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## The Chicago O'Hare Expansion: A Case Study of Administrative Manipulation of Benefit-Cost Principles

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**The Chicago O'Hare Expansion: A Case Study of Administrative Manipulation of Benefit-Cost Principles**

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# **The Chicago O'Hare Expansion: A Case Study of Administrative Manipulation of Benefit-Cost Principles**

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## **1. Introduction**

The principles of benefit-cost analysis have their basis in theoretical welfare economics, and are now well accepted. Application of benefit-cost analysis as a tool for assessing the efficiency effects of public spending and regulatory initiatives is also accepted practice, especially at the Federal government level. However, the gap between the underlying principles and practice is very large, and the subject of concern by many observers. Indeed, the history of benefit-cost applications in the federal funding of public works projects is replete with examples of the failure of analyses to meet minimal accepted standards. Part of the problem stems from the absence of clear statutory and regulatory requirements for sound benefit-cost analysis; agency lack of resources, the limited demand from decision-makers for benefit-cost analysis, and political factors also contribute to this situation.<sup>1</sup>

In this paper, I will describe the application of benefit-cost analysis principles by the Federal Aviation Administration (FAA) to a major infrastructure investment proposal—the expansion of O'Hare International Airport. Chicago O'Hare Airport is one of the most important airports in the National Airspace System. It provides origin and destination service to the nation's third largest metropolitan area, as well as serving as an important connecting hub for American Airlines and United Airlines. O'Hare provides nonstop service to 127 domestic and 48 international destinations.

Most of us have experienced delays as we traveled through O'Hare as connecting passengers. Clearly, the sources of the delays and the dynamics among the variables relevant to understanding these sources are complex. It follows that any effort to alleviate the problem will have to address

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<sup>1</sup> See U.S. General Accountability Office, "Economic Performance: Highlights of a Workshop on Economic Performance Measures." GAO-05-796SP, July, 2005.

a wide variety of issues, and consider the benefits and costs of a large number of proposed alternative solutions to the problem.

The City of Chicago is proposing a major expansion of O’Hare Airport, which is but one of the alternatives solutions that have been proposed. The City uses the existing high level of passenger delays at the current airport—and the future expected (and unconstrained) growth in passenger delays—as the primary rationale for its proposal. This proposed expansion to O’Hare involves reconfigured and expanded runways, additional runways, additional air traffic support, redesigned and expanded terminals, and a new Western terminal. The full build-out master plan is currently estimated to cost in the neighborhood of \$20 billion.

In order to secure federal government financial support for the expansion, the City of Chicago is required to obtain approval of its funding request by the Federal Aviation Administration (FAA). An important component of the required application for federal funding is a benefit-cost analysis.

Hence, the FAA has the potential to be an exception to the long history of federal benefit-cost analysis applications that fail to meet minimal professional standards. Indeed, Congress has clearly mandated that benefit-cost Analysis be a central decision-making component of FAA’s funding decisions.<sup>2</sup> The FAA has responded to that Congressional command by clearly stating that no project will receive funding from FAA’s Airport Improvement Program (AIP) discretionary fund unless the project benefits exceed the project costs.<sup>3</sup>

While there are several phases of expansion prior to full build-out, the City is now requesting FAA subsidization and approval for the first phase of expansion, and the benefit-cost analyses that it has presented are pertinent to it. Phase I involves a substantial reconfiguration of runways

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<sup>2</sup> 49 U.S.C. §47115(d)(1)(B). “In selecting a project for a grant to preserve and improve capacity funded in whole or in part from the fund, the Secretary shall consider... (B) the benefit and cost of the project”.

<sup>3</sup> FAA’s *Policy for Letter of Intent Approvals Under the Airport Improvement Program* states that the agency must find that a project for which AIP discretionary funds are sought has economic benefits greater than the projects costs. “[T]he proposed project must have present value benefits that exceed present value costs...” 59 FR 54482 at 54484 (October 31, 1994) (emphasis added).

and associated infrastructure investment. The capital investment cost of this first phase is \$2.6 billion, and for planning purposes the expanded facility will be in place in 2007-9.

As this process has evolved, the City has released two, quite different, benefit cost analyses. The first, prepared and released in February, 2005, based its analysis of Phase I project benefits on a 'reduction in delay costs' framework. I will refer to this analysis as BCA-I. This analysis was critically reviewed by opponents of the O'Hare expansion plan (a group of villages and small towns surrounding O'Hare and subject to eminent domain loss of housing and business, and a set of religious groups whose long-standing cemeteries would be removed by the expansion). BCA-I was ultimately rejected by the FAA, largely on the basis of these critiques. In September, 2005, the City submitted a second benefit-cost analysis, designed to meet the critique of the earlier study. This analysis based on a totally different rationale, a 'consumer surplus' rationale. I will refer to this analysis as BCA-II. As expected, City finds positive net benefits attributable to the expansion in both reports.

FAA's recent application of benefit-cost analysis principles to the Chicago proposal provides a useful case study as to whether the agency is able to adhere to a responsible application of those principles to which it has stated allegiance in the case of a politically sensitive project. I will describe the analytic framework and empirical approach of both analyses, and summarize their results. I will also critique the conceptual and empirical approaches of both studies. I conclude that neither study provides an estimate of net national benefits that meets minimal accepted professional standards. In my view, the process is a classic illustration of an administrative 'bob and weave'—if strategy one fails to yield a convincing estimate of positive net benefits, just turn to a totally different justification and see if it flies. It also shows the danger of failing to consider the full range of options for meeting a problem, again a common shortcoming of administrative agencies committed to infrastructure expansion.

## 2. BCA-I

BCA-I, dated February, 2005, was based on the assertion that the expansion of O'Hare capacity according to the City's plans would generate large savings in travel times for passengers using O'Hare, and that these time savings, when given a value reflecting the time costs that individuals bear, would exceed the costs of the expansion.

The City's analysis of Phase I of the proposed expansion is stated to have a capital cost of \$2.6 billion, with the present value of the costs being \$1.9 billion. The present value of the benefits is stated to be \$4.1 billion (primarily, asserted reductions in the costs associated with travel time), yielding a net benefits estimate of \$2.2 billion and a benefit-cost ratio of 2.13.

While important issues arise with the estimates of both the benefits and the costs, it is the estimate of benefits that is the major issue. The City's benefit analysis is based on the standard concave relationship between marginal and average delay times (and delay costs) and levels of demand, in the face of limited capacity—delays and the cost of delays increase exponentially as the number of operations (flights) using the airport expands.

First, a forecast of traffic—the 2002 Terminal Activity Forecast (TAF)—was used to project both operations (flights) and passengers expected to travel to and from O'Hare with no constraint on the level of traffic or delay times. This forecast was taken to be the 'base case' or the no-action scenario. Using this traffic forecast, a standard delay time (delay cost) function was computed using a simulation model (the Total Airspace and Airport Modeler [TAAM] developed by a consulting firm for the purpose of analyzing the aircraft and passenger delays associated with varying levels of airport capacity). TAAM was also used to compute a delay time (delay cost) function for the airport, assuming that the expansion occurred—the 'with project case'.

In the attached Figure 1, the higher curve is the per operation delay cost (in minutes) function for the 'no action' case, and the lower curve is the function for the 'with project case.' The dates attached to curves indicate the times at which forecast traffic is expected to yield the stipulated average minutes of delay, given the existing and proposed (expanded) levels of capacity.

With these two curves in hand, the City made a particular assumption regarding the actual levels of traffic ‘without’ the project. Instead of allowing delays to build up along the top curve as traffic demand expanded, the City assumed that a particular ‘cap’ would be imposed on the level of traffic in the ‘no action’ case. In particular, the City assumed that the number of operations would be capped at 974,000 per year without expansion of capacity, reflecting an average delay of about 15.9 minutes, taken to be the “maximum acceptable” level of delay time. (This is, in fact, about the level of traffic that is currently handled at the airport.)<sup>4</sup>

Third, using this arbitrary assumption, the City calculated the savings in delay time due to the first phase expansion using the two delay functions. Using Figure 2, it can be seen how this is done. The cap (at 15.9 minutes) stops delays at the existing airport from increasing until the expansion comes on line in (say) 2009. Then, with the expanded airfield, delays fall by about 4 minutes per operation.

As a fourth step, the City then calculated for each year the product of this per operation savings in delay time (in hours), the number of operations using the airport, the number of

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<sup>4</sup> The FAA claims that traffic would cease growing at the airport when delays of this level are experienced. No economic analysis was done regarding this issue, and the level stipulated (15.9 minutes) is substantially greater than prior FAA statements regarding maximum economically acceptable levels of delay. For example, FAA Order 5090.3C FAA *Field Formulation of the National Plan of Integrated Airport Systems* states that an airport reaches annual capacity “when average annual level of delay is 4 minutes.” (Section 3-3, page 20) The City of Chicago itself acknowledged that FAA considers that “an airport is at its practical capacity when the average annual delay reaches a range of 4-6 minutes per operation.” (City of Chicago Application for an AIP Letter of Intent, March 2004) The Department of Transportation, in a 1995 report to Congress states: “There are no defined criteria that delineate acceptable versus unacceptable delays. FAA has historically regarded up to four minutes of AAW delay per operation to be an “acceptable” level...” In the absence of specific acceptability criteria for delays, a level-of-service scale has been developed to gauge the extent to which delays *will be tolerated* rather than accepted.

- 0 to 4 minutes of delay per operation: efficient overall operations; delays limited to the most extreme weather conditions.
- 4 to 6 minutes of delay per operation: less *efficient* overall operations; limited peak hour VFR delays along with IFR delays experienced in both moderate and extreme weather conditions.
- 6 to 8 minutes of delay per operation: increasing VFR delays in peak hours; increasing delays and eroding operational reliability in IFR conditions; high sensitivity to operational anomalies.
- 8 to 10 minutes of delay per operation: increasing VFR delays in peak hours with translation to shoulder hours in all but optimum conditions, high delay in IFR with resulting flight cancellations.
- Over 10 minutes of delay per operation: VFR operations experience increasing delays in peak periods and shoulder hours in all but optimum conditions; very high delays in IFR resulting in extensive flight cancellations.

(1995 DOT entitled “A Study of the High Density Rule” Report, Technical Supplement # 3)

passengers per operation, and a per hour value of time value adapted from FAA guidelines. This yielded the stream of annual savings in time costs. This annual delay reduction effect was then assumed to apply for the remainder of the life of the project (until 2029). The resulting annual delay savings were then discounted using a discount rate mandated by FAA guidelines, to yield the present value of benefits of the expansion of \$4.1 billion.

Figure 2 illustrates the nature of the “value of time savings” (in minutes) that was developed. The (white and yellow) shaded area beginning in 2009 and extending for 20 years (the life of the project) represents City’s estimate of the annual minutes per operation (about 4 minutes) saved because of the Phase I expansion. For each year, the minutes saved per operation was transformed into the number of passenger hours saved, and this value was multiplied by the dollar value of time, yielding the City’s estimate of the value of time savings benefits from the proposed expansion. This approach leads to a seriously exaggerated estimate of benefits.

First, the approach assumes that the reduction in average delay time that is estimated to be experienced in the first year after the expansion persists over the lifetime of the investment. As Figure 2 indicates, given the traffic forecasts used, average delay time will increase over time after the expansion. This is shown by the dates placed on the lower of the delay functions in Figure 2. By 2013, average delays are projected to return to the 15.9 minute threshold, using the 2002 traffic forecasts used in the analysis.<sup>5</sup>

This increase in delay times will erode the large per operation savings in delay time (4 minutes) suggested by the City. Indeed, per operation delay savings will be exhausted within a few years after the expansion is in place (2013). In fact, when the increased taxi times experienced at the expanded and reconfigured facility are accounted for in the analysis, delay time is expected to reach the 15.9 minute threshold in 2011.<sup>6</sup> Indeed, if more recent traffic

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<sup>5</sup> It is likely that average delays of 15.9 minutes will be experienced prior to 2013, when the increased taxi times associated with the Phase I expansion are factored into the analysis.

<sup>6</sup>The City justified the decision to NOT account for the delay costs associated with added operations that could be handled with the expanded airfield by stating that these effects would be ‘difficult to quantify.’

forecasts are employed, travel times at O'Hare are likely to reach the assumed 15.9 minute threshold virtually on opening day of the new facility. At best, the savings in delay costs would be represented by the white 'triangle' in Figure 2.

Moreover, this approach neglects the fact that airlines adjust to increased delays (just like they adjust to congestion charges) by shifting some of their flights to less-crowded times (thereby, relieving peak congestion and cutting delays), increasing aircraft size, and shifting some of their through flights to other airports. Hence, delays in the 'no action' case would not build up in real time as the curves in Figure 1 suggest. Failure to account for such adjustments leads to both overstating the reduction in delay times immediately after the expansion comes on line (which reduction was assumed to persist for the subsequent 20 years) and understating the date when the existing facility and the Phase I expansion will be at capacity.

In addition to this basic critique, a number of other assertions in the City analysis appear questionable. These were identified in a report prepared for the set of communities surrounding the existing airport by a research firm that specializes in the analysis of airline industry—The Campbell-Hill Aviation Group (CH). In addition to providing a critique of the basic benefits analysis, the CH study identified numerous other ways in which the City analysis deviates from commonly accepted principles of benefit-cost analysis. These include:

1. Failure to consider alternatives other than infrastructure expansion (e.g., congestion pricing, demand management, increased use of other regional airports, construction of a second Chicago airport) as a means of handling increased air travel demands in the Chicago/Midwest area.
2. Use of the 2002 traffic forecast, when 2003-04 forecasts are available. Use of the more recent forecast yields both lower benefits and higher costs.
3. Failure to consider in the analysis the potential effects of risky or uncertain events (e.g., the possible failure of United, which is the largest hub user at O'Hare), which would lower net benefits.
4. Ignoring the effect on traffic demand of the increased airfares caused by the anticipated charges to be imposed on air carriers using the expanded facility (due to their participation in the financing of the expansion).

5. Use of an arbitrary quantity cap (974,000 operations per year), rather than a minutes-of-delay cap that would reflect actual demand-limiting, cost-based impacts on airport users.
6. Failure to discuss, much less quantify, environmental costs of the expansion.
7. Use of a de minimus contingency allowance for costs.
8. Ignoring interest expense during construction.
9. Failure to assess the additional roadway and terminal costs associated with the proposed expansion.
10. Arbitrary multiplying the estimated reduction in delay costs for passengers using O'Hare by 1.8 to reflect 'downstream' effects of the O'Hare proposed expansion.

The CH study reanalyzed the benefits and costs of the Phase I expansion, using the City's own data, and presented estimates of benefits and costs associated with the Phase I expansion that account for these shortcomings. When the 2002 traffic forecast used by the City is maintained, net benefits fall from the City estimate of \$2.2 billion to a negative \$4.0 billion, and the benefit-cost ratio falls from 2.1 to -1.1. Even larger reductions in net benefits result when more recent (2003-04) traffic forecasts are used.

### **3. Between BCA-I and BCA-II**

Critiques of BCA-I—including the Campbell-Hill study—were submitted to the FAA on June 6, 2005. Between that date and September, 2005, the FAA provided guidance to the City on how to respond to the criticisms of BCA-I, and “to ensure the correct application of the alternative methodologies.” During that period, a decision was made to abandon the ‘savings in delay costs’ basis of BCA-I, and to move to an entirely different rationale for providing economic justification for the proposed project. In the words of the FAA: “The benefits estimated under the previous approach are artificial and would never have been realized.” The City responded to this conclusion and to the FAA guidance, and with the help of a consulting firm, presented a brand new benefit-cost analysis, BCA-II, released on September 27, 2005. According to the FAA, that analysis “utilized a consumer surplus analysis as outlined in ... the FAA's Airport Benefit-Cost Analysis Guidance, December 15, 1999.”

#### 4. BCA-II

In the City’s BCA-II analysis, virtually no “savings in delay costs” are claimed; nearly all of the benefits are attributed to ‘Consumer Surplus.’ The following summarizes the benefit cost results. The relevant analysis is for the Phase I, Master Plan, and as can be seen, the new approach produced a benefit-cost ratio of 4.6.

##### Summary of Results from Benefit Cost Analysis-II

Scenario	Present Value Benefits (billions)	Present Value Costs (billions)	Net Present Value (billions)	Benefit-Cost Ratio
OMP Phase 1 Airfield	\$12.4	\$1.9	\$10.4	6.3
<b>Master Plan Phase I</b>	<b>\$12.4</b>	<b>\$2.7</b>	<b>\$ 9.7</b>	<b>4.6</b>

(Base year: 2001; dollars: 2001)

This new BCA, resting on the conventional consumer surplus concept, sought to evaluate the benefits to demanders (i.e., passengers) from changes in the supply (and related price) of airline services in the Chicago market attributable to the proposed Phase I expansion.<sup>7</sup>

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<sup>7</sup> Over 90 percent of the \$12.4 billion of benefits is attributable to calculated consumer surplus; the remaining 10 percent are attributed to travel cost savings. One would think that after the Phase I project reaches the same level of delay as the base case, and limits on operations (and thereby passenger traffic) are imposed, there would be no savings in the value of travel times. Indeed, the central assumption of Chicago’s and FAA’s consumer surplus analysis is that both the base case and Phase I would have the same delays. However, the City finds these savings through its reliance on the Total Airspace and Airport Modeler (TAAM). This model suggests that the airlines will simply add numerous short haul flights and change the timing of the flight schedules so that reductions in travel times will result when compared to longer-haul flights. These additional operations are then credited to the proposed airport expansion, and the expansion project is then credited with some savings in the value of travel time.

There are a number of serious errors in this approach. First, the traffic forecasts and the TAAM based savings are justified by asserting that they reflect the continuation of existing trends, and hence unrelated to the expansion of O’Hare. Second, TAF traffic forecast that is used by the City assumes that the passengers represented in the forecast will be paying the same full price of travel (airline fares plus delay times) with both the existing airport and the proposed expansion. However, in calculating the consumer surplus benefits, the City postulates a substantial decrease in the fares airlines will charge their passengers in response to the expansion. These postulated fare decreases will surely have some effect on the traffic that would be forecasted to use O’Hare. Indeed, with lower fares asserted to be generated by the expansion, it follows that forecasted traffic would most likely be larger with the expansion than the City’s 2002 TAF-based forecast. In this case, traffic with the expansion would grow faster than is indicated in the with-expansion forecast, and hence the limitations on operations would have to be imposed sooner after the expansion, eroding the asserted with-expansion savings in travel times.

Implementation of the consumer surplus framework in estimating the national economic benefits of a change in capacity to an existing public infrastructure requires careful consideration of a number of issues. In the following, I will describe and then critique the benefits estimate of the City of Chicago resting on this concept. I will conclude that Chicago (and the FAA, who assisted in the analysis) failed to attend to these issues, and that the claims made are deeply flawed.

While the consumer surplus approach and its application to the proposed Phase I expansion can be discussed in both numerical and conceptual terms, Chicago and the FAA use a conceptual graph to visually illustrate the consumer surplus benefits which Chicago claims for Phase I (and later for Total OMP Master Plan). I have labeled this graph Figure 3.

Central to the theoretical consumer surplus economic model envisioned in BCA-II is the assumption that the market for ‘operations’ into and out of O’Hare is perfectly competitive. In such a market, when a cap is imposed on the amount of the service that can be supplied, the full price is determined by the willingness to pay for the service by the marginal passenger when the cap is just met. Given a downward sloped demand curve, if the cap is expanded, more passengers will be able to be served, and the marginal passenger will have a lower willingness to pay. Hence, the full price of travel (FPT) will fall because of the expanded cap.<sup>8</sup>

This process is depicted in Figure 3, which shows how an expanded cap results in a lower price (FPT), which must be the result so long as the demand curve (a willingness to pay schedule) is sloping downward and to the right. In this situation, the competitive prices shown in the graph,  $FPT_1$  and  $FPT_2$ , are determined where the available capacity is equal to the demand curve. These prices reflect the willingness of buyers to pay for the last unit of the available supply.

This money fare reduction benefit which the City attributes to the Phase I project is shown in Figure 3, as the area bounded by  $FPT_1$ ,  $FPT_2$  and points a and b, which is the full shaded area. In

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<sup>8</sup> For example, in the year 2007, a fare decrease of approximately \$4 per passenger is calculated, and this value increases over time.

the City's calculation, the discounted present value of these consumer surplus benefits equals 90 percent of the total benefits claimed for Phase I.

This shaded area is, in fact, composed of three components:

- 1) the consumer surplus benefits for existing buyers (the lined area in Figure 3),
- 2) an offsetting loss of producer surplus benefits associated with these same buyers, and
- 3) a consumer surplus benefit for additional buyers who are able to enter the market because of the presumed lower price (the shaded area abc in Figure 3).

Consider these in turn. First, to the extent there is a lower price due to the expansion, existing buyers (passengers) will gain consumer surplus benefits because of this fall in price. However, and second, this lower price will have a fully offsetting effect on the sellers of the service (the airlines). They will lose producers surplus, and their loss will be precisely and exactly equal to the gain in consumer surplus by the passengers. On balance, there is no national benefit that can be claimed from the reduced price affecting existing passengers, as the consumer surplus claimed for these passengers is precisely offset by the loss of producer surplus benefits.<sup>9</sup> Third, the lower full

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<sup>9</sup> Chicago apparently recognized that the increase in consumer surplus on existing passengers will be offset by a decrease in producer surplus. In the GRA consultant report that is a part of BCA-II, the existence of this offsetting producer surplus is noted. However, the BCA-II states (without empirical foundation) that carriers will in fact succeed in avoiding this loss of producer surplus:

“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.”

In their discussion, the FAA cites several economic factors that purportedly could explain why the airlines (primarily, United and American) can “preserve” producer surplus, and hence are willing to support the expansion. These factors include an assertion that the expansion will enable the airlines to: 1) experience economies of scope and density, and 2) increase their flight frequency (which is asserted to be more profitable than adding seats to existing flights). These arguments rest on a model of the structure of the market which is dramatically inconsistent with the perfectly competitive model that is the basis of the consumer surplus analysis and for FAA's central conclusion. The FAA cites the following: 1) “O'Hare is the site for two major airline hubs”, 2) These hubs are “undersized”, 3) Carriers desire to “increase their market share”, 4) The two large carriers at O'Hare are concerned that “competitors are adding capacity at their major hubs...”, 5) These efficiencies will allow the “two large carriers ... to gain [market] shares and compete with their rivals”. All of these points suggest that these major carriers have market power, and behave strategically with respect to their rivals. Essentially the FAA argument being made here is that United and American can increase the size of their hubs at O'Hare, and hence increase market share at the expense of their rivals, and hence increase their profits, and that is why they support the expansion.

The FAA has not demonstrated that such economies are available. To offer such a demonstration it would be necessary to have a full network model of the US air traffic system with demands at various markets

price will lead to some additional passengers using the airport. For these additional passengers—those represented by moving down the demand curve from the prior higher price—the full price they would be willing to pay will be lower than the pre-expansion full price. As a result, they will experience some consumer surplus benefits.

Now, the core problem with the City’s estimate is that it counts both sources of consumer surplus benefit (the lined area and shaded area abc in Figure 3), but ignores the offsetting loss of producer surplus benefits that will be experienced by the airlines. When one accounts for this error, the level of total consumer surplus benefits is limited to those benefits accruing only to the additional buyers (passengers in this case) who are willing to pay more than the lower price but less than the higher price (only area abc in Figure 3). When this is recognized, the consumer surplus benefits claimed by the City fall dramatically.

However, the City’s analysis of consumer surplus benefits also has other serious problems. A second serious problem is that the projected fall in the full price of travel calculated by the City is excessive, and hence generates larger consumer surplus benefits for both existing and additional passengers than is warranted. The City’s calculated full price decrease derives from an assumed elasticity for the demand curve of passengers for the use of O’Hare. In particular, the City uses an elasticity that is appropriate for use in a national market, but not in a local market where there are a number of very close substitutes to the services provided by the local supplier (in this case,

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specified and the costs of suppliers and of various flight and craft size (among other things) fully specified. Further, these density gains are the gains to the two major carriers at O’Hare, who would be able to “recapture some lost passengers” from other carriers. These gains to the major O’Hare carriers are losses to the other carriers, and from a national economic perspective the net effect is zero. FAA’s claim that the expansion can enable airlines to increase flight frequency, and hence “increase their market shares” and their “returns” is supported by a paper by Wei and Hansen, “Impact of Aircraft Size and Seat Availability on Airlines Demand and Market Share in Duopoly Markets.” Importantly, this analysis is for a ‘duopoly,’ and hence is inconsistent with perfect competition assumption that underlies the consumer surplus framework of Figure 3.

O'Hare airport). For such a local market, the appropriate elasticity value implies a much flatter-shaped demand curve than that suggested by the City.<sup>10</sup>

With a more elastic demand curve, the price reduction associated with the larger cap would be much less than that claimed by the City. With a more appropriate smaller estimated price decrease, the consumer surplus benefits for the additional passengers would be substantially smaller than that estimated in BCA-II.

A third basic problem inheres in the interaction of the claimed price decrease with the traffic forecasts that are used by the City. The City created two new forecasts in doing BCA-II (that for the base case and for the Phase I expansion), neither of which take account of the effect on traffic into and out of O'Hare due to any possible reduction in delay times or any possible reduction in fares. In effect, the City accepted forecasts that were developed for wholly different reasons and on wholly different economic and analytic premises, and applied them to the consumer surplus analysis without regard the effect on traffic of any price (airline fare) decreases that might be associated with the expansion.

Given the City's very large (and exaggerated) projected decrease in price associated with the expansion, it is inconsistent and wrong to continue using a forecast that fails to account for this asserted price decrease. Stated simply, if the primary benefit of the expansion (consumer surplus) claimed by the City depends on traffic forecasts which themselves depend on the asserted price decrease that generates the forecast, the interdependence of the forecast AND the asserted price decrease must be recognized and built into the estimate. In short, any reliable forecast of traffic must reflect the additional traffic generated by the price decrease which the City claims is a result of the expansion. If the forecasts do not reflect these increases in additional traffic generated by

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<sup>10</sup> The elasticity measure that the City uses (-1.18) implies a substantial decrease in the full price of travel, and hence additional induced traffic. A more appropriate, more elastic demand curve would generate an even larger increment to traffic. Any 'modeled' lower price would increase the projected future traffic, and hence result in the imposition of the cap sooner after the expansion. This revised cap would alter both the estimate of any savings in delay times and any gains in consumer surplus.

the asserted reduction in the cost of travel, they are inconsistent with the consumer surplus model that is relied upon.

Finally, it should be noted that the perfect competition market framework asserted to underlie the analysis has no empirical support. There are a relatively small number of air carriers servicing the Chicago regional market, and a few carriers dominate the supply. It would be more appropriate to classify the market for airline services in the Chicago region as an ‘oligopolistic’ market, in which producers strategize so as to optimize their own position, given an assumption regarding decisions made by their rivals given the regulatory environment. (This is especially true of that even more limited market—O’Hare airport.) Such suppliers make a wide variety of policy decisions regarding fare structures, flight schedules, flight times, plane sizes, airport usage, etc. in response to a cap or quota or any other institutional arrangement.<sup>11</sup>

It is inconceivable that, in such a market, any expansion of airport capacity could or would, by itself, bring about a fall in fares of the magnitude suggested by the City analysis that was unconnected to the costs of the producers (the airlines). Indeed, in such an oligopolistic market, it

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<sup>11</sup> Evidence that airline services in the Chicago market are not accurately described by this perfectly competitive market structure model abounds. This market is characterized by a variety of complexities regarding public regulation, the concentration of supply in a limited number of producers, long-term lease agreements, and the strategic considerations weighed by existing (and especially dominant) suppliers regarding market contestability (potential competition from other markets and suppliers). In such a complex market, the strategic decisions of suppliers interact with regulations (quotas, caps) to determine prices, outputs, the composition of outputs (think flight frequency, plane size, origin-destination configurations, etc.), and hence any possible profits or ‘rents’. Indeed, the Department of Transportation has issued a study which shows that hub carriers at dominated hubs extract price premiums from consumers: “From a consumer perspective, the primary disadvantage of network hubs is the level of market power that the hub carrier is capable of amassing and the higher prices consumers pay as a result. This stems from the fact that no airline with a similar cost structure can compete effectively at another airline’s hub. DOT and others have reported on the prevalence of high fares paid by passengers at hub airports dominated by a network carrier; indeed, no credible study concludes otherwise....It is the view of some, including the Department, that high fares at dominated hub airports are, in large part, a result of the market power exercised by network carriers at their hubs”

Another DOT publication claims: “...Thus, the high fares at hubs are related to an absence of effective price competition, not quality of service.” “...to the extent dominant hub carriers have market power, they can not only charge higher prices, but also control capacity, keeping it at a lower level than would prevail in a competitive market. Carriers with market power typically do not add capacity to accommodate low-fare demand.” “Clearly, the lack of price competition, not costs, is what drives high prices in hub markets.” “...barriers to entry at dominated hubs are most difficult to surmount considering the operational and marketing leverage a network carrier has in its hub markets.”

is the costs of the producers that ultimately determine changes in price (fares). Hence, any expansion of O'Hare could only influence the price of travel through O'Hare if it affected the costs of the producers (the airlines) which service O'Hare. A proper economic analysis requires empirical evidence of the anticipated cost reductions experienced by the airlines, which savings could be the basis of a fare reduction.

In fact, the analysis put forth by the City implies that fares will increase and not decrease. BCA-II indicates that the expanded and reconfigured airfield will result in substantial increases in taxi times between terminals and runways. These are cost increases resulting in increases (and not reductions) in the full travel price. Moreover, as part of the City's plan, a share of the financing costs of the airport will be directly borne by the airlines, and these too are cost increases that will result in increases (and not reductions) in the full price of travel. Rather than the expansion of O'Hare leading to decreases in the full travel price of using airport (as the City's inappropriate consumer surplus model posits), the expansion would appear to lead to increases in airline costs, exerting upward pressure on the full price of travel at O'Hare.

In sum, a proper economic analysis cannot use a perfectly competitive short-run model to claim consumer surplus benefits in response to increased airport capacity, when in fact the true market structure bears little resemblance to the theoretical model. In such textbook models, increases in capped supply can result in immediate and short-run price decreases that are not reflected in cost decreases. However, even in such artificial markets such price decreases will not persist over time; over the longer-run any price change will reflect changes in costs. In a real world market with few producers, any increases in infrastructure expansion will result in price decreases only if the expansion results in verifiable and measurable cost decreases. Hence, empirical evidence that there would be actual cost savings (*i.e.*, travel time savings) that would reduce the full price of travel as claimed by the City is essential to assessing their claim. Moreover, any documented cost and anticipated fare reduction would have to be reflected in the forecast of passenger demand used in the analysis.

As in the case of BCA-I, the Campbell-Hill Aviation Group (CH) again reviewed and critiqued this benefit-cost analysis. Again, CH used the City's own data, plus some additional information and forecasts, to present a reanalysis of the proposed Phase I expansion. In addition to the issues discussed above, CH identified several concerns with the BCA-II analysis (in addition to the concerns noted in their earlier report on BCA-I, most of which still persist). These include:

1. The analysis continues to reject alternatives other than infrastructure expansion (e.g., congestion pricing or demand management strategies) as a means of handling increased air travel demands in the Chicago/Midwest area.
2. The analysis continues to attribute savings in delay costs to years when Phase I will be constrained, and when no reductions in delays are possible.
3. The City bases its passenger benefits on phantom fare reductions that are unrelated to its own estimates of airline cost savings, including the cost-increasing effect of financing arrangements, leading to higher fares.
4. The analysis ignores the project's impact on other passenger time factors such as access/egress and terminal facilitation that will certainly increase.
5. The analysis credits the project with time savings that are unrelated to the project, and which are projected to occur whether or not the project is constructed.

As with their analysis of BCA-I, Campbell-Hill adjusted the City's analysis in BCA-II to account for two primary problems—the city's asserted fare savings that are unrelated to the effect of the project and the city's exaggerated changes in flight distances between the base case and Phase I. These adjustments alone reduced the present value of benefits attributable to Phase I from \$12.4 billion to -\$1.5 billion. Since these benefits are negative, without factoring in the cost of the projects; overall net benefits are projected to be -\$4.3 billion.

## **5. Conclusion**

Does this case study contain any general lessons regarding the application of benefit-cost analysis principles by public agencies? Each reader will take away from the discussion their own insights; mine are the following.

First, analytic principles are a weak reed in the face of political pressures and perceptions of agency purpose. The administration of Mayor Richard Daley is committed to this project, and is politically powerful. Moreover, the FAA values public construction to the neglect of nonstructural alternatives such as demand management. No real attention was paid to analyzing the benefits and costs of demand management (and a wide range of other) alternatives, and comparing the results to the benefits and costs of the proposed O'Hare expansion.

Second, embarrassment by public agencies to drastic inter-temporal inconsistency in analytic approach, data, and findings seems nonexistent. The drive to produce positive net benefits easily overwhelms any motivation for consistency and sound evaluation.

Third, the reliance on and misuse of sound basic principles by agencies to justify decisions hinders scrutiny of these choices by courts and the public. The clever use of the travel cost savings and consumer surplus models as a cover for questionable data and assumptions hinders understanding and critical assessment.

This assessment is a pessimistic one; can anything be done to assure that federal decisions will be based on analyses that meet minimum acceptable professional standards? Perhaps this is the time to again consider the proposal for a federal government analytic standards office, staffed by professional analysts committed to accepted standards of analysis, and structured to assess the conformance to accepted analytic principles of analyses supporting public regulation and spending, such as BCA-I and BCA-II.

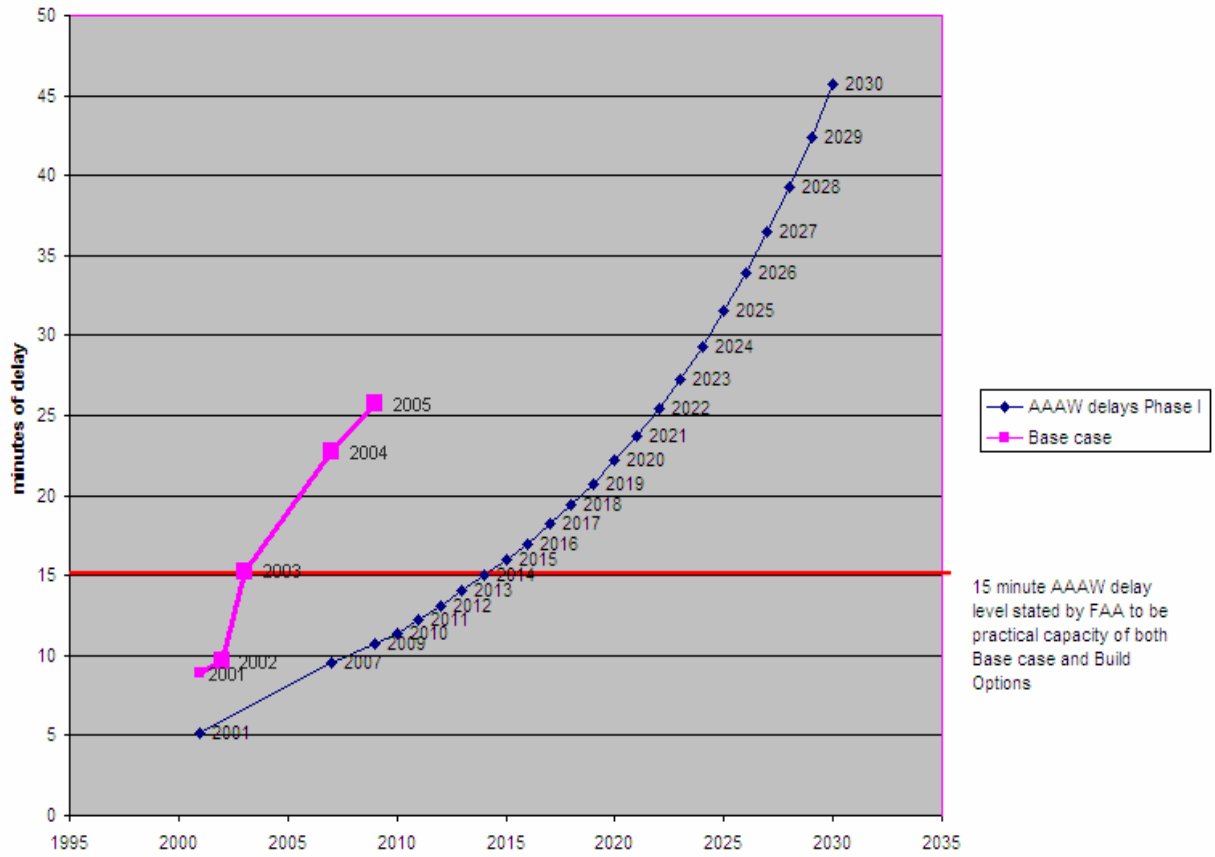


Figure 1

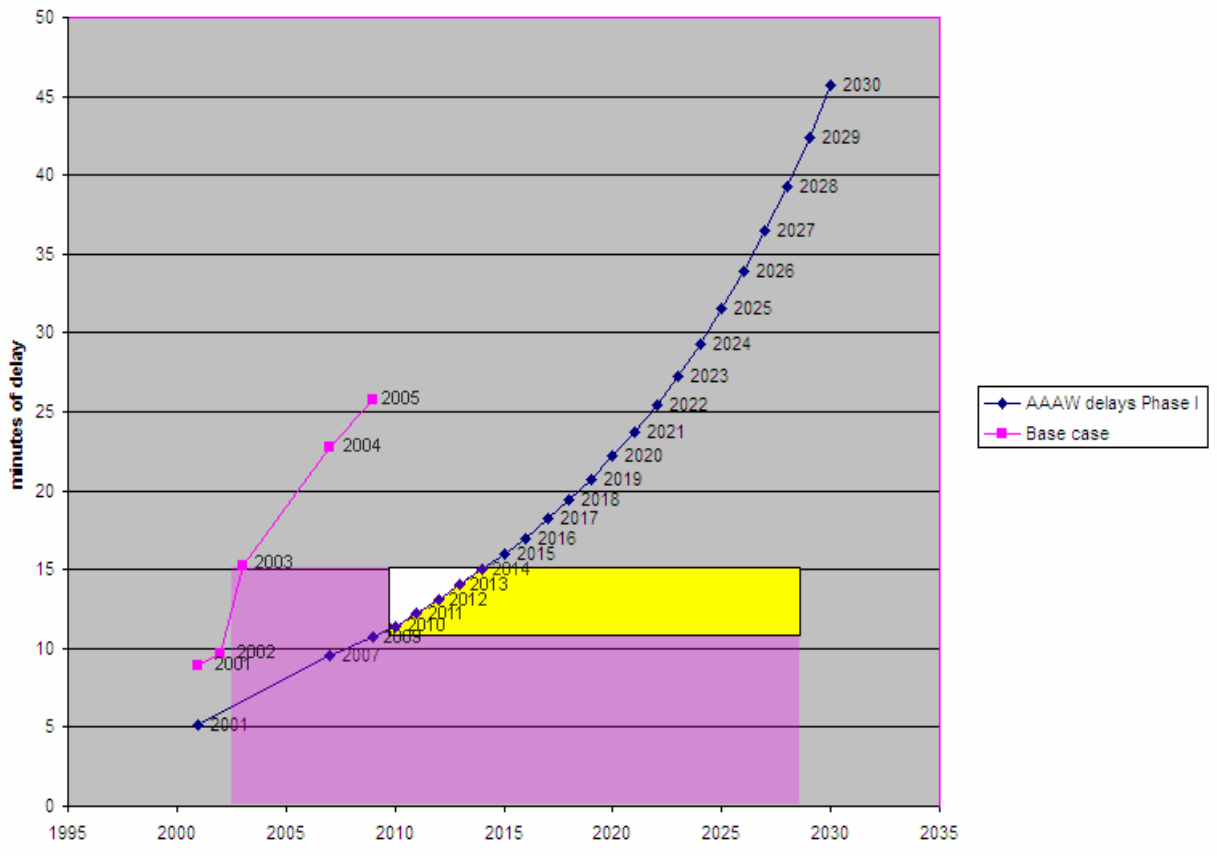


Figure 2

### Consumer Surplus under 'Base' and 'Phase I' Cases

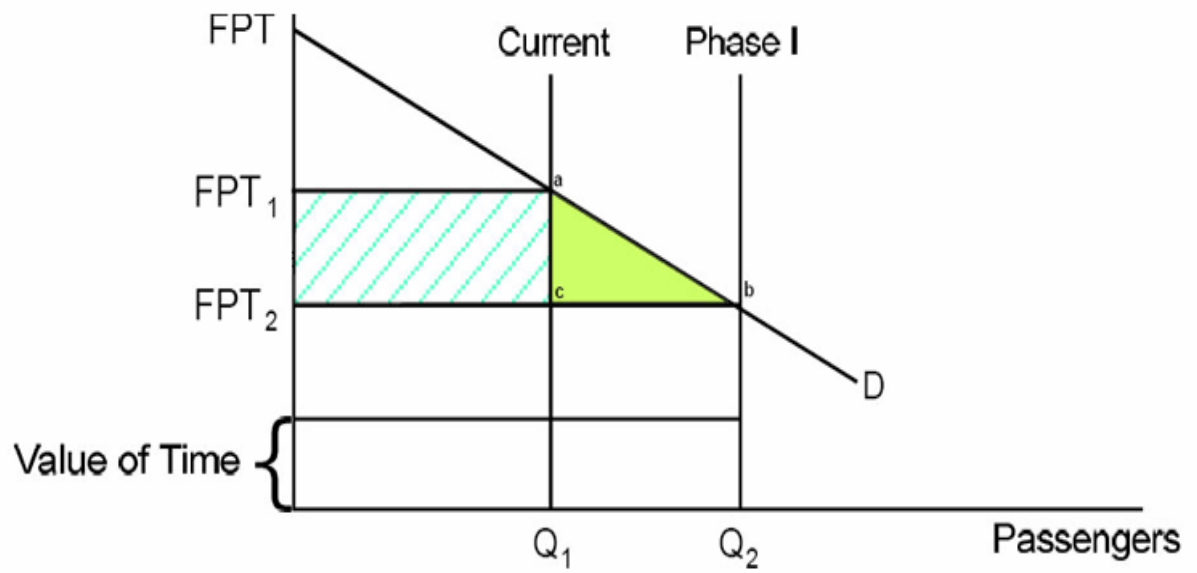


Figure 3