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Railway companies need to be aware of the safety issues involved in overcrowding on station platforms

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Most people walking on a station platform expect to go from point A to B safely. On the platform, the passenger places their fate in the rail company's hands, and it is a reasonable expectation that it will take due care of the passenger.

The rail company is offering transportation services knowing that there are certain risks, and that they have moral and legal obligations to manage and to make these hazards known to those who avail themselves of their services. In general terms, it must manage that which can be managed and control that which can be controlled. It is unwise to depend on luck to prevent injuries happening. A policy needs to be in place to prevent the accident in the first place.

Rail companies operate complex systems and, by their actions, influence the safety of passengers in many ways. They hire and train personnel, establish operating procedures, oversee compliance with their own and government regulations, and establish organisational safety cultures that influence staff attitudes and performance. Each activity area has the potential to create error antecedents and the rail company has the

ultimate responsibility to ensure its actions minimise the role of potential antecedents, so that their system operates safely.

It is difficult to articulate the intense psychological and physiological pressures facing passengers on a crowded platform when their movement is severely restricted. Most crowding situations can be prevented by applying simple safety management strategies, platform design modifications and advanced planning.

Most accidents that happen in a crowded situation are the result of a sudden push where the impact is extraordinary and unexpected. When walking along the platform, passengers exercise reasonable care and common sense, and this is also the case when they prepare to enter the train or when they exit the train and proceed to an access point. They observe their surroundings and take reasonable care to protect themselves from the normal risks that ordinarily accompany platform use.

As passengers have little control over the operation of the railway, they must rely on the operating companies to do everything they can to increase safety. If there is a dangerous situation, the rail company has a duty to give adequate warning, which includes clearly communicating the nature of the problem. Occasionally, a crowded platform can result in a passenger losing control, resulting in injuries and fatalities.

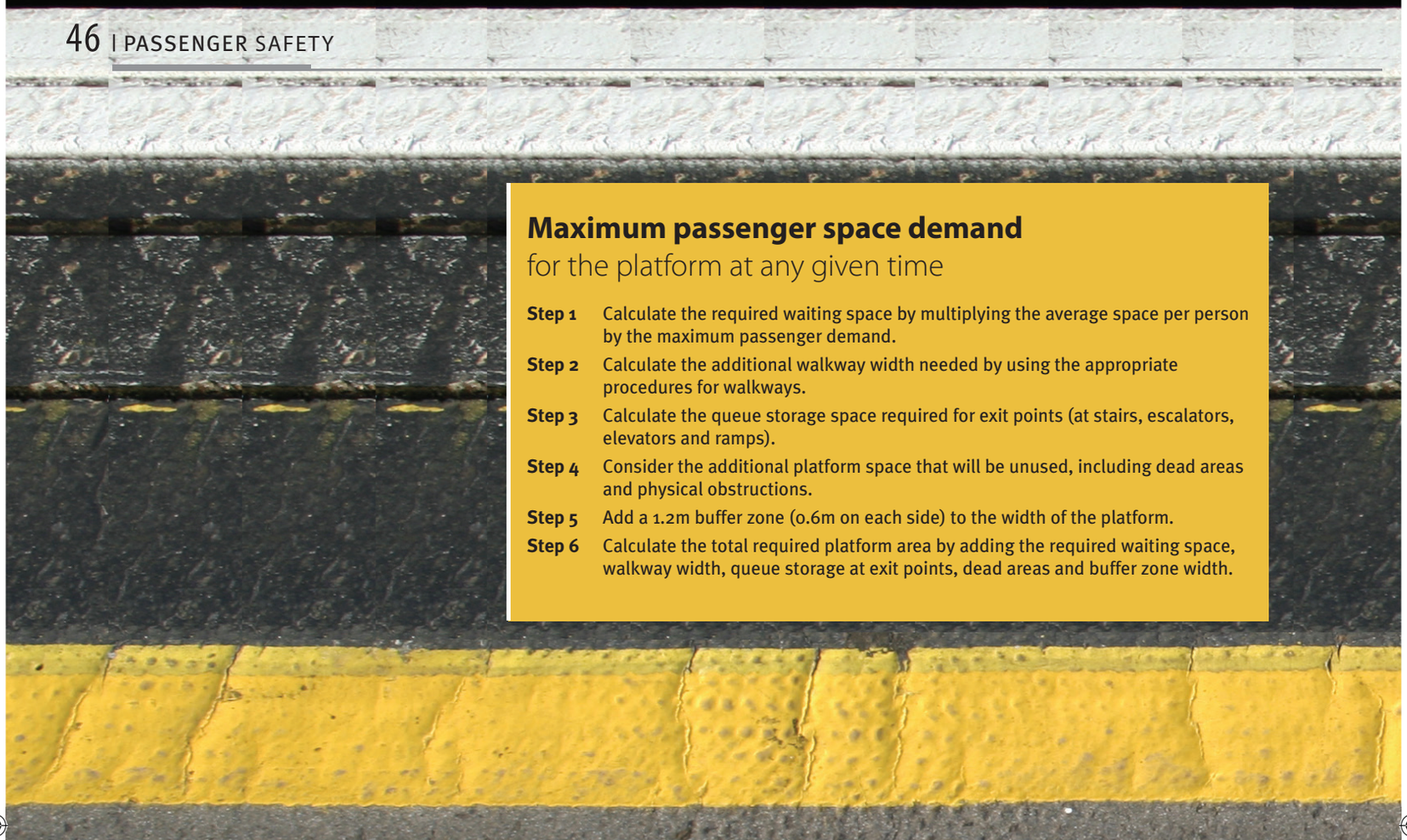
The platform serves different functions during the departure and arrival of trains. For the arrival, the platform must have sufficient area and vertical access facilities for passengers to move down the platform. During the departure, the platform serves as a storage area for passengers waiting for a train and as a movement space for passengers distributing themselves along the platform.

The platform dimensions and lack of access capacity are key factors in crowding, which can cause passengers to bunch at stairs, escalators, elevators and ramps. Studies have shown that when disembarking a train, passengers surge towards the access points and when embarking a train passengers crowd around the area closest to the platform edge. This condition makes the platform more dangerous because passengers become frustrated as they try to exit the platform and are faced with delays.

The platform area facilitates multiple passenger circulation functions, including circulating along the platform, boarding and alighting from trains, queuing at the platform edge when waiting for a train, transferring between trains, waiting for the next train by queuing at access points (stairways, escalators, elevators and ramps), and waiting at benches and information kiosks.

The platform presents challenges for the circulation of passengers, including the fact that linear queues for access points must mix with bulk queuing for boarding that may extend laterally across the platform. In addition, disembarking passengers have to compete with boarding passengers in the area along the length of the platform, which coincides with the queuing space for the access points. Sometimes centre platforms are used simultaneously for loading and unloading, and for the disabled, side walls and other references are not available for location and safety.

The platform area available to passengers is determined by deducting the edge tactile strip along the length of the platform and the footprint areas of any stairs, elevators, ramps, columns or other space-consuming features on the platform (plus a 0.5m buffer around the structure). The location of the stairs will



Maximum passenger space demand

for the platform at any given time

Step 1 Calculate the required waiting space by multiplying the average space per person by the maximum passenger demand.

Step 2 Calculate the additional walkway width needed by using the appropriate procedures for walkways.

Step 3 Calculate the queue storage space required for exit points (at stairs, escalators, elevators and ramps).

Step 4 Consider the additional platform space that will be unused, including dead areas and physical obstructions.

Step 5 Add a 1.2m buffer zone (0.6m on each side) to the width of the platform.

Step 6 Calculate the total required platform area by adding the required waiting space, walkway width, queue storage at exit points, dead areas and buffer zone width.

affect the distribution of passengers along the platform, and it is known from various studies that passengers will cluster around platform access stairways.

The effective platform area required is based on maintaining a minimum level of service for queuing and for passenger circulation. The platform as designed and operated has a critical passenger holding capacity, which, if exceeded, could result in passengers being pushed onto the track area.

Passenger levels of service provide a useful means of evaluating the capacity and comfort of an active passenger platform space. This level of service is related to walking and is based on the freedom to select desired walking speeds and the ability to bypass slower-moving passengers. Other considerations related to passenger flow include the ability to cross a passenger traffic stream, to walk in the reverse direction of a major passenger flow, and to manoeuvre without conflicts with other passengers or changes in walking speed.

Level of service

The New York City Transit Authority's minimum 'Level of Service B' standard specifies that passengers must have at least 0.9-1.2m^2 of space and that anything less is considered a crowded platform. Since the level of service is based on available standing space, perceived comfort and safety and the ability to manoeuvre from one location to another, the level of service thresholds can be used to specify desirable design features, such as platform size and number of stairs.

Level of service is presented in terms of the average space per person. The level of service required for waiting depends on the amount of time spent waiting, the number of people waiting and the desired level of comfort. The longer the wait, the greater the space per person required. People do not accept being tightly packed on a platform.

To determine the number of passengers that are occupying a space is a complex matter requiring information from numerous sources. One basic technique used by transportation engineers is time-space analysis, which considers the space occupied by a person and the time spent engaging in a specific activity within that space. The space required for a particular activity is represented by the number of people involved in an activity, the space required for the activity and the time required for the activity. Simulation models are available for passenger circulation, but are limited in their ability to represent passenger movements.

In the USA, the Americans with Disabilities Act (ADA) has standards that impact platform operations, including the platform edge treatment. The standard recommends an accessible route of at least 0.9m wide maintained along the platform length. When the accessible route is next to the platform edge, the 0.6m platform edge treatment is not included, so the clear width along a platform edge must be 1.5m.

The US National Fire Protection Association Standard for Fixed Guide-way Transit and Passenger Rail Systems specifies that egress routes must be at least 1.7m wide. When the walking path passes between the edge of the platform and an obstacle, such as a stairway, an additional width of 0.5m must be provided at the platform edge, and 0.3m must be provided next to an obstruction as a minimum clearance width of 2.5m is required in such a case.

Clearly platform crowding presents a significant danger for passengers and raises the potential for serious injuries. <<