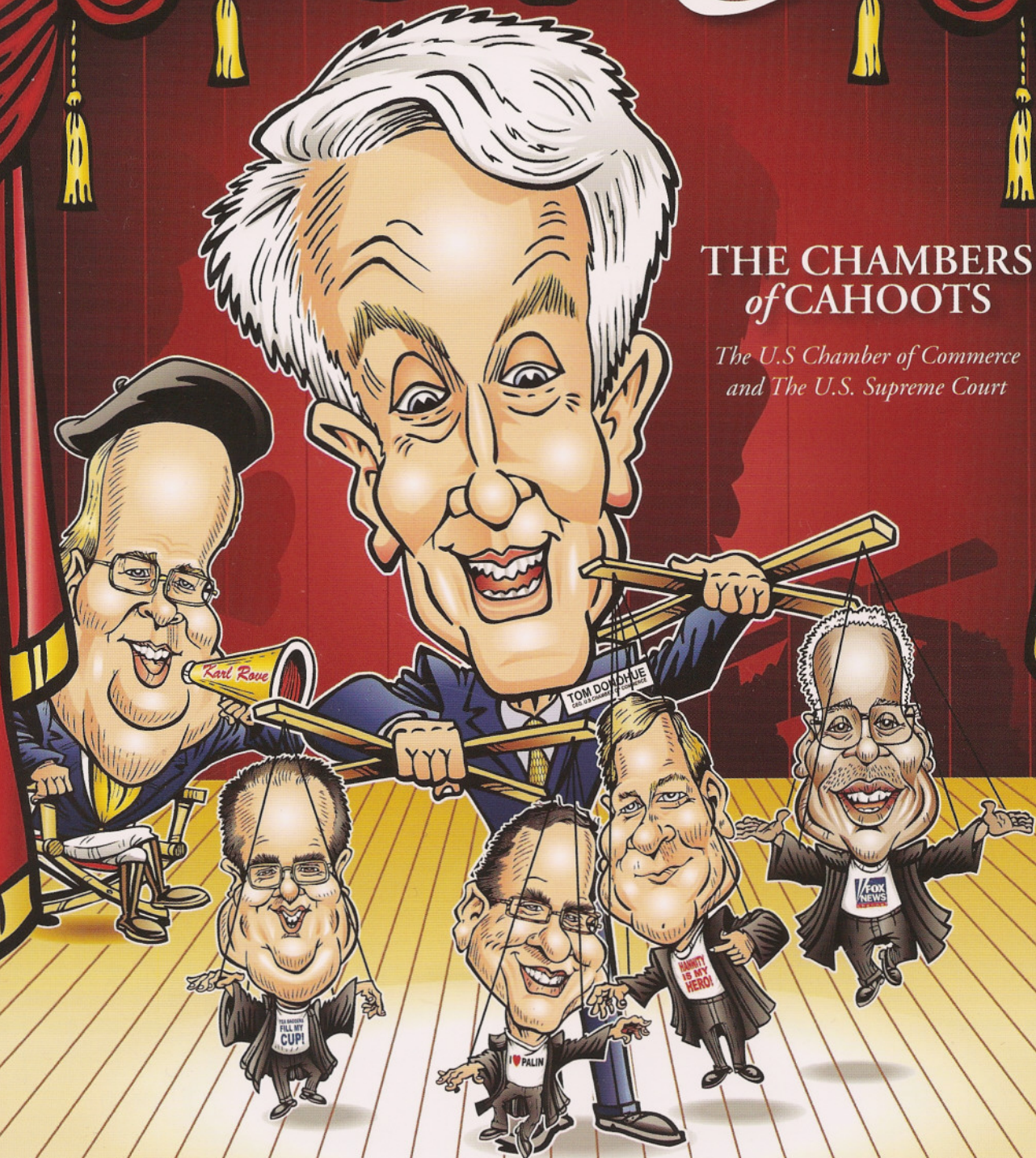


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HAZARDS of Railroad Platform Overcrowding

By Carl Berkowitz, PhD, PE, AICP

A 63-year-old woman fell from a subway platform in Queens, New York and landed on the tracks. Her head struck one of the rails, and she sustained a fatal injury. The plaintiff counsel alleged that the New York City Transit Authority negligently failed to ensure the safety of the platform passengers. Plaintiff counsel claimed the following: a) the fall was a product of an overcrowded platform and the deceased, who required the assistance of a cane, was knocked from the platform, b) the accident occurred during a moment when express and local trains were simultaneously discharging and receiving passengers, crowding the platform queuing area, and c) the New York City Transit Authority had retained four platform conductors who were supposed to monitor the overcrowded platform until 10 am, when the rush-hour period concluded, but their supervisor had discharged the platform conductors early.

Occasionally, overcrowding of rail passengers on platforms, along with platform inadequacies, can result in passengers losing movement control, resulting in serious injuries and fatalities. There are many factors that affect rail platform overcrowding:

- Physical layout of the platform
- Obstructions on the platform slowing the passengers' movement (signs, benches, columns, etc.)
- Location of staircases, escalators, and elevators
- Train timetables
- Lack of coordination between train and bus lines
- Use for multiple train lines
- Outside weather conditions
- Passenger conflict areas and gathering points
- Peaks in passenger flows and time of passenger arrival
- Accommodating passengers with restricted mobility
- Transit staff available to passengers when needed, with extra staff available on short notice
- Effective information available in different formats (audio and visual)
- Effective crowd management plan
- System delays

The station 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 quickly move through the area. 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 are a key factor in overcrowding at the station, as well as the lack of stairway capacity, which can cause passengers to bunch at the access point to the stairs. After disembarking from the train, passengers at the station surge toward the staircase and crowd around the area closest to the platform edge. This condition makes the platform increasingly hazardous because passengers become frustrated as they exit the platform and are faced with delays when they want to begin climbing the stairs.

The platform area facilitates multiple passenger circulation functions including: circulating along the platform, boarding and alighting from trains, queuing at the platform edge while waiting for the next train, transferring between trains, waiting for the next train queuing (stairways, escalators, and elevators), and waiting at benches and information kiosks. The station platform, however, presents challenges for the circulation of passengers, including the fact that linear queues for stairways must mix with less flexible 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 stairways. Also, sometimes two platforms are used simultaneously for loading and unloading, and for the disabled, sidewalls and other references are not available for location and safety.

As the engineering expert for the plaintiff in the New York City subway platform case described at the opening of this article, I measured the platform's dimensions and determined that 4,596 square feet were available for passenger queuing (exclusive of the tactile strip hazard area at the edges of the platform). The New York City Transit Authority estimated that 660 passengers occupied the platform at the time of the incident.

Based on my measurements, each person would have had approximately 7 square feet in which to move. I noted that the New York City Transit Authority's minimum "Level of Service B" standard specifies that passengers must have at least 10 to 13 square feet of available space, and that anything less is considered an overcrowded platform. I opined that the fall occurred when the platform was overcrowded.

The available platform area is determined by deducting the two-foot safety edge (tactile strip) along the length of the platform and the footprint areas of any stairs, columns, or other space-consuming features on the platform (plus an 18-inch buffer). The location of the stairs will 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.

The defense counsel in the subway platform case contended that the platform had 6,655 square feet of usable space for queuing, which would have provided 10.08 square feet for each of the 660 passengers present at the time of the accident. Defense counsel did not present documentation that supported this calculation and also contended that the station's supervisor retained the discretion to discharge the platform conductors, claiming that they were needed to

perform errands away from the station. The jury found that the New York City Transit Authority was liable for the accident.

The Americans with Disabilities Act (ADA) also affects platform operation, including the platform edge treatment. An accessible route of at least 36 inches wide must be maintained along the platform. When the accessible route is next to the platform edge, the 24-inch platform edge treatment is not included, so the clear width along a platform edge must be 60 inches.

The National Fire Protection Association Standard for "Fixed Guideway Transit and Passenger Rail Systems" specifies that egress routes must be at

least 5 feet, 8 inches wide. When a walking path passes between the edge of the platform and an obstacle, such as a stairway, an additional width of one foot, six inches must be provided at the platform edge, and one foot must be provided next to the obstruction since a minimum clearance width of eight feet, two inches is required in such a case.

It is difficult to articulate the intense psychological and physiological pressures faced by passengers on an overcrowded platform when their movement is severely restricted. Most overcrowding situations, however, can be prevented by applying simple management strategies, design modifications, and advanced planning.

Carl Berkowitz, PhD, PE, AICP, is a transportation engineering expert referred by The TASA Group for testimony and consultation. To request more information about Dr. Berkowitz, or any of The TASA Group's independent experts in technology, business, the sciences, including medicine and healthcare, and the arts, please contact TASA at 800-523-2319 or visit www.TASAnet.com.

Platform Crowd Action Cues

Platform Condition	Crowd Cue	Level of Service (LOS)
No crowd issue	Total passenger body visible	LOS A - (13 ft ² /p) Free passenger circulation throughout the platform area
No crowd issue	Generally total passenger body visible	LOS B - (10-13 ft ² /p) Partially restricted passenger circulation throughout the platform area
Minor crowd issue	Passenger body partially obstructed	LOS C - (7-10 ft ² /p) Restricted passenger circulation throughout the platform area
Crowding condition	Only passenger body and head visible, crowd action should be considered	LOS D - (3-7 ft ² /p) Passenger movement without touching is virtually impossible; circulation is severely restricted in the platform area
Severe crowding condition	Only shoulder and head visible, crowd action required	LOS E - (2-3 ft ² /p) Physical contact with other passengers is unavoidable and circulation within the platform is not possible
Dangerous crowding condition	Only head visible, crowd unacceptable	LOS F - (<2 ft ² /p) All passengers within the queue are in direct physical contact, no movement is possible

Note: Level of Service is described in feet square per person occupied (ft²/p)