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09/12/2005 11:03 PM

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bcc

Subject Final Supplemental BCA Document

Please see the attached Supplemental BCA in PDF format.

We will transmit a hard copy with a transmittal letter from the City of Chicago tomorrow. We will also send you the final Excel tables tomorrow.

Please let us know if you have any questions.

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Supplemental BCA 9_13_05.pdf

Summary

In February 2005, the City of Chicago (City) submitted a revised request for a Letter of Intent (LOI) for a multiyear commitment of Airport Improvement Program (AIP) funding for Phase 1 of the O'Hare Modernization Program (OMP). That submittal included a Benefit/Cost Analysis (BCA) based primarily on the delay reduction (measured in terms of changes in total aircraft travel time) benefits anticipated to be produced by the project. The February 2005 BCA relied on an assumption that the Base Case and the OMP Scenarios (Scenario Cases) would realize the Environmental Impact Statement (EIS) constrained forecast's level of operations. The Federal Aviation Administration (FAA) subsequently requested that the City provide a supplemental BCA that relaxed the assumption that aircraft operations in the Scenario Cases were capped consistent with the Base Case. This document outlines the methodology, assumptions, and results of that supplemental analysis.

In this analysis, the capacity benefits of the project, i.e. the airport's ability to process additional traffic and passengers as a result of the proposed project, are estimated using consumer surplus as the appropriate measure of the benefits of the project. Consumer surplus is defined as the difference between what consumers must pay for a given level of service and what they would be willing to pay for that same level of service. The FAA provided a document (included in Appendix C and prepared by GRA, Incorporated (GRA)) that describes how the benefits of a capacity expansion project can be calculated based on an economic model that measures changes in consumer surplus. This methodology is derived from the information contained in Appendix C, Section C.2 of the *FAA Airport Benefit-Cost Analysis Guidance, December 15, 1999* (*BCA Guidance*).

In the original BCA prepared by the City, benefit-cost ratios were estimated for the *OMP Phase I Airfield* (which consists of the OMP projects for which the LOI monies are being requested and includes the airfield components for which the City has received Majority-In-Interest approval from the airlines and the supporting Program-wide requirements such as preliminary engineering, wetlands mitigation, OMP Phase 1 noise mitigation, land acquisition, and other miscellaneous program-wide requirements) using the base assumptions as well as various sensitivity assumptions. In addition, Appendix D of that document included BCRs for the *Master Plan Phase I* (which included the costs of all projects covered under Phase 1 as defined in the Master Plan Study and EIS, including but not limited to the costs of the Western Concourse, Concourse K extension, Taxiway LL, etc.), the *OMP Total Airfield* (which included the costs of all airfield components of the OMP but did not include terminal and other facility development), and the *Total Master Plan* (which included the costs of all capital projects described in the Airport's Master Plan). This supplemental analysis uses the same project groupings and focuses on the two Phase 1 definitions: *OMP Phase I Airfield* and *Master Plan Phase I*. These two scenarios differ in their cost data; however, for the purposes of this analysis, their benefit streams are identical. As in the previous analyses, 2001 is assumed to be the base year for the analysis, and all dollar values are presented in 2001 dollars.

The City has reviewed the methodology provided by FAA, as prepared by GRA, and determined that it is consistent with the FAA's BCA guidance. While the City's February 2005 BCA provided a worst-case scenario of the estimation of project benefits by focusing only on aircraft travel time savings resulting from implementation of the OMP, the methodology provided by FAA for this supplemental analysis provides a mechanism to quantify the benefits associated with the increased traffic and passengers that can be processed by the airport as a result of the capacity increase attributed to the project. This methodology utilizes sound, common economic principles in analyzing the benefits of the program. It relies on the principle that consumers make travel decisions based on the value they receive for the price they are expected to pay. The following is a summary of the results of the application of this supplemental methodology. Results of sensitivity analyses are discussed in Section V.

Table 1
Summary of Results from Benefit Cost Analyses

Scenario	Present Value Benefits (billions)	Present Value Costs (billions)	Net Present Value (billions)	Benefit-Cost Ratio
OMP Phase 1 Airfield	$12.4	$2.0	$10.5	6.2
Master Plan Phase I	$12.4	$2.7	$9.8	4.6

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

New runways at the World's Busiest Airport are necessary. The State of Illinois legislature[1], the Administrator of the FAA[2], and the FAA's EIS all agree on this point. The information contained in this supplemental BCA further substantiates that new runways are worthwhile investments. Consumers will receive more value from a modernized O'Hare than they will from the existing O'Hare; the supplemental BCA supports this conclusion.

The methodology utilized in this supplemental analysis provides for an estimation of project benefits at O'Hare. It does not account for the downstream benefits nor the additional system benefits, expected to be significant, that would also be realized should the project be implemented. For instance, reducing delays at O'Hare would provide benefits to other airports in the national aviation system because O'Hare is a hub for two major airlines. It is well documented that delays at O'Hare have repercussions throughout the country. Likewise, benefits of modernizing O'Hare would "ripple" throughout the system. These additional benefits are not accounted for in this supplemental analysis. Should they be accounted for, the BCA ratios would be even larger than those measured herein.

The costs associated with the OMP have been reviewed by the FAA and their Third Party Consultant as part of the EIS process. They have found these costs to be reasonable, and documentation of this finding is contained in Appendix B of this document.

[1] O'Hare Modernization Act, Illinois Public Act 93-0450, 6 August 2003.
[2] Marion C. Blakely, FAA Administrator, 4 August 2004.

1. Supplemental BCA Methodology

The following assumptions and methodology used to prepare the BCA are in accordance with the FAA's *Benefit-Cost Analysis Guidance* dated December 15, 1999 (the *BCA Guidance*) and the *FAA-APO-03-1, Treatment of Values of Passenger Time in Economic Analysis*, dated March 2003. The methodology for the BCA process is outlined in the *BCA Guidance*. The following generally describes the steps in preparing this BCA:

- *Establish the Objectives:* As stated in the EIS, the proposed Federal action, which is the subject of the EIS, encompasses the following purposes:
  - Address the projected needs of the Chicago region by reducing delays at O'Hare, and thereby enhancing capacity of the NAS.
  - Ensure that existing and future terminal facilities and supporting infrastructure (e.g., access, landside, and related ancillary facilities) can efficiently accommodate airport users.
- *Formulate Assumptions:* Assumptions about future conditions at the airport being analyzed must be clearly explained and documented because they form the framework against which the alternatives are to be evaluated.

  The FAA, as part of the EIS analysis for O'Hare, defined a constrained forecast of activity that would be anticipated to occur without airfield development at the Airport. The 2002 Terminal Area Forecast (TAF), the most recent demand forecast available when the EIS analysis began, was used for the unconstrained scenarios in the EIS. For the purposes of this supplemental analysis, it is assumed that demand would be constrained following the implementation of Phase 1 if the OMP were not completed, and the FAA has developed a constrained forecast of activity for this situation.
- *Identify the Base Case:* The Base Case is a reference point from which incremental benefits and costs can be quantified. In the absence of major airfield construction (such as the OMP), opportunities to increase airfield capacity at the Airport are limited. As such, the Base Case for this BCA is defined as the no action scenario. The Airport's ongoing Capital Improvement Program (CIP), which would occur regardless of the proposed LOI Projects' implementation, is included in the Base Case.
- *Identify and Screen Alternatives:* The FAA has identified and screened alternatives as part of the EIS process. The EIS documents this screening process and identifies the OMP as the preferred alternative. The City of Chicago also believes this is the most effective solution to O'Hare's problems; and, thus, this BCA is based on the OMP.
- *Define Evaluation Period:* Consistent with the BCA Guidance, the evaluation period assumed for this BCA extends from the start of construction to 20 years after the completion of construction. For the OMP Phase I Airfield, the evaluation period ends in 2028.
- *Determine Costs:* Costs must be identified, quantified, and evaluated in total dollar amounts and for each year of a project's life. Typical costs include initial investments, such as planning and construction of the main project as well as any enabling projects, and recurring investments, such as operation and maintenance (O&M) costs. OMP costs are discussed in Appendix B of this document.

- *Determine Benefits:* Typical benefits include reduced delays, the ability to accommodate more efficient aircraft and/or larger aircraft, safer and more secure air travel, and reduced environmental impacts.

1.1 Process for Estimating Benefits According to Consumer Surplus

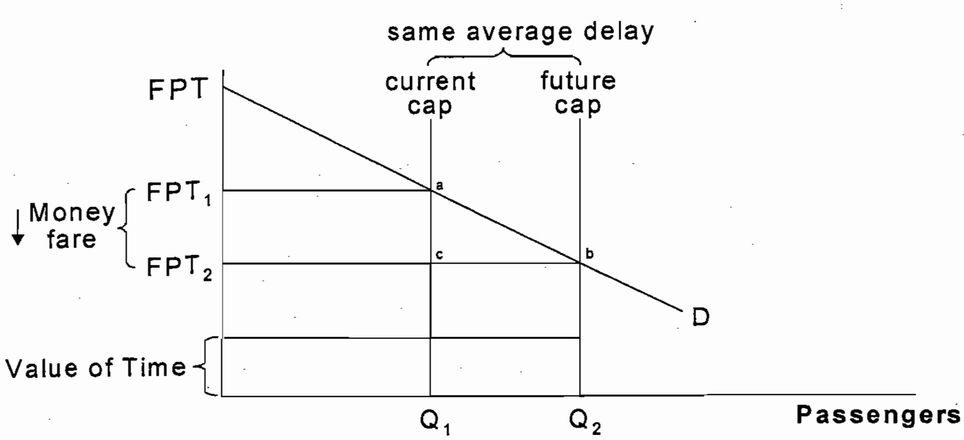
In the present analysis, benefits have been estimated using an economic framework suggested in the *BCA Guidance*, as reported in Appendix C of this document. Benefits were estimated using the economic concept of consumer surplus, defined as the difference between what consumers must pay for a given level of service and what they would be willing to pay. In passenger transportation markets, consumer surplus is usually defined in the context of the full price of travel. The full price of travel includes both the money fare that a consumer must pay and the value of his or her time in transit (including both the scheduled time and any expected delays).

Interpretation of the full price of travel in the context of consumer surplus is straightforward. A consumer would not choose to purchase a transportation service unless it was worth more to him or her than the sum of the money price and the value of his or her time. Consumer surplus is the value of air transportation in excess of the full price of travel.

To illustrate the application of the full price of travel framework to the *OMP Phase I Airfield* and *Master Plan Phase I* projects, refer to **Exhibit I-1**. The horizontal axis shows the annual number of passengers accommodated at the airport, while the vertical axis reports the full price of travel, consisting of the money fare and the value of time. In any given year, in the Base Case, where no project is undertaken, there is an equilibrium defined by Q_1 passengers and FPT_1 (the full price of travel). This occurs at the intersection of the demand curve (showing the total number of passengers accommodated at different levels of prices) and the cap on operations at the airport.[3]

Exhibit I-1

Illustration of Equal Delay in Base Case and Scenario Cases



Source: GRA, Inc.
Prepared by: Ricondo & Associates, Inc.

[3] The cap at O'Hare is on the number of aircraft operations during the day, which can then be translated into passenger counts.

In the *OMP Phase I Airfield* and *Master Plan Phase I* Scenario Cases, additional passengers are accommodated, and the average price paid must fall, so that Q_2 passengers and FPT_2 (full price of travel) is the new equilibrium. In *OMP Phase I Airfield* and *Master Plan Phase I* Scenario Cases (except in the first few years after the completion of construction), the expected delay for passengers would be identical. There would be small variations in unimpeded travel time. However, the value of time for each of the cases would be approximately equal. As a consequence, the reduction in the full price of travel would be largely attributable to a reduction in the money fare. Therefore, in order to increase passenger demand for travel at the airport, money fares would have to decrease. This is consistent with standard microeconomic principles.

The benefits of the *OMP Phase I Airfield* and *Master Plan Phase I* Scenario Cases can be measured in Exhibit I-1. In the Base Case, consumer surplus, defined as the area below the demand curve but above FPT_1 would be the triangle (FPT, FPT_1a). In the Scenario Cases, where the full price of travel is reduced, the benefits would be defined by (FPT, FPT_2b).[4] The difference between the Base Case consumer surplus and the Scenario Cases consumer surplus is the net benefit of the project, defined by the polygon (FPT_1 FPT_2ba).

Interpretation of the net benefit is straightforward. Existing consumers at O'Hare would benefit from the reduction in the full price of travel resulting from the proposed projects. Most of this reduction in the full price of travel would be due to the reduction in money fare, for the reasons discussed above. The benefit to existing consumers is defined as the rectangle (FPT_1 FPT_2ca). Additional consumers accommodated as a result of the expansion would also benefit, and their benefits are defined by the triangle (*abc*).

It is important to note that Exhibit I-1 represents a "snapshot" for computing benefits in each year of the analysis. For each year, the change in consumer surplus (the difference between Base Case and proposed projects benefits) would be computed. The benefit stream would then be discounted to 2001, the base year for the analysis, which is consistent with the evaluation in the LOI request, the OMP EIS and the Airport Master Plan.

In this BCA, the analysis is conducted at the aggregate level. This facilitates the use of the TAF forecast and *Total Airspace and Airport Modeler* (TAAM) simulation results reported elsewhere in this document and used in other evaluations of the *OMP Phase I Airfield* and *Master Plan Phase I* projects, including the EIS. Specifically, to facilitate the analysis the following information was collected:

- Forecasts for passengers accommodated for the period 2007 through 2027
- The unimpeded travel times for both the Base Case and Scenario Cases
- Expected delays in both the base and Scenario Cases
- The average segment money fare at O'Hare
- The value of passenger time as reported by the FAA
- A range of elasticities to define the demand curve

[4] As explained in Appendix C, it has been assumed to the extent there is producer surplus in the Base Case, carriers would seek to preserve it in the *OMP Phase I Airfield* case. Because carriers have influence over the approval of the *OMP Phase I Airfield* case, their expectation must be that they can preserve whatever producer surplus exists in the Base Case, otherwise they would not be in favor of the project.

To identify the demand curve in each year, the full price of travel for the Base Case is computed. This is defined as the money fare plus the value of unimpeded travel time and the value of expected delay time, given the projected number of operations at the airport. The full price of travel in the Base Case and the projected number of passengers defines point *a* in the graph.

Then, the projected number of passengers that would be accommodated in the Scenario Cases and the elasticity of demand as recommended by the *BCA Guidance* document are used to compute the full price of travel in the *OMP Phase I Airfield* and *Master Plan Phase I* project cases. The following equation, $FPT_2 = -FPT_1(1+x)/(1-x)$ where $x = E_D (Q_1+Q_2)/Q_2-Q_1)$, and E_D is the arc elasticity of demand, and Q_1 and Q_2 are Base Case and proposed projects passengers, is used.[5]

With the estimate for the full price of travel in the Scenario Cases and the projected number of passengers that would be accommodated in those cases, point *b* in the graph is also defined. In order to compute the net benefits of the project in each year, is assumed that the demand curve is linear. It is then possible to calculate the polygon (FPT_1 FPT_2ba).

As noted previously, the net benefits of *OMP Phase I Airfield* and *Master Plan Phase I* cases would be computed for each year of the analysis, then discounted back to the year 2001. There are numerous ways to test the plausibility of the results including conducting sensitivity analyses as discussed in **Section V.2**. In addition to varying input variables in the sensitivity analyses, another important test for plausibility relates to the reduction in the money fare in the Scenario Cases over the entire analysis period. As noted previously, most of the reduction in the full price of travel in the *OMP Phase I Airfield* and *Master Plan Phase I* cases would be due to a reduction in the money fare. The money fare in the Scenario Cases can be easily computed from the information available by subtracting the value of time in transit and the value of passenger delay from FPT_2.

The methodology for computing net benefits in each year of the analysis is contained in **Exhibit I-2,** which is summarized in Appendix C of this document. Specific details relating to assumptions can be found in Sections II, IV and V.

[5] The arc elasticity is defined as $E_D = \frac{Q_2 - Q_1}{(Q_1 + Q_2)/2} x \frac{FPT_1 + FPT_2}{(FPT_2 - FPT_1)/2}$. The *FPT* equation in the text is derived by solving this formula for FPT_2.

Exhibit I-2

Estimating Consumer Benefits Due to Infrastructure Expansion at a Congested Airport

	Base [illegible]						Scenario Case		[illegible]			
	1	2	3	4	5	6	7	8	9	10	11	12
	Average Travel Time per Operation (minutes)	Value of Time per Minute	Base Case Value of Travel Time	Average Segment Money Fare	Base Case Full Price of Travel	Base Case Total Passengers (millions)	Scenario Total Passengers (millions): TAF unconstrained	Scenario Full Price of Travel	Benefits to Existing Passengers ($ mil)	Benefits to Incremental Pax ($ mil)	Total Benefits ($ Mil)	PV of Total Benefits @ 7%
Source	Simulation Studies	FAA Critical Values	(1) x (2)	DB1a Database	(3) + (4)	TAF Constrained	Unconstrained TAF [1]	see footnote [2]	((5)-(8))*(6)	0.5*((5)-(8))*((7)-(6))	(9)+ (10)	PV in Year 20XX
Year 1												
2												
3												
-												
-												
20												

1. The unconstrained TAF would be used up to the point where congestion reaches levels beyond which airlines are unwilling to schedule added flights
2. Col 8: -Col (5) *(1+x)/(1-x) where x = elasticity of demand * (col 7 + col 6)/(col 7 - col 6)
Recommended values for elasticity of demand for these analyses can be found in the Guidance document on page C.2.

Comments:

(1) Average Travel Time per Operation Source: OMP Base Case TAAM simulation results - average of arrivals and departures including delay.

(2) Value of Time per Minute Source: Treatment of Passenger Time in Economic Analysis, FAA-APO-03-1, dated March 2003

(4) Average Segment Money Fare Source: Database Products, Inc. 2004 Calendar Year

(6) Base Case Total Passengers Sources: FAA TAF, U.S. DOT, Leigh Fisher Associates. Forecast: Constrained – No Project

(7) Scenario Total Passengers Sources: FAA TAF, U.S. DOT, Leigh Fisher Associates. Forecast: Constrained – Phase I Project

Source: GRA, Inc.
Prepared by: Ricondo & Associates, Inc.

For the purposes of this BCA, the benefit stream was calculated solely using benefits obtained from consumer surplus. As previously mentioned, two benefits can be obtained from consumer surplus calculations: a reduction in total travel time and a reduction in money fare. Other benefits of the *OMP Phase I Airfield* and *Master Plan Phase I,* including greater schedule predictability, ability to accommodate larger aircraft, and safety improvements are not considered at this time. In addition, those system benefits beyond O'Hare are not accounted for in this analysis. While this approach underestimates the overall benefits of the project, these benefits are not needed to demonstrate the program's justification.

As stated by the FAA in their BCA guidance, consumer surplus is based in key assumptions, including (but not limited to) the following:

- Airlines will pass on net operating savings to consumers through lower fares resulting from airport improvements in a competitive market.
- A reduction in travel times provided by airport improvements will benefit passengers.

Exhibit I-3 provides a graphical representation of consumer surplus. This diagram represents a situation where congestion costs at an airport are rising rapidly (steep supply curve ***S***), and passenger demand for flights at the airport is linear. In the Base Case, before any infrastructure improvements are undertaken, ***P*** denotes the full price of travel, which includes the money fare plus an increment representing the value of travel time, and ***Q*** denotes the passenger demand. However, after infrastructure improvements occurs, the supply at the airport increases, thus the supply curve shifts and is now denoted by ***S'***. The demand curve ***D*** is assumed to be linear, and a new equilibrium point occurs at ***c*** where ***S'*** intersects with ***D***. Thus, the new price of travel is ***P**** and the new demand is ***Q****. The benefits from consumer surplus are denoted by the polygon contained by ***P***, ***P****, ***c***, and ***a***. Benefits to existing passengers are contained in the shaded region ***C***.

Exhibit I-3

Graphical Description of Consumer Surplus from the *BCA Guidance*

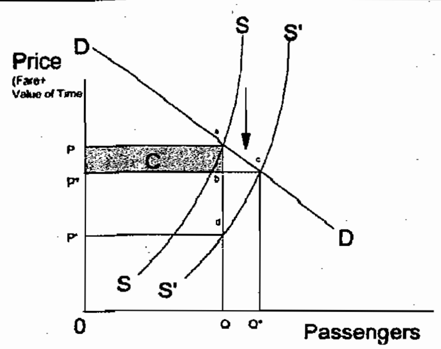


Figure C.2: Consumer Surplus With Radical Delay

Source: FAA, *Airport Benefit-Cost Analysis Guidance, December 15, 1999 BCA Guidance,* Appendix C, Page C-4
Prepared by: Ricondo & Associates, Inc.

In the case of an airport improvement program that reduces delay and provides additional capacity, such as the OMP, additional air service could be provided at the same total price per passenger; or, these improvements could result in a reduction in the price of travel for the level of passengers. In other words, the increase in supply provided by the program benefits the consumer either through additional service opportunities, a reduction in price, or some combination of both.

A fully populated spreadsheet, with comments regarding mathematical steps, as used to develop the benefit stream for the Net Present Value (NPV) calculation is contained in **Appendix C**. This appendix also includes the GRA-prepared document provided to the City by the FAA.

1.2 Benefit-Cost Comparison

The FAA's BCA Guidance requires an airport sponsor to perform the following activities in the preparation of a BCA:

- *Compare Benefits and Costs*: Most airport investments require resources at the outset of a project in return for an annual flow of benefits over the long-term future. Because the costs are incurred up front, and the benefits are returned over a longer time period, an analysis recognizing the time value of money must be conducted to appropriately compare the benefits and costs of alternatives to inform ultimate selection of the preferred alternative for development. In the BCA, discounted benefits and costs are used to accurately compare project scenarios by their NPVs and BCRs. Section V presents the comparison of benefits and costs. Detailed tables for these calculations can be found in Appendix A.

- *Conduct Sensitivity Analyses:* Sensitivity analyses are conducted to assess the ability of the project to meet the BCA requirements under alternative assumptions regarding future demand and economic values. This analysis is included as part of Section V, and detailed tables for these sensitivity analyses can be found in Appendix A.
- *Make Recommendation:* Finally, a BCA must state whether a project should be pursued based on the quantified benefits and costs, non-quantified benefits and costs, and sensitivity analyses.

2. Aviation Activity Forecasts

As previously discussed, the 2002 TAF served as the basis for the EIS analysis. The 2002 TAF, which presents aircraft operations and enplaned passengers by user category at the Airport through the year 2020, was prepared by FAA assuming the absence of any constraints to growth in activity at the Airport. Selected at the initiation of the EIS analysis, the 2002 TAF remains the basis for EIS analysis even though subsequent TAFs were published in 2003 and 2004. To maintain consistency with the EIS, the 2002 TAF is the primary unconstrained forecast used in this BCA.

Table II-1 presents the 2002 TAF of operations and enplaned passengers converted from federal fiscal years, which end September 30, to calendar years, and extrapolated through the evaluation period using linear extrapolation. As shown, the 2002 TAF forecasts grow to approximately 1.2 million operations and 50.4 million enplaned passengers in 2018, the last year of the EIS analysis.

Since initiation of the EIS analysis, the FAA has published a 2003 TAF and 2004 TAF, as shown on **Exhibits II-1** and **II-2**. Both the 2003 and 2004 TAFs contain operations and enplaned passenger forecasts greater than those in the 2002 TAF. As previously mentioned, the 2002 TAF is used in this BCA to maintain consistency with the EIS analysis.

In addition to the unconstrained forecast represented by the 2002 TAF, the FAA, as part of the EIS analysis, developed a constrained forecast to represent the potential activity at the Airport if no action is undertaken to improve Airport capacity. This constrained forecast was developed based on simulation modeling efforts to reflect the assumption that growth in aircraft operations will cease once delays exceed the level the airlines and FAA consider "acceptable." The EIS analysis period extends until 2018; however, the constrained forecast extends through 2028. Data for forecast years after 2018 were obtained by extrapolating values at gradually decreasing annual growth rates. This forecast is used in the benefit calculation and is the source of values for "Base Case Total Passengers."

An alternate constrained forecast is used for the *OMP Phase I Airfield* and *Master Plan Phase I* scenarios. This forecast also extends through 2028. Forecast values are identical to the 2002 TAF until 2016, after which time values are extrapolated using gradually decreasing annual growth rates. In both constrained forecasts passenger enplanements are expected to grow due to increased enplaned passengers per operation and an increase in originating passengers. **Table II-2** and **Table II-3** present the forecasts for enplanements used in the calculation of benefits from consumer surplus.

Table II-1

Unconstrained Forecast – Total Operations and Enplanements

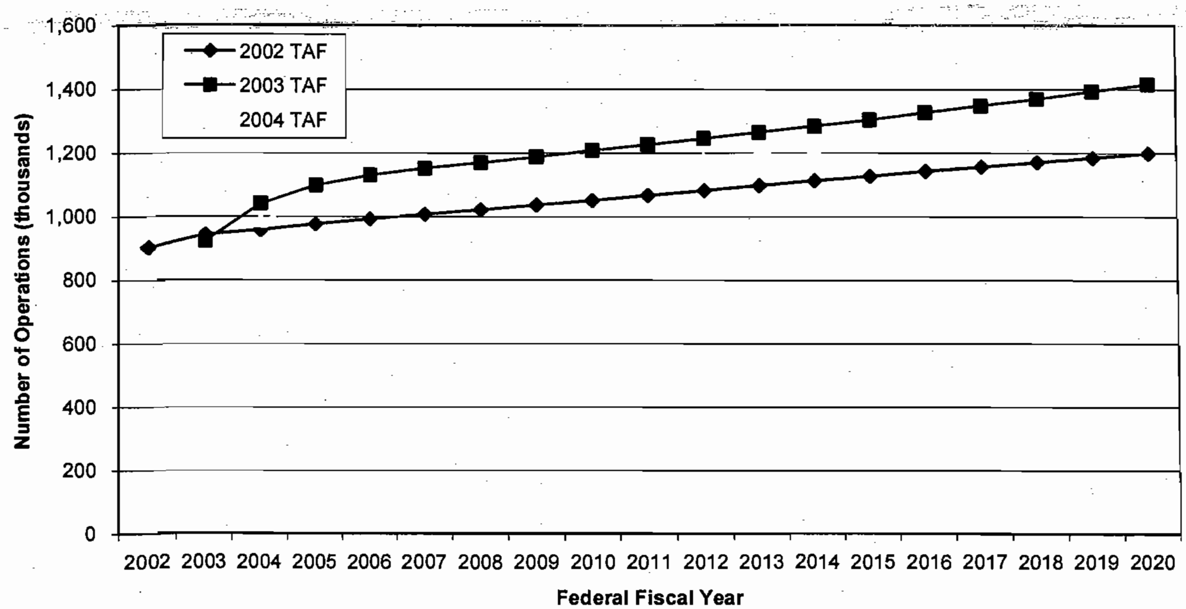
Calendar Year	Total Operations (2002 TAF)	Total Passenger Enplanements 2002 TAF	Total Passenger Enplanements Extrapolation[1]
2002	922,787	31,710,512	
2003	960,500	32,609,000	
2004	976,544	33,633,730	
2005	992,855	34,696,477	
2010	1,072,706	40,280,622	
2015	1,149,402	46,367,491	
2018	1,194,000	50,372,000	
2020			52,224,100
2025			58,060,253
2030			63,896,405
2032			66,230,866

1/ Linear extrapolation based on calendar year projections.

Source: Forecast – FAA; Extrapolation – Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

Exhibit II-1

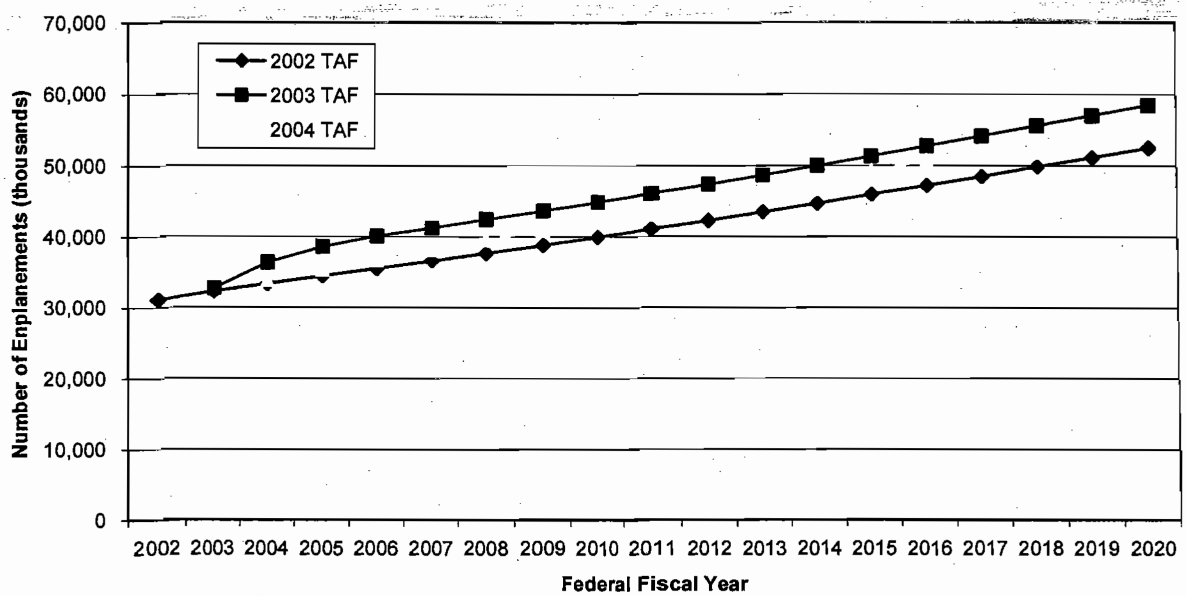
FAA Terminal Area Forecast Comparisons for O'Hare International Airport – Total Operations



Source: FAA
Prepared by: Ricondo & Associates, Inc.

Exhibit II-2

FAA Terminal Area Forecast Comparisons for O'Hare International Airport – Enplaned Passengers



Source: FAA
Prepared by: Ricondo & Associates, Inc.

Table II-2

Constrained Forecast – Base Case – Total Enplanements

	Total Passenger Enplanements	
Calendar Year	2002 TAF	Constrained
2002	31,710,512	
2003	32,609,000	
2004	33,633,730	
2005	34,696,477	
2006	35,798,962	
2007		36,219,500
2008		36,957,132
2009		37,717,500
2010		38,481,562
2011		39,267,508
2012		40,076,189
2013		40,908,500
2014		41,680,693
2015		42,472,622
2016		43,284,845
2017		44,117,940
2018		44,972,500
2019		45,692,000
2020		46,423,000
2021		47,166,000
2022		47,921,000
2023		48,688,000
2024		49,321,000
2025		49,962,000
2026		50,612,000
2027		51,270,000
2028		51,937,000

Source: FAA
Prepared by: Ricondo & Associates, Inc.

Table II-3

Constrained Forecast – OMP Phase I Airfield and Master Plan Phase I – Total Enplanements

	Total Passenger Enplanements	
Calendar Year	2002 TAF	Constrained
2002	31,710,512	
2003	32,609,000	
2004	33,633,730	
2005	34,696,477	
2006	35,798,962	
2007	36,943,000	
2008	38,027,251	
2009	39,149,000	
2010	40,280,622	
2011	41,450,619	
2012	42,660,538	
2013	43,912,000	
2014	45,119,418	
2015	46,367,491	
2016	47,181,000	
2017		48,110,000
2018		49,062,000
2019		49,994,000
2020		50,944,000
2021		51,810,000
2022		52,691,000
2023		53,587,000
2024		54,498,000
2025		55,315,000
2026		56,145,000
2027		56,987,000
2028		57,842,000

Source: FAA
Prepared by: Ricondo & Associates, Inc.

3. Project Costs

To provide the basis for the BCA and NPV calculations, costs associated with the project must be quantified to the extent possible. Quantifiable costs to be considered should consist of capital investment and incremental O&M costs. Only those costs that are attributable to a project being undertaken are to be considered. In other words, costs that would be incurred regardless of whether or not a project is undertaken should not be considered. Appendix B of this document provides information on the cost estimates utilized in this analysis, as well as the FAA's review of those cost estimates.

In addition to capital investment costs, estimated incremental O&M costs are included for the evaluation period. Incremental O&M costs for additional runway pavement were estimated at the unit rate for budgeted 2004 O&M expenses for the existing runways adjusted to 2001 dollars using the Gross Domestic Product (GDP) Implicit Price Deflator. Note, the O&M costs for the *Master Plan Phase I* scenario were over-stated in the February 2005 BCA. The correct O&M costs are used here. Making this adjustment to the February 2005 analysis would increase the associated benefits relative to costs. In addition, the February 2005 analysis utilized incorrect cash flows for Taxiway M; these cash flows have been corrected in this document and are reflected in Appendix B.

4. Project Benefits

The *BCA Guidance* suggests that consumer surplus is an appropriate measure of benefits in projects where an investment for current users of the airport will allow the airport to serve a greater portion of the unconstrained demand. The FAA's EIS proves that the proposed projects provide for significant increases in capacity; thus, making it reasonable to assume that a greater portion of the unconstrained demand will be served. The primary benefits obtained from the OMP will be in the form of lower total travel costs (travel time and money fare) and additional service.

4.1 Simulation Modeling

In the analyses undertaken as part of OMP planning and the EIS, operational delay and travel times were assessed for the Base Case, *OMP Phase I Airfield*, and the OMP Total Airfield. These assessments were undertaken using the TAAM, developed by Preston Aviation Solutions, a Boeing Company. TAAM is a fast-time gate-to-gate simulator of airport and airspace operations that facilitates decision-making, planning, and analysis. TAAM has been used in the United States for airfield and airspace assessments by the FAA, the National Airspace Redesign team, American Airlines, Continental Airlines, Delta Air Lines, and Boeing Air Traffic Management, among others. The FAA and its EIS consultant, known as the third party contractor (TPC), have been actively involved in the TAAM simulation analysis of the OMP. As documented in the EIS:

> "An unprecedented series of TAAM simulation analyses were conducted by the City of Chicago's Consultant Team (CCT) with direction, oversight, review and approval by the FAA and the TPC. The FAA and TPC participated in an intensive, nine-month review process during the simulation effort. The objective of this process was to ensure that TAAM input assumptions, modeling methodologies, and output data conformed to the industry best practices in modeling and accurately reflected air traffic control rules and procedures. In total, FAA invested over 2,000 hours reviewing assumptions, draft results, animations, and final results. The FAA review was conducted by an Air Traffic Work Group, which consisted of FAA Management and National Air Traffic Controller Association (NATCA) representatives from O'Hare Tower, the Chicago Terminal Radar Approach Control Facility (TRACON), and the Chicago Center (ZAU); FAA Airports Division; and the FAA's TPC." [6]

[6] Source: FAA, *O'Hare Modernization Final Environmental Impact Statement & Section 4(f) and Section 6(f) & General Conformity Determination,* July 2005.

The simulation modeling showed that delays increase exponentially under the Base Case as demand approaches capacity. Theoretically, delays can continue to increase to unrealistically high levels as demand exceeds capacity for more and more hours of the day. However, these excessively high levels of delay may not be experienced, as the airlines and passengers may change their behavior to avoid these delays. In response to increasing delays, airlines might increase average aircraft size to accommodate forecast demand, shift connecting passenger traffic through other hub airports.

The FAA in its *BCA Guidance* recognizes the limitations on delay growth, and suggests the need to modify demand growth when delays exceed 15 minutes per operation and that demand should be capped at approximately 20 minutes of delay per operation. Consistent with the *BCA Guidance*, the FAA developed constrained activity forecasts in the EIS for the Airport to reflect the level of aircraft operations at which FAA believes further growth in aircraft activity would cease due to delays reaching "unacceptable" levels. As indicated in the EIS, the constrained forecasts developed by FAA result in maximum average aircraft delays at the Airport of approximately 17 minutes per aircraft, which is lower than the 20 minutes per aircraft threshold outlined in the *BCA Guidance*.

4.2 Simulation Results

As discussed earlier, simulation modeling using TAAM was performed to provide quantitative information on the performance of the Base Case and the Scenario Cases projects. The simulations used in this analysis are those originally prepared for the FAA EIS analysis. The methodologies and assumptions used in the simulation modeling have been documented in numerous data packages developed and published by the FAA in support of the EIS process. **Table IV-1** contains a summary of travel times for the Base Case and *OMP Phase I Airfield* and *Master Plan Phase I* Scenario Cases.

5. Benefit - Cost Comparison

The comparison of benefits and costs involves the calculation of NPVs and BCRs based on recognition of the time value of money in discounting the benefits and costs. Additionally, travel time savings must be converted into monetary values based on appropriate assumptions regarding the value of passenger time.

The analyses performed in this section provide the benefit-cost comparison for the *OMP Phase I Airfield* Projects. The following points outline relevant assumptions associated with the quantification of these benefits and **Table V-1** summarizes the assumptions.

- *Base Year.* Project benefits were evaluated using 2001 as the base year because OMP cost estimates are in 2001 dollars in the LOI request, OMP EIS, and Airport Master Plan. Project benefits and costs are stated in 2001 dollars in the year of accrual/expenditure, and benefits and costs are discounted seven percent per year in accordance with the *BCA Guidance* to calculate present value.
- *Average Travel Time.* The average travel time per operation was obtained from TAAM simulations performed for the OMP. The travel time considered for this BCA is the Base Case scenario. It is an average of the arrival and departure travel times and includes minutes of travel delay.

Table IV-1

Summary of Travel Times from TAAM Simulations

Year	Base Case No Build	Scenario Cases	Difference in Travel Time[1]
2003	137.7	140.5	2.8
2004	139.8	141.5	1.7
2005	141.9	142.6	0.7
2006	144.0	144.7	0.7
2007	146.1	144.3	-1.8
2008	148.4	148.8	0.4
2009	150.7	146.1	-4.6
2010	152.8	146.7	-6.1
2011	154.8	147.4	-7.4
2012	156.9	148.5	-8.4
2013	158.9	155.0	-3.9
2014	159.5	156.7	-2.8
2015	160.1	158.6	-1.5
2016	160.8	158.6	-2.2
2017	161.4	158.6	-2.8
2018	162.0	158.6	-3.4
2019	162.0	158.6	-3.4
2020	162.0	158.6	-3.4
2021	162.0	158.6	-3.4
2022	162.0	158.6	-3.4
2023	162.0	158.6	-3.4
2024	162.0	158.6	-3.4
2025	162.0	158.6	-3.4
2026	162.0	158.6	-3.4
2027	162.0	158.6	-3.4
2028	162.0	158.6	-3.4

1/ Travel time is the average of arrival and departure time. All travel times are expressed in minutes. Difference in travel time calculated by subtracting Base Case from Scenario Case.

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

- *Passenger Value of Time.* As set forth in the BCA Guidance, a blended rate accounting for the value of O'Hare's personal and business travelers' time may be used. As described in *the FAA APO Bulletin APO-03-1,* dated March 2003, the specified value of passenger travel time is $40.10 per hour for business travelers and $23.30 for personal travelers. Results of the In-Flight Air Survey in 1997 by Landrum & Brown indicated that business travel was the main purpose in 52.4 percent of trips while personal travel was the main purpose of 47.6 percent of trips. Based on this passenger distribution, the weighted average passenger cost for O'Hare is $32.10 per hour or $0.54 per minute.

- *Average Segment Money Fare.* The average segment money fare was compiled by Database Products, Inc. and obtained from U.S. DOT sources. The value was determined to be $220.05. Additional information about the average segment money fare can be found in **Appendix D**.

- *Elasticity of Demand.* As set forth in the BCA Guidance, values of total elasticity of demand for all travel distances are –0.8 for business travelers and –1.6 for non-business travelers. When the passenger distribution for ORD is applied to these values, the weighted value of the elasticity of demand is –1.18.

- *Salvage Value.* As set forth in the BCA Guidance, salvage value of the project may be considered. The salvage value of improvements at the end of the 20-year evaluation period is estimated to include only the value of the land acquired for the projects. For purposes of this analysis, it was assumed that the value of the land remains the same as on the purchase date, and the discounted value is included in the project benefits.

- *Sunk Costs.* As set forth in the BCA Guidance, sunk costs of the project should be excluded from the BCA. Through 2003, approximately $105.1 million has been spent on Program-Wide Requirements and land acquisition. Therefore, this amount is considered a sunk cost in the BCA.
- *Evaluation Period.* The evaluation period is the time period over which project benefits and costs are calculated. As recommended in the *BCA Guidance,* the evaluation period extends for 20 years after completion of construction.

Table V-1

Summary of BCA Data Sources and Assumptions

Input	Data Source	Assumptions
Average Travel Time (minutes)	TAAM Simulation Results from EIS	Average of Arrival and Departure times for operations
Passenger Value of Time ($/minute)	FAA-APO-03-1, Treatment of Values of Passenger Time in Economic Analysis, dated March 2003 • Value of Passenger Time: $23.30/hour (personal) $40.10/hour (business)	A weighted value of passenger time was used for calculations. Results from Landrum & Brown's 1997 In-Flight Air Survey indicated that the purpose of an air trip was business 52.4 percent of the time and personal 47.6 percent of the time. • Weighted Value of Passenger Time: $32.10/hour $00.54/minute
Average Segment Money Fare	U.S. DOT O&D passenger survey (10 percent ticket sample), Database Products, Inc.	Except under code-share agreements, the O&D survey does not include foreign flag carriers nor does it include data from air carriers flying aircraft with under 60 seats. The total revenue from passengers that have two stops in their itinerary is included in this fare calculation. Limitations to this data are addressed in a sensitivity analysis. • Average Segment Money Fare: $220.05
Base Case Total Passengers (millions)	Leigh Fisher Associates, FAA Terminal Area Forecast, and U.S. DOT data	An unconstrained forecast based on the 2002 TAF was used until 2007, after which time a "Constrained-Base Case" forecast was used.
Scenario Total Passengers (millions)	Leigh Fisher Associates, FAA Terminal Area Forecast, and U.S. DOT data.	An unconstrained forecast based on the 2002 TAF was used until 2016, after which time a "Constrained – OMP Phase I Project Airfield and Master Plan Phase I" forecast was used.
Present Value of Total Benefits	*BCA Guidance*	• Base Year: 2001 End Year: 2028 • Discount Rate for NPV: 7.0 % • Salvage Value: $51.4 million • Sunk Costs: $105.1 million
Scenario - Full Price of Travel (elasticity of demand)	*BCA Guidance* Table C.2: Total Elasticity of Demand • For all Travel Distances: -0.8 (business) -1.6 (personal)	The same business/personal percentages used to calculate the Value of Time were used to determine the Elasticity of Demand. • Elasticity of Demand: -1.18 (all travelers, all distances)

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

5.1 Project Analysis

Based on the information presented in Table V-1, and information on costs and travel time benefits presented in prior sections of this document, the BCR and NPV were derived for the *OMP Phase I Airfield* and *Master Plan Phase I* scenarios. These values are presented in **Table V-2.** As shown, the BCR is 6.2 for the *OMP Phase I Airfield* and 4.6 for the *Master Plan Phase I.* The NPVs are approximately $10.4 and $9.7 billion dollars, respectively. Supplemental information to illustrate the BCRs and NPVs for the *OMP Phase I Airfield* and *Master Plan Phase I* is contained in **Appendix A, Tables A-1** and **A-2.**

Table V-2

Benefit-Cost Ratios and Net Present Values (2001 dollars)

Scenario	Present Value Benefits (billions)	Present Value Costs (billions)	Net Present Value (billions)[1]	Benefit-Cost Ratio
OMP Phase I Airfield	$12.4	$2.0	$10.4	6.2
Master Plan Phase I	$12.4	$2.7	$9.7	4.6

1/ Total may not add due to rounding.

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

It should be noted that implementation of the OMP is not expected to cause construction-related impacts. The City of Chicago, through its O'Hare Development Program, the Midway Terminal Program, and its annual airfield maintenance work, has displayed a long track record for success in implementing major construction projects. Weekly planning and programming sessions have been held (and will continue to be held through the duration of construction) with the FAA, airlines, and City of Chicago staff members and construction consultants in order to determine the most expedient methods for implementing the program without degradation of existing operational capability. These forums include, but are not limited to, the Phasing Operational Evaluation Team (POET) meetings and the Construction Operations Working Group (COWG) sessions. The efforts in these forums have thus far determined that is it possible to implement a large portion of the project landside; thus, allowing the construction activity to occur "off-airport." To the extent that construction activity must be performed on the active airport, significant attention has been (and will continue to be) paid to minimize disruptions to existing operations. These detailed planning sessions have proven successful in preparing for construction of the OMP. The City's methods have a long, proven track record of success. And the FAA will be involved through the planning, design, and construction of the OMP to ensure that operations at the Airport are not negatively impacted by construction activities.

This supplemental analysis provides for the quantification of benefits both with and without new terminal facilities. The airfield operations in both of these scenarios are the same. The existing terminal facilities at O'Hare have proven able to accommodate levels of passengers forecast to use the Airport in the Scenario Cases, suggesting that new terminal facilities are not necessary at such demand levels. However, this supplemental analysis illustrates sufficient benefits with respect to costs even with the Master Plan's Phase I terminal facilities included. Therefore, one can assume that the landside facilities will be available to process passengers in the Scenario Cases comparable to those processed in the Base Case.

5.2 Sensitivity Analyses

Due to the risks involved in infrastructure development and the number of assumptions regarding future conditions that occur in benefit-cost analyses, the analysis should be evaluated for its sensitivity to certain basic parameters to confirm its economic viability. For this BCA, the following sensitivity analyses were conducted for the *OMP Phase I Airfield* and the *Master Plan Phase I*. These assumptions are used only to demonstrate the continued economic justification for the *OMP Phase I Airfield* and the *Master Plan Phase I* under varying cost and schedule conditions and are not anticipated program changes.

5.2.1 Elasticity of Demand

To evaluate the range of elasticities of demand over which the project is cost beneficial, holding all other variables constant, different values for the elasticity of demand were entered as inputs until a cost-benefit ratio of approximately 1.0 was obtained. **Table V-3** describes the range of elasticity of demand for each scenario where the benefit-cost ratio is positive.

Table V-3

Range of Elasticity of Demand

Scenario	Original Elasticity Value	New Elasticity Value	New Benefit-Cost Ratio
OMP Phase I Airfield	-1.18	-7.65	1.0
Master Plan Phase I	-1.18	-5.62	1.0

Source: FAA, *Airport Benefit-Cost Analysis Guidance,* December 15, 1999; Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

The range over which the elasticity of demand values will still produce a positive benefit-cost ratio is quite large. The FAA has studied the elasticity of demand extensively, as noted in its *BCA Guidance;* the FAA's evidence suggests that elasticity levels are well within the range necessary to produce a positive benefit-cost ratio. A summary of the NPV calculations resulting from this sensitivity analysis can be found in **Table A-3** and **Table A-4** in Appendix A.

5.2.2 Future Enplanements

To evaluate the range of future demand over which the project is cost beneficial, holding all other variables constant, the growth rate of passenger enplanements was reduced. This rate was reduced to the minimum value possible while still achieving a benefit-cost ratio of one. An annual average growth rate for each scenario was calculated for the forecast period (2002 through 2028). The average annual growth rate used in each scenario is presented below in **Table V-4**.

Table V-4

Average Annual Growth Rate for Future Demand

Scenario	Base Case Growth Rate[1/]	Project Growth Rate (Original) [1/]	Project Growth Rate (Sensitivity) [1]	New Benefit-Cost Ratio[1]
OMP Phase I Airfield	1.92 %	2.34 %	2.01 %	1.0
Master Plan Phase I	1.92 %	2.34 %	2.01 %	1.0

1/ Growth Rate refers to the annual average growth rate for the forecast period (2002 through 2028).

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

An annual average growth rate of 2.01 percent results in an 8 percent reduction in passengers in 2028. Expressed as a number of passengers, this is a 9.25 million-passenger decrease. A summary of the NPV calculations resulting from this sensitivity analysis can be found in **Table A-5** and **Table A-6** in Appendix A.

5.2.3 Value of Time

The influence of the value of time on the benefit stream was examined by assuming a passenger's value of time to be equal to zero. When the value of time is equal to zero, a positive BCR is still maintained for both scenarios. *OMP Phase I Airfield* has a BCR of 4.5, and *Master Plan Phase I* has a BCR of 3.3. A summary of the NPV calculations can be found in **Table A-7** and **Table A-8** in Appendix A.

5.2.4 Plausibility of the Money Fare

The plausibility of the analytical results reported above relates to the pattern of changes in the money fare in the *OMP Phase I Airfield* and *Master Plan Phase I* cases. As previously mentioned, the majority of the reduction in the full price of travel in the Scenario Cases is attributable to the reduction in the money fare.

The plausibility of the reduction in the money fare can be evaluated by comparing it to historical airline yield data. The Air Transport Association publishes data on airline yields, both in nominal and real dollars, since 1926. The data on real yields since 1978, the first year of airline deregulation, are reported in **Table V-5**. The annual rate of decline for domestic, international, and system-wide yields is reported at the bottom of the table; the average annual reduction in real yields for all three categories of air travel is 2.6 percent.

Table V-6 reports the money fare for each year of the Scenario Cases. Additionally, the table provides values for the unimpeded travel time and the full price of travel. The full price of travel is decomposed into its two components, the money fare and the value of time. Based on the value contained in Table V-6, the money fare decreases at an average annual rate of 0.43 percent. The average annual reduction in money fare for the Scenario Cases is only a fraction of the average airline industry annual rate since deregulation. Thus, the decrease in money fare is plausible.

Table V-5

Annual Passenger Prices (Yield) for Scheduled Service on Domestic Airlines

	Real Yield (in 1978 cents)		
Year	Domestic	International	System
1978	8.49	7.49	8.29
1979	8.05	6.88	7.81
1980	9.09	6.96	8.70
1981	9.14	6.79	8.85
1982	8.12	6.47	7.95
1983	7.89	6.39	7.61
1984	8.03	5.89	7.60
1985	7.40	5.62	7.07
1986	6.59	5.73	6.50
1987	6.57	5.59	6.38
1988	6.78	5.73	6.55
1989	6.88	5.45	6.54
1990	6.70	5.40	6.37
1991	6.34	5.42	6.10
1992	5.97	5.37	5.81
1993	6.20	5.09	5.89
1994	5.77	4.92	5.54
1995	5.78	4.76	5.51
1996	5.72	4.54	5.41
1997	5.68	4.45	5.35
1998	5.63	4.15	5.24
1999	5.46	3.94	5.06
2000	5.52	4.01	5.12
2001	4.88	3.72	4.57
2002	4.35	3.57	4.15
2003	4.36	3.59	4.17
2004	4.16	3.66	4.04
Average Rate of Yearly Decrease	-2.6%	-2.6%	-2.6%

Source: The Air Transport Association of America, Inc. 1995-2005, http://www.airlines.org/econ/print.aspx?nid=1035
Prepared by: GRA, Inc.; Ricondo & Associates, Inc.

Table V-6

Variation of Money Fare and Scenario Travel Times

	OMP Phase I Airfield and *Master Plan Phase I*			
Year	Unimpeded Travel Time	Full Price of Travel	Money Fare[1]	Value of Time
2003	125.3	$293.70	$218.53	$75.17
2004	125.3	294.82	219.12	75.70
2005	125.3	295.95	219.66	76.29
2006	125.3	297.08	219.66	77.41
2007	128.8	293.25	216.05	77.20
2008	128.8	292.29	212.68	79.61
2009	135.8	291.35	213.18	78.16
2010	135.8	290.33	211.84	78.48
2011	135.8	289.31	210.45	78.86
2012	135.8	288.31	208.86	79.45
2013	140.8	287.31	204.38	82.93
2014	140.8	285.57	201.75	83.82
2015	140.8	283.84	199.01	84.83
2016	140.8	284.52	199.67	84.85
2017	140.8	284.72	199.87	84.85
2018	140.8	284.92	200.07	84.85
2019	140.8	284.21	199.36	84.85
2020	140.8	283.51	198.65	84.85
2021	140.8	283.27	198.42	84.85
2022	140.8	283.04	198.18	84.85
2023	140.8	282.80	197.95	84.85
2024	140.8	281.86	197.01	84.85
2025	140.8	281.39	196.54	84.85
2026	140.8	280.92	196.07	84.85
2027	140.8	280.45	195.60	84.85
2028	140.8	279.99	195.14	84.85

1/ The money fare is computed by subtracting the value of time from the full price of travel.

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

This finding is significant for the following reasons. The *OMP Phase I Airfield* and *Master Plan Phase I* projects would increase the capacity of the Airport and result in an increase in the number of passengers that would utilize the facility. As a consequence, the full price of travel in the Scenario Cases must be lower than in the Base Case. The difference in the full price of travel between the two cases is almost entirely attributable to a decline in the money fare. With additional capacity at the Airport and more flights, it would be expected that the money fare would fall in the Scenario Cases relative to the Base Case, *ceteris paribus*. If the reduction had far exceeded the typical experience since deregulation, this would have suggested a flawed analysis. However, the resultant decrease in money fare in the Scenario Cases is only a fraction of the historic, thus supporting the credibility of the analysis.

5.2.5 Multivariable Sensitivity Analyses

In order to evaluate the effects of multiple sources that reduce benefits, two separate multivariable sensitivity analyses was undertaken for both the *OMP Phase I Airfield* and *Master Plan Phase I*. The first sensitivity analysis examined variations in elasticity of demand coupled with variations in the money fare. The second sensitivity analysis analyzed variations in elasticity and variations in passenger demand, and the third sensitivity analysis analyzed variations in money fare and future passenger demand.

5.2.5.1 Variations in Elasticity and Money Fare

For this analysis, the elasticity was varied from –0.5 to –2.5. The money fare varied from $55.01 to $385.09; representing a 75 percent decrease and increase in money fare, respectively. The lowest values calculated in this analysis were an NPV of 1.38 for the *OMP Phase I Airfield* and 1.02 for the *Master Plan Phase I*. These values occurred when the $55.01 money fare, was combined with a value of –2.5 for the elasticity of demand. A summary matrix for each scenario, including all of the resulting BCRs from the various fare and elasticity combinations, can be found in **Table A-9** and **Table A-10** in Appendix A.

5.2.5.2 Variations in Elasticity and Passenger Demand

As in the previous analysis, the elasticity was varied from –0.5 to –2.5. Passenger demand is assumed not to fall below values found in the Base Case. Thus alternate values for passenger demand were calculated as percent decreases from the Scenario Forecast. However, when these decreases caused the Scenario values to fall below the Base Case, the Base Case value was used instead. Values were decreased in one percent increments until a 10 percent yearly decrease from the Scenario Cases was achieved. For the *OMP Phase I Airfield* and *Master Plan Phase I* scenarios various combinations of passenger demand and elasticity will produce BCRs greater than one. However, in order to have the possibility of a BCR greater than 1.0, passenger growth must not fall by more than the eight percent reduction scenario for the *OMP Phase I Airfield* and the *Master Plan Phase I*. A summary matrix for each scenario, including all of the resulting BCRs from the various passenger demand and elasticity combinations, can be found in **Table A-11** and **Table A-12** in Appendix A. As noted previously in this document, the February 2005 BCA estimates benefits provided by an increase in supply (provided by the OMP) without any increase in passenger demand. As this previous analysis illustrates, a sufficient BCR to justify the project is achievable without any growth in demand.

5.2.5.3 Variations in Money Fare and Passenger Demand

As described in the previous analysis, passenger demand is assumed not to fall below values found in the Base Case, and the scenario forecast values were decreased in one percent increments until a 10 percent yearly decrease from the Scenario Cases was achieved. The money fare varied from $55.01 to $385.09; representing a 75 percent decrease and increase in money fare, respectively. A BCR that is greater than 1.0 is achieved with many combinations of money fare and passenger demand. However, in order to still have the possibility of a BCR that is greater than 1.0, future passenger demand must not decrease by more than the eight percent scenario for the *OMP Phase I Airfield* and not by more than the seven percent scenario for the *Master Plan Phase I*. A summary matrix for each scenario, including all of the resulting BCRs from the various passenger demand and elasticity combinations, can be found in **Table A-13** and **Table A-14** in Appendix A.

6. Recommendation

This BCA has been performed in accordance with the BCA Guidance. Using a consumer surplus calculation results in a BCR and NPV that far exceed the FAA thresholds. Sensitivity analyses also confirm that values for elasticity of demand and forecast values for passenger enplanements can vary significantly while still creating a positive benefit stream. This is also true of the money fare and the value of time. The *OMP Phase I Airfield* and the *Master Plan Phase I* were determined to have the economic justification necessary for FAA to consider the project for AIP discretionary grants. A summary of the results from the Base Scenario is shown in **Table VI-1**. Results from the sensitivity tests can be found in Appendix A.

Table VI-1

Summary of Results from Base Scenarios

Scenario	Present Value Benefits (billions)	Present Value Costs (billions)	Net Present Value (billions)	Benefit-Cost Ratio
OMP Phase I Airfield	$12.4	$2.0	$10.5	6.2
Master Plan Phase I	$12.4	$2.7	$9.8	4.6

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

Appendix A

Tables included in this appendix show detailed information regarding the NPV calculation used to calculate the BCR for the base scenarios and the sensitivity analyses. A calculation of annual benefits and costs is included for the entire analysis period.

Table A-1

Benefit-Cost Analysis Summary, OMP Phase I Airfield (millions of 2001 dollars)

	Benefits	Costs			Present Value				
Year	Benefits from Consumer Surplus	Project Construction Costs	Incremental O&M Expenses	Total Project Costs	Discount Rate Factor	Passenger Delay Savings	Total Project Benefits	Total Project Costs	Annual Net Present Value (Benefits-Costs)
2001	$0.0	$0.0	$0.0	$0.0	1.0000	$0.0	$0.0	$0.0	$0.0
2002	0.0	81.8	0.0	81.8	1.0700	0.0	0.0	76.5	(76.5)
2003	0.0	166.4	0.0	166.4	1.1449	0.0	0.0	145.4	(145.4)
2004	0.0	505.1	0.0	505.1	1.2250	0.0	0.0	412.3	(412.3)
2005	0.0	604.6	0.0	604.6	1.3108	0.0	0.0	461.3	(461.3)
2006	0.0	535.4	0.0	535.4	1.4026	0.0	0.0	381.8	(381.8)
2007	362.4	329.2	4.8	334.0	1.5007	241.5	241.5	222.5	18.9
2008	536 3	316.1	4.8	320.9	1.6058	334.0	334.0	199.8	134.1
2009	717.7	20.0	15.6	35.6	1.7182	417.7	417.7	20.7	397.0
2010	902.1	0.0	15.6	15.6	1.8385	490.7	490.7	8.5	482.2
2011	1,094.9	0.0	15.6	15.6	1.9672	556.6	556.6	7.9	548.6
2012	1,296.3	0.0	15.6	15.6	2.1049	615.9	615.9	7.4	608.4
2013	1,506.8	0.0	15.6	15.6	2.2522	669.0	669.0	6.9	662.1
2014	1,721.0	0.0	15.6	15.6	2.4098	714.2	714.2	6.5	707.7
2015	1,944.7	0.0	15.6	15.6	2.5785	754.2	754.2	6.1	748.1
2016	1,948.7	0.0	15.6	15.6	2.7590	706.3	706.3	5.7	700.6
2017	1,998.4	0.0	15.6	15.6	2.9522	676.9	676.9	5.3	671.6
2018	2,049.0	0.0	15.6	15.6	3.1588	648.7	648.7	4.9	643.7
2019	2,152.9	0.0	15.6	15.6	3.3799	637.0	637.0	4.6	632.3
2020	2,259.8	0.0	15.6	15.6	3.6165	624.9	624.9	4.3	620.5
2021	2,320.4	0.0	15.6	15.6	3.8697	599.6	599.6	4.0	595.6
2022	2,382.4	0.0	15.6	15.6	4.1406	575.4	575.4	3.8	571.6
2023	2,445.8	0.0	15.6	15.6	4.4304	552.1	552.1	3.5	548.5
2024	2,580.5	0.0	15.6	15.6	4.7405	544.3	544.3	3.3	541.0
2025	2,666.1	0.0	15.6	15.6	5.0724	525.6	525.6	3.1	522.5
2026	2,753.5	0.0	15.6	15.6	5.4274	507.3	507.3	2.9	504.5
2027	2,842.9	0.0	15.6	15.6	5.8074	489.5	489.5	2.7	486.8
2028	2,934.0	0.0	15.6	15.6	6.2139	472.2	472.2	2.5	469.7
2029	0.0	0.0	0.0	0.0	6.6488	0.0	0.0	0.0	0.0
2030	0.0	0.0	0.0	0.0	7.1143	0.0	0.0	0.0	0.0
2031	0.0	0.0	0.0	0.0	7.6123	0.0	0.0	0.0	0.0
2032	0.0	0.0	0.0	0.0	8.1451	0.0	0.0	0.0	0.0
Total	$41,416.6	$2,558.8	$322.1	$2,880.9		$12,353.5	$12,353.5	$2,014.3	$10,339.1
Plus: Salvage Value	$51.4						$12,404.9	$2,014.3	$10,390.5

Benefit-Cost Ratio of Project:	**6.16**

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

Table A-2

Benefit-Cost Analysis Summary, Master Plan Phase I (millions of 2001 dollars)

	Benefits	Costs			Present Value				
Year	Benefits from Consumer Surplus	Project Construction Costs	Incremental O&M Expenses	Total Project Costs	Discount Rate Factor	Passenger Delay Savings	Total Project Benefits	Total Project Costs	Annual Net Present Value (Benefits-Costs)
2001	$0.0	$0.0	$0.0	$0.0	1.0000	$0.0	$0.0	$0.0	$0.0
2002	0.0	81.8	0.0	81.8	1.0700	0.0	0.0	76.5	(76.5)
2003	0.0	166.4	0.0	166.4	1.1449	0.0	0.0	145.4	(145.4)
2004	0.0	516.0	0.0	516.0	1.2250	0.0	0.0	421.2	(421.2)
2005	0.0	637.5	0.0	637.5	1.3108	0.0	0.0	486.4	(486.4)
2006	0.0	837.6	0.0	837.6	1.4026	0.0	0.0	597.2	(597.2)
2007	362.4	640.1	5.4	645.4	1.5007	241.5	241.5	430.1	(188.6)
2008	536.3	623.0	5.4	628.4	1.6058	334.0	334.0	391.3	(57.4)
2009	717.7	30.1	21.0	51.1	1.7182	417.7	417.7	29.8	388.0
2010	902.1	0.0	21.0	21.0	1.8385	490.7	490.7	11.4	479.3
2011	1,094.9	0.0	21.0	21.0	1.9672	556.6	556.6	10.7	545.9
2012	1,296.3	0.0	21.0	21.0	2.1049	615.9	615.9	10.0	605.9
2013	1,506.8	0.0	21.0	21.0	2.2522	669.0	669.0	9.3	659.7
2014	1,721.0	0.0	21.0	21.0	2.4098	714.2	714.2	8.7	705.5
2015	1,944.7	0.0	21.0	21.0	2.5785	754.2	754.2	8.1	746.0
2016	1,948.7	0.0	21.0	21.0	2.7590	706.3	706.3	7.6	698.7
2017	1,998.4	0.0	21.0	21.0	2.9522	676.9	676.9	7.1	669.8
2018	2,049.0	0.0	21.0	21.0	3.1588	648.7	648.7	6.6	642.0
2019	2,152.9	0.0	21.0	21.0	3.3799	637.0	637.0	6.2	630.8
2020	2,259.8	0.0	21.0	21.0	3.6165	624.9	624.9	5.8	619.1
2021	2,320.4	0.0	21.0	21.0	3.8697	599.6	599.6	5.4	594.2
2022	2,382.4	0.0	21.0	21.0	4.1406	575.4	575.4	5.1	570.3
2023	2,445.8	0.0	21.0	21.0	4.4304	552.1	552.1	4.7	547.3
2024	2,580.5	0.0	21.0	21.0	4.7405	544.3	544.3	4.4	539.9
2025	2,666.1	0.0	21.0	21.0	5.0724	525.6	525.6	4.1	521.5
2026	2,753.5	0.0	21.0	21.0	5.4274	507.3	507.3	3.9	503.5
2027	2,842.9	0.0	21.0	21.0	5.8074	489.5	489.5	3.6	485.9
2028	2,934.0	0.0	21.0	21.0	6.2139	472.2	472.2	3.4	468.8
2029	0.0	0.0	21.0	21.0	6.6488	0.0	0.0	3.2	(3.2)
2030	0.0	0.0	21.0	21.0	7.1143	0.0	0.0	3.0	(3.0)
2031	0.0	0.0	21.0	21.0	7.6123	0.0	0.0	2.8	(2.8)
2032	0.0	0.0	21.0	21.0	8.1451	0.0	0.0	2.6	(2.6)
Total	$41,416.6	$3,532.7	$514.6	$4,047.3		$12,353.5	$12,353.5	$2,715.6	$9,637.9
Plus: Salvage Value	$51.4						$12,404.9	$2,715.6	$9,689.3

Benefit-Cost Ratio of Project	4.57

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

Table A-3

Elasticity Sensitivity Analysis Summary, OMP Phase I Airfield (millions of 2001 dollars)

	Benefits	Costs			Present Value				
Year	Benefits from Consumer Surplus	Project Construction Costs	Incremental O&M Expenses	Total Project Costs	Discount Rate Factor	Passenger Delay Savings	Total Project Benefits	Total Project Costs	Annual Net Present Value (Benefits-Costs)
2001	$0.0	$0.0	$0.0	$0.0	1.0000	$0.0	$0.0	$0.0	$0.0
2002	0.0	81.8	0.0	81.8	1.0700	0.0	0.0	76.5	(76.5)
2003	0.0	166.4	0.0	166.4	1.1449	0.0	0.0	145.4	(145.4)
2004	0.0	505.1	0.0	505.1	1.2250	0.0	0.0	412.3	(412.3)
2005	0.0	604.6	0.0	604.6	1.3108	0.0	0.0	461.3	(461.3)
2006	0.0	535.4	0.0	535.4	1.4026	0.0	0.0	381.8	(381.8)
2007	56.4	329.2	4.8	334.0	1.5007	37.6	37.6	222.5	(185.0)
2008	83.7	316.1	4.8	320.9	1.6058	52.1	52.1	199.8	(147.7)
2009	112.3	20.0	15.6	35.6	1.7182	65.4	65.4	20.7	44.6
2010	141.6	0.0	15.6	15.6	1.8385	77.0	77.0	8.5	68.5
2011	172.3	0.0	15.6	15.6	1.9672	87.6	87.6	7.9	79.7
2012	204.6	0.0	15.6	15.6	2.1049	97.2	97.2	7.4	89.8
2013	238.5	0.0	15.6	15.6	2.2522	105.9	105.9	6.9	99.0
2014	273.2	0.0	15.6	15.6	2.4098	113.4	113.4	6.5	106.9
2015	309.7	0.0	15.6	15.6	2.5785	120.1	120.1	6.1	114.0
2016	310.1	0.0	15.6	15.6	2.7590	112.4	112.4	5.7	106.7
2017	318.1	0.0	15.6	15.6	2.9522	107.7	107.7	5.3	102.5
2018	326.2	0.0	15.6	15.6	3.1588	103.3	103.3	4.9	98.3
2019	343.1	0.0	15.6	15.6	3.3799	101.5	101.5	4.6	96.9
2020	360.5	0.0	15.6	15.6	3.6165	99.7	99.7	4.3	95.4
2021	370.3	0.0	15.6	15.6	3.8697	95.7	95.7	4.0	91.6
2022	380.3	0.0	15.6	15.6	4.1406	91.8	91.8	3.8	88.1
2023	390.5	0.0	15.6	15.6	4.4304	88.1	88.1	3.5	84.6
2024	412.6	0.0	15.6	15.6	4.7405	87.0	87.0	3.3	83.7
2025	426.6	0.0	15.6	15.6	5.0724	84.1	84.1	3.1	81.0
2026	440.9	0.0	15.6	15.6	5.4274	81.2	81.2	2.9	78.3
2027	455.5	0.0	15.6	15.6	5.8074	78.4	78.4	2.7	75.7
2028	470.4	0.0	15.6	15.6	6.2139	75.7	75.7	2.5	73.2
2029	0.0	0.0	0.0	0.0	6.6488	0.0	0.0	0.0	0.0
2030	0.0	0.0	0.0	0.0	7.1143	0.0	0.0	0.0	0.0
2031	0.0	0.0	0.0	0.0	7.6123	0.0	0.0	0.0	0.0
2032	0.0	0.0	0.0	0.0	8.1451	0.0	0.0	0.0	0.0
Total	$6,597.1	$2,558.8	$322.1	$2,880.9		$1,963.0	$1,963.0	$2,014.3	($51.4)
Plus: Salvage Value	$51.4						$2,014.3	$2,014.3	$0.0

Benefit-Cost Ratio of Project:	1.00

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

Table A-4
Elasticity Sensitivity Analysis Summary, Master Plan Phase I (millions of 2001 dollars)

	Benefits	Costs			Present Value				
Year	Benefits from Consumer Surplus	Project Construction Costs	Incremental O&M Expenses	Total Project Costs	Discount Rate Factor	Passenger Delay Savings	Total Project Benefits	Total Project Costs	Annual Net Present Value (Benefits-Costs)
2001	$0.0	$0.0	$0.0	$0.0	1.0000	$0.0	$0.0	$0.0	$0.0
2002	0.0	81.8	0.0	81.8	1.0700	0.0	0.0	76.5	(76.5)
2003	0.0	166.4	0.0	166.4	1.1449	0.0	0.0	145.4	(145.4)
2004	0.0	516.0	0.0	516.0	1.2250	0.0	0.0	421.2	(421.2)
2005	0.0	637.5	0.0	637.5	1.3108	0.0	0.0	486.4	(486.4)
2006	0.0	837.6	0.0	837.6	1.4026	0.0	0.0	597.2	(597.2)
2007	76.6	640.1	5.4	645.4	1.5007	51.0	51.0	430.1	(379.0)
2008	113.7	623.0	5.4	628.4	1.6058	70.8	70.8	391.3	(320.5)
2009	152.6	30.1	21.0	51.1	1.7182	88.8	88.8	29.8	59.0
2010	192.3	0.0	21.0	21.0	1.8385	104.6	104.6	11.4	93.2
2011	234.0	0.0	21.0	21.0	1.9672	119.0	119.0	10.7	108.3
2012	277.8	0.0	21.0	21.0	2.1049	132.0	132.0	10.0	122.0
2013	323.8	0.0	21.0	21.0	2.2522	143.8	143.8	9.3	134.5
2014	370.9	0.0	21.0	21.0	2.4098	153.9	153.9	8.7	145.2
2015	420.2	0.0	21.0	21.0	2.5785	163.0	163.0	8.1	154.8
2016	420.9	0.0	21.0	21.0	2.7590	152.5	152.5	7.6	144.9
2017	431.7	0.0	21.0	21.0	2.9522	146.2	146.2	7.1	139.1
2018	442.7	0.0	21.0	21.0	3.1588	140.1	140.1	6.6	133.5
2019	465.5	0.0	21.0	21.0	3.3799	137.7	137.7	6.2	131.5
2020	489.1	0.0	21.0	21.0	3.6165	135.2	135.2	5.8	129.4
2021	502.4	0.0	21.0	21.0	3.8697	129.8	129.8	5.4	124.4
2022	516.0	0.0	21.0	21.0	4.1406	124.6	124.6	5.1	119.5
2023	529.9	0.0	21.0	21.0	4.4304	119.6	119.6	4.7	114.9
2024	559.8	0.0	21.0	21.0	4.7405	118.1	118.1	4.4	113.6
2025	578.7	0.0	21.0	21.0	5.0724	114.1	114.1	4.1	109.9
2026	598.0	0.0	21.0	21.0	5.4274	110.2	110.2	3.9	106.3
2027	617.8	0.0	21.0	21.0	5.8074	106.4	106.4	3.6	102.8
2028	638.0	0.0	21.0	21.0	6.2139	102.7	102.7	3.4	99.3
2029	0.0	0.0	21.0	21.0	6.6488	0.0	0.0	3.2	(3.2)
2030	0.0	0.0	21.0	21.0	7.1143	0.0	0.0	3.0	(3.0)
2031	0.0	0.0	21.0	21.0	7.6123	0.0	0.0	2.8	(2.8)
2032	0.0	0.0	21.0	21.0	8.1451	0.0	0.0	2.6	(2.6)
Total	$8,952.4	$3,532.7	$514.6	$4,047.3		$2,664.2	$2,664.2	$2,715.6	($51.4)
Plus: Salvage Value	$51.4						$2,715.6	$2,715.6	$0.0

Benefit-Cost Ratio of Project:	1.00

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

Table A-5

Future Demand Sensitivity Analysis Summary, OMP Phase I Airfield (millions of 2001 dollars)

	Benefits	Costs			Present Value				
Year	Benefits from Consumer Surplus	Project Construction Costs	Incremental O&M Expenses	Total Project Costs	Discount Rate Factor	Passenger Delay Savings	Total Project Benefits	Total Project Costs	Annual Net Present Value (Benefits-Costs)
2001	$0.0	$0.0	$0.0	$0.0	1.0000	$0.0	$0.0	$0.0	$0.0
2002	0.0	81.8	0.0	81.8	1.0700	0.0	0.0	76.5	(76.5)
2003	0.0	166.4	0.0	166.4	1.1449	0.0	0.0	145.4	(145.4)
2004	0.0	505.1	0.0	505.1	1.2250	0.0	0.0	412.3	(412.3)
2005	0.0	604.6	0.0	604.6	1.3108	0.0	0.0	461.3	(461.3)
2006	0.0	535.4	0.0	535.4	1.4026	0.0	0.0	381.8	(381.8)
2007	(7.8)	329.2	4.8	334.0	1.5007	(5.2)	(5.2)	222.5	(227.7)
2008	(35.9)	316.1	4.8	320.9	1.6058	(22.3)	(22.3)	199.8	(222.2)
2009	130.5	20.0	15.6	35.6	1.7182	76.0	76.0	20.7	55.2
2010	95.8	0.0	15.6	15.6	1.8385	52.1	52.1	8.5	43.6
2011	267.9	0.0	15.6	15.6	1.9672	136.2	136.2	7.9	128.2
2012	231.3	0.0	15.6	15.6	2.1049	109.9	109.9	7.4	102.4
2013	414.0	0.0	15.6	15.6	2.2522	183.8	183.8	6.9	176.9
2014	144.6	0.0	15.6	15.6	2.4098	60.0	60.0	6.5	53.5
2015	310.3	0.0	15.6	15.6	2.5785	120.3	120.3	6.1	114.3
2016	281.7	0.0	15.6	15.6	2.7590	102.1	102.1	5.7	96.4
2017	297.4	0.0	15.6	15.6	2.9522	100.7	100.7	5.3	95.4
2018	313.1	0.0	15.6	15.6	3.1588	99.1	99.1	4.9	94.2
2019	388.2	0.0	15.6	15.6	3.3799	114.9	114.9	4.6	110.2
2020	465.8	0.0	15.6	15.6	3.6165	128.8	128.8	4.3	124.5
2021	258.2	0.0	15.6	15.6	3.8697	66.7	66.7	4.0	62.7
2022	286.8	0.0	15.6	15.6	4.1406	69.3	69.3	3.8	65.5
2023	316.3	0.0	15.6	15.6	4.4304	71.4	71.4	3.5	67.9
2024	421.6	0.0	15.6	15.6	4.7405	88.9	88.9	3.3	85.6
2025	478.3	0.0	15.6	15.6	5.0724	94.3	94.3	3.1	91.2
2026	536.4	0.0	15.6	15.6	5.4274	98.8	98.8	2.9	95.9
2027	596.0	0.0	15.6	15.6	5.8074	102.6	102.6	2.7	99.9
2028	657.0	0.0	15.6	15.6	6.2139	105.7	105.7	2.5	103.2
2029	0.0	0.0	0.0	0.0	6.6488	0.0	0.0	0.0	0.0
2030	0.0	0.0	0.0	0.0	7.1143	0.0	0.0	0.0	0.0
2031	0.0	0.0	0.0	0.0	7.6123	0.0	0.0	0.0	0.0
2032	0.0	0.0	0.0	0.0	8.1451	0.0	0.0	0.0	0.0
Total	$6,847.4	$2,558.8	$322.1	$2,880.9		$1,954.2	$1,954.2	$2,014.3	($60.2)
Plus: Salvage Value	$51.4						$2,005.6	$2,014.3	($8.8)

Benefit-Cost Ratio of Project:	1.00

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

Table A-6

Future Demand Sensitivity Analysis Summary, Master Plan Phase I (millions of 2001 dollars)

	Benefits	Costs			Present Value				
Year	Beenfits from Consumer Surplus	Project Construction Costs	Incremental O&M Expenses	Total Project Costs	Discount Rate Factor	Passenger Delay Savings	Total Project Benefits	Total Project Costs	Annual Net Present Value (Benefits-Costs)
2001	$0.0	$0.0	$0.0	$0.0	1.0000	$0.0	$0.0	$0.0	$0.0
2002	0.0	81.8	0.0	81.8	1.0700	0.0	0.0	76.5	(76.5)
2003	0.0	166.4	0.0	166.4	1.1449	0.0	0.0	145.4	(145.4)
2004	0.0	516.0	0.0	516.0	1.2250	0.0	0.0	421.2	(421.2)
2005	0.0	637.5	0.0	637.5	1.3108	0.0	0.0	486.4	(486.4)
2006	0.0	837.6	0.0	837.6	1.4026	0.0	0.0	597.2	(597.2)
2007	178.1	640.1	5.4	645.4	1.5007	118.7	118.7	430.1	(311.4)
2008	347.2	623.0	5.4	628.4	1.6058	216.2	216.2	391.3	(175.1)
2009	130.5	30.1	21.0	51.1	1.7182	76.0	76.0	29.8	46.2
2010	300.0	0.0	21.0	21.0	1.8385	163.2	163.2	11.4	151.7
2011	267.9	0.0	21.0	21.0	1.9672	136.2	136.2	10.7	125.5
2012	231.3	0.0	21.0	21.0	2.1049	109.9	109.9	10.0	99.9
2013	414.0	0.0	21.0	21.0	2.2522	183.8	183.8	9.3	174.5
2014	375.7	0.0	21.0	21.0	2.4098	155.9	155.9	8.7	147.2
2015	334.0	0.0	21.0	21.0	2.5785	129.5	129.5	8.1	121.4
2016	305.9	0.0	21.0	21.0	2.7590	110.9	110.9	7.6	103.3
2017	322.1	0.0	21.0	21.0	2.9522	109.1	109.1	7.1	102.0
2018	338.3	0.0	21.0	21.0	3.1588	107.1	107.1	6.6	100.4
2019	413.8	0.0	21.0	21.0	3.3799	122.4	122.4	6.2	116.2
2020	491.8	0.0	21.0	21.0	3.6165	136.0	136.0	5.8	130.2
2021	276.9	0.0	21.0	21.0	3.8697	71.5	71.5	5.4	66.1
2022	556.6	0.0	21.0	21.0	4.1406	134.4	134.4	5.1	129.4
2023	335.6	0.0	21.0	21.0	4.4304	75.7	75.7	4.7	71.0
2024	441.1	0.0	21.0	21.0	4.7405	93.1	93.1	4.4	88.6
2025	498.1	0.0	21.0	21.0	5.0724	98.2	98.2	4.1	94.1
2026	556.4	0.0	21.0	21.0	5.4274	102.5	102.5	3.9	98.7
2027	616.3	0.0	21.0	21.0	5.8074	106.1	106.1	3.6	102.5
2028	677.6	0.0	21.0	21.0	6.2139	109.0	109.0	3.4	105.7
2029	0.0	0.0	21.0	21.0	6.6488	0.0	0.0	3.2	(3.2)
2030	0.0	0.0	21.0	21.0	7.1143	0.0	0.0	3.0	(3.0)
2031	0.0	0.0	21.0	21.0	7.6123	0.0	0.0	2.8	(2.8)
2032	0.0	0.0	21.0	21.0	8.1451	0.0	0.0	2.6	(2.6)
Total	$8,409.1	$3,532.7	$514.6	$4,047.3		$2,665.5	$2,665.5	$2,715.6	($50.1)
Plus: Salvage Value	$51.4						$2,716.9	$2,715.6	$1.3

Benefit-Cost Ratio of Project:	1.00

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

Table A-7

Value of Time Sensitivity Analysis Summary, OMP Phase I Airfield (millions of 2001 dollars)

	Benefits	Costs			Present Value				
Year	Benefits from Consumer Surplus	Project Construction Costs	Incremental O&M Expenses	Total Project Costs	Discount Rate Factor	Passenger Delay Savings	Total Project Benefits	Total Project Costs	Annual Net Present Value (Benefits-Costs)
2001	$0.0	$0.0	$0.0	$0.0	1.0000	$0.0	$0.0	$0.0	$0.0
2002	0.0	81.8	0.0	81.8	1.0700	0.0	0.0	76.5	(76.5)
2003	0.0	166.4	0.0	166.4	1.1449	0.0	0.0	145.4	(145.4)
2004	0.0	505.1	0.0	505.1	1.2250	0.0	0.0	412.3	(412.3)
2005	0.0	604.6	0.0	604.6	1.3108	0.0	0.0	461.3	(461.3)
2006	0.0	535.4	0.0	535.4	1.4026	0.0	0.0	381.8	(381.8)
2007	267.4	329.2	4.8	334.0	1.5007	178.2	178.2	222.5	(44.3)
2008	394.1	316.1	4.8	320.9	1.6058	245.4	245.4	199.8	45.6
2009	525.3	20.0	15.6	35.6	1.7182	305.7	305.7	20.7	285.0
2010	657.8	0.0	15.6	15.6	1.8385	357.8	357.8	8.5	349.3
2011	795.5	0.0	15.6	15.6	1.9672	404.4	404.4	7.9	396.4
2012	938.4	0.0	15.6	15.6	2.1049	445.8	445.8	7.4	438.4
2013	1,086.9	0.0	15.6	15.6	2.2522	482.6	482.6	6.9	475.6
2014	1,240.1	0.0	15.6	15.6	2.4098	514.6	514.6	6.5	508.1
2015	1,399.7	0.0	15.6	15.6	2.5785	542.8	542.8	6.1	536.8
2016	1,401.0	0.0	15.6	15.6	2.7590	507.8	507.8	5.7	502.1
2017	1,435.3	0.0	15.6	15.6	2.9522	486.2	486.2	5.3	480.9
2018	1,470.1	0.0	15.6	15.6	3.1588	465.4	465.4	4.9	460.4
2019	1,544.6	0.0	15.6	15.6	3.3799	457.0	457.0	4.6	452.4
2020	1,621.3	0.0	15.6	15.6	3.6165	448.3	448.3	4.3	444.0
2021	1,664.7	0.0	15.6	15.6	3.8697	430.2	430.2	4.0	426.2
2022	1,709.2	0.0	15.6	15.6	4.1406	412.8	412.8	3.8	409.0
2023	1,754.7	0.0	15.6	15.6	4.4304	396.1	396.1	3.5	392.5
2024	1,851.4	0.0	15.6	15.6	4.7405	390.5	390.5	3.3	387.2
2025	1,912.8	0.0	15.6	15.6	5.0724	377.1	377.1	3.1	374.0
2026	1,975.5	0.0	15.6	15.6	5.4274	364.0	364.0	2.9	361.1
2027	2,039.6	0.0	15.6	15.6	5.8074	351.2	351.2	2.7	348.5
2028	2,105.0	0.0	15.6	15.6	6.2139	338.8	338.8	2.5	336.2
2029	0.0	0.0	0.0	0.0	6.6488	0.0	0.0	0.0	0.0
2030	0.0	0.0	0.0	0.0	7.1143	0.0	0.0	0.0	0.0
2031	0.0	0.0	0.0	0.0	7.6123	0.0	0.0	0.0	0.0
2032	0.0	0.0	0.0	0.0	8.1451	0.0	0.0	0.0	0.0
Total	$29,790.2	$2,558.8	$322.1	$2,880.9		$8,902.6	$8,902.6	$2,014.3	$6,888.3
Plus: Salvage Value	$51.4						$8,954.0	$2,014.3	$6,939.7

Benefit-Cost Ratio of Project:	4.45

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

Table A-8
Value of Time Sensitivity Analysis Summary, Master Plan Phase I (millions of 2001 dollars)

	Benefits	Costs			Present Value				
Year	Benefits from Consumer Surplus	Project Construction Costs	Incremental O&M Expenses	Total Project Costs	Discount Rate Factor	Passenger Delay Savings	Total Project Benefits	Total Project Costs	Annual Net Present Value (Benefits-Costs)
2001	$0.0	$0.0	$0.0	$0.0	1.0000	$0.0	$0.0	$0.0	$0.0
2002	0.0	81.8	0.0	81.8	1.0700	0.0	0.0	76.5	(76.5)
2003	0.0	166.4	0.0	166.4	1.1449	0.0	0.0	145.4	(145.4)
2004	0.0	516.0	0.0	516.0	1.2250	0.0	0.0	421.2	(421.2)
2005	0.0	637.5	0.0	637.5	1.3108	0.0	0.0	486.4	(486.4)
2006	0.0	837.6	0.0	837.6	1.4026	0.0	0.0	597.2	(597.2)
2007	267.4	640.1	5.4	645.4	1.5007	178.2	178.2	430.1	(251.9)
2008	394.1	623.0	5.4	628.4	1.6058	245.4	245.4	391.3	(145.9)
2009	525.3	30.1	21.0	51.1	1.7182	305.7	305.7	29.8	275.9
2010	657.8	0.0	21.0	21.0	1.8385	357.8	357.8	11.4	346.4
2011	795.5	0.0	21.0	21.0	1.9672	404.4	404.4	10.7	393.7
2012	938.4	0.0	21.0	21.0	2.1049	445.8	445.8	10.0	435.9
2013	1,086.9	0.0	21.0	21.0	2.2522	482.6	482.6	9.3	473.3
2014	1,240.1	0.0	21.0	21.0	2.4098	514.6	514.6	8.7	505.9
2015	1,399.7	0.0	21.0	21.0	2.5785	542.8	542.8	8.1	534.7
2016	1,401.0	0.0	21.0	21.0	2.7590	507.8	507.8	7.6	500.2
2017	1,435.3	0.0	21.0	21.0	2.9522	486.2	486.2	7.1	479.1
2018	1,470.1	0.0	21.0	21.0	3.1588	465.4	465.4	6.6	458.7
2019	1,544.6	0.0	21.0	21.0	3.3799	457.0	457.0	6.2	450.8
2020	1,621.3	0.0	21.0	21.0	3.6165	448.3	448.3	5.8	442.5
2021	1,664.7	0.0	21.0	21.0	3.8697	430.2	430.2	5.4	424.8
2022	1,709.2	0.0	21.0	21.0	4.1406	412.8	412.8	5.1	407.7
2023	1,754.7	0.0	21.0	21.0	4.4304	396.1	396.1	4.7	391.3
2024	1,851.4	0.0	21.0	21.0	4.7405	390.5	390.5	4.4	386.1
2025	1,912.8	0.0	21.0	21.0	5.0724	377.1	377.1	4.1	373.0
2026	1,975.5	0.0	21.0	21.0	5.4274	364.0	364.0	3.9	360.1
2027	2,039.6	0.0	21.0	21.0	5.8074	351.2	351.2	3.6	347.6
2028	2,105.0	0.0	21.0	21.0	6.2139	338.8	338.8	3.4	335.4
2029	0.0	0.0	21.0	21.0	6.6488	0.0	0.0	3.2	(3.2)
2030	0.0	0.0	21.0	21.0	7.1143	0.0	0.0	3.0	(3.0)
2031	0.0	0.0	21.0	21.0	7.6123	0.0	0.0	2.8	(2.8)
2032	0.0	0.0	21.0	21.0	8.1451	0.0	0.0	2.6	(2.6)
Total	$29,790.2	$3,532.7	$514.6	$4,047.3		$8,902.6	$8,902.6	$2,715.6	$6,187.0
Plus: Salvage Value	$51.4						$8,954.0	$2,715.6	$6,238.4

Benefit-Cost Ratio of Project:	3.30

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

Table A-9

Elasticity and Money Fare Sensitivity Analysis Summary, OMP Phase I Airfield

		Money Fare								
		$55.01	$110.03	$165.04	$198.05	$220.05	$242.06	$275.06	$330.08	$385.09
		-75%	-50%	-25%	-10%	0%	10%	25%	50%	75%
Elasticity	-0.50	6.39	8.89	11.38	12.88	13.88	14.88	16.38	18.87	21.37
	-0.60	5.40	7.50	9.61	10.88	11.72	12.56	13.82	15.93	18.04
	-0.70	4.67	6.49	8.32	9.41	10.14	10.87	11.96	13.78	15.61
	-0.80	4.12	5.73	7.33	8.29	8.94	9.58	10.54	12.15	13.75
	-0.90	3.68	5.12	6.55	7.42	7.99	8.56	9.42	10.86	12.29
	-1.00	3.33	4.63	5.93	6.70	7.22	7.74	8.52	9.82	11.11
	-1.10	3.04	4.23	5.41	6.12	6.59	7.07	7.78	8.96	10.14
	-1.18	2.84	3.95	5.05	5.72	6.16	6.60	7.26	8.37	9.47
	-1.30	2.59	3.60	4.61	5.21	5.61	6.02	6.62	7.63	8.63
	-1.40	2.41	3.35	4.29	4.85	5.23	5.60	6.16	7.10	8.04
	-1.50	2.26	3.14	4.01	4.54	4.89	5.24	5.76	6.64	7.52
	-1.60	2.12	2.95	3.77	4.26	4.59	4.92	5.41	6.24	7.06
	-1.70	2.00	2.78	3.55	4.02	4.33	4.64	5.10	5.88	6.66
	-1.80	1.90	2.63	3.36	3.80	4.10	4.39	4.83	5.56	6.29
	-1.90	1.80	2.49	3.19	3.61	3.89	4.16	4.58	5.28	5.97
	-2.00	1.71	2.37	3.04	3.43	3.70	3.96	4.36	5.02	5.68
	-2.10	1.63	2.26	2.89	3.27	3.53	3.78	4.16	4.79	5.42
	-2.20	1.56	2.16	2.77	3.13	3.37	3.61	3.97	4.57	5.18
	-2.30	1.50	2.07	2.65	3.00	3.23	3.46	3.80	4.38	4.96
	-2.40	1.44	1.99	2.54	2.87	3.09	3.32	3.65	4.20	4.75
	-2.50	1.38	1.91	2.44	2.76	2.97	3.19	3.51	4.04	4.57

Note: Shaded cell is the original BCR.

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

Table A-10

Elasticity and Money Fare Sensitivity Analysis Summary, Master Plan Phase I

		Money Fare								
		$55.01	$110.03	$165.04	$198.05	$220.05	$242.06	$275.06	$330.08	$385.09
		-75%	-50%	-25%	-10%	0%	10%	25%	50%	75%
Elasticity	-0.50	4.74	6.59	8.45	9.56	10.30	11.04	12.15	14.00	15.85
	-0.60	4.00	5.57	7.13	8.07	8.69	9.32	10.25	11.82	13.38
	-0.70	3.47	4.82	6.17	6.98	7.52	8.06	8.87	10.22	11.58
	-0.80	3.06	4.25	5.44	6.15	6.63	7.10	7.82	9.01	10.20
	-0.90	2.73	3.80	4.86	5.50	5.93	6.35	6.99	8.05	9.12
	-1.00	2.47	3.43	4.40	4.97	5.36	5.74	6.32	7.28	8.24
	-1.10	2.26	3.13	4.01	4.54	4.89	5.24	5.77	6.65	7.52
	-1.18	2.11	2.93	3.75	4.24	4.57	4.90	5.39	6.21	7.03
	-1.30	1.92	2.67	3.42	3.86	4.16	4.46	4.91	5.66	6.40
	-1.40	1.79	2.49	3.18	3.60	3.88	4.15	4.57	5.27	5.96
	-1.50	1.68	2.33	2.98	3.37	3.63	3.89	4.28	4.93	5.57
	-1.60	1.58	2.19	2.80	3.16	3.41	3.65	4.02	4.63	5.24
	-1.70	1.49	2.06	2.64	2.98	3.21	3.44	3.79	4.36	4.94
	-1.80	1.41	1.95	2.49	2.82	3.04	3.26	3.58	4.13	4.67
	-1.90	1.33	1.85	2.37	2.68	2.88	3.09	3.40	3.91	4.43
	-2.00	1.27	1.76	2.25	2.55	2.74	2.94	3.23	3.72	4.21
	-2.10	1.21	1.68	2.15	2.43	2.61	2.80	3.08	3.55	4.02
	-2.20	1.16	1.61	2.05	2.32	2.50	2.68	2.95	3.39	3.84
	-2.30	1.11	1.54	1.97	2.22	2.39	2.56	2.82	3.25	3.68
	-2.40	1.07	1.48	1.89	2.13	2.30	2.46	2.71	3.12	3.53
	-2.50	1.02	1.42	1.81	2.05	2.21	2.36	2.60	2.99	3.39

Note: Shaded cell is the original BCR.

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

Table A-11

Elasticity and Future Demand Sensitivity Analysis Summary, OMP Phase I Airfield (millions of 2001 dollars)

		Variations in Scenario Case Passengers										
		-10%	-9%	-8%	-7%	-6%	-5%	-4%	-3%	-2%	-1%	0%
Elasticity	-0.50	0.04	0.30	1.10	2.26	3.55	4.98	6.54	8.22	10.03	11.97	13.88
	-0.60	0.04	0.26	0.92	1.90	2.98	4.18	5.49	6.92	8.45	10.09	11.72
	-0.70	0.04	0.22	0.79	1.63	2.57	3.61	4.74	5.97	7.30	8.73	10.14
	-0.80	0.03	0.20	0.70	1.43	2.26	3.17	4.17	5.25	6.42	7.69	8.94
	-0.90	0.03	0.18	0.62	1.28	2.01	2.83	3.72	4.69	5.74	6.87	7.99
	-1.00	0.03	0.16	0.56	1.16	1.82	2.55	3.36	4.24	5.19	6.21	7.22
	-1.10	0.03	0.15	0.52	1.05	1.66	2.33	3.06	3.86	4.73	5.66	6.59
	-1.18	0.03	0.14	0.48	0.98	1.55	2.17	2.86	3.61	4.42	5.29	6.16
	-1.30	0.03	0.13	0.44	0.90	1.41	1.98	2.60	3.29	4.02	4.82	5.61
	-1.40	0.03	0.12	0.41	0.84	1.31	1.84	2.42	3.06	3.74	4.49	5.23
	-1.50	0.03	0.12	0.39	0.78	1.23	1.72	2.27	2.86	3.50	4.20	4.89
	-1.60	0.03	0.11	0.36	0.74	1.15	1.62	2.13	2.69	3.29	3.94	4.59
	-1.70	0.03	0.11	0.34	0.69	1.09	1.52	2.01	2.53	3.10	3.72	4.33
	-1.80	0.03	0.10	0.33	0.66	1.03	1.44	1.90	2.39	2.93	3.51	4.10
	-1.90	0.03	0.10	0.31	0.62	0.98	1.37	1.80	2.27	2.78	3.33	3.89
	-2.00	0.03	0.09	0.30	0.59	0.93	1.30	1.71	2.16	2.65	3.17	3.70
	-2.10	0.03	0.09	0.28	0.57	0.89	1.24	1.63	2.06	2.52	3.02	3.53
	-2.20	0.03	0.09	0.27	0.54	0.85	1.19	1.56	1.97	2.41	2.89	3.37
	-2.30	0.03	0.09	0.26	0.52	0.81	1.14	1.49	1.89	2.31	2.77	3.23
	-2.40	0.03	0.08	0.25	0.50	0.78	1.09	1.43	1.81	2.22	2.66	3.09
	-2.50	0.03	0.08	0.24	0.48	0.75	1.05	1.38	1.74	2.13	2.55	2.97

Note: Shaded cell is the original BCR.

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

Table A-12

Elasticity and Future Demand Sensitivity Analysis Summary, Master Plan Phase I

	Variations in Scenario Case Passengers										
Elasticity	-10%	-9%	-8%	-7%	-6%	-5%	-4%	-3%	-2%	-1%	0%
-0.50	0.03	0.22	0.81	1.68	2.63	3.70	4.85	6.10	7.44	8.88	10.30
-0.60	0.03	0.19	0.68	1.41	2.21	3.10	4.08	5.13	6.27	7.49	8.69
-0.70	0.03	0.17	0.59	1.21	1.90	2.67	3.52	4.43	5.41	6.47	7.52
-0.80	0.03	0.15	0.52	1.06	1.67	2.35	3.09	3.90	4.77	5.70	6.63
-0.90	0.02	0.13	0.46	0.95	1.49	2.10	2.76	3.48	4.26	5.09	5.93
-1.00	0.02	0.12	0.42	0.86	1.35	1.89	2.49	3.14	3.85	4.60	5.36
-1.10	0.02	0.11	0.38	0.78	1.23	1.73	2.27	2.87	3.51	4.20	4.89
-1.18	0.02	0.11	0.36	0.73	1.15	1.61	2.12	2.68	3.28	3.92	4.57
-1.30	0.02	0.10	0.33	0.67	1.04	1.47	1.93	2.44	2.98	3.58	4.16
-1.40	0.02	0.09	0.30	0.62	0.97	1.37	1.80	2.27	2.78	3.33	3.88
-1.50	0.02	0.09	0.29	0.58	0.91	1.28	1.68	2.12	2.60	3.11	3.63
-1.60	0.02	0.08	0.27	0.55	0.85	1.20	1.58	1.99	2.44	2.92	3.41
-1.70	0.02	0.08	0.25	0.51	0.81	1.13	1.49	1.88	2.30	2.76	3.21
-1.80	0.02	0.08	0.24	0.49	0.76	1.07	1.41	1.78	2.18	2.61	3.04
-1.90	0.02	0.07	0.23	0.46	0.72	1.02	1.34	1.68	2.06	2.47	2.88
-2.00	0.02	0.07	0.22	0.44	0.69	0.97	1.27	1.60	1.96	2.35	2.74
-2.10	0.02	0.07	0.21	0.42	0.66	0.92	1.21	1.53	1.87	2.24	2.61
-2.20	0.02	0.07	0.20	0.40	0.63	0.88	1.16	1.46	1.79	2.14	2.50
-2.30	0.02	0.06	0.19	0.39	0.60	0.84	1.11	1.40	1.71	2.05	2.39
-2.40	0.02	0.06	0.19	0.37	0.58	0.81	1.06	1.34	1.64	1.97	2.30
-2.50	0.02	0.06	0.18	0.36	0.56	0.78	1.02	1.29	1.58	1.89	2.21

Note: Shaded cell is the original BCR.

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

Table A-13

Money Fare and Future Demand Sensitivity Analysis Summary, OMP Phase I Airfield

Variations in Scenario Case Passengers	Money Fare								
	$55.01	$110.03	$165.04	$198.05	$220.05	$242.06	$275.06	$330.08	$385.09
	-75%	-50%	-25%	-10%	0%	10%	25%	50%	75%
-10%	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
-9%	0.08	0.10	0.12	0.13	0.14	0.15	0.16	0.19	0.21
-8%	0.24	0.32	0.40	0.45	0.48	0.52	0.56	0.65	0.73
-7%	0.47	0.64	0.81	0.92	0.98	1.05	1.16	1.33	1.50
-6%	0.73	1.00	1.27	1.44	1.55	1.65	1.82	2.09	2.36
-5%	1.02	1.40	1.79	2.02	2.17	2.33	2.56	2.94	3.33
-4%	1.33	1.84	2.35	2.66	2.86	3.06	3.37	3.88	4.39
-3%	1.68	2.32	2.96	3.35	3.61	3.86	4.25	4.89	5.54
-2%	2.05	2.84	3.63	4.10	4.42	4.73	5.21	6.00	6.79
-1%	2.45	3.39	4.34	4.91	5.29	5.67	6.24	7.19	8.13
0%	2.84	3.95	5.05	5.72	6.16	6.60	7.26	8.37	9.47

Note: Shaded cell is the original BCR.

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

Table A-14

Money Fare and Future Demand Sensitivity Analysis Summary, Master Plan Phase I

Variations in Scenario Case Passengers	Money Fare								
	$55.01	$110.03	$165.04	$198.05	$220.05	$242.06	$275.06	$330.08	$385.09
	-75%	-50%	-25%	-10%	0%	10%	25%	50%	75%
-10%	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
-9%	0.06	0.07	0.09	0.10	0.11	0.11	0.12	0.14	0.15
-8%	0.18	0.24	0.30	0.33	0.36	0.38	0.42	0.48	0.54
-7%	0.35	0.48	0.60	0.68	0.73	0.78	0.86	0.99	1.11
-6%	0.54	0.74	0.94	1.07	1.15	1.23	1.35	1.55	1.75
-5%	0.75	1.04	1.33	1.50	1.61	1.73	1.90	2.18	2.47
-4%	0.99	1.37	1.74	1.97	2.12	2.27	2.50	2.88	3.25
-3%	1.24	1.72	2.20	2.48	2.68	2.87	3.15	3.63	4.11
-2%	1.52	2.10	2.69	3.04	3.28	3.51	3.86	4.45	5.03
-1%	1.81	2.52	3.22	3.64	3.92	4.21	4.63	5.33	6.03
0%	2.11	2.93	3.75	4.24	4.57	4.90	5.39	6.21	7.03

Note: Shaded cell is the original BCR.

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

Appendix B

Phase I Project Costs

Table B-1

Project Cash Flow Schedule (in 2001 dollars)

Project Analysis (millions of dollars)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
OMP Phase I Airfield	$0.0	$81.8	$216.6	$505.1	$604.6	$535.4	$329.2	$316.1	$20.0	$0.0	$0.0	$0.0	$0.0	$2,557.0
Master Plan Phase I	$0.0	$81.8	$216.6	$516.0	$837.5	$837.6	$640.1	$623.0	$30.1	$0.0	$0.0	$0.0	$0.0	$3,582.8

	OMP Phase I Airfield	Master Plan Phase I	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Program Wide Requirements																
Program-wide Requirements	X	X	$0	$17,500,000	$21,607,000	$19,170,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$58,277,000
Preliminary Engineering	X	X	0	0	21,845,000	15,291,000	6,553,000	0	0	0	0	0	0	0	0	$43,688,999
Wetlands mitigation	X	X	0	0	1,942,000	22,330,000	0	0	0	0	0	0	0	0	0	$24,272,000
Noise Mitigation (OMP Phase 1 Airfield)	X	X	0	0	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	0	0	0	0	$140,000,000
Land Acquisition	X	X	0	64,348,154	87,088,902	72,816,000	82,524,000	60,194,000	14,563,000	9,709,000	0	0	0	0	0	$391,243,057
Subtotal - Program Wide Requirements			$0	$81,848,154	$152,482,902	$149,607,000	$109,077,000	$80,194,000	$34,563,000	$29,709,000	$20,000,000	$0	$0	$0	$0	$657,481,056
Airfield																
Design of Runway 9L-27R	X	X	$0	$0	$23,301,000	$11,650,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$34,951,000
Construction of Runway 9L-27R	X	X	0	0	0	114,132,000	199,730,000	199,730,000	0	0	0	0	0	0	0	$513,591,999
Design of Runway 10L Extension	X	X	0	0	20,388,000	0	0	0	0	0	0	0	0	0	0	$20,388,000
Construction of Runway 10L Extension	X	X	0	0	0	88,081,000	130,333,000	146,491,000	82,893,000	25,989,000	0	0	0	0	0	$473,767,000
Design of Runway 10C-28C	X	X	0	0	20,389,000	20,388,000	0	0	0	0	0	0	0	0	0	$40,777,000
Construction of Runway 10C-28C	X	X	0	0	0	121,251,000	165,469,000	109,034,000	211,763,000	260,445,000	0	0	0	0	0	$867,962,000
Subtotal - Airfield			$0	$0	$64,078,000	$355,502,000	$495,532,000	$455,255,000	$294,656,000	$286,433,999	$0	$0	$0	$0	$0	$1,951,456,999
Western Terminal Complex																
Design of Western Airside Concourse		X	$0	$0	$0	$9,722,000	$12,964,000	$9,722,000	$0	$0	$0	$0	$0	$0	$0	$32,408,000
Construction of Western Airside Concourse		X	0	0	0	0	0	167,645,000	217,017,000	162,762,000	0	0	0	$0	$0	$547,423,999
Design of Energy Plant		X	0	0	0	1,159,000	2,704,000	0	0	0	0	0	0	$0	$0	$3,863,000
Construction of Energy Plant		X	0	0	0	0	0	16,633,000	33,266,000	5,545,000	0	0	0	$0	$0	$55,444,001
Design of Fuel Storage and Distribution Improvements		X	0	0	0	0	3,672,000	0	0	0	0	0	0	$0	$0	$3,672,000
Construction of Fuel Storage and Distribution Improvements		X	0	0	0	0	0	17,249,000	22,998,000	17,249,000	0	0	0	$0	$0	$57,496,001
Subtotal - Western Terminal Complex			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
WGP Phase 1																
Taxiway A/B Relocation		X	$0	$0	$0	$0	$0	$0	$3,127,478	$14,790,148	$0	$0	$0	$0	$0	$17,917,626
T1/T2 Expansion		X	0	0	0	0	690,346	6,505,992	0	0	0	0	0	0	0	$7,196,338
Concourse K - Allowance		X	0	0	0	0	0	7,028,981	7,028,981	56,221,391	0	0	0	0	0	$70,279,353
Terminal 2 - Interior Upgrade		X	0	0	0	0	12,896,926	51,598,162	0	0	0	0	0	0	0	$64,495,087
Taxiway November - Facility Relocations		X	0	0	0	0	0	0	1,600,348	22,499,016	0	0	0	0	0	$24,099,364
Taxiway M		X	0	0	0	0	0	25,801,173	25,801,173	25,801,173	0	0	0	0	0	$77,403,519
Taxiway November - New		X	0	0	0	0	0	0	0	2,008,280	10,146,000	0	0	0	0	$12,154,280
Subtotal - WGP Phase 1			$0	$0	$0	$0	$13,587,272	$90,934,308	$37,557,981	$121,320,008	$10,146,000	$0	$0	$0	$0	$273,545,568

Source: O'Hare Partners, based on cost estimate analyses by TOK, LLC, and AOR.
Prepared by: Ricondo & Associates, Inc.

Table B-2

Incremental Operating & Maintenance Expense Impacts (millions of 2001 dollars)[1]

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Project Analysis																																
OMP Phase I Airfield	[A]	$0.0	$0.0	$0.0	$0.0	$0.0	$4.8	$4.8	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$15.6	$0.0	$0.0	$0.0	$0.0
Master Plan Phase I[1]	[B]	$0.0	$0.0	$0.0	$0.0	$0.0	$5.4	$5.4	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0	$21.0

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Incremental O&M Impact by Proposed Runway																																
Runway 9L-27R	[A,B]	$0.0	$0.0	$0.0	$0.0	$0.0	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8	$4.8
Runway 10L-28R Extension	[A,B]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Runway 10C-28C	[A,B]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1	9.1
Total Incremental O&M Impact	**[A,B]**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**$4.8**	**$4.8**	**$15.6**	**$15.6**	**$15.6**	**$15.6**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**	**$31.7**
OMP-Phase 1 Terminal incremental O&M Impact																																
Satellite Concourse	[B]	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7	$4.7
WGP-Phase 1 Projects Incremental O&M Impact																																
Concourse K	[B]	$0.0	$0.0	$0.0	$0.0	$0.0	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6)	($0.6
Terminal 2 FIS Facility[2]	[B]	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.
Total OMP & WGP-Phase 1 DBO Projects	**[B]**	$0.0	$0.0	$0.0	$0.0	$0.0	$0.6	$0.6	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.4	$5.

Note:
1/ Totals may not add due to rounding.
2/ Source: Table 2-2 Terminal Functional Area Summary published in the Final Environmental Assessment for the World Gateway Program dated February 8, 2001.

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

Analysis of the 2004 O'Hare Master Plan Cost Estimates for the O'Hare Modernization Environmental Impact Statement

Prepared by:

Crawford, Murphy and Tilly, Inc.
for the

FEDERAL AVIATION ADMINISTRATION

Table of Contents

Introduction

The following three (3) memoranda to file summarize the review of the City of Chicago cost estimates presented in the 2004 Chicago O'Hare Master Plan (MP). This analysis of the MP cost estimates was conducted for NEPA purposes and is not intended to prejudge separate agency processes related to Letter of Intent (LOI) or Passenger Facility Charge (PFC) applications. This analysis was performed on each individual component contained within the MP and was provided to the FAA. These components include:

1) O'Hare Modernization Program (OMP);
2) Capital Improvement Projects (CIP);
3) World Gateway Program (WGP).

Memo To: File
From: Michael Doerfler
Subject: Analysis of Reasonableness in OMP Costs presented in the O'Hare Master Plan
Date: July 22, 2005

The FAA requested that CMT review the City of Chicago Master Plan Costs. This particular analysis reviews the costs associated with the O'Hare Modernization Program (OMP). The OMP, as presented in the Master Plan, was estimated at $6.6 billion in 2001 dollars. The original cost estimates were prepared by the City of Chicago's construction management team in January 2003 as stated in a June 1, 2005 memo to Mr. Phil Smithmeyer of the FAA from Ricondo & Associates. Included in this June 1, 2005 memo, was a summary of total costs inclusive of project and program contingencies as follows:

Summary of Total Costs in 2001 Dollars

Construction Costs	$5,146,200,080
Planning, Design, CM & PM	$589,000,795
Project Contingency	$686,083,349
Subtotal	$6,421,284,223
Program Contingency	$178,715,777
Total	**$6,600,000,000**

The documents provided by the City at FAA's request were helpful in providing a greater level of detail concerning the description of the component parts of the OMP portion of the overall project. The information provided was titled "O'Hare Modernization Program – Project Rollup", consisting of approximately 65 pages which summarized projected costs for the various major airfield development components of the OMP (conveyed in the June 1, 2005 email to Mr. Phil Smithmeyer of FAA from Shawn Kinder of Ricondo and Associates). Each component was further broken down into identified sub-component projects showing associated costs. The sub-component projects had supplementary breakdowns of the total Project Budget shown in the Project Rollup as well as "Estimate Detail" which identified what work items had been included in the cost estimate. CMT's analysis included reviewing the data for completeness and comprehensiveness followed by independent cost checks of selected project elements. Approximately 50 line items from "Estimate Summaries" were checked with approximate quantities and conservative unit prices based upon professional expertise, to determine reasonableness of the City's estimate. These line items represented approximately 50% of the total estimated OMP construction costs.

Initially, review of the information provided by the City involved analyzing the completeness and comprehensiveness of the listed program components and project work items. This review effort indicated that the opinion of probable cost, as presented, was sufficiently detailed and that the major work components and projects associated with the O'Hare Modernization Program were included in the opinion of probable cost provided by the City. Sufficient detail outlining the cost considerations for each major construction component was evidenced in the summary of total cost and validated the legitimacy of the projected costs. Further, a review of the cost summaries indicated that the estimated costs for the major work elements as presented in the Project Rollup Summary are comprehensive and reasonable with expectations of upward adjustments due to annual cost escalations subsequent to the 2001 base year used for the estimates.

Subsequent to the review for completeness and comprehensive inclusion of components, individual projects were analyzed for reasonableness of cost by order of magnitude cost estimate calculations. Order of magnitude cost checks were performed for various components to evaluate the reasonableness of the estimated costs for various components. Approximate quantity calculations and conservative unit prices were used for these checks of the reasonableness of the costs presented in the back-up cost information provided by the City.

Nearly 50 key components of the proposed construction were analyzed side by side. Of those components, CMT specifically analyzed several of the runways, which are essential components of the entire OMP and around which most other components are developed. Some buildings, jetways, roadways and specialty work items were analyzed to provide a wider spectrum to extrapolate the reasonableness and the validity of the estimate. The review was based on historical unit prices for similar airport and roadway construction work in the 2001 time period or other reasonable comparables. Below is a sampling, in tabular form, of some of the major project components comparing the OMP construction cost estimate with the order of magnitude checks done by CMT.

Side-by-Side Comparison of Key OMP Construction Cost Components

Airfield Geographic Area	Work Element	Budget Component	OMP Project Rollup Budget Component Est. Const. Cost	CMT Review
OMP North Airfield	Runway 9L/27R & Assoc. Taxiways	Runway Pavement & Shoulders	$20,934,000	$19,285,000
		Runway Blast Pads	1,173,000	1,116,900
		Runway Edge Lighting System	1,722,000	1,563,000
		Runway Centerline Lighting System	1,859,000	1,245,000
		Runway TDZ Lighting System	1,770,000	1,652,000
		Runway Guidance Signs	230,000	205,000
		Runway NAVAIDS	9,800,000	9,560,000
		New Taxiways	29,349,000	23,987,000
		Taxi Guidance Sign	216,000	457,000
		Taxi Edge Lighting Systems	3,816,000	3,210,000
		ATCT & Utilities	21,449594	26,910,000
	Runway 9C/27C & Assoc. Taxiways	Runway 9C Related Components	197,449,370	202,765,000
		Runway 9C/27/C Pavement & Shoulders	38,371,000	36,585,000
		Runway Centerline Lighting System		
		Runway Edge Lighting System	2,437,000	2,343,500
		Taxiway Pavement & Shoulders	97,698,000	100,417,000
		Taxiway Edge Light System	11,761,000	11,550,000
		Taxiway Guidance Signs	2,456,850	2,220,000
	Runway 9R/27L & Assoc. Taxiways	Earthwork	20,427,000	13,740,000
		General Drainage	12,310,000	6,650,000
		Runway Pavement & Shoulders	9,895,000	10,264,000
		Blast Pads	586,000	583,456
		Runway Edge Light System	1,139,000	756,000
		Runway Centerline Lighting System	785,000	690,000
		Runway TDZ Lighting System	1,008,000	916,000
		Runway NAVAIDS	6,995,000	7,010,000
		Taxiway Pavement & Shoulders	22,668,000	22,443,000
		North Airfield Subtotal	**518,314,814**	**508,723,856**
OMP South Airfield	Runway 10L/28R & Assoc. Taxiways	Relocate Irving Park Road & York Road Construction	33,228,000	34,377,500
	Runway 10C/28 C Related	Cargo & Maintenance Facility Relocation	147,510,660	130,712,880
	Runway 10C/28C & Assoc. Taxiways	Runway Pavement & Shoulders	37,435,000	37,654,000
		Runway Blast Pads	1,408,000	1,116,900
		Runway Edge Light System	2,418,000	2,417,000
		Runway Centerline Light System	1,924,000	2,184,000
		Runway TDZ Light System	1,770,000	1,652,000
		Runway Guidance Signs	366,000	500,000
		Runway NAVAIDS	8,872,000	9,560,000
		South Airfield Subtotal	**234,931,660**	**220,174,280**
OMP Western Terminal Complex	Western Terminal Complex Concourse & Apron	New Roadways & Related	55,228,000	41,500,000
		Earthwork	17,206,000	17,218,000
		Apron Pavement Section	52,836,000	49,552,100
		Edge Lights System	665,000	649,000
		Taxi Guidance Signs	63,000	160,000
	Narrow Body Concourse	Narrow Body Concourse Complete	247,003,550	237,553,000
		Passenger Loading Bridges	32,711,116	33,637,500
	Western Terminal-Terminal & Apron	Apron Pavement Section	63,918,000	59,674,000
		Terminal Wide Body Concourse	399,466,360	362,610,000
		Widebody Terminal T-7 Jet Bridges	8,696,840	9,750,000
	Parking Structure	Parking Garage	69,569,000	65,151,000
	People Mover	People Mover	311,363,000	496,780,000
		Western Terminal Complex Subtotal	**1,258,725,866**	**1,374,234,600**
Totals			**2,011,972,340**	**2,102,532,736**

In general, the cost breakdowns provided by the City appear to be reasonable and somewhat conservative in consideration of the magnitude of scale and relatively high production rates potentially achievable with large work areas and volume. For the line items examined, CMT's review for reasonableness is approximately 4.5% higher than the City's estimate. The City's estimate for the proposed people mover system was the major difference in the line by line analysis. CMT was able to find only a single comparable for review of this item.

The soft costs associated with the construction budget, the Design, Program Management, Construction Management/Field Supervision/Testing and Inspection represent a total of around 12.5% of the estimated construction cost on most work elements. One could expect a range from 12% to 15% for this soft cost depending on breakdown of projects and required effort by the program manager.

Project contingency factors as a percent of the construction budget varied from 10% on large paving projects, 15% on building related work, 20% on demolition and 30% for specialty construction. Due to the apparent level of effort and detail in preparing the program estimates, these contingencies appear reasonable.

A broad scale evaluation of the project costs for construction of the four new runways under the OMP was made comparing the OMP runways analyzed to new runways at five other large airports, Boston Logan, George Bush (Houston), Sea-Tac (Seattle), Hartsfield (Atlanta), and St. Louis Lambert.

Comparison of Estimated Project Costs for Similar Runway Projects at Other Airports

Airport	Major Runway Improvement	Project Cost Estimate (Runway and Taxiway Components)	Base Cost Year	Cost Per S.Y. of Runway Area
Boston Logan	5,000 x 150' Runway	$82,100,000	2002	$986
George Bush (Houston)	8,500' x 150' Runway	$144,000,000	2000	$1,017
Sea-Tac (Seattle)	8,500'x150' Runway	$364,000,000	1994	$2,569
Hartsfield Atlanta	9,000'x150'Runway	$653,366,000	2000	$4,356
St. Louis Lambert	9,000'x150' Runway	$376,000,000	2003	$2,507
Chicago O'Hare (OMP)	**Runway 10R/28L 7,500' x 150'**	**$232,164,896**	**2001**	**$1,858**
Chicago O'Hare (OMP)	**Runway 9C/27C 11,245' x 200'**	**$306,762,181**	**2001**	**$1,227**
Chicago O'Hare (OMP)	**Runway 9L/27R 7,500' x 150'**	**$400,533,743**	**2001**	**$3,205**
Chicago O'Hare (OMP)	**Runway 10C/28C 10,800' x 200'**	**$487,735,000**	**2001**	**$2,033**

Variations shown in the chart above could be the result of differences in supporting infrastructure such as drainage, fill material, or other ancillary project components. This variation can occur from airport to airport and also from runway to runway.

Based on the above numbers, costs for the runway components of the O'Hare OMP prepared by the City of Chicago appear to fall in the middle of the range of costs for large runway programs. The dollar estimates for OMP Runways, purely on a cost per square yard of runway to be built, would indicate that they are comparable to other programs.

In addition, CMT reviewed 1995 budgetary costs used for the Lambert St. Louis International Airport expansion as a comparison for some of the major terminal building and specialty work.

Overall, the City of Chicago OMP estimated costs for the base year 2001 appear to be reasonable and representative of the probable cost for the OMP in that year. For purposes of this review under NEPA, CMT has concluded that the estimated costs considered within this sample analysis are reasonable.

Memo to: File
From: Bruce Jacobson, Michael Doefler, Matt Demos
Subject: Review of Master Plan (MP) Capital Improvement Projects (CIP)
Date: July 20, 2005

The FAA requested that CMT review the City of Chicago MP costs. This particular analysis reviews the Capital Improvement Projects (CIP). This memo is developed to review the reasonableness of the City's representations in the MP for the CIP Costs for the OM EIS. **Attachment A** is a copy of page VII-24 from the Master Plan. The CIP costs are identified as follows:

(2003-2007) - $1,386,151,000
(2008-2020) - $2,742,121,000
Total $4,128,000,000

The City of Chicago provided a three volume set of the City's most recent CIP document entitled "Capital Improvement Program", O'Hare Cost Reports – Volumes 1,2, and 3, dated May 2005. These documents shall be referred to as CIP 5/05. These documents served as the basis for CMT's analysis of the CIP dollars presented in the MP. The proposed projects contained within the CIP 5/05 range in years from 1998 to as far out as 2012. An examination of the projects initiated in 2003 or later and planned through 2012 or sooner represents that the average annual CIP for O'Hare is approximately $114,000,000. See **Attachment B.**

This analysis is generated to compare the average annual CIP dollars set forth in CIP 5/05 against the CIP dollars presented in the MP. Because there is little specificity for the "Subsequent Years (2008 – 2022)" in the master plan, this analysis assumes that an ongoing program "essentially a repair and replacement program" will continue. Further, assuming that a build alternative is identified in the OM EIS and approved in the Record of Decision (ROD), the magnitude of an ongoing CIP, post OM development (2013), could likely be somewhat diminished because the airfield will be essentially new and requiring little, if any, repair or replacement.

The MP CIP for subsequent years (2008 – 2022) is presented as $2,742,121,000 and is escalated. An annual average for CIP would be approximately $183 million per year. Comparing the annual average CIP dollar amount presented in CIP 5/05 of $114 million against the $183 million per year presented in the Master Plan would suggest that the City has adequately budgeted for CIP in the Master Plan. Further, by extrapolating the average annual CIP dollars presented in CIP 5/05 of $114 million/year from 2008 – 2022 yields a total amount over the 15 year "Subsequent Years" (without escalation) of approximately $1.71 Billion. **Attachment C** has been added to reflect the average annual amount in 2004 dollars which could be available with escalation ranges from 1% to 4% applied to the $2,742,121,000 CIP Budget presented in the Master Plan.

When one examines the five year CIP (2003 – 2007) presented in the Master Plan there is some degree of specificity. However, as of the date of this memo there are only 17 months left on the five year CIP (2003 -2007) presented in the MP. In this analysis, it appears more prudent to consider the use of the information in the CIP 5/05 as more recent and representative of the actual value of the CIP as the City goes forward.

To conclude, the CIP dollars presented in the MP appear reasonable, if not somewhat high based upon more recent information presented in CIP 5/05. For purposes of this analysis under NEPA, CMT concludes that the estimated costs associated with the MP CIP are reasonable.

7.3.2 CIP Costs

The CIP addresses the Airport's facility needs and is essentially a repair and replacement program that ensures the Airport will be able to operate throughout the planning horizon. The 20-Year CIP includes the following types of projects: terminal support improvements, terminal improvements, airfield improvements, H&R system improvements, certain noise mitigation projects, fuel system improvements, and safety and security enhancements. The estimated cost for the 20-Year CIP is $4.1 billion in escalated dollars, as presented in **Table VII-3**.

Table VII-3
CIP Cost Estimates (Escalated Dollars)

	Project Cost ($000s)
Five-Year CIP (2003-2007)	
Terminal Support Improvements	$200,264
Terminal Improvements	425,622
Airfield Improvements	372,198
Heating and Refrigeration	102,761
Noise Mitigation Projects	37,305
Fueling System	98,934
Safety and Security	145,734
Planning and Other Projects	3,333
Subtotal – Five-Year CIP	$1,386,151
Subtotal – Subsequent Years (2008-2022)	$2,742,121
Total 20-Year CIP Cost (escalated dollars) 1/	$4,128,274

1/ Total may not add due to rounding.

Source: City of Chicago, Department of Aviation.
Prepared by: Ricondo & Associates, Inc.

7.3.3 WGP Costs

The WGP was conceived to expand gate capacity through construction of new terminal complexes and enabling projects and provide additional improvements within the Terminal Core Area. In December 2000, the City commenced work on the formulation of WGP Phase 1. In September 2002, in light of changed conditions in the industry and the economy, the City and the airlines agreed to suspend work on the WGP. The City's design-build contractor for the Terminal 6 Complex was directed to complete its 30 percent design submittal and demobilize. All other formulation work was suspended. Work will resume consistent with demand. The WGP is comprised of the following two phases:

- *Phase 1:* (1) construction of a new Terminal 6 Complex (including terminal and concourse facilities, curbfront and circulation roads, parking structure, realignment of terminal access roadways); (2) realignment of the ATS; (3) construction of a Concourse K extension; (4) Terminal 2 interior upgrades; and (5) reconfiguration of Taxiway A/B and construction of new Taxiway N.

CIP ATTACHMENT B

City of Chicago - Department of Aviation - Capital Improvement Program Active Projects as of May 2005				
No.	Approved Budget	Planning Start	Construction Complete	Approximate Cost/Year Over a Typical 5-Year Period(a)
1	$16,449,276	Jan-05	Jan-06	$3,289,855
2	$3,600,000	Nov-97	Dec-03	
3	$250,000	Oct-02	Dec-04	
4	$185,000	Jan-00	Jan-00	
5	$48,121,836	Apr-02	Oct-07	
6	$55,444,404	Mar-99	Mar-07	
7	$139,080,611	Aug-02	Jan-07	
8	$67,000	May-04	Oct-04	$13,400
9	$84,103,673	Sep-04	Feb-08	$16,820,735
10	$4,824,841	Jan-02	Sep-06	
11	$7,856,000	Apr-02	Jul-05	
12	$9,596,317	Nov-02	Jun-07	
13	$8,185,199	Aug-02	Sep-05	
14	$1,634,612	Apr-02	Jun-05	
15	$3,877,913	May-03	Feb-06	$775,583
16	$50,000	Jun-03	Apr-05	$10,000
17	$14,459,347	Dec-03	Dec-06	$2,891,869
18	$35,000,000	Apr-03	Aug-05	$7,000,000
19	$9,500,000	Nov-04	Nov-05	$1,900,000
20	$23,599,840	Jul-03	Feb-06	$4,719,968
21	$1,041,521	Oct-04	Feb-06	$208,304
22	$2,403,335	Jan-00	Dec-04	
23	$732,600	Jan-05	Nov-06	$146,520
24	$702,103	Jul-04	Nov-05	$140,421
25	$3,362,045	Aug-98	Jul-05	
26	$12,500,000	Jan-02	Dec-05	
27	$1,292,000	Feb-99	Nov-05	
28	$3,263,000	Sep-98	Sep-04	
29	$1,720,445	Feb-01	Dec-04	
30	$8,868,160	Oct-04	Jan-08	$1,773,632
31	$2,796,552	Jul-04	Nov-05	$559,310
32	$3,114,540	Oct-04	Dec-07	$622,908
33	$61,050	Jan-05	Apr-05	$12,210
34	$7,900,000	Apr-99	Dec-04	
35	$10,117,746	Jan-01	Dec-04	
36	$1,713,624	Jan-01	Dec-04	
37	$4,675,615	Aug-03	Aug-05	$935,123
38	$962,973	Apr-04	Jul-05	$192,595
39	$7,745,726	Oct-03	Oct-05	$1,549,145
40	$11,675,640	Jan-05	Dec-05	$2,335,128
41	$14,149,872	Feb-02	Sep-06	
42	$2,227,926	Jul-02	Jul-05	
43	$5,185,538	Jun-04	Feb-07	$1,037,108
44	$851,678	Jan-05	Oct-06	$170,336
45	$2,910,131	Oct-04	Jan-07	$582,026
46	$943,296	Jan-05	Oct-06	$188,659
47	$11,246,632	Dec-00	May-05	
48	$2,738,728	Apr-03	Sep-04	$547,746
49	$214,929	Apr-00	Dec-04	
50	$2,025,623	Apr-02	Jun-05	
51	$9,025,460	Aug-04	Apr-06	$1,805,092
52	$380,000	Jan-05	Dec-05	$76,000
53	$16,920,151	Dec-04	Dec-12	$3,384,030
54	$22,615,426	Feb-04	Dec-12	$4,523,085
55	$2,718,170	Feb-04	Dec-12	$543,634
56	$1,758,893	Feb-04	Dec-12	$351,779
57	$1,500,000	Feb-04	Dec-12	$300,000
58	$522,726	Feb-04	Dec-12	$104,545
59	$9,043,190	Feb-04	Dec-12	$1,808,638
60	$2,090,900	Feb-04	Dec-12	$418,180
61	$2,524,765	Feb-04	Dec-12	$504,953
62	$1,148,022	Feb-04	Dec-12	$229,604
63	$152,949,523	Mar-05	Dec-12	$30,589,905
64	$47,260,082	Feb-03	Dec-12	$9,452,016
65	$37,450,800	Feb-03	Dec-06	$7,490,160
66	$21,630,000	Dec-02	Dec-08	
67	$43,908,900	Jan-02	Dec-08	
68	$128,293,000	Oct-01	Jan-06	
69	$2,440,000	Oct-03	Dec-04	$488,000
70	$16,060,000	Oct-03	Dec-04	$3,212,000
TOTAL =	$1,115,268,905			$113,704,202

Notes: (a) Only the CIP projects initiated in 2003 or later, and planned through 2012 or sooner, were considered.
(b) Although some projects are planned to extend beyond a 5-year period, the total estimated CIP costs per year over a typical 5-year period yields a higher figure and was used for a more conservative approach.

Total number of CIP projects initiated in 2003 or later, and planned through 2007 or sooner =	28
Total estimated cost of CIP projects initiated in 2003 or later, and planned through 2007 or sooner =	$214,497,327
Total estimated cost per year of CIP projects initiated in 2003 or later, and planned through 2007 or sooner =	$42,899,465 /year (5-year period)
Total number of CIP projects initiated in 2003 or later, and planned through 2012 or sooner =	42
Total estimated cost of CIP projects initiated in 2003 or later, and planned through 2012 or sooner =	$568,521,008
Total estimated cost per year of CIP projects initiated in 2003 or later, and planned through 2012 or sooner =	$56,852,101 /year (10-year period)
Total estimated cost per year of CIP projects initiated in 2003 or later, and planned through 2012 or sooner =	**$113,704,202 /year (5-year period)**

CIP ATTACHMENT C

OMP VALUE OF 2008-2022 CAPITAL IMPROVEMENT PROJECTS IN 2004 DOLLARS

YEAR	RATE	COMPOUNDED RATE	ESCALATED AMOUNT
2004	1.04		
2005	1.04	1.04	
2006	1.04	1.0816	
2007	1.04	1.124864	
2008	1.04	1.16985856	$136,938,497
2009	1.04	1.216652902	$142,416,037
2010	1.04	1.265319018	$148,112,679
2011	1.04	1.315931779	$154,037,186
2012	1.04	1.36856905	$160,198,673
2013	1.04	1.423311812	$166,606,620
2014	1.04	1.480244285	$173,270,885
2015	1.04	1.539454056	$180,201,720
2016	1.04	1.601032219	$187,409,789
2017	1.04	1.665073507	$194,906,181
2018	1.04	1.731676448	$202,702,428
2019	1.04	1.800943506	$210,810,525
2020	1.04	1.872981246	$219,242,946
2021	1.04	1.947900496	$228,012,664
2022	1.04	2.025816515	$237,133,170
		23.4247654	$2,742,000,000
ESCALATED AMOUNT		$2,742,000,000	
2004 AVERAGE ANNUAL AMOUNT		$117,055,601	
2004 AMOUNT		**$1,755,834,020**	0.640

YEAR	RATE	COMPOUNDED RATE	ESCALATED AMOUNT
2004	1.03		
2005	1.03	1.03	
2006	1.03	1.0609	
2007	1.03	1.092727	
2008	1.03	1.12550881	$147,427,964
2009	1.03	1.159274074	$151,850,803
2010	1.03	1.194052297	$156,406,327
2011	1.03	1.229873865	$161,098,516
2012	1.03	1.266770081	$165,931,472
2013	1.03	1.304773184	$170,909,416
2014	1.03	1.343916379	$176,036,699
2015	1.03	1.384233871	$181,317,799
2016	1.03	1.425760887	$186,757,333
2017	1.03	1.468533713	$192,360,053
2018	1.03	1.512589725	$198,130,855
2019	1.03	1.557967417	$204,074,781
2020	1.03	1.604706439	$210,197,024
2021	1.03	1.652847632	$216,502,935
2022	1.03	1.702433061	$222,998,023
		20.93324144	$2,742,000,000
ESCALATED AMOUNT		$2,742,000,000	
2004 AVERAGE ANNUAL AMOUNT		$130,987,836	
2004 AMOUNT		**$1,964,817,543**	0.717

YEAR	RATE	COMPOUNDED RATE	ESCALATED AMOUNT
	1.02		
	1.02	1.02	
	1.02	1.0404	
	1.02	1.061208	
	1.02	1.08243216	$158,557,445
	1.02	1.104080803	$161,728,594
	1.02	1.126162419	$164,963,166
	1.02	1.148685668	$168,262,429
	1.02	1.171659381	$171,627,678
	1.02	1.195092569	$175,060,231
	1.02	1.21899442	$178,561,436
	1.02	1.243374308	$182,132,664
	1.02	1.268241795	$185,775,318
	1.02	1.29360663	$189,490,824
	1.02	1.319478763	$193,280,641
	1.02	1.345868338	$197,146,253
	1.02	1.372785705	$201,089,178
	1.02	1.400241419	$205,110,962
	1.02	1.428246248	$209,213,181
		18.71895063	$2,742,000,000
		$2,742,000,000	
		$146,482,570	
		$2,197,238,554	0.801

YEAR	RATE	COMPOUNDED RATE	ESCALATED AMOUNT
2004	1.01		
2005	1.01	1.01	
2006	1.01	1.0201	
2007	1.01	1.030301	
2008	1.01	1.04060401	$170,343,405
2009	1.01	1.05101005	$172,046,839
2010	1.01	1.061520151	$173,767,308
2011	1.01	1.072135352	$175,504,981
2012	1.01	1.082856706	$177,260,031
2013	1.01	1.093685273	$179,032,631
2014	1.01	1.104622125	$180,822,957
2015	1.01	1.115668347	$182,631,187
2016	1.01	1.12682503	$184,457,499
2017	1.01	1.13809328	$186,302,074
2018	1.01	1.149474213	$188,165,094
2019	1.01	1.160968955	$190,046,745
2020	1.01	1.172578645	$191,947,213
2021	1.01	1.184304431	$193,866,685
2022	1.01	1.196147476	$195,805,352
		16.75049404	$2,742,000,000
ESCALATED AMOUNT		$2,742,000,000	
2004 AVERAGE ANNUAL AMOUNT		$163,696,664	
2004 AMOUNT		**$2,455,449,964**	0.895

Memo to: File
From: Matt Demos
Subject: Review of Master Plan (MP) World Gateway Program (WGP) Cost Estimate
Date: July 23, 2005

The FAA requested that CMT review the City of Chicago Master Plan Costs. This particular analysis reviews the costs associated with the World Gateway Program (WGP). CMT conducted an order of magnitude review of the WGP cost estimate summary (in 1999 dollars) provided in Table VII-4, on page VII-25, of the City of Chicago's 2004 Master Plan for O'Hare International Airport (see **Attachment A).** The review by CMT indicated that the costs presented appear reasonable and representative of the probable costs for WGP in 1999, with expectations of upward adjustment due to annual cost escalations.

This review of the City's cost estimate was based on broad scale historical unit prices for similar construction work. Additionally, a comparison was made to similar projects (i.e., terminal buildings and associated facilities) at other major airports that have recently been constructed or are in the planning stages.

Upon review of the WGP project description and costs presented in the City's 2004 Master Plan, and in the 2001 Request for Letter of Intent (LOI) Funding Application (Section D.1 of Appendix D) for the WGP and related improvements, a cost comparison was made to other terminal building/facility projects currently planned or constructed at other major airports throughout the country (see **Attachment B**). Based on the comparison of average total cost/gate of WGP to these other terminal projects, which in almost all cases the WGP terminal project cost estimates were 2 to 8 times higher, it would appear that the City has adequately budgeted the WGP terminal projects in the Master Plan. Additionally, when a comparison was made to estimated total cost/square foot of terminal space, the results also suggest that the estimated WGP project costs were reasonable, if not conservatively high.

Two separate WGP cost estimates were presented, one in the 2004 Master Plan, and the other in the 2001 LOI application. However, the cost estimate presented in the 2004 Master Plan is more recent, and appears to more adequately reflect the current project components of the WGP. This is primarily due to the reduction in scope of the WGP since the LOI application, most significantly, the exclusion of the re-development of Terminal 2. However, the cost estimates in each document utilized the same project contingency rates as stated in the City's July 20, 2005 letter (see **Attachment C**), and included all applicable soft costs (i.e., architectural/engineering design, construction management, etc). A 20 percent contingency factor was used for *Hard Construction Costs* (measured quantities), and an approximate 15 percent contingency factor was used for *Delivery/Scope* contingencies.

Based upon the information provided by the City of Chicago in the 2004 Master Plan, the 2001 LOI Application, and the information presented herein, CMT concludes that for purposes of this analysis under NEPA, the estimated costs associated with the WGP (1999 dollars) are reasonable and representative of the probable cost for the WGP in that year.

- *Phase 2:* (1) construction of a new Terminal 4 including an FIS facility and (2) construction of a Terminal 2 FIS facility.

The WGP design included a reconfigured Terminal 2 with a new FIS facility. For the purpose of the Master Plan, this component of the WGP is not included (as discussed in Section 5.2) and the program cost is adjusted accordingly. However, such improvements to Terminal 2 are not precluded from future development.

The estimated cost of the WGP is approximately $2.6 billion in 1999 dollars, as shown in **Table VII-4.** The first full year of operation is assumed to be 2013.

Table VII-4

WGP Cost Estimates (1999 Dollars)

	Project Cost ($000s)
Airport-wide, Airfield, and Airside Projects	$243,830
Terminal 2 FIS Facilities	$78,680
Terminal 4:	
Enabling Projects	$99,130
Apron and Fueling	88,680
Roadway/Access/ATS	79,030
Terminal	639,490
Utilities	62,050
Subtotal – Terminal 4	$968,380
Terminal 6	
Enabling Projects	$70,560
Apron and Fueling	48,340
Northern Extension	108,980
Parking Structure	114,220
Roadway/Access/ATS	244,450
Tenant Relocations	35,510
Terminal	546,550
Utilities	184,300
Subtotal – Terminal 6	$1,352,910
Total WGP Cost (1999 dollars)	$2,643,800

Source: Landrum & Brown; Project components included in OMP Master Plan selected by Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

7.4 Financial Feasibility

This section demonstrates the City's ability to fund the Master Plan development. The implementation schedule contained in Table VII-1 was utilized for the purposes of demonstrating financial viability; however, actual financial strategies and plans will be determined during the implementation process. The following topics are presented in this section:

Costs of Planned/Constructed Terminal Building/Facilities Projects at Other Airports

Airport	Terminal Project	Year of Opening	Estimated Cost	Number of Gates	Area (Square Feet)	Estimated Cost/Gate	Estimated Cost/SF
Atlanta Hartsfield (ATL)	East International Terminal	2006	$982,000,000	10	1,200,000	$98,200,000	$818
O'Hare - WGP	**Terminal 6**	---	**$1,352,910,000**	**16**	**570,000**	**$84,556,875**	$2,374
O'Hare - WGP	**Terminal 4**	---	**$968,380,000**	**12**	**608,000**	**$80,698,333**	$1,593
Dallas-Fort Worth (DFW)	Terminal D - American/ International	2005	$1,200,000,000	28	2,000,000	$42,857,143	$600
New York (JFK)	Terminal 5 - jetBlue	2006	$875,000,000	26	625,000	$33,653,846	$1,400
New York (JFK)	Terminal 8/9 - American	2006	$1,400,000,000	56	2,200,000	$25,000,000	$636
Chicago-Midway (MDW)	New Terminal	2004	$927,000,000	43	N/A	$21,558,140	---
Boston Logan	Terminal A - Delta	2005	$500,000,000	22	686,000	$22,727,273	$729
Detroit Metro (DTW)	North Terminal	2008	$443,000,000	27	685,000	$16,407,407	$647
Detroit Metro (DTW)	McNamara Terminal/ Northwest World Gateway	2002	$1,200,000,000	97	N/A	$12,371,134	---
Baltimore (BWI)	Terminal A - Southwest	2005	$264,000,000	26	510,000	$10,153,846	$518

WGP ATTACHMENT C

RICONDO & ASSOCIATES

MEMORANDUM **VIA E-MAIL**

Date: July 20, 2005

To: Bruce Jacobson
Crawford, Murphy, & Tilly, Inc.

From: Shawn M. Kinder [ORIGINAL SIGNED]

Subject: WGP Cost Estimates

The Master Plan for O'Hare International Airport details those elements of the long-planned World Gateway Program (WGP) that are currently being proposed for implementation by the City of Chicago. These WGP elements are also illustrated on the October 2003 Airport Layout Plan. The costs for these currently-planned WGP elements are listed in Table VII-4 of the Master Plan.

As you are aware, the City of Chicago originally announced the WGP several years ago, and this program was the subject of an Environmental Assessment (EA). In addition to the EA, the City of Chicago submitted to the Federal Aviation Administration in February 2001 a Request for Letter of Intent (LOI) Funding for the WGP and related improvements. This Request for LOI funding document details the cost estimates for WGP and describes the soft cost assumptions, including contingencies, utilized in the estimates.

Appendix D of the February 2001 Request for LOI funding document describes the cost estimate assumptions. As stated in Section D.1, the *Hard Construction Costs* include quantities estimated with a 20 percent contingency. In addition, the various components include Delivery Contingency of approximately 6 percent and Scope Contingency of approximately 9 percent. In other words, the WGP costs estimates, as described in the February 2001 Request for LOI funding document, include contingencies of approximately 15 percent in addition to the unit quantity contingency of 20 percent. Figure D.1 of the Request for LOI funding document further describes the components of this cost estimate. Also, please note that the unit costs utilized in this cost estimate were based on historical costs of work at O'Hare International Airport, factoring in those costs relative to the Chicago market.

The WGP cost estimates described in the Master Plan are based on those cost estimates utilized in the February 2001 Request for LOI funding. The cost estimates in the Master Plan utilize the same contingency rates as those described in the Request for LOI funding document. As you are aware, some elements of the original WGP have been removed from the plans, and, thus, the overall scope has been reduced (most significantly, the Master Plan

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RICONDO & ASSOCIATES

and the October 2003 ALP do not include the re-development of Terminal 2). Note, the Master Plan costs are listed in 1999 while the Request for LOI funding document lists the total costs in escalated terms.

The WGP costs listed in the Master Plan include all applicable soft costs and contingencies. Thus, escalation of the Master Plan's $2,643,800,000 (1999) to current year dollars would include an escalation of the contingencies as well as all other hard and soft costs.

Please let us know if you have any questions or require additional information.

cc: M. Boland, OMP
P. Smithmeyer, FAA
M. Schneiderman, OMP
02-01-0215-01-4120
Read File

Crawford, Murphy & Tilly, Inc.

CMT has provided a full range of airport engineering and planning services to airports since 1946. The firm has performed such work at over 100 civilian and military airports in 20 states throughout the country. *Engineering News Record* (ENR) has ranked CMT among the top 25 aviation engineering firms in the nation since 1999.

CMT provides services to airport facilities of all sizes and is experienced in both civilian and military airport design. CMT's military experience includes being selected five times in a row by the U.S. Army Corps of Engineers to provide Indefinite Delivery Services for airfield pavements worldwide since 1992.

The 65 staff members of CMT's Aviation Services group consist of professional engineers focused exclusively on airport design and construction. Detailed cost estimates are a key element of project services provided by these individuals in the planning and design of airport projects. In addition to providing design and cost estimating services for several hundred airport projects over the past few years, these professionals assist several airports in the development of their 5-year capital improvement plans on an annual basis.

CMT's excellent track record of estimating construction costs for airfield-related development has been gained by focusing on logistical factors affecting construction phasing. This is especially critical at busy large hub or reliever airports where construction activities must be fine-tuned to minimize operational disruptions.

Familiarity with airfield construction and the ability to anticipate operational sensitivities have been factors leading to many awards for airfield-related projects.

CMT Facts

Established: 1946
Staff: 250
Offices: 9
Headquarters: Springfield, Illinois
Primary Business Organizational Units:

- Aviation
- Highways and Bridges
- Land Development
- Water and Wastewater

Appendix C

This appendix includes information related to the calculation of benefits obtained from consumer surplus. Appendix C: Adjustments of Benefits and Costs for Induced Demand, of the BCA Guidance, recommends that a BCA address the dynamic interaction of project benefits and costs and level of airport usage. The net benefits generated by an airport improvement investment will allow the airport to serve a greater portion of the unconstrained demand. The new users will benefit from the improvement; however, the increased demand at the airport generated by the new users may reduce the net benefits of the project to current users.

The BCA Guidance suggests the use of Consumer Surplus as a method to quantify benefits to passengers, while capturing the effects of increased demand. GRA prepared a document describing a methodology for the consumer surplus calculation. This document can be found (provided to the City) attached at the end of this appendix. Exhibit 3 of this document contains the basis for the mathematical calculation of consumer surplus. An example of how this exhibit was used by R&A to calculate consumer surplus is shown in **Table C-1** on the following page.

Table C-1

Example Calculation to Develop Benefits Stream

Col #	1	2	3	4	5	6	7	8	Arc Elasticity	9	10	11
GRA Inputs	Average Travel Time per Operation (minutes)	Value of Time per Minute	Base Case Value of Travel Time	Average Segment Money Fare	Base Case Full Price of Travel	Base Case Total Passengers (millions)	Scenario Total Passengers (millions) TAF unconstrained	Scenario Full Price of Travel	Calculation of "x" for col 8 x=elasticity*(col7+col6)/col7-col6)	Benefits to Existing Passengers ($ mil)	Benefits to Incremental Passenger ($ mil)	Total Benefits ($ Mil)
Source	Simulation Studies	FAA-APO-03-1 March '03	(1) * (2)	DB1a Database	(3)+(4)	Constrained No Project	Constrained Phase 1	col5*(1+x)/(1-x)	Elasticity Values - BCA Guidance	((5)-(8))*(6)	0.5*((5)-(8))*(7)-(6))	(9)+(10)
Year								1.18				
2001												
2002												
2003	137.65	0.54	73.65	220.05	293.70	65.22	65.22	-			-	0.00
2004	139.76	0.54	74.77	220.05	294.82	67.27	67.27	-			-	0.00
2005	141.87	0.54	75.90	220.05	295.95	69.39	69.39	-			-	0.00
2006	143.98	0.54	77.03	220.05	297.08	71.60	71.60	-	-		-	0.00
2007	146.08	0.54	78.15	220.05	298.20	72.44	73.89	293.2[illegible]	-119.41	358.81	3.58372793	362.40
2008	148.40	0.54	79.39	220.05	299.44	73.91	76.05	292.29	-82.74	528.62	7.65323971	536.27
2009	150.72	0.54	80.63	220.05	300.68	75.44	78.30	291.35	-63.40	704.36	13.3663183	717.72
2010	152.77	0.54	81.73	220.05	301.78	76.96	80.56	290.33	-51.69	881.52	20.6061721	902.13
2011	[illegible]		82.83	220.05	302.88	78.54	82.90	289.31	-43.66	1,065.26	29.6119431	1,094.87
2012	[illegible]		83.93	220.05	303.98	80.15	85.32	288.31	-37.80	1,255.81	40.490897	1,296.30
2013	[illegible]		85.02	220.05	305.0[illegible]	81.82	87.82	287.31	-33.35	1,453.44	53.3556129	1,506.79
2014	[illegible]		85.35	220.05	305.40	83.36	90.24	285.57	-29.81	1,652.86	68.1816957	1,721.04
2015	[illegible]		85.68	220.05		[illegible]4.95	92.73	283.84	-26.93	1,859.44	85.2580726	1,944.70
2016	160.76	0.54	86.01	220.05		[illegible]6.57	94.36	284.52	-27.42	1,864.73	83.9241349	1,948.66
2017	161.38	0.54	86.34	220.05		[illegible]8.24	96.22	284.72	-27.28	1,911.91	86.5005949	1,998.41
2018	161.99	0.54	86.66	220.05	306.71	89.95	98.12	284.92	-27.15	1,959.93	89.1113699	2,049.04
2019	161.99	0.54	86.66	220.05	306.71	91.38	99.99	284.21	-26.26	2,056.13	96.79[illegible]5965	2,152.93
2020	161.99	0.54	86.66	220.05	306.71	92.[illegible]	101.89	283.51	-25.43	2,154.88	[illegible]	2,259.81
2021	161.99	0.54	86.66	220.05	306.71	[illegible]	103.62	283.27	-25.17	2,211.49	[illegible]	2,320.37
2022	161.99	0.54	86.66	220.05	306.71		105.38	283.04	[illegible]	2,269.43	[illegible]	2,382.37
2023	161.99	0.54	86.66	220.05	306.71		107.17	282.80		2,328.67	117.155701	2,445.83
2024	161.99	0.54	86.66	220.05	306.71	98.64	109.00	281.86		2,451.81	128.677734	2,580.49
2025	161.99	0.54	86.66	220.05	306.71	99.92	110.63	281.39	-23.22	2,530.53	135.562256	2,666.09
2026	161.99	0.54	86.66	220.05	306.71	101.22	112.29	280.92	-22.78	2,610.84	142.710834	2,753.55
2027	161.99	0.54	86.66	220.05	306.71	102.54	113.97	280.45	-22.36	2,692.72	150.12972	2,842.85

Benefits

Values for "x"

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

ECONOMIC FRAMEWORK FOR ESTIMATING AIRPORT PROJECT BENEFITS

This memorandum provides information on how to apply economic principles to the estimation of airport project benefits. It focuses specifically on projects that enhance the capacity of the airports to process additional traffic and passengers. The methodology is briefly outlined in Appendix C, Section C.2 of: **FAA Airport Benefit - Cost Analysis Guidance** (December 15, 1999). In the appendix, the Guidance document suggests the use of consumer surplus as the appropriate measure of the benefits of a project. This is defined as the difference between what consumers must pay for a given level of service and what they would be willing to pay. In passenger transportation markets, the concept of full price of travel (FPT) includes the money price plus an increment representing the value of transportation time.

The rationale for this measure of consumer surplus in passenger transportation markets is straightforward. Consumer invests both money and time when consuming a transportation service. The rational consumer would purchase the service only in the event that the value (or consumer surplus) of the service exceeded both the money fare and the value of time.

In an airport context, the benefits of an airport expansion project might result in additional consumer benefits to both existing passengers and incremental passengers who would be able to utilize the facility as a result of the expansion. This is illustrated in the following exhibit, which was copied directly from page C-4 of the Guidance document. It shows a circumstance at an airport where congestion costs are rising rapidly. This is reflected in the very steep supply curves (S and S'). In the base case (before an investment is made), total passengers equal the amount Q, and the full price of travel is P. The consumer surplus in the base case would be the triangle P a D.

Exhibit 1

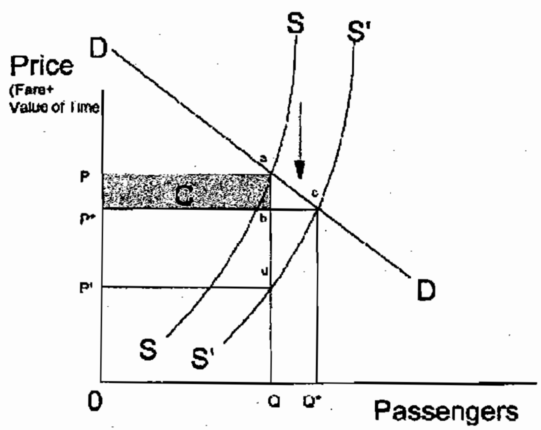

Figure C.2: Consumer Surplus With Radical Delay

Now suppose that an infrastructure program is undertaken so that the supply curve shifts to the right to S'. The infrastructure program makes it possible to provide service to passengers at a lower full price of travel at any level of demand (Q). For example, if demand at the airport remained at the initial base case equilibrium of Q, the

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cost to providing service would fall from P to P' – a very large reduction in the full price of travel which could be made up of both the reduction in the money fare (due to the lower cost of operating at the airport) and reduced travel time. But, as is typical in most markets, when there is additional supply (S') in the market place, and the price is falling, a new and higher equilibrium level of output will be reached (Q*). As a consequence, the new equilibrium price of travel with the additional infrastructure is P*.

It is important to note that as a result of the infrastructure improvement, both existing and new passengers gain consumer surplus. The gain to existing passengers is measured by the rectangle P P* b a. The consumer surplus realized by new passengers is described by the triangle a b c. The total benefits of the infrastructure project will be described by the polygon P P* c a. The existing passengers are better off because the full price of travel has fallen. Because the full price of travel has fallen, additional passengers can be accommodated at the facility. The benefits reflect changes in money fare and/or service time.

UNDERLYING ASSUMPTIONS PER THE GUIDANCE DOCUMENT

It is important to note that on page C-1, the Guidance document provides an important set of assumptions that are to be made in undertaking the analysis. Essentially, the assumptions are that airline markets are competitive so consumers realize the full benefits of reductions in both money fare and travel time that result from airport infrastructure projects. This means that by measuring consumer surplus in the way described immediately above, we will have captured all of the local benefits of the infrastructure projects. To the extent there are other benefits in the National Aviation System, these would not be captured using the consumer surplus measure described immediately above.

THEORY AND PRACTICE

The theoretical underpinnings for the measure of benefits (consumer surplus including value of time) discussed in the Guidance document is well established in the economics literature. Much of this literature was first developed in urban transportation to address the problem of deriving optimal tolls and investment guidelines in the presence of congestion on urban roads. The literature can be traced to the early work of Ellet (1840), DuPuit (1849), Pigou (1912), and Knight (1924) and also parallels the development of peak-load pricing in the public utility literature (Boiteux, 1949). Mohring and Harwitz (1962) developed the first formalized treatment of an optimal investment/pricing framework. The analytical framework demonstrates that optimal investment will occur when the marginal costs of an additional unit of investment in a facility (e.g., an airport) just equals the marginal value of the benefits to the users of the facility (including the money price and the value of time).

Morrison (1983) estimated a set of landing fees and investment levels for congested airports in the United States using this framework. The Department of Transportation utilized the same model to estimate consumer benefits in its own High Density Rule Study (1995).

More generally, most of the economic work on the effects of airline deregulation are based upon models that measure consumer benefits using the full price of travel framework (see, for example Morrison and Winston, 1986, 1989 and 1995).

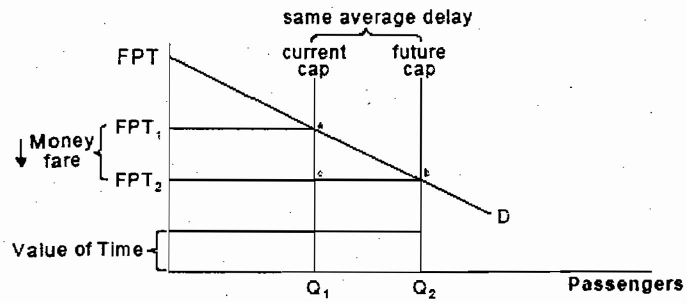
APPLICATION TO AIRPORT EXPANSION PROJECTS

One of the most important applications of this economic framework would be at airports that exhibit substantial congestion, including those that are slot constrained. At these airports, because demand exceeds available capacity by a wide margin, incremental expansions may result in increases in the number of passengers, but only modest reductions in observed delays. In these circumstances, it is important to value both the benefits to additional passengers and the benefits to existing passengers of the expansion using the framework described above.

To illustrate this problem, refer to Exhibit 2. Here, the base case shows Q_1 passengers and a full price of travel of FPT_1. There is a cap established at the airport that results in operations and passengers at levels below those that would otherwise be demanded. Now suppose there is an expansion project which, when it is completed, results in additional passengers being accommodated at the facility (Q_2) but at identical average delay. In this case, the expansion will have resulted in a reduction in the full price of travel. But because the delay experience in the two examples is identical (and because we are assuming that taxi and en route time are identical in the two cases), the value of time at the two equilibrium levels will be identical. As a consequence, the reduction in the full price of travel will have to have been brought about by a reduction in the money fare. That is, in order to induce additional demand, airlines would have to reduce their fares below the levels that would otherwise obtain without the project.

Exhibit 2

When Delay is Equal in Base Case and Scenario Cases



From an economics standpoint, this outcome makes sense. In order to induce additional demand, the full price of travel will have to decline. So, in cases where delay experience would be identical in both the base and scenario cases, the money price would have to decline to induce additional passengers to use the facility. The expansion has made possible the additional passenger output, but the incremental capacity will only be fully utilized if it is produced at a lower full price of travel.[1]

Although Exhibit 2 has been used to describe consumer surplus gains that result from an expansion project that may take several years to complete and where delay

[1] To the extent there is producer surplus in the base case, carriers would seek to preserve it in the scenario case and would not support the expansion unless this were the case. Our assumption is that because the carriers have supported an expansion, they will preserve any such producer surplus. Thus, the consumer benefit area FPT_1 a b FPT_2 represents a net increase in social surplus.

ultimately returns to its base case level, the same type of analysis can be applied to year-by-year comparisons of the full price of travel with and without the expansion project. In other words, Q_1 and FPT_1 could refer to the base case in, say, Year 5 if no project were undertaken, while Q_2 and FPT_2 could represent the expected results from Year 5 of the expansion project. In this context, the net consumer gain from the project in Year 5 would be the area FPT_1 a b FPT_2.

To make an analysis such as the one illustrated in Exhibit 2 operational, one needs to collect data that is typically available to analysts undertaking a benefit-cost study for the subject project. One such approach that is based on the year-by-year comparison method is illustrated in Exhibit 3. The analysis would be undertaken over the economic life of the project – typically 20 years. The analyst would construct both base and scenario cases in each year. From simulation models for the base case, one can collect information on the expected average travel time for passengers in each year of the analysis (column 1). Multiplying the average travel time by the FAA's prescribed value of time for passengers (column 2) results in an estimate of the base case value of travel time (column 3). To this, the analyst would add the average segment money fare for the airport (column 4) to develop a base case full price of travel. The analyst would also need a constrained passenger forecast reflecting the continuation of the cap in the base case (column 6).

Exhibit 3

Estimating Consumer Benefits Due to Infrastructure Expansion at a Congested Airport

ESTIMATING CONSUMER BENEFITS DUE TO INFRASTRUCTURE EXPANSION AT A CONGESTED AIRPORT

	1	2	3	4	5	6		7	8		9	10	11	12
	Average Travel Time per Operation (minutes)	Value of Time per Minute	Base Case Value of Travel Time	Average Segment Money Fare	Base Case Full Price of Travel	Base Case Total Passengers (millions)		Scenario Total Passengers (millions): TAF unconstrained	Scenario Full Price of Travel		Benefits to Existing Passengers ($ mil)	Benefits to Incremental Pax ($ mil)	Total Benefits ($ Mil)	PV of Total Benefits @ 7%
Source	Simulation Studies	FAA Critical Values	(1) x (2)	DB1a Database	(3) + (4)	TAF Constrained		Unconstrained TAF [1]	see footnote 2		((5)-(8))*(6)	0.5*((5)-(8))*((7)-(6))	(9)+(10)	PV in Year 201X
Year 1 2 3 . . 20														

1. The unconstrained TAF would be used up to the point where congestion reaches levels beyond which airlines are unwilling to schedule added flights
2. Col 8 -Col (5) *[(1+e)/(1-e)] where e = elasticity of demand * (col 7 + col 6)/(col 7 - col 6)
   Recommended values for elasticity of demand for these analyses can be found in the Guidance document on page C.2.

For the scenario case, the analyst would need an unconstrained forecast of passenger demand (column 7). In the case illustrated in Exhibit 2, demand would rise each year until the point where the expected delays per passenger would be identical in both the scenario and base cases. After that point, demand in the scenario case would be capped. Using the equation illustrated in Footnote 2 of Exhibit 3, the analyst would then derive the scenario full price of travel.

The consumer benefits in each year could then be developed in a straightforward manner by computing the area of the polygon FPT_1 a b FPT_2. These would then be discounted at a seven percent discount rate (per the Guidance document) to derive an estimate of total benefits over the investment life of the project in constant year dollars. These total benefits would then be compared to an estimate of the present value of total costs to determine whether the project was cost-beneficial.

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Sensitivity Studies

Ideally, the preceding analysis would be developed in an integrated way. For example, both the base case and scenario case demand forecasts would reflect consumers' reactions to the average expected delay and money price levels that will likely obtain in the future. But, often, demand forecasts in airport benefit-cost studies are either based on or taken directly from FAA Terminal Area Forecasts, which are typically unconstrained forecasts that do not directly take into account price elasticities or expected changes in the full price of travel. Regardless of the source of the forecast, it is useful to test the robustness of the results against relevant range values for the key parameters in the analysis. These are illustrated in Exhibit 4.

Exhibit 4

Sensitivities

1. Check the plausibility of the value of time and the money fare in the scenario case.
2. Evaluate the range of elasticities of demand over which the project is cost beneficial.
3. Evaluate the range of future demand in the scenario case over which the project is cost beneficial
4. Make alternative assumptions about future money fare levels and assess the effect on the project.

For example, the analyst will want to check on the plausibility of the value of time and the money fare in the scenario case. In the example illustrated above in Exhibit 2, the expected average delay will be identical in both cases. In such a circumstance, the full price of travel will only fall if the money fare falls. The analyst should assess whether the expected reduction in the money fare is plausible given market circumstances and experience.

Likewise, the analyst should assess the range of elasticities of demand over which the project remains cost-beneficial. Ideally, the outcome of the analysis will not be altered within the range prescribed in the Guidance document. That is, if a project were cost-beneficial at the average elasticities of demand shown in the Guidance document, the robustness of the results would be stronger if the same outcome were to occur throughout the whole range shown in the Guidance document.

Another approach that an analyst might take in evaluating the robustness of the results would be to assess the range of demand levels in the scenario case over which the project remains robust. To the extent that a project remains cost-beneficial at lower levels of demand in the scenario case than are projected in TAF or another independent forecasts, the resulting outcome is more robust.

Finally, the analyst might be concerned with future money fares in both the base and scenario cases. Since deregulation, average yield (fare divided by average stage length) has fallen continuously at approximately one percent per year. The analyst could make similar assumptions about the future and determine if the implied reduction in money fares in the scenario case remain plausible.

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Appendix D

This appendix addresses the calculation of the average money fare for calendar year 2004. Database Products, Inc. (Database Products) provided the average money fare. In order to obtain this fare, Database Products uses the DB1A database. This database contains a 10% sample of all reporting U.S. air carriers. Ai carriers are required to report if they fly aircraft with more than 50 seats. The marketing carrier reports this information. The carrier is required to provide the entire itinerary. This allows for much of the regional jet traffic to be captured. Also, some international traffic is captured in this manner.

Database Products also performs additional data processing to ensure data quality. For example they employ an algorithm to sort flights and break arrivals and departures into directionally logical itineraries. For example, an itinerary from Los Angeles to New York to Phoenix to Mexico would be broken between New York and Phoenix. Database Products also uses the T-100 database to normalize and improve the accuracy of the 10% sample obtained from DB1A. They also add additional data for non-reporting carriers not captured in the DB1A sample. Non-reporting carriers usually account for less than 1.0% of the data. This data is taken from the T-100 database or other commuter airline data.

Table D-1

Data for Calendar Year 2004

	Originating			Connecting			Total		
	Domestic	**International**	**Total**	**Domestic**	**International**	**Total**	**Domestic**	**International**	**Total**
Revenues	$1,817,979,280	$763,890,240	$2,581,869,520	$2,437,986,530	$3,138,515,999	$5,576,502,529	$4,255,965,810	$3,902,406,239	$8,158,372,049
O&D passengers	13,138,840	1,587,850	14,726,690	14,701,960	5,330,179	20,032,139	27,840,800	6,918,029	34,758,829
Average Fare	$138.37	$481.08	$175.32	$165.83	$588.82	$278.38	$152.87	$564.09	$234.71
2001 Dollars									$220.05

Note: Data converted to 2001 dollars using the CPI conversion

Source: Database Products, Inc.
Prepared by: Ricondo & Associates, Inc.

Appendix E

The February 2005 BCA presented, as Supplemental Information, analysis on the Total Master Plan. The Total Master Plan includes all of the OMP and World Gateway Program (WGP) projects detailed in the Airport's Master Plan and analyzed in the FAA's EIS.

Benefits accrued by the Total Master Plan were estimated using the consumer surplus method defined in this Supplemental BCA. The Unconstrained Forecast was utilized for the Scenario Cases (the Base Case is identical to that elsewhere in this Supplemental BCA), and all costs are consistent with those detailed for the Total Master Plan in the February 2005 BCA.

As in the other analyses contained in this Supplemental BCA, no downstream benefits or other benefits beyond those calculated through the consumer surplus method were accounted for; should those other benefits be accounted for, the BCR would be greater than illustrated in **Table E-1.**

Table E-1
Benefit-Cost Analysis Summary – Total Master Plan

	Benefits	Costs			Present Value				
Year	Benefits from Consumer Surplus	Project Construction Costs	Incremental O&M Expenses	Total Project Costs	Discount Rate Factor	Passenger Delay Savings	Total Project Benefits	Total Project Costs	Annual Net Present Value (Benefits-Costs)
2001	$0.0	$0.0	$0.0	$0.0	1.0000	$0.0	$0.0	$0.0	$0.0
2002	0.0	81.8	0.0	81.8	1.0700	0.0	0.0	76.5	(76.5)
2003	0.0	166.4	0.0	166.4	1.1449	0.0	0.0	145.4	(145.4)
2004	0.0	554.0	0.0	554.0	1.2250	0.0	0.0	452.3	(452.3)
2005	0.0	675.9	0.0	675.9	1.3108	0.0	0.0	515.6	(515.6)
2006	0.0	1,182.8	0.0	1,182.8	1.4026	0.0	0.0	843.3	(843.3)
2007	362.4	1,052.1	4.2	1,056.3	1.5007	241.5	241.5	703.8	(462.3)
2008	536.3	1,262.4	4.2	1,266.6	1.6058	334.0	334.0	788.8	(454.8)
2009	717.7	980.4	27.8	1,008.2	1.7182	417.7	417.7	586.8	(169.1)
2010	902.1	1,518.6	27.8	1,546.4	1.8385	490.7	490.7	841.1	(350.4)
2011	1,094.9	1,087.5	27.8	1,115.3	1.9672	556.6	556.6	567.0	(10.4)
2012	1,296.3	785.3	27.8	813.1	2.1049	615.9	615.9	386.3	229.6
2013	1,506.8	20.0	76.5	96.5	2.2522	669.0	669.0	42.8	626.2
2014	1,721.0	0.0	76.5	76.5	2.4098	714.2	714.2	31.7	682.4
2015	1,944.7	0.0	76.5	76.5	2.5785	754.2	754.2	29.7	724.5
2016	1,948.7	0.0	76.5	76.5	2.7590	706.3	706.3	27.7	678.6
2017	1,998.4	0.0	76.5	76.5	2.9522	676.9	676.9	25.9	651.0
2018	2,049.0	0.0	76.5	76.5	3.1588	648.7	648.7	24.2	624.5
2019	2,152.9	0.0	76.5	76.5	3.3799	637.0	637.0	22.6	614.3
2020	2,259.8	0.0	76.5	76.5	3.6165	624.9	624.9	21.1	603.7
2021	2,320.4	0.0	76.5	76.5	3.8697	599.6	599.6	19.8	579.9
2022	2,382.4	0.0	76.5	76.5	4.1406	575.4	575.4	18.5	556.9
2023	2,445.8	0.0	76.5	76.5	4.4304	552.1	552.1	17.3	534.8
2024	2,580.5	0.0	76.5	76.5	4.7405	544.3	544.3	16.1	528.2
2025	2,666.1	0.0	76.5	76.5	5.0724	525.6	525.6	15.1	510.5
2026	2,753.5	0.0	76.5	76.5	5.4274	507.3	507.3	14.1	493.2
2027	2,842.9	0.0	76.5	76.5	5.8074	489.5	489.5	13.2	476.4
2028	2,934.0	0.0	76.5	76.5	6.2139	472.2	472.2	12.3	459.9
2029	0.0	0.0	76.5	76.5	6.6488	0.0	0.0	11.5	(11.5)
2030	531.4	0.0	76.5	76.5	7.1143	74.7	74.7	10.8	63.9
2031	540.9	0.0	76.5	76.5	7.6123	71.1	71.1	10.0	61.0
2032	512.3	0.0	76.5	76.5	8.1451	62.9	62.9	9.4	53.5
Total	$43,001.3	$9,367.2	$1,649.4	$11,016.6		$12,562.1	$12,562.1	$6,300.7	$6,261.4
Plus: Salvage Value	$67.4						$12,629.5	$6,300.7	$6,328.8

Benefit-Cost Ratio of Project:	2.00

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