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

(Bi-Monthly Meeting)

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

- Objectives of this Meeting
- Overview of the Proposed Framework for a Combined Quantitative and Qualitative Approach to Airport Ground Access Planning
- Literature Review
- California Airport Ground Access Needs
- Case Studies
- Next Steps
- Discussion
Objectives of this Meeting

• Review California Airport Ground Access Needs and Role of Intermodal Access
• Discuss Agency Decision-Making Process and Need for Quantitative Analytical Framework
• Identify Potential Case Studies
• Discuss Selection of Case Study for Development of Quantitative Analytical Airport Ground Access Planning Tool
Overview of the Proposed Combined Quantitative and Qualitative Approach

Intermodal Airport Ground Access
Transportation Planning & Analysis Tool

Road traffic network model
Mode & transportation agency model
Decision making in the Tool
Parameters relevant to alternative solutions
Factors from Qualitative Consideration which are Difficult to quantify

Decision Maker:
Policy making

Recommended policy and guidelines
Policy gaps

Data analysis for Policy evaluation

Policy execution

Practical Intermodal Transportation Systems in level 3 & 4

Data analysis & modeling
Overview of the Proposed Combined Quantitative and Qualitative Approach
Literature Review

• Previous work on California Airport Ground Access: Passengers and air cargo
  – Strategic planning
  – Qualitative approach

• Quantitative approach
  – Air passenger mode choice models: empirical approach – prediction issues with new modes/services
  – Airport employee mode choice models not available
  – Lack of quantitative model for transportation provider behavior

• Qualitative approach
  – Institutional issues
  – Funding sources
  – Relationships between decision-makers
  – Airport ground access needs

• Previous work on combined quantitative and qualitative approach for airport ground access planning
  – Strategic planning
## California Airport Ground Access Needs Addressed in this Project

### Decision Making Level and Principles

<table>
<thead>
<tr>
<th>System Level</th>
<th>Function</th>
<th>Strategic Planning</th>
<th>Refined (Implementation Related) Planning</th>
<th>Real-time Coordination (Synchronization in Operation)</th>
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<td>National</td>
<td>Landrum &amp; Brown Team: policy recommendations focusing on institutional issues and function and relationships of all the levels</td>
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<td>State</td>
<td>Landrum &amp; Brown Team: policy recommendations focusing on institutional issues and function and relationships of all the levels</td>
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California Airport Ground Access Needs – Decision Making Issues

• **State level**
  – Traffic impact on the state highway network
  – Impact of airport accessibility on the state economy
  – Air quality
  – Capital investment requirements
  – Total travel time savings
  – Interests of local communities
    • Land use
    • Noise

• **Metropolitan, County and City levels – environmental and socioeconomic concerns**
  – Air quality
  – Noise
  – Community disruption
  – Impact of airport activity on communities and businesses (job generation, etc.)
  – The need for funding to construct and operate transportation systems
  – Land use
California Airport Ground Access Needs – Decision Making Issues

• **Airport level**
  – Terminal curb-front traffic regulation
  – Facility improvements or modification
    • Parking
    • Consolidated rental car facilities
    • Off-airport terminals
  – Reducing total emissions from airport operations
  – Public transit services
  – Airport revenue considerations
    • Setting parking rates
    • Rental car concession fees
    • Revenues from vehicle access – taxis, limos, shared-ride vans, off-airport shuttles, etc.
There needs to be an integrated airport ground access planning, priority assignment, programming, funding allocation and implementation mechanism which includes full coordination and cooperation of different levels of government:

- State level – Caltrans
- Metropolitan, County and City level – MPOs, RTPAs
- FAA (AIP, PFC funding), Airport Authority

Airport ground access should be integrated into the master plans of different levels.

Air transportation is critical for regional, California and US economies. Airport ground access needs are part of the transportation needs for regions and the State from traffic, environmental and economic points of view.

Airport authorities should have an integrated planning, programming, priority assignment, funding allocation and implementation process for airport airside and landside construction to ensure that ground access capability balances airport capacity increases.

Air cargo is a key element for US trade in the international market place. Air cargo should be given equal importance as air passengers in planning airport intermodal access facilities.
California Airport Ground Access Needs

- **Large/Medium commercial airports:**
  - Regional mobility - Not enough transit links
  - Parking availability and costs
  - Local access arterial roads
  - Highways

- **Small non-hub commercial airports:**
  - Roadway geometrics
  - Curbside space
  - Parking

- **General aviation/business airports:**
  - Parking
  - Roadway geometrics
  - Roadway condition

- **Air cargo:**
  - Roadway infrastructure – low capacity vs. high demand
  - Peak hour highway congestion
  - Difficulties of access between off-airport sorting sites and airport

- **Transportation agencies:**
  - Need funding to improve their services and infrastructure
Case Studies

• **Representative intermodal airport access projects**
  • Rail links to airports
  • People-mover or shuttle bus links to nearby rail stations
  • Express bus services to regional intermodal terminals
  • Express bus services to off-airport terminals

• **Conditions for effective intermodal rail access projects**
  • Rail service frequency and hours of operation
  • Proportion of airport trip ends near rail system stations
Potential Case Study Airports

- **California airports with direct rail connections**
  - San Francisco International (BART)
  - Burbank (Amtrak/Metrolink)

- **California airports with shuttle bus links to rail service**
  - Los Angeles International (Metro)
  - Oakland International (BART) – planned people-mover
  - San Jose International (Santa Clara Light Rail) – planned people-mover

- **California airports with off-airport terminals**
  - Los Angeles International (Van Nuys FlyAway)
  - San Francisco International (Marin Airporter)

- **California airports with nearby rail service but no dedicated link**
  - Long Beach (Metro)
Proposed Case Study Selection for Development of Intermodal Airport Ground Access Planning Tool

- **San Francisco Bay Area**
  - Three commercial service airports of varying size with wide range of airport ground access options
    - San Francisco International
    - Oakland International
    - San Jose International
  - Variety of regional and intercity rail systems
    - BART
    - Caltrain
    - Santa Clara light rail
    - Amtrak (Capitols/San Joaquin)
  - Express bus and off-airport terminals

- **Air passenger data considerations**
  - MTC air passenger survey (2001-2002)
    - Consistent survey at all three airports
    - Sample size
    - Information on access to fixed route modes
Next Steps: Data Collection Plan

• Considerations:
  – What data are needed for modeling, validation and case studies
  – What data is readily available and what will require research to identify
  – Level of detail of needed data
  – Available data sources

• Data for air passenger and airport employee behavior modeling:
  – (a) Data type: Trip origins and destinations, routing, demand, flow patterns for hour of day and day of week;
  – (b) Data Sources:
    • MTC Survey
    • BART
    • CalTrain
    • AC Transit
    • SamTrans
    • Shuttles & taxis: vehicle counts from transponder data
    • Airport parking
    • Rental cars – usage may be inferred from airport concession fees
    • Off-airport parking
Next Steps: Data Collection Plan

- Data for transportation providers
  - (a) Data type: Routing, schedule, fare and usage (reflecting demand – or response from customers)
  - (b) Data sources
    - BART
    - CalTrain
    - AC Transit
    - SamTrans
    - Shuttles, Taxis
    - Airport Parking
    - Car Rentals
    - Off-Airport Parking

- Data for traffic network in airport vicinity
  - (a) Data type and duration: (Density and flow for hour of day and day of week)
  - (b) Data sources:
    - Within 3~5 miles of airport: from MTC and Caltrans District 4
    - Arterial data: from MTC, CMAs or Caltrans District 4
    - Freeway traffic data related to airport: from MTC or PeMS 4.1 data from Internet
Next Steps: Data Collection Plan

• **Data for Air Freight:**
  – (a) Market segments
    • Freight on passenger flights
    • Freight-only carriers: FedEx, UPS, DHL, Airborne, etc.
  – (b) Data Sources
    • Data in EIR/EIS documents for air freight facilities
    • Contact air freight service providers
    • US DOT airline and freight flow data
    • Prior and current ITS research on air freight transportation
    • Air freight studies by MPOs and others
    • Vehicle counts near air freight facilities
Next Steps: Preliminary Modeling Considerations – Decision Making

• The main decision-making process requires a quantitative analysis of costs and benefits of proposed projects
  1. Capital and operating costs
  2. Benefits to users and others
  3. Sensitivity of results to value of time

• Define a finite set of alternative projects to be evaluated or compared to a proposed project

• Use of operational research techniques to quantify the expected response of different agencies and service providers to the introduction of a specific alternative

• Use of behavioral modeling to quantify the user response to the changes in the choice sets available under each specific alternative

• Identify trade-offs in performance criteria among the possible alternatives, to aid decision-makers in seeking the best alternatives
**Next Steps: Preliminary Modeling Considerations – Decision Making at Different Levels**

**Maximize:** Social and economic benefit – maximize commodity and passenger transport flow, etc

**Minimize:** Cost (in building new link and/or services), pollution, impact on urban traffic, total travel time

**Decision:** Recommended policies and guidelines (infrastructure & non-infrastructure related)

Modeling and decision making in this block should focus on cost benefit analysis. To make a proper trade-off between benefit and cost.

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**Parameters (policies) directly affecting transportation agency behaviors:** Revenue, to encourage cooperation or competition in services

**Airport Policies:** to influence shuttle, taxi, bus, rental car, and other transportation providers

**Parameters (policies) affecting transportation traffic network (Infrastructure related):** Any factor affecting services the traffic network reconfiguration will affect passenger mode choice and transportation provider’s services.

Services: Improve information systems like 511

**Parameters (Caltrans policies) affecting customer behaviors:**
Price on Bridge Toll
Policies on HOV Lane access
Policy on CNG vehicle and Hybrid vehicles use

**Airport Policies:** Parking price, information at airport

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2. **Mode & agency model: agency activities**

3. **Customer behavior: Mode choice model**

4. **Traffic Network Configuration**

- Rail, Light rail, People mover
- Roadway traffic model
Next Steps: Preliminary Modeling Considerations – Mode Choice

• Air passenger access/egress mode choice determines vehicle trips and hence roadway traffic levels
  – Shared-ride vehicle trips also depend on vehicle occupancy

• Air passenger mode choice models
  – Well-developed theoretical basis for behavioral choice models
  – Disaggregate (air party) approach
    • Choice influenced by air party characteristics
  – Nested logit structure required to reflect mode substitution patterns and mode access considerations
  – Model parameters estimated from air passenger survey data using maximum likelihood techniques

• Model application
  – Model applied to a representative sample of air party trips to predict mode choice when ground access system characteristics change
  – Inherent attributes of new modes (mode-specific constant terms) will need to be estimated outside the model, by comparison with other models, use of stated preference techniques, etc.
Next Steps: Preliminary Modeling Considerations

**Mode choice model**

- **Air Passenger Demand**
  - Mode Choice Decision Principle
    - Personal Travel
      - Resident
        - Low & Medium income
          - Minimize cost
      - Non-Resident
        - High income
          - Minimize travel time; Maximize convenience, Comfort and safety
    - Business travel
      - Resident
        - All level income
          - Minimize travel time; Maximize convenience, Comfort and safety
      - Non-Resident
    - Mode choice model not available
  - Airport employees

- Passengers using other transport means
- Passengers using their own vehicles

Decision variable: mode & service choices (routing is determined by service)

Mathematical modeling: From passenger demand to traffic – passenger ramifications

- Passenger own vehicles
- Airport parking
- Pickups and drops
Next Steps: Preliminary Modeling Considerations –

Roadway traffic model: flow & volume

1. Traffic network model for an influence area planning:
   - **zone 1**: within 5 miles, involving main local streets, arterials and freeways;
   - **zone 2**: between 5-10 miles, involving arterials and freeway, centroid connectors;
   - **zone 3**: between 10-30 miles, involving freeways only, centroid connectors

2. Traffic networks for intra-regional planning: Involving both freeways and Arterials

3. Traffic networks for inter-regional planning: Involving freeways only

Modeling in this part should focus on:

(a) The traffic flow into general traffic network from the airport. This will need to count the vehicle demand and flow pattern;
(b) Back effect of passenger mode choice by general traffic flow pattern Such as Bay Bridge, US-101 traffic for SFO and I-880 for OAK
(c) Back effect of passenger mode choice by airport traffic flow pattern
Next Steps: Preliminary Modeling Considerations - Software Structure, Data Flow and Interfaces
Discussion

• Selection of SF Bay Area for model development
  – Range of ground access modes and services
  – Extensive and well-integrated regional rail network
  – Validation opportunity provided by BART link to SFO
  – Proposed people-mover projects to enhance rail access at OAK and SJC
  – Extension of analysis to airport employee and air cargo traffic

• Requirements for other case study airports
  – Range of airport sizes and nature of air service
  – Nature of feasible ground access services at smaller airports