Perceptions of Passenger Aggression and Car Supervision at Metrolink

Methods: Explanation of estimation processes

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For more information see the full research paper:
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This Study

Negative perceptions about the safety of a commuter rail system can act as a barrier to using public transportation. When operational issues increase rider tension (i.e., crowding or worsening on-time performance), or the management capabilities of conductors and law enforcement personnel are called into question, an upsurge in passenger-on-passenger aggression may occur. In turn, riders concerned about their safety may retreat to personal vehicles or other forms of "less risky" transit—such as express busses.

Volume of Incidents vs. Perception of Safety per Segment

This study presents a new method of identifying the trip segments where rider reports and concerns about public safety concentrate. When analyzing public safety issues it is important to consider:

- The volume of incidents occurring on each trip segment: they indicate where problems concentrate (raw data). This is useful for knowing where to aim interventions for maximum impact.
- The rate of occurrence based on the number of people accessing the system. Travel segments servicing a disproportionate level of worried passengers reveal parts of the system where the ridership feels more vulnerable. These rates suggest where the customer service department and marketing team can focus outreach efforts to address safety concerns.

Data

Complaint information from August 1, 2009 to Dec 31, 2012 was extracted from an archive maintained by the Customer Engagement Department of Metrolink. Complaints from formal correspondence (email, letters, and phone calls) were used. Each issue raised is recorded: a single customer contact can include multiple complaints and/or commendations. Cases were lost due to missing information about the origin or destination of the trip.

TABLE 1. DESCRIPTION OF CUSTOMER COMPLAINTS ABOUT INCIDENTS OCCURRING DURING THE TRIP.

Category	Description	Total Issues	Included in Study	% Lost
Rider Tension				
On-Time Performance *(OTP)*	Delays and disruptions to regular service (excluding planned maintenance)	1,574	1,423	9.6
Crowding	Inability to find seating, and congestion in vestibules and stairs	99	82	17.2
Supervision	Conductor or sheriff not enforcing rules, behaving inappropriately, aggressiveness, or failing to respond to a request	497	455	8.5
Passenger Aggression	Victimization or witnessing aggressive behavior by a passenger on another rider, including assaults, verbal threats, as well as defiance and disorderly conduct	192	163	15.1

In what trip segments do passenger aggression incidents accumulate?

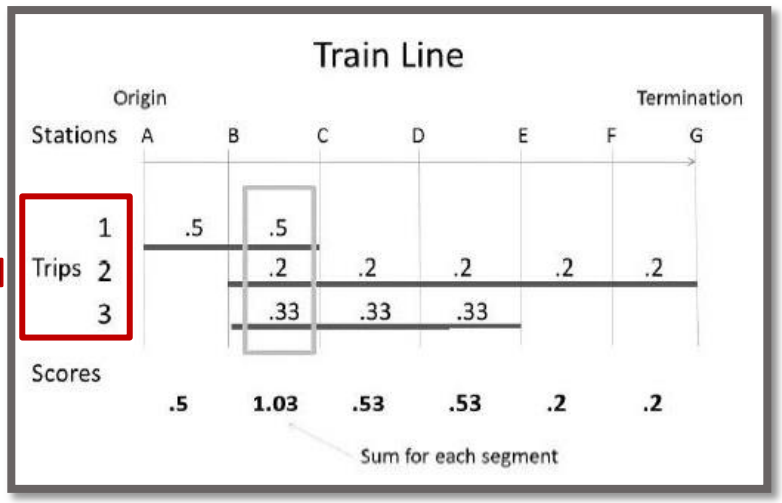

FIGURE 1. TRIP SEGMENT ESTIMATION PROCESS

Interstitial Estimation Technique

Interstitial estimation[1], as depicted in Figure 1, provides a method for determining where problems are likely to have occurred given where a person got on the train and at what station they departed.

For example:

TRIP 1. A rider writes in to complain about an issue occurring during their trip (. In this instance, the trip involves two segments (between stations) and we estimate that it is equally likely that the incident occurred during the first segment as the second. A value of .5 (probability) is assigned to each segment.

TRIP 2. A second incident is reported by someone getting on at station B and traveling to the end of the line. The likelihood that the incident occurred on any segment is 1/5 segments or 0.2.

TRIP 3. The third reported issue involved a person traveling three segments and the probability of the incident occurring on any one segment is 1/3 or .33.

By summing all probabilities for each segment, we arrive at a total estimated probability of issues occurring for each segment of a line. Separate estimates were generated for inbound (toward L.A. Union Station or Riverside Station) and outbound travel. These values are used to weight the transportation network.

Is the level of concern about safety spread evenly across the system?

The process described above provides the estimated number of incidents (raw estimate) per segment. It does not take into consideration the number of passengers that typically ride the line. To convert the raw estimates into rates per 1,000 passengers we divided the estimated probability of problems by the number of riders per segment. To calculate the number of riders on each segment we used the number of boardings per station and the number of riders per line during peak travel. This process is outlined in Figures 2 and 3.

[1] Newton, A.D., H. Partridge, and A. Gill (2014). Above and Below: Measuring Crime Risk in and Around Underground Mass Transit Systems. *Crime Science*, 3(1): 1-14.

Calculating Rates

We began (Step 1) with the total number of boardings at each station. This count of passengers entering the system is divided by the number of lines servicing the station (Step 2) and the number of travel directions of each line, at each station (Step 3). This estimates the number of passengers entering each line in each of the travel directions (inbound or outbound). The end of line station is not included, as passengers would only be able to get off the train, not on it. The first part of the calculation results in the percent of boardings for each station (Step 4), per line and by direction traveled is calculated.

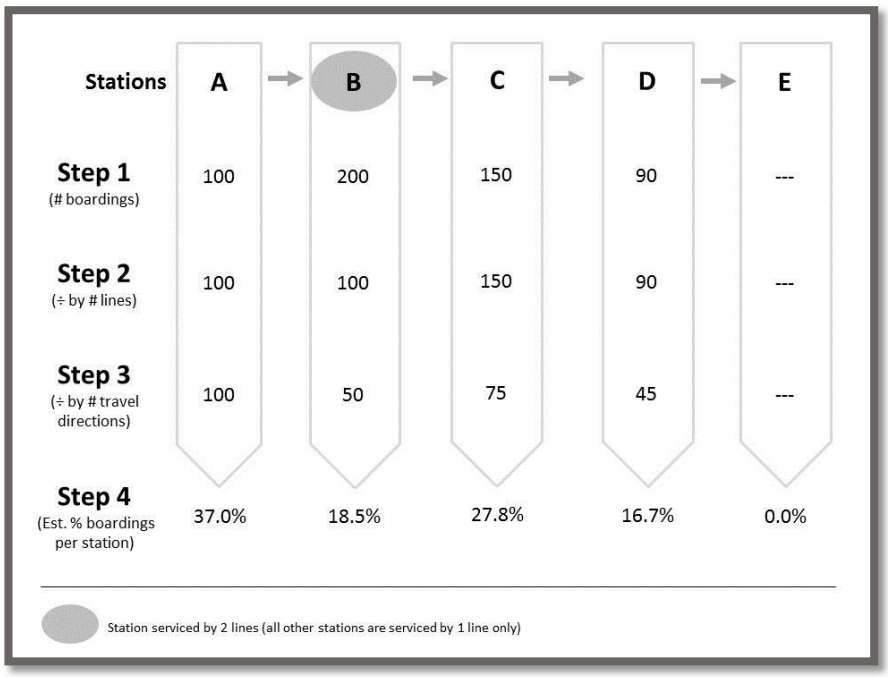

FIGURE 2. CALCULATING THE PERCENT OF BOARDINGS FOR EACH STATION, PER LINE AND BY DIRECTION TRAVELED

The second part of the calculation generates an estimate of ridership per trip segment. In Step 5, the percent of boardings per station is applied to the total number of riders per line and direction traveled. Finally, the estimated ridership per segment is obtained by adding the number of riders cumulatively toward the end of the line (Step 6).

The incident rate is calculated dividing the number of incidents (Figure 1) by the number of riders (Figures 2 and 3) per segment.

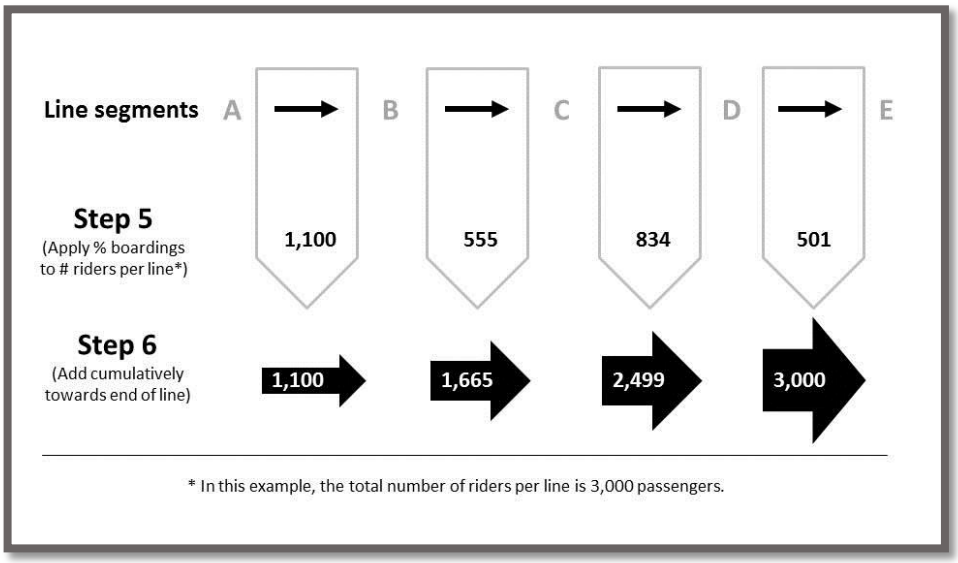

FIGURE 3. PROCESS USED TO ESTIMATE RIDERSHIP PER TRIP SEGMENT