A Combined Quantitative and Qualitative Approach to Planning for Improved Intermodal Connectivity at California Airports (TO5406)

(Quarterly Meeting)

May 9, 2006

Project Team: Dr. Xiao-Yun Lu, Dr. Geoffrey Gosling, Ms. Jing Xiong, Dr. Steven Shladover,
Outline

- **Objective**
- **Project Status**
  - Progress on Current Tasks
  - Working Paper
  - First Year Report
- **IAPT Development**
- **IAPT Demonstration**
- **Next Steps**
- **Discussion**
Objective

- Develop techniques for analyzing the effectiveness of alternative strategies for improving intermodal connectivity at airports using a combined quantitative and qualitative approach
  - Quantitative: Analytical models of airport traveler and transportation provider’s behavior, traffic networks
  - Qualitative: Descriptive case studies and analysis of agency decision making processes

- Research products:
  - Case studies of intermodal access projects at California airports
  - Develop prototype Intermodal Airport Ground Access Planning Tool (IAPT)
  - Using IAPT to evaluate selected case study projects at California airports
  - Policy recommendations and planning guidelines
Project Status – Progress on Current Tasks

- Develop prototype user interface module for the Intermodal Airport Ground Access Planning Tool.
  - Preliminary screen design distributed for review
  - Programming of user interface in progress

- Develop mode choice analysis module for the prototype Intermodal Airport Ground Access Planning Tool and calibrate on data for selected region
  - Define mode choice model structure
  - Define mode choice analysis module data structure and interfaces with other IAPT modules
  - Review recent airport access mode choice models developed in other studies
  - Assemble airport ground transportation service data for calibration region
  - Assemble air passenger survey data for the model calibration region and geocode to analysis zones
  - Review and clean the air passenger survey response data
  - Assemble mode choice model estimation input files and perform iterative model estimation runs to develop mode choice model utility functions and parameter values
Project Status – Progress on Current Tasks

- Developing model of transportation service provider behavior
  - Selection of modeling paradigms (Nash game and elasticity-based)
  - Mathematical modeling and analysis
  - Algorithm development and programming in C code
  - Definition of example case for a single zone with multiple modes to test convergence
  - Generalize approach to multiple zones for all the modes

- Developing interface between sub-modules
  - Explore software language/application interface
  - Development of data table specifications
  - Commence programming module interface code

- Explore intermodal connectivity considerations in airport ground access
  - Review connectivity issues in transit network planning
  - Measuring connectivity in airport ground access
  - Integration with IAPT performance measures
Project Status – First Year Products

• Working paper
  – Published in final form in March 2006

• First Year Report
  – Added abstract
  – Added Executive Summary
  – Incorporated Caltrans comments
  – Under PATH review for publication
Current Status of IAPT Development

• **Graphical user interface**
  – Programming IAPT functions in progress
  – Interaction with IAPT data tables achieved

• **Mode choice model development**
  – Preparation of model estimation datasets in progress

• **Implementation of mode choice calculations**
  – Initial version of mode choice model implemented using model coefficients from Dowling Associates model for San Jose International Airport
    • Model specification hard coded in software
    • Future enhancements will allow user specification of model functional form

• **Implementing other calculations**
  – Work commenced on programming transportation provider behavior module
Mode Choice Model Development

- Assemble model estimation datasets
  - Air party data
    - Response data from MTC 2001/2002 Bay Area air passenger survey
    - Sample size (2001 survey wave)
      - Oakland 1,298 usable responses
      - San Francisco 1,869 usable responses
      - San Jose 1,122 usable responses
    - Variables
      - Air party size
      - Bay Area residency and trip purpose (res/bus, res/nonbus, vis/bus, vis/nonbus)
      - Ground origin type (home, office, hotel, etc.)
      - Ground origin location (TAZ)
      - Trip duration
      - Household income
  - Transportation service data
    - Travel times and costs for each available mode
    - Airport ground access trips to each airport from each analysis zone
      - MTC 1,454 traffic analysis zone (TAZ) system
Mode Choice Model Development

- **Technical challenges in assembling model estimation datasets**
  - Missing or incomplete air party data
    - Trip duration
    - Household income
  - Access to primary fixed-route mode (e.g. BART, scheduled airport bus)
    - Currently assume drop-off by private vehicle
    - In practice likely to vary by air party characteristics and location
      - Walk for short distances
      - Ride feeder transit bus routes where available
      - Drive and park in some situations
      - Taxi
  - Accounting for full perceived disutility of private vehicle use
    - Driver time for drop-off by private vehicle
      - Two-way trip
    - Vehicle operating costs
  - Some modes are only available to certain air parties
    - Hotel courtesy shuttle
    - Parking for duration of air trip
Mode Choice Model Development

- Household income (Oakland Airport air parties 2001)
Mode Choice Model Development

- **Technical issues in model specification**
  - Influence of time of day or day of week on travel times or service availability
    - AM peak, PM peak, off-peak, weekend
  - **Choice of multiple transit routes**
    - Transit bus direct to airport
      - Most likely with transfer between routes
    - Transit bus to rail system
      - May involve shuttle link to airport (e.g. AirBART)
  - **Choice of parking location**
    - Involves trade-off between cost and convenience
      - Direct representation in nested model
      - Approximated by non-linear cost function by trip duration
  - **Appropriate modeling of rental car use**
    - Decision to rent a car typically involves more than the airport access trip
      - Need for mobility during a visit to the area
    - Once a car is rented in needs to be returned to the rental location
      - Rental car users do not have an access mode choice decision
Model Estimation Dataset – Oakland Airport

2001 Estimation Dataset Mode Use

- Auto drop
- Auto park
- BART
- Transit bus
- Airport bus
- Taxi
- Hotel courtesy van
- Limousine
- Shared-ride van
- Rental car

Legend:
- Resident Business
- Resident Nonbusiness
- Visitor Business
- Visitor Nonbusiness
IAPT Demonstration

- Prototype version of IAPT is being developed in Visual C++
- Current focus on implementing model logic
  - Air party mode choice
  - Transportation provider behavior
  - Evaluation
- Demonstration of current status of software development
Intermodal Airport Ground Access Planning Tool

The Intermodal Airport Ground Access Planning Tool (IAPT) provides a user-friendly analysis environment to support the definition and evaluation of a range of alternative potential projects to improve airport ground access. The IAPT contains an analysis model that projects the use of available ground access/egress modes defined for each project and that takes into account the response of transportation service providers to the changing use of the available modes.

Terminology

The following terminology is used in the IAPT:
Next Steps – Continued Development of IAPT

• GUI development
  – Modify screen layouts for consistency with IAPT design
  – Complete interface with database, data files and other modules

• Calibration of mode choice model
  – Complete preparation of Bay Area service data
  – Model estimation and development

• Transportation provider modeling and algorithm
  – Modeling constraints to generate realistic results
  – Refining representation of transportation provider decision making
  – Testing alternative optimization software
  – Convergence issues

• Development of project evaluation module
  – Calculating measures of performance
  – Interface with mode choice model results