IMPROVING BOARDING ASSISTANCE SYSTEMS PRACTICE

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Summary: Boarding assistance systems (BAS) in form of gap bridging systems, different kinds of ramps or lifts offer significant accessibility improvement to rail vehicles. Analysis of different experiences with different vehicle based or platform based systems in the Europe and the world within EU project PubTrans4All shows possibilities to upgrade existing practices. The paper gives a brief overview of recommendations and examples of good practice that can be commonly applied to all types of the BAS, as well as examples specific for different BAS technical solutions, in order to improve their operation.

1. Introduction

Improvement of rail vehicle accessibility is highly related to Boarding Assistance Systems (BAS). These systems represent different kind of technical means which facilitate boarding and alighting for PRM (**P**eople with **R**educed **M**obility) e.g. wheel chair users and people with walking impairments. Variety of BAS solutions and their usage practices makes sometimes difficulties to users. Project PubTrans4All co-funded by EU within FP7, among other goals, tries to provide ideas for improvement of access to rail vehicles using the existing BAS [1].

This task is mainly based on the evaluation of existing BAS completed earlier in the project according defined criteria [2, 3]. Further subject related analyses of existing European or national norms like PRM TSI, RVAR, UIC, and documents prepared by some international bodies or organizations like COST, and UITP were also performed, in order to make a comprehensive set of recommendations for usage of existing BAS. The results of some EU Projects dealing with accessibility of rail vehicles were also taken into consideration.

The approach was to elaborate relevant issues and then stipulate corresponding recommendations. There are recommendations that can be applied to all types of BAS and include mainly the organisational measures that can improve the usage of the existing BAS. Other recommendations address specifics of four typical boarding/alighting situations:

- level boarding/alighting
- one or two steps upwards boarding and downwards alighting

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- step down boarding and upwards alighting
- boarding/alighting in case of a height difference of more than approximately 400 mm

2. General recommendations

Both vehicle-based and platform-based systems are in use by operators as BAS, depending on the operational environment and task. Platform based systems should be used in all cases when the operation with various train types not fitted with their own BAS is present. Vehicle based systems are recommended as providing a usable BAS at all times, regardless of the train station infrastructure. They are also better protected from vandalism and other influences, can be used in case of an emergency stop between two stations for the evacuation of persons with reduced mobility and are operated by the on board train staff.

To improve the client satisfaction and efficiency of the personnel it is very important to make available exact and timely information about the possibilities and achievements for accessible and assisted transport. This information should be provided in all available ways: trough internet, call services, written and oral information on the information's desks or download on mobile phones, etc.

The precise and clear information should be provided at stations as a combination of visual and audible information, information on the platform about exact location of the BAS within train and appropriate well visible signage on the vehicle with BAS.

The use of customer assistance services and the BAS should be organised to be flexible enough, and accordingly pre-registration notice times need to be as short as possible, to be attractive and helpful to all users. Additional services at the station like assistance for luggage, not only for people with disabilities but for all passengers is a good practice example.

BAS should be operated by well trained staff only. In case of malfunction a clear identification is needed in order to save time and reduce the train delay. If automated vehicle based BAS are used by the passengers they should be installed at the doorway nearest to the driver, so that he may observe the process of boarding and alighting and react if a problem occurs. In closed units (EMU, DMU) surveillance cameras in the boarding area connected to the display in the driver cabin and possibility of audio communication in entrance area with driver can significantly improve the safety and shorten the dwell time.

If it is impossible to install a technical Boarding Assistance System which could be used by all passengers, it seems to be a very good compromise to offer a technical solution only for wheelchair occupants, and if possible also for the group of severely walking impaired persons, and to have additional personal service available for all other passengers needing help.

It is a good practice to have on-board staff of the train especially trained to wait in advance at dedicated and signed accessible doors of the vehicle, who will offer help to all persons needing and wishing assistance. The experience of some operators shows that an assistant service for all passengers is possible and also well accepted by passengers.

3. Specific recommendations for typical boarding situations

3.1. Level boarding

The maximum horizontal gap that doesn't require a gap bridging system should not be greater than 75 mm (preferably 50 mm), assuming the vertical gap is smaller than 50 mm.

When using any type of gap bridging or gap reducing system, the remaining horizontal gap should be not greater than 75 mm (preferably 50 mm),.

In any case, horizontal gap of more than 300 mm is not recommended at all, since this is the limit for people with severe walking difficulties, and this limit value is still comfortable for all other people.

The gap reducing devices (gap fillers) are recommended in case of level boarding for tram and metro systems as the simplest solution for decreasing the gap to an acceptable level for wheelchair users. In case of railway systems, these devices can significantly improve the entrance comfort for people with walking difficulties and all other passengers, but often not for wheelchair users, fig.1.

Fig. 1. Gap reducer

Fig. 2. Vehicle-bound bridging plate

In case of relatively small horizontal gaps, the automatic bridging system has advantages compared to ramps. If the design of bridging plate allows overlapping the station platform, it is necessary to provide additional functions, e.g rotation along the longitudinal axis to avoid getting stuck. Therefore bridging plates should be designed to prevent overlapping with station platforms using a mechanical stop as shown in fig. 2 or using sensors for gap measurement. The height of the mechanical limiter should be greater than the maximum expected height difference between the station platform and the vehicle floor.

The movement of the bridging plate should be synchronised operated and monitored by the door system, and shall remain standstill if the bridging plate is under load. In case of bridging system malfunction, the door should remain closed for a preset time and warn the passengers e.g. visual and audio warning information. The bridging plate location is more suitable on the vehicles than on station platforms. In case that only few stations are located in curves where bigger gaps occur, fitting the gap bridging systems on the platform can be an efficient solution.

An application of the platform based bridging systems is justified in the case where there are platform screen doors or a fence protection with a predefined position of the doors relative to station platform.

3.2. One or two step upwards boarding and downwards alighting

This scenario allows solving the boarding/alighting for people with reduced mobility applying different types of ramps, but does not exclude the possibility of using lifting devices if such devices are available.

To provide barrier free entrance for height differences up to 150 mm it is recommended to use ramps with a slope not greater than 8%. This allows the use of self-propelled wheelchairs, facilitate boarding/alighting of all people with disabilities, and minimally disturbs the passenger flow.

To provide barrier free entrance for height differences from 150 up to 300 mm it is recommended to use ramps with a slope not greater than 17%, to have a ramp length that does not disturb the passengers flow too much. This slope requires assistance from the personnel. However as best practice, assistance should be available regardless of the ramp gradient.

For BAS applications at railway lines, a maximum horizontal gap up to approximately 450mm from the platform edge to the vehicle side should be taken into account. Additionally, internal steps can increase the gap.

If the ramps are used for height difference of more than 300mm it is recommended to apply the ramp parallel to vehicle. Ramps higher than 300mm shall have handrails. For height differences of more than 450 mm it is not recommended to use the ramps. Lifts are a better solution in this case.

The effective or clear width of the ramp must be at least 760 mm. For safety reasons it is not recommended that ramps are made of two separate tracks, although there might be some advantages in the winter period. Surfaces of all obstacle-free routes including all boarding devices and mobility aids shall be slip resistant and shall have anti-reflecting properties. When in use the ramp must be fixed securely to the vehicle to avoid unintended movement during boarding/alighting Fig. 3.

Control must ensure that an automatic ramp cannot be operated until the vehicle is at standstill and the doors are released, and also that the vehicle cannot be moved if an automatic ramp is not securely locked in the stowed position. An automatic ramp should be fitted with a device capable of stopping the movement of the ramp if its front edge comes in contact with an object or a person whilst being in motion. An acoustic signal in such a situation can be added. The ramp should be incapable of movement in any direction if the surface of the ramp is subjected to a load of 15 kilograms or more i.e. with passenger on it. The train should be prevent of movement if the door is not closed and locked or the ramp is not locked in the stowed position –refer also to EN 14752.

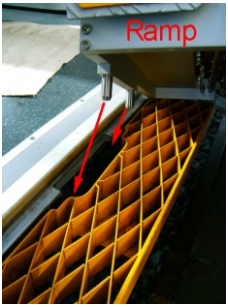

Fig. 3. Ramp fixing example

Fig.4. Ramp with raised edges in contrast colours

A secure storage method shall be provided to ensure that ramps, including portable ramps, when stored do not cause an obstruction to passengers or pose any hazard to passengers in the event of an emergency stop, or similar service condition.

Ramps shall have raised edges on both sides to prevent wheelchair wheels from slipping off. It is good practice to raise the side edges regardless of the ramp width. The height of the raised edges along each side which is not to be crossed by the wheelchair shall be at least 50 millimetres higher than the surface of the ramp. The upstands at both ends of the ramp should be bevelled and should not be higher than 20 mm. At both ends they should have contrasting hazard warning bands. Good practice is to highlight vertical outer sides of the raised edges with a colour that is bright and contrasts with the surrounding surfaces, fig. 4.

3.3. Step down boarding and upwards alighting

Boarding/alighting in the case of a higher platform than the vehicle doorway level for more than 250 mm is considered dangerous for passengers and is not recommended.

Internal vehicle lifts can provide comfortable level boarding for wheelchair occupants if the vehicle entrance and vehicle floor do not provide the same floor level.

An adaptable ramp with an initially inclined vehicle floor or the ramps extendible into the vehicle can be applicable for step-down boarding only in the case when the ramp slope can be retained in acceptable limits.

3.4. Boarding/alighting in the case of height difference greater than 400 mm

In the case where the height difference between vehicle floor and platform level is greater than 400 mm, the best solutions for boarding/alighting are lifts. The lift can be platform based or vehicle based integrated into the doorway of the respective coach. Lifts should be operated only by well trained personnel.

The control of the lift should be based on the principle hold-to-run. It is recommended to control the lift from one place only. Any unintentionally or contradictory commands should be avoided. The lift should have a protection against overload. The emergency stop button should be available for the lift user and for the staff and both on the lift and on the platform or vehicle. Additional protecting

and safety measures such as obstacle detector, foot entrapment protection, visual and optical indication signals, etc. are recommended.

The lift platform must be unobstructed and must be slip resistant. The lift platform should be equipped with side barriers at least 25mm high (50mm is advisable), to prevent any of the wheels of a wheelchair from rolling off the lift platform during its operation. To prevent a wheelchair from rolling-off the lift the barrier at least 100mm high should be provided at the front and rear platform end. Handrails at least on one side of the lift platform should be provided.

Lift operation should be possible only at zero speed of the vehicle. A control should ensure that the vehicle cannot be moved when a lift is in use. Boarding aid should incorporate an emergency scenario of manual operation in a case of power fault or system fault and also in the event of a boarding device power failure.

Regardless of staff involvement visual and audible signals during lift operations are recommended. Lift platform surface edges should be appropriately marked to be well recognisable for all users. Lifts should be stowed so that they do not significantly obstruct the flow of passengers inside the vehicle or at the station platform.

A boarding device must be stowed-in securely in all in-service condition, so that it does not to endanger the safety of passengers, fig.5. Platform based lifts should be stowed in a secure stowage area that would prevent the risk of damage and vandalism, to provide a short time of response as well as protection against weather influences.

Fig.5. Stowed lift at Stadler train (Hungarian Railways)

The lift platform's dimensions for standard self propelled or motor driven wheelchairs should be at least 1200 x 760 mm. The lift-platform should be capable of supporting a weight of not less than 300kg (excluding its own weight). The lift-platform should not travel up or down at a speed in excess of 150mm per second. Duration of the loading/unloading should be about 2 minutes each time.

Having in mind that in Europe there are various height differences between platform and vehicle floor, it is recommended that lifts should have capability of overcoming height differences up to 1300 mm. This is necessary in emergency cases in which the BAS system should be used out of the station areas as well.

Vehicle based lifts can in some fail cases cause remarkable train delays and therefore must be highly reliable and, in case of malfunction, easily to stow manually.

It is recommended to use ramps or lifts for boarding/alighting parallel (or occasionally at some angle smaller than 90°) to the vehicle, in order to allow the usage of the BAS on very narrow platforms. In case of lifts, it is recommended to use lifts that land as close as possible but not less than 75mm to the plane of vehicle side wall. If necessary the lower turning step on the coach stairway (if it exists) should be uplifted before the use of the BAS, to allow landing close to the vehicle side, and the use of the BAS on narrow platforms.

In the case of lifts with the platform perpendicular to the vehicle, it is recommended to use side barriers that can be turned down to allow wheelchair roll-off sideward, and make the use of BAS on narrow platforms possible.

4. Conclusions

The comprehensive overview of the existing boarding assistant systems across the Europe and the world as well as established evaluation criteria within EU FP7 project PubTrans4All were the base to build up recommendations for existing and new BAS to be designed. A further approach was to combine the results from PubTrans4All research and relevant European projects, international, European or national regulations etc. in order to make the list of recommendations for existing BAS as complete as possible.

The recommendations given in overview in this paper should help to improve existing praxis of BAS usage as well as to facilitate the build of the new BAS systems or stipulate requirements for their acquiring.

In the next step within PubTrans4All project the design recommendations for improved BAS for the most difficult accessibility case of classic UIC wagons will be developed. According to design recommendations the prototype of the new improved BAS shall be built, tested and presented to the public in the year 2012.

References

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