ACRP Current Status

176 research projects authorized
  - 47 starting up
  - 50 research in progress
  - 15 research completed
    - 64 ACRP publications

Over 700 industry volunteers participating
  - Participants come from airports; airlines; consultants; academics; state and federal government; and industry associations

Dozens of research contractors also from the airport industry
Airport Cooperative Research Program

4 ways to become involved:

• Submit a research idea, also called a Problem Statement.
• Volunteer to participate on a project panel. (We reimburse for travel.)
• Prepare a proposal to conduct research.
• Use our research results.

www.TRB.org/ACRP
For More Information: www.TRB.org/ACRP

- Information on ACRP (look for our brochures)
- Search engine
- All research projects
- Project statements (requests for proposals)
- Anticipated projects
- CRP publication lists (how to order)
- Registration form for receipt of RFPs
- Forum for success stories
The Transportation Research Board (TRB) Airport Cooperative Research Program (ACRP) combined two research projects,

**ACRP 07-04**
Terminal Planning Spreadsheet Models

and

**ACRP 07-05**
Airport Passenger Terminal Planning Guidebook

into,

**ACRP REPORT 25**
*Volume 1: Guidebook*
*Volume 2: Spreadsheet Models*
Report 25: Airport Passenger Terminal Planning
Volume 1: Guidebook

• ACRP Project 07-05
• Research Agency:
  • Landrum & Brown
• Principal Investigator:
  • Bruce Anderson
• Subcontractors:
  • Hirsh Associates
  • Kimley-Horn and Associates
  • Jacobs Consultancy
  • The Strategic Airport -Planning Group
  • TranSecure, Inc.
  • Steven Winter Associates, Inc.
  • Five Star Systems (G&T Conveyor)
  • Presentation & Design, Inc.
Report 25: Airport Passenger Terminal Planning
Volume 2: Spreadsheet Model

• ACRP Project 07-04
• Research Agency:
  • Landrum & Brown
• Principal Investigator:
  • Matt Lee
• Subcontractors:
  • Hirsh Associates
  • Planning Technology, Inc.
  • Presentations & Design, Inc.
A07-05 Project Panel

Chair:
Dr. Robin R. Sobotta
Department of Business,
Embry-Riddle Aeronautical University

Members:
Dr. Manuel Ayres
Senior Engineer
Applied Research Associates

Blair K. Hanuschak
Principal, Director of Airport Projects
Walter P. Moore and Associates

Dr. Lloyd McComb
President & CEO
Greater Toronto Airports Authority

C. Allen McRee
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Freese and Nichols, Inc.

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Director of Architecture
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George P. Vittas
Senior Vice President
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Federal Aviation Administration

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Transportation Research Board
ACRP 07-04 Project Panel

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Hellmuth, Obata + Kassenbaum (HOK)

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Thomas Wade
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Federal Aviation Administration

TRB Liaison:
Christine Gerencher
Senior Program Officer
Transportation Research Board
Report 10: Innovations for Airport Terminal Facilities

- ACRP Project 07-01
- Research Agency: Corgan Associates
- Principal Investigator: Phil Mein
- Subcontractors: Ricondo & Associates, TransSolutions, LLC, TranSecure LLC
ACRP 07-01 Project Panel

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V.P. Terminal Planning
Landrum & Brown

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Federal Aviation Administration
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Belinda Hargrove
Co-Investigator
TransSolutions, LLC

Allen Hoffman
Co-Investigator
Ricondo & Associates, Inc.

Art Cosatka
Co-Investigator
TransSolutions, LLC

Jacob Strawn
Co-Investigator
Ricondo & Associates, Inc.
ACRP REPORT 25
Airport Passenger Terminal Planning and Design
Volume 1: Guidebook
Joel Hirsh
Hirsh Associates

ACRP REPORT 25
Airport Passenger Terminal Planning and Design
Volume 1: Guidebook
ACRP 07-04 Objectives

- To develop a user-friendly spreadsheet model (or models), with an accompanying manual to analyze issues common to airport passenger terminal planning and design.

- To produce a compendium that identifies the types, scopes and availability of spreadsheet and discrete event models that can be used by airport operators for airport passenger terminal planning and design.
ACRP 07-05 Objectives

- To produce an Airport Passenger Terminal Planning Guidebook that:
  - Provides a comprehensive and up-to-date approach to the terminal planning process.
  - Addresses current issues and emerging trends
  - Will be useful for airport managers, consultants, industry organizations and other stakeholders of commercial aviation market.

- The Guidebook will now include the results of ACRP 07-04 Spreadsheet Models for Planning and Design and will be published as ACRP Report 25
Relevance to the Aviation Industry

- Aimed at the general airport planning and design industry
  - Guidebook is broad in scope with basic level of detail supplemented by detailed treatise on selected topics, for example, the development of facility requirements.
  - Guidebook attempts to bring into one location the various sources of information needed to plan a terminal, in particular, FAA AC references with typical information on how to get updates through the web.
  - The Guidebook is more of a “how to” approach based on the latest accepted practices as compared to research. Our approach was to provide “guidelines” as a point of departure from which various practitioners can then impart their creativity.
Terminal Planning Historical Documents

1973

1975

2004

2010
ACRP 07-04 Research Team

- ACRP Senior Program Officer – Theresia Schatz
- O-I-C and Project Manager – Bruce Anderson (Landrum & Brown)
- Principal Investigator – Matthew H. Lee (Landrum & Brown)
- Co-Investigator – Joel Hirsh (Hirsh Associates)
- Co-Investigator – Robert Ori (PTI)
- Senior Investigator – John Ernst (Landrum & Brown)
- Deputy Project Manager – Shane Wirth (Landrum & Brown)
- Research Consultant – David Burns (Landrum & Brown)
ACRP 07-05 Key Research Team Members

- ACRP Senior Program Officer – *Theresia Schatz*
- Principal Investigator – *Bruce Anderson (Landrum & Brown)*
- Co-Investigator – *Joel Hirsh (Hirsh Associates)*
- Terminal Research Advisor – *Edward (Gary) Blankenship (Landrum & Brown)*
- Landside Research Advisor – *Foster de la Houssaye (Kimley-Horn Associates)*
- Airside Research Advisor – *Russell Blanck (Landrum & Brown)*
- Research Consultant – *Shane Wirth (Landrum & Brown)*
- Advisor – Terminal business and Financial Analysis – *Spencer Ballard (JACOBS)*
- Advisor – Concessions Revenue Maximization – *Bill Matz (The S-A-P Group)*
- Advisor – Sustainability – *Andrew Hathaway (Steven Winter Associates)*
- Advisor – Terminal Security – *Art Kosatka (TranSecure)*
- Advisor – Information Technology Systems – *James McGuire (TranSecure)*
- Advisor – Baggage Handling Systems – *Dan Stricklin (Five Star Systems)*
Resource Base – FAA “White Papers”

- Industry professionals and leaders began making conceptual contributions.
- While the FAA owns the rights for the use of these materials, the Research Team considered it important to notify authors of the potential use of their white papers in the coming Guidebook release.
- 43 FAA unpublished topic papers produced by 42 industry experts on the subject of airport passenger terminal.
Resource Base – FAA “White Papers”

- Gloria G. Bender
- Peter Bianconi
- Edward (Gary) Blankenship
- Thomas H. Brown
- Greg Casto
- David A. Daileda
- Richard de Neufville
- Paul Dorsey
- Daniel J. Feil
- Andrew Grenier
- Steve Rondinelli
- Joel B. Hirsh
- Robert Hornblower
- Michael O’Brien
- Robert Jones
- Art Kosatka
- David Lind
- Peter B. Mandle
- Douglas M. Mansel
- Ted McCagg
- Francis X. McKelvey
- Phil Mein
- Ralph Bauer
- Eric E. Miller
- Mark W. Nagle
- Michael O’Brien
- Colleen E. Quinn
- Frederick R. Busch
- James M. Robinson
- Derrick Choi
- LaVern D. Rollet
- Joseph F. Romano
- Fred Silverman
- Ron Steinert
- Marilyn Taylor
- Keith Thompson
- Tony Vacchione
- Regine Weston
- Norman D. Witteveen
- Harry P. Wolfe
Guidebook Table of Contents

CHAPTER I: INTRODUCTION
CHAPTER II: THE TERMINAL PLANNING AND DESIGN PROCESS
CHAPTER III: PLANNING CONSIDERATIONS
CHAPTER IV: FORECASTS
CHAPTER V: TERMINAL AIRSIDE FACILITIES
CHAPTER VI: TERMINAL BUILDING FACILITIES
CHAPTER VII: TERMINAL LANDSIDE FACILITIES
APPENDICES
Guidebook Table of Contents

CHAPTER I: INTRODUCTION
1. Purpose and Organization of the Guidebook
2. Previous Terminal Planning Guides
3. Current Need for Terminal Planning Guidance
4. Retrospective
5. Airline Deregulation

CHAPTER II: THE TERMINAL PLANNING AND DESIGN PROCESS
1. Defining the Terminal Complex
2. Terminal Planning and Design Project Process

CHAPTER III: PLANNING CONSIDERATIONS
1. Airport Master Plan
2. Land Use Compatibility
3. Ground Access Transportation
4. Terminal Site Planning
5. Airport Security
6. Information Technology and Communications
7. Environmental
8. Sustainability
9. Business Planning
Guidebook Table of Contents

CHAPTER IV: FORCASTS
1. Methodologies
2. Data Sources
3. Typically Forecasted Information
4. Peak Hour Demand Analysis

CHAPTER V: TERMINAL AIRSIDE FACILITIES
1. Airside Planning Requirements
2. Terminal Apron Planning
3. Aircraft Gate Requirements

CHAPTER VI: TERMINAL BUILDING FACILITIES
1. Terminal Planning and Design Considerations
2. Terminal Concept Development
3. Terminal Facility Requirements
4. Other Facility Considerations
Guidebook Table of Contents

CHAPTER VII: TERMINAL LANDSIDE FACILITIES
1. Transportation/Traffic Planning
2. Intermodal Connections
3. Airport Roadway Systems
4. Terminal Curb Requirements
5. Parking Facility Requirements
6. Roadway/Circulation Signage
7. Landside Security
Guidebook Table of Contents

APPENDICES
APPENDIX A – CHECKLISTS
APPENDIX B – OTHER PERTINENT TRB STUDIES
APPENDIX C – FAA WHITE PAPERS
APPENDIX D – AIRCRAFT TYPES AND KEY DIMENSIONAL CRITERIA
APPENDIX E – DIMENSIONS OF AIRLINE EQUIPMENT
APPENDIX F – REGULATIONS
APPENDIX G – ISSUES AND TRENDS
APPENDIX H – REFERENCES
APPENDIX I – ACRONYMS
APPENDIX J – GLOSSARY
APPENDIX K – QUICK REFERENCE GUIDE FOR SPREADSHEET MODELS
This same decade saw jet aircraft evolve from the B707/DC-8/CV880-990 in the early 1960s (typical capacity of 125 to 150 passengers) to the B747-100 in 1969 to 1970 (typical capacity of 350 to 450 passengers). Figure I-5 depicts the 300% growth in aircraft capacity.

Chapter Highlights

CHAPTER 1: INTRODUCTION

1. Purpose and Organization of the Guidebook
2. Previous Terminal Planning Guides
3. Current need for Terminal Planning Guidance
4. Retrospective
5. Airline Deregulation

300% Increase
Definition of Terminal Complex – The terminal complex consists of the interface between aircraft, travelers, and the various modes of landside transportation. It is for this reason that the Guidebook has defined the Terminal Complex as including three primary components - Landside, Terminal and Airside.
CHAPTER 2: THE TERMINAL PLANNING AND DESIGN PROCESS

1. Defining the Terminal Complex
2. Terminal Planning and Design Project Process
3. Terminal Planning and Design Project Approach
Chapter Highlights

CHAPTER 2: THE TERMINAL PLANNING AND DESIGN PROCESS

1. Defining the Terminal Complex
2. Terminal Planning and Design Projects
3. Terminal Planning and Design Project Approach
The integration of a new passenger terminal with a major multi-modal ground transportation center and associated commercial and residential developments at the Shanghai Hongqiao Airport is another example.

Figure III-1 is from Graphic Illustration of Hongqiao Integrated Transportation Hub.
Chapter Highlights

CHAPTER 4: FORECASTS

1. Methodologies
2. Data Sources
3. Typically Forecasted Information
4. Peak Hour Demand Analysis

Figure IV-1 is a chart that is created in the Peak Hour Determination model which is part of the companion set of models developed to work with the material in the guidebook.
Chapter Highlights

CHAPTER 5: TERMINAL AIRSIDE FACILITIES

1. Airside Planning Requirements

2. Terminal Apron Planning

3. Aircraft Gate Requirements

NarrowBody Equivalent Gate (NBEG) This metric is used to normalize the apron frontage demand and capacity to that of a typical NarrowBody aircraft gate. The amount of space each aircraft requires is based on the maximum wingspan of aircraft in its respective aircraft group.

<table>
<thead>
<tr>
<th>Airplane Design Group (ADG)</th>
<th>Maximum Wingspan</th>
<th>NBEG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feet</td>
<td>Meters</td>
</tr>
<tr>
<td>I. Small Regional</td>
<td>49</td>
<td>15</td>
</tr>
<tr>
<td>No. of Narrowbody Aircraft in wingspan of ADG I Aircraft = 0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. Medium Regional</td>
<td>79</td>
<td>24</td>
</tr>
<tr>
<td>No. of Narrowbody Aircraft in wingspan of ADG II Aircraft = 0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III. Narrowbody</td>
<td>118</td>
<td>36</td>
</tr>
<tr>
<td>No. of Narrowbody Aircraft in wingspan of ADG III Aircraft = 1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illa. B757</td>
<td>135</td>
<td>41</td>
</tr>
<tr>
<td>No. of Narrowbody Aircraft in wingspan of ADG Illa Aircraft = 1.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV. Widebody</td>
<td>171</td>
<td>52</td>
</tr>
<tr>
<td>No. of Narrowbody Aircraft in wingspan of ADG IV Aircraft = 1.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V. Jumbo</td>
<td>214</td>
<td>65</td>
</tr>
<tr>
<td>No. of Narrowbody Aircraft in wingspan of ADG V Aircraft = 1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI. A380</td>
<td>262</td>
<td>80</td>
</tr>
<tr>
<td>No. of Narrowbody Aircraft in wingspan of ADG VI Aircraft = 2.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter Highlights

CHAPTER 5: TERMINAL AIRSIDE FACILITIES

1. Airside Planning Requirements
2. Terminal Apron Planning
3. Aircraft Gate Requirements
CHAPTER 6: TERMINAL BUILDING FACILITIES

1. Terminal Planning and Design Considerations
2. Terminal Concept Development
3. Terminal Facility Requirements
4. Other Facility Considerations

Chapter Highlights

Legend:
- Departure PAX path
- Arrival PAX path
- Inbound/Outbound Baggage path
- Sterile Corridor

Access Road System
Figure VI-28 depicts a typical holdroom configuration.
Chapter Highlights

CHAPTER 7: TERMINAL LANDSIDE FACILITIES

1. Transportation/Traffic Planning
2. Intermodal Connections
3. Airport Roadway Systems
4. Terminal Curb Requirements
5. Parking Facility Requirements
6. Roadway/Circulation Signage
7. Landside Security

Note: Assumes a 4-lane curbside roadway where double parking is allowed.
Matt Lee
Landrum & Brown

ACRP REPORT 25
Airport Passenger Terminal Planning and Design
Volume 2: Spreadsheet Models
Spreadsheet Models Contents

- Created to supplement the learning and understanding of the planning principles in the Guidebook.
- Developed as simple Excel spreadsheet models for the purpose of learning basic planning principles as building blocks to more complex space programs.
- Developed in Excel 2003 and compatible with Excel 2000 or newer, and in Windows 2000 or newer and MAC OS.
Spreadsheet Model Contents:

1. Design Hour Determination
2. Gate Requirements
3. Curbside Requirements
4. Ticketing/Check-in
5. Baggage Screening
6. Bag Make Up
7. Security Screening
8. Holdrooms
9. CBP/FIS
10. Circulation
11. Baggage Claim

11 models are presented in the spreadsheet program.
This workbook is a set of modules that looks at the major functional areas of both Airstide and Landside terminal operations. The models are shown to the right as command buttons and include Gate Demand, Holdrooms, Circulation, FIS/CBP, Check In/Ticketing, Baggage Screening, Baggage Make Up, Security, Baggage Claim, Curb Requirements. Their purpose is to help illustrate the relationships between space, processing, flow, delay and level of service (LOS) for passengers.

The data necessary to set up the models and determine the passenger demand is discussed in the 'Data Checklist', 'Design Hour Determination', and 'Gate Demand' areas. Further functional area specific information is required in each of the nine main sections.

To initiate the models start with a review of the Data Checklist tab and then proceed to the Design Hour Determination and Gate Demand tabs and go through the exercises that will provide the necessary data for the main functional modules.

Cells are color coded for easy identification, and non-input cells are locked with password protection to prevent accidental formula loss.
## DATA CHECKLIST

The following data will be needed to complete the model exercises:

<table>
<thead>
<tr>
<th>Source</th>
<th>Data Needed</th>
<th>Suggested Source for Needed Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport data /T-100</td>
<td>Annual Enplanements and Deplanements</td>
<td>Most recent full year</td>
</tr>
<tr>
<td>Airport data /T-100 /OAG</td>
<td>Monthly Enplanements or Departing Seats</td>
<td>Previous 5 years</td>
</tr>
<tr>
<td>Airport data /T-100 /OAG</td>
<td>Peak Month Average Week - Operations and Seats</td>
<td>Closest month with data</td>
</tr>
<tr>
<td>Airport data /T-100</td>
<td>Peak Month Daily Enplanements (after Peak Month is determined)</td>
<td>Closest month with data</td>
</tr>
<tr>
<td>OAG /T-100</td>
<td>Peak Month Average Day Schedule (after PMAD is selected)</td>
<td>Closest PMAD</td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>Schedule Data Required for PMAD</td>
<td></td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>- Destination/Origin</td>
<td></td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>- Published Carrier</td>
<td></td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>- Seats Configuration or Enplanements</td>
<td></td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>- Departure/Arrival Time</td>
<td></td>
</tr>
</tbody>
</table>

### Gate Demand

<table>
<thead>
<tr>
<th>Source</th>
<th>Data Needed</th>
<th>Suggested Source for Needed Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airport data/T-100 / TAF</td>
<td>Annual Enplanements</td>
<td>3 years</td>
</tr>
<tr>
<td>Airport data/T-100 / TAF</td>
<td>Annual Departures</td>
<td>3 years</td>
</tr>
<tr>
<td>Airport data</td>
<td>Existing number of Gates</td>
<td>Each year</td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>Planned aircraft design for each gate</td>
<td>Current</td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>Equivalent Aircraft (if known)</td>
<td>Current designation</td>
</tr>
</tbody>
</table>

Each sheet will have a “Return” button. In some cases a specified time period of data will be suggested.
## Spreadsheet Model Highlights: DESIGN HOUR DETERMINATION

### Input Data

1. **Click the 'RESET ALL INPUTS' button to begin.**
2. **Access the most recent OAG or Airport date for one entire week within the Peak Month and Input the Arrival and Departure operations and seats data into Cells D9:G15 in the worksheet. This week should not contain any holidays.**
3. **Input the date of the first day of the selected week and Select the first day of the month from the dropdown list in Cells B9 and C9 and the remaining cells will auto fill.**
4. **Select a day of the sample week as the average day of the month that closely matches the average weekday. Use the % difference values in H9:J15 to help choose the average day. Avoid any holidays or other anomalies.**
5. **Access the most recent OAG or Airport data for the Peak Month Average Day. This data will include 1) Origin or Destination, 2) Time of Departure or Arrival, 3) Seat Configuration, and 4) Published Carrier.**

### Detailed Instructions Provide Specific Needs and Comments to Keep Each Step Simple

### Each tab follows the same process: Reset, Input, Proceed

<table>
<thead>
<tr>
<th>Day of Week</th>
<th>Arrivals</th>
<th>Departures</th>
<th>Daily Operations</th>
<th>Daily Scheduled Seats</th>
<th>%Diff. (Ops)</th>
<th>%Diff. (Seats)</th>
<th>%Diff. (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
<td>142</td>
<td>142</td>
<td>14,826</td>
<td>11,699</td>
<td>0.08</td>
<td>0.09</td>
<td>0.77</td>
</tr>
<tr>
<td>Monday</td>
<td>155</td>
<td>155</td>
<td>12,744</td>
<td>12,705</td>
<td>0.09</td>
<td>0.07</td>
<td>0.16</td>
</tr>
<tr>
<td>Tuesday</td>
<td>153</td>
<td>153</td>
<td>12,657</td>
<td>12,618</td>
<td>0.07</td>
<td>0.05</td>
<td>0.12</td>
</tr>
<tr>
<td>Wednesday</td>
<td>153</td>
<td>153</td>
<td>12,657</td>
<td>12,618</td>
<td>0.07</td>
<td>0.05</td>
<td>0.12</td>
</tr>
<tr>
<td>Thursday</td>
<td>156</td>
<td>156</td>
<td>12,922</td>
<td>12,883</td>
<td>0.11</td>
<td>0.10</td>
<td>0.21</td>
</tr>
<tr>
<td>Friday</td>
<td>156</td>
<td>156</td>
<td>12,922</td>
<td>12,883</td>
<td>0.11</td>
<td>0.10</td>
<td>0.21</td>
</tr>
<tr>
<td>Saturday</td>
<td>122</td>
<td>120</td>
<td>10,597</td>
<td>10,497</td>
<td>0.38</td>
<td>0.29</td>
<td>0.65</td>
</tr>
</tbody>
</table>

| Average     | 148      | 148         | 12,332           | 12,268                |             |                |               |
Spreadsheet Model Highlights: DESIGN HOUR DETERMINATION

1. Click the ‘RESET ALL INPUTS’ button to clear input cells.
2. Access the most recent forecast available to the airport and input the Annual Enplanement Values in Cells C13:C17. If no recent or updated forecast exists at the airport, use the latest TAF forecast from the FAA.
3. Input the desire or expected Peak Month Factors for the Forecast years into Cells B22:B26.
4. Input the number of Days in the Peak Month selected in Tab 1.
5. Input the desired or expected Enplaned and Deplaned Design Hour Factors into Cells B41:B45 and D41:D45 respectively.

Input most recent forecast data
Choose peak month factor levels for forecast period
Choose percent of average day levels to based on expectation of airport growth
Results are the Design Hour enplaning and deplaning values to use in the other models
Spreadsheet Model Highlights:
DESIGN HOUR DETERMINATION

Rolling peak departing seats chart shows likely congestion periods for departing passengers.

Summary of Departing Seats schedule assessment.

Peak Rolling Hour: DEPARTING SEATS

Peak Hour Begins at 6:50
Daily Total = 17,988
Peak Seats = 2,764
% of Daily = 15.4%
Spreadsheet Model Highlights: GATE DEMAND

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Enplaned Passengers</th>
<th>Annual Departures</th>
<th># of Gates</th>
<th>Enplaned Passengers per Gate</th>
<th>Enplaned Passengers per Dept.</th>
<th>Average of Both Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>3,462,920</td>
<td>62,670</td>
<td>36</td>
<td>96,200</td>
<td>55</td>
<td>44</td>
</tr>
<tr>
<td>2007</td>
<td>3,336,027</td>
<td>63,808</td>
<td>36</td>
<td>92,700</td>
<td>52</td>
<td>47</td>
</tr>
<tr>
<td>2008</td>
<td>3,399,000</td>
<td>63,000</td>
<td>36</td>
<td>94,400</td>
<td>54</td>
<td>47</td>
</tr>
<tr>
<td>2010</td>
<td>4,429,000</td>
<td>79,500</td>
<td>45</td>
<td>97,500</td>
<td>56</td>
<td>50</td>
</tr>
<tr>
<td>2015</td>
<td>5,267,000</td>
<td>91,500</td>
<td>52</td>
<td>101,100</td>
<td>56</td>
<td>50</td>
</tr>
<tr>
<td>2020</td>
<td>6,240,000</td>
<td>106,500</td>
<td>61</td>
<td>102,500</td>
<td>59</td>
<td>56</td>
</tr>
<tr>
<td>2025</td>
<td>7,096,000</td>
<td>121,000</td>
<td>69</td>
<td>102,600</td>
<td>59</td>
<td>61</td>
</tr>
</tbody>
</table>

Departs per Gate Approach

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Enplaned Passengers</th>
<th>Annual Departures</th>
<th># of Gates</th>
<th>Annual Departures per Gate</th>
<th>Daily Departures per Gate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>3,462,920</td>
<td>62,670</td>
<td>36</td>
<td>1,740</td>
<td>5.0</td>
</tr>
<tr>
<td>2007</td>
<td>3,336,027</td>
<td>63,808</td>
<td>36</td>
<td>1,770</td>
<td>5.1</td>
</tr>
<tr>
<td>2008</td>
<td>3,399,000</td>
<td>63,000</td>
<td>36</td>
<td>1,750</td>
<td>5.0</td>
</tr>
<tr>
<td>2010</td>
<td>4,429,000</td>
<td>79,500</td>
<td>44</td>
<td>1,820</td>
<td>5.2</td>
</tr>
<tr>
<td>2015</td>
<td>5,267,000</td>
<td>91,500</td>
<td>47</td>
<td>1,930</td>
<td>5.5</td>
</tr>
<tr>
<td>2020</td>
<td>6,240,000</td>
<td>106,500</td>
<td>50</td>
<td>2,110</td>
<td>6.0</td>
</tr>
<tr>
<td>2025</td>
<td>7,096,000</td>
<td>121,000</td>
<td>53</td>
<td>2,290</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Each model has a link to more information and guidance in appropriate section of the User’s Guide.

Resets are used in some spreadsheets to make starting over easier.

Input existing and Forecast data.

Check the comments to see the difference in approaches.
## Spreadsheet Model Highlights: CHECK-IN/TICKETING

The spreadsheet model for check-in/ticketing is linked to the Design Hour Worksheet. It allows users to input known and desired processing conditions and adjust the number of staffed positions for the queue model. Interactive drawings show how area changes as values change in the spreadsheet.

### Interactive Drawing: Area changes as values change in the spreadsheet

- **Demand**: Inputs like Design Hour Departing Passengers (example year) and % Connecting Traffic.
- **Queue Model (Processing)**: Outputs such as AVG. Queue Wait Time using Model Inputs (min).
- **Existing Conditions**: Metrics like Actual # of ATO Counter Positions and Average Width of Position (ft.).
- **Passenger Level of Service (Space)**: Ratios such as Passenger Space Required for LOS Input (sq. ft./pax) and Required Queue Area for LOS Input (sq. ft.).

**Repeat the process for Kiosks and Curbside check-in to create a summary of Check-In Requirements** based on number of positions, queue size, wait times, and queue area requirements.
Spreadsheet Model Highlights: CHECK-IN/TICKETING

Kiosk and Curbside check-in positions are determined in a similar fashion as are staffed positions.

The dashboard at the top of the spreadsheet tab summarizes the number of determined positions and some useful design factors.

Space requirements associated with the number of positions are provided in a Space Summary for Check-In.
<table>
<thead>
<tr>
<th>Demands</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Throughput Rate from Check-In Model</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>Peak 30 Min Originating Passengers from Check-In</td>
<td>713</td>
<td></td>
</tr>
<tr>
<td>% Additional Traffic (non-passenger, employees, crew)</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Total Peak Period Security Traffic (passengers)</td>
<td>819</td>
<td></td>
</tr>
<tr>
<td>Throughput Rate (Passengers/Hour per lane)</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td># of Passengers Processed/minute per lane</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>Maximum Target Wait Time (in Queue)</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Minimum Required # of Screening Lanes</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

**Queue Model for Required Screening Lanes**

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Screening Lanes for Queue Model Input</td>
<td>11</td>
</tr>
<tr>
<td>Adequate # of Lanes</td>
<td>2.7</td>
</tr>
</tbody>
</table>

**Existing Conditions**

<table>
<thead>
<tr>
<th>Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth of Security Queue (ft)</td>
</tr>
<tr>
<td>Width of Scanning Lane Module (2 Lanes) (ft)</td>
</tr>
<tr>
<td>Overall Length of Check Point Area (ft)</td>
</tr>
<tr>
<td>Reconciliation Area Depth (ft)</td>
</tr>
</tbody>
</table>

**Space Requirements**

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security Queue Area (sq. ft)</td>
<td>2.750</td>
</tr>
<tr>
<td>Passengers in Queue based on Queue Wait Time</td>
<td>87</td>
</tr>
<tr>
<td>Passenger Space Required for LOS input (sq. ft/pax)</td>
<td>10.8</td>
</tr>
<tr>
<td>Required Security Queue Area for LOS input (sq. ft)</td>
<td>945</td>
</tr>
<tr>
<td>Passenger Space with Current Dimensions (sq. ft/pax)</td>
<td>31.4</td>
</tr>
<tr>
<td>Total Checkpoint Area -tables, equipment, search area (sq. ft)</td>
<td>6.875</td>
</tr>
<tr>
<td>Total Security Screening Area (sq. ft)</td>
<td>9.625</td>
</tr>
</tbody>
</table>

**Input percent of passengers in Peak Period (use 30 min.)**

**Input Throughput rate which will need to be an observed rate**

**Adjust queue model input and observe flow and space conditions**
Spreadsheet Model Highlights: BAGGAGE CLAIM

Input O&D Data to determine passengers claiming bags

Input Survey Data to estimate total claim frontage required

Follow the same process as above to size a single claim unit

Simple estimate of claim use time
Each User’s Guide section provides a more detailed and specific set of instructions on how to proceed through the steps of the model as well as provides additional background information and excerpts from the Guidebook.
Potential Value and Lessons Learned

- A major step forward from not having any U.S. focused Guidebook for airport terminals for over 20 years, this however should be an initial step in a continuing evolution for a comprehensive Guidebook.

- In a sense the Guidebook and Spreadsheets research reflects a current slice in time where the ACRP 07-01, “Innovations for Airport Terminal Facilities” looks ahead to the future with new and creative planning ideas as compared to current “tried and true” industry accepted guidelines.
Report 10: Innovations for Airport Terminal Facilities

ACRP Project 07-01

- Research Agency: Corgan Associates

- Principal Investigator: Phil Mein

- Subcontractors:
  - Ricondo & Associates
  - TransSolutions, LLC
  - TranSecure LLC
Phil Mein
Corgen Associates, Inc.

ACRP Report 07–01
Airport Terminal Planning and Innovative Facilities
Introduction

- **Project Objectives**
  - To develop new concepts for airport terminal landside facilities that:
    - Improve the passenger experience
    - Stimulate innovative design solutions
    - Address the needs of the elderly traveler
    - Are implementable within a 5-10 year time frame

- **Context**
  - Changing demographics and their influence on travel patterns
  - Empowerment of the passenger through technology and self service
  - Processed based planning and its impact on passenger movement
  - The need to cost effectively reduce congestion in terminals and at roadways
Key Issues for Passengers

- Waiting / Queuing
- Walking / Vertical Transitions
- Baggage Handling by Passengers
- Information / Signage / Wayfinding
- Vehicular Movement / Pickup / Drop-off
- Safety and Security
Terminal Innovations

- Process-based Departures Hall
- Self-service Baggage Check
- Check-in Alternatives
- Low-profile Passenger Baggage Devices
- High-capacity Flow-through Elevators
- Consolidated Meeters and Greeters Area
- Arrivals Hall
- Arrivals Lounges
Process-based Departures Hall

MULTIPLE AIRLINES

SELF SERVICE DEVICES  |  SELF SERVICE BAG CHECK  |  STAFFED POSITIONS

BOARDING PASS  |  BAG CHECK  |  FULL SERVICE

PROCESS-BASED
Self-service Baggage Check

CURRENT TWO STEP SYSTEM

FULL SERVICE   BAG DROP
  SSDs

AIRLINE ONE

FULL SERVICE   BAG DROP
  SSDs

AIRLINE TWO

SELF-SERVICE BAG CHECK

FULL SERVICE   SELF-SERVICE BAG CHECK
  SSDs

AIRLINE ONE   AIRLINE TWO

COMMON USE

SELF-SERVICE BAG CHECK
Vienna International Airport
Main Street Check-in
Three-lane Check-in
Three-stage Check-in
Directional Check-in
Low-profile Passenger Baggage Devices

- **TYPICAL ARRANGEMENT**
  - BAG WELL
  - TAKE-AWAY BELT

- **TYPICAL CAROUSEL CLAIM**

- **LOW PROFILE**
  - TICKET COUNTER BAG WELL

- **FLAT PLATE CLAIM**
  - BAGGAGE CLAIM
High-capacity Flow-through Elevators

Typical Arrangement

Flow Through Arrangement
Vertical Transit – Heathrow
Consolidated Meeters and Greeters Area
Arrivals Lounges

TYPICAL ARRIVALS ROADWAY

ARRIVALS LOUNGE CONCEPT
Arrivals Lounges
Landside Innovations

- Bag Check Plaza
- Supplemental Curbsides
- Passenger Assistance Parking Area
- Passenger Processing Facility Concepts
- Passenger Processing Facility Examples
Bag Check Plaza
Drive Through Bag Check
Supplemental Curbsides

- **TERMINAL**
- **CURBSIDE**
- **CURBSIDE**
- **PARKING**

**TERMINAL AND GARAGE**

- **TERMINAL**
- **CURBSIDE**
- **CURBSIDE**
- **PARKING**

**GARAGE ONLY**
Heathrow Terminal 5
Passenger Assistance Parking Area
Adjacent Passenger Processing Facilities
On-Airport Passenger Processing Facility
Remote Passenger Processing Facility
APPF – Concept Example

DEPARTURES LEVEL
APPF – Concept Example

ARRIVALS LEVEL
APPF – Concept Example

TWO LEVEL TERMINAL AND SINGLE LEVEL ROADWAY

TWO LEVEL TERMINAL AND ROADWAY
OPPF – Concept Example

APM STATION LEVEL
OPPF – Concept Example
Thank You!