking distance and use shorter sections | |
| | electronic material. | | Reduction in the number of In-service | x | reduction to 25 % of | |
| | New power electronics able to | System Reliability | failures per million kms in a specific Increased reliability | _ | reduction to 25 % of actual values | |
| TD 1.1 Traction Drives | control motors at a higher frequency, | | through the better design, implemention | x | This is a must also for | |
| | based on emerging | | and monitoring of Reduction in capital costs | x | rolling stock | |
| | Silicon Carbide semi-conductors, a | | (infrastructure) Reduction in capital | x | 20% Reduction of cost of traction equipment (no | |
| | step change in | LCC | costs (Rolling Stock Reduction in | | fun, no or limited cooling | |
| | energy efficiency, reliability and LCC. | LCC | maintenance costs (infrastructure) Reduction in | x | | |
| | | | maintenance costs (Rolling | x | reduction to 40 % of actual values reduce of 50 % energy loss | |
| | wireless | | Reduction in Energy consumption | x | in traction, reduce wheight of 20 % to reduce traction Increase of space available | |
| | technologies to | System Capacity | Passengers per Metre of Train Length | x | for passenger (600-650 ir 200 m train) Reduce wheight to limit | |
| | reduce cabling and complexity, | oystem ouplierty | Increased Line Occupancy | × | braking distance and use shorter sections; make | |
| | improve reliability of communications | | number of In-service failures per million kms | x | reduction to 25 % of | |
| | between cars and | System Reliability | through the better | x | actual values mandatory to reach target | |
| TD 1.2 Wireless Train Control and | | <u> </u> | design, implemention Reduction in capital | | also for rolling stock | |
| Management System (TCMS) | architectures, remove train lines. | | costs (infrastructure) | × | reduction of 20% of actua | |
| (10.00) | Distributed | | Reduction in capital costs (Rolling Stock Reduction in | x | cost of rolling stock and 50% of LCC train makes diagnosis to | |
| | computing for higher reliability. | LCC | Reduction in maintenance costs (infrastructure) Reduction in | × | infrastucture: 10% reduction of track access reduction to 30 % of | |
| | Improved sensoring. Reduce | | Reduction in maintenance costs (Rolling | x | reduction to 30 % of actual cost of maintenance | |
| | cost and | | Reduction in Energy consumption | x | Reduce wheight of 50 % | |
| | Lighter car bodyshell | | Passengers per Metre of Train Length | x | to reduce traction need. Increase of space available for passenger (600-650 in | |
| | structures with the | System Capacity | Increased Line | x | 200 m train) Reduce wheight to limit braking distance and use | |
| TD 1.3 Car body-shells | same cost, safety, repairability and | | Occupancy Reduction in the number of In-service | x | shorter sections | |
| | performance of present metallic car | System Reliability | failures per million kms Increased reliability | | | |
| | bodyshells, by | | through the better design, implemention Reduction in capital | x | reduction of 20% of actua | |
| | incorporating composite | | costs (infrastructure) | × | cost of rolling stock and 50% of LCC reduction of 20% of actual | |
| | materials into | | Reduction in capital costs (Rolling Stock Reduction in | x | cost of rolling stock and 50% of LCC | |
| | either a hybrid or 100% composite structures. Ideal for producing pre- | LCC | maintenance costs (infrastructure) Reduction in | x | | |
| | | | Reduction in maintenance costs (Rolling | x | | |
| | assembled components. | | Reduction in Energy consumption | x | Reduce wheight of 20 % to reduce traction need. | |
| | Optimised bogie | | Passengers per Metre of Train Length | x | | |
| | materials, such as lightweight | System Capacity | Increased Line Occupancy | x | | |
| | materials. Sensoring | | Reduction in the number of In-service | x | | 1 |
| | Functionality | System Reliability | failures per million kms Increased reliability through the better | x | reduction to 20% of actual | values |
| TD 1.4 | (health and usage monitoring can be | | design, implemention Reduction in capital | x | Here CBM is hardly used to train makes diagnosis to infrastucture: 10% | |
| Running gears | enabled and condition-based | | (infrastructure) Reduction in capital | | reduction of track access | |
| | maintenance can | | costs (Rolling Stock Reduction in | x | train makes diagnosis to | |
| Car body-shells | be employed rather than scheduled). | LCC | maintenance costs (infrastructure) Reduction in | × | infrastucture: 10% reduction of track access | |
| | Active Suspension and bogie control | | maintenance costs (Rolling | x | CBM reduce LCC to 40 % | |
| | technology. | | Reduction in Energy consumption | × | Reduce wheight of 20 % | |
| | Brake energy storage and | System Capacity | Passengers per Metre of Train Length | x | | |
| | recuperation. Reduced wear and | _ystem oupatity | Increased Line Occupancy | × | Stop distance reduced con | ribution to 10 |
| | tear. Advanced | | Reduction in the number of In-service follower per million kmo | x | Reduction to 75% of actua | |
| | frictionless braking technologies. | System Reliability | failures per million kms Increased reliability through the better | x | | |
| TD 1.5 | Advanced brake control handling | <u> </u> | design, implemention Reduction in capital costs | x | CBM used to reach the tar | jet |
| Brakes | low adhesion situation. Increased | | (infrastructure) Reduction in capital | x | reduction of 20% of actua cost of rolling stock and | |
| | reliability. Target | LCC | costs (Rolling Stock Reduction in | | 50% of LCC | |
| | stop braking. Weight reduction | LCC | maintenance costs (infrastructure) Reduction in | x | | |
| | and size of | | maintenance costs (Rolling | × | Reduce maintanance cost of 35% | |
| | components to be built. inAir supply | | Reduction in Energy consumption | x | Reuse energy from braking | |
| | | System Capacity | Passengers per Metre of Train Length | × | 600-650 pax in 200 m | |
| | | | Increased Line Occupancy | x | | |
| | | | Reduction in the number of In-service failures per million kms | × | reduction to 40 % of actua | values |
| | Comfort improvement. PRM | System Reliability | through the better | x | use CBM to reach the targe | |
| TD 1.6 | & safety solutions. | | design, implemention Reduction in capital costs | x | and convict reach the targe | |
| Doors | Intelligent systems. Energy & axle load | | (infrastructure) Reduction in capital costs (Rolling Stock | x | reduction of 20% of actua cost of rolling stock and | |
| | optimization. | LCC | Reduction in maintenance costs | x | 50% of LCC | |
| | | | (infrastructure) Reduction in maintenance costs | × | | |
| | | 1 | (Rolling | * | | L |
| | | | Reduction in Energy | x | | |

| SHIFT?RAIL INNOVATION F ADVANCED TRAFFIC MANAGEM HIGH SPEED/MAINUNE | PROGRAMME 2 MENT AND CONTROL SYSTEM | 5 | | | | |
|--|---|-------------------------|---|-----------------------|--|-------------|
| то | Description | Targets | кры | Improvement indicator | Functional Requirements | LINKS FR |
| | | System Capacity | Passengers per fibrite of frain Length Increased Line Occupancy | x | spliniation in such hypolgy of subary disabusture almost 120% of existing minuterry | F |
| | - | System establity | Reduction in the number of tr-service failures per ration xms in a specific subsystem affecting operation | × | of 102 Senior fallow cause almost 1 tools of 102 Senior fallow cause almost 1 tools being fallow cause almost 2 tools Risched | |
| TO 3 Rahary retreach capacity increases (\$70 ay in Gold) ** | increase the network utilitation and decrease operator's costs by adding ATO on all types of main lines including embelians to CHTC functionables, it will | | Increased initiality through the better design, implemention and increasing of infrastructure Reduction in capital costs (infrastructure) | x | excellaring with a related system for exhibits cystem requirement management of TEO 10% in a medium scale of kinn, 10 year, shilling cost of investment for TEE in a | <u> </u> |
| | he see energy and improve dramatically the costainable development. | | Reduction in capital costs (Rotling Stock | × | dation and low denses of SDK of existing sets in a medium wate of time, 10 year , of investment for | |
| | | 100 | Reduction in maintenance costs (infraetructure) Reduction in maintenance costs (Roting 3bock) | × | Indiana Bank Inr 192 almost of 10% of motiong soci in a readure scalar of isone, 13 year , of infondensioner mathemature for 100 almost of 10% of motiong soci in a readure scalar of 10%, 20 year , of redlag slock | <u> </u> |
| | | | 3bock) Reduction in Energy consumption | × | taale of time, 20 year , of rolling slock mathémateur Toldenar of utileria is under to minimize denait of 50% of relating berry measured | |
| | | System Capacity | Passengers per three of Train Length | × | | |
| | - | | Increased Line Occupancy Reduction in the number of to-service failures per retion time in a specific subsystem affecting constant | x | optimization in much typology of schway of schwaitway almost 2006, of existing miniparity of 1021. Bender failure cause almost 2 train doiny . Bincking failure cause almost 2 train | _ |
| - 44 | Reduce the breadway between insiss disusing more insiss on a given main line, expenially on High Speed Lines and long Islamce mainly beight lines. Evalutions to | System reliability | subsystem affecting operation increased reliability through the better design, implemention and monitoring of inflantifucture | * | Binked runduring with a related system for relation updates requirement management of TDD | |
| 223 - Line capacity increase through moving fluid block and smart suitching and sensing | evening is bringing infolgence in individual paths are main lines at junctions or pairs of paths. Unling one back to the other or adaction it. Unling | | Increased reliability theough the better design, impremention and monitoring of infrastructure Reduction in captor codes (infrastructure) | × | 12% in a median scale of time, 10 year, mining cost of invariance) for 722 in a datum and for denote of 52% of existing soci in a median taske of time, 10 year, of invariance) for helding block for 722 | |
| • | alten a turis in son an Do apposite track n.g. for morpaoing or in case of track works or periorkations. | LCC | Reductor in capital costs (Rolling Stock Reductor in maintenance costs (Infraetructure) | x | almost of SDK of existing cost in a mediam scale of time, 12 year , of inhavinustare | |
| | | | Reduction in maintenance-costs (Ruting Stock) | × | namenance for 702 denote of 50% of existing cost in a mediant scale of time, 30 year, of rolling stock existences | |
| | | | Reduction in Energy consumption Passengers per Mette of Train Length | × | rationance Indexes of collects in order to minimize denset of 52% of existing Energy consumption | <u> </u> |
| | | System Capacity | Increased Line Occupancy | × | optimization in much hypology of subway of subscience admost 120% of motion | |
| | Ī | System reliability | Reduction in the number of to-service failures per relice sons in a specific subsystem affecting operation | × | of TOE Service failure cause almost 3 train delay. Elocking failure cause almost 3 train Elocked | |
| T26 - On loand train ningrip (such makin loads, built with SLI) | Intent i tuto integrity in a dependable and fall safe manner. Provide IL: 4 fall safe information on tuto length and tuto completeness. Electroite convertineal touth side bute detection equipment. | | Increased reliability through the better design, impremention and monitoring of infrastructure Reduction in capital costs | x | mandaring with a related system for prindle spinon requirement management of TDS EDS in a medium scale of time, 10 pror, publicg and investiment the TDS in a denosi of SDS of existing sent in a medium | _ |
| | | | (Ministructure) Reduction in capital costs (Roting Stock | | wate of time, 33 year , of investment for | |
| | | LCC | Reduction in maintenance costs (infraetructure) Reduction in maintenance costs (Rolling 3bock) | x | denosi of SDN of existing cost in a medium scale of lines, 32 year , of inhadracian Dalamas of scalence in order to indicate denosi of SDN of existing cost in a medium scale of time, 32 year , of rolling stack | |
| | | | Reduction in Energy consumption Passengers per thitte of Train Length | x x | dmasi at 525. at existing Energy consumption | |
| | | System Capacity | Increased Line Occupancy Reduction in the number of income | × | Maximize by TDE adoption the team optimization in each typology of schway of schwaizer admost 320% of existing sciongeory Minimize Namiley of minute/year of Falser | ⊢ |
| | | System reliability | Paduction in the number of In-service Salares per cettors two in a specific subsystemathecting operation increased reliability through the better design, implementaria and minimizing of infrance.com | × | enquiry Elements Tamber of nonatelyses of failure of 205, lemeins failure same almost 2 tools delay, fileschap failure same almost 2 tools delay, fileschap forodaar a performance sprime noniseing with a notated upters far ensishil spilme requirement management | <u> </u> |
| | increase the length of a train to allow nore parameters and/or bright to pass in | | | × | exclusing with a related system for existing system requirement management of TSD foldence of criteria in order to minimize of DSL in a methom scale of time, 20 year, mining cost of investment for TSE in a | ⊢ |
| 128 - Virtually coupled hair sets (in optimize fire Droughyse) B | a glown time. Today, to serve unversitiations along a line, some insise have in skey al some stations and this leads to capacity limitation. | | Reductors in capital costs (inflateIncture) Reductors in capital costs (Roting Stock | x | Note in a minimum state or tend, so pair, including cost of investment for T28 in a dution and low Endower of solitetia in under to minimum denois of T285 of endoing cost in a medium state of time, 10 year, of investment for failing block for T28 | - |
| | | 100 | Reduction in capital costs (Holling Stock Reduction in maintenance costs (Infrastructure) | × | uair of time, 12 year , of investment for fulling linesh for 728 folderur off scheric to under to minimize densi of 1500 of existing and in a medium scale of time, 23 year , of informizedner | \vdash |
| | | | (HiteEuclare) Reduction in mandemance costs (Rolling 3bock) | * | scale of time, 13 year, of infrastructure maintenance for TOB Existence of a scalar is under to minimize almost of SON of mining soni in a median scale of time, 35 year, of noting stock | - |
| | | | Reduction in Energy consumption | × | nablenanar Isldenar of otteria is unler to missiniar densi of 50% of existing Energy consumption | |
| | | System Capacity | Passengers per Mete of Tran Leigh | x | blacinize by TDE adoption the trace optimization in each typology of solvery refunctions admost 120% of reading | |
| | - | | Reduction in the number of In-service Sebures per relice tons in a specific subsystem affecting operation | × | Monthly TDE give evidence criteria for minimize Namiler of minute/year of failure of each #2 32. Service failure cause | |
| | Ann haar anamaring during on site insites | System reliability | Increased reliability though the better design, implementarian and nontaring of infrastructure | × | densei 2 tuin delay. Einking failure naos densei 2 tuin Hindard birodaze a performanze repiren resolucing with a rotated updem fur reliabli squiren reparemoi manageneri effabli. | |
| TDE - Due vite insing (unried command in demonstration) | er waars anarker during aparation sests op in 12 innes: or mare the soil and effort in fis k in samparkon with its management and fising during the | | Reductor in capital codes (Infrastructure) | × | foldence of criteria in order to minimize of 10% in a medium scale of time, 10 year ; | |
| | instagement phase in lab. The objective is in largest "Zoro on site insting" by simulating all the steps needed with simulating statis and demonstration. | | Reduction in capital costs (Rating Stock | × | tee by adopting T26 Exidence of uniteria to under to minimize denois of S2% of existing cost in a medium scale of time, 12 year , of investment for | |
| | | LCC | Reduction in maintenance costs (infraetructure) | × | Aufling Steck lay adapting TDS Indexes of sciencia in order to minimize denset of SDK of existing seal in a median scalar of lines, 13 year, of informissioner existences by adapting TDS Indexes of sciencia in order to minimize | |
| | | | Reduction in maintenance costs (Rolling Stock) | × | traditionance by adopting T26 Endonce of collects in order for minimize dimoni of T276 of existing cost in a medium trade of time, 20 year , of noting shock minimized | |
| | | | Reduction in Energy consumption Passengers per Mette of Train Length | × | failenar of otheria is order to minimize densi of 50% of existing lowery concomption | |
| | | System Capacity | Increased Line Occupancy | × | Maximize by TST adoption the total optimization in each typology of solvary of solvarizer almost 13215 of existing summary | |
| | Vandenbactors of engineering and | System relability | Reduction in the number of to service failures per million xms in a specific subsystem affecting operation | × | Elizabete Namber of minute/year of failure of 2023 Ennior failure cause almost 2 insin delay. Elizable failure cause almost 2 insin Elizabet | |
| - | sperational rates will allow quick and easy orytementation of signaling system, teni and assemblationing, then navy and himselfy insideg of speculars (signaliers, | System reliability | Increased reliability through the better design, implemention and monitoring of inflavoructure | × | cloudar a performance spilen monitoring with a related spilen for reliabili spilen requirement management in 102 | |
| 127 - Romal methods and standard satism for unait signaling systems | bloom, maintainers, etc.] and, afterwands, a smooth operation in all circamalamous soluting for trains parsing from one infra remove in another one. The other part is in | | Reduction in capital coles (influetisclare) | * | in 102 Establisher of criteria in under to intrinsize of 10% in a medium scale of Line, 10 pear, whiteg cost of investment in a station and for its admitter 107 | |
| | the sortical command system and its the sortical command system and its components, and their servicenment on one side, and their familiand operation requirement on the other side. Also | | Reduction in capital costs (Rulling Stock | × | mining cost of improvement in a station and for the administra TEP Endowner of Stefana by adopting TEO in- index to minimum almost of TEN of mining tool in a medium scale of time, 32 year , of transformers for further time. | |
| ind | mbaling standardised interfaces between enabling park of the system. | LCC | Reduction in maintenance costs (infinitiviciare) | × | teal in a median scale of time, 32 year, of hyperbaret for fielder Back fieldness of telfina is under to minimize denosi of 50% of existing seri in a median scale of time, 35 year, of infrastructure mathematics do adopting 525 foldness of turbina is under to minimize | |
| | | | Reductor in mandenance costs (Rolling 3bock) Reductor in Energy consumption | x | Induses of collects in order to minimize denset of IDN of existing and in a medium scalar of time, 30 year, , of ending shock mathematications industriant existing and the minimize denset of IDNs of realing lowing isomanytion | |
| | | System Capacity | Passengers per Mette of Train Length | × | among in so, a sung tong examples Hamiler by TEI adoption the tech- splorisation in each typology of schere of solvesture almost 120% of existing | ╞ |
| | - | 4 | Increased Line Occupancy Reduction in the number of In-service failures per relition kins in a specific subsystem affecting operation | × | all search and a se | - |
| | | System reliability | Salues per ration kins in a specific subsystem affecting operation increased reliability through the better design increasements and ecological of | | events failed and the second system in table of TSI lenking failure cause about 2 tools drivy. Brokeling failure cause about 2 tools failured britesheet a performance system for manifering with a related system for related system resolvement management | <u> </u> |
| - | New communication solution for supporting train control applications (in | | Information Reduction in capital costs (Information) | * | eritalii spilen repairmenti management ef TGG foldenar af criteria is antier ta minimize af 1926 in a mediam scale of time, 10 pear ; mining cost of imeniment for T25 in a | - |
| noon compatible communications for all the solutorys | supporting leafs control applications (in inners of architecture, speiner, producted by definition of Quality of Environ and Institute thirefanes in signaling architecture, as well as anomiated Bachero, Model. | | (Infrastructure) Reduction in capital costs (Ruting Stock | * | mining cost of insertment for T21 is a dation and low foldower of sciencia in order to minimize denot of 10% of existing cost in a median scale of time, 20 year, of insertiment for foldow for the T21 | - |
| | | LCC | Reductor in mandemance costs (infraretucture) | * | Indexes of unlerse in order to minimize denses of 2029, of existing cost is a medium with of time. More and indexision | - |
| | | | (initiallucture) Reduction in maintenance costs (Rolling 380ck) | × | scale of time, 23 year , of infraction/see eachiersame for 701 foldower of uniteria to under to minimize densel of 50% of existing and in a medium scale of time, 30 year , of noting sholk eachiersame | - |
| | | | Reduction in Energy consumption | * | Unidence of otheria is order to minimize denosi of 50% of existing Energy concernition | |
| | | System Capacity | Passengers per Mette of Train Length Increased Line Occupancy | × | Maximize by TSA adoption the train optimization in much topology of solvary of solvarizer admost 120% of existing | |
| | Ī | | Reduction in the number of to-service failures per retion tons in a specific subsystem affecting operation | × | monganey Ubinize Number of ministelysar of Talker of TAL Senior Faller score almost 3 insis delay. Hinking Talker score almost 3 insis Binked | |
| | | System calability | Increased reliability through the Setter design, impremention and monitoring of infrastructure | × | structure a performance sprine monitoring with a related system for restoring sprine requirement management of TDE | |
| Tod - Advanced fail safe toxic prolitioning (satisfile) | tions totals derivation spatiants kannell andy on arkelite indexemptions i.e. independenti from teach state. That spatient well respect presidely adverte mach muchile is ("Insuring"). For a basis, its full such location will der factus be zweihelder. | | Reduction in capital costs (infraetructure) | × | of TGG Existence of criteria in order to minimize of 10% in a medium scale of time, 10 pear, minimg cost of tenedenent for TGG in a station and ten | |
| | insuline will de faste be available. | | Reduction in capital costs (Rolling Stock | × | Informer of unionia is under to minimize administ of SDN of exhibing unsil in a medium tracke of SDN, 32 year , of investment for further Stack for TE4 Address of antipation in order to exhibition | |
| | | LCC | Reduction in maintenance costs (infrastructure) | × | hallow lands for T2d Indianas all schenics in under its minimum dense of 120% of exchangement in a medium scale of time, 23 year , of infrastructure maintenance for T2d Indianas in schenic is scale to be | |
| | | | Reduction in maintenance costs (Rolling Stock) | × | Eddenar of schedu in order to minimize denosi of UDE of waking cost of TDE in a needoo scale of time, 32 year , of nilling block maintenane Schedur of schedu is order to minimize denosi of SDE of waking Energy | |
| | | | Reduction in Energy consumption Passecours per Metre of Train Length | x | | ⊨ |
| | - | System Capacity | Increased Line Occupancy Reduction in the number of In-service | × | Manimize by TEGS adaption the team optimization to much typology of schway advantages admini 320% of mining measure Minimize Namizer of minizer of minizer of TEGS. Enviro Techer scale admini 2 team of they. Mining Tahwa cause admini 2 team | - |
| | | System cellulolity | Reduction in the number of linearvice failures per ration kins in a specific subsystem affecting operation increased reliability through the tester | × | of FEGL. Service follow same alread 2 train delay. Histolog Taluer same alread 2 train Histolog Histolog with a related system for munisiring with a related system for ministry spiner reparement management | - |
| - | More and more signaling/social command equipment desires are stabled in very constraint areas with difficult more because into a | | Increased relability through the better design, implemention and monitoring of infractivities Reduction in capital costs (infractivities) | × | existing uses a make queen to existing spinor requirement management of TOLS Endower of criteria to other to minetake of 20% in a mellow stake of time, 10 perc., shilling coult of investigation for TOLS in a | \vdash |
| All and a second | access for sensiting, Development of an automorphy, complete, intelligent, self- sofficient smart equipment ("heat") able to connect with any supplier styres and communicating device (by radio, | | (Infrastructure) Reductors in capital costs (Ruting Stock | × | dation and low foldenar of unlasta in unlaw to minimize draws of SDK of existing unst in a medium | \vdash |
| | satellin) in the area. | 100 | Reductor in maintenance costs (influenciarie) | * | constraint, or year, all investment for fulling linesh for TELL Endowser of ordering in other for minimizer alment of 120% of existing and in a medium scale of 120% of existing and in a medium scale of 120% of existing and in a medium. | \vdash |
| | | | (HitsEuclare) Reductor in maintenance costs (Rolling 38xxk) | * | table of item, 20 year , of invariances for failing likes the TELL Indexes of 10 threa is under the subscript hands of 10 threa of studing and in a medium varies of time, 21 year , of infrastinuture varies of time, 21 year , of infrastinuture varies of time, 21 year , of infrastinuture durated at 70 th studies the subscript mathema of 10 threa is under the subscript varies of time, 20 year , of subing their mathemater TELL | \vdash |
| | | | Reduction in Energy consumption | × | foldence of orderia is order to minimize denoti of 50% of existing lowgy comparation | |
| | | System Capacity | Passengers per Mette of Train Length Increased Line Occupancy | x | blacterier by 1202 adoption the base optimization in each typology of solvary obscillations adressi 120% of ensing | |
| | | | Reduction in the number of ti-service failures per retion tons in a specific subsystem affecting operation | × | momentry Biointer Norder of minute/pair of failure of FDG2. Service failure source almost 2 train delay . Electing failure source almost 2 train Elected . Increase the level of security of source correspondential. | |
| | - | | | × | open commutation bitroduce a performance splices munitaring with a related system for reliable spices requirement management | |
| | To and itsee the highest level of epher- menting against any significant thread for | System reliability | increased reliability through the better design, impremention and monitoring of infrastructure | · · | | |
| TEI - Egler Spinn routing | To advise the highest level of spher- monity against any significant times for the specific pointers. On the Key Management sectors and the strength of agreement within of the subset. A specific sector is also in a summittee, and subset, sector is also it assummittee. | lyden oldelly | Increased relability through the better design, implemention and incritioning of adherization Reduction in capital codes (infineElucture) | * | of FDE2 Soldenue of collects in under to minimize of RDS, in a medium scale of time, 10 peer , | |
| TEE Cyber Spinn cauring BEE Cyber Spinn cauring BEE Cyber Spinn cauring | To antivers the biginst local of sphere menolog spaces are specificated bound are seen spacing arrows. Since long Management is assumed as to the Management is assumed as to the specificate of a specificate are paraticle part of the specificate are antivers are difficulty, servers and sufficient or short specifications. | kydem oddeliby | | | of TEO Indexes of orderia in order in minimize of ENL in a median scale of time, 20 year, mining cost of investment for TOSD in a duline and low failures of white its order in minimize denost of TOSL of existing and in a median | |
| TEE Cyberlysian sawrify BEE Cyberlysian sawrify | Sa salawa ita bigtan basi at apar mula gana ang pigata at hana at Manggana at ang pigata at hana Manggana at ata at ang pigata mula at ang pigatat at ang pigata at ang pigata at ang pigata at ang pigata at ang p | Rydom vilability LCC | | × | ef TGG Challenar of referencia le andre las ministen el 10% in es emblem sucie el lism, 32 para abilitar con el mentiones las 7523 i es deritar and tore Challenar al referencia i su ador ten animismo densei ad 10% el enainig anol in a mediane adur el lism, 32 para, , al inventiones la facilitar dan far TG12 Challenas al referencia su ador en animismo densei ad 10% el enainig anol in a mediane densei ad 1 | |
| Tital (gher bysim samer) i | To analyze the righted hard of patter- serving approximation of the patter- ters of the patter pattern in the pattern between the pattern pattern in the pattern beam pattern of the pattern in the pattern beam pattern of the pattern in the pattern pattern of the pattern of the pattern of the of the pattern of the pattern of the of the pattern of the | | Reduction in capital costs (InflateInuclare) Reduction in capital costs (Roting Stock | × | of FDE2 Soldenue of collects in under to minimize of RDS, in a medium scale of time, 10 peer , | |

FOSTER RAIL / D5.3 – Report from "pre-requirements and implementation group"

| | HIGH SPEED/MAINLINE | CAPACITY INFRASTRUC | TURE | | | | |
|---------------|--|--|--|--|---|----------------------------|----------|
| | тр | | | | Improve | Enertie | |
| | TD | | Targets | KPIs | Improvement indicator | Functional Requirements | LINKS FR |
| | | | System capacity | Passengers per Metre of Train Length | x | | |
| | | | | Increased Line Occupancy Reduction in the number of In-service | × | | |
| | | Iterative development | System reliability | failures per million kms in a specific subsystem affecting operation Increased reliability through the better | × | | |
| | TD1 - Improvement of | of existing S&C with new materials, new | | design, implemention and monitoring of infrastructure Reduction in capital costs | x | | |
| | existing S&C | embedded Monitoring systems, new fail safe | | (infrastructure) Reduction in capital costs (Rolling Stock | x | | |
| | | locking techniques. | LCC | Reduction in maintenance costs (infrastructure) | × | | |
| S&C | | | | (Intrastructure) Reduction in maintenance costs (Rolling Stock) | × | | |
| | | | | Reduction in Energy consumption | × | | |
| | | | System capacity | Passengers per Metre of Train Length Increased Line Occupancy | x x | | |
| | | Radical new S&C design. Adaptive self | System reliability | Reduction in the number of In-service failures per million kms in a specific Increased reliability through the better | x | | |
| | TD2 - Mechatronic S&C | adjusting. Enabled by mechatronic steering | System removely | Reduction in capital costs | x | | |
| | | trains. New switch mechanisms. Nano | | (infrastructure) Reduction in capital costs (Rolling Stock Reduction in maintenance costs | × | | |
| | | materials (rail steel). | LCC | (infrastructure) Reduction in maintenance costs (Rolling Stock) | x | | |
| | | Bottom-up approach | | Reduction in Energy consumption Passengers per Metre of Train Length | x | | |
| | | starting with the "traditional" | System capacity | Increased Line Occupancy Reduction in the number of In-service | × | | |
| | | ballast/sleeper system. The next step is more | System reliability | failures per million kms in a specific Increased reliability through the better design, implemention and monitoring of infrastructure Reduction in capital costs | x | | |
| | TD 3 - Track - Medium Term | radical redesigns of components and | | Reduction in capital costs (infrastructure) Reduction in capital costs (Rolling Stock | x | | |
| | | subsystems. This implies innovative rail | LCC | Reduction in maintenance costs | x | | |
| | | grades, fastening | | (infrastructure) Reduction in maintenance costs (Rolling Stock) Reduction in Energy consumption | x | | |
| | TD4 - Track - Long term | systems and sleepers Focusing on entirely new solutions will instead set out | System capacity | Passengers per Metre of Train Length | × | | |
| | | from a top-down approach. Define a vision of the | System reliability | Increased Line Occupancy Reduction in the number of In-service failures per million kms in a specific Increased reliability through the better | x | | |
| Track | | perfect track. Here the best of the features of a ballasted track (fast installation, low | System renadorcy | Increased reliability through the better design, implemention and monitoring of infrastructure Reduction in capital costs | x | | |
| | | installation costs) are combined with the best | LCC | (infrastructure) Reduction in capital costs (Rolling Stock Reduction in maintenance costs | x | | |
| | | features of a slab-track solution (low geometry | icc. | (infrastructure) Reduction in maintenance costs (Rolling Stock) | × | | |
| | | deterioration, high New alternative methods for tunnel and bridge | System capacity | Reduction in Energy consumption Passengers per Metre of Train Length | x | | |
| | | inspections and new enhanced reparing and | System reliability | Increased Line Occupancy Reduction in the number of In-service failures per million kms in a specific | × | | |
| | TD5 - Proactive Bridge and Tunnel Assessment and | upgrading methods. The new reparing and upgrading | System renadorcy | subsystem affecting operation Increased reliability through the better design, implemention and monitoring of infrastructure | × | | |
| | repairing/upgrading | methods will meet new demands like less traffic | | Reduction in capital costs (infrastructure) Reduction in capital costs (Rolling Stock | × | | |
| | | disturbance, quick to implementation and | LCC | Reduction in maintenance costs (infrastructure) Reduction in maintenance costs (Rolling Stock) | x | | |
| | | possible to use with short track assess time. | | Stock) Reduction in Energy consumption Passengers per Metre of Train Length | × | | |
| | | Able to store, process and manage dynamic heterogeneous information to provide input not only to | System capacity | Increased Line Occupancy Reduction in the number of In-service failures per million kms in a specific | x | | |
| | TD6 - The Dynamic Railway | | System reliability | subsystem affecting operation Increased reliability through the better | × | | |
| | Information Management System | | | (infrastructure) | × | | |
| | | the maintenance but also to other railway tasks. | LCC | Reduction in capital costs (Rolling Stock Reduction in maintenance costs (infrastructure) | x | | |
| | | | | Reduction in maintenance costs (Rolling Stock) Reduction in Energy consumption | × | | |
| | | | System capacity | Passengers per Metre of Train Length Increased Line Occupancy Reduction in the number of In-service | x | | |
| tenano | | Composed by an integrated set of cutting-edge on- | System reliability | failures per million kms in a specific subsystem affecting operation Increased reliability through the better | × | | |
| Mainte | TD7 - The Railway Integrated Measuring and | board, wayside and remote- | | design, implemention and monitoring of infrastructure | x | 1 | |
| nt M | Integrated Measuring and | sensing asset-specific | LCC | Reduction in capital costs (infrastructure) | × | | |
| ent | Integrated Measuring and Monitoring System | sensing asset-specific measuring and monitoring sub-systems. | LCC | Reduction in capital costs (infrastructure) Reduction in capital costs (Rolling Stock Reduction in maintenance costs (infrastructure) | x x x | | |
| Intelligent M | Integrated Measuring and | measuring and monitoring | LCC | Reduction in capital costs (infrastructure) Reduction in capital costs (Rolling Stock Reduction in maintenance costs (infrastructure) Reduction in maintenance costs (Rolling Stock) | x | | |
| ent | Integrated Measuring and | measuring and monitoring | LCC System capacity | Reduction in capital costs (infrastructure) Reduction in capital costs (Roling Stock Reduction in maintenance costs (infrastructure) Reduction in maintenance costs (Roling Stock) Reduction in Energy consumption Passengers per Metter of Train Length Increased Line Cocupanyo | x x | | |
| ent | Integrated Measuring and | measuring and monitoring | | Reduction in capital costs Reduction applied costs (Roing Stack Reduction in maintenance costs Interactions) Reduction in maintenance costs Reduction in maintenance Reduction in Genergy costs (Rolling Passengers per Meter of Train Length Interaction Line Concerny Reduction in the number of Inservice Reduction in Reduction reduction Reduction in Reduction reduction Reduction in Reduction reduction Reduction in Reduction reduction Reduction reduction Reduction reduction reduction Reduction reduction reduction Reduction reduction Reduction Reduction reduction Reduction reduction Reduction reduc | x x x x | | |
| ent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering | measuring and monitoring sub-systems. | System capacity | Reduction in capital costs (Roling Block Reduction in maintenance costs defaultion in maintenance costs Reduction in maintenance costs (Reduction in Roling) Reduction in Roling costs Reduction and Reduction Reduction Reduction and Reduction Reduction Reduction and Reduction Reduction Reduction on an costboard cost Reduction on an costboard cost Reduction Reduction on an costboard cost Reduction Reduction Reduction Reduction Reduction Reduction and Reduction Reductio | X X X X X X X X X | | |
| ent | Integrated Measuring and Monitoring System | measuring and monitoring sub-systems. | System capacity System reliability | Reduction in capital casts (Roling Stock Reduction in maintenance casts Reduction in maintenance casts Reduction in maintenance casts Reduction in Renge comunities Reduction and inclusion account in the second large comparison Reduction and inclusion account reduction capital costs Reduction in capital costs | x x x x x x x x x x x x x x x | | |
| ent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering | measuring and monitoring sub-systems. | System capacity | Reduction in capital catis (Reing Stock Reduction in maintenance catis Reduction in maintenance catis Reduction in maintenance catis Reduction in maintenance catis Reduction in forng comunitorin Pattenance in forng comunitorin Pattenance in forng comunitorin Reduction in the mainter aff an Langth Pattenance in the mainter aff anyone failures per million knins in a specific subsignities indicating cational and Reduction in capital cation Reduction in maintenance catis (Infrastructure) Reduction in maintenance catis | X X X X X X X X X | | |
| ent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering | measuring and monitoring sub-systems. | System capacity System reliability | Reduction in capital costs (Roling Stock Reduction in maintenance costs (Mathematicular) Reduction in maintenance costs (Mathematicular) Reduction in fining consumption Passengers per Mathematicular International Line Consumption Reduction in finings consumption Reduction in a specific subsystem atfacting costs (Reduction in capital costs) (Reduction in antiferance costs) (Reduction in antiferance costs) (Reduction in antiferance costs) (Reduction in antiferance costs) (Roling Reduction in antiferance costs) (Roling Reduction in Economy Consumption | x x x x x x x x x x x x x x x | | |
| ent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering | measuring and monitoring sub-systems. | System capacity System reliability LCC System capacity | Reduction in capital cashs (Reing Stock Reduction in maintenance cashs Reduction in maintenance cashs Reduction in maintenance cashs Reduction in maintenance cashs Reduction in forreg comuniform Passengers per Meter of Tan Langth The Stock and the Congregation Reduction in forreg comuniform Reduction in fortige cash and the Reduction in capital cashs Reduction in capital cashs Reduction in maintenance cashs Reduction in maintenance cashs (Infrastructure) Reduction in Refers generation (Infrastructure) Reduction in Refers (Results) Reduction in Refers (Results) Researce (Infrastructure) Researce (Infrastructure) | x x x x x x x x x x x x x x x x x x x | | |
| ent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering | measuring and monitoring sub-systems. Aimed at condition based and/or predictive system maintenance. DC traction power as basis for failway Power Micro- Grids. Energy Regeneration | System capacity System reliability LCC | Reduction in capital cetts (Reing Steve Reduction capital cetts (Reing Steve Reduction in maintenance cetts Reduction in maintenance cetts Reduction in maintenance cetts Reduction in Genery certainty Reduction in capital cetts Reduction in maintenance cetts Reduction in Interpret Certainty Reduction in Genery consumption Reduction in the number of the sevice Reduction and regretion of inflancements | x x x x x x x x x x x x x x x x x x x | | |
| ent | Integrated Measuring and Monitoring System | measuring and monitoring sub-systems. | System capacity System reliability LCC System capacity | Reduction in capital cets (Reing Steek Reduction in maintenance cets Reduction in maintenance cets Reduction in maintenance cets Reduction in maintenance cets Reduction in Genery centempton Parameters and the service Reduction in Genery centempton Reduction in Genery centempton Reduction in Genery centempton Reduction in Genery centempton Reduction in capital cets Reduction in capital cets Reduction in capital cets Reduction in capital cets Reduction in maintenance cets Reduction in Genery Consumpton Reduction and Reduction of Advances Reduction and Reduction of Sector Reduction and Reduction of Consumpton Reduction and Reduction of Consumpton Reduction and Reduction of Consumpton Reduction (Reduction Consumpton) Reduction (Reduction Consumpton) Reduction (Reduction Reduction Reduction (Reduction Reduction Reduction (Reduction Reduction Reduction (Reduction) Reduction (Reduction) Reduct | x x x x x x x x x x x x x x x x x x x | | |
| ent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering and Strategies TD9 - Integrated DC power | measuring and monitoring sub-systems. Almed at condition based and/or predictive system maintenance. DC traction power as basis for Railway Power Micro- Grids. Energy Regeneration Systems & Optimised network Control. Integration | System capacity System reliability LCC System capacity | Reduction in capital cets (Reing Steck Reduction in maintenance cets Reduction in maintenance cets Reduction in maintenance cets Reduction in maintenance cets Reduction in General cetter Stecks Reduction in General cetter failures per Maint of Yash Length Reduction in General cetter failures per million from in a specific Leases per million from in a specific Mainten per million from in a specific maintenance of the statistical Reduction in capital cets Reduction in maintenance cets Reduction in maintenance Stecks Reduction in General cetter Reduction in General Cetter Reduction in General Cetter Reduction in General Cetter Reduction in Stecks Reduction in the number of In-service Reduction in the number of In-service failures per Mainte of In-service Reduction in the number of In-service Reduction and monitoring of inflamitudes Reduction in the number of In-service Reduction in capital cets Reduction in capital cets Reduction in capital cets Reduction in maintenance cets Reduction in performance cets Reduction in performa | x x x x x x x x x x x x x x x x x x x | | |
| ent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering and Strategies TD9 - Integrated DC power | measuring and monitoring sub-systems. Aimed at condition based and/or predictive system maintenance. DC traction power as basis for failway rower Micro- Grids. Energy Regeneration Systems & Optimised network.control. Integration of energy storage systems & controlled inverter DC- substations for integration | System capacity System rulability LCC System rulability LCC | Reduction in capital cashs (Reing Stevic Reduction capital cashs (Reing Stevic Reduction in maintenance cashs Cashs) (Reing Reine) Reduction in maintenance cashs (Reing Reine) (Reing Reine) Reduction in Gengs consumption Passengen per Meter of Tan Langth Passengen per Meter of Tan Langth Passengen per Meter of Tan Langth Reduction in Reings consumption (Reing Reing) (Reing Reing) Reduction in maintenance cashs (Reing Reing) (Reing Reing) Reduction in maintenance cashs (Reing Reing) (Reing Reing) Reduction in Steps) Reduction in Steps) | x x x x x x x x x x x x x x x x x x x | | |
| Intelligent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering and Strategies TD9 - Integrated DC power | measuring and monitoring sub-systems. Aimed at condition based and/or predictive system maintenance. DC traction power as basis for failway Power Micro- Grids. Inergy Regeneration Systems & Optimised network Control. Integration in Virtual DC Power Plants. | System capacity System reliability LCC System capacity System reliability | Reduction in capital cetts (Reing Stevic Reduction in maintenance cetts Reduction in maintenance cetts Reduction in maintenance cetts Interface and the second state of the second Reduction in Genery centempton Parageness per Mote of Tan Length Reduction in Genery centempton Reduction in Genery centempton Reduction in center of the service Reduction in capital cetts Reduction in Service Reduction in Service Reduction in Capital cetts Reduction in Capital cetts Reduction in Service Reduction in Reduction Reduction in Service Reduction in Service of Service | x x x x x x x x x x x x x x x x x x x | | |
| Intelligent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering and Strategies TD9 - Integrated DC power supply system | measuring and monitoring sub-systems. Aimed at condition based and/or predictive system maintenance. DC traction power shads for failuwy Power Micro- Grids. Lengy Regeneration Systems & Optimised network Control. Integration in Virtual DC Power Plants. Optimised investment & operation influence for AC Rail power suppy with | System capacity System rulability LCC System rulability LCC | Reduction in capital cets (Neirag Steve Reduction in maintenance cets Reduction in maintenance cets Reduction in maintenance cets Reduction in maintenance cets Reduction in General cetterature Steve Reduction in General cetterature Reduction in General cetterature Reduction in General cetterature Reduction in General cetterature Reduction in capital cetter Reduction in capital cetter Reduction in capital cetter Reduction in maintenance cetter Reduction in maintenance cetter Reduction in capital cetter Reduction in Steve Reduction in General cetterature Reduction in Cetterature Reduction in Cetterature Reduction in Steve Reduction in General cetterature Reduction in Cetterature Reduction in General cetterature Reduction in General cetterature Reduction in General cetterature Reduction in General cetterature Reduction in Cetterature Reduction in General cetterature Reduction in Generature Reduction in Generature Reduction in Generature Reduction | x x x x x x x x x x x x x x x x x x x | | |
| Intelligent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering and Strategies TD9 - Integrated DC power | measuring and monitoring sub-systems. Almed at condition based and/or predictive system maintenance. DC traction power as basis for Failway Power Micro- Grids. Energy Regeneration Systems & Optimised network Corto: Integration of energy storage systems & controlled inverter DC substations for integration in Virtual DC Power Plants. | System capacity System capacity LCC System reliability LCC System reliability LCC System capacity | Reduction in capital cells (Reing Steck Reduction in maintenance cells Reduction in maintenance cells Reduction in maintenance cells Reduction in maintenance cells Reduction in General cells Reduction in Capital Cells Reduction in Capital Cells Reduction in Capital Cells Reduction in maintenance Reduction in maintenance Reduction in maintenance Stock) Reduction in General Reduction in General Reduction in Capital Cells Reduction in Capital Cells Reduction in Capital Cells Reduction in Capital Cells Reduction in Reinford Reduction in Cells Reduction in Reinford Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reduction Reductio | x x x x x x x x x x x x x x x x x x x | | |
| ent | Integrated Measuring and Monitoring System TD8 - The Intelligent System Maintenance Engineering and Strategies TD9 - Integrated DC power supply system TD10 - Integrated AC power | measuring and monitoring sub-systems. Almed at condition based and/or predictive system maintenance. DC traction power as basis for Railway Power Micro- Grids. Energy Regeneration Systems & Optimised network Control. Integration of energy storage systems & controlled inverter DC- substations for integration of energy storage systems & controlled inverter DC- substations for integration in Virtual DC Power Plants. Optimised investment & operation influence for AC Rail gower supply with industry frequency. Balancing single phase relavable to the phase separatons on line to | System capacity System capacity LCC System reliability LCC System reliability LCC System capacity | Reduction in capital cells (Reing Steck Reduction in maintenance cells Reduction in maintenance cells Reduction in maintenance cells Reduction in maintenance cells Reduction in Serger cells Reduction in Capital cells Reduction in capital cells Reduction in maintenance cells Reduction in Capital Cells Reduction in Serger Reduction in Serger Cells Reduction in Cells Reduction in Cells Reduction in Cells Reduction in Serger Cells Reduction in Serger Cells Reduction in Cells Cells Reduction in Serger Cells Reduction in Cells Cells Reduction in Serger Cells Reduction in | x x x x x x x x x x x x x x x x x x x | | |
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| Intelligent | Integrated Measuring and Monitoring System TD8 - The Intelligent System TD9 - Integrated DC power supply system TD10 - Integrated AC power supply system TD10 - Integrated AC power supply system TD11 - Smart metering for a railway distributed energy resource management | measuring and monitoring sub-systems. | System capacity System reliability LCC System reliability LCC System reliability LCC System capacity LCC System reliability | Reduction in materia (Reing Steel) Reduction in materia (Reing Steel) Reduction in materia (Reing Steel) Reduction in materia (Reing Steel) Reduction in materia (Reing Reing) Reing (Reing) Reing (Reing) Reing) Reing (Reing) Reing (Reing) Reing) Reing (Reing) Reing) Reing (Reing) Reing) Reing (Reing) Reing) Reing (Reing) Reing) Reing (Reing) Reing) Reing) Reing (Reing) Reing) Reing) Reing) Reing (Reing) Re | x x x x x x x x x x x x x x x x x x x | | |

| | SHIFT ² RAIL INNOVA | | | | | | |
|---|--|--|---|---|--------------------------|----------------------------|-----|
| | SEAMLESS ATTRACTIVE RAIL | VAY TRANSPORT SYSTEM | | | | | |
| | HIGH SPEED/MAINLINE | | | | | | |
| | TD | Description | Targets | KPIs | Improvement indicator | Functional Requirements | LIN |
| nion | | The travel companion will help | System capacity | Increase the total number of passengers and increase the multimodal usage (supporting | X | Kendinginging | Γ |
| el Companion | TD 5 Travel Companion | passengers to effectively travel seamlessly throughout Europe by providing a hassle free interface to | System reliability | Reduce and facilitate the users time spent planning travel; less time spent searching and booking tickets, less | x | | |
| Travel | | the European travel industry. | LCC | Increase the overall occupancy rate with limitation of peak and off peak periods (reducing costs) | x | | |
| | | Eliminating difficulty and risk from multimodal travel shopping. Providing comprehensive choice of | System capacity | Increase the total number of passengers and increase the multimodal usage (supporting | X | | |
| | TD2 - Travel shopping | trip solutions combining relevant modes of transport and associated services, with relevant comparison | System reliability | Reduce and facilitate the users time spent planning travel; less time spent searching and booking tickets, less | X | | |
| TD 3 - Ticketing | | criteria. Converting travel intentions into travel execution. | LCC | Increase the overall occupancy rate with limitation of peak and off peak periods (reducing costs) | Х | | |
| | | Manage all European travellers entitlements in a consistent and open way. Provide all services | System capacity | Increase the total number of passengers and increase the multimodal usage (supporting | x | | |
| | necessary for the entitlements lifecycles (booking, issuance, information, billing, payment and | System reliability | Reduce and facilitate the users time spent planning travel; less time spent searching and booking tickets, less | Х | | | |
| | settlement, validation, control, exchange, refund, etc.). Instant and | LCC | Increase the overall occupancy rate with limitation of peak and off peak periods (reducing costs) | Х | | | |
| | TD 4 Trip tracker | Providing intelligent information to the customer about the impact of service disruptions on their entire multimodal itinerary. Propose re- accommodation options if itinerary | System capacity | Increase the total number of passengers and increase the multimodal usage (supporting | x | | |
| | | | System reliability | Reduce and facilitate the users time spent planning travel; less time spent searching and booking tickets, less | X | | |
| | | is impacted. | LCC | Increase the overall occupancy rate with limitation of peak and off peak periods (reducing costs) | х | | |
| | | Insulate business applications from the underlying mechanics of interoperability across an open- | System capacity | Increase the total number of passengers and increase the multimodal usage (supporting | x | | |
| ž | TD1 - Interoperability framework | ended, ever-expanding network of connected, linked data and services. Automate the discovery and linking | System reliability | Reduce and facilitate the users time spent planning travel; less time spent searching and booking tickets, less | x | | |
| Tech nical fram ework | | of data and service resources. Automate the integration of existing | LCC | Increase the overall occupancy rate with limitation of peak and off peak periods (reducing costs) | х | | |
| echnical | | Travel Intelligence framework for service lifecycle continuous improvement of rail-centric travel | System capacity | Increase the total number of passengers and increase the multimodal usage (supporting Reduce and facilitate the users time | x | | |
| - | TD6 - Business analytics | experience. Setting, Planning, Tracking and Optimizing S2R target strategic KPIs. Enabling | System reliability | spent planning travel; less time spent searching and booking tickets, less Increase the overall occupancy rate | X | | |
| | | Rail&Transport operators with multichannel Travellers Relationship | LCC | with limitation of peak and off peak periods (reducing costs) | X | | |
| onstration | | Coordinate with the other TDs as an | System capacity | Increase the total number of passengers and increase the multimodal usage (supporting capacity) | x | | |
| Gate Strategy of the strategy | integrated project with the relevant architecture design methodology. Ensure that the overall production of the TDs can be deployed as an integrated demonstrator of end-to- end seamless travel across Europe. | System reliability | Reduce and facilitate the users time spent planning travel; less time spent searching and booking tickets, less time spent wailing for the transport mode and rearranging the journey (increasing quality of service); | X | | | |
| Coord | | | LCC | Increase the overall occupancy rate with limitation of peak and off peak periods (reducing costs) | х | | |