A Combined Quantitative and Qualitative Approach to Planning for Improved Intermodal Connectivity at California Airports (TO5406-6406)

(Quarterly Meeting)

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

- Objective
- Project Status
- 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
  - Preliminary version of multinomial logit model estimated for OAK
  - Model development in progress
Project Status – Progress on Current Tasks

– Developing model of transportation service provider behavior
  • Module development underway

– Developing interface between sub-modules
  • Nearly finished

– 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

– First Year Report - Printed
Current Status of IAPT Development

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

• **Implementation of mode choice calculations**
  – Allow user specification of model functional form
  – Calculate mode choice probability from three aspects:
    • Multinomial model
    • Nested logit model
    • Survey data
Current Status of IAPT Development

• Implementing other calculations
  – Transportation provider behavior module development

• Appearance of the IAPT (GUI): Different from design presented in PowerPoint slides and Year 1 report – to simplify computer programming

• Functionality: Similar to previous design

• What we can deliver: A prototype – not a final product
Mode Choice Model Development

- Preliminary estimation of mode choice model for OAK
  - Based on 2001 air passenger survey data
  - Four market segments
    - Resident business trips (279 air parties)
    - Resident personal trips (506 air parties)
    - Visitor business trips (178 air parties)
    - Visitor personal trips (335 air parties)
  - Variables included in the model
    - Alternative-specific constants
      - Includes times and costs that are constant for each mode e.g. AirBART fare and travel time
    - Total door-to-door travel time (minutes)
      - Including average waiting time
    - Total out-of-pocket costs ($)
Mode Choice Model Development

• **Structure of the preliminary model**
  – Multinomial logit model
  – 7 modes included in model
    • Auto drop-off
    • Auto park for trip duration
    • BART
    • Public transit bus
    • Scheduled airport bus
    • Taxi/limousine
    • Shared-ride van
  – **Use of 2 modes estimated independently**
    • Rental car
    • Hotel courtesy shuttle
Mode Choice Model Development

2001 Estimation Dataset Mode Use

OAK

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

Modes and categories:
- Resident Business
- Resident Personal
- Visitor Business
- Visitor Personal
Mode Choice Model Development

- **Initial estimation results**
  - **Resident model parameters** statistically significant and have plausible values
    - Implied values of time seem rather high
  - **Visitor model parameters** (not shown) are similar but generally have statistically weaker fit and/or incorrect sign
    - Indicates potential problems with model specification and/or data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Res/Bus</th>
<th>Res/Pers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constants</strong></td>
<td></td>
<td></td>
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<tr>
<td>Auto park</td>
<td>+0.46 (1.58)</td>
<td>+0.35 (1.69)</td>
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<tr>
<td>BART</td>
<td>-2.53 (6.71)</td>
<td>-1.82 (9.34)</td>
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<td>Transit bus</td>
<td>-5.80 (4.75)</td>
<td>-5.02 (8.26)</td>
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<td>Airport bus</td>
<td>-0.92 (1.59)</td>
<td>-0.37 (1.21)</td>
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<tr>
<td>Taxi/limousine</td>
<td>-1.72 (4.24)</td>
<td>-1.86 (5.69)</td>
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<tr>
<td>Shared-ride van</td>
<td>-3.81 (5.18)</td>
<td>-2.22 (7.88)</td>
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<tr>
<td>Travel time (min)</td>
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<td>-0.0149 (5.22)</td>
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<tr>
<td>Cost ($)</td>
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<td>-0.0215 (6.00)</td>
</tr>
<tr>
<td>Implied value of time ($/hr)</td>
<td>116</td>
<td>42</td>
</tr>
</tbody>
</table>
Mode Choice Model Development

- **Potential improvements to model**
  - Improved model specification
    - Additional variables and availability restrictions
    - Nested structure
  - Address data problems uncovered in model estimation

- **Inclusion of additional variables and restrictions on availability of alternative modes**
  - Explore role of household income, luggage, trip origin type
  - Some modes not available for some air parties
    - Drop-off by private vehicle not generally available for visitors staying in hotels
  - Geographical constraints
    - Scheduled airport bus (Airporter) only available in the North Bay counties
Mode Choice Model Development

• Need for further data cleaning
  – Errors in reported trip origin type
    • Stated trip origin type does not agree with reported address
  – Errors in reported access mode use
    • Stated mode not available from origin location

• Typical data reporting problems
  – A number of visitors appear to have misunderstood the question about where they began their trip
    • Reported how they got to the airport where they began their trip
  – Confusion over what is a “regular transit bus” or “scheduled bus”
    • Some respondents appear to have considered the AirBART shuttle as one or other of these categories (or may actually have taken an AC Transit bus from the Coliseum BART station to the airport)
    • Others appear to have reported a shared-ride van service as a “scheduled bus”
Mode Choice Model Development

• **Importance of data cleaning**
  – Inclusion of records with incorrect mode or other attributes can significantly bias the estimated model parameters
    • Model estimation software attempts to explain these anomalies by adjusting the parameter values
  – Some errors can be identified but the correct value cannot be inferred from the reported data
    • Two options:
      – Discard the record
      – Assign an assumed value based on other reported attributes
    • Choice depends on the extent of missing or suspect data
      – Sample size is not so large that we can afford to discard many records

• **Implications for project workload**
  – Data cleaning is very labor-intensive
    • Difficult to automate
Modeling rental car use

- Rental car use is a significant access mode for visitor trips
  - Over 50 percent of visitor business trips at OAK in 2001
  - Decision to rent a car is generally influenced by the need for local transportation during the visit
    - No information on this in the survey
    - Vehicle will usually be rented at the airport and therefore used to return to the airport
  - Can develop a simple model based on trip origin type and duration of visit

Modeling hotel courtesy shuttle use

- Travelers staying in hotels with courtesy shuttles who have not rented a car can be assumed to use the courtesy shuttle
  - Airports have lists of hotels that provide courtesy shuttles, since there is an access fee for each shuttle trip
IAPT Demonstration

- Prototype version of IAPT is being developed in Visual C++

- Current focus on implementing model logic
  - Nested logit model
  - Transportation provider behavior
  - Performance parameter calculation

- Demonstration of current status of software development
Next Steps – Continued Development of IAPT

• Calibration of mode choice model
  – Improved model for OAK
  – Extension to other two Bay Area airports

• 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

• Case studies

• Policy and recommendations
Discussion

- Requirements to develop IAPT into a distributable product
- Refinement of the GUI appearance
- Demonstration of the IAPT to potential users
- Research needs beyond the current project
  - Airport employees trips
  - Air cargo access/egress trips