

**ACRP PROJECT 07-07
EVALUATING TERMINAL RENEWAL VERSUS REPLACEMENT
OPTIONS**

DRAFT FINAL REPORT

Prepared for
Airport Cooperative Research Program
Transportation Research Board
of
The National Academies

**TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES
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The report, not released for publication, is furnished only for review to members of or participants in the work of the CRP. This report is to be regarded as fully privileged, and dissemination of the information included herein must be approved by the CRP.

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January 2012

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This is an uncorrected draft as submitted by the research agency. The opinions and conclusions expressed or implied in the report are those of the research agency. They are not necessarily those of the Transportation Research Board, the National Academies, or the program sponsors.

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ABSTRACT

This research, conducted under Airport Cooperative Research Program (ACRP) Project 07-07, *Evaluating Terminal Renewal versus Replacement Options*, supports the development of a Guidebook to provide airport professionals, policymakers, and industry professionals with a step-by-step process for conducting a business-driven evaluation of competing options to renew or replace airport terminal facilities. The process is repeatable and scalable to airports of different sizes. Furthermore, the Guidebook is intended to assist the user in identifying the need for terminal redevelopment and selecting among competing options for renewing versus replacing existing terminal facilities. The Guidebook promotes a sequential four-step process wherein the need for terminal redevelopment is determined; options are developed; evaluations are performed; and recommendations are documented.

EXECUTIVE SUMMARY

PROJECT OBJECTIVES AND SCOPE

Airport operators are challenged to develop alternatives to evaluating strictly cost-driven approaches for renewing or replacing terminal facilities. While it may be easier to reach consensus using strictly cost-driven approaches to decision making, such approaches may not provide airport operators the ability to implement long-range strategies that would improve the competitiveness of their airports. The purpose of *ACRP Study 07-07: Evaluating Terminal Renewal versus Replacement Options* (hereafter referred to as the Guidebook) is to formulate guidelines for conducting a business-driven evaluation of competing options to renew or replace terminal facilities that is repeatable and scalable to airports of varying sizes.

This Guidebook is based on the knowledge, expertise, opinions, and recommendations of airport executives and airport industry professionals gained through literature review, interviews, and analyses. The Guidebook sets forth and relies upon proven techniques and tools currently being used by airport operators, as well as practices used in other industries with significant facility asset management requirements. The contributing factors assessed when developing the decision-making tool include: the airport governance structure, historical market conditions, expected growth in aviation activity, airport strategic plan, financial capacity, revenue growth and diversification, existing conditions, functionality, and Capital Improvements Program (CIP).

KEY RESEARCH FINDINGS

The basic principles for conducting an evaluation include the following:

- Provide a clear statement of the project objectives.
- Investigate all reasonable options to satisfy a given program's objective while conforming to the overall airport's Strategic Plan.
- Consider options in terms of its total life cycle costs, and operational and functional benefits.
- Ensure documentation of all assumptions and factors that contribute to decisions.
- Ensure that an appropriate balance is maintained between an airport's capital needs; an airport's ability to pay for capital projects; and affordability to the airlines.

RECOMMENDATIONS

The Guidebook promotes a sequential four-step process wherein the need for terminal redevelopment is determined; options are developed; evaluations are performed; and recommendations are documented. Specifically, the four steps are titled:

Step 1: Determine Need For Terminal Redevelopment

Step 2: Refine Terminal Redevelopment Objectives and Generate Options

Step 3: Evaluate Options

Step 4: Document Results From the Analyses

PRODUCTS

Several products were developed to document the findings of this research project and facilitate application of the findings:

Guidebook – The Guidebook is the primary product of this research project. The intent of the Guidebook is to serve as a valuable resource for airport professionals, policymakers, and industry professionals when making or advising terminal renewal versus replacement decisions. The Guidebook provides a framework for a repeatable evaluation process that is scalable to airports of varying sizes and incorporate lessons learned, analytical techniques, tools, and checklists identified through research and interviews. The Guidebook also offers practical guidance on the recommended stages and sequence of an evaluation process, including objectives, participation, and techniques. In the Guidebook, a case study example terminal redevelopment case referred to as City Airport is used to facilitate user understanding of techniques to evaluate competing options. The City Airport example is intended to enhance user recognition of the general process, techniques, and specific tools used in the evaluation. More importantly, the City Airport example will facilitate user understanding of the sources of data needed to conduct an evaluation, synthesize separate analyses that may be undertaken by different groups involved in the evaluation, and interpret the analyses in terms of an airport's Strategic Plan or Master Plan.

Executive Summary of Guidebook – A high-level Executive Summary is intended to help airport professionals, policymakers, and industry professionals understand the usefulness of the information presented in the Guidebook and to generate interest in the ACRP Project 07-07 research results and products.

CONCLUSIONS

The research conducted under ACRP Project 07-07 provides quantitative information on conducting a business-driven evaluation of competing options to renew or replace airport terminal facilities. The decision-making process outlined in this Guidebook can inform airport and airline management and consultant's strategies for evaluating the various alternatives.

It should be noted that airport terminals are complex facilities and exhibit vastly different characteristics in terms of size, air service, business arrangements, governance, and physical conditions, among other considerations. Consequently, tools described in the Guidebook should not be considered formulaic. Users of the Guidebook will necessarily have to adapt templates provided in the appendices to the Guidebook to reflect the unique operating and business environment of a particular airport. Even so, users will find the evaluation methodology described by the Guidebook to be fully adaptable and easy to integrate into their existing processes for developing and evaluating terminal related capital programs.

CHAPTER 1 BACKGROUND

This Final Report for ACRP Project 07-07, *Evaluating Terminal Renewal versus Replacement Options*, is intended to provide background to the research conducted in support of development of the Guidebook. This report is organized into 4 chapters and 2 appendices as follows:

- Executive Summary
- Chapter 1 – Background
- Chapter 2 – Research Approach
- Chapter 3 – Findings and Application
- Chapter 4 – Conclusion and Recommendations
- Appendix A – Annotated Bibliography
- Appendix B – Airport Interview Summaries

PROBLEM LEADING TO THE STUDY

Passage of the Airline Deregulation Act of 1978 began a period of rapid growth and expansion for U.S. airlines that lasted through the 1990s; however, since 2000, the effects of expansion, competition, increasing fuel prices, and global economic downturns have placed severe financial constraints on the airlines. The airlines have responded by reducing capacity nationwide and, in some cases, consolidating. Even as airport operators were adjusting to airline service reductions, the September 11, 2001, terrorist attacks caused unprecedented federal oversight and administration of air transportation security that dramatically transformed the way airport terminals function. As a result, aging terminal facilities — some already nearing the end of their service life — are more rapidly approaching functional obsolescence.

As airlines reduce costs in an attempt to return to long-term profitability, airport operator initiatives to renew or replace aging terminal facilities frequently encounter resistance from the airlines. Purely demand-driven terminal replacement projects have become rare; instead, airport operators are just as often required to find ways to reuse terminal areas that have been “given back” by the airlines. Airports with underutilized space are facing scrutiny from the airlines to justify the replacement of aging facilities as being more cost effective than facility renewal.

Airport operators are challenged to develop alternatives to evaluating strictly cost-driven approaches for renewing or replacing terminal facilities. While it may be easier to reach consensus using strictly cost-driven approaches to decision-making, such approaches may not provide airport operators the ability to implement long-range strategies that would improve the competitiveness of their airports.

ACRP Study 07-07: Evaluating Terminal Renewal versus Replacement Options (hereafter referred to as the Guidebook) directs the user through a step-by-step process for conducting a business-driven evaluation of competing options to renew or replace terminal facilities. The process is repeatable and scalable to airports of varying sizes.

DATA SOURCES

The research team conducted a review of published literature pertaining to practices involving the redevelopment of facility assets for airports specifically; and from industries and organizations involved with managing mission critical facility assets in general. To complement the findings of the literature review, research team conducted interviews with airport and airline staff that

recently completed similar evaluations to decide whether to renew or replace their aging terminal facilities. Each data source is discussed below.

Literature Review

The research team conducted a review of published literature related to practices involving the redevelopment of facility assets for airports specifically; and from industries and organizations involved with managing mission critical facility assets in general. **Appendix A** contains the annotated bibliography of relevant published literature related to airport development planning and financing; terminal building and system design; economic analyses and asset management; building and facility management; and building and facility management software/tools.

Airport Operator Interviews

Representatives from 10 U.S. Airports who recently completed similar evaluations to decide whether to renew or replace their aging terminal facilities at some point over the past five years (2006 – 2011) were interviewed to understand their experiences in the decision making process. The selected airports represented a cross-section of characteristics that were considered relevant to the research topic, including airport size, financing arrangements, and operating structure. **Appendix B** provides a synopsis of the interviews conducted.

CURRENT KNOWLEDGE ON TERMINAL REDEVELOPMENT DECISIONS

At present, there is limited aviation industry literature that is easily related to using economic analyses to evaluate terminal redevelopment options. Industry publications predominantly pertain to the Federal Aviation Administration's Benefit Cost Analyses process regarding the preparation of grant applications under the Airport Improvement Program. While the Research Team is aware of airports that are using software tools to manage facility assets, their number remains limited and were not found in those airports interviewed as part of our research. Applications used to manage maintenance work orders are more prevalent compared to using asset management software to create capital project plans and budgets.

The interviews discussed the procedures, influences, and types of analyses undertaken at each stage of the airport's decision-making process. The general factors that impact the decisions made by airport management include the following:

- The contributing factors associated with why the existing facilities were reaching the end of their useful life or were becoming functionally obsolete.
- The organizational structure and stakeholders involved in decision-making.
- The airport's business strategies, short- and long-term objectives, and resulting strategic plans.
- The revenue growth at the airport and the need for diversification.
- The ongoing and anticipated Capital Improvements Program (CIP) projects and the capacity for leveraging additional capital.
- The historical and current market conditions at the airport.
- The expected growth in aviation activity.
- The need to maintain flexibility with terminal infrastructure based on the occurrence of unexpected events.

Meanwhile, the general tools and processes current used by airport decision makers include the following:

- Management software and tools are used to monitor facility performance, including organizational management scorecards.
- Guiding principles and analyses are used to identify facility gaps that were seen as constraints to the airport's ability to achieve long-term objectives.
- Benefit/cost analyses are used to evaluate or rate options.
- Business and financial pro forma analyses are used separately or as part of the benefit/cost analyses.

OBJECTIVES AND SCOPE OF THE RESEARCH PROJECT

The primary objective of this research project was to develop a Guidebook that airport professionals, policymakers, and industry professionals can use to conduct business-driven evaluations of competing options to renew or replace terminal facilities that is repeatable and scalable to airports of varying sizes.

To meet this objective, the scope of the research included identifying applicable practices, techniques, and tools being used by aviation and non-aviation organizations at key stages in a business-driven decision-making process. The scope of research also included the identification of contributing factors and guiding principles that influence the evaluation process. From the research and analysis a process for evaluation options to rehabilitate or replace terminal facilities is proposed.

DEVELOPMENT OF THE GUIDEBOOK

The scope of this research project included the development of a Guidebook to assess the evaluation process associated with the renewal or replacement of terminal facilities. The Guidebook covers the following topics:

1. Understanding of terminal building life cycles;
2. Motivations for and factors that affect terminal redevelopment at U.S. airports;
3. Understanding the contributing factors and guiding principles that influence the evaluation process;
4. Roles and responsibilities of persons and organizations undertaking a major terminal redevelopment program;
5. Understanding an Airport's Strategic Plan and how it impacts development decisions; and
6. The financial considerations associated with the evaluation of alternative development options.

In the Guidebook, a case study example terminal redevelopment case referred to as City Airport is used to facilitate user understanding of techniques to evaluate competing options. The City Airport example is intended to enhance user recognition of the general process, techniques, and specific tools used in the evaluation. More importantly, the City Airport example will facilitate user understanding of the sources of data needed to conduct an evaluation, synthesize separate analyses that may be undertaken by different groups involved in the evaluation, and interpret the analyses in terms of an airport's Strategic Plan or Master Plan.

CHAPTER 2 RESEARCH APPROACH

The initial task of assembling and reviewing existing data source, contacting industry representatives, and formulating the list of factors that affect terminal development related decisions at airports served as the framework for much of the subsequent research. To develop a thorough understanding of the evaluation process, the research was focused on developing an understanding of the following issues:

1. Review and evaluate existing literature and practicable asset management tools.
2. Interview airport and airline staff who have completed a similar evaluation of terminal facilities within the past five years.
3. Identify contributing factors and guiding principles that influence the evaluation process.
4. Develop process for evaluating options to rehabilitate or replace terminal facilities.
5. Develop the Guidebook for Evaluating Terminal Renewal versus Replacement Options.

This chapter presents the approach followed in this research project and used to develop the Guidebook:

- Literature Review
- Case Studies
- Development of the Guidebook

LITERATURE REVIEW

Relevant published information was reviewed and research on the process used to evaluate terminal development alternatives (as indicated in Appendix A, Annotated Bibliography) to frame the issue and serve as a reference throughout the research project. Key words for each entry in the annotated bibliography identify the relevant topics in each article reviewed, such as the specific airport discussed in the article or a process or tool implemented at an airport related to evaluating terminal development alternatives. The literature review was focused on airport development planning and financing; terminal building and system design; economic analyses and asset management; building and facility management; and building and facility management software/tools.

A large body of information pertaining to airport planning, development and financing is available through the Airport Cooperative Research Program and are referenced throughout this report. ACRP's publications pertaining to the airport planning process and financial considerations involved with terminal redevelopment are directly applicable to evaluating options to renew or replace a terminal. Where applicable, this report uses terminology, and references methodologies that are consistent with existing ACRP publications.

At the present time, there is limited aviation industry literature that is easily related to using economic analyses to evaluate terminal redevelopment options. Industry publications predominantly pertain to the Federal Aviation Administration's Benefit Cost Analyses process regarding the preparation of grant applications under the Airport Improvement Program. Even so, information from these sources will be used to inform the guidebook in a manner that will be consistent with FAA guidelines.

The research team's investigation of software for building and facility management that would be compatible with an airport environment is detailed within Appendix B. While the Research Team is aware of airports that are using software tools to manage facility assets, their number remains limited and were not found in those airports interviewed as part of our research.

Applications used to manage maintenance work orders are more prevalent compared to using asset management software to create capital projects, plans and budgets.

CASE STUDIES

Relevant case studies were developed through interviews with airport and airline staff that recently completed similar evaluations to decide whether to renew or replace their aging terminal facilities. Interviews were conducted with the following airports, listed by airport size (FAA airport size definition) and the decision for terminal renewal or replacement ultimately reached by the airport:

Large Airports:

Dallas/Fort Worth International Airport (DFW)	Terminal Renewal
John F. Kennedy International Airport (JFK)	Terminal Replacement
Phoenix Sky Harbor International Airport (PHX)	Terminal Replacement

Midsized Airports:

Dallas Love Field (DAL)	Terminal Replacement
Indianapolis International Airport (IND)	Terminal Replacement

Small and Non-Hub Airports:

Asheville Regional Airport (AVL)	Terminal Renewal
Gulfport-Biloxi International Airport (GPT)	Terminal Renewal
McClellan-Palomar Airport (CLD)	Terminal Replacement
Wichita Mid-Continent Airport (ICT)	Terminal Replacement

The interviews discussed the process, influences, and types of analyses undertaken at each stage of the airport's decision-making process, including:

- Contributing factors that determine when and if existing facilities reach their useful life or become functionally obsolete.
- Organizational structure and stakeholders involved in decision-making.
- The airport's business strategies, short- and long-term objectives, and resulting plans.
- Management software and tools used to monitor facility performance, including organizational management scorecards.
- Guiding principles and analyses used to identify facility gaps that were seen as constraints to the airport's ability to achieve long-term objectives.
- Participants involved and the process used to develop discrete alternative solutions, factors used to analyze programmatic and opportunity objectives, and total life-cycle costs.
- Considerations and valuation of criteria used in benefit/cost analyses to rate options; or, if benefit/cost analyses were not used, why were they not used, and what alternative methods were used to determine the optimal solution.
- Business and financial pro forma analyses used separately or as part of the benefit/cost analyses.

DEVELOPMENT OF THE GUIDEBOOK

Development of the Guidebook to assist in the evaluation of competing options to renew or replace terminal facilities was largely based on the research conducted for this project. The purpose of the Guidebook is to formulate guidelines for conducting a business-driven evaluation of competing

options to renew or replace terminal facilities that is repeatable and scalable to airports of varying sizes and incorporate lessons learned, analytical techniques, tools, and checklists identified through research and interviews. The Guidebook also offers practical guidance on the recommended stages and sequence of an evaluation process, including objectives, participation, and techniques.

CHAPTER 3 FINDINGS AND APPLICATIONS

This chapter provides a discussion of how the research conducted for this project advances the knowledge of issues relevant to the evaluation of terminal redevelopment options. The Guidebook promotes a sequential four-step process wherein the need for terminal redevelopment is determined; options are developed; evaluations are performed; and recommendations are documented. Specifically, the four steps are titled:

Step 1: Determine Need For Terminal Redevelopment

Step 2: Refine Terminal Redevelopment Objectives and Generate Options

Step 3: Evaluate Options

Step 4: Document Results From the Analyses

The evaluation of options for terminal renewal versus replacement is in reality only one phase of a larger process for planning terminal redevelopment. As such, the Guidebook references available literature that will assist the user to develop prerequisite information needed to undertake the actual evaluation of competing options, which primarily occurs under Step 3.

STEP 1: DETERMINE NEED FOR TERMINAL REDEVELOPMENT

The principal goal of Step 1 is to determine if a need exists for a comprehensive terminal redevelopment program that would either extend the useful life of an existing terminal another 10 to 30 years, or replace the terminal. To achieve this goal, Step 1 involves two major tiers of analysis:

- Identify the gap between existing terminal conditions and capabilities and that needed to achieve the airport operator's strategic goals and objectives.
- Determine the financial capacity of the airport enterprise to fund a terminal redevelopment program.

Through the Step 1 process, consensus is built between the airport operator and the airlines serving the airport regarding the scope of needed terminal improvements.

Figure 1 illustrates the sequence of analysis and points in the sequence when analyses conducted by different organizational units should be correlated and reviewed with stakeholders or decision-makers.

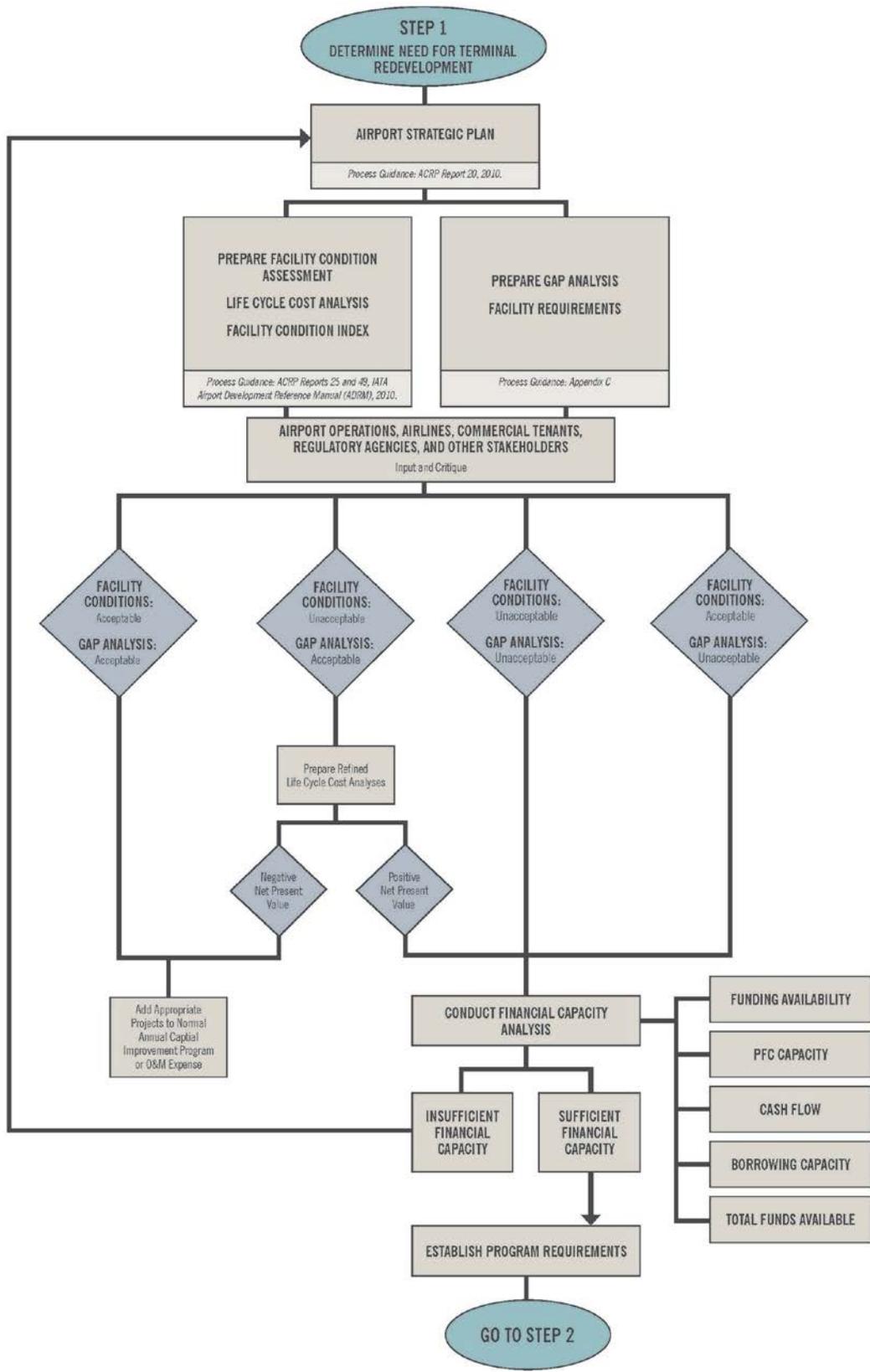


Figure 1 Step 1 Process Diagram
 Source: Ricondo & Associates, Inc., June 2011.

The first tier of analysis under Step 1 requires participants to: understand the airport's Strategic Plan or Master Plan; identify the gaps between existing terminal capabilities and those needed to achieve the airport operator's strategic goals and objectives. This involves:

- Gathering data and assessing the condition of existing terminal assets.
- Determining requirements needed to align terminal capabilities with the airport operator's strategic objectives for the airport's mission, competitiveness, forecast activity levels, level of service, and regulatory compliance

Figure 1 identifies several outcomes that could result from the first tier analyses:

- When both facility conditions and requirements are at *acceptable* levels within the timeframe specified for the analysis, then it is not necessary to undertake a major terminal redevelopment program.
- When both facility conditions and requirements are at *unacceptable* levels, then a financial capacity analysis should be undertaken to determine the financial capacity of the airport enterprise.
- Similarly, when facility requirements are at *unacceptable* levels, but facility conditions are at *acceptable* levels, then a financial capacity analysis should also be undertaken.
- When overall facility conditions are at *unacceptable* levels, but facility requirements are at *acceptable* levels, a benefit-cost analysis (BCA) should be undertaken to compare the costs and savings among options to continue "preventative" maintenance versus system replacement. In this situation, an airport's terminal is most likely reaching the end of its useful life in terms of major building systems, yet able to meet operational requirements. If the BCA indicates a positive net present value or a life cycle cost analysis (LCCA) indicates savings from replacement, then a financial capacity analysis should be undertaken.

The second tier of analysis involves a financial capacity analysis to estimate the resources available to undertake a terminal redevelopment project. Figure 1 identifies the principal inputs to the financial capacity analysis. Two outcomes could result from the analysis:

- A finding of insufficient capacity to overcome the facility conditions and requirements gap—identified from the first tier analyses—would require reconsideration of the airport operator's strategic objectives. This is an unlikely finding if the airport operator developed its Strategic Plan or Master Plan using available guidelines.
- A finding of available capacity would allow participants to refine a terminal redevelopment program and develop consensus among stakeholders and decision-makers to advance to Step 2 of the evaluation process.

STEP 2: REFINE TERMINAL REDEVELOPMENT OBJECTIVES AND GENERATE OPTIONS

The principal goal of Step 2 is to develop terminal concepts that represent reasonable options for terminal renewal or terminal replacement. ACRP Report 25, *Airport Passenger Terminal Planning and Design*, describes the iterative process typically undertaken to refine a terminal program and generate concept options.

Figure 2 illustrates the typical activities that occur in Step 2. While shown sequentially, the process to refine the terminal program and generate concepts is an iterative process in which results are improved by feedback from stakeholders involved in the terminal redevelopment program.

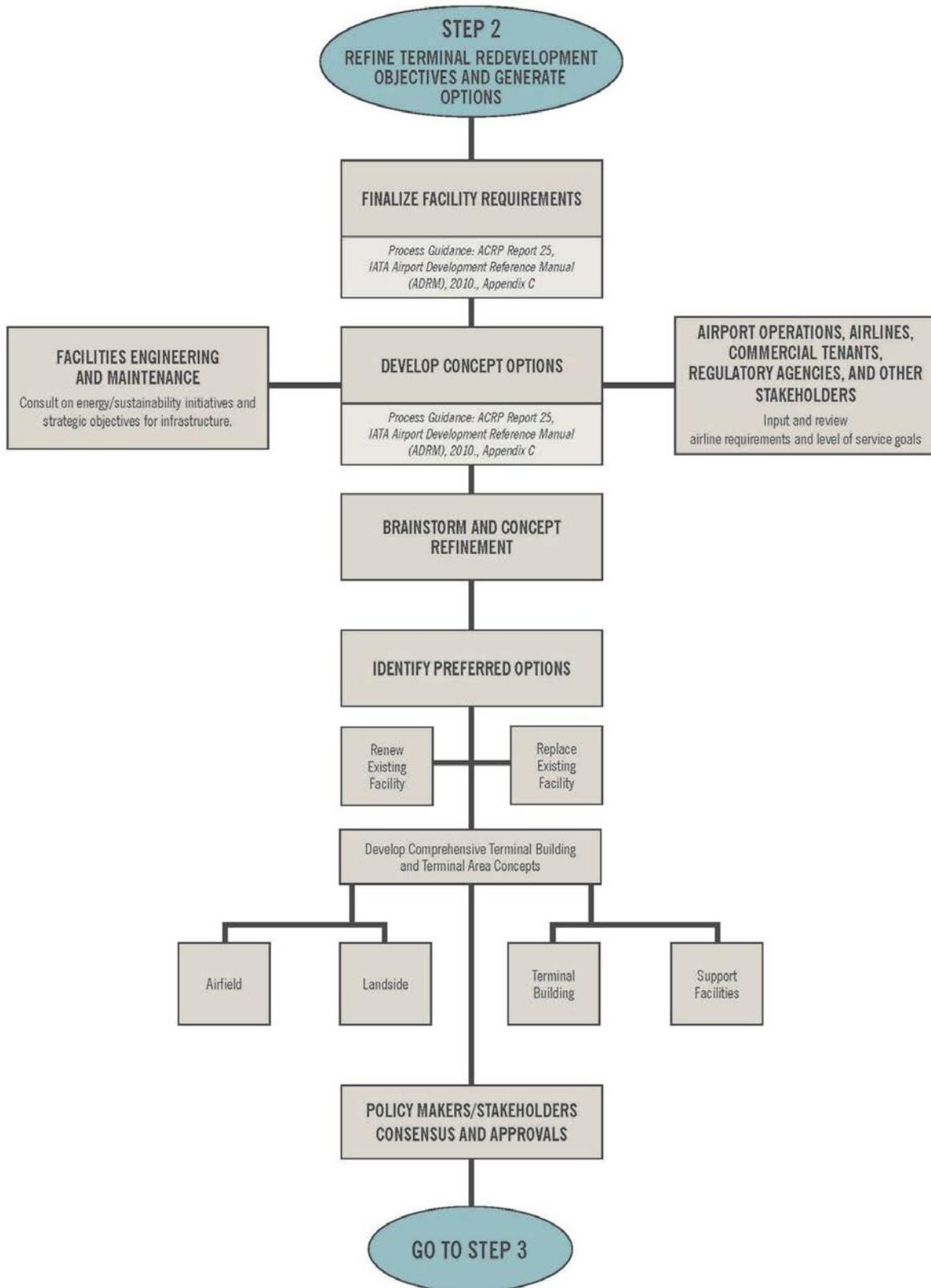


Figure 2 Step 2 Process Diagram
Source: Ricondo & Associates, Inc., June 2011.

To achieve the stated goal, several important objectives should be met:

- Refinements to the terminal program must correlate with the airport's Strategic Plan.
- Descriptions of terminal requirements must be unbiased in terms of interpreting or representing the objectives and goals for terminal redevelopment.
- Concept options must reasonably satisfy the terminal program.

Depending on the terminal development program, the concept options may or may not include a status quo (i.e., do nothing) option. In cases where the program statement identifies mission requirements that are new or unmet, then, for all practical purposes, a status quo (do nothing) option is most likely irrelevant, as the current terminal does not meet the minimum requirements.

The documentation of each concept option should minimally include the following to proceed with subsequent evaluations:

- Drawings of the facility, including the placement of properly sized facilities to house terminal functions.
- Illustrated site requirements (addressing phasing issues if the current site is to be used; addressing relocation and phasing issues if a new site is to be used).
- Illustrated phasing requirements at a conceptual level, addressing requirements for relocated functions during construction.
- Building area tabulations that correlate to airline rates and charges space categories.

STEP 3: EVALUATE OPTIONS

The principal goal of Step 3 is to develop qualitative and quantifiable factors to focus the decision makers on the business aspects of their decisions.

- Qualitative evaluations focus on the ability of each concept option to reduce or eliminate gaps in the existing terminal in a manner that best achieves the airport operator's strategic goals.
- Detailed financial analyses address the issues of debt capacity and affordability based on the total life cycle project costs of each option and related terminal revenue increases.

Figure 3 illustrates the sequence of analyses under Step 3 and points in the sequence when analyses conducted by different organizational units should be correlated and reviewed with stakeholders or decision-makers. The outcomes from Step 3 are:

- First, confirmation that one or both options are fundable.
- Second, if all options are fundable, then additional value and sensitivity analyses should be conducted to select the best option based on business-driven considerations rather than purely on cost.
- In cases where the option(s) is (are) not within the funding capacity of the airport enterprise, the assumptions used in the model must be revisited or Step 2 should be revisited.

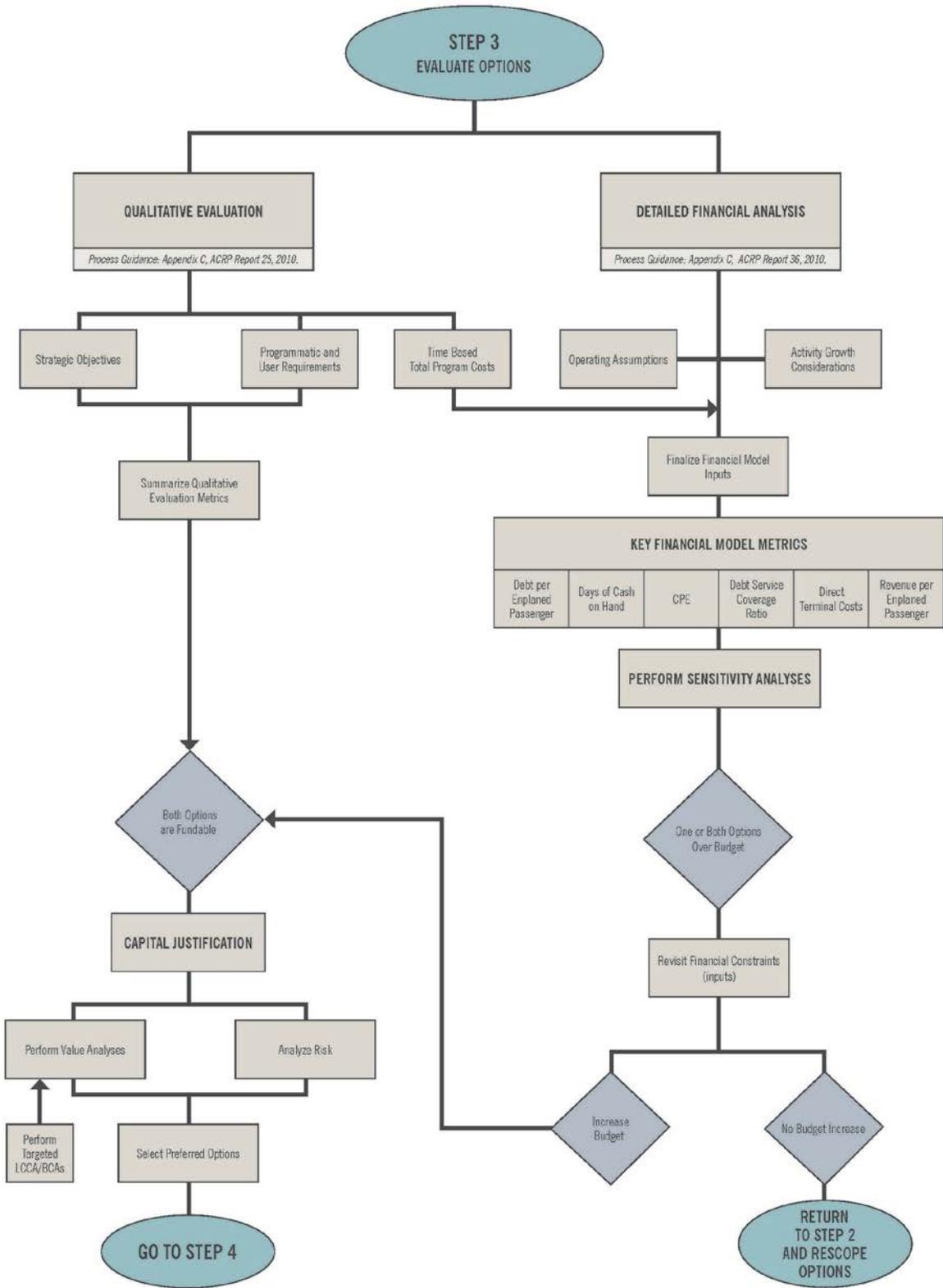


Figure 3 Step 3 Process Diagram
Source: Ricondo & Associates, Inc., June 2011.

STEP 4: DOCUMENT RESULTS FROM THE ANALYSES

The principal goal of Step 4 is to document results from the analyses. Typically, the project documentation would be referred to as the Terminal Redevelopment Program, as it would contain:

- Pertinent statements from the airport Strategic Plan or Master Plan
- Commercial Passenger Activity Forecasts
- Specific Goals and Objectives for redeveloping the terminal
- Concept Design
- Terminal space and other statistical requirements
- Financial Analysis

Figure 4 illustrates the typical activities that occur in Step 4, under which the terminal redevelopment program transitions from a planning process to an implementation process. The terminal redevelopment program documentation, which documents the results from the analyses, conveys the scope, conceptual design, and relationships among the terminal facilities to an implementation team that, for the most part, was not involved in the planning process.

Users of the Guidebook will necessarily tailor the documentation to meet the practices and standards of the particular airport under consideration. For example, the terminal redevelopment program may be a concise brief that is tailored to convey only needed information to a design team, and a separate comprehensive planning report would be prepared to document the analyses and outcomes from the preceding steps.

Similarly, the activity sequence of program implementation activities will necessarily be tailored to the specifics of redevelopment program. For example, the program could require an environmental approval process prior to commencing full implementation activities.

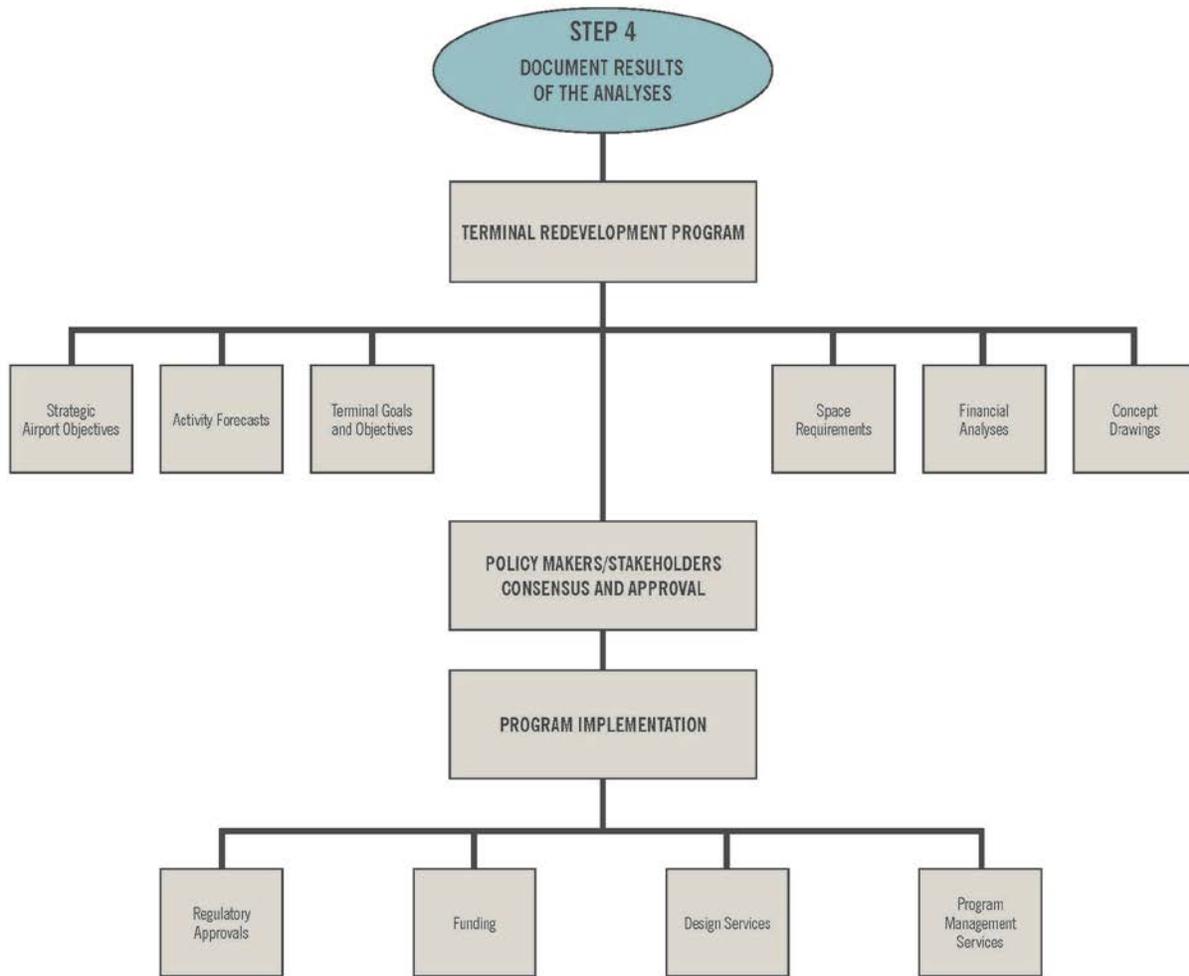


Figure 4 Step 4 Process Diagram
 Source: Ricondo & Associates, Inc., June 2011.

CHAPTER 4 CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The following main conclusions resulted from the research conducted under ACRP 07-07.

Provide a clear unbiased statement of the project objectives. This requires active participation at all levels of the airport's executive, business, facilities, and operational units; and regular interface with all significant stakeholders, particularly the air carriers, and federal and local agencies.

Investigate all reasonable alternatives to satisfy a given program's objective while conforming to the overall airport's Strategic Plan. The Airport's Strategic Plan or Master Plan is the basis for conducting any evaluation of terminal redevelopment options using a business driven approach. The approach recommended within the Guidebook requires participants to: understand the airport's Strategic Plan or Master Plan; identify the gaps between existing terminal capabilities and what would be needed to achieve the airport's strategic goals and objectives. This process involves (1) Gathering data and assessing the condition of existing terminal assets and (2) Determining requirements needed to align terminal capabilities to the airport's strategic objectives for mission, competitiveness, forecast activity levels, level of service, and regulatory compliance.

Consider alternatives in terms of its total life cycle costs and operational and functional benefits. A life cycle cost analyses should be conducted to compare the cost and savings between options to continue maintenance versus replacement of terminal systems. In addition to a terminal approaching the end of its useful life, terminal redevelopment may be motivated by changed operational and functional requirements that cannot be reasonably accommodated by an existing facility. A gap analysis can be used to compare the existing terminal facility with the type of terminal facility that would be needed to reach the desired operational capabilities and service levels described in the airport's Strategic Plan.

Ensure documentation of all assumptions and factors that contribute to decisions. Assumptions can consist of the current and future aviation activity levels, the target customer and operational levels of service, passenger and airline operational considerations, and the development capability of the Airport. Additionally, the document should address desired capabilities, strategic issues, and long term objectives; for example:

- Meeting customer expectations for service levels.
- Operating in a changing airline industry.
- Addressing unfunded or underfunded mandates.
- Identify additional financial resources and revenue generating opportunities.

Ensure that an appropriate balance is maintained between an airport's capital needs; an airport's ability to pay for capital projects; and affordability to the airlines. Analyzing the financial capacity of an airport must take into account the unique conditions of an airport, for example, overall market tolerance for higher levels of airport rates and charges may be different from one airport to another. Generally, as the overall cost and scope of the development increases, more scrutiny over justifications should be expected from the stakeholders (i.e., the project's operational benefits ability to justify the financial commitment to implement it). Understanding and identifying existing airport operator funding and financial commitments is a key first step in measuring the remaining financial resources available to fund prospective capital development.

RECOMMENDATIONS

The Guidebook promotes a sequential four-step process wherein the need for terminal redevelopment is determined; options are developed; evaluations are performed; and recommendations are documented. Specifically, the four steps are titled:

Step 1 – Determine Need For Terminal Redevelopment: The principal goal of Step 1 is to determine if a need exists for a comprehensive terminal redevelopment program that would either extend the useful life of an existing terminal another 10 to 30 years, or replace the terminal. To achieve this goal, Step 1 involves two major tiers of analysis:

- Identify the gap between existing terminal conditions and capabilities and that needed to achieve the airport operator’s strategic goals and objectives.
- Determine the financial capacity of the airport enterprise to fund a terminal redevelopment program.

Step 2 - Refine Terminal Redevelopment Objectives and Generate Options: The principal goal of Step 2 is to develop terminal concepts that represent reasonable options for terminal renewal or terminal replacement. To achieve the stated goal, several important objectives should be met:

- Refinements to the terminal program must correlate with the airport’s Strategic Plan.
- Descriptions of terminal requirements must be unbiased in terms of interpreting or representing the objectives and goals for terminal redevelopment.
- Concept options must reasonably satisfy the terminal program.

Step 3 - Evaluate Options: The principal goal of Step 3 is to develop qualitative and quantifiable factors to focus the decision makers on the business aspects of their decisions. To achieve the stated goal, two important objectives should be met:

- Qualitative evaluations focus on the ability of each concept option to reduce or eliminate gaps in the existing terminal in a manner that best achieves the airport operator’s strategic goals.
- Detailed financial analyses address the issues of debt capacity and affordability based on the total life cycle project costs of each option and related terminal revenue increases.

Step 4 - Document Results from the Analyses: The principal goal of Step 4 is to document results from the analyses. Typically, the project documentation would be referred to as the Terminal Redevelopment Program, as it would contain:

- Pertinent statements from the airport Strategic Plan or Master Plan
- Commercial Passenger Activity Forecasts
- Specific Goals and Objectives for redeveloping the terminal
- Concept Design
- Terminal space and other statistical requirements
- Financial Analysis

Plan for Implementing the Research Products

Guidebook

This research project included the development of a Guidebook to provide information to airport professionals, policymakers, and industry professionals. The Guidebook will be posted on the TRB website, available for download by interested parties.

Executive Summary

The Executive Summary provides a high-level summary of the research findings. This Executive Summary is written for airport operators, airlines, and consultants, to help them understand the usefulness of the Guidebook and to generate interest in the ACRP Project 07-07 research products.

Potential Webinar to Introduce Research Products to Industry

The research team and Project Panel suggest that a webinar be conducted to introduce the research products to the industry.

Conference Presentations to Introduce Research Product to Industry

The research team will pursue opportunities to present the findings of this research project and the resulting research products at industry conferences.

Notification of Availability of Case Study Airports

The research team intends to notify the operators of those airports that contributed to this research project on the availability of the research products.

REFERENCES

Dallas/Fort Worth International Airport (DFW)

- (1) Max Underwood, Mike Phemister, and Rusty Hodapp, Dallas / Fort Worth International Airport; Laura Einspanier and Tom Sparks, American Airlines Corporate Real Estate. On-site interview by Jeff Schulthess, Joe Chang, Tom Brown, and Tom Simanivanh, Ricondo & Associates, Inc., December 13-14, 2010.

John F. Kennedy International Airport (JFK)

- (2) Kiran Merchant, William Myers, and William Radinson, Port Authority of New York and New Jersey; Mike Ferrigno and Rich Louis John F. Kennedy International Airport. On-site interview by Jeff Schulthess, Tom Brown, and Tom Simanivanh, Ricondo & Associates, Inc., December 7, 2010.

Phoenix Sky Harbor International Airport (PHX)

- (3) Brent Cagle, Chris Andres, Dave Hensley, Diane Nakagawa, Jay DeWitt, Judy Ross, Roxann Favors, and Tamie Fisher, Phoenix Sky Harbor International Airport. On-site interview by Jeff Schulthess, Joe Chang, John Williams, and Tom Brown, Ricondo & Associates, Inc., February 10-11, 2011.

Dallas Love Field (DAL)

- (4) Diego Rincon, City of Dallas; Bob Montgomery, Chris Czarnecki, and John Zuzu, Southwest Airlines; Jonathan Massey, Corgan Associates. On-site interview by Jeff Schulthess, Joe Chang, and Tom Brown, Ricondo & Associates, Inc., December 13, 2010.

Indianapolis International Airport (IND)

- (5) Greta Thomson, James Mooney, Keith Berlen, Mike Medvescek, Randy Coffin, Robert Thomson, Scott Lawson, Susan Zellers, and Tim Method, Indianapolis Airport Authority. On-site interview by Jeff Schulthess and Tom Brown, Ricondo & Associates, Inc., January 27, 2011.

Ashville Regional Airport (AVL)

- (6) David Nantz, Ellen Heywood, Lew Bleiweis, and Vickie Thomas, Ashville Regional Airport Authority. Telephone interview by Jeff Schulthess, Joe Chang, Tom Brown, and Tom Simanivanh, Ricondo & Associates, Inc., January 18, 2011.

McClellan - Palomar Airport (CLD)

- (7) Mike Quarry and Peter Drinkwater, County of San Diego. Telephone interview by Jeff Schulthess, Joe Chang, and Tom Brown, Ricondo & Associates, Inc., January 13, 2011.

Gulfport-Biloxi International Airport (GPT)

- (8) Casey Lyons, Don Shelpey, Jim Foster, and Stephen Oberlies, Gulfport-Biloxi International Airport. Telephone interview by Jeff Schulthess, Joe Chang, Tom Brown, and Tom Simanivanh, Ricondo & Associates, Inc., January 13, 2011.

Wichita Mid-Continent Airport (ICT)

- (9) Victor White, Wichita Airport Authority. Telephone interview by Jeff Schulthess, Tom Brown, and Tom Simanivanh, Ricondo & Associates, Inc., January 18, 2011.

APPENDIX A ANNOTATED BIBLIOGRAPHY

AIRPORT DEVELOPMENT PLANNING AND FINANCING

- (1) ACRP Project 11-03, Synthesis 01, *Innovative Finance and Alternative Sources of Revenue for Airport*, Transportation Research Board, Washington, D.C., 2007

This synthesis study is intended to inform airport operators, stakeholders, and policymakers about alternative financing options and revenue sources currently available or that could be available in the future in the United States. The report provides a brief overview of common capital funding sources used by airport operators, a review of capital financing mechanisms used by airports, descriptions of various revenue sources developed by airport operators, and a review of privatization options available to U.S. airport operators.
- (2) ACRP Project 11-03 Synthesis 13, *Effective Practices for Preparing Airport Improvement Program Benefit-Cost Analysis*, Transportation Research Board, Washington, D.C., 2009

Airport Improvement Program (AIP) authorizing legislation requires that airports applying for funding of capacity-enhancing projects needing more than \$5 million in discretionary funds conduct a benefit-cost analysis (BCA). The objective of this synthesis is to describe successful assessment techniques that can be used by airports in performing BCAs for hard to quantify benefits from projects needing more than \$5 million in AIP discretionary funding.
- (3) ACRP Project 11-03, Synthesis 19, *Airport Revenue Diversification*, Transportation Research Board, Washington, D.C., 2010

Airports are increasingly focused on diversifying their revenue streams in response to airline industry consolidation and emphasis on lowering costs. Synthesis 19 provides an overview of how the business model for airports has changed, and how alternative revenue development fits within the airport planning process and reviews various strategies that airports employ to leverage their resources.
- (4) ACRP Report 16, *Guidebook for Managing Small Airports*, Transportation Research Board, Washington, D.C., 2009

ACRP 16 provides comprehensive advice on resources and techniques that can be applied to meet responsibilities that operators and managers of small airports have including: financial management, oversight of contracts and leases, safety and security, noise control, community relations, compliance with federal grant conditions, facility maintenance, and capital improvements.
- (5) ACRP Report 20, *Strategic Planning in the Airport Industry*, Transportation Research Board, Washington, D.C., 2009

ACRP 20 is a guidebook for airport managers and policymakers using strategic planning to guide their decision making process. The report links business concerns of managing an airport with other planning efforts, such as those conducted as part of a master planning process. The guidebook includes proven traditional techniques and tools that have been effectively applied by some airport executives, as well as innovative practices that are emerging in the airport and other industries.

- (6) ACRP Report 26, *Guidebook for Conducting Airport User Surveys*, Transportation Research Board, Washington, D.C., 2011
- ACRP Report 26 explores the basic concepts of survey sampling and the steps involved in planning and implementing a survey. The guidebook also examines the different types of airport user surveys, and includes guidance on how to design a survey and analyze its results.
- (7) ACRP Report 36, *Airport/Airline Agreements – Practices and Characteristics*, Transportation Research Board, Washington, D.C., 2010
- ACRP 36 provides a tool to assist both airport operators and airlines during business arrangement negotiations by describing the range of business relationships between airports and airlines including the underlying rates and charges methodologies, presenting a general negotiation process and schedule, identifying key information for a negotiation, identifying the various issues that typically surface, describing the various alternatives for resolving potential conflicts and issues, and identifying the linkages among these various critical issues.
- (8) ACRP Report 42, *Sustainable Airport Construction Practices*, Transportation Research Board, Washington, D.C., 2011
- ACRP Report 42 explores a set of best practices, methods, procedures, and materials that if implemented during construction may have a sustainable, positive economic, operational, environmental, or social effect. The report includes the collection of sustainable airport construction practices in a searchable, filterable spreadsheet format on a CD-ROM, which is packaged with the report.
- (9) ACRP Report 43, *Guidebook of Practices for Improving Environmental Performance at Small Airports*, Transportation Research Board, Washington, D.C., 2011
- ACRP Report 43 outlines federal environmental regulations and requirements, and identifies activities in which airport operators can be proactive in promoting environmental stewardship. As a quick reference, summary graphics provide information pertaining to the cost and savings as well as the necessary knowledge and amount of time to implement a particular activity. In addition, there are five case studies that discuss environmental initiatives already undertaken at airports that can serve as a guide for other airports.
- (10) ACRP Report 49, *Collaborative Airport Capital Planning Handbook*, Transportation Research Board, Washington, D.C., 2011
- ACRP Report 49 provides guidance to those in the airport community who have responsibility for, and a stake in, developing, financing, managing, and overseeing an airport capital plan and the individual projects included in it. The handbook provides guidance on appropriate performers for each task in the collaborative planning process, and defines and describes the different ways to communicate to help ensure effective exchanges between internal and external stakeholders.
- (11) ACRP Synthesis 21, *Airport Energy Efficiency and Cost Reduction*, Transportation Research Board, Washington, D.C., 2010
- ACRP Synthesis 21 explores energy efficiency improvements being implemented at airports across the country that are low cost and short payback.

- (12) ACRP Synthesis 27, *Airport Self-Inspection Practices*, Transportation Research Board, Washington, D.C., 2011

ACRP Synthesis 27 provides insight into common airport self-inspection practices. A comprehensive self-inspection program includes the components of training; inspecting; reporting discrepancies and findings; follow-up, resolution, and close-out; and quality control. The report may be useful to airports in benchmarking their self-inspection programs to peer airports and practices considered successful by regional U.S. Federal Aviation Administration personnel.

- (13) Airports Council International, *Policies and Recommended Practices Handbook 2009*, Airport Council International, Geneva, Switzerland, November 2009.

The ACI Policy and Recommended Practices Handbook contain the current policies of the organization for use by the staff of ACI World and the regional offices and by ACI representatives at international meetings.

- (14) Federal Aviation Administration, *Airport Business Practices and Their Impact on Airline Competition*, United States Department of Transportation, Washington, D.C., October 1999.

This order provides guidance and procedures to be used by FAA personnel in the administration of the Passenger Facility Charge (PFC) Program. The guidance and procedures reflect established FAA practices that have successfully met the statutory and regulatory requirements of the PFC Program. The guidance and procedures are current as of the date of issuance of this order and incorporate all changes to the PFC Program introduced by the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR 21), as well as prior legislation.

- (15) Federal Aviation Administration, *Airport Capital Improvement Plan*, United States Department of Transportation, Washington, D.C., August 22, 2000.

This order prescribes the development of the national Airports Capital Improvement Plan (ACIP). The ACIP serves as the primary planning tool for systematically identifying, prioritizing, and assigning funds to critical airport development and associated capital needs for the national airspace system (NAS). The ACIP also serves as the basis for the distribution of grant funds under the Airport Improvement Program (AIP).

- (16) Federal Aviation Administration, *Airport Improvement Program Handbook*. United States Department of Transportation, Washington, D.C., June 28, 2005.

This order provides guidance and sets forth policy and procedures to be used in the administration of the Airport Improvement Program. Several FAA orders and advisory circulars are referred to in this directive. The references appear as the basic publication number without any suffix. However, the latest issuance of the publication should be used as the reference.

- (17) Federal Aviation Administration, *Land Acquisition and Relocation Assistance for Airport Projects*. United States Department of Transportation, Washington, D.C., August 1, 2005.

This order provides guidelines and identifies responsibilities for FAA acceptance and monitoring of airport sponsor compliance with provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act) (42 USC 4601 et seq.), as amended, on airport projects receiving federal financial assistance. This order incorporates all applicable requirements as provided in the Uniform Act implementing regulation 49 CFR Part 24, Uniform Relocation Assistance and Real Property Acquisition for Federal and

Federally Assisted Programs (Federal Register 70, No. 590, January 4, 2005, and as may be amended).

- (18) Federal Aviation Administration, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Projects*. United States Department of Transportation, Washington, D.C., April 28, 2006

This order provides information to FAA Office of Airports personnel and others interested in fulfilling NEPA requirements for airport actions under the FAA's authority. This order is part of FAA's effort to ensure its personnel have clear instructions to address potential environmental effects resulting from major airport actions. In preparing FAA Order 5050.4B, the Office of Airports has made it consistent with FAA Order 1050.1E.2. Information on federal environmental laws other than NEPA appears in another document titled An Environmental Desk Reference for Airport Actions. The Office of Airports will publish notices in the Federal Register announcing the Desk Reference's availability.

- (19) Federal Aviation Administration, *Passenger Facility Charge*. United States Department of Transportation, Washington, D.C., August 9, 2001.

This order provides guidance and procedures to be used by FAA personnel in the administration of the Passenger Facility Charge (PFC) Program. The guidance and procedures reflect established FAA practices that have successfully met the statutory and regulatory requirements of the PFC Program. The guidance and procedures are current as of the date of issuance of this order and incorporate all changes to the PFC Program introduced by the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR 21), as well as prior legislation.

- (20) Fitch Ratings, *Airports Rating Criteria Handbook for General Revenue, Passenger Facility Charge, and Letter of Intent Bonds*, New York, N.Y., March 12, 2007.

Fitch Ratings published methodology of how it reviews the economic, market, financial, and other factors in determining a rating for various types of airport related debt.

- (21) International Air Transport Association, *Airport Development Reference Manual*, Edition 9, January 2004.

The ADRM represents a consolidation of best industry practice with respect to the development of world class airports through better design. Its content reflects the recommendations of IATA experts in all areas of airport planning, development, financing and operation, as well as input from world-renowned industry specialists and organizations keen to promote the development of world-class airport facilities.

- (22) Roper, Kathy O., *"A White Paper on Strategic Facility Planning"*, International Facility Management Association, Houston, TX, 2009.

Strategic facility planning (SFP) is a process that can lead to better, more proactive delivery of services from a facility management organization to its stakeholders. The time taken to carry out SFP is well spent in that it helps to avoid mistakes, delays, disappointments and customer dissatisfaction. It can actually allow facility plan implementations to run more quickly and smoothly. This white paper provides information on the SFP process, its requirements and benefits, and gives a facility manager the basic tools to launch and successfully complete a SFP for the supported organization. Definitions are provided in an appendix to help clarify terms quickly or for reference. A process model is also provided to support visual thinkers and learners.

TERMINAL BUILDING AND SYSTEMS DESIGN

- (1) Airports Council International, *Guidance Manual: Airport Greenhouse Gas Emissions Management*, ACI World Environment Standing Committee, 1st Edition, November 2009

This document speaks to airports about the things they can do to manage and reduce emissions. There are arguments for changing infrastructure out and while there is a cost, there is also a cost savings such as the installation of LED lights and variable speed ventilation fans literally paying for themselves over time. There are the regulatory drivers which may vary from state to state although the US Environmental Protection Agency is requiring mandatory reporting for large GHG emissions sources which airports would classify as. There is mention of a corporate responsibility airports may feel as being a good neighbor to the community.

- (2) Airports Council International, *Policies and Recommended Practices Handbook*, Seventh Edition, November 2009.

Section 6.2 titled Emissions and Local Air Quality addresses best practices airport could follow in order to lessen their impact on the environment. Sub section 6.2.10 addresses best practices to be considered for airport infrastructure suggesting stationary sources can emit a significant amount of pollutants. Section 6.3 discusses greenhouse gas emissions and climate change. In sub section 6.3.1 airport utility plants are mentioned as an infrastructure area for upgrades to lessen impact. The main focus of this chapter is actually determining emissions and pollutant types by measuring. Often times aircraft are considered the larger outpour of pollutants but airport infrastructure needs to be recognized as well. Sub section 6.3.7 speaks to recommendation for new buildings to employ best practice energy efficiency and GHG technology and existing building be reviewed to ascertain areas of deficiencies. Section 6.4 speaks to the sustainability of the airports infrastructure.

- (3) ACRP Report 10, *Innovations for Airport Terminal Facilities*, Transportation Research Board, Washington, D.C., 2008

ACRP 10 discusses the recent worldwide developments in landside facilities design and discusses future trends and innovative passenger service/processing concepts. Discussions focus on innovative approaches that improve the experience of passengers between the airport entrance and the secure portions of the passenger terminal, particularly as it relates to needs of an aging population. The innovations and concepts developed as part of this research effort were focused on those that could be implemented within the next 5 to 10 years at large- and medium-hub airports.

- (4) ACRP Project 11-02, Digest 2, *Model for Improving Energy Use in U.S. Airport Facilities*, Transportation Research Board, Washington, D.C., 2007

Research Results Digest 2 presents data on U.S. airports' utilization of 11 major energy management practices, offers a set of best practices for reducing energy use, and summarizes three case studies of recent recommissioning projects that resulted in significant reductions in energy use. Among the various comparative tables are potential energy indices for utility and energy costs on the basis of square foot, and in terms of enplanements.

- (5) ACRP Project 11-03 Synthesis 10, *Airport Sustainability Practices*, Transportation Research Board, Washington, D.C., 2008

This synthesis study informs airport operators, stakeholders, and policy makers about a range of airport sustainability practices gathered from a literature review and web-based survey. It

specifically targets airport operators and provides a snapshot of airport sustainability practices across the triple bottom line of environmental, economic, and social issues.

- (6) ACRP Project 11-03 Synthesis 21, *Airport Energy Efficiency and Cost Reduction*, Transportation Research Board, Washington, D.C., 2010

Synthesis 21 documents energy efficiency improvements being implemented at airports across the country that are low cost and short payback by means of a survey, interviews and a literature review. It targets terminal managers of small airports, staff, consultants, and other stakeholders interested in energy efficiency.

- (7) ACRP Project A11-03, Synthesis 20, *Airport Terminal Facility Activation Techniques*, Transportation Research Board, Washington, D.C., 2010.

This synthesis study is intended to inform airport terminal operators and those involved in the facility activation process about lessons learned during recent airport facilities openings so that effective airport terminal facility activation practices can be identified and shared across the industry. Information was largely gathered from individuals involved with one or more terminal activations at 14 domestic and international airports.

- (8) ACRP Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook*, Transportation Research Board, Washington, D.C., 2010

ACRP 25 provides guidance in planning and developing airport passenger terminals and assist users in analyzing common issues related to airport terminal planning and design. The guidebook addresses the airside, terminal building, and landside components of the terminal complex; describes the passenger terminal planning process and the important criteria and requirements needed to address emerging trends and create solutions for airport passenger terminals.

- (9) ACRP Report 30, *Reference Guide on Understanding Common Use at Airports*, Transportation Research Board, Washington, D.C., 2010

Common Use is a facility allocation and management approach intended to maximize airport facility access and allocation through non-dedicated resources. ACRP 30 provides a guidebook for airport operators, airlines, and other entities interested in considering common-use initiatives. The Reference Guide considers common use as more than simply technology and includes analysis and review of all areas and functions within an airport that might be affected by a non-dedicated shared-use facility. This Guide identifies common-use issues and opportunities and provides guidance for decision-making efforts, recognizing that there are a multitude of common-use approaches and variables.

- (10) ACRP Report, 40, *Airport Curbside and Terminal Area Roadway Operations*, Transportation Research Board, Washington, D.C., 2010

ACRP Report 40 includes guidance on a cohesive approach to analyzing traffic operations on airport curbside and terminal area roadways. The report examines operational performance measures for airport curbside and terminal area roadway operations and reviews methods of estimating those performance measures. The report includes a quick analysis tool for curbside operations and low-speed roadway weaving area, highlights techniques for estimating traffic volumes, and presents common ways of addressing operational problems.

- (11) Report 52, *Wayfinding and Signing Guidelines for Airport Terminals and Landside*, Transportation Research Board, Washington, D.C., 2011

ACRP Report 52 is designed to provide airports with the tools necessary to help passengers find their way in and around the airport. The guidelines focus on four areas of the airport: (1) roadways—both on-airport, and off-airport access roads; (2) parking; (3) curbside and ground transportation; and (4) terminal. In addition, the guidelines discuss developing a wayfinding strategy; the use of technology and visual displays; and color, fonts, and sizes.

- (12) ACRP Synthesis 8, *Common Use Facilities and Equipment at Airports*, Transportation Research Board, Washington, D.C., 2008

TRB's Airport Cooperative Research Program (ACRP) Synthesis 8: *Common Use Facilities and Equipment at Airports* explores common use technology that enables an airport operator to take space that has previously been exclusive to a single airline and make it available for use by multiple airlines and their passengers.

- (13) Clean Airport Partnership, *10 Airport Survey – Energy Use, Policies, and Programs for Terminal Buildings*, A report to the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, May 16, 2003

This survey of 10 airports provides information on the policies and programs that these airports have developed to monitor and maximize energy efficiency; information allowing comparisons for energy use on a square foot basis between the various airports and at buildings within the same airport. Interestingly, while surveys document that investments in building efficiency can yield significant rewards, it provides evidence that new terminal construction may not in many cases be more energy efficient than older facilities, largely due to the more dramatic nature of new terminal construction.

- (14) Federal Aviation Administration, *Airport Design, Advisory Circular 150/5300-13 (and Change 11)*, United States Department of Transportation, Washington, D.C., August 9, 2001.

This advisory circular presents guidance material for the planning and design of airport terminal buildings and related access facilities. It includes material and nomographs that provide general guidelines and approximations for determining space and terminal facility requirements for planning purposes. AC 150/5360-9, *Planning and Design of Airport Terminal Building Facilities at Nonhub Locations*, contains guidance material for use in planning terminal facilities at low activity airports. It may be used in lieu of or in conjunction with AC 150/5300-13.

- (15) Federal Aviation Administration, *Airport Master Plans, AC 150/5070-6B*, United States Department of Transportation, Washington, D.C., August 9, 2001.

This Advisory Circular provides guidance for the preparation of master plans for airports that range in size and function from small general aviation to large commercial service facilities. The intent of this AC is to foster a flexible approach to master planning that directs attention and resources to critical issues.

- (16) Kampschroer, Kevin, *Federal Green Buildings Statement*, US General Services Administration (GSA), July 21, 2010.

The Office of Federal High Performance Green Buildings (OFHPGB) was created by Congress to enhance Federal leadership in the field of large scale sustainable real property portfolio management and operations. This statement provides an informational overview into the resources available from OFHPGB for green facility planning and justification. The

statement includes not only cost savings for the building operation itself but also the reduction of carbon footprints, reduction in worldwide energy consumption and providing a healthier interior workplace for employees.

- (17) Transportation Security Administration, *Recommended Security Guidelines for Airport Planning, Design and Construction*, Department of Homeland Security, Washington, D.C., June 15, 2006.

This document presents recommendations for incorporating sound security considerations into the planning, design, construction, and modification of security-related airport facilities and airport terminal buildings. It consolidates information developed through the participation of the Transportation Security Administration (TSA) and other government and aviation industry professionals.

- (18) SITA, Baggage Report 2010.

Since 2005, SITA has produced an annual baggage report, which is designed to offer all air transport industry stakeholders the latest facts, figures and trends related to global baggage processing and management.

- (19) U.S. Customs and Border Protection, *Airport Technical Design Standards Passenger Processing Facilities* Department of Homeland Security, Washington, D.C., August, 2006

The ATDS is to serve as the primary reference document for Airport Authorities, architect/engineering consultants, airport owners/operators and all CBP personnel involved with the planning, design, renovation and development of CBP passenger processing facilities at airports. It integrates federal inspection elements, establishes unified primary inspections, along with specialized secondary inspections.

BENEFIT COST ANALYSES

- (1) Abate, Douglas, Towers, Michael, Dotz, Richard, Romani, Luca, Luftkin, Peter, S., “The Whitestone Facilities Maintenance and Repair Cost Reference,” Whitestone Research, published annually.

The Whitestone Facility Maintenance and Repair Cost Reference is a comprehensive source of building maintenance & repair (M&R) cost statistics. It provides a collection of unique tools for answering simple but important questions. The information is organized by both building type and by components like exterior enclosure, roofing, HVAC, etc. This publication can provide the M&R information that is required when performing the Life-Cycle Cost Analysis.

- (2) Bernhardt, Eric, Ballard, Spencer, Richardson, Nora. “*Capital Investment Decision-Making in a Slow Growth Environment*,” LeighFisher Consultants, November, 2009.

This article contains information on the methods and process of evaluation and justification of capital investments for airport terminal rehabilitation or replacement. It explains how the standard analyses have been primarily based on future demand compared to current capacity. Now with the slower growth in demand the evaluation should include cost benefit analyses of replacing older systems or entire facilities with ones that are more efficient and sustainable. This article can provide good insight into how the evaluation process has changed and what factors should have an impact on the decision to renovate or replace an existing terminal.

- (3) Dell'Isola, Alphonse, Kirk, Stephen, *Life-Cycle Costing for Facilities*, Reed Construction Data, 2003.

This book is both a tutorial manual that explains how to perform Life-Cycle Cost Analysis (LCCA), and a reference manual with data on many of the building systems and components. The tutorial chapters provide an easy to follow step by step explanation of the entire LCCA process including complex LCC analyses. The reference data includes information on the annual maintenance, energy demand, and replacement life. Also included in this publication are LCCA Case Studies for various types of facilities and building systems, and forms that can be helpful in preparing the Life-Cycle Cost Analysis.

- (4) Federal Aviation Administration, Benefit Cost Analysis on Airport Capacity Projects for FAA Decisions on Airport Improvement Program (AIP) Discretionary Grants and Letters of Intent (LOI), United States Department of Transportation, December 15, 1999.

The policy for AIP grants, issued on June 24, 1997, was that, for all capacity projects for which an airport sponsor seeks \$5 million or more in AIP discretionary funds, commencing in Fiscal Year 1998, a completed BCA must accompany the grant application. The policy for LOIs was that a BCA must be completed for any request for a LOI to be issued in Fiscal Year 1997 and thereafter. The BCA policy covers those projects which will upgrade airport facilities to meet higher design standards and which will allow new classes or aircraft to use the airport. The BCA policy is not applicable to those projects undertaken solely for the objective of safety, security, conformance with FAA standards, or environmental mitigation.

- (5) Fuller, Sieglinde, K., Petersen, Stephen, R., *Life-Cycle Costing Manual*, Federal Energy Management Program (FEMA), 1996.

This handbook is a guide to understanding how to perform Life-Cycle Cost Analysis (LCCA) of investments in projects for federal buildings and facilities. This publication was originally aimed at supporting the FEMP LCC methods but has evolved into being one of the leading guides for conducting LCC analysis of buildings and building systems by both government agencies and the private sector. It is an excellent source for understanding the process and provides references to other publications and software. In addition to the manual, a supplement to Handbook 135, "Energy Price Indices and Discount Factors for LCC Analysis" is published annually by NIST to provide updated information.

- (6) Horvath, James, L., Strychaz, Stan, Haigh, Ian, Kimmel, Matt, *Commercial Square Foot Building Costs*, Saylor Publications, Inc., published annually.

This manual was designed to provide building cost data that can be used for preliminary planning and "ballpark" estimating. The manual is recognized as an industry standard by contractors, architects, lenders, planners and appraisers. It is published annually and therefore costs are based on current construction costs. The manual includes 65 building types including an airport terminal and contains additional cost information on the various portions of the building and systems that are typically associated with terminals. This publication can provide cost information for both major renovations and terminal replacements.

- (7) Rohm, Howard, "A Balancing Act", Performance Magazine, Volume 2, Issue 2, The Balanced Scorecard Institute.

The Balanced Scorecard is a Performance Management system that can be used in any size organization to align vision and mission with customer requirements and day-to-day work,

manage and evaluate business strategy, monitor operation efficiency improvements, build organization capacity, and communicate progress to all employees.

- (8) Transportation Security Administration, *Planning Guidelines and Design Standards for Checked Baggage Inspection Systems*, Department of Homeland Security, Washington, D.C., January 20, 2009

This publication is fundamentally a planning guideline with TSA design standards for airport checked baggage inspection systems. It contains extensive information on the types of baggage handling systems along with cost and useful life expectancy of the equipment. Chapter 9 has the guidelines for calculating life-cycle costs for alternatives and includes average cost of the equipment. Chapter 5 contains information on the different types of systems and EDS machines. This publication can provide life-cycle expectancy and cost information for both major renovations and terminal replacements.

BUILDING AND FACILITY MANAGEMENT

- (1) APPA, Federal Facilities Council, Holder Construction, IFMA, NASFA, “A Framework for Facilities Lifecycle Cost Management – Framework, Glossary & Definitions”

To help foster effective communication among public and private-sector organizations with interests in infrastructure and real property, a charter, inter-association working group was formed. This report sets forth a guide for consistent use of appropriate terminology in order to enable effective communication among the various decision makers, building managers, operators and technicians involved with facilities and physical infrastructure investment and management.

- (2) Berger, David, “*Ten Pitfalls to Avoid When Selecting a CMMS/EAM*”, Western Management Consultants, 2009.

This is a white paper to help guide facility managers in selecting software tools to help with Computerized Maintenance Management Systems/Enterprise Asset Management.

- (3) Motamedi, Ali and Hammad, Amin, “*Lifecycle Management of Facilities Components Using Radio Frequency Identification And Building Information Model*”, IT Con, Journal of Information Technology in Construction – ISSN 1874-4753,” June 2009.

The article discusses Radio Frequency Identification (RFID) tags in an expanded and more integrated way to whole building lifecycle management. The Industry Foundation Classes (IFC) is standardizing interoperability as a standard Building Information Modeling (BIM). Completion of the IFC model has now lead to a collaboration between National Building Information Model Standard (NBIM) and the Construction Operations Building Information Exchange (COBIE) with a vision for “an improved planning, design, construction, operation, and maintenance process using a standardized machine-readable Information model for each facility, new or old, which contains all appropriate information created or gathered about that facility in a format useable by all throughout its lifecycle.” The result is either existing or new facilities have lifecycle information recorded and tracked and integrated for best business practice decisions on when a facility and/or components of the facility need to be rehabilitated or replaced.

- (4) www.wbdg.org

The Whole Building Design Guide (WBDG), a program of the National Institute of Building Sciences, is a web-based portal providing government and industry practitioners with one-

stop access to up-to-date information on a wide range of building-related guidance, criteria and technology from a 'whole buildings' perspective. Currently organized into three major categories—Design Guidance, Project Management and Operations & Maintenance—at the heart of the WBDG are Resource Pages, reductive summaries on particular topics.

- (5) Williams, E., *Construction Operations Building Information Exchange (COBie)*, Whole Building Design Guide, October 4, 2010.

Construction Operations Building Information Exchange (COBie) is a component of the Building Management Modeling (BIM) process. This document provides an overview of what COBie produces from an asset/facility management approach during the early stages of a buildings development. It discusses assets broken down as not just generators and HVAC systems but includes floors and walls, the structure itself to be considered an asset to be tracked and managed. The explanation is carried through from design data gathering to construction data input. The author offers various solutions given the individuality of each project and the availability of integrated software programs.

- (6) Young, John, *Convergence Yields Smarter Facilities: Practical Applications for Building Planners and Operators*, Journal of Building Information Modeling, Fall 2010.

The author speaks about facility manager's pressures to make their buildings "smarter." Operating and maintaining buildings for longer periods of time requires retrofitting existing buildings or designing and constructing new buildings to be sustainable for optimal occupancy and use and why GIS operability with BIM can help support the facility manager goals. The article discusses proximity analysis and why it is important to planners and for green building analysis. The integration of BIM and GIS creates a smarter facility and by better managing assets produces an eventual positive return on investment.

BUILDING AND FACILITY MANAGEMENT SOFTWARE/TOOLS

- (1) AssetWorks, "AssetMAXX,"
<http://www.assetworks.com>

AssetMAXX is a web-based solution to asset management, allowing users to securely maintain, collect, and retrieve data. It is reported to be the most comprehensive and flexible asset management tool available in the capital asset and real property tracking industry. This system appears to be more for tracking property assets and insurance. It supports maintenance repairs and history tacking. No printable brochure was available, but demos are available on line. This does not seem to be specifically applicable to airports. Many other facilities are mentioned but they do not parallel airport facility management.

- (2) Cityworks, "Cityworks"
<http://www.cityworks.com>

Cityworks provides a comprehensive set of solution software for asset and work management along with add-on products that extend the user's capabilities to conduct day-to-day business. This software appears to offer solutions that are GIS based for handling asset management, permitting and licensing for city management. This does not appear compatible with airport management.

- (3) IBM, “AssetMAXX”
<http://www-01.ibm.com/software/tivoli/products/maximo-asset-mgmt>

This software provides asset lifecycle and maintenance management for all asset types on a single platform. It is used to help maximize the value of critical business and IT assets over their lifecycles by enforcing best practices that yield benefits for all types of assets, including transportation, production, delivery, facilities, communications and IT. Maximo is one of the most common systems in use at airports for computerized maintenance management. It is a tried and tested software solution. It can also be very costly. If an airport wants the Asset Management feature they must first invest in the Maximo v7.1. If the investment is made this is a vast tool for airport management including tracking, trending, resource management, maintenance, lifecycle costs, KPIs and reports. It is a very high level solution but will be a large investment just for base licensing.

- (4) Infor EAM, “*Enterprise Asset Management*”
<http://www.datastream.net>

Infor provides business-specific software to enterprising organizations, such as airports. With experience built-in, solutions assist organizations of all sizes in being more enterprising and adapting to rapid changes in the marketplace. The Enterprise Asset Management system offers solutions for maintenance, including scheduling preventive maintenance, and assigning resources where they’ll do the most good. It organizes where and why capital assets might fail, and plans for alternatives. It offers the ability to predict equipment problems so they can be prevented from happening. The system helps with inventory/warranty by reducing inventory and purchasing costs, and collects on warranty-related claims. There is no printable brochure but demos and other information is available at the website. Most of the elements of this software seem geared towards manufacturing agencies and not airport facilities.

- (5) JD Edwards “*EnterpriseOne*”
<http://www.oracle.com/us/products/applications/jd-edwards-enterpriseone/asset-lifecycle-management/index.html>

This is an Oracle licensed technology solution. EnterpriseOne offers a suite of products including asset management, life cycle cost. The suites interact into each business sector of the organizations environment from finance and human resources to computerized maintenance management systems and day to day operations. Airports have used this system and with adequate training may utilize all that this robust system can offer. It is an expensive license to invest in but ties nearly all business sectors into one system.

- (6) VFA Inc. “VFA.facility”
<http://www.vfa.com/products-services/software-solutions/vfa-facility/vfa-facility-key-features>

This software has assisted organizations in managing information regarding facility assets and leveraging that information to create capital projects, plans, and budgets. The key features include Centralized Information about Facility Assets: Supports the collection and management of a wide range of asset information, such as location, structure, type, uses, conditions, requirements and their associated costs, and related projects and plans.

This software offers a number of useful tools and does seem to be compatible for an airport environment and is also compatible with MAXIMO CMMS.

- (7) WebTMA, "Maintenance Management Software Solutions
http://tmasystems.com/tma_products.asp

This is a scalable, web-based solution that uses Microsoft .NET technology. It allows users to access the software via any standard web browser. Base module offers the functionality to manage work orders and preventive maintenance. Software also features project management, time manager, materials management, and contractor management modules. This company offers both desktop and web based solutions. They appear to have clients in the aviation industry. The software seems to be a robust CMMS system with many tools for asset management.

APPENDIX B SUMMARY OF CASE STUDY INTERVIEWS



ACRP 07-07: Evaluating Terminal Renewal versus Replacement Options

Task Two - Airport and Airline Staff Interviews

PREPARED FOR:

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I. Introduction

Representatives from 10 U.S. Airports who recently completed similar evaluations to decide whether to renew or replace their aging terminal buildings were made at some point over the past 10 years (2001 – 2011) were interviewed to understand their experiences in the decision making process. The selected airports represented a cross-section of characteristics that were considered relevant to the research topic, including airport size, financing arrangements, and operating structure.

Interviews were conducted with the following airports, listed by airport size (FAA airport size definition) and the decision for terminal renewal or replacement ultimately reached by the airport:

- Large Hub Airports:
 - Dallas/Fort Worth International Airport (DFW) Terminal Renewal
 - John F. Kennedy International Airport(JFK) Terminal Replacement
 - Phoenix Sky Harbor International Airport PHX) Terminal Replacement
- Medium Hub Airports
 - Dallas Love Field (DAL) Terminal Replacement
 - Indianapolis International Airport (IND) Terminal Replacement
- Small and Non-Hub Airports
 - Asheville Regional Airport (AVL) Terminal Renewal
 - Gulfport-Biloxi International Airport (GPT) Terminal Renewal
 - McClellan-Palomar Airport CLD) Terminal Replacement
 - Wichita Mid-Continent Airport (ICT) Terminal Replacement

The interviews discussed the process, influences, and types of analyses undertaken at each stage of the airport's decision-making process, including:

- Contributing factors that determine when and if existing facilities reach their useful life or become functionally obsolete.
- Organizational structure and stakeholders involved in decision-making.
- The airport's business strategies, short- and long-term objectives, and resulting plans.
- Management software and tools used to monitor facility performance, including organizational management scorecards.
- Guiding principles and analyses used to identify facility gaps that were seen as constraints to the airport's ability to achieve long-term objectives.
- Participants involved and the process used to develop discrete alternative solutions, factors used to analyze programmatic and opportunity objectives, and total life-cycle costs.
- Considerations and valuation of criteria used in benefit/cost analyses to rate options; or, if benefit/cost analyses were not used, why were they not used, and what alternative methods were used to determine the optimal solution.
- Business and financial pro forma analyses used separately or as part of the benefit/cost analyses.

II. Large Hub Airports

2.1 Dallas/Fort Worth International Airport (DFW), TX

Airport Classification	Large Hub
Annual Passengers (2009)	56.0 million
Number of Terminals	5
Number of Aircraft Loading Positions	155
Case Study	Terminal Renewal: DFW Terminal Renovation and Improvement Program (TRIP)
Considerations for Evaluating Alternatives	Cost Outcome Financial Model
	Rough Order-of-Magnitude Cost Estimates
	Implementation Phasing Schedule
	Projected O&M Impacts
	Revenue Impacts

In July 2007, the Airport Board of the Dallas/Fort Worth International Airport (DFW) initiated an airport master planning process entitled “VFR | 2030: (VISION of the FUTURE. REALIZED)” which produced a long-range plan to address changes in the global aviation industry, changes in the Airport Board’s corporate philosophy, issues related to the Airport’s aging infrastructure; and to provide direction to the individual DFW departments in achieving the Airport Board’s strategic goals, as defined in the 2008 Strategic Plan for DFW. As a result of VFR | 2030, the Airport Board secured management and airline approvals and financing for a \$1.75 to 2.0 billion Terminal Renovation and Improvement Program (TRIP). The TRIP is for Terminals A, B, C, and E and commenced in February 2011. This follows recent completion of replacement Terminal D.

The following people graciously contributed their time to this research study:

- Mike Phemister, DFW
- Max Underwood, DFW
- Rusty Hodapp, DFW
- Laura Einspanier, Vice President, American Airlines Corporate Real Estate
- Tom Sparks, Managing Director, American Airlines Corporate Real Estate

2.1.1 Airport Activity and Terminal Facilities

DFW is categorized as a large hub airport and one of the largest airports in the U.S. having recorded 56.0 million annual passengers (MAP) in 2009 down from a peak of 60.7 MAP in 2000. DFW is served by 11 U.S. domestic airlines, including American Airlines, which operates its largest hub at DFW, and six foreign flag airlines. These airlines provide non-stop service to 184 cities.

DFW has 155 aircraft loading positions within 5 terminals.

2.1.2 Ownership and Management Structure

DFW has been owned by the cities of Dallas and Fort Worth since its opening in 1974. A 12-member Airport Board appointed by the City of Dallas (7), the City of Fort Worth (4) and

neighboring communities (1 non-voting) reviews and approves airport policies, operational issues and major airport projects, concession contracts and leases, and annual airport budgets.

DFW is managed and operated through a Chief Executive Officer and his staff. The current Chief Executive Officer is Mr. Jeffrey Fegan. The administrative and operating staff is organized into the following six divisions, each managed by a respective vice president:

- Finance and ITS
- Administration and Diversity
- Operations
- Revenue Management
- Governmental and Stakeholder Affairs
- Air Service Development
- General Counsel and Audit Services report directly to the Airport Board.

2.1.3 Airport Capital Improvement Plan Process

Following the Airport Board's adoption of an update to the Strategic Plan for DFW in 2008 and with the 1997 Airport Development Plan approaching the end of its 10-year implementation stage, the senior management team initiated a master planning process to establish new long-range vision for capital development. In July 2007, the DFW Planning Department initiated the "VFR 2030: VISION of the FUTURE. REALIZED." The VFR 2030 planning effort was prepared by the Planning Department in conjunction with all of the Airport's departments. The VFR 2030 Team was comprised by members of the Planning Department and supported by technical consultants covering various planning disciplines, including airside, terminal, landside, baggage handling systems, cargo, and support facilities. The major phases of the VFR 2030 planning process were:

- **Phase 1: Scoping and Visioning** – consisted of extensive outreach and collaborative brainstorming / workshop sessions with DFW's business partners and stakeholders to determine their needs, expectations, and ideas for the future.
- **Phase 2: Concept Development and Integrated Plan** – consisted of a series of technical analyses to identify solutions to accommodate future needs that would carefully balance facility requirements, asset capacity, and financial performance criteria. This technical analysis resulted in the families of concepts identified for further definition in Phase 3.
- **Phase 3: VFR 2030 Wrap-Up** – the Terminal Development Plan consisted of detailed technical analyses to refine the concepts established in Phase 2 through a Proof of Concept effort. Conceptual scopes of work were developed for each component – airside, terminal, baggage handling system (BHS), and landside – to establish rough order of magnitude cost estimates. The concepts were compared and individual components were combined to establish a recommended alternative for the Central Terminal Area. Concurrently, a list of the non-Terminal Development Plan projects – airfield, terminal, transportation (roads, bridges, rail, and Skylink), utilities, parking, commercial development, environmental, information technology, safety and security, and other – were similarly developed and analyzed in terms of scope and priority.

The result was a recommended Terminal Renovation and Improvement Program (TRIP) for the Central Terminal Area. TRIP projects were integrated with other capital projects identified during the process (covering airfield, other terminal, transportation, utilities, parking, commercial development, environmental, information technology, safety and security, and other) and prioritized to create a recommended 10-year capital program.

2.1.4 Form of Airport/Airline Agreement

HIGHLIGHTS

- Terminal Rate Setting Method:
 - Hybrid, airlines pay costs of terminal costs center less certain transfers of non-airline revenue.
 - Term: 10 years
- Terminal Revenue Sharing:
 - The Airport Board shares certain revenues from its DFW cost center and its Joint Capital Account
- Other:
 - The TRIP was pre-approved per the new airline agreement. The airlines retain capital project approval rights for projects in their cost centers.

2.1.5 Case Study: DFW Terminal Renovation and Improvement Program (TRIP)

HIGHLIGHTS:

Size of terminal that was rehab/replaced and number of aircraft gates:

- Terminals A (25 gates), B (39 gates), C (29 gates), and E (35 gates) with 128 total gates

Number of passengers served in last full year of normal operations:

- 51.5 MAP (2009)

Size of replacement or rehabilitated terminal and number of aircraft gates:

- No Expansion;

Design Capacity:

- Unknown, however, 128 gates could serve 57 MAP at 450,000 annual passengers per gate

Highest annual passenger volume served in rehab/replacement terminal to date:

- Project construction just beginning.

CPE (pre/post):

- \$6.93 for FY 2011¹; \$15.18 projected for FY 2018²

Airline terminal revenues to total operating revenues ratio (pre/post):

- 19.6% projected for FY 2011; 38.6% projected for FY 2018³

2.1.5.2 Key Issues and Principles

The 2008 updated Airport Strategic Plan provided a mission, a vision statement, business goals, and a set of core drivers for Airport development, which were used as evaluation criteria to help identify solutions to issues facing DFW that were identified during the VFR | 2030 planning process.

- Mission: “DFW International Airport will provide our Customers outstanding facilities and services, expanding global access and economic benefits to those we serve.”

¹ DFW International Airport, Presentation to Dallas City Council, September 14/15, 2010.

² Report of the Airport Consultant, Dallas/Fort Worth International Airport, Joint Revenue Improvement Bonds, Series 2010A and Joint Revenue Refunding Bonds, Series 2011A, 2011B, and 2011C, October 18, 2010.

³ Ibid.

- Vision: “DFW International Airport – Connecting the World”
- A primary business goal: “Grow the Core Business of Domestic and International Passenger and Cargo Airline Service.”
- The set of core drivers:
 - Keep DFW cost competitive
 - Maintain customer satisfaction
 - Deliver operational excellence
 - Foster employee engagement

The issues driving VFR | 2030 were identified through extensive outreach and collaboration with internal and external stakeholders included:

- Economy – Increasing global economic integration is a fundamental driver of air transportation demand and its rate of growth.
- Security/Safety – Since the terrorist attacks on September 11, 2001, new security requirements have had a dramatic effect on terminal facilities.
- Airline Competition – Airlines have faced unprecedented economic challenges, resulting in bankruptcy filings, mergers, and the fundamental restructuring of the industry. While the airlines have made major changes that have improved their overall efficiency and reduced costs; it has in some cases created new challenges for passengers.
- Competitive Landscape - DFW faces increased challenges posed by low-cost carriers at Dallas Love Field Airport following repeal of the Wright Amendment; as well as from other hub airports that have already begun their airport renewal programs.
- Environment – DFW management is an industry leader in developing and implementing comprehensive programs and practices designed to protect the environment. Several key environmental issues will need to be addressed, including sustainability (green building standards), storm water, aircraft noise, energy efficiency, and air quality.
- Technology/Innovation – Technology is a fundamental driving force in the air transportation industry. Technological improvements have dramatically changed passenger circulation patterns and airport operational characteristics for landside, terminal, and airside systems.
- Time/Aging Infrastructure – Terminals A, B, C, and E were built more than 35 years ago, as were the majority of the roadways, utilities, and parking garages. The aging facilities create a variety of issues related to the future development and use of Airport facilities.

Through a collaborative effort, the Airport & the Airlines reached consensus on a common set of planning goals:

- Maintain DFW as a cost competitive airport.
 - Remain cost competitive with benchmark airports
 - Manage the growth in capital and O&M expenses
 - Optimize non-airline revenue
- Maintain DFW as an operationally reliable and efficient airport
 - Improve reliability of building system
 - Improve efficiency of baggage movement
 - Improve efficiency of airport and airline operations
 - Identify infrastructure to Support future growth and development

- Maintain operational integrity during construction
- Maintain DFW's competitive level of customer service
 - Maintain DFW as an easy to use airport
 - Provide competitive level of amenities
 - Focus on initiatives that empower customers

2.1.5.3 Important Tools and Techniques

A Cost Outcome Model (COM) was specifically developed to provide adequate information on the financial implications of the options to make a decision on a preferred direction. While the COM did not produce the level of detail required for financial planning, it provided a comprehensive comparison of the alternatives, which considered the following financial considerations:

- Rough Order-of-Magnitude (ROM) Cost Estimates
 - ROM cost estimates would provide unit costs by component and category, which would be used to establish a general level of capital investment.
- Implementation Phasing
 - Phasing plans were developed for all alternatives to establish a general duration and sequence for the capital program as well as to support the financial analysis being performed in the COM.
- Operations & Maintenance (O&M) Impacts
 - O&M cost for each terminal per square foot, both during construction and after the date of beneficial occupancy (DBO). O&M costs considered included: facility maintenance, electricity, custodial, and heating, ventilation, and air conditioning (HVAC).
- Revenue Impacts
 - Concession revenue impacts were estimated for both lost sales during construction and potential increases after sections of the terminals were completed.

A qualitative evaluation was conducted to examine how well each Alternative satisfies the evaluation criteria, so that the high performing attributes that are common to most or all of the Alternatives can be carried forward into the Recommended Alternative. The analysis was based on the primary guiding principles established in the strategic framework: cost competitiveness, operational efficiency and reliability, and customer experience.

Many alternatives were developed and priced and cost/benefit studies completed; however, this early work did not include cost per enplanement calculations (the project and its costs and funding requirements led to a new Use and Lease Agreement based on a hybrid rather than straight residual based accounting.) These findings were presented to teams of Airport and airline executives that were established as part of the master planning process. These decision teams (one for AA/DFW and one for OALs/DFW) evaluated alternatives based on results of the cost/benefit analysis, expected operational improvement, and potential customer service benefits.

When CPE was brought in as a criterion, agreement on forecast activity became an issue. CPE was looked at primarily in relation to existing and historical levels, not as a competitive factor compared with other airport hubs (particularly as DFW's CPE is lower than most major hubs with the exception of Atlanta and Minneapolis-St. Paul).

2.1.5.4 Decision-Making Process

Identifying Need/Objectives

As DFW's previous 1997 Airport Development Plan (ADP) approached the end of its 10-year implementation stage, the Airport Board along with the senior management team recognized that the airport was at a point requiring a new long-range vision for capital development in response to changing circumstances where the airline industry and the Airport are more mature, growth has slowed, competition has intensified, and the future seems more uncertain. At the same time, they recognized more opportunities that the Airport can take advantage of to improve connections to the world from deepening global economic integration.

The purpose of the VFR | 2030 planning process was to develop a long-range plan to respond to changes in the aviation industry since the ADP was completed, changes in the Airport Board's corporate philosophy, and issues related to aging infrastructure. Focus groups were established and organized into six topics: aging infrastructure/energy efficiency, baggage handling systems, landside, non-secure people mover, passenger processing, and Terminal E/ Other Airlines (OALs). Initial findings of the focus groups were coordinated with stakeholders during a series of workshops that identified critical issues and concerns affecting terminal development:

- Aging Infrastructure/Energy Efficiency
 - Significant replacement required to improve energy efficiency. Replacing major systems could increase energy efficiency by 10 to 25 percent.
- Inability to accommodate future growth or operational requirements
 - Some of the current buildings' systems (primarily the electrical systems) are unable to accommodate much, if any, additional demand, particularly for expanding concessions, expanding restrooms, or adding features such as below-seat electrical outlets in the gate lounges.
- Complex implementation
 - Systems within each terminal have overlapping service zones causing inefficient operations and potentially leading to large section being shut down for maintenance.
- Replacement is inevitable
 - Proactive repairs and component replacement are only expected to extend the life of the systems another 10 to 15 years, after which their reliability will greatly diminish and total system replacement will be the only option.
 - Diminishing availability of replacement parts makes proactive repairs increasingly more difficult.
 - Expected future changes in code requirements will lead to mandatory replacement.
- Baggage handling and passenger processing was a primary concern, particularly for American Airlines.
 - Gate changes are a big driver.
 - Early arrival and "wrong terminal" bags.
 - Operating parameters have changed.
 - As the ticket counters are relocated or consolidated, the baggage handling system and baggage screening will have to be re-balanced and the input lines reconfigured.
 - Preference for a gate-based, sort-delivery system.
 - Establishing inter-terminal connections between Terminals A, B, C, and D was a priority.
 - Older baggage systems are incompatible with newer installations, i.e., 33 inch wide transport conveyors versus 39 inch wide conveyors.

- Ticketing/check-in consolidation for American Airlines would have minimal benefits, i.e., labor savings (i.e., less than \$1 million annually per terminal) alone would not justify the cost of the facility renovation.
- Expanded self-service ticketing/check-in is important. Approximately 88 percent of American Airlines' local origin-destination (O&D) passengers at DFW are expected to use some form of automation, including Skycap Service, the Internet, or self-service kiosk to check-in in 2009.
- Reconfiguration of the security screening checkpoints is highly desirable.
- Consolidation of passenger flow supports enhanced concessions.
- Maintaining passenger convenience is critical. The passenger convenience provided by the parking-to-gate walk distance is a major competitive advantage that DFW has compared with local and peer airports. Consolidation of the ticketing/check-in and bag claim functions without reconfiguration of the parking garages would not improve customer convenience. Passenger convenience, primarily the proximity of the ticket counters to the gates, should be equitable for all carriers
- Relocating baggage claim to the lower level was not required to resolve the roadway congestion on the upper level.

Alternatives

Terminal redevelopment concepts were established within a tiered framework that defined the parameters for determining modifications to existing facilities. A series of five tiers, as defined in **Table 1**, were established with Tier 1 representing the minimum infrastructure work required up to Tier 5, which includes complete replacement of all major functional components to optimize operational efficiency. Concept planning focused on terminal and landside facilities. Three other key considerations included improvements to the baggage handling systems, opportunities to integrate a future non-secure people mover in each of the terminal and landside concepts; and options for consolidating ground transportation operations to reduce roadway congestion. With the assistance of the of the decision teams these tiers were narrowed down to three alternatives that progressed through the planning process:

- Alternative 1(Baseline): The alternative assumes the minimal level of required improvements to renew the useful life of the terminal and landside facilities. Those improvements primarily included:
 - Replacement of terminal building systems.
 - Replacement of damaged or worn finishes.
 - Code required or safety issues, such as additional restrooms and new landside vertical circulation.
 - Repair of terminal garages.
 - Replacement of terminal garages due to their structural condition.
 - Reversing traffic flow on the carousel roadway to improve level of service.
- Alternative 2 (Renovation): improvements to renew the useful life of the terminal and landside facilities as described in Alternative 1 plus additional improvements to enhance both airline operations and passenger processing. Those improvements primarily included:
 - Reconfiguration of the ATOs and SSCPs.
 - Reconfiguration and expansion of the concessions program.
 - Inter-terminal baggage transfer system.
 - Additional terminal parking capacity.

- Alternative 3 (Redevelopment): Improvements to renew the useful life of the terminal and landside facilities as described in Alternatives 1 and 2 plus major new building components to optimize both airline operations and passenger processing. Those improvements primarily included:
 - Construction of a new landside terminal facility and unit garage at Terminals A and B.
 - Reconfiguration and expansion of the concessions program.
 - Inter-terminal baggage transfer system with terminal and central early bag storage.
 - Additional terminal parking capacity.

Evaluation and Decision

The effort was organized around two decision teams, essentially reflecting the stakeholder group for each of the four terminals:

- Terminal A/B/C Decision Team – The decision team for Terminals A, B, and C included active participation of senior management from both DFW and AA.
- Terminal E Decision Team – The decision team for Terminal E was made up of DFW senior management. An airline stakeholder group was created to provide a review and coordination mechanism for the airlines that operate from Terminal E.

This process involved three major elements:

- Program Framework – reach consensus on the program goals and target facility requirements.
- Alternative Development – focused on the alternative development and evaluation.
- Hybrid Development – focused on creating the preferred development alternative.

As part of this process each of the selected alternatives went through additional concept refinement and ROM cost estimation. Upon completion of the alternative refinement process each alternative was evaluated from a total cost perspective utilizing a Cost Outcome Model developed by the DFW Finance department and a qualitative comparison used to identify common high performing components (**Exhibit 1**). The Hybrid Alternative combined the high-value components from Alternatives 1 and 2 for each terminal with the infrastructure replacement common to all alternatives:

- Replacement of the building systems to create a 30-year useful-life.
- Removal of existing landside escalators and construction of new cores with high capacity elevators.
- Reconfiguration of the ticketing to improve passenger processing.
- Reconfiguration of security checkpoints, the SSCPs, to meet current and projected TSA requirements.
- Expansion of the concessions program to take advantage of the confluence of passengers near the Skylink stations.
- Operational improvements to the baggage handling systems.
- Renovation and repair of the existing terminal parking garages.
- Additional parking capacity at Terminals A and E.
- Reversal of the carousel roadways at Terminals A, C, and E.

Table 2 through **Table 4** shows the evaluation using the Cost Outcome Model and qualitative comparison with the Hybrid (Recommended) Alternative.

- Alternative 3 (Redevelopment) ranked the lowest in critical metrics, such as the capital program's impact on cost competitiveness, on-going operations during construction, and passenger inconvenience during implementation.

- Alternative 3 provides incremental benefits over Alternative 2.1 and 2.2 in terms of operational efficiency, reduced O&M costs, and enhanced revenue generation; but at a substantially higher capital cost.
- Alternative 3 would not provide considerably more benefits than Alternative 2.1 and 2.2, but would be significantly more expensive.
- Alternative 2.2 provided substantial benefit for the landside operations but those were outweighed by the terminal costs associated with switching the airline occupancies.
- The Hybrid (Recommended) Alternative outperforms Alternatives 2.1, 2.2, and 3 in terms of benefits relative to cost (as measured by net present value) and is only slightly behind Alternative 1, even though a number of additional scope items were added to the Recommended Alternative.

2.1.5.5 Financial Analyses

A COM was designed to provide a basis for comparing the terminal development alternatives from a comprehensive financial perspective. In addition to comparing the development cost of the alternatives, the model provides a life-cycle cost perspective by considering the long-term impact of revenue and operating and maintenance costs associated with each of the alternatives. The COM did not include a detailed financial feasibility of the alternatives. It was based on rough order-of-magnitude (ROM) cost estimate, which can provide enough detail to compare options but not enough detail to be considered for cost estimating or budgeting purposes.

The COM was a spreadsheet-based system that included a series of tables and exhibits, which collectively summarize the differences between a baseline (no-action) scenario and the three alternatives under consideration. The model was constructed to allow for adjustment to key variables within the alternatives and to be able to quickly evaluate the implications to the alternatives. The model was developed by DFW Finance Department with input from numerous internal and external stakeholders.

The framework of the model began with a basic understanding of the existing operating environment at each of the terminals. Specifically, it considers all of the cost items for operating and maintaining the terminal facilities. It also includes the basic data on non-airline revenue (terminal parking and concessions). Specific data for each of the alternatives was entered into the model regarding its development cost, phasing, potential change to O&M costs, and revenue.

Based on the entire model inputs, a series of statistical outputs were generated:

- Incremental impacts to revenue
- Incremental impacts to O&M expenses
- Total capital cost
- Net cash flow
- Cumulative cash flow
- Cumulative net expense increase / decrease
- Net present value (NPV)

2.1.5.6 Asset/Facility Management Software

The Airport maintains program called Airport Infrastructure Management, which serves as an asset management system for major equipment and systems throughout facilities managed by the Airport. The program was implemented as part of the 1997 ADP Update. It includes an asset inventory, condition assessment, and life cycle information. It is primarily run by staff input, not real time computer monitoring and updates. It can be used for life cycle audits, annual conditions assessments, monitoring trends in O&M costs, etc.

- The system can be characterized as an expanded work order administration program.
- The Airport prepares a rolling 10 year forecast of capital (and O&M) costs related to equipment and systems condition. Required equipment/system downtime for repair, rehab and/or replace is considered in the programming and budgeting process.
- The Airport is aware of the BOMA recommendation to budget three to five percent of replacement asset value for annual capital investment; however, this result is typically out of scale with actual yearly expenditures at the Airport. The Airport has determined that between 0.6 and 0.7 percent is more typical and realistic per the 1997 ADP.
- The Airport applies manufacturers’ standards when determining for life cycles.
- The VFR2030 included a specific assessment per ASHRE standards.

Table 1

DFW - Facility Modification Parameters

Tier	Building System Components	Approximate Useful Life with Improvements	Key Terminal Functions	Building Area	Landside Improvements
1	Repair or replace ^{1/}	15 years	No changes to aesthetics or function	No expansion	No improvements
2	Replace to extent necessary	40 years	Re-functionalize key terminal functions ^{2/} to better address current and projected operational requirements	No expansion	Improvements would address lighting and vertical circulation
3	Replace to extent necessary	40 years	Re-functionalize	Some expansion to improve circulation and passenger throughput	Modifications would include improvements to reduce roadway weaves and provide additional parking capacity in the infield
4	Replace to extent necessary	40 years	Re-functionalize by relocating arrivals (bag claim) to lower level	Expand on both levels	Reconfigure terminal roadways and parking facilities
5	Replace	40 years	Reconfigure within existing Skylink alignment to optimize passenger processing, operational efficiency, and non-airline revenue	Reconfigured and expanded	Consolidated into a single parking structure with a split-level roadway with improved curbside operations

Notes:

1/ Based on the findings of the Infrastructure Conditions Assessment.

2/ Key terminal functions include ticketing/check-in, security screening checkpoint, and bag claim.

Source: VFR 2030 Phase 2A Task 1.1 *Task Summary*, Corgan Associates, Inc., June 2008.

Prepared by: Ricondo & Associates, Inc., March 2011.

Table 2

DFW - Qualitative Evaluation

Criteria		Alternative ^{1/, 2/}				
		1	2.1	2.2	3	H
Cost Competitive Airport	• Does the alternative provide opportunities for concession revenue enhancement?	1	2	2	3	2
	• Does the alternative provide opportunities to improve parking profitability?	0	1	1	3	1
	• Does the alternative reduce O&M costs?	1	1	1	3	1
	• Does the alternative improve energy efficiency?	2	2	2	3	2
	• Does the alternative reduce ground transportation costs?	2	2	2	3	2
	• Does the impact of capital spending maintain DFW as a cost competitive airport?	3	2	1	0	2
Operational Efficiency and Reliability	• Does the alternative meet the program requirements?	1	2	2	2	2
	• Does the alternative improve building system reliability?	3	3	3	3	3
	• Does the alternative improve the efficiency of the baggage movement?	0	2	2	3	2
	• Does the alternative improve staffing efficiency?	0	1	1	2	1
	• Does the alternative improve ground transportation efficiency?	1	1	1	2	1
	• Does the alternative provide reasonable opportunities to accommodate future growth?	1	2	2	3	2
	• Does the alternative provide adequate flexibility to accommodate future technological or operational changes?	1	2	2	3	2
	• Does the alternative improve the airport or airlines ability to operate during irregular operations?	0	1	1	2	1
• Does the implementation minimize disruptions to on-going operations?	3	3	1	0	3	
Customer Experience	• Does the alternative adequately address premium passengers?	0	2	2	2	2
	• Does the alternative maintain or improve walk distances?	2	2	2	1	2
	• Does the alternative improve vertical circulation in the terminal and garages?	1	1	1	3	1
	• Does the alternative improve horizontal transitions between the terminal and garages?	0	1	2	3	1
	• Does the alternative improve wayfinding between the major terminal and landside components?	0	1	1	3	1
	• Does the implementation plan minimize customer inconvenience?	3	1	1	0	2
	• Does the alternative contribute to the overall positive image of DFW airport?	0	1	1	3	1

Notes:

1/ Evaluation Scale: (Yes) 3 2 1 0 (No)

2/ The shaded scores in Alternatives 1 – 3 indicate scores that are the same as the Hybrid Alternative.

Source: VFR 2030 Phase 2A Task 1.1 *Task Summary*, Corgan Associates, Inc., June 2008.
 Prepared by: Ricondo & Associates, Inc., March 2011.

Table 3

DFW - Cost Outcome Model – Hybrid (Recommended) Alternative

Incremental Cashflow for Fiscal Years Ending September 30 (in thousands of dollars, except as noted)	Terminal Development Plan									
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Incremental Impact to Revenue (+/-)										
Concessions	\$ 1,147	\$ 910	\$ 1,194	\$ (63)	\$ (38)	\$ 787	\$ 1,292	\$ 1,318	\$ 1,344	\$ 1,371
Parking	\$ (432)	\$ (678)	\$ (176)	\$ (135)	\$ (59)	\$ 194	\$ 843	\$ 10,516	\$ 11,211	\$ 11,926
Total Revenue Impact	\$ 1,863	\$ 233	\$ 1,018	\$ (198)	\$ (97)	\$ 981	\$ 3,427	\$ 13,152	\$ 13,899	\$ 14,668
Incremental Impact to O&M Expense (+/-)										
Facility Maintenance	\$ -	\$ (144)	\$ (312)	\$ (276)	\$ 669	\$ 672	\$ 695	\$ 716	\$ 737	\$ 759
Electricity - Terminals	\$ (1,455)	\$ (2,491)	\$ (3,102)	\$ (2,691)	\$ (2,661)	\$ (3,022)	\$ (2,652)	\$ (2,731)	\$ (2,813)	\$ (2,898)
Custodial	\$ (825)	\$ (849)	\$ (875)	\$ (394)	\$ (406)	\$ (418)	\$ 264	\$ 272	\$ 280	\$ 288
HVAC	\$ (764)	\$ (1,290)	\$ (1,834)	\$ (1,902)	\$ (1,966)	\$ (2,216)	\$ (2,166)	\$ (2,231)	\$ (2,298)	\$ (2,367)
Electricity - Garages	\$ -	\$ (152)	\$ (156)	\$ (161)	\$ (166)	\$ (254)	\$ (272)	\$ (262)	\$ (327)	\$ (280)
Total O&M Expense Impact	\$ (3,044)	\$ (4,926)	\$ (6,280)	\$ (5,424)	\$ (4,530)	\$ (5,238)	\$ (4,131)	\$ (4,237)	\$ (4,421)	\$ (4,498)
Capital Construction Costs										
Terminal A	\$ 241,787	\$ 251,458	\$ 261,517	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Terminal B	\$ 116,594	\$ 121,258	\$ 126,108	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Terminal C	\$ -	\$ -	\$ -	\$ 177,779	\$ 184,890	\$ 192,286	\$ -	\$ -	\$ -	\$ -
Terminal D	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Terminal E	\$ 313,621	\$ 232,813	\$ 92,820	\$ 111,620	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
System Wide	\$ 7,154	\$ 7,440	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Total Capital Costs	\$ 679,156	\$ 612,970	\$ 480,444	\$ 289,399	\$ 184,890	\$ 192,286	\$ -	\$ -	\$ -	\$ -
Total Capital / O&M Costs	\$ 676,112	\$ 608,044	\$ 474,165	\$ 283,975	\$ 180,360	\$ 187,048	\$ (4,131)	\$ (4,237)	\$ (4,421)	\$ (4,498)
Net Cash Flow	\$ (674,249)	\$ (607,811)	\$ (473,147)	\$ (284,173)	\$ (180,457)	\$ (186,067)	\$ 4,974	\$ 17,389	\$ 18,321	\$ 19,166
Cumulative Cash Flow	\$ (674,249)	\$ (1,282,061)	\$ (1,755,207)	\$ (2,039,380)	\$ (2,219,838)	\$ (2,405,905)	\$ (2,380,204)	\$ (2,380,958)	\$ (2,362,637)	\$ (2,343,471)

Source: VFR 2030 Phase 2A Task 1.1 *Task Summary*, Corgan Associates, Inc., June 2008.
 Prepared by: Ricondo & Associates, Inc., March 2011.

Table 4

DFW - Cost Outcome Model – Summary of Business Yield Metrics for all Alternatives

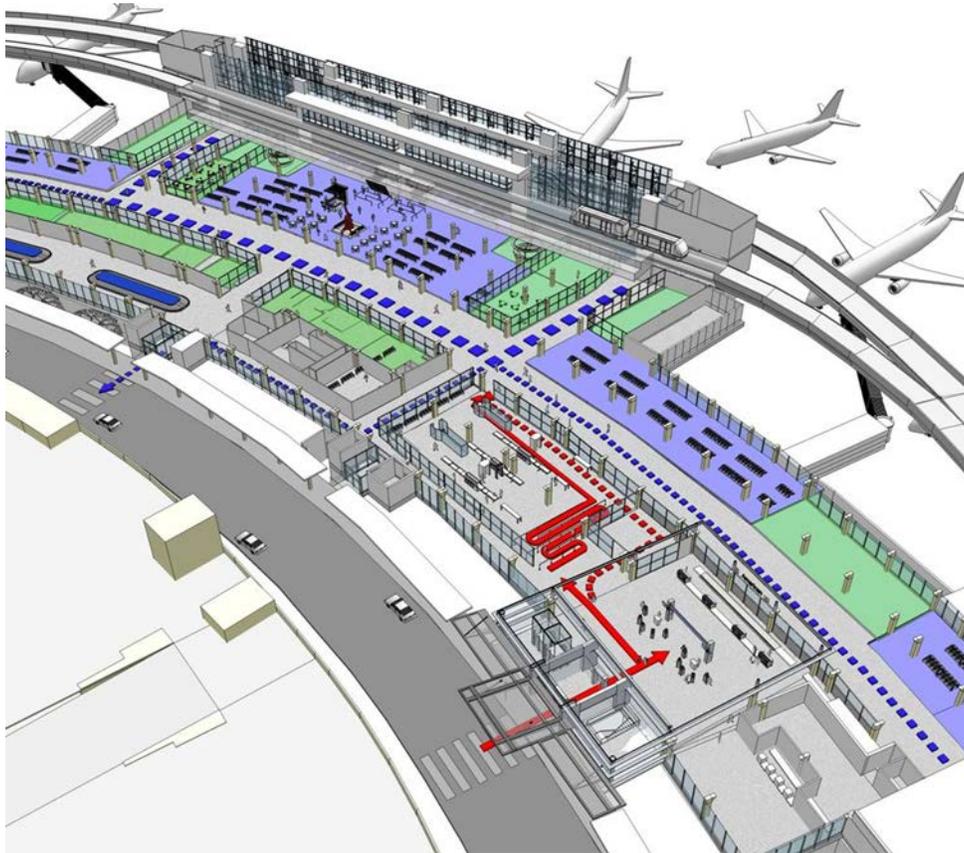
Alternative	20 years		38 years	
	Cumulative Net Expense	NPV	Cumulative Net Expense	NPV
1	\$(110,750)	\$(1,827,951)	\$(268,294)	\$(1,800,128)
2.1	\$(51,704)	\$(2,706,424)	\$(105,247)	\$(2,685,594)
2.2	\$(76,094)	\$(2,718,786)	\$(181,415)	\$(2,690,318)
3	\$(2,191)	\$(3,332,883)	\$25,641	\$(2,690,318)
Recommended Alternative	\$(99,398)	\$(1,890,050)	\$(243,971)	\$(1,863,690)

Note: Amount in thousands of dollars.

Source: VFR 2030 Phase 2A Task 1.1 *Task Summary*, Corgan Associates, Inc., June 2008.
Prepared by: Ricondo & Associates, Inc., March 2011.

Exhibit 1

DFW - Recommended Hybrid Alternative for Terminal A, B, C, E



Source: VFR 2030 Phase 2A Task 1.1 *Task Summary*, Corgan Associates, Inc., June 2008.
Prepared by: Ricondo & Associates, Inc., March 2011.

2.2 John F. Kennedy International Airport (JFK), Jamaica, NY

Airport Classification	Large Hub
Annual Passengers (2009)	45.5 million
Number of Terminals	8
Number of Aircraft Loading Positions	140
Case Study	Terminal Replacement: Terminal 3
Considerations for Evaluating Alternatives	Rough Order-of-Magnitude Cost Estimates
	Operating Level of Service (LOS)
	Implementation Phasing Schedule

John F. Kennedy International Airport (JFK) is one of three large hub airports under the jurisdiction of the Port Authority of New York and New Jersey (PANYNJ, or Port Authority). JFK has 8 unit terminal buildings in the Central Terminal Area, six of which have undergone major refurbishment, expansion or replacement in the past 30 years. Terminals 1, 4, 5 and 8 have been replaced, Terminal 6 has been refurbished (although soon to be demolished), and Terminal 7 has been expanded. In 2010 the PANYNJ reached an agreement with Delta Air Lines and the operator of Terminal 4, JFK International Air Terminal, LLC (JFK IAT), to expand Terminal 4 to accommodate a significant portion of Delta’s operations. Additionally, the plan calls for the demolition of Terminal 3 from which Delta currently operates the majority of its international service and enhanced access between Terminals 2, from which Delta will continue to operate domestic and regional service, and Terminal 4. This interview focused on the issues considered when deciding to demolish, rather than replace or renovate Terminal 3.

The following people graciously contributed their time to this research study:

- Rich Louis, Deputy General Manager, JFK
- William Radinson, Assistant Director for Capital Programming, PANYNJ
- Kiran Merchant, Manager, Aviation Planning, PANYNJ
- Mike Ferrigno, Manager of Business and Property Development, JFK
- William Myers, Program Director, PANYNJ

2.2.1 Airport Activity and Terminal Facilities

JFK is categorized by the FAA as a large hub airport, having served 45.5 million annual passengers in 2009 down from a high of 47.5 MAP in 2008. JFK is served by 14 U.S. domestic and 54 foreign national airlines. Air carriers operating at JFK offer non-stop service to 60 domestic destinations and 98 international destinations.

JFK has approximately 140 active numbered gate positions (not including Terminal 6) served from eight terminals (**Exhibit 2**):

- Terminal 1, opened in 1998, was built and is operated by the Terminal One Group Association (TOGA), a consortium of Air France, Japan Airlines, Korean Airlines and Lufthansa German Airlines. It is a 685,000 square foot (SF) structure with 11 gates. Costs for O&M, as well as rehabilitation and modernization, are the responsibility of TOGA.

- Terminal 2 is a former Northwest Airlines terminal now serving Delta operations. It has 225,000 SF, 7 contact and 17 remote access commuter gates. Costs for O&M, as well as rehabilitation and modernization, are the responsibility of Delta.
- Terminal 3 is the former PanAm WorldPort with 804,000 SF. It is also operated by Delta Air Lines with 16 contact gates and 6 remote parking positions. Costs for O&M, as well as rehabilitation and modernization, are the responsibility of Delta.
- Terminal 4, also known as the International Air Terminal, opened in 2001, replacing the former International Arrivals Building. It has 1.6 million SF with 16 contact gates and 10 remote gates and a further 9 remote staging positions. Costs for O&M, as well as rehabilitation and modernization, are the responsibility of IAT.
- Terminal 5 is a new terminal behind the former TWA Flight Center building. It has 676,000 SF and 26 contact gates with 8 remote staging positions. It serves as the primary hub for JetBlue Airways. Costs for O&M, as well as rehabilitation and modernization, are the responsibility of JetBlue.
- Terminal 6 is the former National Airlines terminal and temporarily served JetBlue operations before completion of Terminal 5. It is now closed and scheduled for demolition.
- Terminal 7 is leased to British Airways and serves several other airlines, including United. It has 428,000 SF and 12 gates after a 3 gate expansion in 1987. Costs for O&M, as well as rehabilitation and modernization, are the responsibility of British Airways.
- Terminal 8 was opened in 2007, following phased demolition and reconstruction by American Airlines on the site of former Terminals 8 and 9. It has 1.8 million SF and 36 contact gates. Costs for O&M, as well as rehabilitation and modernization, are the responsibility of American Airlines.

A significant element in the operations at JFK is the continuation of slot controls. A maximum of 81 operations per hour are allowed during the primary operating hours of the day. Airlines are granted a fixed number of slots within each of these hours based on grandfather rights and continued use.

2.2.2 Ownership and Management Structure

JFK is owned by the City of New York and operated by the PANYNJ, which also operates La Guardia, Newark Liberty, Teterboro, and Stewart airports. The Port Authority was established in 1921 to operate and maintain the region's primary air service airports as well as other regional transportation facilities such as tunnels, bridges, marine terminal and port facilities and regional rail transit. The Port Authority is governed by a 12 member Board of Commissioners appointed by the governors of New York and New Jersey.

The Port Authority has operated JFK since 1947. The current lease term extends to 2050, and includes establishment of an eight member airport board of Port Authority and City of New York representatives. The Board oversees airport operations with respect to financial and performance standards, which are reported to the Board by airport management on a quarterly basis.

- The administration of the Port Authority Aviation Department is led by the Aviation Director and includes staff to plan, finance, monitor, and operate the airports under its jurisdiction. In addition, each airport has its own operating and administrative staff, which works jointly with the Aviation Department staff on major issues related to planning and expansion.
- JFK IAT initially constructed and currently operates Terminal 4 under a lease from the Port Authority that expires in 2043.

- Delta Air Lines currently leases and operates Terminal 3. Delta’s leasehold was acquired as part of its purchase of PanAm international routes and properties in 1991. The terminal serves Delta’s international and some domestic operations.
- Delta Air Lines also leases and operates Terminal 2. This terminal serves Delta’s regional operations as well as some additional mainline flights.
- As noted above, all long term leases with the PANYNJ typically assign responsibility for operations and maintenance of the terminal to the lessee, as well as any tenant initiated projects for upgrading the facility and installed equipment and systems.

2.2.3 Airport Capital Improvement Plan Process

The Port Authority Aviation Department and the Airport maintain an annually updated 10 year Capital Plan. The Capital Plan is prepared under a routine interdepartmental determination of needs, culling these needs and cost estimates to a reasonable budgeting level, senior management review and approval, and transmittal to Port Authority headquarters for inclusion in the overall PANYNJ Capital Plan. FAA Entitlement funds, specific project grants, airline and concessionaire initiatives and revenue enhancement related to project improvements are considered when developing the Capital Plan.

The Port Authority maintains a life cycle monitoring system for major facility components. This feeds their 10 year Capital Plan look ahead. As part of the process they monitor the points when components and systems will reach their life cycle midpoint. Within the system the Port Authority also can monitor operating, maintenance and repair costs on an annual basis; however, the system is based primarily on manual inputs by staff, not computerized real-time inputs.

The Capital Plan covers different elements of each of the eight terminals at JFK, depending on the leasing and operating agreements that govern each terminal. In general, the PANYNJ is responsible for access related elements, such as roadways, the inter-terminal people mover (SkyTrain), taxiways, and central utility facilities. Improvements and capitalized maintenance funding for terminal facilities are covered within the leases. JFK IAT is responsible for capital investments in Terminal 4 and Delta for investments in Terminals 2 and 3.

2.2.4 Form of Airport/Airline Agreement

- Rate Setting Method: Each terminal has its own specific rate-setting methodology.
- Term: Varies by terminal: Terminal 4: 2026 (to be extended), Terminal 3: 2017, Terminal 2: 2020
- Joint Use Formula: Varies on terminal.
- Revenue Sharing: Each terminal has its own specific rate-setting methodology.
- Other: As part of the agreements to expand Terminal 4, JFK IAT will be responsible for the expansion through issuance of PANYNJ Special Project Bonds; Delta will be responsible for demolition of Terminal 3 and restoration of the aircraft apron. Delta will make sublease payments to IAT for its use of Terminal 4 and remains the primary lease holder of Terminal 2.

2.2.5 Case Study: Terminal 3 Replacement

Delta currently operates from Terminals 2 and 3 at JFK, which are supplemented by 3 gates at Terminal 4 (leased from JFK IAT in 2009). Terminals 2 and 3 cannot accommodate Delta's current or future needs, with Terminal 3 considered to be functionally obsolete. Over the past few years Delta has studied the possibility of upgrading Terminal 3 up to and including wholesale replacement; however, the carrier could not develop a phasing schedule without significantly restricting its operations during construction.

In 2009, Delta presented to the Port Authority and JFK IAT plans, costs and issues related to an expansion and relocation of the airline's international operations to Terminal 4, with the subsequent demolition of Terminal 3 (**Exhibit 3**).

HIGHLIGHTS:

Size of terminal (Terminal 3) that is to be rehab/replaced and number of aircraft gates:

- 804,000 SF
- 16 Gates plus four remote positions

Number of passengers served in last full year of normal operations:

- 11.6 MAP (Delta only), plus additional handled and alliance partner carriers

Size of replacement or rehabilitated Terminal 4 and number of aircraft gates:

- Nine contact gates to be added to Terminal 4 (for a total of 25) plus headhouse expansions to improve passenger security screening and add in-line baggage screening, Delta to lease the nine new gates plus three additional existing gates it currently leases in the existing facility and up to four additional gates in the existing facility, for a total of 16. (Delta's current operation in Terminal 2 would continue, with no changes to the current facility except an improved connection corridor between Terminals 2 and 4).

Design Capacity:

- Not Available.

Highest annual passenger volume served in rehab/replacement terminal to date:

- NA; project construction has not commenced

CPE (pre/post):

- Not Available.

Airline terminal revenues to total operating revenues ratio (pre/post):

- Not Available.

2.2.5.2 Key Issues and Principles

HIGHLIGHTS:

- The Terminal 3 internal configuration does not meet current operating requirements, with incompatible structural elements and limited capacity internal landside access.
- The original Terminal 3 structure was completed in 1960 on a modified pie-shaped site. A major expansion in 1971 created additional gates but site restrictions limited the extension of the access curb. An internal curb was therefore included in the expansion, limiting the amount of facility available for passenger processing.

- Passenger security requirements implemented in the mid 1970s further diminished the efficiency of and increased congestion in the terminal areas.
- The irregular shape of the site and terminal, and the internal roadway system created a building infrastructure (particularly column spacing) that was found to be incompatible with a major renewal, leading to Delta's determination that a major renewal of the structure together with redesign to accommodate current operations and equipment would not be economically feasible. Long term design plans for Terminal 4 include the extensions of both the A and B Concourses into existing remote parking positions within the Terminal 4 leasehold. Current activity levels in Terminal 4, together with these extensions indicated that significant additional gate capacity could be obtained by Delta as an alternative to redevelopment of Terminal 3.
- While this project was primarily generated by Delta's need for modernized facilities, the Port Authority, as landlord, generally supports projects that improve the overall level of service and condition of facilities at the Airport. In this case the conditions in Terminal 3 were considered inferior; therefore, the Port Authority encouraged and supported Delta's plans.
- Although the technical planning and analysis for this project were conducted by Delta with Port Authority review and comment, the PANYNJ has its own process for analyzing the planning and financial feasibility of a proposed project. For most significant project analyses, the Port Authority generally retains a 'rehabilitation' scenario in its project identification and development process. Can the existing facility be made to work? For Terminal 3, after several detailed studies over the years, it was finally decided that the facility could not be made to work with today's passenger handling processes and level of service (LOS) goals. In general, a replacement option is assumed to cost \$1,000 per square foot; whereas, renewal or rehabilitation projects are significantly lower - \$500 per square foot and lower.
- When Port Authority projects are identified and considered viable, senior management will allocate up to four percent of the ROM project cost estimate for pre-planning.
- The Port Authority explained that most projects narrow the brainstorming alternatives to three or less, which are taken as far as 20 percent design (the Port Authority usually allocates funds specifically for this exercise, based on staff budget estimates.).

2.2.5.3 Important Tools and Techniques

Not Applicable.

2.2.5.4 Decision-Making Process

Narrative describing process from needs identification to DOB. What triggered the project? Discuss comprehensively, i.e., different stakeholder viewpoints/interactions/responsibilities. Techniques and tools used

Identifying Need

In the case of Terminal 3, Delta, as leaser and operator, determined the need to proceed with alternatives other than rehabilitation or expansion. Over the years several studies initiated by Delta determined that the terminal was structurally incompatible with current service needs and that replacement of the terminal within the Terminal 3 ground lease area had significant phasing problems.

The project to provide updated terminal facilities for Delta at JFK has been in under consideration since 1997. Once DL determined that the station was to be an international hub rather than a large gateway spoke city, planning involved developing facilities for up to 60 gates and significantly improved landside access and passenger handling areas

Terminals 2 and 3 were seen to have the following deficiencies:

- The terminal structure is 50 years old (with the south side expansion in 1972). The overall terminal is worn out, including all major systems.
- The Federal Inspection Service (FIS) is small and undersized for even the current Delta activity levels.
- Passenger access between gates and the FIS is limited to 12 of the 16 Terminal 3 gates.
- Space for security functions since 2001 is inadequate
- Passengers and meeter/greeters have multiple (four) terminal arrival/entry points
- Passenger flow is poor leading to difficult wayfinding
- Available curb frontage adjacent to the landside access roadways is severely limited.
- Aircraft circulation to gates is limited by lack of parallel taxiways and narrow taxilane between Terminals 2 and 3, leading to flight delays.

Organization

As noted above, major projects are either initiated by terminal leasees or the Port Authority. Depending on the scope of the proposed change and or if the leasee requests funding from the PANYNJ, the Port Authority will initiate its own analysis. These are then scoped by PANYNJ planning and engineering staff, and with airline concurrence, are presented to Port Authority management for consideration. If approved for planning by management, funds are allocated to complete detailed planning and preliminary cost estimates.

Port Authority Finance participates at several points in the process, including initial review of the value-added by the project, appropriation of planning and design funds, and final sign off on project cost, project priority from a capital investment standpoint and ability to finance.

Evaluation

The Port Authority noted that the project development process is different if an airline or vendor is the primary funding source. The Port Authority's primary role in these cases is review and approval. This includes American Airline's recent redevelopment of the Terminals 8 and 9 sites. Terminal 5 was redeveloped by JetBlue, with funding from the Port Authority, similar to the arrangements for the Terminal 4 expansion and Terminal 3 demolition by Delta.

For the Terminal 3 replacement, project costs, phasing, and operating level of service (LOS) analyses determined that expansion of Terminal 4 provided the greatest utility.

In early years, many alternatives were analyzed including: Redevelopment of Terminal 5; development of a combined terminal complex including Terminals 5 and 6, Terminals 1, 2, and 3, and Terminals 2, 3 and 4. Some early Terminal 3 rebuild alternatives included phasing options to demolish the south side addition, but kept the original T3 'saucer' facility for RJs.

A site combination that included Terminal 4 was the leading alternative prior to September 11, 2001, after which planning/design, negotiations, and business development work was suspended. Terminal 4 provided new, modern facilities, with spillover to a rebuilt terminal facility and concourse on the Terminals 2 and 3 sites to meet capacity needs of up to 60 gates.

In the next few years funds were invested in Terminals 2 and 3 to repair, maintain and make some improvements in wayfinding and security as part of a renovate/dress up program to Terminals 2 and 3 (\$320 million).

Capital repairs cost between \$10 million and \$15 million annually in addition to high O&M expenses.

When bankruptcy was declared in 2005, all terminal planning and capital repairs were suspended except for life safety requirements.

When the airline exited bankruptcy in 2007, focus was placed on international activity. Delta's strategic plan included major international growth with JFK as a hub and one of the main Delta gateways.

In 2007, Delta hired SOM/Arup to assist in a site selection evaluation and concept planning exercise. Various alternatives were estimated to ROMs and Delta selected to move forward with a T2/3/4 plan (which was scaled back incrementally as the industry was struggling in a volatile fuel cost environment):

- Originally demolish and replace Terminal 2, Terminal 3 and expansion of Terminal 4 in multiple phases (\$4 billion).
- Various redesigns reduced to 3 phases (\$3 billion).
- Scaled back to demolish and rebuild Terminal 3, renovate Terminal 2, and expand the Terminal 4 B Concourse (\$2.2 billion).
- Final plan was to occupy a portion of Terminal 4 Concourse B and build a nine gate extension, demolish Terminal 3 and continue to use Terminal 2.

Coordination with the Port Authority was on-going with the PANYNJ-checking Delta results and suggesting shortcomings and additional work as needed to meet PANYNJ objectives, such as landside access, security, and maintaining capacity of other airlines.

Life cycle costs were considered in evaluating alternatives, both in annual O&M and capital costs.

Terminal 4 provides dual taxiway access (not available at Terminal 3, new and modern facility, full gate access to FIS). The alternative provides less aircraft taxi delays, therefore less fuel burn, reduced staffing due to the reduction of passenger access points and the opportunity to upgauge flights.

The increased cost of fuel became a significant factor in favor of the Terminal 4 alternative because of improved taxi flow and reduced delays.

Both cost per enplanement and total cost were considered in evaluating alternatives.

The evolution in ticketing and baggage check requirements in the last 12 years reduced the expected investment in expanding the Terminal 4 headhouse.

The final plan scaled development back to 43 gates at only Terminal 4 and Terminal 2 with demolition of Terminal 3 and conversion to remote aircraft parking.

While the selected alternative provides the same number of gates, aircraft size passenger processing capabilities are significantly increased.

Negotiations proceeded with the airline, the Port Authority, and Terminal 4 management to determine the terms under which Delta would expand and increase their presence in Terminal 4, including the possible relocation of other airline flights to other terminals.

A financial analysis was undertaken to determine the feasibility of financing the expansion through Port Authority Special Project Bonds, which were subsequently sold.

The airline is proceeding with completing the final plan and design changes, and developing bid packages.

2.2.5.5 Financial Analyses

Narrative discussing how PANYNJ incorporates analyses into decision making process...what metrics and benchmarks used.

As stated above, the PANYNJ indicated that they generally approach a terminal redevelopment project from a renewal perspective as the costs of replacement are significant – generally estimated at \$1,000 per square foot. Once the planning department has made an initial assessment on the scope of the project (i.e., renewal or replacement), the PANYNJ finance department will then get involved to analyze the financial impacts of the investment. If a replacement proposal is presented, the project must demonstrate significant justification to warrant such an investment (e.g., functionality, safety, security, or other operational efficiency).

At this stage in the process, the planning, finance, and business departments (among other groups) are generally working on the project in parallel. Because most terminals at JFK are operated by third parties, each individual assessment is generally different and has its own set of issues. However, the business agreement between PANYNJ and the third party must be sound and provide proper financial protections to the Port Authority. Also, any business deal for a terminal must provide the proper mix of risk versus reward for the PANYNJ to approve.

Given that financial analyses are generally evaluated on a case-by-case basis, there is no standard approach to evaluating terminal replacement versus renewal. However, each project generally undergoes an upfront affordability analysis, a general business case analysis, and very detailed financial modeling of the business deal once the project has been scoped further.

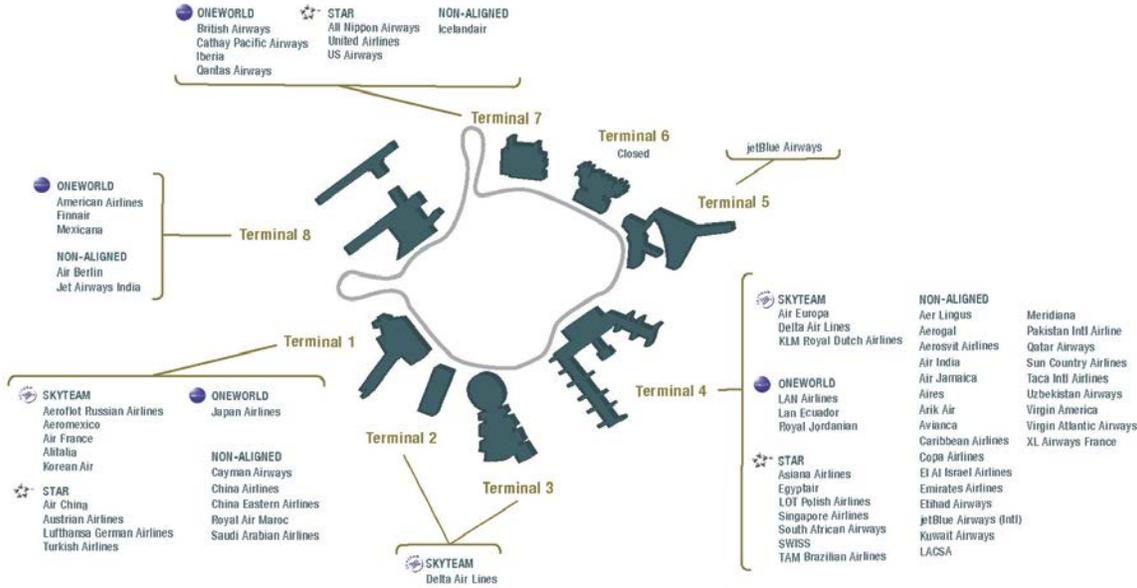
2.2.5.6 Asset/Facility Management Software

Life cycle and life cycle half-life monitoring, with O&M annual cost monitoring, primarily through spreadsheet recording and analysis.

The Port Authority also noted some use and lease agreements allow self-funding of O&M and that the Port Authority's O&M monitoring and data would not include these costs.

Exhibit 2

JFK - Terminals and Airline Distribution



Source: Port Authority of New York & New Jersey, reflects carrier activity as of June 2010. Prepared by: Ricondo & Associates, Inc., March 2011.

Exhibit 3

JFK - Terminal 3 Replacement and Terminal 4 Redevelopment



Source: Preliminary Official Statement, Special Project Bonds, Series 8, Port Authority of New York & New Jersey, November 15, 2010. Prepared by: Ricondo & Associates, Inc., March 2011.

2.3 Phoenix Sky Harbor International Airport (PHX), Phoenix, AZ

Airport Classification	Large Hub
Annual Passengers (2010)	38.5 million
Number of Terminals	3
Number of Aircraft Loading Positions	100
Case Study	Terminal Replacement: Terminal 2
Considerations for Evaluating Alternatives	Rough Order-of-Magnitude Cost Estimates
	Implementation Complexity
	Flexibility of Alternative
	Operating Level of Service (LOS)

Phoenix Sky Harbor International Airport (PHX) is classified by the FAA as a primary large hub airport. PHX followed a methodical process to decide whether to replace or rehabilitate Terminal 2, its oldest terminal facility, or otherwise accommodate Terminal 2 traffic within the existing Terminal 3 and Terminal 4 or with new facilities. At the time of the interview, the Aviation Department had accepted the recommendations of a working group established to evaluate options for accommodating Terminal 2 activity and staff was preparing to begin detailed planning on the basis of these recommendations.

The following people graciously contributed their time to this research study:

- Tamie Fisher, Acting Assistant Aviation Director
- Brent Cagle, Deputy Aviation Director, Financial Management Division
- Roxann Favors, Acting Deputy Aviation Director, Business and Properties Division
- Chris Andres, Deputy Aviation Director, Planning and Environmental Division
- Judy Ross, Deputy Aviation Director, Capital Programs Division
- Dave Hensley, Deputy Aviation Director, Design and Construction Services
- Jay DeWitt, Special Projects Administrator, Business and Properties Division
- Diane Nakagawa, Planning Project Manager, Planning and Environmental Division

2.3.1 Airport Activity and Terminal Facilities

In 2010, PHX accommodated approximately 38.5 million annual passengers (MAP), which was down from a peak of approximately 42 MAP in 2007, but up from approximately 37.8 MAP in 2009. PHX is served by most U.S. domestic airlines, including US Airways and Southwest Airlines, who operate hub and focus city operations, respectively. Air carriers operating at PHX offer non-stop service to more than 85 domestic destinations and 19 international destinations.

PHX has 100 numbered gate positions within three terminals (**Exhibit 4**):

- Terminal 4 was opened in 1990 and cost approximately \$248 million to construct. It measures approximately 2.3 million square feet in size with a dual level roadway system; and as of March 2011, principally houses US Airways, Southwest Airlines, Aeromexico, Air Canada, British Airways, WestJet, and it also has customs and border protection facilities.
- Terminal 3 was opened in 1979 and measures approximately 562,100 square feet in size with a single level roadway system; and as of March 2011, principally houses AirTran Airways,

American Airlines, Delta Air Lines, Frontier Airlines, Hawaiian Airlines, JetBlue Airways, and Sun Country Airlines.

- Terminal 2 was opened in 1962 and measures approximately 233,200 square feet in size with a single level roadway system; and as of March 2011, principally houses United Airlines, Continental Airlines, Great Lakes Airlines, and Alaska Airlines.

2.3.2 Ownership and Management Structure

PHX has been owned and operated by the City of Phoenix (the City) since 1935. The Aviation Department operates three airports, including PHX, Deer Valley Airport, and Goodyear Airport. The current Aviation Director is Mr. Danny Murphy. A nine member advisory board appointed by the Mayor and City Council named the Phoenix Aviation Advisory Board (PAAB) meets monthly to review airport policies, make recommendations to the City Council on major airport projects, concession contracts, and leases.

The administration of the Aviation Department is led by the Aviation Director and two Assistant Aviation Directors. The Aviation Department comprises nine divisions that are each managed by a Deputy Aviation Director:

- Business and Properties
- Capital Management
- Design and Construction Services
- Facilities and Services
- Financial Management
- Operations
- Planning and Environmental
- Public Relations
- Technology

2.3.3 Airport Capital Improvement Plan Process

The Aviation Department organizes an Airport Capital Improvement Plan (ACIP) Committee that comprises various Department representatives to annually update the ACIP, which lists critical needs of each of the City's airports over the next five years. ACIP recommendations are approved by Aviation Department administration, and recommended sequentially to the PAAB and City Council prior to submission to the Federal Aviation Administration and the Arizona Department of Transportation. Approval of the ACIP by the airlines that serve PHX is not legally required; however the Aviation Department works collaboratively with the airlines, provides informational presentations regarding capital development at PHX, and obtains their input.

2.3.4 Form of Airport/Airline Agreement

The following summarizes pertinent elements of the airline agreement at PHX.

- Airline Rate Setting Method for Terminals: Commercial Compensatory; each terminal is a separate cost center and has its own rates.
- Term: Monthly
- Joint-Use Space Cost Recovery: "80/20 Formula" – 80 percent of the cost of joint-use facilities is charged to airlines based on a per passenger basis for using facilities and 20 percent of the cost is shared equally among the airlines using the facilities. Typical joint-use facilities include baggage claim, baggage make-up, etc.; however, concourse corridors are also considered joint-use space at PHX.

- Airline Revenue Sharing in Terminal: None

2.3.5 Case Study: Terminal 2 Rehabilitation or Replacement

FACTS:

Size of terminal to potentially be rehabilitated or replaced and number of aircraft gates:

- 233,200 SF
- 8 gates in use as of March 2011.

Number of passengers served in most recent full year of normal operations:

- Terminal 2 served approximately 8 percent (3.02 MAP) of total PHX 2010 passenger volume (38.5 MAP).

Size of replacement or rehabilitated terminal and number of aircraft gates:

- Unknown as of March 2011, pending further planning

Design Capacity:

- Unknown as of March 2011, pending further assessment

Highest annual passenger volume served in rehab/replacement terminal to date:

- Not Available.

CPE (pre/post):

- \$4.99 (for FY 2010 from OS dated 8-11-10) Post improvements CPE unknown pending further planning and financial analysis

Airline terminal revenues to total operating revenues ratio (pre/post):

- 19.4 percent (for FY 2010 from FAA Form 127) Post improvements ratio unknown pending further planning and financial analysis

2.3.5.1 Key Issues

- The Terminal 2 apron was determined to be in a failed condition with replacement costs estimated to be approximately \$50 million.
 - Apron costs affect the airfield cost center, which impact landing fees; airlines in general saw no benefit from further investment at Terminal 2.
- Terminal 2 airline rates and charges: low base unit square footage charges, but joint-use charges results in Terminal 2 airlines paying the highest overall unit costs among the three terminals.
 - Joint-use allocation affected by the reductions in the number of airlines operating from Terminal 2.
- City's desire to equalize rates amongst the terminals at PHX.
- Terminal 2 configuration and location is not consistent with the long range development plan for the west side of the Airport.
 - Terminal 2 is within the planned alignment way of the PHX Sky Train.

- Impediment to future plans to straighten the alignment of Sky Harbor Boulevard.
- Airfield limits use of concourse gates at Terminal 2.

2.3.5.2 Key Principles

- Political leadership: Consistent goals and considerations regarding Airport development that drive Aviation Department decision-making include, but are not limited to:
 - Improve competitiveness of Airport among its peers
 - Support the air carrier(s), particularly those that serve major markets
 - Work with airlines and other tenants as business partners
 - Safeguard position of the Airport as the leading economic engine of the City and the State of Arizona
 - Recognize that all rates and charges must be approved by the Phoenix City Council and the Mayor
- Airports and Airlines have inherently different positions towards airport development:
 - Airlines desire to be nimble; able to quickly react to market conditions and other factors, including fuel costs.
 - Airports desire predictability; recognize that development represents long term commitment of “sunk costs.”
- Gaining political and airline acceptance (buy-in) of the plan is critical:
 - Be proactive in developing different economic scenarios to understand risks to and needs of the Airport’s business partners, particularly the airlines.
 - Recognize instances where the City and airlines agree to disagree; but make decisions that have the least negative effect on airline costs.
 - Solicit airline input to understand how they want to operate; what industry or other changes they may anticipate.
 - Plan and develop carefully to minimize the potential for developing future stranded assets.
- Imagine the Airport 50 years from now:
 - Establish air service development goals
 - Develop and regularly update a strategic plan
 - Consider reactive scenario planning: How should the City react to short term industry crises?
- Important to monitor internal financial benchmarks and analyze different scenarios:
 - Any plan must have a solid business case; avoid the pitfall of reaching too far or developing beyond what is needed
 - Consider multiple financial metrics: debt to enplanements ratio, cash reserves, overall airline revenue, CPE, Passenger Facility Charge leverage, operating expenses, and debt service coverage
 - Safeguard bond ratings
 - Safeguard against “Field of Dreams” syndrome
 - Perform pro-forma analyses to monitor the Airport’s financial position 15 to 20 years out

- The financial success of the Airport’s business partners naturally results in higher customer satisfaction.
- Ensure that contingencies used in the ACIP process are not overstated.
 - Creates credibility gap when programs consistently underspend budgets.
 - Affects efforts to prioritize need projects when contingencies result in budgets that are higher than needed.

2.3.5.3 Important Tools and Techniques

Not Applicable.

2.3.5.4 Decision-Making Process

The need for a decision regarding the future of Terminal 2 reached an apex in 2009 when an apron pavement conditions survey indicated imminent failure conditions that would require an expenditure of \$50 million to replace the apron with new 30-year pavement. In addition to the condition of the apron pavement, extensive rehabilitation of the building and building systems would be needed to maintain the useful life of Terminal 2 for the long term. A number of other issues affect the long-term viability of Terminal 2, including its location relative to future development at the Airport. Also, the passenger processor facilities and concourses are not balanced and therefore unable to efficiently support airline operations.

Given the condition and other factors affecting Terminal 2, the Aviation Department and the airlines agreed that long-term investment in Terminal 2 would be neither viable nor prudent. The Aviation Department then considered the option of closing Terminal 2 and accommodating the traffic in the remaining Terminals 3 and 4. After an initial study, it was determined that Terminal 2 traffic could not be accommodated in the existing facilities at Terminals 3 and 4 and additional planning would be needed to determine the best way to accommodate Terminal 2 traffic after its closure. To meet the schedule for development of Stage 2 of the Sky Train, Terminal 2 would need to be closed by the 2016/2017 timeframe. Internal consultation within the Aviation Department resulted in the identification of a “select” pavement replacement project that would extend the operational life of the terminal apron for five to ten years at a cost of between \$5 and \$10 million. The Aviation Department then instructed staff to conduct a planning study to identify the best means to accommodate Terminal 2 traffic while considering its closure by 2016/2017.

Organization

The Department created a working group consisting of Deputy Aviation Directors from:

- Business and Properties
- Capital Management
- Design and Construction Services
- Facilities and Services
- Financial Management
- Operations
- Planning and Environmental
- Technology

The working group reviewed technical studies prepared by a planning consultant working under the technical management of the Planning and Environmental Division.

Evaluation

The study produced discussion and materials enabling the working group to reach consensus on planning parameters, level of service, gap analyses, alternatives (to mitigate facility gaps), and evaluation. Rather than using a no growth scenario, facility requirements and alternatives were developed on the basis of “background” growth through the planning period to be able to compare capabilities of alternative concepts and to accommodate growth among different airline groups. Alternatives included development in Terminal 3 or Terminal 4, as well replacement of Terminal 2 with a new terminal facility. Rehabilitation of Terminal 2 was considered as a comparative alternative. Development costs for each alternative were estimated for facilities that would be needed at near, mid and long range activity levels to compare both near term costs for development with cumulative long range costs.

It was important to the working group that the decision affecting Terminal 2 was evaluated in the context of requirements/needs for background growth in Terminals 3 and 4 – in other words holistically.

Criteria for evaluating alternatives were developed for four main categories:

- Utility – measuring the capacity and operational capability of the facilities to accommodate demand
- Cost – measuring the initial capital investment required
- Implementation – measuring the complexity of delivering the alternative
- Future Considerations – measuring the ability or flexibility of the alternative to respond to a range of future demand scenarios

Using these criteria, the working group determined that the best means to accommodate Terminal 2 traffic and to provide the best flexibility for future development and changes in the airline industry, would be to redevelop Terminal 3 to accommodate both background growth from carriers in Terminal 3 and the Terminal 2 activity.

Although the decision to close Terminal 2 had been made prior to the commencement of this study, the potential cost and effects of rehabilitating and continuing to maintain Terminal 2 were compared with all of the alternatives, further supporting the decision to close the terminal.

Status

The Aviation Department accepted the recommendation of the working group to redevelop Terminal 3 to accommodate the airlines relocated from Terminal 2. As of March 2011, the Aviation Department is initiating detailed planning studies to refine airline and other stakeholder requirements in order to define the initial project as well as subsequent projects related to the phased redevelopment of Terminal 3. A project definition document will be prepared to provide a guide for design and construction. The detailed planning will also begin the Aviation Department’s efforts to procure PAAB and City Council approvals.

2.3.5.5 Financial Analyses

Financial analyses are critical to the City’s decision making process for capital development, including terminal improvements and rehabilitation. One factor, among many, that is critical in decision making is the City’s compensatory rate-making methodology per its rate ordinance with the airlines serving PHX. This type of structure places much of the financial risk for the operation of PHX on the City. As such, the City can benefit financially from sound investments in capital development through increased revenues or more efficient operating expenses; however, the City is

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also at risk financially if these decisions do not work out as planned (e.g., decreased revenue or increased operating costs which can lead to decreases in its debt service coverage ratio or increases in airline CPE).

In discussions with Aviation Department staff, it is also apparent that controlling airline CPE is an objective that is shared across the organization, as well as City Council and other City staff. Other key financial measures that the City indicated they track are provided below. Many of these financial measurements are critical in preserving the AA bond rating for PHX.

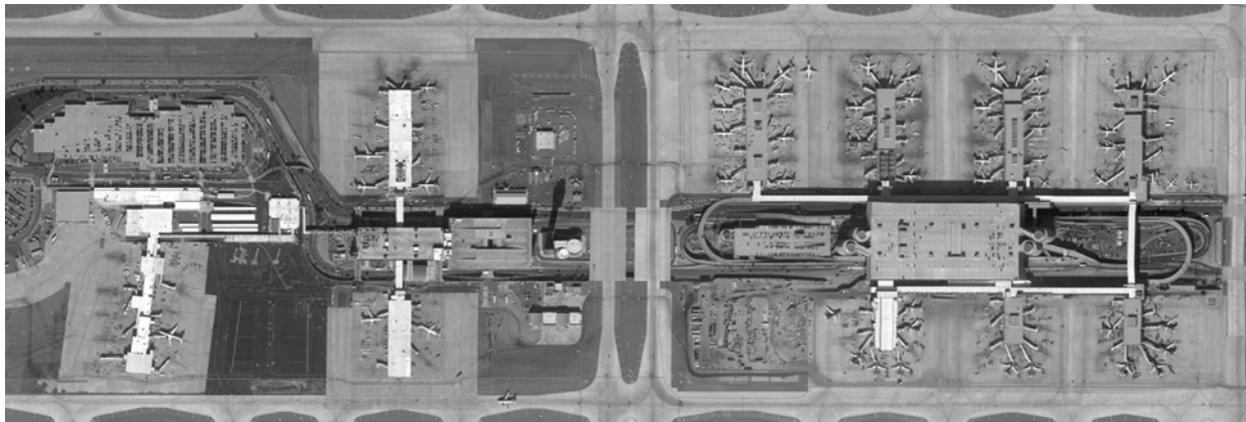
- Debt service coverage ratio
- Unrestricted cash reserves (liquidity)
- PFC leveraged amounts
- Total airline billings
- Operating expenses
- Non-airline revenue
- Outstanding debt per enplaned passenger

2.3.5.6 Asset/Facility Management Software

Not Applicable.

Exhibit 4

PHX – Aerial View



Terminal 2

Terminal 3

Terminal 4

Source: Google Maps, May 2010.
Prepared by: Ricondo & Associates, Inc., March 2011.

III. Medium Hub Airports

3.1 Dallas Love Field, Dallas (DAL), TX

Airport Classification	Medium Hub
Annual Passengers (2009)	7.7 million
Number of Terminals	1
Number of Aircraft Loading Positions	20
Case Study	Terminal Replacement
Considerations for Evaluating Alternatives	Spending Cap for Terminal Redevelopment
	Prioritize List of Projects (“Must Haves” to “Nice to Haves”)
	Flexibility of Alternative
	Operating Level of Service (LOS)

Dallas Love Field (DAL) is the original primary commercial service airport for the Dallas/Fort Worth area. DAL was constrained by Congressional legislation (the 1979 Wright Amendment), when agreements were made for the development of Dallas/Fort Worth International Airport (DFW), to serve only contiguous states. The subsequent Wright Reform Act of 2006 changes the original legislation to open the Airport to more distant airports. The Wright Reform Act came about from an agreement between the Cities of Dallas and Fort Worth, the DFW Airport Board, American Airlines, and Southwest Airlines, known as The Five Party Agreement (FPA). This new legislation allows through ticketing and one-stop, direct through flights to points beyond the Love Field Service Area to begin immediately, and in 2014, all remaining domestic flight restrictions of the Wright Amendment would be repealed.

The Five Party Agreement and Wright Reform Act of 2006 provided the basis for a Terminal Area Redevelopment Program Study (TARPS) that was completed in 2008 by the City of Dallas (or the City), which owns and operates DAL. As a result of the TARPS effort, three options were developed for terminal redevelopment using a common activity constraint of 20 gates operating under a voluntary noise curfew between 11p.m. and 6 a.m. The options ranged from minimal impact (renewal) to new construction (replacement, albeit on the same site as the existing terminal).

The following people graciously contributed their time to this research study:

- Bob Montgomery, Vice President, Properties, Southwest Airlines
- Diego Rincon, Assistant Director – Capital Development Program, City of Dallas
- Chris Czarnecki, Property Manager, Southwest Airlines
- John Zuzu, Sr. Director Facilities Department, Southwest Airlines
- Jonathan Massey, Principal, Corgan

3.1.1 Airport Activity and Terminal Facilities

DAL is categorized as a medium hub airport having recorded 7.7 million annual passengers in 2009, down from a high of 8.1 MAP in 2008. DAL is served by three U.S. domestic airlines, including Southwest Airlines, as a focus city, and its headquarters airport. Continental Airlines and Delta Air Lines also operate at the Airport. Air carriers operating at DAL offered non-stop service to 17

domestic destinations as of Spring 2011. The FPA stipulates that international commercial air service to the region is limited to Dallas-Fort Worth International Airport and additionally limits DAL to operating a maximum 20 gate positions, which is a reduction to its current inventory of 32 gates (**Exhibit 5**).

The original DAL terminal opened in 1958 with three one-story concourses that were equipped with 26 ramp-level gates. The air travel boom during the 1960s triggered several terminal expansions between 1968 and 1970 that included the introduction of jet bridges and a monorail connecting the terminal to remote parking areas. Following the opening of DFW in 1975, DAL experienced substantial service reductions that resulted in the City having to decommission or mothball several concourses. The City attempted to reuse mothballed facilities by leasing them to an entrepreneur who transformed the main lobby at the front of the terminal into movie theaters, ice rink, roller rink, video arcades, restaurants and bowling alley. Following airline deregulation in 1978, Southwest Airlines successfully initiated service from DAL resulting in a series of legislation and court litigations over air service from DAL. The FPA and Wright Reform Act of 2006 represents a conclusion to the litigation and has allowed the City of Dallas and air carriers to reach agreement in early 2009 for the Love Field Modernization Program, which represents a \$519 million master plan to replace the existing terminal facilities with a new 20-gate concourse that is scheduled to open in 2014, concurrent to the final repeal of any remaining Wright Amendment restrictions.

3.1.2 Ownership and Management Structure

DAL has been owned by the City of Dallas since 1943 and is operated by the Aviation Administration currently under the direction of Mark Duebner, Interim Director of Aviation. The Aviation Administration is organized under four principle divisions:

- Finance and Administration is responsible for the finance, budget and human resource functions of the Aviation Department. This includes developing and administering departmental budgets, ensuring prompt payments to service providers and suppliers, collecting revenues, and providing a skilled workforce.
- Airport Operations includes four sub-divisions, each with specific functions or areas of responsibility: Operations Division, Field Maintenance Division, Building Maintenance Division, and the Custodial Division. Together, these divisions oversee the daily activities at the airport to ensure compliance with all regulatory requirements and perform all of the functions necessary to maintain a safe and secure environment for the traveling public, aircraft operators, airport tenants and Department of Aviation employees.
- Property Management manages the department's real estate assets by seeking new commercial development and redevelopment of aviation use properties.
- Environmental Affairs manages environmental issues associated with operating the airport system.

3.1.3 Airport Capital Improvement Plan Process

The Capital Improvement Plan (CIP) for DAL has been tightly intertwined with the growth of Southwest Airlines and continuous litigation between the City of Dallas and City of Fort Worth/American Airlines related to the Wright Reform Act and subsequent Shelby Amendment. The current CIP, as embodied by the Love Field Modernization Program (LFMP), is based on the 2001 Airport Impact Analysis\Master Plan and subsequent development of a Terminal Area Redevelopment Program Study (TARPS). The initial draft TARPS and Revised CIP report completed in April 2006 provided recommendations for facility improvements based on activity

forecasts with the constraints on the terminal facility posed by the Wright and Shelby Amendments. Both the TARPS and CIP were revised in June 2008 in response to the FPA and repeal of the Wright Amendment.

Following completion of the revised TARPS, the City collaborated closely with the air carriers, particularly Southwest Airlines on the selection of the preferred redevelopment option for the Terminal. Stakeholders adopted the option (Option C) that reconfigures the terminal and concourse to more efficiently utilize the airfield, consolidates functional areas, and creates flexibility to adapt to changes in technology, market share and security requirements, and increases passenger LOS and circulation efficiency (**Exhibit 6**). The \$1 billion LFMP embodies a CIP of \$519 Million to replace Love Field's terminal, \$250 million for a hoped-for automatic people mover and the rest for new taxiways, aprons, drainage and other nonterminal improvements.

3.1.4 Form of Airport/Airline Agreement

- Terminal Rate Setting Method: Currently based on fixed, negotiated rates. Upon completion of the first phase of LFMP or completion of first 11 gates of new concourse (plan for 2012), new rate structure will take effect which will be Terminal Building Cost Center residual.
- Term: 20 years through September 30, 2028
- Terminal Revenue Sharing: In addition to Terminal Building Cost Center non-airline revenue, a portion of the net revenue generated in the Parking and Ground Transportation Area Cost Center is credited to offset terminal rental rates.
- Other: Aviation Capital Fund established to fund ongoing capital development. Upon completion of the LFMP, this fund has been agreed to be capped at \$30 million (adjusted for inflation). Any surplus over the cap would be credited to reduce airline rates and charges.

3.1.5 Case Study: Terminal Rehabilitation or Replacement

FACTS:

Size of terminal that was rehab/replaced and number of aircraft gates:

- 860,000 SF
- 32 Gates

Number of passengers served in last full year of normal operations:

- 7.7 MAP (2009)

Size of replacement or rehabilitated terminal and number of aircraft gates:

- 600,000 SF
- 20 gates

Design Capacity:

- Unknown, however, 20 aircraft gates could be expected to serve up to 10 MAP at 500,000 passengers per gate per year

Highest annual passenger volume served in rehab/replacement terminal to date:

- Project not yet complete

CPE (pre/post):

- FY 2009 estimated at \$2.52, FY 2016 projected at \$6.96⁴

Airline terminal revenues to total operating revenues ratio (pre/post):

- FY 2009 estimated at 9.1%, FY 2016 projected at 21.7%⁵

3.1.5.2 Key Issues

- Terminal redevelopment has been tightly intertwined with the growth of Southwest Airlines and continuous litigation between the City of Dallas and City of Fort Worth/American Airlines related to the Wright Reform Act and subsequent Shelby Amendment. The FPA and Wright Reform Act of 2006 represents a conclusion to the litigation and has allowed the City of Dallas and air carriers to reach agreement in early 2009 for the Love Field Modernization Program.
- Agreement to a voluntary noise curfew precluding scheduling passenger airline flights between 11 p.m. and 6 a.m.
- Airlines shall enter into agreements with respect thereto with the City of Dallas.
- The specificity of the FPA in terms of: developable gates; gate allocation between Southwest Airlines and other carriers; and maximum number of daily operations per gate provided a basis for Southwest Airlines to determine supportable CIP.
- Love Field's improvements are financed by a partnership between the city and Southwest Airlines. The airline backs the bonds sold for the project, and revenue from the airport will help pay them off.
- Replacement option adopted by stakeholders was arguably more difficult to implement and results in higher construction costs, however, reasons for selecting the replacement option included:
 - Produced higher level of operational efficiency.
 - Resulted in higher passenger level of service and greater flexibility for future considerations including technology advances and market fluctuations.
 - Provides an improved gateway image for the City of Dallas.

3.1.5.3 Key Principles

Bullet format to highlight analyses techniques, benchmarks, decision making tools, principles expressed by airport.

- Political leadership: A complex relationship between airport jurisdictions in larger metropolitan areas, and between competing airlines serving these airports, requires negotiation and compromise.

⁴ Report of the Airport Consultant – Love Field Modernization Corporation Special Facilities Revenue Bonds, Series 2010, January 20, 2010.

⁵ Ibid.

- FPA represented a compromise that essentially accepted reduction in DAL capacity to support scheduled commercial service in exchange for the elimination of constraints on air service markets and end to litigation.
- Different business strategies for low cost carriers and network carriers are reflected in terminal redevelopment :
 - Low cost carriers seek lower airport CPEs as a primary business objective, and generally have less of a focus on passenger levels of service as compared to legacy carriers.
 - Major legacy carriers generally tend to compete with low cost carriers through offering better amenities, and larger route networks.
- Airports and Airlines have inherently different positions towards airport development:
 - Competing airlines must balance costs with maintaining a competitive level of service.
 - Airports must take competing airline needs into account, while keeping debt within manageable levels, and meeting community expectations and needs.
- CIP is closely aligned to the dominant airline’s business strategy for the airport.

3.1.5.4 Important Tools and Techniques

Not Applicable

3.1.5.5 Decision-Making Process

Narrative describing process from needs identification to DOB. What triggered the project? Discuss comprehensively, i.e., different stakeholder viewpoints/interactions/responsibilities. Techniques and tools used

An initial effort to identify terminal deficiencies was completed in early 2006 on the basis of the 2006 Master Plan Update. This analysis was revised to incorporate activity forecasts, which essentially assumed minimal growth rate of passenger traffic as a result gate restrictions and a voluntary noise curfew adopted in the FPA. The 2006 TARPS was revised based on a maximum 20 gate facility operating at an average of 10 and 15 turns per gate. The City and airlines reached an agreement to a “Spending Cap” that provides for a minimum of \$150 million and up to a maximum of \$200 million investment for terminal redevelopment as part of the FPA; furthermore capital costs in excess of the Spending Cap that impact terminal rents and landing fees are subject to agreement between Southwest Airlines and the City. The terminal redevelopment project is being financed by a partnership between the City and Southwest Airlines. Southwest Airlines backs the bonds sold for the project and revenue from the Airport will help pay them off.

The TARPS analyzed facility requirements for the main passenger terminal facility, terminal curbside, roadways, parking structures and vehicle rental facilities; and even though aggregate requirements effectively would decrease the current terminal inventory by approximately 25 percent, projected facility requirements were determined to present a significant impact to the existing facilities, specifically in LOS offered, economies of scale, and operational efficiencies.

Multiple alternative concepts were developed including a new terminal site southeast of the existing terminal; however space limitations and added cost of new infrastructure made the concept unfeasible. Three feasible concepts for redeveloping the existing terminal area ranging from renewal to replacement were selected for refinement. Costs exceeded the Spending Cap from the outset ranging from \$357 million to \$571 million; and varying capabilities to achieve the performance target (**Table 5**). Southwest and the City engaged in an iterative process to separate “must haves” from “nice to haves” while at the same time, Southwest Airlines internally determined the range of

CIP levels that they could support based in part on the predefined constraint on scheduled flight activity. Ultimately, the most expensive concept was selected after refinements that reduced the budget to \$519 million (See **Table 6** for cost estimates), but provides for the demolition of three original concourses and construction of a consolidated centrally located concourse for all airlines. The main lobby space will be renovated but will retain the overall structure and volume of the original design. As previously stated, the terminal will decrease in size approximately 25 percent by replacing a large amount of unused and outdated space with modern and efficient facilities. Southwest is overseeing the construction project.

3.1.5.6 Financial Analyses

As described above, pursuant to the FPA, the City and Southwest Airlines agreed to significant redevelopment of certain areas of DAL including the passenger terminal complex defined per the LFMP. Following the enactment of the Wright Amendment Reform Act of 2006, the City retained its consultants to perform the previously described TARPS to establish requirement and a plan for DAL terminal modernization. Southwest Airlines, in a parallel effort, retained its consultants to explore alternative concepts for the terminal redevelopment.

The initial Spending Cap agreed by the City and airlines was \$200 million in project costs; however, upon further examination of facility requirements and conditions, it was apparent that this amount was not sufficient to provide for adequate facilities into the future. As such, further investigation and analysis was conducted. Both the City and Southwest recognized the importance of a low airline cost per enplaned passenger at DAL for both of their respective business models. The City realizes that DAL is a low cost alternative to DFW and therefore needs to keep its costs below DFW's. Southwest Airlines' business model as a low-cost carrier recognizes that it is of critical importance to keep CPE low for it to be able to offer lower fares on a point-to-point basis, especially at one of its focus airports where it has a substantial amount and share of the traffic.

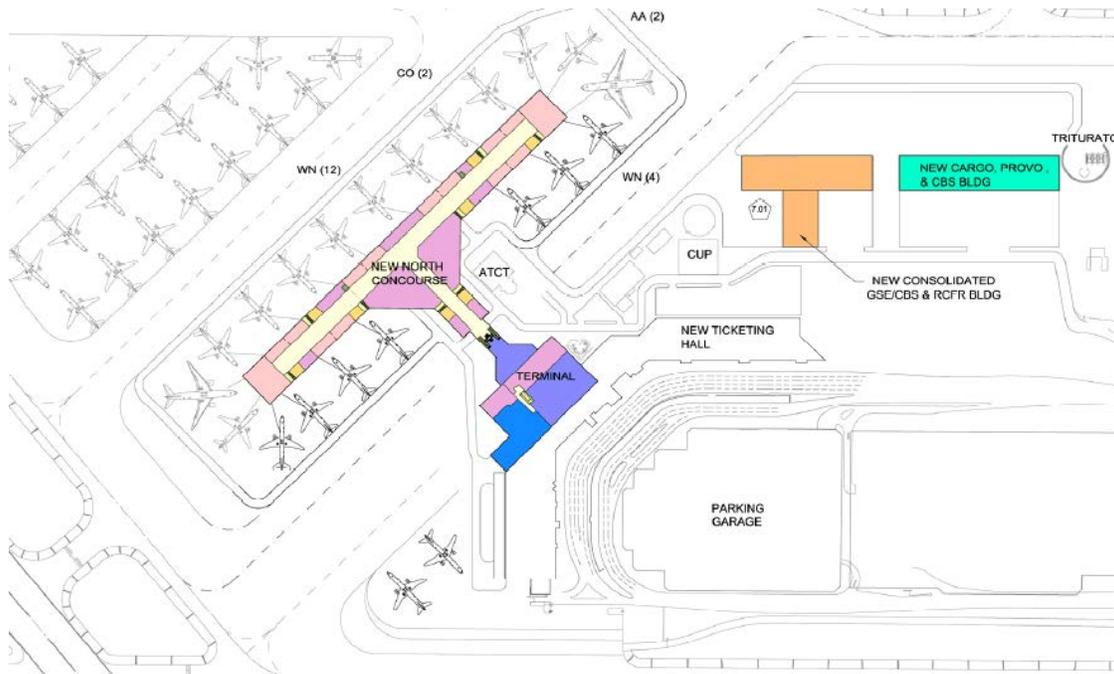
Given the objective of a low CPE, Southwest and the City both conducted an initial high-level affordability analysis to determine an upper level of project costs they could absorb. This financial analysis revealed that approximately \$500 million of project costs was a reasonable target level. The City and Southwest Airlines in 2008 agreed upon "Option C" from the LFMP which satisfies the requirements set forth in the TARPS, and the Dallas City Council approved a term sheet that was negotiated by the City and Southwest Airlines that outlined a basic framework for the program.

The City and Southwest approved a budget for the LFMP of \$519 million. The plan of finance was based on an initial budget of \$536 million; however, Southwest has tasked the program management team to identify scope areas to reduce the budget to \$519 million. The initial funding plan for the LFMP was as follows:

• FAA AIP Grants -	\$38.2 million
• TSA Grants -	\$20.0 million
• PFC (pay-as-you-go) -	\$29.2 million
• Aviation Capital Fund -	\$16.2 million
• Southwest Funds -	\$11.0 million
• Bonds -	<u>\$404.4 million</u>
• Total -	\$519.0 million

Exhibit 6

DAL - Terminal Redevelopment



Source: Corgan Associates, Inc., June 2008.
Prepared by: Ricondo & Associates, Inc., March 2011.

Table 5

DAL - Terminal Redevelopment

Facility Component	Performance Target	Existing	Option		
			A	B	C
Performance Requirements					
Terminal Facilities					
Ticketing Counter Positions	15	24	14		14
Self-Service Devices	50	10	12		12
Ticketing Curbside Positions	12	14	49		49
Bag Claim (area)	12,500 sf	19,000 sf	23,400 sf	45,000	23,400 sf
Bag Claim (frontage)	729 lf	450 lf	729 lf	1,000 lf	729 lf
Passenger Security Checkpoints	14	7	12 to 14	12 to 14	12 to 14
EDS Screening Devices	10	9	10	10	10
Concessions	72,719	20,400	75,000	73,000	75,000
Gate Holdroom (avg.)	2,250 sf/gate	1,835 sf/gate	2,250 sf/gate	2,250 sf/gate	2,250 sf/gate
Landside Facilities					
Arrivals Curb	1,043	820	-	-	
Departures Curb	992	690	-	-	
Commercial Curb	568	110	-	-	
Evaluation Matrix					
Implementation					
Time To Implement	1 low, 5 high		5	2	3
Operational Complexity	1 low, 5 high		2	1	4
Customer Inconvenience	1 low, 5 high		2	1	4
Cost of Overall Program	1 low, 5 high		5	2	3
Operations					
Operational Efficiency	1 low, 5 high		4	3	5
Estimated Relative O&M Cost	1 high, 5 low		2	4	5
Customer Convenience					
Curbside	1 low, 5 high		2	4	4
Ticketing	1 low, 5 high		2	4	4
SSCP	1 low, 5 high		2	4	4
Holdrooms	1 low, 5 high		2	5	5
Concessions and Amenities	1 low, 5 high		2	5	5
Baggage Claim	1 low, 5 high		4	4	4
Walk Distance	1 low, 5 high		3	4	4
Summary					
			37	43	54

Source: Five Party Agreement TARPS for Dallas Love Field, Gresham Smith & Partners, June 25, 2008.
 Prepared by: Ricondo & Associates, Inc., March 2011.

Table 6

DAL - Terminal Redevelopment Cost Estimates

	Hill & Wilkinson	Connico	Variance
Terminal, Concourse	\$ 298,819,271	\$ 349,140,000	\$ 50,320,729
Baggage	\$ 27,773,400	\$ 30,950,000	\$ 3,176,600
Apron	\$ 83,062,347	\$ 68,310,000	\$ (16,752,347)
Roadwork	\$ 11,828,088	\$ 10,530,000	\$ (1,298,088)
Utilities	\$ 2,007,954	\$ 1,390,000	\$ (617,954)
Hydrant Fueling	\$ 42,490,517	\$ 41,310,000	\$ (1,180,517)
Phase 7	\$ 14,508,885	\$ 18,360,000	\$ 3,851,315
Phase 1	\$ 34,235,963	\$ 34,235,963	\$ -
Program Reconciliation Design Services	\$ 265,000	\$ 265,000	\$ -
Relocate West Airfield Lighting Vault	\$ 1,435,832	\$ 1,420,000	\$ (15,832)
Upgrade CUP (Cooling Tower / Boiler)	\$ 15,134,473	\$ 17,540,000	\$ 2,405,527
Projected Total Design and Construction Cost	\$ 531,561,230	\$ 571,450,863	\$ 39,889,633

Source: Five Party Agreement TARPS for Dallas Love Field, Gresham Smith & Partners, June 25, 2008.
 Prepared by: Ricondo & Associates, Inc., March 2011.

3.2 Indianapolis International Airport (IND), Indianapolis, IN

Airport Classification	Medium Hub
Annual Passengers (2009)	7.5 million
Number of Terminals	1
Number of Aircraft Loading Positions	40
Case Study	Terminal Replacement: Midfield Terminal
Considerations for Evaluating Alternatives	Rough Order-of-Magnitude Cost Estimates
	Flexibility of Alternative
	Operating Level of Service (LOS)

Indianapolis International Airport (IND) has been engaged in a discussion with the airlines for many years. In 2003 they initiated a planning process to decide whether to relocate the main passenger terminal or rehabilitate terminal facilities in the current location and structure. Because of the deteriorating condition of the existing terminal area as well as future expansion limitations from runways and landside roadways, the Airport decided to relocate the terminal to a mid-field location, which was completed in 2008.

The following people graciously contributed their time to this research study:

- Mike Medvescek, Chief Operating Officer, Indianapolis Airport Authority (IAA)
- Robert Thomson, Sr. Finance Director, IAA
- Greta Hawvermale, Sr. Director of Engineering & Environmental Matters, IAA
- Susan Zellers, Interim Director of Planning & Project Management, IAA
- Tim Method, Director, Environmental & Conservation Program, IAA
- James Mooney, Deputy Director, Airport Operations and Maintenance, IAA
- Keith Berlen, Airport Operations, IAA

3.2.1 Airport Activity and Terminal Facilities

IND is categorized as a medium hub airport having recorded 7.5 million annual passengers in 2009 - down from a high of 8.5 MAP in 2005. IND is served by 9 U.S. domestic airlines plus Air Canada, Air carriers operating at IND offer non-stop service to more than 35 domestic and international destinations. The airport is also the eighth largest cargo center in the U.S. and home to the second largest FedEx operation in the world.

IND has 40 numbered gate positions on two concourses at the new mid-field terminal (**Exhibit 7**):

3.2.2 Ownership and Management Structure

IND has been in operation since 1937 and has been owned since 1962 by the Indianapolis Airport Authority (IAA) which also owns and operates 5 other general aviation airports and heliports in Marion and Hendricks counties. An eight member Board appointed by the Mayor and county commissioners governs the Airport. Three non-voting advisory members also sit on the Board. The board reviews and approves airport policies, operational issues, and major airport projects, concession contracts and leases. In 1995 the Authority entered into a management agreement with BAA Indianapolis LLC to operate, maintain, and manage IND on behalf of the Authority. This agreement was the first of its kind at a major airport in the United States. The agreement was concluded and responsibility for operation of the Airport returned to the Authority in 2007.

3.2.3 Airport Capital Improvement Plan Process

The IAA had been expanding and renovating the prior terminal facility since 1957. The capacity to expand and adapt to modern aviation needs appeared to be limited and the following operational and functional issues were of concern:

- Congested access from I-465/Airport Expressway intersection
- Traffic conflicts with High School Road
- Congestion in passenger pick-up/drop-off terminal drive areas
- Parking capacity constraints
- Passenger amenity enhancements
- Baggage handling and screening system constraints
- Flexibility and utilization of the terminal facility
- Need to accommodate future growth
- Better access for tenants in the southeast quadrant of IND

As such the IAA Board initiated a four-phase program to address these needs: Terminal Area Master Plan, Peer Review Process, Project Definition, Design, and Construction.

In 1997, the IAA engaged a consultant to prepare a Terminal Master Plan Update for IND. The objective of this study was to compare the relative benefits of expanding the then existing passenger terminal facility with the alternative to develop a new “Midfield Terminal” on a site that had been reserved for expansion since 1975. The Terminal Master Plan Update documented the feasibility of developing a new Midfield Terminal as the recommended action for accommodating passenger terminal facilities into the future including the sizeable expansion of parking facilities. Two primary alternative concepts for the Midfield Terminal were developed in this study.

In 1998, the IAA conducted an independent Peer Review of the Terminal Master Plan through engaging a group of professional consulting firms. The Peer Review confirmed that the Midfield Terminal concept was the preferred approach to addressing future passenger terminal capacity constraints at IND. The IAA Board then determined that the Midfield Terminal concepts needed to be further developed to enable reliable project cost estimates and detailed evaluation of alternatives.

Upon consultation with the airlines, the IAA then authorized a detailed Project Definition Phase that commenced in August 1999 to accomplish three primary objectives:

- Select a Midfield Terminal concept through evaluation of the alternatives
- Prepare a Project Definition Manual for the selected concept
- Develop the Midfield Terminal in the most environmentally friendly way

Based on the analysis conducted in the Project Definition phase, the IAA chose the preferred option of an “Attached Concourse Terminal Concept”.

As part of negotiations in a new airline agreement, the airlines serving IND approved the implementation of the Midfield Terminal Attached Concourse Option. The new airline agreements were entered into on March 15, 2001 and expired on December 31, 2010. The original budget for the program was \$808 million in 2000 dollars.

Design and construction of the Midfield Terminal was initiated after the Project Definition phase and after all stakeholder approvals were granted. Given the events of September 11 and other economic

disturbances that occurred throughout the decade, several project delays occurred. However, construction started in July 2005 and the facility opened in November 2008 about 16 months behind initial planned opening of July 2007.

3.2.4 Form of Airport/Airline Agreement

- Rate Setting Method: Terms are in accordance with the residual methodology. Signatory airlines will receive credit from Authority's nonairline revenue and, in exchange, they agree to cover revenue shortfalls and cost increases, should they occur.
- Term: 5 years
- Joint Use Formula: 80/20. 80 percent of the cost being charged based on a per passenger basis for the passengers using the terminal and 20 percent of the cost is shared equally among the airlines using the terminal.
- Revenue Sharing: None
- Majority-in-Interest Requires no majority-in-interest (MII) vote among signatory airlines for IAA capital projects not funded by bond proceeds.
- Other: Cargo accounted for approximately 50 percent of total landed weight in FY 2009.
- Other: Case Study: Terminal 1 Rehabilitation or Replacement

3.2.5 Case Study: IND New Midfield Terminal

HIGHLIGHTS:

Size of terminal that was rehab/replaced and number of aircraft gates:

- 711,000 SF
- 33 contact gates plus 5 ground level commuter positions

Number of enplaned passengers served in last full year of normal operations:

- FY 2007 4,142,657
- FY 2009 3,740,873

Size of replacement or rehabilitated terminal and number of aircraft gates:

- 1.2 million SF
- 40 contact gates

Design Capacity:

- Unknown, however, 33 aircraft gates could be expected to serve up to 16.5 MAP at 500,000 passengers per gate per year

Highest annual passenger volume served in rehab/replacement terminal to date:

- 7.5 MAP

CPE (pre/post):

- FY 2007 (Pre) \$7.26
- FY 2009 (Post) \$11.33

Airline terminal revenues to total operating revenues ratio (pre/post):

- FY 2007 (Pre) 16%
- FY 2009 (Post) 22%

3.2.5.2 Key Issues and Guiding Principles

HIGHLIGHTS

- The former terminal area is constrained on both the landside and airside by major infrastructure. The crosswind Runway 14-32 limits gate expansion on the airside. Regional expressways (I-465) and local access roads limit expansion of the landside.
- The terminal building had limited lobby width, poor security clearance area, and less than ideal concessions accommodations. The facility was also in need of major rehabilitation, including major environmental systems and equipment.
- However, demand for gates did not exceed gate availability, particularly in the years following 2005. The airlines continually opposed the new terminal based on effects on costs and cost per passenger.
- Political leadership: the Airport management and Authority Board felt that capacity limitation with the inability to expand on site, the costs to maintain the existing structure and the less than idea service level and appearance that could not be changed, and difficulty of phasing any significant reconfiguration warranted proceeding with the new plan.
- Airports and Airlines have inherently different positions towards airport development:
 - Airlines desire low CPE; maintaining capacity at or near demand.
 - Airports desire predictability; recognize that development represents long term commitment of “sunk costs”, and that development times usually exceed reliable forecast periods.
- Imagine the airport 50 years from now:
 - Establish air service development goals
 - Strategic Plan that is regularly updated
 - Reactive scenario planning: How should the airport react to short term industry crises?
- Look at all aspects of plan alternatives. For example, the IND mid-field location facilitated much shorter taxi times because runway crossings were eliminated; a major saving for the airlines. Capture of off-Airport parking revenue.
- Front line operations personnel, including airline staff, should be involved in all aspects of the planning, and design reviews.
- Important to monitor internal financial benchmarks and analyze different scenarios:
 - Airline cost per enplaned passenger

- Financial success of the Airport's business partners naturally results in higher customer satisfaction.
- Over conservative contingencies used in the ACIP harm the process.
 - Creates credibility gap when programs consistently underspend budgets.
 - “Sandbagging” affects efforts to prioritize projects.

3.2.5.3 Important Tools and Techniques

Not Applicable.

3.2.5.4 Decision-Making Process

Identifying Need

The need for major terminal upgrade or relocation lay in the constraints of the site and the condition of the building, not in the demand for gates.

BAA prepared a cost estimate for rehabilitating the original terminal.

Through the execution of a new 10-year airline use and lease agreement in March 2001, the airlines approved the development of the new mid-field terminal. The timing of this approval was critical as several major impacts to the airline industry occurred after approval was granted (e.g., the events of September 11, 2001; several airline bankruptcy filings, major airline capacity reductions in 2008). As a result, the project was delayed several times; however, the Authority proceeded forward with the project.

Organization

The process organization was traditional with consultant/designer contracts held within the planning/engineering departments, and project and document reviews radiating out to parallel departments and senior management, then to airlines, as and if they were willing to participate.

Evaluation

Project elements and details were defined based on cost/benefit of the particular system or equipment (e.g., capital versus on-going O&M costs, and the life cycle status of major terminal systems).

Airlines withdrew any support for the project around 2003. Airport agreed to delay project 2 years from 2003 to 2005, based on economy.

Following completion of the mid-field terminal, the Airport began re-use studies of the old terminal area.

Attic inventory changes should have been included in overall project costs.

Design should have been staged so that technologies issues were flexible and specified as late in the process as possible.

3.2.5.5 Financial Analyses

Historically, the IAA has employed a residual rates and charges methodology pursuant to its airline agreement. As with most residual agreements at other airports, the airlines have certain approval rights over capital development. In general for the signatory airlines to approve of certain capital projects, an airport operator must perform various financial analyses to demonstrate the impacts to airline rates and charges. These may include descriptions and costs estimates, need justifications,

proposed benefits from the capital development, specific rate and cost impacts, and the proposed funding plan among others.

As mentioned above, in the IAA's prior airline agreement for IND, the signatory airlines consented to the implementation of the Midfield Terminal project when they entered into that agreement on March 15, 2001. This agreement has since expired and has been replaced with a new agreement; however, certain terms and conditions on this approval were outlined in the prior airline agreement. Some of the selected conditions are as follows:

- Targeted Limits – Given airline concern over potential cost per enplaned passenger and landing fee impacts as a result of the development, the IAA and signatory airlines agreed upon certain Targeted Limits on these from the DBO of the Midfield Terminal through the end of the prior agreement (December 31, 2010).
 - The Targeted Limits were not guaranteed, but the IAA would use best efforts not to exceed these.
 - Targeted Limits were averaged throughout the period and were established at an average cost per enplaned passenger of \$9.65 and an average landing fee rate of \$1.89 per 1,000 pounds.
 - The IAA and airlines recognized that the Targeted Limits may need to be revised due to changes in program scope or other mandates.
 - The IAA is required to prepare and distribute an updated financial model for review annually by the signatory airlines.
- Appointment of Signatory Airline's Representative (SAR)
- Program Budget – the budget in the airline agreement was \$808 million in 2000 dollars
- Other consultative and review procedures between the IAA and signatory airlines as the financial plan and program budget evolved.
- Grants-In-Aid – the IAA will use its best efforts to obtain maximum airport development grants-in-aid.

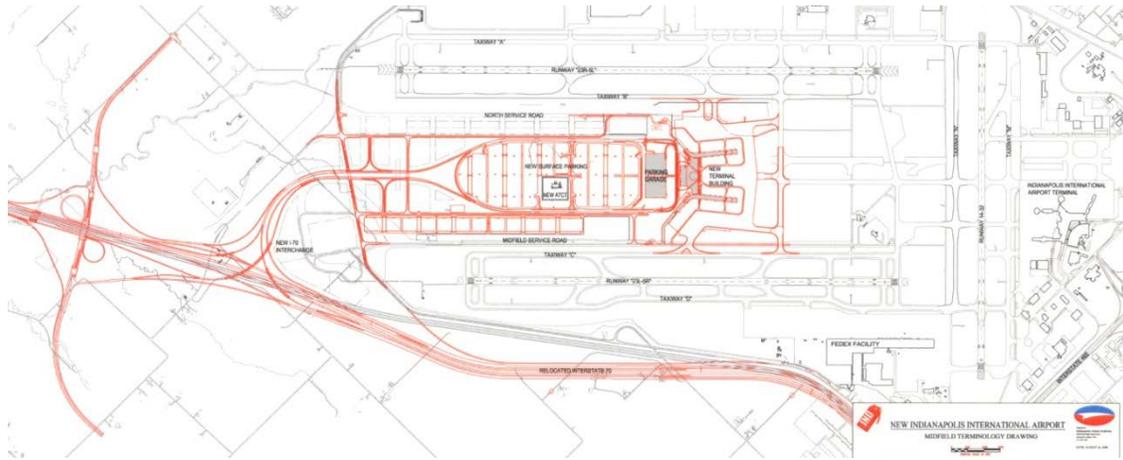
The total cost of the total midfield program was approximately \$1.1 billion. Funding for the program consisted of a combination of federal grants, passenger facility charges, revenue bonds and other IAA funds. Regarding federal grants, the IAA received a Letter of Intent (LOI) from the FAA for project costs related to airfield elements. The LOI was for \$120.8 million and is to be paid by the FAA from 2003 through 2011.

3.2.5.6 Asset/Facility Management Software

Not Applicable.

Exhibit 7

IND - New Midfield Terminal



Source: Indianapolis Airport Authority, March 2001.
Prepared by: Ricondo & Associates, Inc., March 2010.

IV. Small and Non-hub Airports

4.1 Asheville Regional Airport (AVL), Asheville, NC

Airport Classification	Non-hub
Annual Passengers (2010)	735,760
Number of Terminals	1
Number of Aircraft Loading Positions	6
Case Study	Terminal Renewal: Terminal 1
Considerations for Evaluating Alternatives	

Asheville Regional Airport (AVL) is the original primary commercial service airport for the Asheville area, having changed from the Asheville and Hendersonville Airport in 1961. It is owned by the City of Asheville and has been operated by the Asheville Regional Airport Authority since 1980. Several significant terminal improvements have been made between 1980 and 2008. This analysis focused on changes initiated by receipt of American Recovery and Reinvestment Act of 2009 funds, used primarily for further terminal improvements.

The following people graciously contributed their time to this research study:

- Lew Bleiweis, Airport Director
- Vickie Thomas, Director of Finance
- Ellen Heywood, Executive Assistant to the Airport Director
- David Nantz, Director of Operations and Maintenance

4.1.1 Airport Activity and Terminal Facilities

AVL is categorized as a non-hub airport having recorded 735,760 passengers in 2010, an increase of over 27 percent as compared to 579,443 passengers in 2009. AVL is served by six U.S. domestic airlines, offering non-stop service to eight domestic destinations (increasing to seven airlines and nine destinations in April 2011).

AVL has 6 numbered gate positions (**Exhibit 8**).

4.1.2 Ownership and Management Structure

AVL has been owned by the City of Asheville since 1961 and operated and managed by the Asheville Regional Airport Authority (ARAA) since 1980. The ARAA Board has overall financial and policy-making responsibility for the airport and is comprised of seven members. Three Airport Authority members are appointed by the Asheville City Council, three by Buncombe County Board of Commissioners, and the seventh is appointed by the six as the At-Large member from Buncombe or Henderson County. AVL is administered by a staff led by Airport Director Lew Bleiweis, assisted by department directors/managers for Development & Operations, Administration, Finance, IT, Marketing, Public Relations & Air Service, and Public Safety.

4.1.3 Airport Capital Improvement Plan Process

Not Available

4.1.4 Form of Airport/Airline Agreement

- Rate Setting Method: Compensatory
- Term: 60-day operating permit
- Joint Use Formula: Not Available.
- Revenue Sharing: Not Available.
- Other: Holdrooms are considered common-use space

4.1.5 Case Study: Terminal 1 Renewal

HIGHLIGHTS:

Terminal improvements at AVL were completed in Fourth Quarter 2010. The project was paid for with \$7.8 million in American Recovery and Reinvestment Act funds. The grant paid for improvements to Terminal A, including departure gates, the security checkpoint and replacement of two passenger boarding bridges. The funding became available because other ARRA-funded airport projects came in under budget.

Size of terminal that was rehab/replaced and number of aircraft gates:

- Not Available.
- 6 Gates

Number of passengers served in last full year of normal operations:

- 735,760 (2010), 579,443 (2009)

Size of replacement or rehabilitated terminal and number of aircraft gates:

- Not Available.
- 6 gates

Design Capacity:

- Not available, but 6 gates at 300,000 passengers per gate would provide approximately 1.8 MAP

Highest annual passenger volume served in rehab/replacement terminal to date:

- 0.7 MAP

CPE (pre/post):

- Not applicable as no actual data yet available due to project opening in October 2010

Airline terminal revenues to total operating revenues ratio (pre/post):

- Not applicable as no actual data yet available due to project opening in October 2010

4.1.5.2 Key Issues and Guiding Principles

HIGHLIGHTS:

- The AVL terminal facility has been expanded and improved a number of times since the City of Asheville took over ownership in 1961. Following a significant expansion in 1980, a series of changes were made between 1987 – 1992, 2003, 2006 and 2008. An Airport Master Plan was completed in 2003.
- During earlier studies the Airport looked at replacing the existing terminal but costs were estimated at \$140 million, which was beyond the City's need and capability.
- When funds for infrastructure investment were authorized as part of the ARRA, AVL submitted several applications, including one for terminal improvements, which was approved. These funds were the basis for the A Gates Renovation project; minimal airport funds were needed for the project.
- Political leadership: Capture available funds from state or federal programs for the benefit of the local economy.
- Given the compensatory nature of the airline agreement and limited-to-no capital impacts to their rates and charges, the airlines had minimal involvement in process.
- In deciding whether to renew old or build new, make sure recent and planned projects are included in the analysis process.
- At smaller airports be sure to include staff time requirements in the project phasing analysis.
- Airport staff indicated that for a renovation project, many of the costs are not necessarily captured as the project occupies staff time, there are costs to disruption of operations, and other facility maintenance can be neglected.

4.1.5.3 Important Tools and Techniques

Not Applicable.

4.1.5.4 Decision-Making Process

Identifying Need

The potential availability of federal funds led to planning and preliminary design effort to determine potential areas of need. When the ARRA was passed, the Airport submitted five projects, including a request for \$14 million to renovate the terminal. The terminal request was approved.

Organization

The project and evaluation followed typical a project definition, preliminary design, funding, final design and construction process, with staff overview of design and cost estimates, review of estimates for accuracy, and approval, followed by implementation.

Evaluation

The FAA did not require a BCA because only rehab/renovation was in the scope. Approval process was simplified as this project required a minimal investment of local funds.

The project began as a 70-day design and bid document assignment. The scope included gutting and rebuilding the existing structure in phases, with code issues addressed.

The project is currently at or nearing completion. Day-to-day operations during construction were a constant problem, taking staff time and interrupting daily routines. Operating costs and concession revenue changes (up or down) are not yet known.

4.1.5.5 Financial Analyses

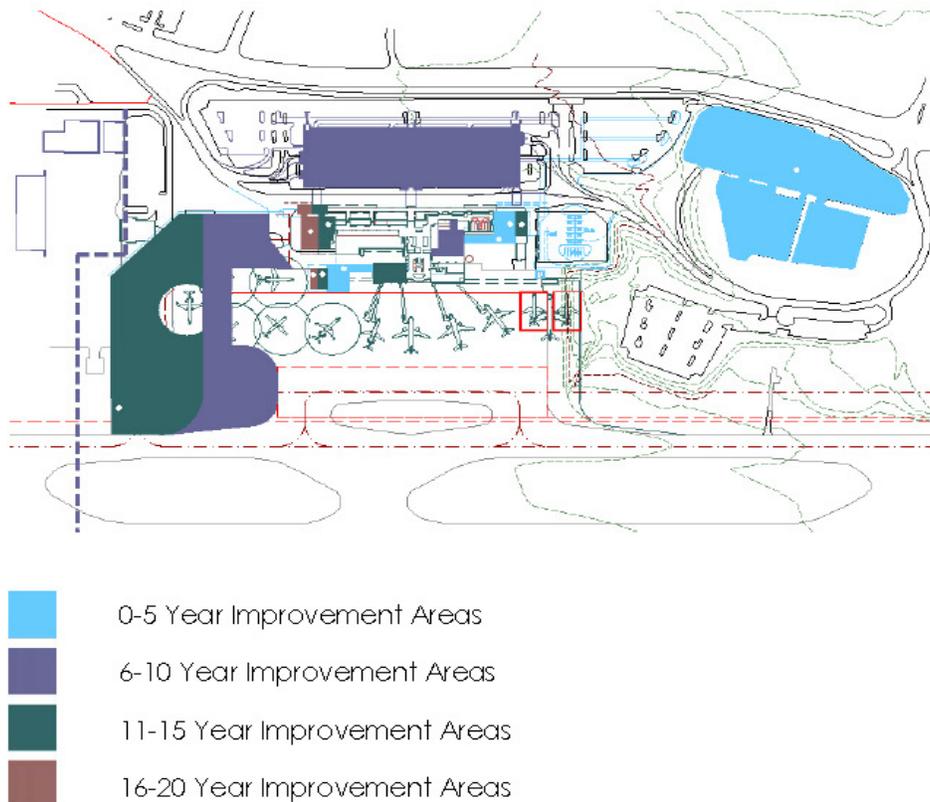
Minimal financial analysis was needed for this project as the project was almost completely funded with federal grants. However, the Authority is expecting an increase in its operating costs due to the increase in facility size. It is also expecting an increase in its in-terminal concessions due to enhanced facility and new food and beverage concessions contract arrangements. Given the recent completion of the project, these operating cost and revenue impacts are not known yet.

4.1.5.6 Asset/Facility Management Software

Not Applicable.

Exhibit 8

AVL - Master Plan Terminal Improvements



Source: Asheville Regional Airport Authority <http://www.flyavl.com> (Accessed: January 18, 2011).
Prepared by: Ricondo & Associates, Inc., March 2011.

4.2 Gulfport-Biloxi International Airport (GPT), Gulfport, MS

Airport Classification	Small Hub
Annual Passengers (2009)	800,742
Number of Terminals	1
Number of Aircraft Loading Positions	7
Case Study	Terminal Renewal
Considerations for Evaluating Alternatives	

Gulfport-Biloxi International Airport (GPT) is the original primary commercial service airport for the Gulfport-Biloxi region. GPT is owned and operated by the Gulfport-Biloxi Regional Airport Authority (Authority). The Authority underwent an analysis several years ago to determine whether to build a replacement terminal facility or rehabilitate and expand its existing facility at GPT. The Authority ultimately chose to rehabilitate and expand its current terminal facilities; however, it is important to note that this project was under construction in August 2005 when Hurricane Katrina struck. The hurricane damaged or destroyed many structures on the Airport and the project was re-scoped to accommodate the hurricane damage and completed in 2008.

The following people graciously contributed their time to this research study:

- Jim Foster, AAE – Assistant Executive Director
- Casey Lyons – Director of Operations & Maintenance
- Stephen Oberlies, CPA – Director of Finance & Administration
- Don Shepley – Director of Planning & Business Development

4.2.1 Airport Activity and Terminal Facilities

GPT is categorized as a small hub airport having recorded 800,742 annual passengers in 2009 down from a high of 949,229 annual passengers in 2000. GPT is served by 6 U.S. domestic airlines with non-stop service to 7 domestic destinations.

4.2.2 Ownership and Management Structure

GPT has been owned by the City of Gulfport since acquiring the airport from the War Department in 1947. The Authority was created in 1977 to manage and operate the airport. Commissioners are appointed by the cities of Gulfport and Biloxi and Harrison County.

The administration of the Authority is led by Executive Director, Bruce Frallic, Assistant Executive Director, Jim Foster, and other directors for the following departments:

- Planning and Business Development
- Operations
- Finance and Administration
- Air Service and Business Development
- Marketing and Business Development

4.2.3 Airport Capital Improvement Plan Process

The Airport initiated a Master Plan Update in 2009 to address changes at the Airport since the 2002 Master Plan and to plan for future industry changes that may impact airport operations. The terminal planning element of the Master Plan Update is focused on improving passenger flows through security, options for accommodating Federal Inspection Services (FIS) facilities in the terminal, and enhancing the use of space in the terminal. A depiction of the proposed layout associated with the Master Plan Update is provided within **Exhibit 9**.

Capacity needs are determined on an annual basis and evaluated based on ability to recover costs within expected future budgets, or if costs are high, the ability to finance. Plan is developed by staff and consultants with review and approval by management.

4.2.4 Form of Airport/Airline Agreement

- Terminal Rate Setting Method: Compensatory
- Term: Month-to-month
- Joint Use Formula: Not Available
- Revenue Sharing: Not Available
- Other: The Authority is currently modifying its methodology to seek full cost recovery of operating expenses.

4.2.5 Case Study: Terminal Renewal

HIGHLIGHTS:

The expansion project increased the size of the airport terminal from 92,000 square feet to 165,000 square feet at a cost of approximately \$51 million. The project included two new gates, expanded lobby and ticket area, improved roads to and from the terminal, larger baggage claim and security areas and space for two new airlines.

Size of terminal that was rehab/replaced and number of aircraft gates:

- 92,000 SF (55,000 SF rentable)
- 6 Gates

Number of passengers served in last full year of normal operations:

- 873,378 passengers in 2004 (last year with prior terminal and pre-Katrina)

Size of replacement or rehabilitated terminal and number of aircraft gates:

- 165,000 SF
- 7 gates

Design Capacity:

- 1.0 million annual passengers

Highest annual passenger volume served in rehab/replacement terminal to date:

- 0.8 MAP (2009)

CPE (pre/post):

- Pre - \$3.79 (2004 estimate from FAA Form 5100-127)
- Post - \$7.91 (2009 estimate from FAA Form 5100-127)

Airline terminal revenues to total operating revenues ratio (pre/post):

- Pre – 21.7% (2004 estimate from FAA Form 5100-127)
- Post – 14.3% (2009 estimate from FAA Form 5100-127)

4.2.5.2 Key Issues and Guiding Principles

HIGHLIGHTS:

- Dockside gaming became legal in 1992. In 1999, “Las Vegas-style” casinos such as the Beau Rivage, which had a positive impact on the demand for air travel into GPT.
- Due to casino destination resort growth and a 130 percent increase in Coast hotel rooms, passenger boardings grew 400 percent during the 1990s and the economic impact of the Airport exceeded \$600 million annually.
- AirTran Airways started service at GPT in 1999.
- The airport had 949,229 passengers in 2000, its highest level ever.
- GPT underwent two terminal expansions during the 1990s to keep pace with growth. In 1995, the Authority implemented the first concourse expansion. In 1997, the second concourse was added with three gates on the northside.
- Passenger growth still outpaced facility expansion which warranted the development of a new passenger terminal facility or the rehabilitation and expansion of the existing.
- Hurricane Katrina in August 2005 had a devastating impact on GPT and the surrounding region. The terminal project was under construction at the time of the storm; which resulted in major damage to the project causing delays and some re-scoping of the project.
- Gross utility costs may go up from a larger facility even though unit costs may go down.
- Changes in materials and systems affects attic stock, and often makes current attic stock useless.
- Major renovation projects require significant levels of staff time to handle project related issues, and also interrupt normal operations, requiring more staff time.

4.2.5.3 Important Tools and Techniques

Not Applicable.

4.2.5.4 Decision-Making Process

Narrative describing process from needs identification to DOB. What triggered the project? Discuss comprehensively, i.e., different stakeholder viewpoints/interactions/responsibilities. Techniques and tools used

Identifying Need

The initial GPT terminal was built in 1981. The terminal was expanded on the south side by two gates in 1995 and on the north side by three gates in 1997 (thus they currently have relatively new concourses but old infrastructure for the terminal portion of the building. The approval of dockside gaming in Mississippi in 1992 led to an increase in hotel construction and a related increase in flight activity at GPT. AirTran started service in April 1999 which led to a doubling of enplanements (450,000 total annual passengers – confirm) (AirTran service was suspended in Jan 2009).

A new master plan is underway by URS and GS&P currently.

A forensic study was initiated to catalog terminal condition issues, including verifying as-builts, investigating ‘behind the wall’ conditions, code problems, ground stability affecting flooding and drainage/storm sewer systems.

Organization

The project and evaluation followed typical a project definition, preliminary design, funding, final design and construction process, with staff overview of design and cost estimates, review of estimates for accuracy, and approval, followed by implementation.

The Authority switched consultants (to Campbell & Paris / Gresham Smith) to do further planning. Sabre Consulting Group prepared report on forecasts.

Consultation with the airlines was undertaken (particularly since required to use PFC funds). The airlines did not want a ‘Taj Mahal’ and per passenger costs had to be kept in line with current costs at the time.

Evaluation

A terminal expansion/replacement study was undertaken. Airside (apron) capacity was checked. They have enough area to place 80 gates (only 8 currently). The current terminal site allows adding 50 feet to the holdrooms and/or expanding terminal 30 feet out into the curb and roadway.

The current terminal has column spacing and ceiling height limitations. Rehabilitating the existing terminal and expanding to 170,000 square feet was estimated at \$25 to \$30 million.

An alternative for a new terminal was developed (2 stories, Y shape, 2 level roadway) on a site that would allow reuse of the existing terminal (e.g., charter, GA). ROM estimate for this alternative was \$60 million.

An initial financial analysis, determined that the Authority could not afford building the new terminal. The passenger market for GPT consists of a high level of destination passengers, many of which travel on low-cost carriers. As such, the cost per enplaned passenger needs to remain at competitive levels to continue to attract low-cost service.

Renovation of the terminal was ‘interrupted’ by Hurricane Katrina. Before the hurricane, the tenants blamed the project and management for phasing issues which strained relations. After the hurricane, Katrina was blamed for most problems.

Costs escalated to \$51 million, but this includes additional work and repeat work caused by Katrina, as well as increased labor and materials costs because of recovery projects in the region. Final terminal cost was \$41 to \$43 million.

AIP grants forced accelerated project schedule for bag claim, security (\$6 million).

During the course of the design, development and construction, the following was also determined:

- You cannot do half the building from a utility standpoint; eventually you will end up replacing it all.
- New and old must be matched from a materials and design standpoint.
- Relationships with tenants were strained because of phasing and issues associated with mixing construction with continuing to operate.

4.2.5.5 Financial Analyses

The Authority did initial financial analyses of both options to build new and to renovate and expand its existing terminal facility. This financial analysis was needed both to evaluate affordability and financial risk to the Authority and to satisfy the requirements of the airlines. Given GPT’s destination market and its current short-term airline agreement and compensatory rate-making methodology, the following financial measures were key to the financial analyses:

- Airline cost per enplaned passenger
- PFC capacity – both leveraged and pay-as-you-go

- Authority debt service coverage ratios
- Authority liquidity

The Authority understands it needs to keep airline costs low to attract low-cost carrier service to meet the demand of its growing destination market passengers. The airlines also were involved in the project on the front end to indicate they would not support a project that increased airline cost per enplaned passenger substantially. A primary funding source for this project to help mitigate increases in airline cost per enplaned passenger is PFCs. The Authority used PFCs on both a leveraged and pay-go basis to fund a significant portion of the project.

As the Authority has only short-term airline use and lease agreements in place combined with their compensatory nature, it has much of the financial risk for the operation of GPT. The airlines only pay for what they use and are not bound by long-term agreements, so they can enter and exit the market with limited financial exposure. Not to mention, the demand for air travel at GPT is seasonal in nature. As such, it is important for the Authority maintain reasonable levels of liquidity to offset the risks associated with drops in air traffic due to air carriers decreasing service or other times of economic uncertainty when the destination demand can decrease. For many of the same reasons discussed, the Authority also needs to maintain reasonable debt service coverage ratio levels. This demonstrates that the Authority’s cash flow is sufficient to pay its ongoing operating costs and debt service.

4.2.5.6 Asset/Facility Management Software

Not Applicable.

Exhibit 9

GPT – Proposed Layout



Source: GPT Master Plan Update, Gresham Smith & Partners (Accessed: January 05, 2012).
 Prepared by: Ricondo & Associates, Inc., March 2011.

4.3 McClellan – Palomar Airport (CLD), Carlsbad, CA

Airport Classification	Non-hub
Annual Passengers (2010)	52,594
Number of Terminals	1
Number of Aircraft Loading Positions	N/A

Case Study	Terminal Replacement
Considerations for Evaluating Alternatives	Provide Enhanced “Front Door” Image
	Rough Order-of-Magnitude Cost Estimates
	Flexibility of Alternative

McClellan - Palomar Airport (CLD) is a non-hub airport owned and operated by the County of San Diego, located wholly within the City of Carlsbad, California. The County recently completed a terminal replacement of two old poorly configured terminal structures with one new facility. The project was part of a significant renewal of various components at the Airport.

The following people graciously contributed their time to this research study:

- Peter Drinkwater, Director of Airports, County of San Diego
- Mike Quarry, CLD Project Manager

4.3.1 Airport Activity and Terminal Facilities

McClellan - Palomar Airport is categorized as a primary non-hub airport having recorded 52,594 annual passengers in 2009 down from a high of 157,038 annual passengers in 2000. CLD is served by United Express, operating daily flights to LAX. In recent years the Airport had also been served by American Eagle and US Airways Express. Small, non-scheduled low cost carriers and chartered service carriers also serve or have provided service.

- CLD has an open apron aircraft parking area serving a new 18,000 square foot single level terminal finished in 2010 (**Exhibit 10**).

4.3.2 Ownership and Management Structure

CLD is owned and operated by the County of San Diego, within the Department of Public Works (DPW). The Department owns and operates 7 other airports. The Director of County Airports is Mr. Peter Drinkwater. The Airport is operated by a small on-site staff. Improvements to the Airport are managed within the Airports group in the DPW.

4.3.3 Airport Capital Improvement Plan Process

Not Available.

4.3.4 Form of Airport/Airline Agreement

- **Rate Setting Method:** Not Available
- **Term:** Not Available
- **Joint Use Formula:** Not Available
- **Revenue Sharing:** Not Available
- **Other:** Not Available

4.3.5 Case Study: Terminal Replacement

HIGHLIGHTS:

A commercial terminal that was an old 3,600ft² multi-trailer / prefabricated building near the control tower installed over a 24-hour period in 1999 was replaced by a new terminal building in January 2009. The 18,000ft² terminal (six times larger than the old one) required an investment of \$24 million, which has been paid for using Federal Aviation Administration grants totaling \$13.2 million and the remainder in funds from San Diego County. This expansion project included three new long-term parking lots (700-car capacity) along the southern edge that is connected to the terminal building via elevators and a passenger bridgesee **Exhibit 11**).

Size of terminal that was rehab/replaced and number of aircraft gates:

- 24,000 SF
- Open Apron

Number of passengers served in last full year of normal operations:

- 52,594 Annual Passengers).

Size of replacement or rehabilitated terminal and number of aircraft gates:

- 18,000 SF
- Open Apron

Design Capacity:

- Unknown

Highest annual passenger volume served in rehab/replacement terminal to date:

- 52,594

CPE (pre/post):

- Not Available

Airline terminal revenues to total operating revenues ratio (pre/post):

- Not Available

4.3.5.2 Key Issues and Guiding Principles

HIGHLIGHTS:

- Scheduled airline service is not the primary airport function. Scheduled flights make up approximately 5 to 6 percent of overall operations.
- Political leadership:
 - Goals of the community housing the Airport had different priorities than goals of owner/operator. Airport owned and operated by a different governmental agency than the community in which it is located.
 - Airport must compete for funds with county wide operating and facility improvement needs.
 - Provide enhanced 'front door' image, i.e. below standard facilities in upscale business and suburban community.
 - Support business development through better transportation infrastructure.

- There needs to be a synergy between political and private goals and funding. This can be used as leverage to optimize public funding. Be aware of and be willing to leverage other projects and funding sources within the local/regional political and commercial sectors.
- Process should accommodate and serve the local cultural climate.
- At a primarily general aviation airport, corporate and private aircraft owner/operators sometimes have different goals than policy makers. Seek out and negotiate solutions with adversary stakeholders:
 - Adversaries can be turned to supporters with simple consideration and a share in the results.
 - Small airports should develop a business strategy that encompasses GA, large GA and commercial service.
- Develop achievable plans within reasonable and pre-determined funding limits
 - Be proactive in seeking out related funding sources.
 - Combine projects where scale can reduce project costs.
 - Leverage community leaders, especially within the design and construction industries.
 - In many cases the ‘nuts and bolts’ of the plan/design needs to serve a ‘vision’.

4.3.5.3 Important Tools and Techniques

Not Applicable.

4.3.5.4 Decision-Making Process

Identifying Need

The initial impetus for the new terminal came from the political and local cultural conditions of the airport area. The community and surrounding region is upscale with significant white collar employment. The City pushes to maximize its regional economy through supporting development of business parks, improved roadway and utility infrastructure.

In 2003 the City met with the County airport management and requested a plan to make significant improvements at the Airport, including a new terminal. The goals were subsequently fully endorsed by the Fifth District County Supervisor.

These efforts were begun concurrent with large private investment in hangar and FBO facilities. The only remaining area for terminal expansion required the relocation of general aviation tie-down areas to the north side, resulting in legal proceedings related to FAA Part 16 discrimination rules.

The elements of the required airport improvements included:

- Roadway and airport entrance
- Long and short term vehicle parking
- Adequate general aviation replacement facilities
- Terminal replacement

The new terminal plan was developed for an 18,000 square foot building to replace the two old buildings which totaled 24,000 square feet. No Environmental Assessment (EA) was required by the FAA because the project involved solely the removal and replacement.

Organization

The project was administered as an ordinary County DPW project, with funds from outside sources deposited with the County and County funds used to pay contractors.

Early coordination with the FAA resulted in combining many small projects into one major infrastructure 'program'. The FAA also waived benefit/cost analysis requirements because the terminal related projects were primarily replacement.

Evaluation

With a funding cap determined a project team was assembled of primarily local firms (but including Gensler). Planning included developing alternative scenarios, and reviewing scenarios for cost, ability to expand, etc. The selected plan facilitated development of otherwise unusable land (vehicle parking down the hill).

4.3.5.5 Financial Analyses

Under the assumption that much of the required infrastructure costs could be shared with other airport development (private FBOs), the County first determined what it could afford, then designed to cost. It was determined that stormwater mitigation credits could also be used to offset costs.

The County also allowed the Airport to tap Enterprise Funds and borrow ACIP funds from other projects. Use of Enterprise Funds required that capital be spent within 24 months and had to be used for revenue producing projects at the Airport (e.g. on-airport public parking).

4.3.5.6 Asset/Facility Management Software

Not Applicable.

Exhibit 10

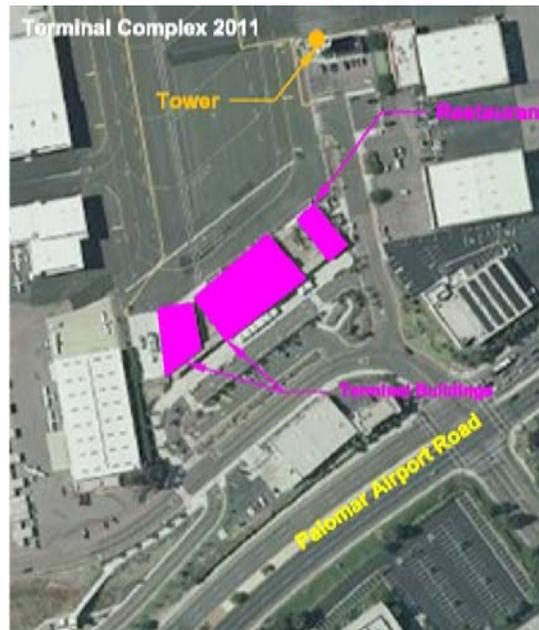
CLD - Original Terminal Area



Source: Ricondo & Associates, Inc., March 2011.
Prepared by: Ricondo & Associates, Inc., March 2011.

Exhibit 11

CLD - Terminal Replacement



Source: Ricondo & Associates, Inc., March 2011.
Prepared by: Ricondo & Associates, Inc., March 2011.

4.4 Wichita Mid-Continent Airport (ICT), KS

Airport Classification	Small Hub
Annual Passengers (2009)	1,460,000
Number of Terminals	1
Number of Aircraft Loading Positions	11
Case Study	Terminal Replacement
Considerations for Evaluating Alternatives	Flexibility to Meet Future Growth
	Efficient, Distinctive, and Model Facility
	Improved Airport Access

Wichita Mid-Continent Airport (ICT) is owned and operated by the City of Wichita, Kansas. A new terminal study was recommended by the master plan completed in 2002-2003. A terminal planning process was undertaken to compare renovation options against replacement options, and recommendations to replace the existing terminal were approved in 2004. As of October 2010, plans for the terminal (**Exhibit 12**) had been approved by the FAA and TSA, and the project was ready to bid; however, the Wichita City Council deferred its decision on moving forward with bidding until 2011 citing uncertainties in the economy and renewal of the state-funded Affordable Airfares program. Several air carriers representing a major share of ICT traffic objected to PFC applications, even though there was early support from air carriers.

The following graciously contributed his time to this research study:

- Victor White, Executive Director of Airports

4.4.1 Airport Activity and Terminal Facilities

Wichita Mid-Continent Airport is categorized as a small hub airport having recorded 1.46 million annual passengers in 2009 down from a high of 1.6 MAP in 2008. ICT is served by most domestic carriers or their regional affiliates, with flights primarily to domestic hubs. The Airport has no scheduled international activity at this time.

The current terminal has a single level roadway and lobby with second level gates. It was constructed in 1953 (almost 60 years ago) with subsequent additions:

- Two concourses with 10 gates added in 1976.
- Expansion of Ticketing and two additional gates in 1985.
- Last Major Renovation & Expansion in 1989 at a cost of approximately \$ 6 million.

4.4.2 Ownership and Management Structure

ICT has operated in its current location since 1954. It is owned by the City of Wichita and operated by an airport management that reports to the Wichita Airport Authority (WAA). In fall of 1999, there was a change in the governance of the airports. The previous semi-autonomous, nine-member administrative board was replaced with a 13-member advisory board. The Wichita City Council is now the Authority Board.

Airport staff is divided into five divisions associated with the management, operation, development and maintenance of the airport:

- The Division of Airport Administration is responsible for all records, funds and fiscal matters, as well as related documentation, having application to lease agreements, budgets, receivables, payables, personnel, insurance, payroll, bonds and federally sponsored programs.
- The Division of Engineering and Planning does the planning, design and construction of projects for airlines, general aviation, and others involved in construction programs to meet the changing conditions in aviation and airport development. Engineering and Planning is also responsible for coordination of the construction activities with federal and local government, airlines and general aviation representatives.
- Airport operations and maintenance is divided into three divisions: Airport Public Safety, Building Maintenance and Airfield Maintenance.

4.4.3 Airport Capital Improvement Plan Process

The WAA maintains a 10-year ongoing, regularly updated list of necessary capital improvements. Under the Airport-Airline Use and Lease Agreement, the airline approval of the CIP is not required. The current CIP includes projects planned for the period 2008-2018 Capital Program. The centerpiece of the current Capital Program is the proposed new terminal building and related projects known as the Air Capital Terminal 3 (ACT 3). Development of ACT 3 and related financial analyses that were undertaken included:

- Master Plan (2003)
 - 20 year analysis of development opportunities and challenges.
 - Concluded that existing facility was nearing the end of its functional life and that some type of major development of airline terminal facilities would be needed.
- Terminal Area Plan (2004)
 - Examined renovation/expansion versus new facility.
 - Estimated cost of renovation was \$150 million.
 - WAA unanimously supported plan to begin design of a new terminal.
- Schematic Design (early 2006)
 - Development of a comprehensive design.
 - Refinement to cost estimates which resulted in \$211million projection.
 - Reduced scope of design to meet funds availability.
- Financial Capacity Analysis (late 2006)
 - Considered various funding alternatives.
 - Analysis based on Base, Low and High traffic scenarios.
 - Defined range of capital development costs that was affordable at reasonable rates to users (\$6.50 - \$9.50 cost per enplaned passenger).
 - Confirmed \$150 million target project budget plus a \$10 million reserve.
- Parking Garage Financial Feasibility Study (2008)
 - Parking demand can support a multi-level garage
 - Garage is financially feasible as a stand-alone project based on given growth assumptions.
 - Projected to not negatively affect the terminal expansion project financially.
- ACT 3 Financial Plan (2008 - 2010)

- Comprehensive financial model with projections of traffic, CIP costs, funding sources, debt service, operating results and airline rates.
- Established financial targets and evaluated financial feasibility.

4.4.4 Form of Airport/Airline Agreement

- Terminal Rate Setting Method: Commercial Compensatory. Airline rates by ordinance.
- Term: 1 year
- Joint Use Formula: Not Available
- Revenue Sharing: Possible consideration of airline rate subsidization at Authority's option.
- Other: Not Available

4.4.5 Case Study: Terminal Rehabilitation or Replacement

FACTS:

Size of terminal that would be rehab/replaced and number of aircraft gates:

- 194,881 SF
- 11 Gates

Number of passengers served in last full year of normal operations:

- 1.5 MAP (2009).

Size of replacement or rehabilitated terminal and number of aircraft gates:

- 230,000 SF
- 10 Gates

Design Capacity:

- 2.0 MAP, with expansion planned for 2.4 MAP

Highest annual passenger volume served in rehab/replacement terminal to date:

- N/A

CPE (pre/post):

- 2009 CPE was \$5.83, 2014 CPE projected at \$8.50

Airline terminal revenues to total operating revenues ratio (pre/post):

- 2009 11.6 percent (based on FAA Form 5100-27), projected not available.

4.4.5.2 Key Issues

Consultant studies cited numerous functional deficiencies that limit suitability of the existing terminal facility to support current and future passenger activity at the level of service desired by the City Council:

- Congestion occurs at ticketing and around the baggage claim devices because space for queuing and passenger movement is inadequate. Congestion also occurs at curbside in front of terminal building.
- There is excessive unused space on the second floor that must be maintained and environmentally controlled.
- The distance from ticketing to most distant gate is almost 1,400 feet.
- Most concessions are located ahead of the passenger security checkpoint rather than in the passenger boarding areas where they are needed most.
- The building is not in compliance with currently required Life Safety Building Code upgrades. It is not fully protected with a fire sprinkler system which reduces the allowable distances to fire exits; consequently, some areas of the concourse do not meet code requirements for exiting distances.
- The ramp between the terminal and the concourse is too steep and too long to meet requirements for access by those with disabilities under the Americans with Disabilities Act (ADA). Passenger security screening checkpoint is at the top of the ramp, and queuing must occur on the ramp.
- Asbestos exists in building materials throughout the facility. Most of the asbestos has been removed, but much remains. Further mitigation will require shutting down portions of the terminal facility, which will interfere with operations.
- Air handling units are old and operating at maximum capacity and continued use will require replacement. These units do not have capacity to heat and cool the quantity of fresh air required to meet current requirements for outside air exchanges.
- Multiple roofs are out of warranty requiring high maintenance and having frequent leaks.
- Portions of the building structure, especially in the concourses, lack the structural bracing required by today's building code for resistance of lateral loads, especially current seismic requirements.
- Below standard facilities based on master plan and community interests.
- TSA Concerns with Existing Terminal Configuration
 - Terminal configuration will not allow TSA to deploy advanced technology systems available at other airports and necessary to maintain appropriate security at the required speed and efficiency.
 - The space available for passengers to divest items and collect clear items is approximately half the recommended space.
 - The passenger Security Screening Checkpoint has inadequate space to install AIT's (whole body imager).

Consultant studies of the renovation option concluded:

- The cost of renovations was estimated to be \$ 152 million with major cost elements attributable to non-passenger related work.
- Base terminal would still be 50 years old:
 - Terminal functional improvements limited to existing configuration.

- Limited potential for improving passenger service.
- Significant challenges to overcome in order to pursue the renovation option:
 - Will need to maintain operations during renovation with small incremental phases of construction resulting in significantly longer construction disturbance

WAA identified broad and specific goals that would be better achieved with a replacement terminal:

- Satisfy future terminal facility growth requirements.
- Develop an efficient, distinctive and modern terminal facility.
- Provide improved terminal access and parking facilities.

Benefit-Cost Analyses was not performed since it was not required by the FAA; Risk Assessment occurring late in process (project ready to be bid) resulted in sufficient uncertainty as to delay implementation or possibly require further modification to the project.

4.4.5.3 Key Principles

Bullet format to highlight analyses techniques, benchmarks, decision making tools, principles expressed by airport.

- Contemporaneous risk assessments should be conducted against assumptions used to develop costs and financial capability in order to understand exposure or sensitivity to external factors.
- Benefit-Cost Analyses (BCA) or Life Cycle Cost Analyses (LCCA) comparing renovation options against replacement options should be performed to quantitatively evaluate performance (BCA) or use LCCA to determine “total cost”.
- External factors (evolution of local building code) affect the extent of renovation required and can increase renovation costs.
- Community image plays a part in decisions to renovate or replace terminal facilities at mid-size airports.
- Monitor internal and external factors that affect project decisions throughout the planning and design process.
 - Typically long planning and design process are subject to external factors that affect project evaluation and outcome. In this case, uncertainties in the economy and renewal of the state-funded Affordable Airfares program delayed the project.

4.4.5.4 Important Tools and Techniques

Not Available

4.4.5.5 Decision-Making Process

Narrative describing process from needs identification to DOB. What triggered the project? Discuss comprehensively, i.e., different stakeholder viewpoints/interactions/responsibilities. Techniques and tools used

Identifying Need

The Airport Master Plan completed in 2003 concluded that the existing terminal was nearing the end of its functional life and that some type of major development of terminal facilities would be needed. It cited numerous deficiencies including:

- Life safety
- Utilities
- Structure/seismic
 - Wichita's building code requires that in cases where remodeling projects reach a high enough percent value of the asset (facility), then the entire facility must be brought up to code.
- Space planning

Organization

The planning process was conducted as an element of the Airport's 10-year ongoing, regularly updated Capital Improvements Program that is administered by airport staff and approved by City Council. Air carriers are consulted and advised of capital improvements; however airline approval of the CIP is not required. City Council contracted with various consultants to perform terminal planning and financial analyses.

Evaluation/Decision Process

Subsequent to the Master Plan, ICT conducted a Terminal Area Plan to compare options for renovating versus replacing the terminal. Estimated cost for renovation/expansion was \$152 million versus \$160 million for replacement (including landside and airside costs, but excluding a new parking garage). The FAA did not require a BCA because the project was replacement, not a capacity increase. In 2004, City Council approved the recommendation from the Terminal Area Planning Study to move forward with the design of a replacement terminal. Schematic Design (Two level terminal with a two level roadway) was completed in early 2006 but refinements increased costs to an estimated \$211 million, at which point the airlines raised objections. There was considerable back and forth between the airlines and City Council over the proposed budget; ultimately, the terminal design was modified and subsequent a Financial Capacity Analyses in late 2006 confirmed \$150 million target project budget plus a \$10 million reserve that would result in rates in the range of \$6.50 - \$9.50 cost per enplaned passenger.

A risk assessment performed by the City's Department of Finance in April 2010 challenged the consultant's assumption of growth in passenger traffic particularly if the Affordable Airfares program were discontinued, see **Exhibit 13**. The five-year state program, which expires on June 30, 2011, currently provides subsidies to Frontier and AirTran airlines; and requires re-approval by the Kansas Legislature. Subsequent analyses performed by the consultant indicated that without Affordable Airfares, passenger traffic would likely decline to the point where the airport would lose money and the City would have to pick up the debt load.

While design and construction plans were approved by FAA and TSA for bidding by October 2010, City Council deferred its decision to seek bids until early 2011 citing uncertainties in the economy and the state-funded Affordable Airfares program as reasons for delaying the request for bids.

The delay has complicated capital plan spending; specifically, how much should be fixed in the interim period; should O&M problems/needs have short or long term solutions.

4.4.5.6 Financial Analyses

Narrative discussing how Airport incorporates analyses into decision making process...what metrics and benchmarks used.

Revenues generated from the Airport are used to cover operating expenses, debt service and part of the capital improvements. The majority of non-revenue-producing capital improvements at Mid-Continent Airport are financed from FAA Airport Improvement Program (AIP) grants and PFCs. The 2009 operating expense budget was approximately \$12.2 million, and the operating revenue budget for that year was approximately \$17.4 million.

The Authority has used double-barreled general obligation bond funding for capital improvements since 1969, and has matched these funds with approximately \$100.2 million of FAA Airport Improvement Program funds.

Airline rates are set by ordinance, and the Authority has no legal obligation to seek airline approval for capital development. PFC funding was applied for and granted against objection letters from 14 airlines. City also hopes for FAA AIP discretionary funds in addition to entitlement funds. Airlines are on a year by year compensatory use and lease agreement. The Authority is seeking to keep CPE at/or below \$7.50 as a goal; however, there is no obligation or formal deal with the airlines for this. This may require subsidizing commercial component of the terminal. The effect of the project funding on the CPE was a significant consideration in the initial project approvals.

The Authority initiated an initial financial capacity analysis in 2006; however, as airline support for the project dwindled in 2008, it pursued a parking garage feasibility study and the ACT 3 financial plan. The primary objectives of the Authority's financial planning for the project were to develop a feasible funding plan to support the capital development and to establish financial targets. The funding plan was to maximize pay-as-you-go to limit debt requirements, not exceed practical debt capacity, allow funding capacity for future capital, and maintain competitive airline costs. The goals of the financial targets were to seek an annual net income to the Authority of around \$2 million, produce a debt service coverage ratio of 1.10, and to maintain liquidity via producing sufficient debt service and operating reserves.

The Authority determined it could meet these financial objectives through its baseline financial forecast. It also evaluated several sensitivity scenarios to further identify its financial risk in this capital development. As a result, the Authority identified potential future actions such as deleting project elements, community improvement district funding, and potential project sponsorship opportunities to offset future financial risk if activity growth were not to materialize or if the project were to experience unforeseen cost escalation.

4.4.5.7 Asset/Facility Management Software

Not Applicable.

Exhibit 12

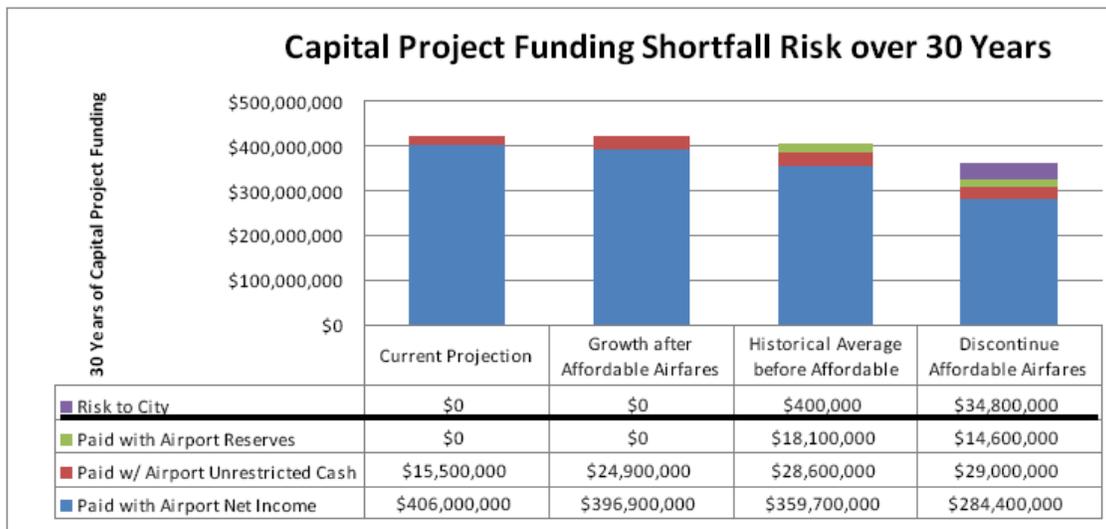
ICT - Replacement Terminal Artist Site Plan



Source: Schematic Design, HNTB Architecture, June 2007.
 Prepared by: Ricondo & Associates, Inc., March 2011.

Exhibit 13

ICT - ACT 3 – Risk Assessment



Source: Capital Program and Financial Plan, LeighFisher, October 5, 2010.
 Prepared by: Ricondo & Associates, Inc., March 2011.

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