"Testing activities on train boarding device: methodological approach, experimental procedure, and preliminary results“

WP7: Accessibility to passenger trains (M01 – M27)
Leader: DICEA

Advisory Board Meeting

January, 17th 2021

WHY do we need to test the train boarding device?

WHAT is the boarding device to test?

WHERE & WHEN the testing activities took place?

HOW have the tests been performed?

WHY do we need to test the train boarding device?

The accessibility system at the platform-train level is a crucial issue ……..

The train access system: a key issue

Accessibility to **infrastructure** and **service** is a relevant feature in all mobility systems. It is a crucial issue in **rail-based systems**, intended as **discontinuous** because accessible only in specific network nodes (stations).

Station: 1st interface between the rail and the landside. It must allow passengers to cover independently and safely the route linking the entrance with its main functional areas, e.g. ticket office, waiting room and platform

Train-station platform system: 2nd interface, at the running plane

Both former and latter interfaces must be fully accessible to provide all rail users with a safe and comfortable travel experience.

Grant agreement
No 881814

The train access system: a key issue

For PRM travelers currently, there is no **solution** for their **autonomous boarding**

- Dedicated procedures are required to enable a coherent operation between IMs and RUs managing assistance services for disabled passengers boarding and alighting from trains.
- Such services, activated upon reservation in advance, are always necessary for wheelchair users.

https://www.sagetraveling.com/train/

Since the **time** required for **booking is quite large**, this **prevents** the **disabled passenger** from **making short-term travel decisions**.

https://youtu.be/qCn4Px-B2QE

The train access system: a key issue recognized at EU level

The Technical Specifications for Interoperability – TSIs (Directive EU n° 2016/797) "*define the **technical** and **operational standards** which **must be met by each subsystem** or part of subsystem in order to meet the essential requirements and **ensure the interoperability of the railway system of the European Union**"*

PRM TSI defines (cf. Reg. EU n°1300/2014 §2.2 + Reg. EU n°772/2019) a person with **disabilities** and a **person with reduced mobility** *"[…] any person who has a **permanent** or **temporary physical, mental, intellectual** or **sensory impairment** which, in **interaction with various barriers**, may **hinder** their **full** and **effective use of transport** on an equal basis with other passengers **or whose mobility when using transport is reduced due to age**".*

The train access system: a key issue recognized at EU level

Guide for the PRM TSI application (cf. ERA Guide, §2.2.1, v. 1.2 of 16/05/2021) *"[…] It does not specifically include people with children, people with bulky luggage, and foreign people with lack of knowledge of the local language. It does not include automatically* ***elderly people*** *and* ***pregnant women****.*
Concerning those last 2 categories, they do not systematically lead to reduced mobility, but obviously ***old age can decrease the speed and ability with which passengers can move within the station or rolling stock environment****. Therefore,* ***elder passengers can be considered as persons with reduced mobility when compared with the average passenger****. Similarly, pregnancy is not systematically a cause of reduced mobility. However, when* ***a pregnant passenger's mobility is affected*** *(e.g., preventing her from moving easily and quickly), then* ***she may be considered a person with reduced mobility.***

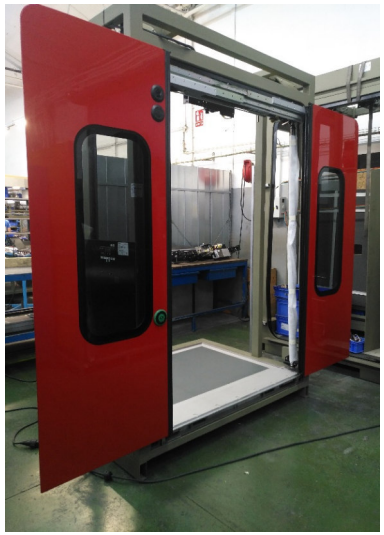
The revision process of the PRM TSI is currently going on, considering the results/technical opinions of various WGs, correcting minor mistakes, and updating interfaces with other TSIs and standard references.

WHAT is the boarding device to test?

A mock–up conceived and built by Masats for simulating and assessing the train accessibility for PRM….

Functional features for the simulation process: mock-up designing

The prototype has been proposed as a **new solution** to fill the existing **horizontal** and **vertical** gaps between **trains and station platforms.**

Such a mock-up (*emulating the side panel of a typical train wagon*) accommodates 2 types of devices:

1. a gap filler bridge/ramp device;
2. a complete door system composed of a mechanism and two-door leaves (sliding/plug movement).

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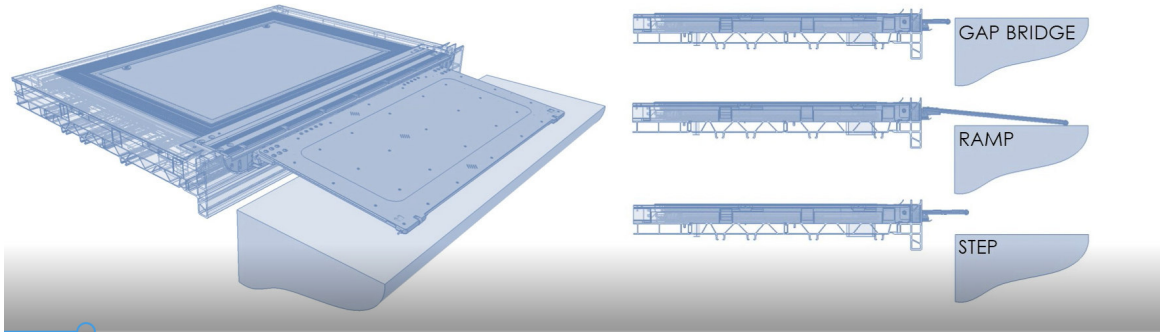
Functional features for the simulation process: mock-up designing

The max. **vertical gap** compensated by the device is **140 mm**, while the max. **horizontal gap** is **300 mm**.
The ramp/gap bridge has a minimum effective width of **1300 mm** and its opening will always be from a higher train position to the platform or a the level.



An integrated **sensors system** detects the position of the platform; thus deploying the device as **gap filler**, **ramp** or **step** depending on the condition.

(the only input from the end-user is to push the button on the door)

WHERE the testing activities took place?

At MASATS premises, Sant Salvador de Guardiola, Manresa (Barcelona)

WHEN the testing activities took place?

They lasted three days:
Sept. 21th, 22nd and 23rd 2021

HOW have the tests been performed?

Test procedure involving a sample of PRM as descriptive and heterogeneous *(disability, age and gender criteria)* as possible

Testing (mock-up & platform system) in critical boarding and alighting conditions (B&A)

Sample: 11 volunteers (3 females and 8 males) living near the test site.
Based on disability, participants were separated into 4 groups: 1 Visually impaired (VI), 1 Crutch user (CU), 4 Manual wheelchair (MW) and 5 Electric wheelchair (EW) users.

The main parameters influencing accessibility from a human (disability, age, with/without the assistance of an accompanying person) and functional (different height of the train platform) perspectives have been considered.

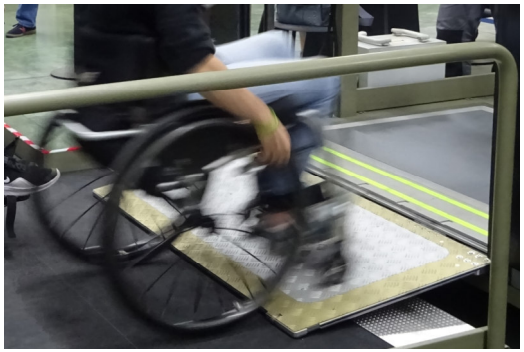
The experimental procedure

The accessibility was assessed by **3 specific criticality levels**, simulated with replication of B&A procedures in different platform conditions:

- **Low Level (LL):** 3 B&A cycles for each of the PRM clusters;
- **Medium Level (ML):** 3 B&A cycles for each combination without repetition of all pairs of the PRM clusters;
- **High Level (HL):** 3 B&A cycles for each combination of all groups of 3 people belonging to each PRM cluster.

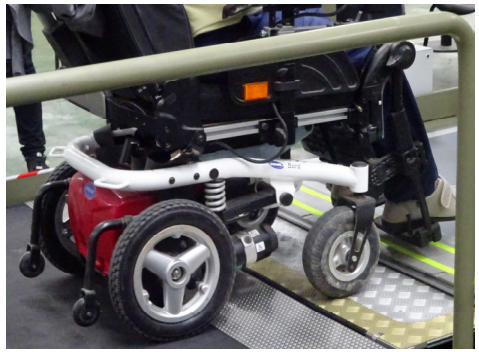
The experimental procedure

In the 3 days, the 11 participants performed the B&A cycles involving different vertical and horizontal gaps by the **3 types of ramp deployment usage**



T1 - RAMP

T2 - STEP



T3 - GAP BRIDGE

A total of 294 boarding and alighting times were measured to have an average value and calculate the standard deviations

Main findings

Main findings

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High critical level – ramp mode (T1)

Concluding remarks

Accessibility requirement at the level of the **train-platform system** becomes **crucial** when it refers to **people** with **temporary or permanent disabilities** to whom it is necessary to guarantee safe and, at the same time, comfortable train access.

The main results of the demo activity deal with:

- **a time saving for autonomous PRM entrance** within the train (a decrease of around 20%)
- an increase of accessing **passenger comfort perception by 15%;**
- a reduction of the **train stopping time in the station by 5%** ***compared to the situation of boarding equipment manually handled.***

The above outputs will be arranged in a systemic view to finalize the **D7.2 - Planning and results of tests and design revision of improved boarding equipment** (**Due in February 2022 - M27**)

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