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TRANSPORTATION RESEARCH BOARD

Passenger Value of Time, BCA, and Airport Capital Investment Decisions

Thursday, September 13, 2018
2:00-3:30 PM ET

Purpose

Discuss research from the Airport Cooperative Research Program (ACRP)'s Web-Only Document 22: Passenger Value of Time, Benefit-Cost Analysis, and Airport Capital Investment Decisions. The webinar will focus on Volume 1: Guidebook for Valuing User Time Savings in Airport Capital Investment Decision Analysis.

Learning Objectives

At the end of this webinar, you will be able to:

- Describe how values of time vary by which segments of a trip are impacted by specific capital improvement projects
- Understand how to value time for business and personal travelers
- Understand how to incorporate value of time into a BCA

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- Managed by TRB and sponsored by the Federal Aviation Administration (FAA).
- Seeks out the latest issues facing the airport industry.
- Conducts research to find solutions.
- Publishes and disseminates research results through free publications and webinars.

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Unmanned Aerial Systems at Airports

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Additional ACRP Publications Available on Today's Topic

Report 25: *Airport Passenger Terminal Planning and Design, Volumes 1* and *2*

Report 79: *Evaluating Airfield Capacity*

Report 104: *Defining and Measuring Aircraft Delay and Airport Capacity Thresholds*

Synthesis 28: *How Airports Measure Customer Service Performance*

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Today's Speakers

Steven Landau and Glen Weisbrod
Economic Development Research Group, Inc.
and
Geoffrey Gosling
Aviation System Consulting, LLC

Presenting Web-Only Document 22:

Passenger Value of Time, Benefit-Cost Analysis, and Airport Capital Investment Decisions

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ACRP Research Project 03-19 (Web-Only Document 22)

Passenger Value of Time, Benefit-Cost Analysis, and Airport Capital Investment Decisions

Steven Landau, EDR Group
Geoffrey Gosling, Aviation System Consulting
Glen Weisbrod, EDR Group

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Presenters

Steven Landau, Principal Investigator

Geoffrey Gosling, Co-Principal Investigator

Glen Weisbrod, Guidebook Task Leader

Other Key Research Staff: Thomas Adler, Mark Fowler, Sharon Sarmiento, Kenneth Small & Christopher Williges

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ACRP 03-19
Oversight Panel

Mr. William Radinson, Chair
Mr. Jerry Allen, AAE
Dr. Jeffrey Cohen
Mr. Robert A. Hazel
Mr. Theodore S. Kitchens
Dr. Iris M. Mack
Mr. Robert Samis, FAA Liaison
Mr. Dennis Walsh, FAA Liaison
Mr. David S. Lee, Air Transport Association
Mr. Chris Oswald, ACI-NA
Ms. Christine Gerencher, TRB Liaison
Mr. Lawrence D. Goldstein, ACRP Senior Program Officer

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Context and Motivation

- Air passenger travel time savings are a key part of benefit-cost analysis of airport projects
- Current practice and guidance assign the same value to all stages of a traveler's air journey
- FAA and US DOT recommended values:

Trip Purpose	Recommended Values	Plausible Range	
		Low	High
Business	$60.00	$48.00	$72.00
Personal	$32.60	$28.00	$41.90
All Purposes	$43.70	$36.10	$54.10

- However, our research shows that travelers value time savings differently depending where they occur

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Purpose of Research

1. Understand how air travelers value their time

2. Improve the application of benefit-cost analysis for airport investment decision-making

3. Develop a guidebook on applying the research findings, which could be of immediate use in evaluating capital investments at airports

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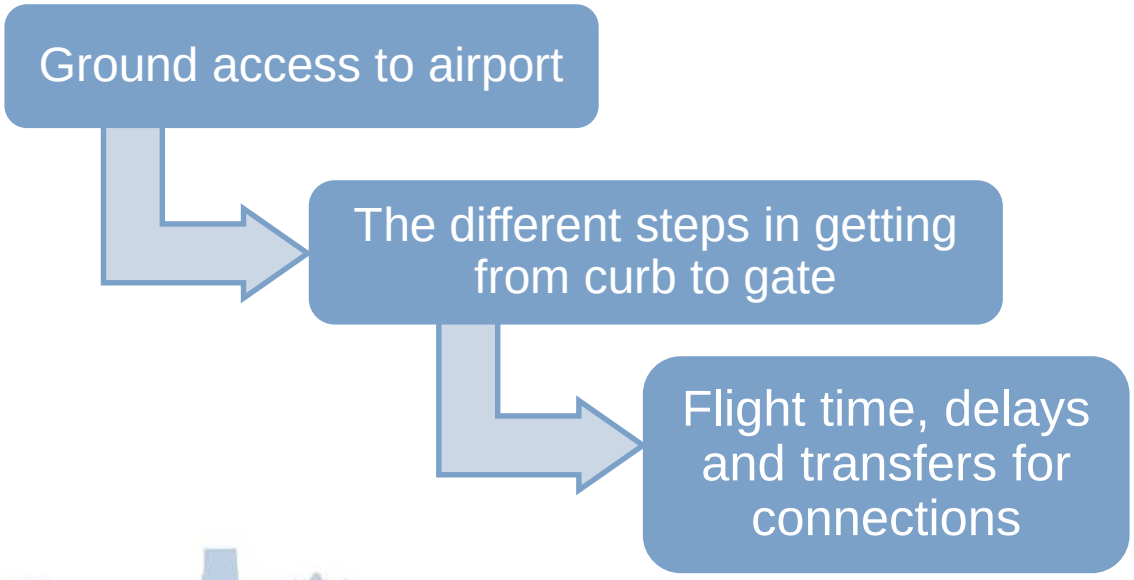
Research Objectives

- ✓ Improve the application of benefit-cost analysis for airport investment decision-making by considering how air traveler values of time vary over the different stages of a given air trip
- ✓ More specifically, develop estimates of the value of travel time savings for:



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Trip Segments Related to Capital Improvement Projects

Arrival & Departure

- ✓ Ground-side access time to the airport
- ✓ Baggage pickup and terminal egress time
- ✓ Ground-side egress time from the airport

Access to Gate

- ✓ Time spent in flight check-in and security screening
- ✓ Time walking to gate

Travel Time

- ✓ Time spent in the gate area before boarding the flight
- ✓ In-aircraft time, distinguished between scheduled flight time and arrival delay
- ✓ Transfer time to make flight connections

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Setting the Context

- ✓ Literature review of tools and techniques used for capital investment decision making
- ✓ Case studies of airport capital investment decisions
- ✓ Considerations in valuing of time

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Considerations in Valuing Time

- Willingness to pay
- Reliability
- Individual components of time in air travel
- Productive use of time
- Other considerations*
- Implications for measurements

* e.g., safety, income, multi-person parties

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Research Methodology

An online survey was undertaken of a sample of air travelers who had made a paid domestic air trip in the previous six months

- Respondents were obtained from a commercial survey panel vendor and screened for a qualifying air trip
- A sample of 1,171 valid responses was obtained

Respondents completed stated preference experiments designed to allow the estimation of perceived values of travel time savings

- Addressed different segments of an air trip

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Survey Approach

Survey collected data on respondent household characteristics and details of their most recent air trip

- Origin and destination airport
- Departure and arrival times and any flight connections
- Airline and airfare

Respondents were presented with two sets of 8 choice scenarios for their most recent trip

- Each scenario presented two alternatives and respondents indicated which alternative they would have preferred had those been the only options available
- The scenarios varied the time that would have been spent in each stage of the trip as well as the air fare and flight details

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Stated Preference Experiments

To keep the dimensions of the choice experiments manageable, each set of scenarios addressed ***either***

- Choice between two alternative flights
  - Airline and aircraft type; airfare
  - Departure and arrival times, non-stop or connecting
  - Percent flights delayed and expected delay duration
- Choice between two landside scenarios
  - Ground access mode with associated travel time and cost
  - Time spent in different stages of the passenger terminal
    - Terminal access (from parking lot or transit stop to terminal)
    - Check-in and security
    - Time to reach the gate area; time spent in gate area

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Stated Preference Analysis: Scenario Generation

Hypothetical values for each scenario were generated automatically for each respondent by systematically varying the actual values reported for their most recent air trip

Each scenario is thus a plausible alternative for the air trip actually taken

Filters were applied to eliminate unrealistic scenarios (e.g. a connecting flight taking less time than a nonstop) or scenarios where one alternative was clearly superior on all criteria

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Stated Preference Modeling

Binary logit choice models were estimated to predict the chosen alternative in each scenario

- Each utility function included coefficients for the different time components and a cost variable (airfare or ground access cost)
- The ratio of the estimated time coefficient to the estimated cost coefficient gives the implied *perceived value of time* for that time component

Implied values of time were estimated for subsets of survey respondents

- Business vs. leisure trips
- Ranges of individual income

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Analysis Results (1 of 4)

Implied values of time

- Willingness-to-pay (WTP) for time savings - $/hour

Component	WTP - Business	WTP - Leisure
Airport Time Components Choice Experiments		
Ground access time	$18.60	$16.95
Terminal access time	$33.85	$26.01
Check-in and security time	$37.19	$28.45
Time to reach the gate area	$32.25	$22.83
Gate time	$20.48	$17.62
Flight Itinerary Choice Experiments		
Flight time	$51.01	$34.91
Expected value of flight delay	$286.32	$123.30

Analysis Results (2 of 4)

Implied values of time

- Percent US DOT recommended values

Component	WTP - Business	WTP - Leisure
Airport Time Components Conjoint		
Ground access time	31%	52%
Terminal access time	56%	80%
Check-in and security time	62%	87%
Time to reach the gate area	54%	70%
Gate time	34%	54%
Flight Itinerary Conjoint		
Flight time	85%	107%
Expected value of flight delay	477%	378%

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Influences of Respondent Characteristics

Respondent income

- Analysis used individual income rather than household income
- Values of flight time and delay about three times higher for respondents with incomes of $200,000 or more than those with incomes under $75,000
- Differences in values of ground access and terminal times for respondents with incomes of $200,000 or more compared to those with incomes under $75,000:
  - About 2.75 times for business trips
  - About 1.5 times for leisure trips

Analysis Results (3 of 4)

Implied values of time (by income range)

- Business trips

Component	Individual Income (2012 $ before taxes)		
	Less than $75,000	$75,000 - $199,999	$200,000 or more
Airport Time Components Choice Experiments			
Ground access time	$13.92	$21.31	$38.49
Terminal access time	$23.75	$36.34	$65.66
Check-in and security time	$27.75	$42.45	$76.70
Time to reach the gate area	$22.63	$34.62	$62.55
Gate time	$14.23	$21.78	$39.34
Flight Itinerary Choice Experiments			
Flight time	$33.66	$58.91	$100.99
Expected value of flight delay	$186.34	$326.09	$559.01

Analysis Results (4 of 4)

Implied values of time (by income range)

- Leisure trips

Component	Individual Income (2012 $ before taxes)		
	Less than $75,000	$75,000 - $199,999	$200,000 or more
Airport Time Components Choice Experiments			
Ground access time	$14.56	$16.63	$22.14
Terminal access time	$22.09	$25.22	$33.58
Check-in and security time	$24.27	$27.71	$36.90
Time to reach the gate area	$19.27	$22.01	$29.30
Gate time	$14.91	$17.03	$22.67
Flight Itinerary Choice Experiments			
Flight time	$30.05	$41.18	$95.43
Expected value of flight delay	$107.11	$146.77	$340.16

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Guidebook

- Objective: more accurate benefit-cost analysis for proposed airport improvement projects (meeting FAA requirements)
- Covers passenger benefits (ground access, terminal, airside)
- Does *not* cover time savings for airport or airline staff, vendors, cargo shippers, or ground transportation providers.
- Based on a 5-step process that applies applicable time values for different types of projects.

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Step 1: Screen Project Types

Project Type	Action Type	Effect on Time Delay	
		Yes (potentially)	No
Airport (non-terminal) - Airside			
Air Traffic Control	Upgrade	Increase airport capacity, reduce aircraft delays	
Aircraft Ground Control	Capacity	Save time in waiting to take off	
Runway	New, expanded or enhanced	Reduce aircraft delay via gate or aircraft capacity	
	Maintain, repave		X
	Enhance (lighting, drainage, grading)		X
Taxiways	Expand or improve	Reduce aircraft delay via faster runway exit	
	Maintain, repave		X
Apron Area, Taxilanes, Gate Positions	Expand area	Reduce aircraft ground delay waiting for gate	
	Maintain, repave		X
Hangers, Tie-Downs	Add number		X
Maintenance Facility	Expand		X
Cargo Complex	Handling Capacity (aircraft, tonnage)		X
Airport (non-terminal) – Groundside			
Access Road to Airport	Add lanes, increase travel speed	Reduce congestion delay, save travel time	
People Mover Access to Airport Terminal	Construct; or add frequency, increase speed	Reduce waiting delay, save travel time	
Parking Lot/ Garage	Capacity, travel time, driver information	Reduce parking search time or walk to terminal	
Bus/ Train Transfer to/from Airport	Capacity, travel time	Reduce wait time, walk time	
Airport Circulation Improvments for Taxis	Add capacity	Reduce wait time, walk time	
Drop-off & Pickup Areas, Terminal Curb	Add Capacity	Reduce wait time, walk time	
Terminal – Airside			
Aircraft Gates	Number, aircraft size	Reduce delays to arriving aircraft waiting for a gate	
Seat Capacity at Gates	Expand		X*
Walkway to Gates	Provide moving walkway or people mover	Reduce time getting to gate (offset wait at gate)	
Moving Walkway, People mover to Gate	Capacity, frequency, travel time		
Terminal - Landside			
Passenger Check-in	Add positions	Savings due to faster check in	
Passenger Screening (TSA)	Add lanes and other capacity enhancements	Reduce passenger wait time	
Baggage Handling	Improve inbound baggage facilities	Save wait time to pick up baggage	
Baggage Claim	Expand claim devices	Save wait time to pick up baggage	
Food Court, Shops	Expand or enhance		X*

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Close-Up of Screening Project Types

Project Type	Action Type	Effect on Time Delay
		Yes (potentially)
Airport (non-terminal) - Airside		
Air Traffic Control	Upgrade	Increase airport capacity, reduce aircraft delays
Aircraft Ground Control	Capacity	Save time in waiting to take off
Runway	New, expanded or enhanced	Reduce aircraft delay via gate or aircraft capacity
	Maintain, repave	
	Enhance (lighting, drainage, grading)	
Taxiways	Expand or improve	Reduce aircraft delay via faster runway exit
	Maintain, repave	
Apron Area, Taxilanes, Gate Positions	Expand area	Reduce aircraft ground delay waiting for gate
	Maintain, repave	
Hangers, Tie-Downs	Add number	
Maintenance Facility	Expand	
Cargo Complex	Handling Capacity (aircraft, tonnage)	

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Step 2: Projects →Time Categories

Project Type (Elements)	Ground Access	Terminal Access	Check-In and Security	Reach Gate	At Gate	Flight Time	Flight Delay	To Bag Claim or Exit	Baggage Claim	Ground Egress
AIRSIDE										
Air Traffic Control						X	X			
Runway					X	X	X			
Taxiways						X	X			
Apron Area, Taxilanes and Aircraft Gate Positions						X	X			
GROUNDSIDE										
Access Road to Airport	X									X
People Mover Access to/from Terminal		X								X
Parking Lot/Garage		X								
Central Bus or Train to/from Airport Terminal*		X								X
Airport Circulation Improvments for Taxis		X								X
Drop-off & Pickup Areas by Terminal Curbfront		X								
TERMINAL LANDSIDE (DEPARTURES)										
Passenger Check-in			X							
Passenger Screening (TSA)			X							
People Mover to Gate				X						
Aircraft Gates						X	X			
TERMINAL LANDSIDE (ARRIVALS)										
People Mover from Gate								X		
Baggage Handling									X	
International Arrival Facilities			x**					x	x	

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Step 3: Calculate ΔTime Delay

Affected Passengers

Type of Traveler	Peak Period	Off-Peak Period	Total
Business			
Leisure			
Total			

Terminal / Groundside Delay per passenger

- Based on design and facilities changes affecting passenger capacity, throughput, reliability

Airside Delay per aircraft operation

Weather Conditions and Time Periods	VFR		IFR*	
	Percent Time	Total Pass x Avg. Delay	Percent Time	Total Pass x Avg. Delay
Peak Periods				
Off Peak Periods				

Step 4: Valuation: Reduced Delay

Time Category	Total Annual Person-Hours of Time Saved x Value per Hour of Time ($2013)		
	Base Case	Project Case	Difference
Terminal landside (Departure)			
Ground access time			
Terminal access time			
Check-in and security time			
Time to reach gate area			
Gate time			
Airside (Flight)			
Flight time			
Unexpected flight delay			
Terminal Landside (Arrival)			
Time to reach bag claim or exit			
Baggage claim wait time and exit			
Ground egress time			
GRAND TOTAL			

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Step 5: Benefit-Cost Analysis

Component	Sum Across All Years		
	Undiscounted Value	Discounted Value	Net Present Value
Airline – Revenue Added*			
– Staff Time Cost Savings			
– Operating Expense Savings			
Airport – Revenue Added*			
– Staff Time Savings			
– Operating Expense Savings			
Passengers – Time Savings			
– Expense Savings			
Shifted Trips – Time Savings			
– Expense Savings			
Cargo Operators: Cost Savings			
Salvage Value of Asset			

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Guidebook Use

- Guide is based on *segmentation* by project and user types
- Segmentation allow for *more precise time values* to be applied.
- Result is a change in the *relative benefit* of different types of projects in different locations/contexts.
- Project *ranking, payback* and *BC ratios* are all affected.

Examples shown for Runway, Ground Access, Nav Aid projects.

Warnings: Care needed for passenger diversions among airports.

Limitations: Focus on passenger travel; air cargo and airline impacts are not addressed.

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Conclusions

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Significance of Findings for Benefit-Cost Analysis

Use of recommended FAA/US DOT values of time will overstate the benefits of some projects and understate the benefits of others

- Understate the benefits of flight delay reduction
- Overstate the benefits of projects that reduce ground access or in-terminal times

Values of time increase significantly with income

- Since higher income households make more air trips per year, the values of time found in the ACRP study need to be weighted by air travel propensity to properly reflect the air passenger population

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Need for Further Research

The findings of the ACRP project are not the final word on the topic

- Need to reconcile differences between values for flight time savings and time spent in the airport and access trip

Values of time savings are likely to change over time

- Changing income levels relative to travel and other costs

Recommended further research

- Larger sample size survey to allow combining flight time differences with ground access and airport time differences
- Analysis of differences in the values of time using traveler characteristics other than income

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For additional information:

ACRP Web-Only Document 22

***Passenger Value of Time, Benefit-Cost Analysis, and Airport Capital Investment Decisions* (3 volumes)**

- http://www.trb.org/Main/Blurbs/172472.aspx
- http://www.trb.org/Main/Blurbs/172473.aspx
- http://www.trb.org/Main/Blurbs/172474.aspx

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The Three Volumes

- Volume 1: Guidebook for Valuing User Time Savings in Airport Capital Investment Decision Analysis
- Volume 2: Final Report
- Volume 3: Appendix A Background Research and Appendix B Stated Preference Survey

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Thank You

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Today's Participants

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- Steven Landau, *Economic Development Research Group, Inc.*, slandau@edrgroup.com
- Geoffrey Gosling, *Aviation System Consulting, LLC*, gdgosling@aol.com
- Glen Weisbrod, *Economic Development Research Group, Inc.*, gweisbrod@edrgroup.com

Panelists Presentations

http://onlinepubs.trb.org/onlinepubs/webinars/180913.pdf

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