

LINKING TRAVEL DEMAND AND TRAFFIC SIMULATION TOOLS: SKY HARBOR INTERNATIONAL AIRPORT

**WHITE PAPER FOR THE 2008 TRB CONFERENCE –
INNOVATIONS IN TRAVEL DEMAND MODELING**

PORTLAND, OREGON

By

Jill Bennett, PE – Senior Project Manager
Brent Cain, PE – Senior Transportation Engineer
Michael Gorton, AICP – Senior Transportation Planner
Jessica Hernandez – Transportation Planner
Michael Trueblood, PE, PTOE – Senior Transportation Engineer

Linking Travel Demand and Traffic Simulation Tools: Sky Harbor International Airport

Background

The Phoenix Sky Harbor International Airport, the nation's eighth busiest passenger airport in year 2006, is currently planning on implementing a variety of ground access strategies to accommodate future growth in air travel. The evaluation of ground access needs at Sky Harbor is complicated by the fact that the main passenger terminal access road is also a key link in the regional transportation system. Traffic currently spills over from the congested arterial/freeway network and uses Sky Harbor Boulevard as a cut-through route. Non-airport traffic shares the road with airport users adding to congestion at the passenger terminals during peak periods.



Traffic Congestion along Sky Harbor Boulevard

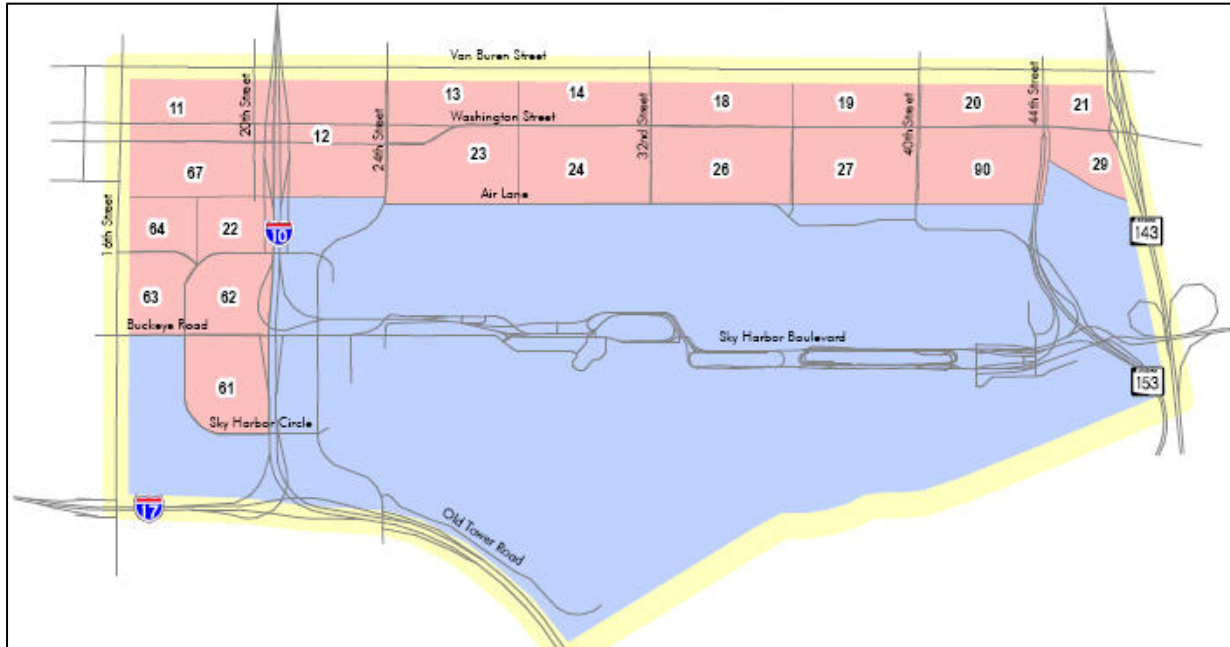
In order to fully understand the current and future transportation issues at Sky Harbor International Airport, an integrated approach that considered both the demand as well as the supply side was developed. This approach would allow the analysis to be responsive to both changes specific to airport land use/access changes and potential modifications with the regional travel demand of the Phoenix area. To achieve this goal, HDR created a sub-area travel demand model (TDM) to more accurately reflect travel patterns at Sky Harbor International Airport. The resulting origin-destination information was used to develop a traffic simulation model for detailed analysis that reflected the complex travel patterns of both airport and non-airport traffic. A key benefit of this approach was the capability of graphically depicting (via screen shots or animation movies) the operational results in a straight forward and understandable format. Ultimately, this tool will be used to identify ground access deficiencies and evaluate potential solutions within the complex environment.

Travel Demand Modeling

The airport sub-area model was developed using the TransCAD software platform to provide seamless integration with the population and employment data from the Maricopa Association of Governments (MAG) travel demand model. Airport trip generation and distribution was based on surveys conducted as part of multiple terminal expansion studies over the past several years. The Sky Harbor model included nine separate trip purposes that account for private car and shuttle trips for both passengers and employees. Mode split was also based on recent passenger survey data. The model also included service and cargo trips within the study area network. The airport model estimates travel on the roadway network through a process that converts passenger enplanements and employment data to 24-hour ground vehicle trips for each airport activity center. This includes the passenger terminals, air cargo areas, rental car center, employee parking, and remote parking areas. The internal airport traffic circulation included the recent consolidation of the rental car terminal.

The airport travel demand model off-airport trip generation was based on vehicle trip generation rates based on Institute of Transportation Engineers (ITE) data and other studies including the National Cooperative Highway Research Program (NCHRP) Report 365 *Travel Estimation Techniques for Urban Planning*. Trips were estimated for three trip purposes: Home-Based Work; Home-Based Other; and, Non-Home Based.

Trips at each external station location were estimated using MAG travel demand model output and modified in the iterative model validation process. Trip distribution combined the external trip tables and internal study area trips to produce a trip table of the estimated number of off-airport trips between each of the TAZs in the study area. Vehicle trip distribution for this study was estimated using a gravity model.

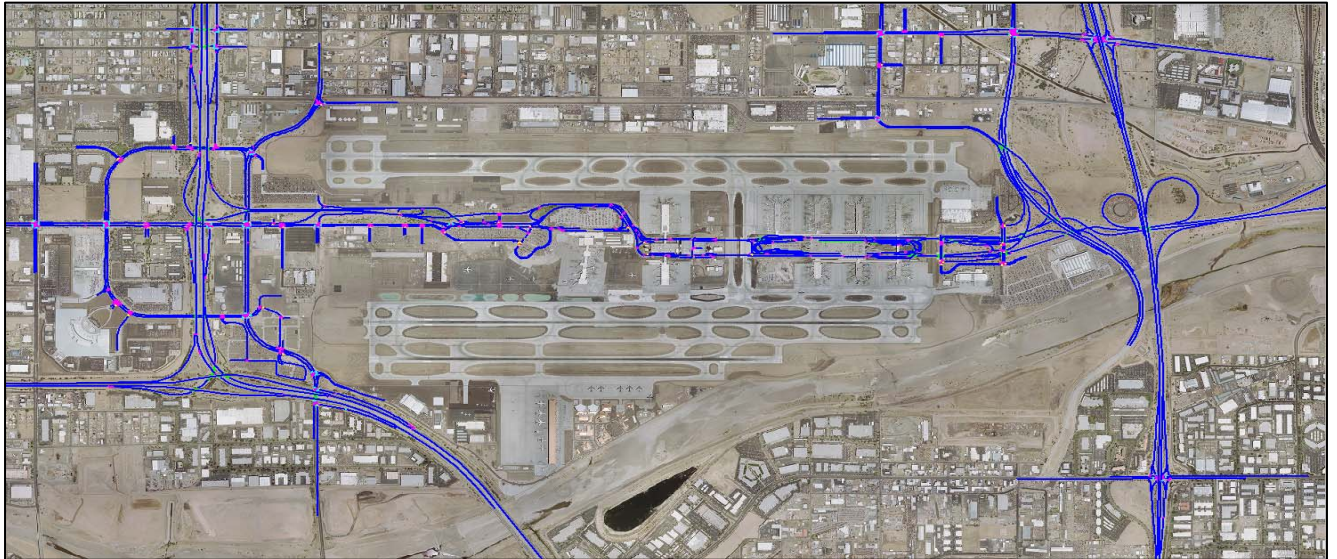


Sky Harbor International Airport Sub-Area Model TAZ Map

Traffic Simulation Modeling

For purposes of this project, the traffic simulation model of the study area network was developed using VISSIM. The model attempts to simulate how each vehicle operates using a behavior-based, multipurpose traffic flow model. VISSIM was selected based on some of its key features, including transit features, vehicle routing by mode, and 3D capabilities. The base traffic simulation model focused on existing operations along Sky Harbor Blvd, I-10, SR 143, SR 153 as well as a number of adjacent arterial roadways.

The model was calibrated for existing conditions based on existing traffic counts, roadway geometrics, vehicle classification and speed distributions. One of the key complexities related to traffic flow at Sky Harbor is the vehicle mix along the roadway network. Seven different vehicle types were coded within VISSIM to account for the affect they have on the traffic flow stream. For example, shuttle buses make frequent stops, thus slowing down through vehicles along the roadway network. These vehicles were coded in VISSIM using the transit function and were routed separately in the model based on bus routing information. Separate routes were coded for inter-terminal shuttles as well as rental car center shuttles.



VISSIM Traffic Simulation Network

Integration – The Key to Providing Efficiency to the Analysis & Communication Processes

The main goal of this project is to provide Sky Harbor management with the ability to accurately assess the impacts (as well as identify potential solutions) of various Sky Harbor initiated alternatives (i.e. moving employee parking) and their potential impacts to key roadways and intersections that provide access for both customers and employees of the Sky Harbor. A key element in the integration was the transfer of origin-destination data from the Phoenix Sky Harbor Airport travel demand model to the traffic simulation model. This capability was a key ingredient in modeling the complex airport and non-airport travel patterns.

It was decided that to achieve the goals of the project, the approach of integrating the travel demand model with the traffic simulation model was developed. The main reason for integrating the models is two-fold; (1) more accurately analyze the operations along the study roadways by having the ability to easily transfer results between both tools and perform multiple iterations and (2) easily communicate the results through the animations created by VISSIM.

This integrated approach to transportation planning for Sky Harbor International Airport is a work in progress. Next steps include developing models for year 2015 and year 2030 planning horizons. Once these tools are developed, they will be used to evaluate multiple airport ground access improvement scenarios and assess the interface with the regional transportation network.



3D Screen Shot Depicting Existing Roadway Network

Author Information

Jill Bennett, PE – Senior Project Manager
Brent Cain, PE – Senior Transportation Engineer
Michael Gorton, AICP – Senior Transportation Planner
Jessica Hernandez – Transportation Planner

HDR Engineering, Inc.
3200 East Camelback Road, Suite 350
Phoenix, AZ, 85018
(602) 522-7700

Michael Trueblood, PE, PTOE – Senior Transportation Engineer
HDR Engineering, Inc.
1870 Park 270 Drive, Suite 105
St. Louis, MO, 63146
(314) 275-1700