



TRANSPORT  
RESEARCH  
ARENA  
BUDAPEST

18-21/05/26

# Enabling Independent Mobility for Wheelchair Users in Railway Vehicles

A Multi-stakeholder Dialogue  
for the Derivation of  
Requirements for Vehicle  
Boarding Aids

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# CONTEXT

- Mismatch at the PTI
- Failure of Current Approach

# CONTEXT

## Mismatch at the Platform-Train-Interface (PTI)

- Level boarding not achieved
- Boarding Aids (BA) necessary
- BA not ready for independent use by PRM
- Ramps too steep and manual (in rail)
- Accessibility today often depends on assistance



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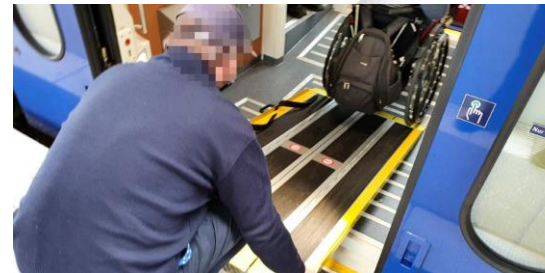


Image: Katrin Denecke



Image: Palfinger AG

# CONTEXT

## Failure of Current Approach to Grant the Rights of Persons with Reduced Mobility (PRM)

- Art. 20 UN CRPD:

### **Article 20 Personal mobility**

States Parties shall take effective measures to **ensure personal mobility with the greatest possible independence for persons with disabilities**, including by:

- a. Facilitating the personal mobility of persons with disabilities **in the manner and at the time of their choice**, and at affordable cost;
- b. Facilitating access by persons with disabilities to quality mobility aids...

- BGG §4 (German Equal Opportunities Act):

### Translation of **§ 4: Accessibility**

Buildings and other facilities, **means of transport**, technical commodities, information processing systems, acoustic and visual information sources and communication facilities as well as other designed areas of life **are barrier-free if they can be found, accessed and used by people with disabilities** in the generally customary manner, without particular difficulty and in principle **without external support**. The use of disability-related aids is permitted.

- Standards define thresholds, but they are not really usable
- This creates a gap between regulation and real-world usability

# METHODOLOGY

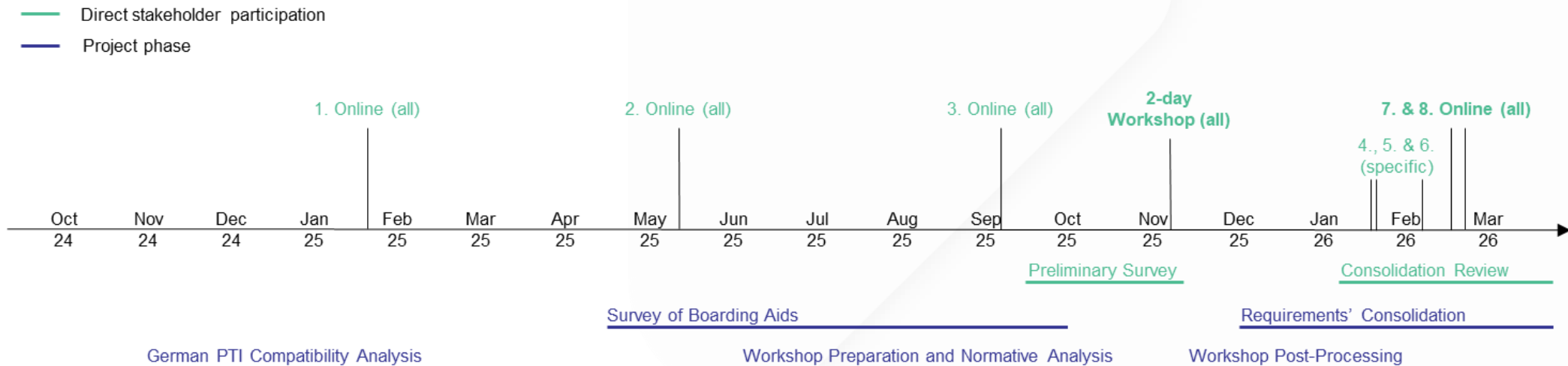
- Survey of Boarding Aids
- Normative Analysis
- Stakeholder Dialogue

# METHODOLOGY

- Survey of Boarding Aids
- Normative Analysis
- Stakeholder Dialogue
  - 8x Online Sessions
  - 1x 2-day Workshop

## Participants:

- Associations of **persons with disabilities**
- Railway **operators** and their associations
- Rolling stock **manufacturers** and BA suppliers
- Infrastructure managers and **standards bodies**



# RESULTS

## Survey of Boarding Aids

# SURVEY OF BOARDING AIDS

- Level boarding only partially achievable
  - **Vehicles with several entry heights**
  - **Platforms with several heights (Kombibahnsteige)**
- Urban transport solutions
  - **Longer automatic / telescopic ramps**
  - **Kneeling**
  - **Inclined floor section near the door**
- Lifts
  - **Onboard external lifts**
  - **Onboard internal lifts**
  - **Cassette-lifts**
- Car body lowering systems (in development)



Image: © Deutsche Bahn AG / Oliver Lang



Image: Kecko, CC BY-SA 2.0. Flickr



Image: Marc Sparsbrod

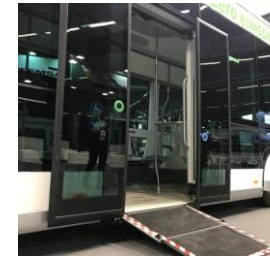


Image: Masats



Image: Palfinger AG



Image: DLR

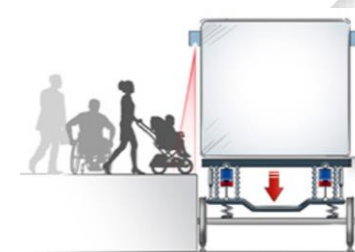


Image: Liebherr

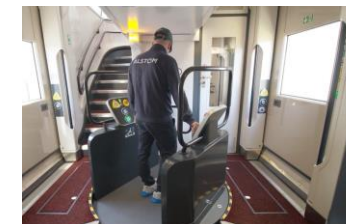


Image: SNCF



Image: DLR

# RESULTS

## Normative Analysis

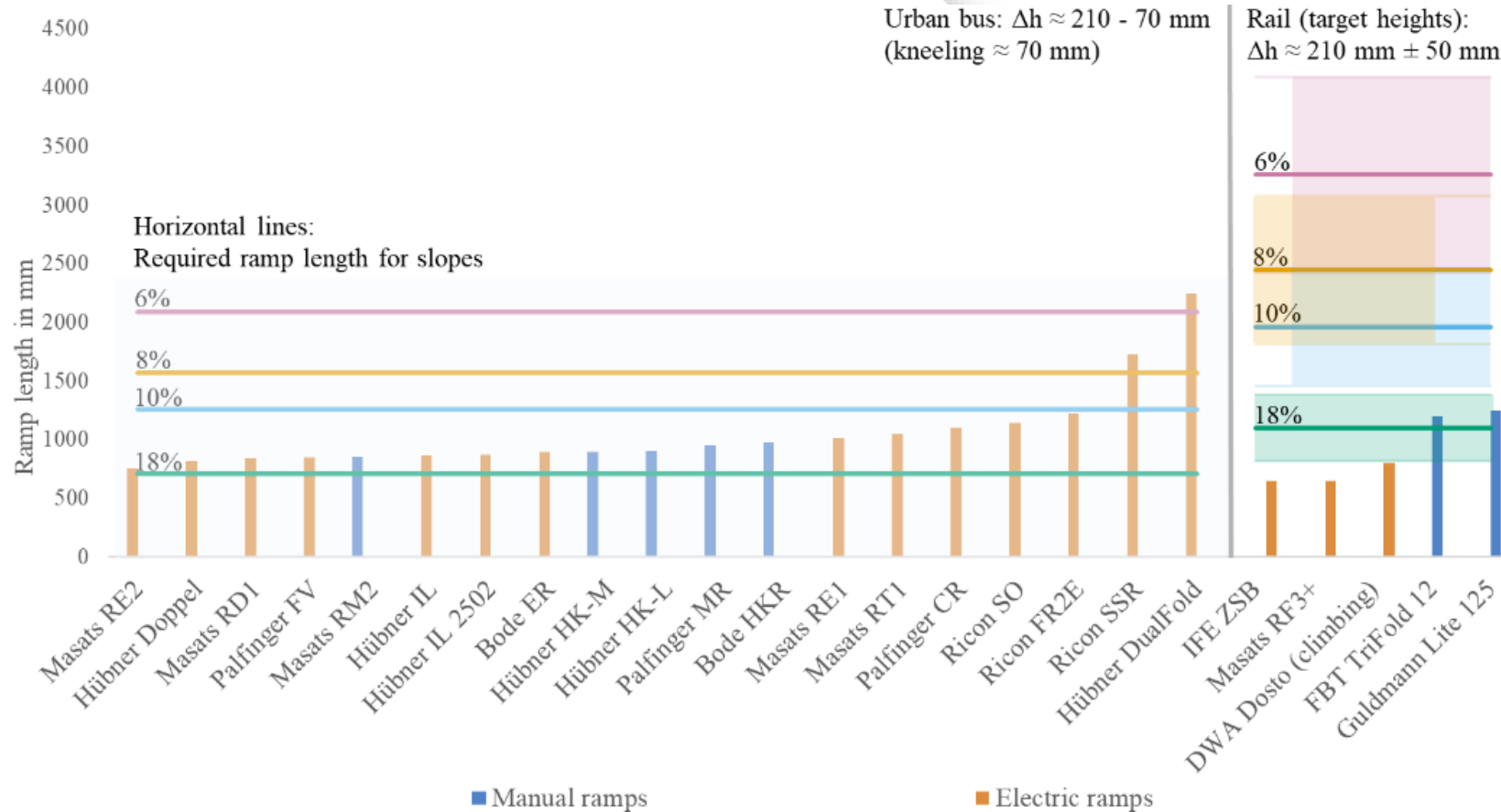
# NORMATIVE-USABILITY MISMATCH

Standards allow solutions that are not always usable in practice:

Issue	Provision	User critique
Gap tolerance for level boarding	$\leq 75$ mm horizontal $\leq 50$ mm vertical (TSI PRM & DIN EN 16856-2)	Tenders cite TSI PRM compliance Bidders maximize tolerances, causing overruns
Ramp gradient	$\leq 18\%$ slope acc. TSI PRM	18% slope exceeds stability limits and wheelchair feasibility
Lift operation	Constant manual pressure required	Too demanding for some wheelchair users
Fallback provisions	Trains may run up to six days without BA	Accessibility fails even with assistance

# NORMATIVE-USABILITY MISMATCH EXAMPLE

Reducing vertical gap has a disproportionate impact on usability of BA



# RESULTS

## Stakeholder Dialogue

# IDENTIFIED COMPETING REQUIREMENTS AND DISSENT POINTS

Accessibility is not a purely technical or normative problem, but a negotiation:

Aspect A	Aspect B
User Autonomy	Safety
User Autonomy	Operational Efficiency
Redundancy & Reliability	Cost Efficiency
Feasible Solutions	Affordability
Legacy Infrastructure	Rolling Stock
Legacy Infrastructure	Standardization / Harmonization
Universal Thresholds	User Diversity

## 7 CONSENSUS AREAS

1. Common understanding of the concept of **“spontaneous mobility”**:
  - **Without pre-registration**
  - **Reduced complexity of BA handling**
2. Independent BA use by PRM shall **not increase cycle times** beyond acceptable operational thresholds
3. Reliability through **BA Redundancy** beyond secondary BA manual handling
  - **Combination of electric and manual BA** on the same or different doors
  - **Platform-side BA to sidestep the 6-day repair clause** for onboard BA (TSI PRM 4.5.2)
  - **Platform-side BA for curved stations** -> less-steep onboard ramps elsewhere
4. Sensor-based **technical monitoring** instead of physical delimitation **of BA unfolding** area
5. **Lift platform size** for independent use of **1400 mm length and >= 800 mm width**
6. Active **BA start command by wheelchair users**
7. Independent use does **not** mean **without interaction** with the staff / driver

# CONCLUSION

# FINAL IMPLICATIONS AND CONCLUSION

- Accessibility / **User Autonomy requires system design**, not only compliance
- Current **regulatory frameworks insufficient**
- **Procurement** as a key **to implement changes** while standards evolve
- Roadmap with **7 Consensus Areas**

**Thank you for your  
attention!**

**Questions?**

