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Tech Brief

CUSTOMER BEHAVIOR RELATIVE TO GAP BETWEEN PLATFORM AND TRAIN

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SUMMARY

New Jersey Transit's commuter rail network consists of 11 lines, 162 stations and a fleet of over 1,000 passenger cars. In addition, several railroads hold trackage rights agreements to operate freight service on New Jersey Transit-owned lines. To accommodate the variety of train types using the system, it is necessary to allow for "gaps" between the train and platform to ensure trains to operate safely at authorized speeds. Figure 1 shows the types of gaps studied in this research. Narrow gap sizes could result in trains striking the platform, while wide gaps would lead to difficulties in passengers boarding or detraining at the platform.

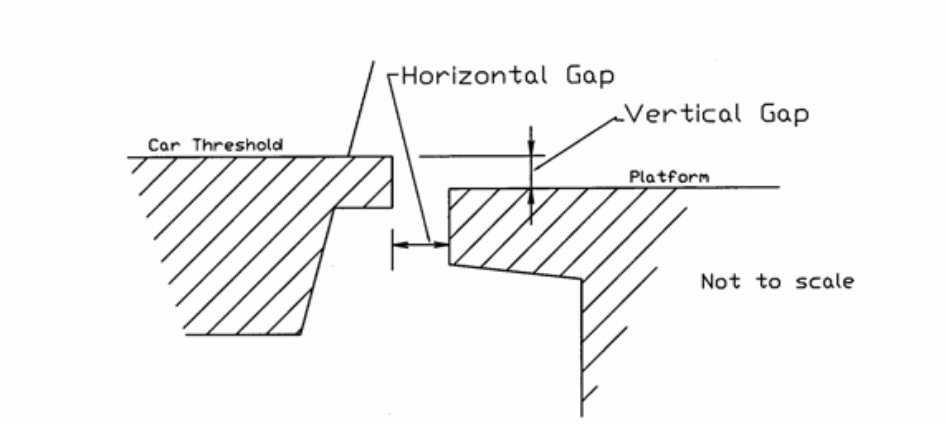

Figure 1. Horizontal and Vertical Gap between Train and High Level Platform

INTRODUCTION/BACKGROUND

Managing gap safety at the train platform interface has been an on-going concern for passenger rail systems. The major questions this research seeks to answer are what customer behaviors are associated with the risk of gap injury incidents and what are potential ways to reduce these behavioral risks. To answer these questions, the research approach is two pronged. The first prong analyzes and reviews the NJ TRANSIT Rail accident data and reports to gain a clear picture of the accidents in relation to demographic, seasonal, and temporal characteristics. The second prong involves observational studies of passengers boarding trains to identify behavioral patterns that are associated with risk of gap accidents.

RESEARCH APPROACH

The specific tasks performed include:

Task 1. Literature Search.

Task 2. Gather data and perform analysis of NJ TRANSIT Rail data.

Task 3. Observe passengers under varying conditions.

Task 4. Examine state of practice at other large commuter rail systems.

Task 5. Make recommendations based on analysis of the data, and state of practice.

FINDINGS

Summary of the Literature Review

The literature search found that while the thrust of analysis of gap-related injuries is one of human factors, no direct behavioral study of passengers crossing the gap were uncovered. Human factor analysis identified demographic issues (age, disability) and behavior issues (rushing, pushing, distractions caused by children, luggage, cell phones) that may contribute to gap accidents at railroads. Platform conditions, including crowding, wetness, size of gap, all contributed to the number and occurrence of gap accidents. Mitigation measures used to treat gap accidents included staff training, public awareness campaigns, staff deployment, dwell times and the use yellow lines.

SUMMARY OF THE WORK PERFORMED

Gap Injury Analysis

An analysis of gap injuries on NJ TRANSIT Rail found that for 2005 to 2008, gap injuries accounted for 25 percent of passenger injuries on NJ TRANSIT Rail. From 2005 to 2006, gap injuries increased by 97 percent to 75 gap injuries compared to a 3 percent increase in non-gap injuries. Between 2006 and 2007 both gap and non-gap injuries increased by 11 percent. Between 2007 and 2008 there was a 30 percent reduction in gap injuries compared to a 10 percent reduction in non-gap injuries. The reduction may be attributed to efforts on the part of NJ TRANSIT Rail to alert passengers to the gap.

Time of Injury

The majority of injuries occurred during the AM and PM peak periods. A higher percentage of gap injuries in the AM and PM Peak periods than at other times reflected passenger volumes. Gap injury rates by time of day would have been expected to have been lower during the peak period than for other periods given the typical peaking of commuter rail passenger traffic during the peak period.

Month of Injury

The highest percentage of gap injuries occurred during October to December. The highest percentage of non-gap injuries occurred during July to September. The data showed differences in the percentage distribution of gap and non-gap injuries by month. Passenger volumes by month**,** lighting, weather, level of distraction and other behavioral factors that change by month may explain the specific characteristics that lead to differences in gap and non-gap injuries by month.

Day of Week

Almost 80 percent of gap injuries occurred during the weekday, compared to 86.5 percent of non-gap injuries that occur during the weekday. The peaking of gap injuries on Wednesdays may be associated with increased passenger volumes on Wednesdays.

Age of Injured

For gap injuries the percent of injuries peaks for the very young, under 10 years old, then increased with age until the 30-40 year group. After this age group the percent of injuries remained flat for older age groups. For non-gap injuries, the highest percent of injuries occurred for ages between 50 and 60 years old. The data indicated that unlike non-gap injuries, gap injuries did not increase with age. Gap injuries associated with the very young may be attributed to distraction, shorter strides and general unfamiliarity with train boarding and detraining. Gap injuries associated with 30 to 40 years old may

be a result of higher number of passengers in this age category.

Gender of Injured

For both gap and non-gap injuries, the majority of the injured were women. Gap injuries associated with women passengers were more likely to occur during October to December, on a Thursday, during either the AM or PM peak period and associated with women aged 30 to 50 years old.

Boarding and Detraining

Sixty-six percent of gap injuries occurred while passengers were boarding. Seventy percent of gap injuries for female passengers occurred while boarding compared to 56 percent for male passengers. The largest differences between boarding and detraining passengers occurred for those under 10 years. The study indicated that young children are particularly vulnerable to gap injuries while detraining.

Stations with Highest Gap Injuries

Newark Penn Station and New York Penn Station had the highest number of gap injuries at 28 and 26 gap injuries, respectively. The stations with the highest number of gap injuries were also the stations with the highest number of boarding and detraining passengers. For most of the stations, the highest percent of gap injuries occurred during boarding. Long Branch and Secaucus Junction were the two stations where the majority of gap injuries occurred during detraining.

Summary of Passenger Observational Surveys

Seventy-eight percent of detraining passengers and 88 percent of boarding passengers were observed to look down while detraining or boarding. Long Branch was observed to have the lowest percentage of passengers looking down and Secaucus Junction was observed to have the highest percentage of passengers looking down.

The largest type of distraction observed was passengers carrying luggage. For the stations studied, passengers with luggage were more likely to be boarding than detraining. Cell phone usage was not a large distraction as the high noise levels on the platform made cell phone use impractical.

Summary of Gap Sizes

NJ TRANSIT Rail measured existing vertical and horizontal gap sizes at all tracks with high level platforms. From this data, the maximum gaps at NJ TRANSIT Rail stations ranged from 24.45 in. at Princeton Junction (NJT) station to 1.75 in. at New York Penn Station. The excessive gap at Princeton Junction station is associated with the tight track curvature of the Princeton Line, and only affects equipment with center doors. Passengers board and alight only at end doors at Princeton Junction Station. No clear relationships were observed between the maximum gap size at each station and the gap injury frequency or rate.

CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis of the data, recommendations on strategies for reducing gap accidents at NJ TRANSIT Rail stations were developed. The recommendations sought to address mitigating factors that contribute to these accidents and are recommended for implementation if feasible and when budget permits.

Passenger Information

- Use of additional platform personnel during peak periods and at stations with high gap injuries
- Use of easily viewed platform monitors indicating the train and track numbers, and time of departure. Large signs and consistency in the placement of track number signs.
- Use of pre-recorded messages to “Watch the Gap” that is played while passengers are waiting at the platform and while on the train.

Platform and Train Treatments

- Use of reflective markings at train door thresholds and at locations of the platform with large gaps
- Use of color to bring attention to existing train hand rails
- Reduce unusually large gaps where this is feasible given train clearance requirements.

Training

- Involving train conductors in the development and deployment of solutions to treating gap injuries.
- Providing a greater awareness of NJ TRANSIT Rail's current gap injury rates and the target goal for reducing these injuries.
- Alerting conductors to the passenger types and stations where assistance may be needed.

Public Awareness Campaign

The research indicated that women are more likely to be involved in a gap injury and also more likely to not look down while boarding and detraining compared to men. For this reason a targeted public awareness campaign should be developed to address this group.

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A final report is available online at http://www.state.nj.us/transportation/refdata/research/

If you would like a copy of the full report, please FAX the NJDOT, Burea of Research, Technology Transfer Group at (609) 530-3722 or send an e-mail to Research.Bureau @dot.state.nj.us and ask for:

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