ACRP Report 175
Improving Intelligibility of Airport Terminal Public Address Systems

Gary Glickman
Associate Principal
ACRP 07-14 Research Team

Wilson Ihrig
   Richard Carman
   Deborah Jue
   Gary Glickman

HKS Architects
   Rick Lee
   Lee Glenn

Audiovisual Consultant
   Joel Lewitz

CCD (Human Factors)
   Adam Parkes
   David Watts
   Karen Jackson

Cross-Spectrum Acoustics
   Herb Singleton

Chips Davis Designs
   Chips Davis
Participating Airports

- Anchorage International Airport
- Broward County Aviation Department
- Burlington International Airport
- City of Chicago/Department of Aviation
- City of Boise/Boise Airport
- City of Phoenix Aviation Department
- City of San Antonio/SAAS
- Corpus Christi International Airport
- Dallas/Fort Worth International Airport
- Denver International Airport
- Fairbanks International Airport
- Fort Wayne International Airport
- Los Angeles World Airports
- Maryland Aviation Administration
- Maryland Aviation Administration (BWI)
- McCarran International Airport
- Metropolitan Airports Commission
- Monterey Regional Airport
- Nantucket Memorial Airport
- Oakland International Airport
- Philadelphia International Airport
- Pittsburgh International Airport
- Portland International Airport
- Prince George Airport Authority
- Salt Lake City/Department of Airports
- San Diego County Regional Airport
- San Francisco International Airport
- Savannah Airport Commission
- Seattle-Tacoma International Airport
- Stockton Metropolitan Airport
- Wichita Airport Authority
ACRP Report Highlights

- Industry and Passenger Perspectives
- Architectural Design
- Public Address System Design
- Commissioning Public Address Systems
- Public Address System Announcements
- Operation and Maintenance
- Decision Tools and Examples
What matters?

Speech Intelligibility of PA Systems

- Architectural Design
  - Room Acoustics
  - Ambient Noise
  - Room Shape and Volume
  - Human Factors

- PA System Design
  - Human Factors

- Announcement Quality
  - Training and Operation
  - Human Factors
Reverberation Time ($RT_{60}$)

- Good control of $RT_{60}$
- Poor control of $RT_{60}$

Sound Pressure Level (dB) vs. Time (seconds)

ADS 27: 0.6 sec
ADS 1: 3.4 sec
## Speech Transmission Index (STI)

<table>
<thead>
<tr>
<th>STI Range</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>0.66 to 0.75</td>
<td>High speech intelligibility</td>
</tr>
<tr>
<td>0.62 to 0.65</td>
<td>Good speech intelligibility</td>
</tr>
<tr>
<td>0.58 to 0.61</td>
<td>High-quality PA systems</td>
</tr>
<tr>
<td>0.46 to 0.53</td>
<td>Acceptable for voice address (target 0.5)</td>
</tr>
<tr>
<td>0.00 to 0.41</td>
<td>Not suitable for PA systems</td>
</tr>
</tbody>
</table>
Speech Transmission Path

- Objective measure of how the transmission speech path affects intelligibility [0 to 1]
- Takes into account physical, site-specific factors that affect the intelligibility of transmitted speech
- Based on the field measurements conducted for the research, a target STI 0.50 has been identified for daytime conditions.

**Diagram:**

1. **TEST SIGNAL**
2. **PA SYSTEM**
3. **ROOM**
4. **STI**

**STIPA test signal**
Speech Intelligibility and Reverberation Time

STI

RT$_{60}$, sec

MORE SOUND ABS.  LESS SOUND ABS.

BETTER INTELL.

WORSE INTELL.
Occupied vs. Unoccupied
Ceiling height
42 feet

RT 3.5s

STI 0.39
Ceiling height 38 feet

RT 1.1s

STI 0.69
Ceiling height
24 feet

RT 1.0s

STI 0.64
Guidance Highlights – Design

- Speech Transmission Index (STI) target: 0.60+
- PA system must be 10 to 15 dB louder than background noise
- Introduce sound absorptive surfaces
- Where ceiling heights are higher than 24 feet... …get professional help!
Guidance Highlights – Operations

- Require **commissioning** to verify and optimize the PA system prior to sign-off or acceptance.

- Prepare **announcements** so they take advantage of human response to broadcast information.
Announcement Example

Short, concise message

“Denver, Denver, Flight XY123 to Denver, now boarding at Gate 4”

- Initial identifying information
  - ‘hook’ to draw passenger attention

- Repetition of identifying information
  - confirm identifying information

- Name + Flight Destination
  - confirmation for the passenger that this is specific to them

Source: CCD

Figure 10-1. Announcement information example.
For Additional Information

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Gary Glickman
gglickman@wiai.com