

## **Use of Simio in Airport Planning, Design, and Management**

Airports are an integral part of modern civilization. Through its ability to rapidly connect people and freight around the world, an airport helps improve its cities' influence, promote tourism and travel, and strengthen the local and global economy. Due to recent growth in aviation, airports have become the gateway which travelers use to visit new regions. Airports are the first and last piece of architecture that a visitor sees during their journey. As a result, a region's perceived prosperity is often associated with the state of its airport. It is a key piece of infrastructure.

Arup is an independent firm of designers, planners, engineers, consultants and technical specialists offering a broad range of professional services, with its main focus on making a positive impact on the built environment. Arup employs over 13,000 staff in 90 offices around the world. Aviation is one of Arup's main sectors of expertise. It includes the planning, design, and engineering of airports and related facilities.

As the demand for air travel continues to grow worldwide, airports are constantly looking to expand their facilities to meet this demand. The proper planning of airports require extensive analysis to determine facility requirements and resultant passenger experience. It includes the provision of sufficient number of processors to maintain a reasonable wait time, as well as enough queuing space for the resultant accumulation of passengers.

There are many closed-form solutions to estimating facility requirement for airport terminals. These tools make substantial assumptions related to the homogeneity and deterministic nature of passengers and processors. Unfortunately, the real world is often complex and passenger behavior has more randomness. Therefore, simulation tools are required to address the multitude of these different passenger behaviors at an airport terminal.

At Arup's Toronto office, Simio is used as the preferred simulation software for its strong statistical tools and ease of use. Simio is used to determine the number of counters/units required at each of the passenger processors, such as check-in, security, immigration, and bag reclaim carousels. At these various processors, we calibrate the number of processors to keep the maximum wait times experienced by a passenger within the allowed limits set by the client (airport authority, airline, or agency). We also use the resultant passenger flows within the terminal to determine the corridor width requirements at key points along the departure and arrival corridors. At our clients' request, we also use Simio to model bussing and light-rail train requirement, meeter/greeter hall accumulation, and airside congestion.

Currently, we are working with several airports and airline clients worldwide. These clients include JetBlue's various hub of operations, Beijing New International Airport, and Taiwan Taoyuan Airport.

At JetBlue's Boston Terminal C check-in lobby, Simio was used to assess new layout options for JetBlue's new Two-Step Check-in. With the new Two-Step Check-in hall, JetBlue aims to replace its full service check-in counters with self-serve kiosks, to significantly reduce passenger queue time and accumulation. After determining the number of kiosks and counters needed, Simio was used to animate the resultant check-in hall for visualization and presentation purposes. Simio was continuously used with actual flight schedules to ensure the renovations had minimal impact during the various phases of construction. This allowed for the check-in lobby to remain open throughout the renovations.

In Beijing New International Airport and Taipei Taoyuan Airport, Simio was used to determine all facility requirements in all departure and arrival processors and evaluate their passenger processing methods. In both projects, simulation was used to verify that the facility provisions are adequate in processing passengers with reasonable resultant wait times. After the planning drawings are fine-tuned using simulation results, Simio was used again to visualize the passenger flow through the entire airport. Various output files are also generated by Simio to determine other key aspects at the airport, such as Automated People Mover (APM) demand and greeter hall accumulation. In addition, outputs from Simio regarding passenger travel times is also used as input in Arup's pedestrian congestion model. This helps the planning team to further refine the geometry of the terminal building to streamline passenger flow through the building.

Arup's airport planning team extensively relies on the outputs from Simio in its work to help size terminal facility requirements. Simulation models are constantly being updated with increasingly efficient ways to input data and output results. Using passenger flow simulation models in Simio, Arup aims to accurately determine facility requirements for its airport clients and to help optimize airport facility designs around the world.