



## Engineering Crowd Management for Public Safety

The Port Authority of New York and New Jersey (PANYNJ) is tapping a high-tech approach developed by the DHS S&T Center for Visualization and Data Analytics (CVADA) at Rutgers to enable safer crowd movement during emergencies and other events. The CVADA-Rutgers research team uses a combination of mathematical modeling and LiDAR (light and radar) to determine the best way to manage rush-hour crowds and bus schedules—including emergency evacuations— before, during, and after PANYNJ's major reconstruction and rehabilitation construction projects.



CVADA's PABT crowd-management study documents and analyzes obstacles to pedestrian movement such as doors and gates. **Photo credit:** Yoshizumi Endo, Creative Commons

The Port Authority Bus Terminal (PABT) in midtown Manhattan, the busiest such terminal in the world, is vulnerable to disruptions that could put the region's public transit system and its commuters at risk. The terminal is already at peak capacity, with more than 65 million people passing through its doors every year. It's projected that by 2040, evening peak-hour passenger traffic will increase by nearly 50 percent to 34,000 riders per hour, with a corresponding increase in bus traffic. The PABT is a key component of any plans to evacuate Manhattan in case of an emergency, so enabling large crowds to move freely toward safety is a must.

## How It Works

To simulate crowd movements, CVADA-Rutgers researchers capture and analyze data related to pedestrian traffic flows and bus schedules at the terminal. They study how individuals move differently when carrying luggage, buying a snack, acting unsure of where to go, and how groups of two or more people behave, as social groups move differently than individual pedestrians. This data is then used to develop computer simulations of crowd movement. The simulations show how the different phases of the planned reconstruction of the terminal are likely to impact crowd movement, which can help the Port Authority design pathways that facilitate people flow.

## LiDAR Technology Employed

CVADA-Rutgers employs LiDAR, a remote sensing technology that captures the precise dimensions of facilities and can be extremely useful in analyzing proposed redesigns. The LiDAR imaging identifies potential obstacles to crowd movement, such as doors, gates, ramps, retail stores and the like, providing important input to the PABT crowd-management study. This led to the development of a Building Information Model that supports a variety of facility management functions critical to the safe, efficient, and effective operation of a large transportation facility.

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CVADA at Rutgers is using advanced data analysis, mathematical/computer modeling, LiDAR technology, and field observations to simulate and predict crowd movements in the PABT reconstruction project.

## Real Users, Real Results

The Port Authority of New York and New Jersey is currently using this CVADA-developed tool to plan for reconstruction of their bus terminal.