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ATTACHMENT E



Federal Aviation Administration

Memorandum

Date: NOV 17 2005

From: Bob Robeson, Manager, APO-200

A handwritten signature in black ink, appearing to read "Bob Robeson".

To: Joe Hebert, Manager, Financial Analysis Branch, APP-510

Subject: Clarification of APO Review of the Chicago O'Hare Modernization Program
Benefit Cost Analysis

Thank you for your memorandum of October 26, 2005, requesting clarification on several aspects of our review of the Chicago O'Hare Modernization Program (OMP Phase-1) Benefit Cost Analysis (BCA). As noted in your memorandum, there are four topic areas in which you would like some additional clarification. The areas are: 1) the use of changes in consumer surplus as an appropriate conservative approximation for changes in social surplus – the primary measure of economic benefit cited in the BCA; 2) the rationale for assuming that an operational cap would be required by 2016; 3) why one should expect the full price of travel to decline over the study period; and 4) how one should interpret the sensitivity tests reported in the BCA. Each of these topic areas is discussed below.

The use of changes in consumer surplus is an appropriate conservative approximation for changes in social surplus. As noted in our memorandum dated October 5, 2005, the supplemental BCA would typically need to consider both changes in consumer and producer surplus to measure changes in social surplus from the proposed project.¹ However, since air carriers are supporting the project, measuring changes in social surplus solely on the basis of consumer surplus is conservative and appropriate, as explained below.

To properly evaluate a capacity expansion project, such as the one proposed in the OMP Phase-1, one must recognize that there can be a transfer of surplus from the producer to the consumer. This transfer represents an increase in consumer surplus, but a loss to the producers. To

¹ A change in social surplus is comprised of changes in consumer and producer surplus. Consumer surplus is the amount that consumers benefit by being able to purchase a service for a price that is less than they would be willing to pay for it. Similarly, producer surplus is the amount that producers benefit by selling at a price that is higher than they would be willing to sell it for. Valuing the benefits of a proposed project based on changes in social surplus is at the heart of modern cost-benefit analysis and can be found in any cost-benefit textbook. A particularly useful discussion can be found in Broadman, A. et al., Cost-Benefit Analysis: Concept and Practice, (New Jersey: Prentice Hall, 2001).

determine the net societal impact, this transfer is typically ignored and only the net changes in consumer and producer surplus are considered. While measuring changes in consumer surplus is generally a straightforward exercise, measuring changes in producer surplus is significantly more difficult. As a result, most BCAs submitted to FAA's Office of Airports and subsequently reviewed by the FAA's Office of Aviation Policy and Plans do not attempt to measure benefits on the basis of changes in social surplus, but instead only rely on changes in passenger delay.

However, in the case where air carriers publicly support the project and accept a financial stake in the project, one need not estimate changes in producer surplus, but can rely solely on changes in total consumer surplus as a measure of the project's benefits. The reason for this is that because air carriers are supporting the project, their economic benefit must be at least as large as the amount of producer surplus they transfer to the consumer; otherwise, they would not have supported the project. As a result, using changes in consumer surplus as a measure of the project's benefits understates the benefits of the project and is a conservative estimate of the project's true benefits.

The rationale for assuming that an operational cap would be required by 2016. Our office was asked to conduct a review on the first phase of a two-phase modernization project at Chicago's O'Hare International Airport. For analytical purposes, the BCA for Phase-1 was conducted as if it were a stand-alone project. Any potential benefits and costs associated with the second phase of the proposed project were not considered, nor were they provided by the city. As a result, the analysis assumed that an operational cap would need to be put in place once average annual delays at the airport reach a level comparable to what was experienced in the base case. In reality, assuming that the second phase is cost beneficial and proceeds, the need to impose an operational cap by 2016 would not exist since Phase-2 of the modernization program would be completed by 2013. At that point there would be enough capacity to accommodate unconstrained demand.

The full price of travel would decline over the study period. To calculate changes in consumer surplus, a full-price of travel demand curve was specified. The demand curve was constructed based on a number of factors including the average segment money fare, total passengers in both the base case and in the scenario case, and the elasticity of demand. Using this information, a downward sloping demand curve was constructed. This demand curve represents the aggregate preferences of the traveling public flying in and out of O'Hare.² Assuming that the law of supply and demand holds and the initial base case operational cap is a binding constraint, as the cap is relaxed carriers will attempt to serve additional passengers at a lower price.³ The slope of the demand curve determines the rate at which the full price of travel will decline. For the purpose of this analysis, an elasticity of demand of -1.18 was used.⁴ This elasticity of demand was

² The standard textbook definition of a demand curve is that it represents a schedule of quantities that consumers would purchase at various prices. In the case of an airport, the quantities are seats and the price is full cost of travel including air fare and expected delay.

³ A more detailed discussion of this point can be found in FAA's Response to Robert Haveman 11/8/05 Affidavit and to Some Further Comments by Campbell-Hill 10/28/05.

⁴ The elasticity of demand measures the percentage change in quantity demanded of a good (or service) resulting from a given percentage change in the good's pricing, holding all other independent influences (income, price of related goods, etc.) constant.

estimated based on information contained in FAA's Airport Benefit-Cost Analysis Guidance, Table C2: Total Elasticity of Demand and weighted by the distribution of trip purpose (business and non-business) of passengers at O'Hare.⁵

Because the elasticity of demand is a critical parameter in the analysis, the BCA conducted a sensitivity allowing the value of this parameter to vary from -0.5 to -2.5. As the elasticity varies so too does the full price of travel as well as the benefit cost ratio. The BCA does not report how the full price of travel varies as the elasticity of demand varies. However, the BCA does indicate that, using an elasticity of demand of -1.18, the real money fare (ignoring delay costs) falls at an average annual rate of 0.43 percent per year from \$293.25 to \$280.45 during the period of analysis.

Interpretation of the sensitivity tests reported in the BCA. As noted above, it is necessary to derive a demand curve for the purpose of calculating changes in consumer surplus. The derivation of the demand curve relies on a number of critical parameters. Because none of the values associated with parameters are known with certainty, the BCA included a multivariate sensitivity tests to determine how changes in these critical parameter values would influence the benefit cost ratio. How one interprets the results of the sensitivity tables reported in the BCA is relatively straightforward. Each cell in the table represents a benefit cost ratio. As one begins to change the value of these parameters -- such as the elasticity of demand and the real money fare (see table A-12) -- the benefit cost ratio also changes. To ensure that the model used to estimate changes in consumer surplus is robust, the benefit cost ratio should remain above one as these parameter values change. In certain cases, the value of the benefit cost ratio may fall below one, and then the analyst must determine whether the suggested parameter values are plausible. If the Benefit Cost Ratio is above one, which appears to be the case for the majority of sensitivity tables reported in the BCA, then one can be fairly confident that the model is producing reasonable results and that the proposed project is cost beneficial within a range of plausible parameter values.

⁵ A detailed discussion of air travel demand elasticities can be found in Gillen, D. et al., "Air Travel Demand Elasticities Concepts, Issues and measurement, Final Report, November 6, 2002.