

An Overview of Operational Issues in Airport Security – A Level of Service Perspective

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Infrastructure Management Conference

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Who are We?

- TransSolutions
 - Based in Fort Worth, TX
 - Branch office in DC
 - Spin-off from Sabre
- Solving facility design and operational problems
 - Simulation modeling
 - Passenger
 - Baggage

Projects

Checkpoint Screening

TSA/Lockheed Martin
Atlanta
Boston
Chicago Midway
Dallas-Fort Worth
Denver
Houston
Miami
Oakland
Ontario
Los Angeles
St. Louis

Baggage Screening

TSA/Boeing
Atlanta
Boston
Dallas-Fort Worth
Miami
Nashville
Oakland
Ontario
Los Angeles
Seattle
St. Louis

Methods Study

Atlanta
Denver
Oakland
St. Louis

Outline

- Level of Service Definition
 - Security and Level of Service
 - Definitions
 - IATA/Fruin
 - How to measure
- Checkpoint Issues
- Baggage screening Issues
- Roadway Issues

The LOS Concept

- LOS includes both qualitative and quantitative assessments of:
 - Comfort (*space*), Convenience (*hassle factor*)
 - Efficiency (*fast*), Throughput (*volume*)
- A Chronology
 - 1960s - Highway Capacity Manual
 - 1971 - John Fruin's *Pedestrian Planning and Design*
 - 1979 - Transport Canada's LOS Definition and Methodology for Calculating Airport Capacity
 - 1981 - AACCC/IATA *Guide for Airport Capacity/Demand Management*
 - 2005 - *New Duration Based IATA*

The LOS Concept

- In airport terminals, typically expressed as space requirement
 - Will passengers fit?
 - Will passengers be comfortable?
- Two aspects
 - Physical capacity
 - Varying demand

Security and LOS

- Secure, but at what cost?
- Increased security brings equipment and staffing costs, further increasing the cost of air travel...
 - Long lines at SSCPs cause missed flights and frustration
 - Airports lose market to others forms of transportation

Perception Framework

LOS	Definition
A	Excellent LOS; condition of free flow; no delays; excellent level of comfort
B	High LOS; condition of stable flow; very few delays; good level of comfort
C	Good LOS; condition of stable flow; acceptable delays; good level of comfort
D	Adequate LOS; condition of unstable flow; acceptable delays for short periods of time; adequate level of comfort
E	Inadequate LOS; condition of cross-flows, system breakdown and unacceptable delays; inadequate level of comfort
F	Unacceptable LOS; condition of cross-flows, system breakdown and unacceptable delays; unacceptable level of comfort

IATA&Fruin LOS

IATA LOS

Terminal Area LOS	Allocated square feet per person					System Breakdown
	A	B	C	D	E	
Check-in Queue	19	17	15	13	11	
Wait/Circulate	29	25	20	16	11	
Hold Room	15	13	11	9	6	
Bag Claim	22	19	17	15	13	
FIS	15	13	11	9	6	

IATA developed specifically for airport terminals

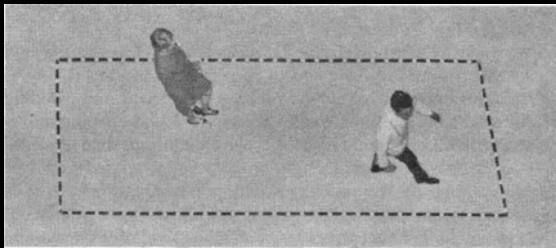
Fruin's work developed based on research conducted in bus terminal

Fruin's Queue LOS

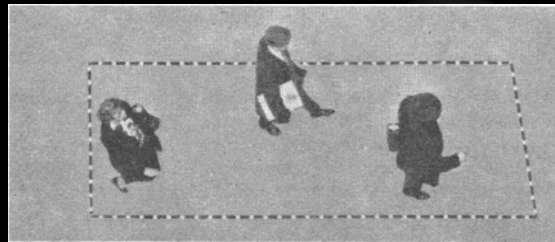
LOS	Description	SF per Person
A	Free circulation zone	13 or more
B	Restricted circulation zone	10 – 13
C	Personal comfort zone	7 – 10
D	No-touch zone	3 – 7
E	Touch zone	2 – 3
F	Body ellipse	2 or less

Fruin's LOS

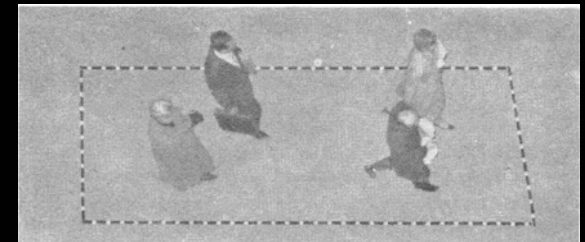
Fruin, J.J., Pedestrian Planning and Design, Revised ed., Elevator World, Inc., 1987.



LOS A (>35 sq.ft. per pax)



LOS B (25-35 sq.ft. per pax)



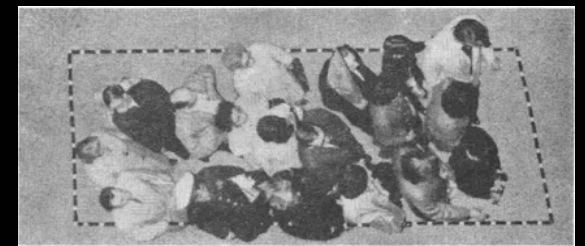
LOS C (15-25 sq.ft. per pax)



LOS D (10-15 sq.ft. per pax)



LOS E (5-10 sq.ft. per pax)



LOS F (<5 sq.ft. per pax)

An Alternative View

- LOS as defined by acceptable passenger processing time or maximum delay
 - Possible to meet processing time specifications yet fail crowding LOS limits
- Percentiles (95% screened in 10 minutes)
 - But 5% may wait very long
 - E.g., ATL security screening checkpoints
 - ~6000 pax in an hour, 5%=300 passengers!... Still a lot of pax to experience poor LOS

Airport Terminal Planning “Draft” Standards

Planning Element	Service/Planning Standard	Recommended Practice
Airport Access	90% of passengers can access the airport within 30 - 45 minutes.	Express train service should be available every 15 - 20 minutes; Employee transportation plan is required.
Check In	Business Class – 90% of passengers are served within 3 minutes. Economy Class – 90% of passengers are served within 5 – 10 minutes. Tourist (Charter/ No Frills) Class – 90% of passengers are served within 10 - 15 minutes. Space for passengers waiting up to 15 minutes. 1.7m ² per passenger, incl. inter-queue space and baggage trolleys. Seating for 5% of passengers.	Island layout is preferred. Minimum distance between islands of 22.25m; T1 JFK counters - a “benchmark” design; CUTE system; Special counters for handling over size baggage; Automated baggage system using IATA 10 digit LP bar code tags or RFID tags; In-line HBS system; Ticket counters at head of each island, or located close-by, with space for back office & safe; Proximity to Alliance partners; Space for future “e”- self check-in kiosks including baggage acceptance.
Security Screening	90 - 95% of passengers are screened within 3 minutes. Space - 0.6m ² per passenger.	
Outbound Passport Control	90% of passengers are served within 10 minutes. Space - 0.6m ² per passenger.	Introduction of biometrics to speed up processing is preferred.
CIP Lounges	4m ² per passenger	Preferred location for lounges is airside in normal passenger flow between check-in and aircraft gates; Size sufficient to be shared by Alliance partners Arrival lounges may be required at large terminating airports.
Departures Lounge	Space – 1.0m ² per passenger. Seating for 10% of passengers where passengers do not have to wait. 60% where passengers do have to wait..	
Gate Lounges	Space – 1.0 – 1.2m ² per passenger. Seating for 70% of passengers. Walking Distance Maximums of 250 – 300m unaided & 650m with moving walkways (of which not more than 200m unaided). APMs for travel over 500m.	WB aircraft should be parked close to the main PTB to reduce the walking distances for largest numbers of passengers; Gate lounge should include podium counter close entrance to PBB & include CUTE system with 2 boarding pass readers for aircraft larger than type C, a document printer & boarding pass printer; Shared baggage facility (shutes/freight elevator to apron level) at the gate lounges for excess cabin baggage, strollers & wheelchairs.
Passenger Boarding Bridges	90 - 95% of passengers (on an annual basis) will be served by a passenger boarding bridge.	Apron drive bridges with 400 Hz fixed ground power, air conditioning & potable water attached; Glass construction preferred; Double bridges for 747s & NLA's; Aircraft docking guidance system; Ramps (with slope not exceeding 1:12) should be used to connect the PBB with the departures gate lounge (upper level) and with the arrivals corridor (lower level);
Aircraft On-Time Performance	Departure – 90% of aircraft will take-off 15-20 minutes after departure (timetable) time. Arrival – 90% of aircraft will dock within 10-15 minutes after landing.	Sufficient land for twin independent (~2000m separation) parallel runways (3500 – 4000m length x 60m width) with space for 2 additional close parallel runways; Dual taxiways & dual taxiways.
Inbound Passport Control	90% of passengers will be served with 10 minutes. Space - 0.6m ² per passenger.	Introduction of biometrics to speed up processing is preferred.

Airport Terminal Planning “Draft” Standards

Planning Element	Service/Planning Standard	Recommended Practice
Baggage Delivery	Business Class – 90% of passengers will retrieve their bags within 12 - 15 minutes after wheelstop (NB) & within 15 - 18 minutes (WB). Economy Class – 90% of passengers will retrieve their bags within 20 -25 minutes after wheelstop (NB) and within 30 – 40 minutes (WB). Space - 1.6 – 1.8m ² per passenger (excluding baggage claim unit)..	Sufficient numbers to be provided to allocate at least one 85m baggage claim unit per 2 B747 flights; Separate device(s) for handling over size baggage; Sufficient baggage trolleys to be available on entry to the baggage claim hall; ATM(s) located in baggage claim hall; Left luggage storage facilities should be located airside.
Inbound Customs	90% of passengers will be handled within 3 minutes.	Recommended use of Red/Green Channels.
Meeter Greeter Hall	Space - 1.6 – 1.8m ² per passenger. Seating for 5% of passengers.	Easy access to Express train station
Passenger Arrival– Wheelstop to Curbside	Business Class – 90% of passengers will be on the curbside 20 - 25 minutes after aircraft arrival. Economy Class – 90% of passengers will be on the curbside 40 - 45 minutes after aircraft arrival.	
ICAO standard is 45 minutes		
Wayfinding		The PTB should incorporate self-evident passenger flow routes through the building, but where signs are required they must provide a continuous indication of direction; Signposting system should use a concise & comprehensive system of directional, informational, regulatory & identification messages. It should adhere to a basic guideline of copy styles & sizes, consistent terminology, recognizable & universally acceptable symbols & uniform colors; Signposting should be in “mother tongue” & English.
Airline Offices	10m ² per staff member	Sufficient space to lease to airlines & Alliances; Located landside reasonably close to check-in; Clearly signposted.
Elevators	Waiting time – 90-95% up to 2 minutes with 50% up to ½ minute.	
Passengers with Disabilities	Airport facilities must comply with national laws and regulations.	
Retail/Concessions		Airport Authority should obtain 50 – 60% of total airport revenue from retail/concessions; Retail/concession facilities should not interfere with passenger flows between check-in and the departure gate lounges
MCT - (Minimum Connecting Time)	Business Class – 90% of passengers will connect between flights within 30-45 minutes. Economy Class – 90% of passengers will connect between flights within 45-60 minutes Transfer Counters – 90% of passengers will be served in 5 – 10 minutes. - 0.6m ² per passenger plus inter-queue	
Car Parks	Car Parking Spaces - 100% availability. 90 – 95% of customers will queue not more than 1 minute for entry to the car park. 90 – 95% of customers will queue not more than 3 minutes at cashiers exit.	

How to Measure LOS

- Observations
 - Cameras, pictures
 - Passenger intercept (questionnaire)
 - Applicable **only** for existing systems:
- Calculations
 - FAA AC 150/5360-13
 - Security Design Guidelines (?)
- Simulation modeling
 - Great tool for analyzing new designs or operational changes



Checkpoints

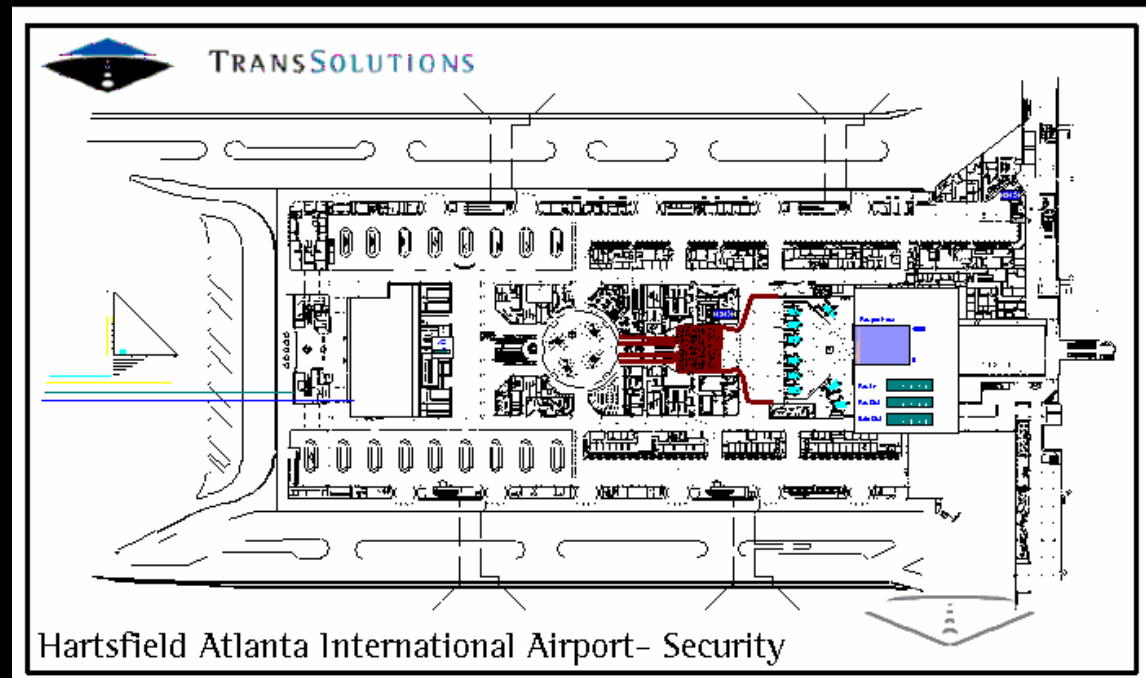
- SSCP processing times **were** in the magnitude of 500-600 pax per hour per x-ray lane
- Post TSA: 150-200 pphpl. [$\sim 1/3$]
 - Probably safer now, but there is cost associated with that
- Denver, early 2002
 - Long lines
 - To avoid long lines, pax told to come earlier
 - **LONGER** lines!



Long Walks

- Atlanta, now
 - One of the faster checkpoints in the nation with a throughput of 200-250 pax per hour per lane
 - Still long lines, especially Monday mornings
 - Long walk in the queue!..

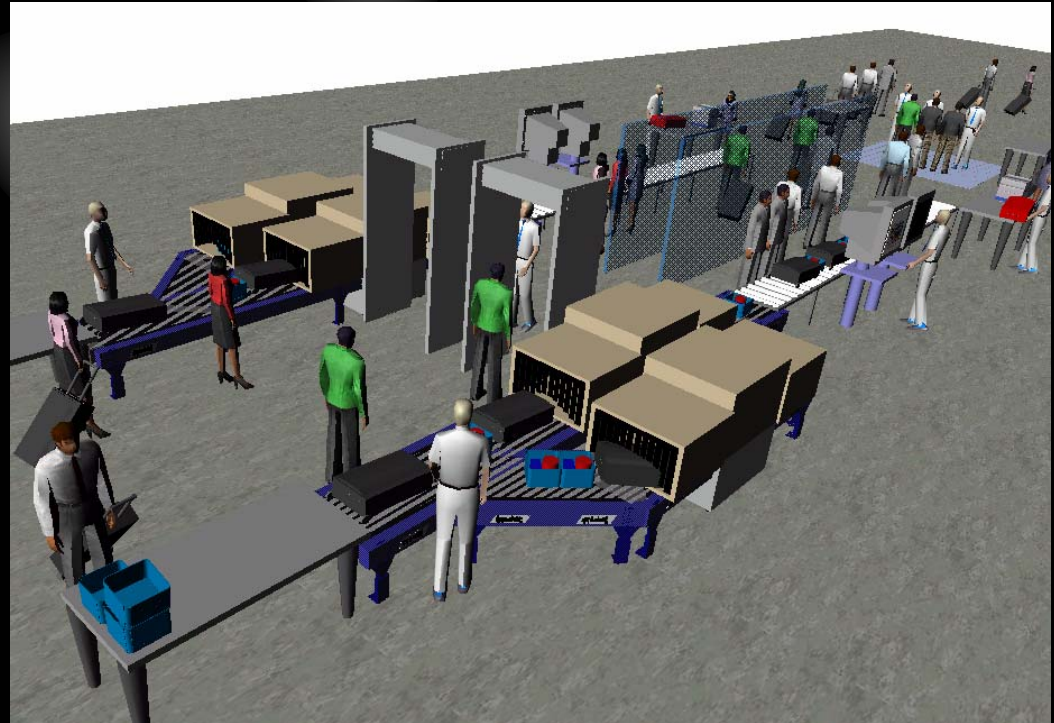
- Long queues cause crowding and pose safety and security risk



Dual X-Ray Concept

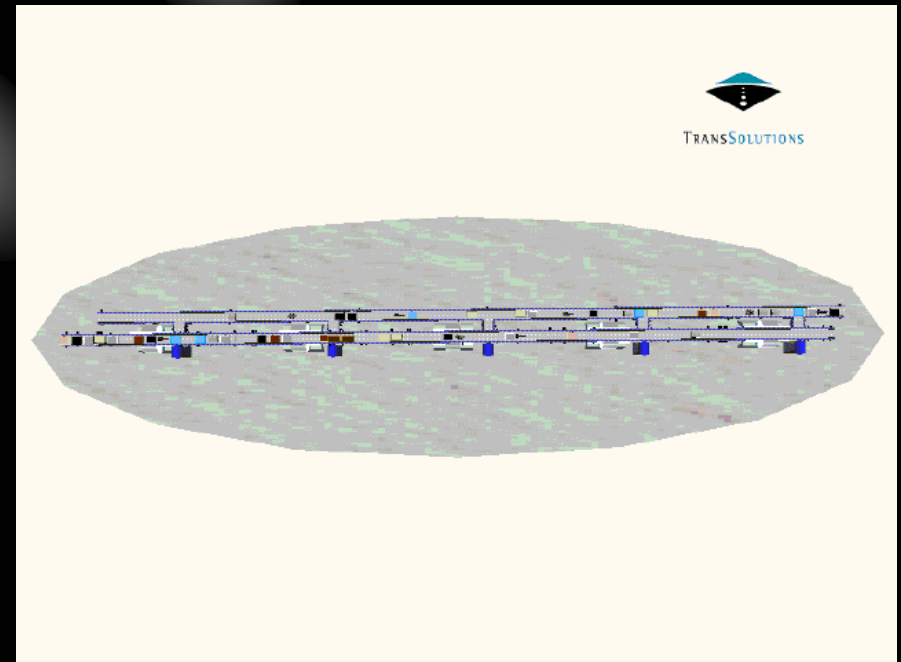
- X-ray is currently the bottleneck in security checkpoints
- Looking for ways for ATL to cut long lines, developed this dual x-ray configuration

- Atlanta, 2003
 - Dual x-ray concept
 - Rates improved
 - Some problems though...



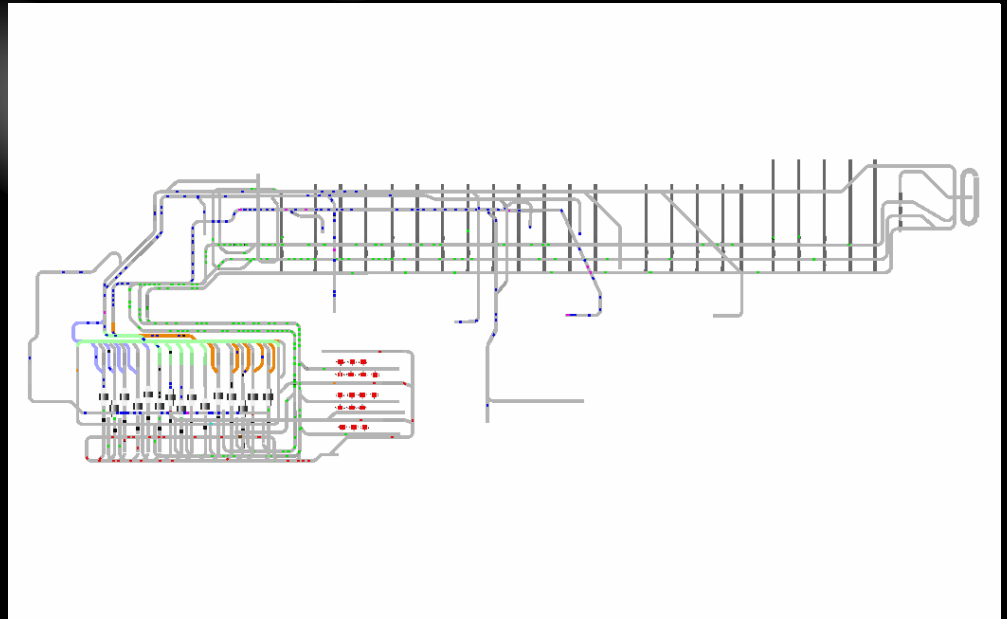
Baggage Screening

- Explosive screening of baggage causes additional delays to either passengers or bags, and may impact connect times or cause misconnect bags.
- Dallas-Fort Worth, 2004
 - In-line baggage screening
 - Determined the required number of EDS machines
 - Time
 - Queues



Baggage Screening

- EDS systems tend to be large, resulting in long conveyors and baggage travel times. Complex systems.
 - Need to consider reliability of these EDS machines.
-
- Atlanta
 - In-line baggage screening
 - Determined the required number of EDS machines
 - Time
 - Queues



Curbside Roadways

- New security rules (no parking at curbside, no dwelling, etc.) impacts airport roadways as well.
- Ontario, CA, 2003
 - No parking rule causes cars to re-circulate
 - In-turn, more cars on the road...
 - Curbside congestion...



Summary

- Increased security (as handled today) results in reduced throughput at airports.
 - Price: Lower Level of Service, Passenger missing flights, delays.
 - Impacts:
 - Security checkpoints
 - Baggage systems
 - Curbside roadways
 - Need to understand the causes and effect of these costs, preferably system-wide.
 - A delay in one city may cascade to system-wide delays.
- New technology may improve throughput and delays, but likely not as the current mindset seems to be improving security first.
 - New security checkpoint screening machines
 - Puffer, body scan, etc.... All slower processing time...

Questions?

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