FINANCIAL PLANNING FOR THE CONSTRUCTION OF A REGIONAL AIRPORT

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This paper describes a key implementation tool for financial planning applied to a major expansion of the metropolitan airport system in Louisville, Kentucky. The tool is a financial model including detailed forecasts and regional and national economic assumptions. The methodology developed airport facility requirements, implementation phasing, activity forecasts, and facility requirements in response to the defined need. A cash flow model was developed, and consideration was given to land acquisition, relocation, a passenger terminal, parking facility, runway and taxiway construction, and other project development costs. A technique for scheduling capital costs consistent with annual assessment of demand was developed. Revenues and costs anticipated for airport operation were defined, and the contributions to project revenues of the Federal Aviation Administration through the Airport Development Aid Program and the Federal Highway Administration were analyzed and projected. The model places major emphasis on inputs, outputs, and mathematical logic. Pessimistic, likely, and optimistic ranges of parametric values input to the cash flow model were used to treat conditions of uncertainty. The final results of the fiscal planning exercise became an input to the site selection process.

•BECAUSE aviation is a vital part of the American economy, communities must plan adequately for accommodation of future aviation requirements. As part of this planning requirement, the Louisville and Jefferson County Air Board organized a site evaluation process. The board met in Louisville with representatives of the citizens' advisory committee to the board and nationally recognized planning and aviation professionals to select a regional airport site that would best serve the Louisville region. Twenty-eight sites chosen by the Air Board were initially considered. This number was reduced to 9 on the basis of gross deficiencies in 1 or more site evaluation criteria such as topography, soil condition, distance from access roads, and environmental considerations. These 9 sites were further reduced to 4 prospective sites during the first site evaluation committee session. The second session deliberations selected the site that best fulfilled all weighted criteria used in the evaluation process. The 4 prospective sites were augmented by the alternative of expanding the existing Standiford Field. This paper addresses 1 criterion used throughout the evaluation of these 5 sites during the second committee session—financial feasibility. To analyze both the financial and economic aspects of proposed airport sites, data were collected for detailed cash flow and economic impact analysis for each alternative under study.

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ENPLANEMENT FORECASTS

Forecasts of the number of enplaning passengers were developed by the Air Board's staff (1). Just as factors affecting the growth of aviation (economic trends and population growth) are most accurately projected at the national level, aviation forecasting, too, usually begins with national forecasts. Three groups develop national aviation forecasts: the federal government, the airlines, and special interest groups. The Air Board staff used material from these sources in preparing forecasts. Projections were modified according to historic trends of the Louisville region in use of air service.

The following basic assumptions were made when these forecasts were prepared:

1. The Louisville region will maintain its place in the national economy;
2. Aviation's role in the region's transportation system will continue unchanged; and
3. No artificial constraints will be placed on the growth of aviation in this community.

It must be remembered that these forecasts were generated to assist in long-range planning of aviation facilities. They cannot project annual or seasonal variations, and, therefore, must be updated continuously to ensure the best possible projections. Enplanements were projected to grow as follows (1 ton = 0.907 metric ton):

Item	1973	2000
Enplanements	900,000	6,700,000
Cargo, tons	18,186	301,750
Air carrier aircraft operations	61,196	197,060
General aviation operations	297,843	1,797,506
Military operations	8,897	8,897

ANALYSIS OF AIRPORT FACILITY REQUIREMENTS AND DEVELOPMENT PHASING

Based on the forecasts previously mentioned and the practical annual capacity of a particular layout, an optimum airfield layout to serve long-range demands in this region would incorporate 2 pairs of parallel runways. Although only 1 pair of parallel runways would be required initially, all necessary land should be acquired at the start. This protects the airport from incompatible land use development in adjacent areas and ensures availability of land for long-range development. Based on this, it was determined that an 8,000-acre (3200-ha) site should be acquired. This amount would be adequate to encompass the 115 composite noise rating (CNR) impacted area. In the case of Standiford Field expansion, land requirement was defined as the area necessary to accommodate a new terminal building, a runway parallel to runway 1-19, and the 115 CNR area for the new runway.

The area required for a terminal building is directly related to the number of passengers moving through the terminal. In 1972 there was a ratio of 0.28 sq ft (0.026 m^2) per annual enplaned passenger at Standiford Field. A major criterion for determining the size of a new terminal building was that no expansion should be required during its first 10 years. Therefore, the initial size of the terminal should be 600,000 sq ft (55 700 m^2). This would provide an opening-year ratio of 0.24 sq ft (0.022 m^2) per annual enplaned passenger, which would result in about 14 percent greater initial use than that now existing, and would also allow approximately 10 years' use without any expansion. Cargo terminal size was based on current projections of enplaned mass in tons (metric tons); the sizes of emergency and maintenance facilities, terminal aprons, ramps, and utilities were based on accepted facility requirements analysis techniques.

PROJECT DEVELOPMENT COSTS

Capital Cost Items

Capital expenses were developed from requirements estimates and general design considerations of a facility to accommodate the aviation demand forecast. Unit cost estimates were obtained from various sources such as a consulting firm, the Air Board, airports, area utility companies, and real estate companies.

Land Acquisition and Relocation

Real estate appraisals of the Standiford Field expansion area and the 4 rural sites were made in July and August 1973. The real estate company also estimated relocation costs for the expansion area under the provisions of the Uniform Relocation Assistance and Land Acquisition Policies Act of 1970. The consulting firm estimated these costs for the rural sites and modified, to an extent, the real estate company's relocation costs for Standiford Field based on a more detailed survey of the affected area.

Passenger Terminal and Cargo Building

Passenger and cargo terminal unit cost estimates were developed by the Air Board based on recent construction cost experience at Standiford Field and other airports around the country. The unit cost estimates were \$30/sq ft (\$323/m^2) for the terminal building and \$25/sq ft (\$269/m^2) for the cargo building. These include all construction and finishing costs for the cargo facilities. For the terminal building, estimates anticipated a building shell including all mechanical and electrical systems. Finishing was included only for the public areas; finishing costs for exclusive use areas were left to the tenant.

Parking Facilities

Costs of parking facilities were not included in the overall project estimates. It was assumed that such facilities would be operated by a parking lot concessionaire who would assume the capital costs associated with them.

Runways and Taxiways

Runway and taxiway costs included runway base, paving, and lighting. Estimates for the Standiford expansion were based on existing engineering data on Standiford Field and recent construction cost experience.

Grading and Drainage

The same basic considerations used in estimating runway and taxiway costs were employed in developing cost estimates for grading and drainage. In addition, a detailed contour analysis was accomplished. Unit costs for the designated quantities were based upon the Kentucky Department of Transportation's average awarded unit bid prices for 1972; adaptations were made to meet the specific conditions of each site.

Maintenance and Emergency Buildings

The required sizes for maintenance and emergency facilities were assumed to be in direct proportion to the existing airfield (1-runway field). For a parallel runway configuration, these facilities would be doubled in size. The Air Board estimated the cost to be \$25/sq ft (\$269/m^2).

Roads and Utilities

The cost of constructing and relocating new roads related to airport development was estimated by using mileages previously calculated and cost-per-mile estimates developed by the Kentucky Department of Transportation for the 1972 National Highway Functional Classification and Needs Study. For the rural sites, the cost of roadway construction for rolling terrain in a rural area of average population density was employed. Estimates of construction costs included grading, drainage, base, surface, and other associated costs.

Utilities cost estimates were based on data obtained from the various utility companies serving Standiford Field and the 4 rural sites. Based on forecasts of aviation activity, gross estimates of capacity requirements for telephone, electricity, gas, water, and sewage were determined that provided the Air Board with total cost or unit cost estimates for utilities at each of the sites.

Schedule of Capital Costs

Schedules of development costs for the first phase of airport development for Standiford Field and each of the 4 rural sites were made. These schedules included all costs that would have to be borne initially by the airport sponsor; however, many of the sponsor's expenses will be reimbursed by the Federal Aviation Administration (FAA). Although rail and highway access are part of overall project cost, none of the rail costs and only a small portion of the indicated highway costs will be funded directly by the airport sponsor. Consequently, they were not included in the cost schedule used in the financial analysis.

FEDERAL AVIATION ADMINISTRATION AND RELATED FUNDING PARTICIPATION

A very large share of airport development costs is eligible for varying levels of federal reimbursement through the FAA. These funds are provided by the Airport and Airways Development Act of 1970 and administered through the Airport Development Aid Program created by the Act. The Airport Development Acceleration Act of 1973, legislation that provided for increased levels of airport funding, amended the earlier legislation. Estimates of FAA funding in the Louisville region's case were based on eligibility criteria expressed in this legislation. Other federal and state highway funds would help to cover the vast majority of total highway access costs. Although there may be sources of funding for the project other than those identified, their potential participation levels would not be sufficient to affect significantly the financial analysis of the airport project.

AIRPORT OPERATING REVENUES AND EXPENSES

Preliminary statistical correlation analysis indicated that enplanements and terminal and cargo building area in square feet (square meters) strongly influence operating revenues and expenses. Multiple linear regression models were fitted to historical data to obtain projections of revenues and expenses. The 2 basic models that were

used in the regression analyses included a linear model in which

$$\text{Operating revenue} = a + b\,(\text{area}) + c\,(\text{enplanements})$$
$$\text{Operating expense} = d + e\,(\text{area}) + f\,(\text{enplanements})$$

and an exponential model in which

$$\text{Operating revenue} = a\,(\text{area})^{b}\,(\text{enplanements})^{c}$$
$$\text{Operating expense} = d\,(\text{area})^{e}\,(\text{enplanements})^{f}$$

FINANCING MODEL

Because of the number of computations involved in the financial analysis of the various alternatives, a computerized model was used. The model was programmed in an interactive time-share mode so that the user could provide inputs at run time. The model allows the user to specify the size and time of each bond issue. The model accepts inputs of operating revenues and expenses, capital cost requirements, and land development as well as other parameters and uses these inputs to produce a detailed cash flow analysis for each alternative.

Inputs to the Model

The cash flow computer model requires the following 6 major annual data inputs (uninflated):

1. Bond issues,
2. Construction costs by category,
3. Enplanements,
4. Terminal area (passenger terminal + 0.25 cargo terminal),
5. Miscellaneous revenues, and
6. Miscellaneous expenses.

The major control parameters are as follows:

1. Number of years to be analyzed,
2. Year construction begins,
3. Year operation begins,
4. Interest rate for short-term borrowing,
5. Interest rate for long-term borrowing,
6. Interest rate for short-term investments,
7. Inflation rate for capital costs,
8. Inflation rate for revenues and expenses,
9. Regression model number,
10. Regression constants for operating revenues,
11. Regression constants for operating expenses,
12. Years of capitalized interest on first bond issue,
13. Years of interest placed in reserve on all bond issues,
14. Bond discount rate,
15. Fraction of a bond issue equivalent to 1 year's total sinking fund contribution (principal and interest),
16. Number of periods of lag in federal reimbursements, and

17. Percentage of capital costs paid by federal funds by category.

Outputs From the Model

Using these inputs, the program develops a cash flow summary for the project alternative. The outputs are

1. Year,
2. Bond issues (including interest and reserves) at beginning of year,
3. Total construction costs paid,
4. Federal reimbursements received,
5. Bond interest paid,
6. Bond principal paid,
7. Bond reserves available at the beginning,
8. Capitalized interest remaining at the end,
9. Operating revenue,
10. Operating expenses,
11. Operating net revenue,
12. Interest earned,
13. Miscellaneous revenue,
14. Outside funds required,
15. Annual net operating profit,
16. Construction fund remaining at the end,
17. Short-term debt required to finance the federal lag,
18. Miscellaneous expenses, and
19. Cash on hand at the end.

In addition, the totals and present worth calculations of various columns were presented. All present worth calculations were related to the year of data input and were adjusted according to the long-term interest rate.

Logic of the Model

Using the inputs from the data file, the model computes the Air Board's share of capital costs for each year and displays this series to the user who then specifies the years and sizes of bond issues for these capital cost requirements. The program adjusts this additional input according to the parameter values for capitalized interest and reserve requirements and establishes an adjusted annual bond issue series. These issues are assumed to be available at the beginning of the year. Bond interest is paid twice a year. All other flows, in and out, are assumed to occur equally over each of the specified periods in the year.

In each period the first transaction to occur is allocation of construction cost requirements. Money is allocated from the construction fund. If this is not enough, additional money is allocated from cash on hand. Any remaining shortages are financed through short-term borrowing. When construction costs are covered, the remaining flows of money in and out are computed and assigned. Any annual net operating deficit is covered by cash on hand. If this is not sufficient, the model attempts to sell more land and rent less, if this option is available. The next transaction is short-term borrowing, but the total amount of short-term credit is limited to the federal funds due for previous construction. If all of this is not enough, the model seeks outside funds from some source, such as the state, to meet the operating deficit. When all of these transactions have taken place, the model advances to the next period. The model outputs yearly summaries of all of the cash flows.

DEFINITION OF POTENTIAL CONDITIONS FOR EVALUATION OF THE ALTERNATIVES

Because of the uncertain nature of future events, each of the 5 alternatives was subjected to a cash flow analysis under 3 separate sets of potential conditions. These conditions are

1. A pessimistic set of parameter values,
2. A likely set of parameter values, and
3. An optimistic set of parameter values.

Differences in the potential conditions considered result from variations in the following important parameters:

1. Interest rates,
2. Support from existing airport,
3. Construction contingency,
4. Federal reimbursement lag time,
5. Inflation rates,
6. Effect of user centroid adjustment on enplanements and land values,
7. Revenue model, and
8. Expense model.

Nominal values and determinations were made for each of these factors. These become the likely "settings." In addition, a set of optimistic and pessimistic choices was made over the range of variations of the various parameters. When the cash flow analysis procedure outlined herein had been completed, the results were presented to the site evaluation committee for use in their evaluation process.

REFERENCE

1. Aviation Activity Forecasts, Louisville, Kentucky—1973-2000. Louisville and Jefferson County Air Board, July 1973.