CHAPTER 7 AIRPORT SITE SELECTION

Raleigh County Memorial, Beckley W. Virginia

1. **GENERAL.** Selecting a site for a new airport comes from a decision that existing airport facilities cannot be expanded to accommodate aviation demand. In arriving at such a decision, there will likely have been an investigation of potential new airport sites for comparison with the alternative of continuing all operations at the existing airport.

Master planning for high activity airports will often include an investigation of potential new sites to permit a review of all options for providing additional capacity, as discussed in Chapter 6. In these cases the emphasis is on the need for and feasibility of a new airport; the site investigation is limited in scope to that which is necessary to make an informed decision. If the decision points to the need for a new airport then there should be a preliminary determination on the role of the existing airport, the limits to which it might be upgraded and the timing of transfer of some, or all, operations to the new location.

Thus, the site selection process may be a refinement of the preliminary investigation of alternatives during the master planning of an existing airport. On the other hand, it may result from a need identified in other prior or ongoing study efforts as in regional or state system planning.

Prior to initiating a detailed site selection study, there should be sufficient evidence of the need for a

new airport and its viability in terms of potential community and user support as well as the legal, organizational and financial capability to build and operate it.

The scope of the site selection process will vary with the size, complexity and role of the proposed airport. While many of the steps will be equivalent, the sophistication of the analysis and the complexity of the decision making process can vary greatly, in line with the magnitude of the potential development investment.

2. **STUDY ORGANIZATION AND ROLE DEFINITION.** While the organization and preplanning considerations outlined in Chapter 3 are generally appropriate to a site selection study, there may exist the possibility that a public agency other than that which operates the existing airport would construct and operate a new airport. If the establishment of a new organization is an issue, this may be a study element in the project, or a parallel activity that involves timely enactment of enabling legislation. It is also possible that a new organization would sponsor the site selection study. In any case, the agency sponsoring the study should be one that is legally and financially capable of developing the airport. This is a requirement if Federal financial assistance for the planning study is contemplated.

There should be a consensus as to the intended role of the new airport, at least to the extent that its requirements and size can be ascertained. Prior master or system planning studies will likely have made this preliminary determination. This does not rule out a changing of the new airport's role as a result of the study findings. This could occur for a new commercial service airport based on environmental impacts, site remoteness or financial limitations. This should not be the case for general aviation or reliever airports. The role of a new commercial service airport could be:

- Supplement the existing commercial service airport, with emphasis on a specific type of traffic such as international and long haul domestic;
- Replace the existing airport for all operations, with the existing airport reverting to non-aviation use; and
- Replace the existing airport for all air carrier operations with the existing airport reverting to general aviation status with the possibility of limited air carrier shuttle or short haul traffic.

An airport site can be selected and preserved, or land banked, for potential future use. Detailed planning for the site would then be delayed until justified by demand. The opportunity for this should not be overlooked when an existing military facility becomes a candidate site. Innovative interim uses may be possible to assure its availability if cessation of military activity is contemplated.

3. **SITE SELECTION PROCESS, OVERVIEW.** In many cases site selection follows from recommendations made in prior studies of existing airports to accommodate increased aviation demand. Therefore, much of the information, such as demand forecasts and capacity needs, will be available and can be used with minimum refinement to determine general airport size and requirements. If this is not the case, then of course, this kind of information must be compiled.

a. When basic information has been assembled the process moves on to a screening of potential sites and the selection of the most appropriate candidate. Again, prior studies may have identified and evaluated potential sites and the process may consist largely of a review and refinement of this work. Whatever the case, there is a systematic evaluation of all potential sites, screening out those that have obvious shortcomings in terms of construction costs, topography, airspace, access, and environmental impacts. The number of candidates is narrowed to the fewest possible. Then there is detailed review of each for comparative purposes.

This review can be aided by the application of comprehensive evaluation criteria based on community and regional values and plans as well as traditional technical factors. The evaluation process must include a visual inspection of candidate sites.

b. Where the need for the new airport is not immediate, it will be necessary to make a transfer analysis. This will compare quantifiable costs of various transfer times from the existing to new airport, assisting in decisions on scheduling land acquisition, construction and financing for the new

facility as well as modernization decisions relative to the existing airport.

c. The site finally selected will be subjected to the rigorous review of alternatives as required under the NEPA and commitments will be made on specific environmental mitigative measures. It will likely receive a large measure of public scrutiny through information sessions, representation on policy, advisory and review committees and finally, public hearings.

The site must also receive the required Federal, state and local governmental approvals and certifications, and the need for a new airport will be indicated in the FAA's National Plan of Integrated Airport Systems.

d. The process then moves on to the plans development stage where airfield, terminal and access concepts are detailed within the context of the approved site. This assumes that the transfer analysis supports an early initiation of the planning and design activities.

4. **DATA ASSEMBLY AND FACILITY REQUIREMENTS.** Information may be available from a prior master planning study done for an existing airport which found that a new airport is needed. At most, an updating of this basic data will be needed. Additional information on a region-wide basis will be necessary in support of the site investigation activity and will include:

- Mapping for the region within which candidate sites could conceivably be located, including aerial photogrammetry, topographical and geological maps;
- Comprehensive land use and transportation plans;
- Utility networks, both above and below ground;
- Data and charts on ground and surface water conditions and flow;
- Specific data on soil conditions and availability of construction materials;
- Pertinent land use controls and building regulations;
- General information on land ownership and value;
- Environmental information on a regional basis similar to that discussed in Chapter 4, paragraphs 5 and 7;
- Aeronautical charts and other appropriate airspace and air traffic control information;
- Meteorological information, including wind data, for all relevant stations—these conditions can vary significantly from airport to airport within the same general region, and
- Information on structures that could constitute obstructions and land uses which could attract birds.

The level of detail required for some of this information, such as local land use controls, ownership and values, and soil conditions will be greatest, of course, for the final candidate sites.

Facility requirements and general airport sizing may have been determined in prior studies or there may be sufficient information to develop a preliminary conceptual configuration and airport size, which should be sufficient for initial site screening purposes. However, when the candidate sites are narrowed down to a final few, it will be necessary to refine the concepts to fit site specific requirements. The guidance in Chapter 6 should be followed in developing site-oriented concepts. It can be expected that the concepts presented for the site finalists may be modified during the plans development stage and possibly even further during design. However, modification should not be so extensive as to invalidate the environmental impact statement or jeopardize local support.

5. **EVALUATION CRITERIA.** To evaluate candidate sites systematically, there must be criteria which can be applied to each site as a basis for comparison. Values must be assigned to each of the criterion based on relative importance. The assignment of values may be difficult due to different points of view of what is important and because the nature of the available data will preclude some of the criteria from being quantified. There also may be cases where a unique consideration exists which cannot be applied to all sites and has to be treated separately. On the other hand, there may be one overriding factor which rules out the need for a systematic evaluation.

If a systematic evaluation of candidate sites is appropriate, the following types of evaluation criteria should be considered.

a. *Operational Capability* - Even if all candidate sites, once developed, could provide the operational capability required by the airport's role, there may be a variation among sites as to how well each can perform. For example, the achievement of lowest category II minima at a site may not be possible. While this may not be critical, the occasional requirement for such capability would indicate a small reduction in service reliability and would constitute a limitation.

b. *Capacity Potential* - If the need for the new airport is based largely on the requirement for additional capacity, the capability of the site to provide long term capacity is important. Demand forecasts beyond the traditional planning horizons of, say, 20 years will be highly speculative. However, insuring capacity capability for long-term forecast demand is important. Key factors are land availability, topography, environmental impacts, and airspace use.

c. *Ground Access* - An important consideration in how well an airport serves the public's air transportation needs is the airport's accessibility. The key factor is access time, which depends on distance and the ground transportation infrastructure. Another factor is cost of personal and public transportation and operating/maintenance costs for public transportation services.

d. *Development Costs* - Development costs include airfield, terminal, and ground transportation capital costs and land acquisition costs. The importance of development costs are obvious. Also obvious is the fact that there are limits beyond which the project may not be financially feasible or at which the costs far outweigh the benefits. This threshold is quantifiable and easily understood. Relative cost data will suffice. Precise figures are not necessary. The key factors influencing construction costs are topography, geology, ground access distance and systems, land values and utility system availability.

e. *Environmental Consequences* - The environmental impacts associated with airport development and operation cannot be overemphasized in that they may be critical to gaining site approval, regardless of where the site may fall in the ranking process. Environmental impacts must be assessed in terms of both the human and natural environment.

(1) Aircraft noise is usually the first impact which comes to mind. It can be determined through the use of noise contours based on the general airport configuration, runway use and activity forecasts. The noise impact factor will probably have the greatest influence on how the site fares in term of public acceptance.

(2) The impact of the airports location on the flora and fauna and biotic communities, while important, may not weigh heavily during the early stages of the site evaluation process, unless there are endangered species which will be affected.

(3) While air quality and ground/surface water quality impacts are important, they will likely not differ significantly from one site to the other. Water quality impacts can usually be minimized through airport planning and design treatment. The air quality impacts are not usually significant, except in densely populated urban environments where the airport, along with other sources, jointly contribute to the violation of air quality standards.

(4) A change in the use of the land, either direct or induced, from agricultural and forest to more intense development is a quantifiable factor, but its relative value is subjective.

(5) The existence of endangered species; the presence of historic, archaeological, architectural and cultural resources; and a potential effect on parks and recreation areas are evaluation factors which are unique and require separate consideration.

f. *Socio-Economic Factors* - These include the relocation of families and businesses, changes in employment and commercial patterns, changes in tax base and the demand for new public services at the new site.

g. *Consistency with Areawide Planning* - A major airport can be one of the most crucial influences on regional growth patterns. Even a small airport can have substantial impacts on land use patterns. How well the candidate site fits regional land use policy

as expressed in the comprehensive land use and transportation plan or in a regional airports system plan will be a key factor in gaining public acceptance.

6. **SITE EVALUATION.** If the screening of sites results in more than one solid candidate, then an application of the evaluation criteria discussed in paragraph 5 will be appropriate. If it is not clear which site is superior, then there must be a further, more rigorous, application of the evaluation criteria.

This will involve assigning values to the criteria, rating each site and summing the weighted ratings. The summations and the weighted ratings are then reviewed and subjected to a sensitivity analysis to detect distortions in the logic.

It cannot be assumed that this analysis conclusively points to the best site or that which will finally be selected. There may be overriding political, jurisdictional, institutional, environmental or financial considerations which may influence the choice of sites.

a. The process of assigning values to evaluation criteria and rating sites will usually be performed, at least initially, by the consultant, individually or in conjunction with the airport operator. In the more complex studies, there may be more extensive participation in determining values for criteria and in ratings. For example, it may be useful to conduct surveys among members of an appropriate advisory committee or committees to obtain values for the criteria, or a consensus may be required from members of the policy committee as to the assignment of values.

b. The application of evaluation criteria will be aided by field investigation. This will involve the physical inspection of candidate sites to review pertinent physical characteristics. It may be necessary to take soil samples and borings. Access times over different routings should be noted as well as any other pertinent observations. Ground level photographs, including a 360 degree horizon profile, will prove useful. An aerial inspection of potential sites may prove highly desirable in gaining a visual overview. This may include simulating approaches and departures to hypothetical runways and, if possible, taking aerial photographs.

7. **TRANSFER ANALYSIS.** A comparative analysis should be performed for the existing airport and the new airport to determine the best timing for transfer of all or part of the existing operations to the new airport. The transfer analysis may assist in scheduling development of the new site and in determining whether interim expansion of the existing airport's capacity to prolong its useful life is economically justified.

a. The analysis is an economic one and does not treat social, environmental and political issues. Total cash costs for different transfer dates are computed and the date with the lowest cash cost is the theoretically best transfer date from an economic standpoint. Cash costs include those attributable to airport and access construction costs, aircraft delay costs and user ground access costs. The costs are computed in constant (today's) dollars and converted to "present value". (Present value is a concept used to compare costs incurred in different time periods. The present value is the amount of money necessary to invest today at the going interest rate in order to have a specific sum of money available at a given date in the future. The interest rate used should reflect the market cost of capital.)

b. Construction costs and aircraft delay costs can be estimated with sufficient accuracy consistent with the nature of the analysis. However, the economic analysis may be highly sensitive to the value of time assigned to passenger airborne delay costs and to airport user ground access costs. For example, the assignment of high value for time in computing user ground access costs will likely favor a later transfer date to a remote new airport site. On the other hand, assessment of a higher value to passenger airborne delay costs will favor early transfer from the congested existing airport. While it is appropriate to consider dollar "proxies" for the value of time (and probably most appropriate to assign conservative values), the planner should understand the sensitivity of the transfer analysis to these assumptions.

8. **REGIONAL AIRPORTS.** The potential for having one airport serve the aeronautical interests of two or more communities, which would otherwise have individual airports, should not be overlooked during requirements analysis and site selection activities. Such consideration is most appropriate

when two or more nearby communities are in need of major airport improvements or new sites.

a. The benefits of regional airports are numerous. The consolidation of general aviation activities results in better services for the user and the consolidation of commercial service will result in better schedules and frequencies for the passenger.

The higher revenues, lower overall operational and maintenance costs, and possibly even lower capital costs, could result in a self-sufficient airport operation. If this is not feasible, at least the distribution of airport costs over a larger population is a distinct advantage.

b. In analyzing the potential benefits that might be derived from consolidation of demand, the key factor will be user access distance and time. The elasticity of the ground access will directly influence the meeting of demand and should be carefully evaluated through user surveys and examination of the regional transportation infrastructure.

c. If the benefits of the regional alternative clearly outweigh the costs, endorsement by the directly involved communities may be achievable.

d. Early identification of the potential for regional airport applications is a function of airport system planning. Should the concept prove feasible as a result of a follow on master planning study, the support of state authorities should be enlisted for purposes of state financial assistance and the establishment of a regional airport authority.

9. **SITE APPROVAL.** Timely site approval by the sponsor who will develop and operate the airport is important because it permits implementation of the necessary steps to assure airport establishment while the decision making apparatus is politically and organizationally intact. The extensive coordinative activities that may have taken place to gain public consensus on the need for an airport and where it should be located should not be wasted due to inaction.

Assuming that state and regional approval procedures have been followed, an important next step will be Federal approval. FAA approval is necessary if financial assistance under the Airport and Airway Improvement Act for follow on planning or site acquisition and development is contemplated. Such approval must be supported by environmental documentation (see Chapter 8), public hearings and evidence that the proposed airport will be reasonably consistent with the planning for the area in which it is to be located.

Regardless of the applicability of Federal financial assistance in the planning or development of the airport, the FAA will advise on the aeronautical suitability of the site after having studied the site from the standpoint of airspace use as required by FAR part 157.

CHAPTER 8 ENVIRONMENTAL PROCEDURES AND ANALYSIS

Wide body takeoff

1. **GENERAL.** Prior to 1970, environmental matters were not a prime consideration in airport master planning. Now, environmental feasibility is as important as economic or engineering feasibility. The phrase "environmental feasibility" means capable of being accomplished from an environmental standpoint, paralleling the meanings of economic or engineering feasibility. There have been cases where there was no question of need, or economic and engineering feasibility, but where the absence of environmental feasibility stopped the proposed development completely.

There was a time, also, when environmental documentation was considered as merely another justification document to be prepared after the development decision had been made. Today, environmental considerations begin to play a role when the scope of work of a master plan is developed, and this early input provides an opportunity for not only avoiding, or mitigating impacts, but also for developing innovative and creative approaches for enhancement of the environment.

a. Environmental feasibility has several components. A major component, often not adequately recognized, is political acceptability. The master plan, whether it contemplates a new airport or improvements to an existing airport, must be acceptable to the public and the public's representatives, if

it is to be useful. This "public" includes the public at large, the airport neighbors, and the airport users.

The other obvious component of environmental feasibility is compliance with regulatory and statutory requirements. However, there have been cases where proposals documented by fully approved environmental impact statements, and judged in complete compliance with these requirements have failed because of public opposition based on the public's perception of environmental impacts. And sometimes the opposite is also true. In spite of public support, environmental consequences which are unacceptable to government authorities have resulted in a decision to proceed no further.

The responsible airport master planner must recognize both of these factors and design a program through which the public is completely and truthfully informed. A creative approach to environmental considerations, results in a better overall design, and a greater possibility of public support, rather than just meeting the statutory requirements.

b. Just as a proposal can be halted by economic or engineering infeasibility, so also can it be halted by environmental infeasibility. Consequently, the environmental investigations must proceed, at an appropriate level, in parallel with the other investigations. The environmental task is not something to be undertaken after other tasks have been completed, or completed before other tasks can be started.

It follows that, in preparing a scope and schedule of work, environmental tasks must be integrated with the whole planning process. At the same time, the environmental effort should be sized and resources allocated appropriately to the expected size and complexity of the planning effort. As will be discussed in section 4, the appropriate environmental effort may range from little or no effort to an examination of several alternatives and mitigation measures to eliminate significant impacts.

2. **ENVIRONMENTAL ACTIONS.** Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Parts 1500-1508), issued by the President's Council on Environmental Quality, provide for three categories of environmental actions. Every proposed project will eventually be classified as one of these three categories. Further, as will be discussed later, under the heading Cumulative Impact, projects are not to be considered as individual work items, but from a broader program context. Any program will be categorized according to the project or combination of projects with the greatest environmental significance.

The three categories are:

a) Categorical Exclusions
b) Actions normally requiring an environmental assessment
c) Actions normally requiring an environmental impact statement

a. FAA Order 5050.4, *Airport Environmental Handbook* (or subsequent revisions), specifies the procedures applicable to airport actions. In general, actions categorically excluded are actions which have been found, in normal circumstances, to have no potential for significant environmental impact. (See Paragraph 23 of FAA Order 5050.4). Under extraordinary circumstances (see Paragraph 24 of FAA Order 5050.4), an action which would ordinarily be categorically excluded may require an environmental assessment. For example, the addition of extended safety areas to a runway would not be categorically excluded if it involved wetlands, critical habitat of an endangered species, or a floodplain.

b. Actions normally requiring an environmental assessment (see Paragraph 22 of FAA Order 5050.4) are actions which have been found by experience to sometimes have significant environmental impacts, and sometimes not. Actions having significant impacts will require the preparation of an environmental impact statement. There may be actions with minor potential impacts which could be eliminated or minimized through mitigating actions. Hence, the environmental assessment process provides the opportunity for the critical and useful function of focusing attention on mitigation measures at a time in the planning process when they can be incorporated without significant disruption or commitments made. The purpose of an environmental assessment is to determine whether

or not a proposed action will have, or is likely to have, one or more significant impacts.

Based upon the results reported in an environmental assessment, and any other investigations deemed necessary, the FAA will prepare either a finding of no significant impact, or an environmental impact statement. The mitigation measures developed in the planning process and documented in the environmental assessment can be made conditions of a finding of no significant impact, and may, in many cases, make an environmental impact statement unnecessary.

c. Relatively few airport actions require an environmental impact statement (see Paragraph 21 of FAA Order 5050.4). If, because of potential significant impacts, an environmental impact statement is required, the process should be initiated as soon as possible in order to minimize delays. Preparation of an environmental impact statement in accordance with the NEPA is the responsibility of the FAA. It is often possible to adjust the plans so that significant impacts can be avoided, thus avoiding the necessity to prepare an environmental impact statement.

Obviously, if there are two development choices available which will meet the need equally well, one with significant impacts and one without, the one without significant impacts will proceed much more rapidly. Indeed, the choice of a development proposal with significant impacts may never proceed, because in many cases there is a requirement that a finding be made that no feasible and prudent alternative exists, and such a finding is unlikely in the face of the existence of a viable alternative.

3. APPLICATION TO AIRPORT MASTER PLANNING.

a. The FAA does not approve a master plan. However, a major product of the master planning effort is an airport layout plan (ALP), showing existing and ultimate facilities. Federal Aviation Regulations require that a sponsor seeking a grant for airport improvement, or seeking unconditional approval of a new or revised ALP must submit with the plan an environmental assessment prepared in accordance with FAA Order 5050.4, if an assessment is required by FAA Order 5050.4. The FAA will not approve a grant for airport development unless the airport operator has a current approved ALP.

b. Of course, little purpose is served by preparing a plan showing development which is infeasible because of cost or engineering requirements, or which cannot be approved because of failure to adhere to design standards. Similarly, an ALP prepared in the absence of environmental considerations, unless it consists solely of items which are categorically excluded, may not be acceptable because of either perceived or actual environmental problems. For environmental activities which are part of master planning for an airport requiring ALP approval, the primary reference document is FAA Order 5050.4 (or subsequent revisions).

c. An ALP is approved unconditionally when all items on the plan which are items normally requiring either an environmental impact statement or an environmental assessment have in fact received environmental approval. Such approval is evidenced either by a finding of no significant impact, or in the case of items covered by an environmental impact statement, a record of decision at least 30 days after the date of the environmental impact statement. When environmental approval has not been completed, an ALP may receive a conditional approval, which identifies the items which have not received environmental approval and specifies that they shall not be undertaken without such approval (see Paragraph 30 of FAA Order 5050.4).

d. It is the responsibility of the planner preparing a master plan to prepare the environmental assessment, unless the development proposed consists entirely of items categorically excluded, with no exceptional circumstances requiring environmental assessment, as defined in Paragraph 24 of FAA Order 5050.4. Based on the data in the assessment, and such other information as may be pertinent, the FAA will either issue a finding of no significant impact, or prepare an environmental impact statement.

4. DESIGN OF THE ENVIRONMENTAL STUDY.

The environmental work must be undertaken by an environmental professional who is experienced with and skilled in the environmental disciplines.

Depending upon the particular situation, more highly specialized skills may be required. Just as the skills of a soil or pavement engineer may be required in some cases but not in others, so may there sometimes be requirements for the skills of a marine biologist, an acoustical engineer or a public communication specialist. The environmental professional who is skilled in the regulatory requirements, in the environmental process, and in the recognition and identification of problems requiring specialty assistance should be an active participant in the master planning process from the very beginning.

When the scope and schedule of work for preparing an airport master plan is developed, it is the responsibility of an environmental specialist to assure that the environmental effort to be undertaken is appropriate to the overall task. The planner, the airport operator, and the FAA should agree on the development to be covered in the environmental documentation, particularly if an environmental impact statement is expected to ultimately be required. This subject was mentioned briefly in paragraph 4 of Chapter 3.

a. Depending upon the issues involved, a decision must be made as to the kinds of projects that are likely to be proposed and whether there may be impacts of potential significance. If the planner, in the light of the identified issues and concerns of the airport operator, can estimate the time and resources needed for the planning process, he or she must have some idea of the types of projects which are likely to be examined. If a proposal is to be examined for technical or financial feasibility, it should also be examined for environmental feasibility. To the extent that alternatives are expected to have different environmental impacts, provision for examining these differences should be made in the study design.

Sometimes it will be clear at the beginning that an environmental impact statement will ultimately be required, because a significant impact appears to be unavoidable. However, it will often be wise to postpone the allocation of resources for an environmental impact statement until the issues have been clearly identified by means of an environmental assessment. The expected significant impact may not materialize, or may be successfully mitigated, or other equally significant impacts may emerge from the initial studies. Sometimes, particularly with smaller airports, it will be clear that all proposals will be categorically excluded. However, in many cases an environmental assessment will be required, specifying appropriate mitigation measures.

The purpose of an environmental assessment is to determine if the potential impacts are significant, explore alternatives and mitigation measures, and provide the information to determine whether or not an environmental impact statement is required. FAA Order 5050.4, in Paragraph 47, describes the format and the content of an environmental assessment. In preparing a master plan for an airport, the planner should not be required to do more than is required for an environmental assessment, which is a limited investigation. If significant (as defined in FAA Order 5050.4) potential environmental impacts are identified which cannot be mitigated, they should be identified in the final report.

The document called an "Environmental Assessment" is simply a record of these preliminary investigations. After reviewing an environmental assessment, if the FAA determines that there are no significant impacts, or that with appropriate mitigation the impacts could be prevented or minimized to the point that they are not significant, the FAA will issue a finding of no significant impact. On the other hand, if an environmental impact statement is required, it is an FAA responsibility.

b. In a master planning effort, it may be tempting to go into greater depth or detail than is required for an environmental assessment by Paragraph 47 of FAA Order 5050.4. There are, however, good reasons why such effort should not be committed at the beginning of the study. As stated, the purpose of an environmental assessment is to determine if significant impacts cannot be avoided and an environmental impact statement will be required. In developing the information for this decision, it will be determined which of the potential impacts may be significant.

The environmental impact statement process starts with a "scoping process" which determines which of the possible impacts should be addressed in the impact statement. Investigations conducted before scoping which are beyond that necessary for

the assessment will require effort which is difficult to estimate and ultimately may not be required at all. In these circumstances it is almost inevitable that the estimated effort will be either too large or too small.

In the initial design of the environmental study as part of a master plan, therefore, it is necessary to consider the probable proposals in the planning process, and the environmental analysis required in an environmental assessment for these proposals. For example, consider the requirements of FAA Order 5050.4, Paragraph 47 (e) (1) regarding noise. Sub-paragraph (a) defines conditions where no noise analysis is required. If these conditions are not met, then an initial analysis is required, which does not necessarily involve the use of the FAA's Integrated Noise Model. Depending upon the number and kinds of present and projected operations, simple hand or graphic calculations may be all that is necessary.

If the thresholds specified in Paragraph 47 of FAA Order 5050.4 will be exceeded, then an environmental impact statement will likely be required. With the knowledge gained from the assessment, a determination of the effort required for the noise study will be much easier than it would have been without the assessment. The same reasoning applies to other investigations. Normally, the impact statement would be expected to discuss only those impacts which exceed the threshold of significance in Paragraph 47 of FAA Order 5050.4, and estimating the resources to be devoted to an Environmental Impact Statement being prepared should not be difficult after the impacts to be investigated have been identified.

5. **CUMULATIVE IMPACT AND TIERING.** The Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Parts 1500-1508) contain specific requirements on the subject of cumulative impact. The Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Parts 1500-1508) also introduce the concept of tiering of environmental actions. Tiering and cumulative impact may appear to be contradictory, but they are often mutually supportive.

a. Cumulative impact is discussed in Paragraph 26 of FAA Order 5050.4. The requirement to consider cumulative impact stems from the situations where individually minor but collectively significant actions take place over a period of time. Assume that a master plan has been prepared for a general aviation airport, containing a number of items, e.g., lengthening the runway, adding an MLS, providing for additional fixed base operators, and expanding terminal facilities including conference space, etc. to attract business jet aircraft and relieve a neighboring air carrier airport. It is not enough to conclude, because any one of these actions will not cause a significant change in the fleet mix or a significant increase in traffic, that together they will not result in a significant change.

b. The concept of tiering is discussed in Paragraph 101 of FAA Order 5050.4. The basic idea is that decisions should be made when the time is ripe, but need not be made earlier. For example, an airport master plan may contain a development program which is expected to cover, say, a period of twenty years, contingent upon certain demand forecasts. The master plan may show specific proposals for the first phase, say five or ten years, and conceptual proposals for the remaining development. If the first phase is sufficient for a safe and efficient airport, and is covered by appropriate environmental documentation (categorical exclusion, finding of no significant impact or environmental impact statement), then the ALP for the first phase can be unconditionally approved, with a conditional approval of the remaining phases, subject to environmental documentation (categorical exclusion, finding of no significant impact or environmental impact statement) at the time that the requirement for the future development is ripe.

Clearly, even though the environmental documentation and unconditional approval of the ALP may cover only the short term, the environmental documentation, whether it be a categorical exclusion, finding of no significant impact or an environmental impact statement, must consider the cumulative impacts of the approved short-term development over a longer period. Traffic on a new runway, for example, will continue to grow past the development period.

c. An alternative course of action is to consider the environmental impacts of the total long-term proposed development, which is then subject to a written re-evaluation to assure that the conditions have not changed. For example, suppose that a new runway is planned approximately ten years after the master plan is completed. An environmental impact statement is approved, with the statement that there will be no residential development within a specified distance of the ends of the proposed new runway. The re-evaluation should verify that, in fact, no residential development has taken place in the interim between the approval and the actual construction.

If, on the other hand, the requirements have so changed in the intervening period that the airport development proposed is now different, then new environmental documentation (categorical exclusion, finding of no significant impact or environmental impact statement) will be necessary for the new development program.

6. **PUBLIC PARTICIPATION.** There are statutory requirements for public information and participation; there are regulatory requirements for public participation; and there are often political requirements. It is sometimes true that the political requirements are the most stringent; it is often true that they are the least recognized.

a. Public acceptance is dependent upon whether the potentially affected public understands and accepts the need for the development; receives complete, truthful and unbiased information about the impacts; and recognizes that public concerns have been considered adequately and fairly. The only way to achieve these conditions is by designing and accomplishing a program to achieve them. One cannot gloss over unfavorable impacts or attempt to hide the true purpose of a development without arousing suspicion and opposition. It follows that the program for public involvement must be designed with careful consideration for not only providing accurate and unbiased information, but also for the perception of openness and completeness, along with a demonstrated commitment to the development of mitigation measures appropriate to the situation.

If there is initially the slightest indication of potential problems with public acceptance, then consideration should be given to opening the public involvement program with public discussion of the aviation problems and the potential alternatives, including taking no action or demand constraint. The objective is not to sell airport development, but to provide an understanding of the reasons why development is being considered, and a recognition that it will not be forced on the public. Comment should be solicited, accepted and considered.

Information about alternatives, and their financial, social and environmental costs and benefits should be made available to the public as it is developed. The objective is to identify and air all of the problems before the decision is imminent. The probability of political acceptance is much enhanced if the public, and its representatives, elected or otherwise, understand the process and the results by participation rather than by having the conclusions and recommendations presented as decisions already made.

Each public involvement or public participation program should be tailored to the situation. The more complex and far reaching the development that is proposed, the more complex and far reaching the public involvement program that may be required.

b. The Council on Environmental Quality's *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act*, 40 CFR Part 1506.6 contains the regulatory requirements for public involvement. Federal agencies are directed to:

(1) Make diligent effort to involve the public in implementing NEPA procedures.

(2) Provide public notice of NEPA related hearings, meetings, and the availability of environmental documentation (categorical exclusions, findings of no significant impact or environmental impact statements).

(3) Hold public hearings when appropriate.

(4) Solicit information from the public.

(5) Make findings of no significant impact and environmental impact statements and underlying documents available to the public.

Detail about each of these is given in 40 CFR 1506.6, including a list of suggested means for keeping the public informed.

c. For certain projects, even if there appears to be neither public interest nor controversy, an opportunity for a public hearing is required by statute for a new airport, a new runway, or a major runway extension. A major runway extension is defined in Paragraph 5 of FAA Order 5050.4. A proposed development program which includes any of these (or some other items as specified in Paragraph 22 of FAA Order 5050.4) requires an environmental assessment, followed by a finding of no significant impact or an environmental impact statement. The assessment is provided to the public as an information document in advance of the public hearing. Directions for public hearings are provided in Paragraph 49 of FAA Order 5050.4. For the three types of development listed, the opportunity for a public hearing is required. Without this minimum public participation Federal action will not be taken.

7. **POTENTIAL ENVIRONMENTAL IMPACTS.** The possible impacts of airport development can run the gamut of impacts that might be the result of any construction. However, some are more common than others.

Paragraph 47 (e) of FAA Order 5050.4 discusses types of impact and thresholds which determine whether or not the impact is significant. Sometimes the determination is made by measurement, by calculation, or by observation. Other times it may be determined by correspondence with local, state or Federal authorities, relying on determinations already made. In the case of Federal authorities, the procedures are often specified by Federal regulations of the department involved. In each case, Paragraph 47 (e) has been designed to provide overall guidance.

However, it must be remembered that environmental requirements are still changing. Since FAA Order 5050.4 was originally published in 1980, there have been some significant changes in procedures, requirements and levels of significant impact. These include changes in noise, air quality, and farmland considerations, along with new categories involving Wild and Scenic Rivers and the Coastal Barriers Resources Act. Although FAA Order 5050.4 is updated from time to time, further changes will undoubtedly occur. It is therefore important that an organization undertaking a master plan establish and maintain a current knowledge, through FAA contacts, of the environmental requirements.

Often, when an impact is found to cross the threshold of significance, it is possible to modify the proposal so as to mitigate the impact. Mitigation takes many forms, depending upon the type of impact. If the mitigation changes the impact so it is no longer significant, then an environmental impact statement will not be required. However, any mitigation measures specified in a finding of no significant impact, or in an environmental impact statement, must be implemented. The environmental approval, be it incorporated in a finding of no significant impact, or in a record of decision, will be contingent upon the mitigation measures specified. Therefore, the planner should make sure that the airport operator, or other responsible authority, recognizes and accepts the obligation to incorporate the mitigation measures in the development.

a. Certainly the most common impact encountered is that of noise. Aviation noise extends beyond the boundary of the airport, into areas over which the airport operator has no authority. However, the airport operator is considered responsible for the noise resulting from aircraft operations. If there are noise sensitive activities within specified noise levels, then there is a significant impact. There may also be a significant impact if the noise increase on noise sensitive areas exceeds a specified level.

Sometimes there are obvious mitigation measures which can eliminate significant noise impacts, such as acquisition, runway realignment, or changing a runway extension from one end to the other. For more complex cases, a structured approach to airport noise compatibility planning is provided by FAR Part 150 and AC 150/5020-1. Airport noise compatibility planning may include consideration of runway use programs, takeoff and landing profiles and power settings, and approach and departure tracks as well as strategies for encouraging and maintaining land uses compatible with the noise levels projected. Chapter 9 contains a more complete discussion.

Noise problems have sometimes developed around airports because the communities have not been farsighted enough to limit development to compatible uses. The consequence has been community unrest, lawsuits, stifling of needed airport development, and expensive acquisition of developed property for clearing or conversion to airport compatible use.

Therefore, even when it is concluded that no significant impact exists and that there should be no land use problem, appropriate steps should be taken to prevent the encroachment of incompatible uses. At the least, the sponsor must be able to provide assurance in accordance with the Airport and Airway Improvement Act of 1982 that appropriate action, including the adoption of zoning laws, has been or will be taken, to the extent reasonable, to restrict the use of the land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of airplanes. This required assurance is discussed more fully in Paragraph 47 (e) of FAA Order 5050.4.

b. Social impacts arise from the disruption of established communities, the necessity for relocation, altered transportation patterns, changes in employment patterns, and so forth. They may or may not be present. They are obviously more common in established metropolitan areas than in rural areas, and are less probable if land acquisition is not part of the proposal. Along with incompatible land use and social impacts, there may be induced socioeconomic impacts. These are indirect, rather than direct, impacts. Basically, they may be estimated by examining the projected state of the community with the proposed development as compared with the state if there is no airport development. If the purpose of the development is to attract industry and promote growth, then it should not be claimed that there will be no induced socioeconomic impacts. The purpose is to induce impacts. They may not be significant in terms of the natural environment, but their impact in terms of the human environment should be recognized.

c. There are other potential impacts upon the man made environment than the socioeconomic impacts. Under various statutes, consideration must be given to the potential impacts of proposals upon public parks, recreation areas, wildlife or waterfowl refuges, historic sites, and historic and cultural properties, including archaeological sites. The details for these determinations are usually procedural, but it may be necessary in some cases to conduct surveys. The planner and the airport operator should be aware, however, that proposed development affecting public parks and similar areas is almost impossible, by virtue of statutes and decisions of the Supreme Court. The procedural details are given in Paragraph 47 (e) (7) & (8) of FAA Order 5050.4.

d. Air quality is usually not a significant factor in airport development. Procedures for determining the extent, if any, of air quality analysis required is contained in a document entitled *Air Quality Procedures for Civilian Airports and Air Force Bases*, (report No. FAA-EE-82-21).

e. Water quality impacts may be more of a potential problem, depending upon current water quality and quantity, and the location of the proposed development with respect to sources. If the proposed development involves an airport location, runway location, or a major runway extension, then a certification is required from the Governor of the State that there is reasonable assurance that the project will be located, designed, constructed and operated in compliance with the applicable air and water quality standards.

f. Routine detailed inventory of biotic communities in environmental documents, as was common in the past, is not necessary. Consideration of biotic impact now emphasizes quality, not quantity. It is necessary to be alert to potential impacts of significance, as already mentioned, on wildlife and waterfowl refuges and on water resources. Other areas requiring consideration are rare and endangered species, alteration of existing habitat (which may not be significant), and wetlands. The consideration of effects on wetlands may include not only the issues of water quality and quantity, but also the biotic communities in the wetlands, and their place in the overall ecology. Special permits may be required from the Corps of Engineers or from the state, even if the impacts are not significant. Procedures have been published, and an interagency agreement reached between the Department of Transportation and the Department of the Army.

Detailed procedures are given in Paragraph 47 (e) (9), (10) and (11) of FAA Order 5050.4.

g. Special consideration has been extended to floodplains by Executive Order 11988. If a proposal involves a 100 year floodplain, then some mitigation measures may avoid significant impacts. Details are in Paragraph 47 (e) (12).

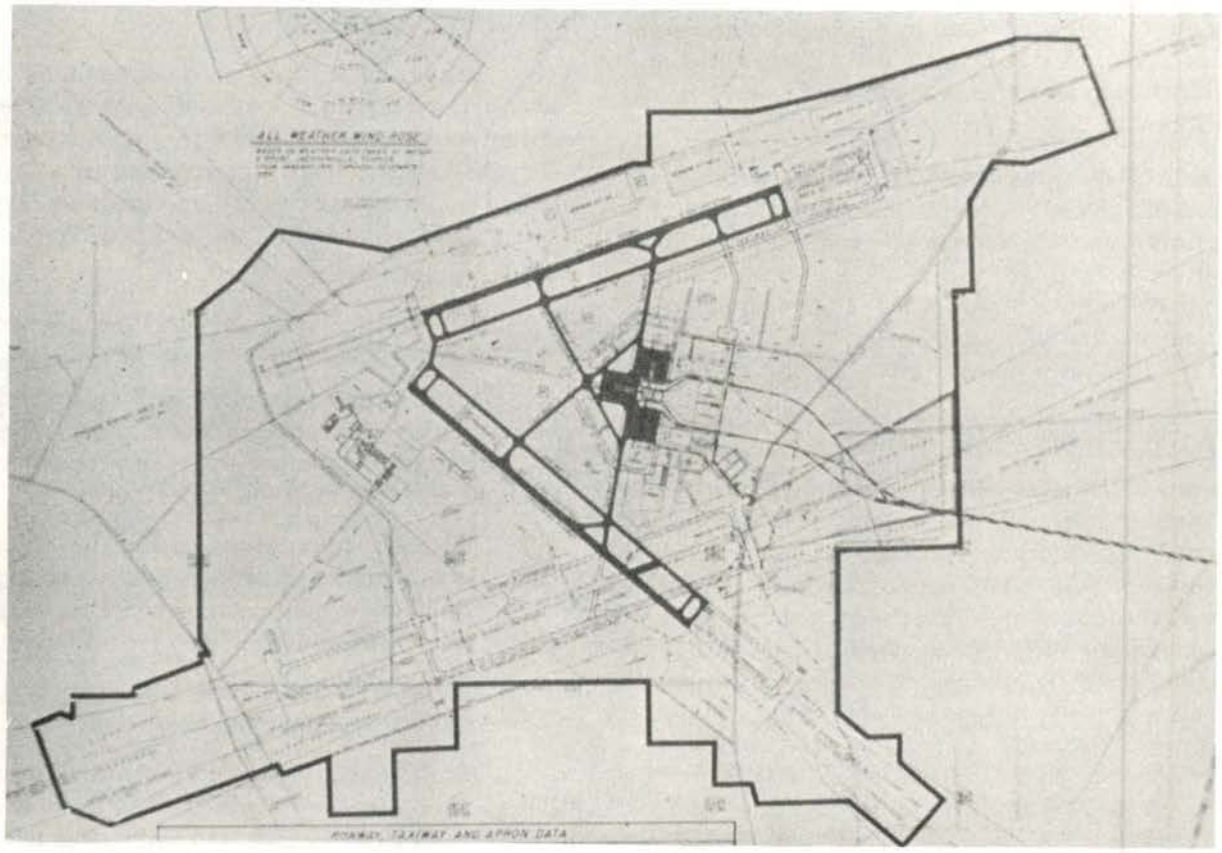
h. Consistency of proposed development with approved coastal zone management programs is another requirement. It is not uncommon to find that a generic basis for airport development has been included in an approved plan. Procedures for checking are found in Paragraph 47 (e) (13) of FAA Order 5050.4. The Coastal Barriers Resources Act prohibits development on undeveloped coastal barriers along the Atlantic and Gulf coasts, as more specifically discussed in Paragraph 47 (e) (14) of Order 5050.4.

i. If farmland is to be converted to other uses, it must be determined whether any of that land is prime or unique, or of state or local significance, which would be protected under The Farmland Protection Policy Act. Procedures for determining the Acts' applicability and for evaluating the land are contained in Paragraph 47 (e) (16) of Order 5050.4.

j. Occasionally, wild and scenic rivers (Paragraph 47 (e) (15)) light emissions (Paragraph 47 (e) (18)) or solid waste disposal (Paragraph 47 (e) (19)) may be issues. For major developments in some areas, energy requirements which are significant with respect to local supply (Paragraph 47 (e) (17)) may be an issue.

k. Finally, it is common that, because of the surrounding habitat, drainage, water quality, human habitation or other situations particular to the site, special mitigation measures must be taken during construction. For example, in a case of a runway extension requiring fill into deep water, special measures to control silting away from the construction site may be necessary. Any such measures should be specified.

CHAPTER 9 AIRPORT PLANS



Typical Layout Plan

1. **GENERAL.** Upon completion of the requirements analysis and, where appropriate, the selection of a new airport site, the master planning proceeds to the synthesis of airside and landside concepts and the development of plans. These include airport layout plans, and landside plans.

The development of plans under the master planning effort does not include plans normally associated with design such as architectural drawings, grading and drainage details, runway profiles, paving sections, etc.

The complexity and number of planning documents will vary with the size of the airport. The high activity commercial service airport may require a series of supplemental plans to clarify the basic drawings. This may be particularly appropriate for the terminal area. Also, there should be a title page giving a title and revision blocks, sponsor approval block, sheet index, wind roses and data and location map.

On the other hand, the low activity general aviation and commercial service airport may have landside plans incorporated in the airport layout plan.

2. **AIRPORT LAYOUT PLAN.** The airport layout plan (ALP) is a graphic presentation to scale of existing and ultimate airport facilities, their location

on the airport and the pertinent clearance and dimensional information required to show relationships with applicable standards.

The ALP is a key document which should be kept current, reflecting changes in physical features on the airport and critical land use changes in the vicinity which may affect the navigable airspace or the ability of the airport to expand.

The ALP serves as a public document which is a record of aeronautical requirements, both present and future, and as a reference for community deliberations on land use proposals and budget and resource planning. As a record of aeronautical requirements, it is referred to by the FAA in its review and findings on proposals involving the development of other nearby airports and objects which may affect the navigable airspace.

Along with the airfield configuration of runways, taxiways and aprons, the terminal area is shown schematically. Runway approach and clear zones should be included. A separate drawing extending beyond the immediate airport vicinity should show the imaginary surfaces described in FAR Part 77, "Objects Affecting Navigable Airspace." A property map, which may be separate, should be included.

In most cases involving low activity general aviation and commercial service airports, it will not be necessary to develop separate terminal area and access plans. These plans may be included on the ALP where this level of detail will suffice. Off airport land use plans may also be included on the ALP for these airports unless aircraft noise is a local issue requiring land use controls and changes.

Photogrammetry should prove useful in the preparation of the ALP and new photogrammetry should be considered when there is none available. Photographs should be of such quality to depict 1′-2′ contour intervals.

a. *ALP drawing*. This drawing should have, as a minimum, the layout of the airport, terminal area and on-airport access systems and land uses within the airport property. There should be a basic data table, wind information, a vicinity map and location map. However, it is not necessary to include these on the drawing. It may be more appropriate to include these on a separate sheet such as a title page. The use of a light background photo base is encouraged.

(1) *Airport layout*. The drawing should depict the existing and ultimate airport development and land uses, to scale. Included should be:

(a) Prominent airport facilities such as runways, taxiways, blast pads, stabilized shoulders and runway safety areas, buildings, navaids, parking areas, roads, lighting, runway marking, pipelines, fences, major drainage facilities, segmented circle, wind indicators, and beacon.

(b) Prominent natural and man-made features such as trees, streams, ponds, rock outcrops, ditches, railroads, power lines, and towers.

(c) Revenue-producing non-aviation-related property, with the current status and use specified. The details of this property may be shown on a separate property map for clarity.

(d) Areas reserved for existing and future aviation development and services such as for general aviation fixed base operations, heliports, cargo facilities, airport maintenance, or service areas, etc.

(e) Areas reserved for non-aviation development, such as industrial areas, motels, etc.

(f) Existing ground contours to an interval that does not clutter the drawing (up to 10′, depending on terrain), drawn lightly, but legibly. Similarly, a light overlay of the state grid coordinate system (where applicable) may facilitate the location of coordinates.

(g) Fueling facilities and tiedown areas.

(h) Facilities that are to be phased out.

(i) Airport boundaries and areas owned or controlled by the sponsor, including avigation easements; section and township corners, survey control points and bench marks, with adequate property ties should be shown.

(j) Runway clear zones and associated approach surfaces, indicating height and location of controlling objects, i.e., usually the tallest object within a limited area exceeding obstruction criteria if this information is not given on other drawings. This can be a note if the objects are located outside the limits of the drawing.

(k) Airport reference point (ARP) with latitude and longitude to the nearest second based on the U.S. Geological Survey grid system. There should be coordination with FAA to determine the need for accuracy closer than one second.

(l) Latitude, longitude and elevation of existing and ultimate runway ends and thresholds; elevation of high and low points, and runway intersections. For ILS runways, changes in elevation within 3,000 feet of the threshold should be shown.

(m) True azimuth of runways (measured from true north).

(n) North point - true and magnetic, with the magnetic declination and epoch year.

(o) Pertinent dimensional data - runway and taxiway widths and runway lengths, taxiway-runway-apron clearances, apron dimensions, building clearance lines, runway clear zones, and parallel runway separation. Deviations from FAA standards should be noted.

(p) A 24" × 36" layout sheet should be used as a minimum, with a minimum lettering size of .120". If necessary, increase the sheet size but maintain the same ratio of sheet height to length. Oversized sheets are discouraged.

i. The map scale should be between 200 to 600 feet to the inch, depending on the size of the airport, and illustrated on the layout. It is advisable to coordinate the sheet sizing and scales with FAA, if non-standard size is contemplated.

ii. Include a legend in graphic and descriptive form with symbols that differentiate between existing and ultimate development.

iii. Provide space for the title, revision, and necessary approvals.

iv. Avoid the use of shading and "shadow" lettering.

(2) *Location Map.* This is a map drawn to scale (1:500,000) sufficient to depict the airport, cities, railroads, major roads and tall towers within 25 to 50 miles of the airport. A sectional aeronautical chart may be used. This may be shown on the title page in lieu of the ALP.

(3) *Vicinity Map.* This is a map showing the relationship of the airport to the city or cities, nearby airports, roads, railroads, and built-up areas. It should be drawn to a scale of 1:24,000 (U.S.G.S. 7 minute quadrangle). A vicinity map may be omitted if sufficient detail is covered on the Approach and Runway Clear Zone Layout.

(4) *Basic Data Table.* This table contains the following information on existing and ultimate runway and airport conditions where applicable:

(a) Airport elevation (highest point of the usable landing area), to the nearest tenth of a foot.

(b) Airport reference point coordinates, to the nearest second.

(c) Airport magnetic variation, to the nearest minute.

(d) Mean maximum daily temperature for the hottest month.

(e) Airport and terminal navaids.

(f) Runway identification, magnetic numerical, such as 13/31, 4/22.

(g) Percent effective runway gradient for each existing and proposed runway.

(h) Percent wind coverage by runway.

(i) Designated instrument runway.

(j) Pavement type (sod, asphalt, concrete).

(k) Pavement strength of each runway in gross weight and type of main gear (single, dual, dual tandem), as appropriate.

(l) Approach surfaces for each runway (by individual end, if different).

(m) Runway lighting.

(n) Runway marking.

(o) Electronic and visual approach aids and weather facilities.

(5) *Wind Information.* A wind rose should be presented, with the runway orientation superimposed. Crosswind coverage at 12 mph (all runways) and 15 mph (transport category runways) for each runway and combinations and the weather station source and time period of data should also be given.

This data may be on a separate sheet or sheets, such as the title sheet, especially if low visibility wind data are given. Wind information should be for all-weather conditions, supplemented by instrument meteorological conditions (visibility less than 3 miles and ceiling less than 1000 ft.) where annual instrument approaches exist or are expected.

At locations where no satisfactory wind data exist, the basis for the wind analysis and runway alignment should be given in the master plan documentation and an appropriate note included on the plan. Where the principal runway is not aligned with the main wind coverage, note why. Wind should be presented on a 36 point compass.

Information on wind analysis and display is contained in AC 150/5300-4B, "Utility Airports-Air Access to National Transportation."

(6) *Designated Instrument Runway.* The runway, or runways, that are to be planned for precision instrument approach procedures (both horizontal and vertical instrument guidance) and ultimately have an instrument landing system and related facilities installed by FAA, must be indicated on the plan and in the basic data table. The FAA designates the instrument runway(s) based on coordinated airport operator planning recommendations. It is important that the planning for this key element be well coordinated with FAA and that its designation on the ALP be timely.

(7) *Detail Required.* To avoid clutter, all items need not be drawn if a note can adequately cover the development or facility under consideration. For example, standard taxiway lighting, runway and taxiway marking, and the taxiway sign system can be covered by a note in the basic data table. Where detailed planning has not been performed for areas reserved for future aviation or non-aviation development, an outline of these areas is generally adequate.

b. *Approach and Runway Clear Zone Drawing.* This should depict the following information:

(1) Area under the imaginary surfaces as defined in FAR Part 77, Objects Affecting Navigable Airspace.

(2) Existing and ultimate approach slopes and any height or slope protection established by local zoning ordinance.

(3) A plan and profile of the runway clear zones, approach zones and surfaces showing the controlling structures and trees therein (i.e., usually the tallest object within a cluster) and their elevations. Also roads, railroads, and polelines that cross clear zones and approach areas should be shown on the profile (highest elevation). It is highly important that there be clear topographic detail and dimensions of close-in obstructions. Roads and railroads should be shown on the profile to the highest elevation plus the added elevation specified in FAR Part 77.

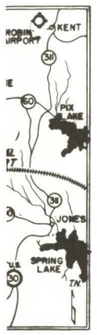
(4) Location and elevation of obstructions exceeding criteria in FAR Part 77. Obstructions off the plan may be indicated by a note or by extending the plan and profile to its full length (with a possible break, where such obstructions are significant - such as a mountain range). For a cluster of tall objects within close proximity of each other, only the elevation of the tallest object need be shown. There should be a listing of all obstructions and the measures taken to remove, light, mark or waiver them. Any plans concerning the alteration or removal of obstructions should be noted on the plan and in the basic data table. Where an obstruction chart (O.C.) exists, it should be used as a basic reference.

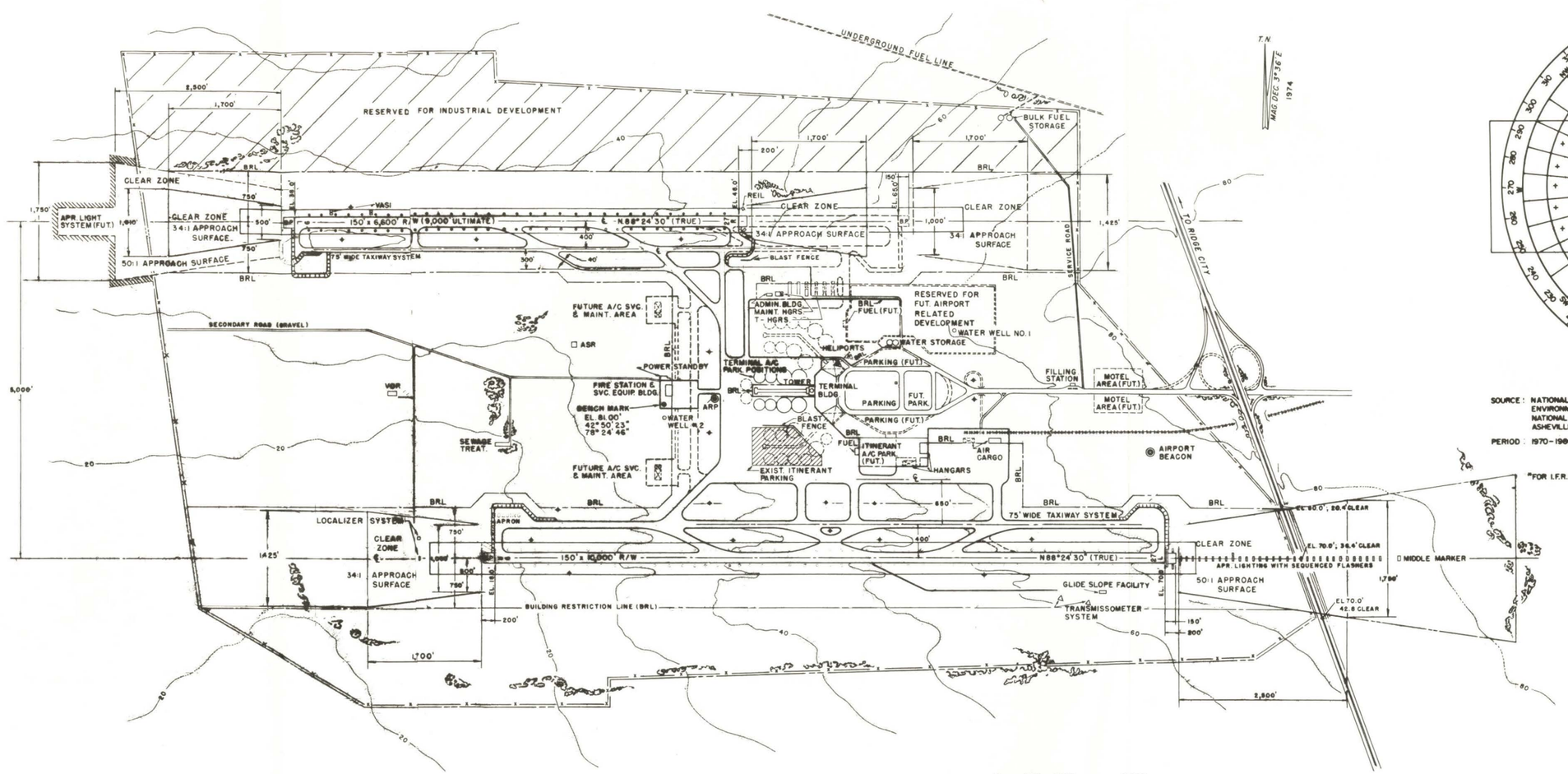
(5) In the approach areas, tall smokestacks, television, and radio transmission towers; garbage dumps or other areas which could attract a large number of birds; and any other potential hazard to aircraft flight.

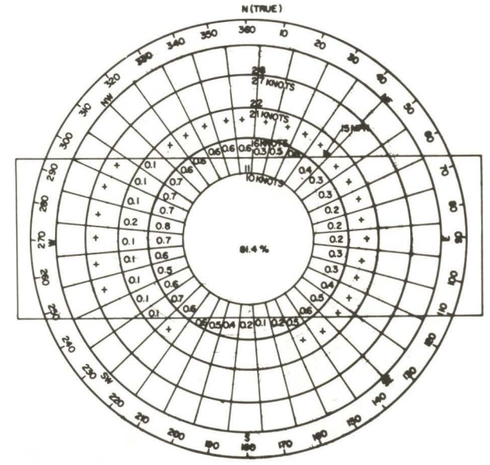
(6) Where obstructions are a significant problem, the plan and profile graphics should be in appropriate detail.

c. *Property map.* The property map should show ownership or interest in each tract within the airport boundaries. How and when the airport property was obtained should be noted or described separately. Detailed ownership or interest in property immediately adjacent to the airport is not necessary unless germaine to airport operation or expansion. If there have been obligations incurred as a result of obtaining property, or an inter-

FIGURE 9-1







SOURCE: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
ENVIRONMENTAL DATA SERVICE
NATIONAL CLIMATIC CENTER
ASHEVILLE, N.C.

15 MPH CROSSWIND COVERAGE = 97.7%
% V.F.R. WEATHER = 90.5
% I.F.R. WEATHER = 9.5

PERIOD: 1970-1980 (109,536 OBSERVATIONS)

* WIND ROSE (ALL WEATHER)

*FOR I.F.R. WIND DATA, SEE SUPPLEMENTAL SHEET

0 500 1,000 2,000
SCALE IN FEET

	RUNWAY 9L - 27R
XISTING	ULTIMATE
0.12	0.30 ℄
98.2	SAME
85	✓
MOD./AIRCRAFT	1700,300DT
34:1	50:1 & 34:1
HIRL	SAME
H-PRECISION	PRECISION
EIL, VASI*	ADD ILS, ALS
D TO R/W 9L.	
NGLE (S), DUAL (D),	

BASIC DATA TABLE

AIRPORT DATA

	EXISTING	ULTIMATE
AIRPORT ELEVATION	70.0'	SAME
AIRPORT REFERENCE POINT (ARP) COORDINATES	LAT. 42°50'25" LNG. 78°24'48"	SAME
NORMAL MAXIMUM TEMPERATURE	80°F	SAME
AIRPORT AND TERMINAL NAV. AIDS	VOR, ASR	SAME
AIRPORT CATEGORY	TRANSPORT	SAME
MISCELLANEOUS FACILITIES		
TAXIWAY LIGHTING, CENTERLINE MARKING AND SIGN SYSTEM	✓	✓

LEGEND

EXISTING	ULTIMATE	
		BOUNDARY FENCE
		STORM WATER INLETS
80		GROUND CONTOURS
		THRESHOLD BAR (ALS)
		FACILITIES
		SHOULDER STABLIZATION
		EASEMENT
		PROPERTY LINE
		BUILDING RESTRICTION LINE (BRL)
BP	BP	BLAST PAD
		STORM INLET
		RAILROAD TRACK

NOTE

1. THESE PLANS SHOULD NOT BE USED AS STANDARDS FOR PLANNING OR DESIGN.

NO.	REVISIONS	BY	APP.	DATE

RIDGE CITY AIRPORT COMMISSION

SUBMITTED BY DATE: 8-7-84:
E.B. PETROLE INC.
CONSULTING ENGINEERS

APPROVAL BLOCK

MUNICIPAL AIRPORT
RIDGE CITY, MASS.

AIRPORT LAYOUT PLAN

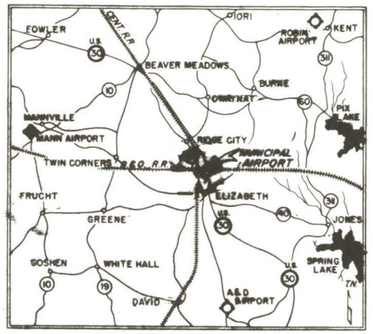
E.B. PETROLE INC.
CONSULTING ENGINEERS

DESIGNED BY: _____ DATE: _____ TRACED BY: _____ DATE: _____
DRAWN BY: _____ DATE: _____ CHECKED BY: _____ DATE: _____

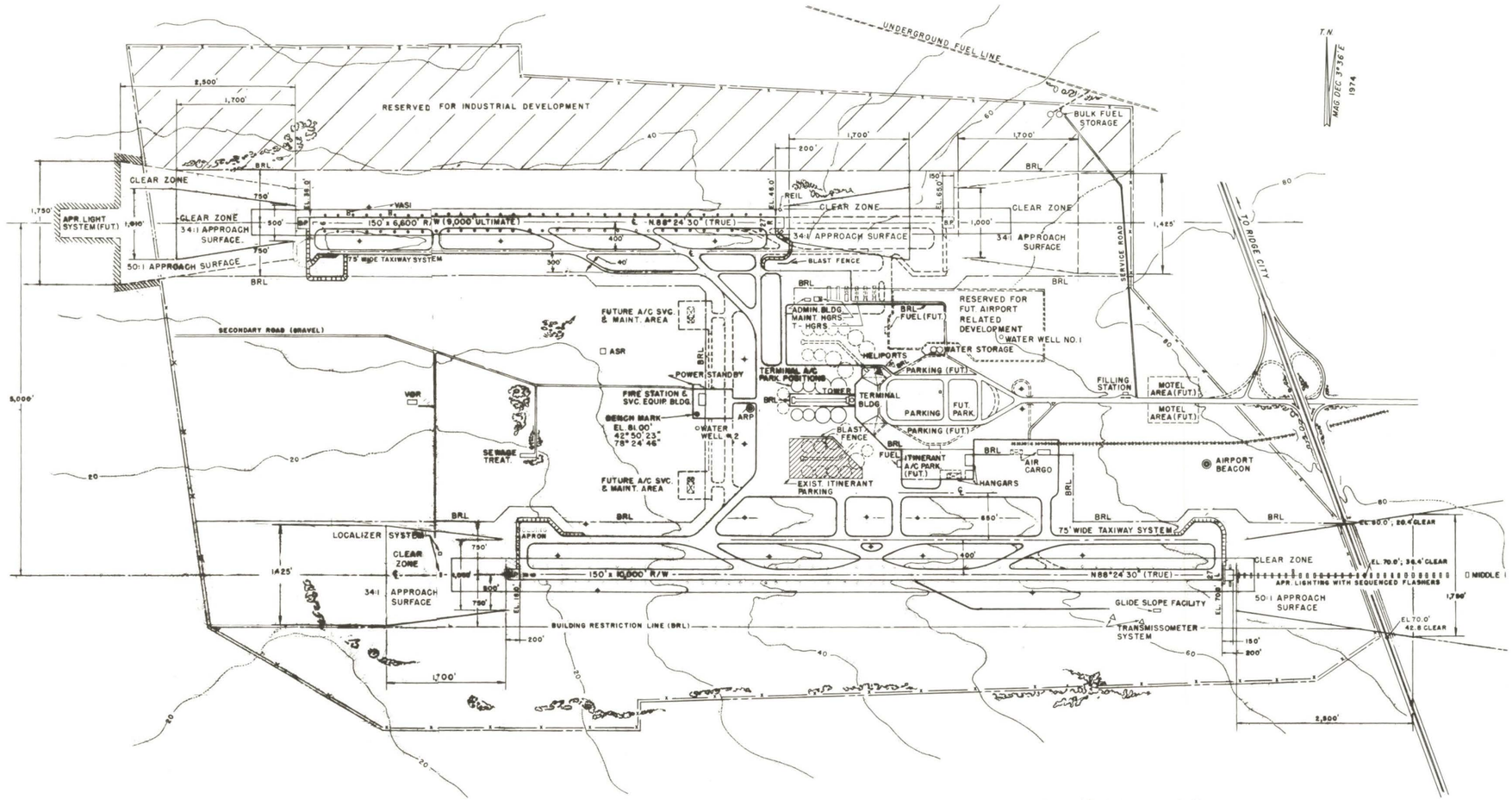
DRAWING NO: 4322 - AB3

SCALE AS SHOWN
SHEET: 1 OF 2

FIGURE 9-1



LOCATION MAP



BASIC DATA TABLE

RUNWAY DATA

	RUNWAY 9R-27L		RUNWAY 9L-27R	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
EFFECTIVE GRADIENT	0.52	SAME	0.12	0.30 ‡
% WIND COVERAGE	98.2	SAME	98.2	SAME
INSTRUMENT RUNWAY	✓	✓		✓
PAVEMENT STRENGTH	1700, 3000T	SAME	60S, 600, 1400T ‡‡	1700, 3000T
APPROACH SURFACES	34:1 & 50:1	SAME	34:1	50:1 & 34:1
RUNWAY LIGHTING	HIRL	SAME	HIRL	SAME
RUNWAY MARKING	PRECISION	SAME	NON-PRECISION	PRECISION
NAVAIDS, VISUAL AIDS	ALS, ILS	SAME	REIL, VASI	ADD ILS, ALS

‡ RELOCATED FROM R/W 9L TO 9R WHEN ILS AND ALS IS ADDED TO R/W 9L.
‡‡ VALUES GIVEN ARE THE GROSS WEIGHT IN 1000 LBS. FOR SINGLE (S), DUAL (D), DUAL TANDEM (DT) GEAR AIRCRAFT.

BASIC DATA TABLE

AIRPORT DATA

	EXISTING	ULTIMATE
AIRPORT ELEVATION	70.0'	SAME
AIRPORT REFERENCE POINT (ARP) COORDINATES	LAT. 42°50'23" LNG. 78°24'46"	SAME
NORMAL MAXIMUM TEMPERATURE	80°F	SAME
AIRPORT AND TERMINAL NAV. AIDS	VOR, ASR	SAME
AIRPORT CATEGORY	TRANSPORT	SAME
MISCELLANEOUS FACILITIES		
TAXIWAY LIGHTING, CENTERLINE MARKING AND SIGN SYSTEM	✓	✓

LEGEND

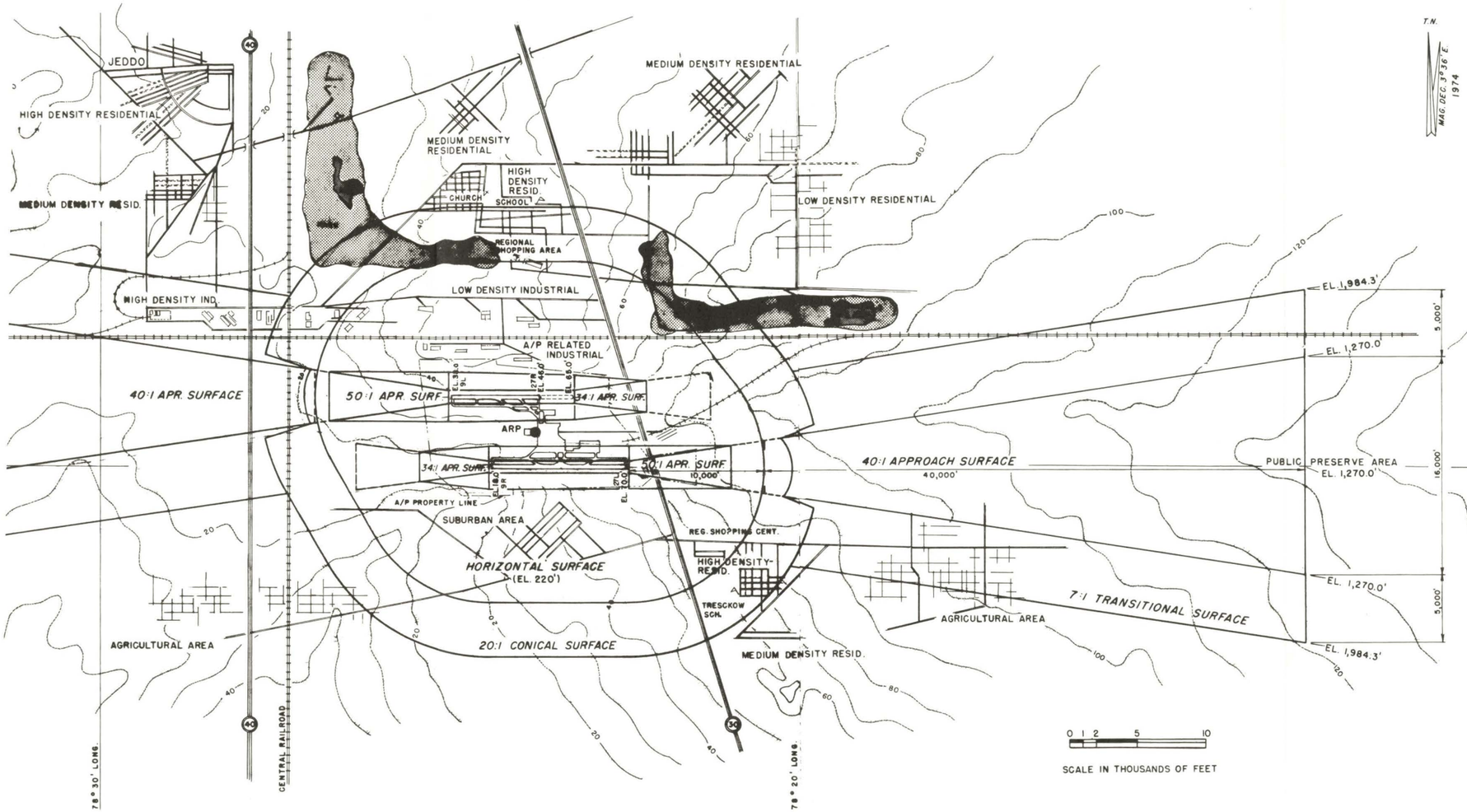
EXISTING	ULTIMATE	
		BOUNDARY FENCE
		STORM WATER INLETS
80		GROUND CONTOURS
		THRESHOLD BAR (ALS)
		FACILITIES
		SHOULDER STABLIZATION
		EASEMENT
		PROPERTY LINE
		BUILDING RESTRICTION LINE (BRL)
BP	BP	BLAST PAD
		STORM INLET
		RAILROAD TRACK

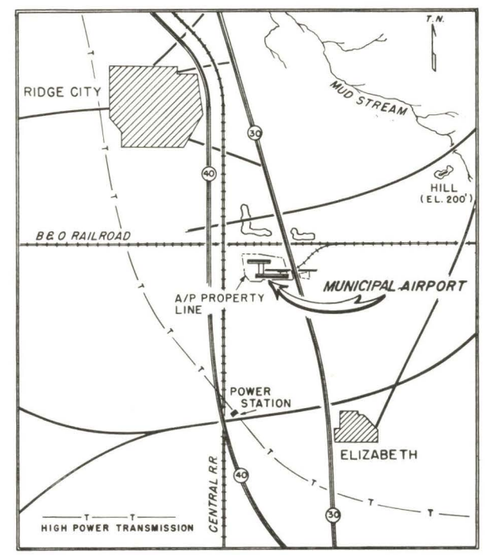
NOTE
1. THESE PLANS SHOULD NOT BE USED AS STANDARDS FOR PLANNING OR DESIGN.

SUBMITTED BY
E.B. P
CONSULT

APPRO

FIGURE 9-2



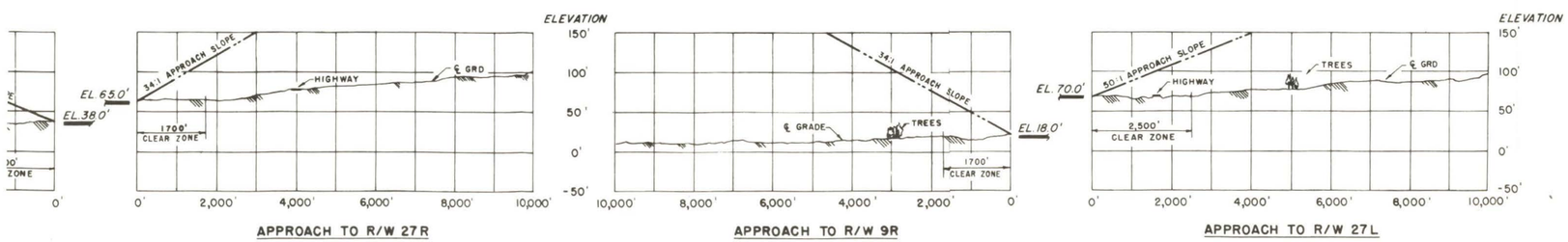


VICINITY MAP

ESTABLISHED AIRPORT ELEVATION : 70.0'

AIRPORT REFERENCE POINT (ARP) COORDINATES : LAT. 42°50'24"
LONG. 78°24'45"

NOTE:
THESE PLANS SHOULD NOT BE USED AS STANDARDS FOR PLANNING OR DESIGN.



NO.	REVISIONS	BY	APP.	DATE

RIDGE CITY AIRPORT COMMISSION

SUBMITTED BY: E. B. PETROLE INC. CONSULTING ENGINEERS — DATE 2-7-84

APPROVAL BLOCK

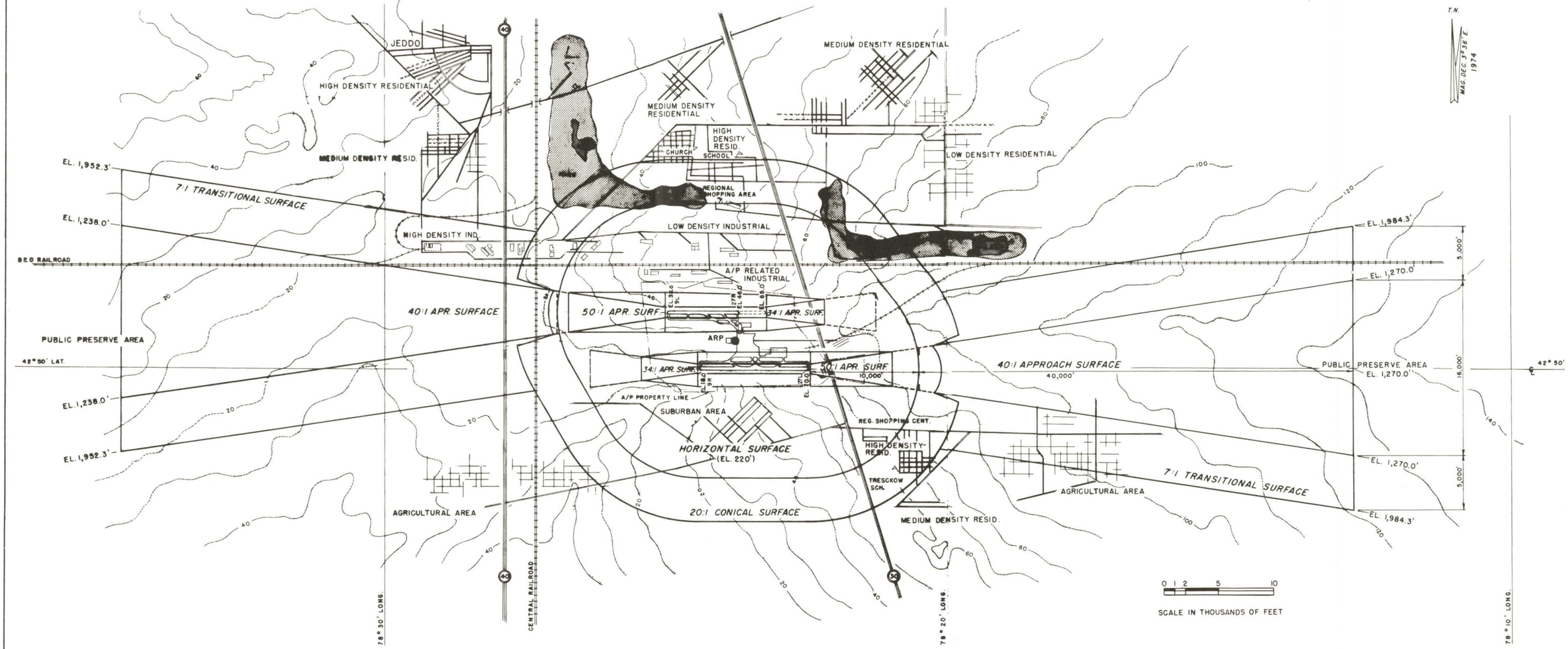
MUNICIPAL AIRPORT
RIDGE CITY, MASS.

APPROACH & CLEAR ZONE PLAN

E.B. PETROLE INC.
CONSULTING ENGINEERS

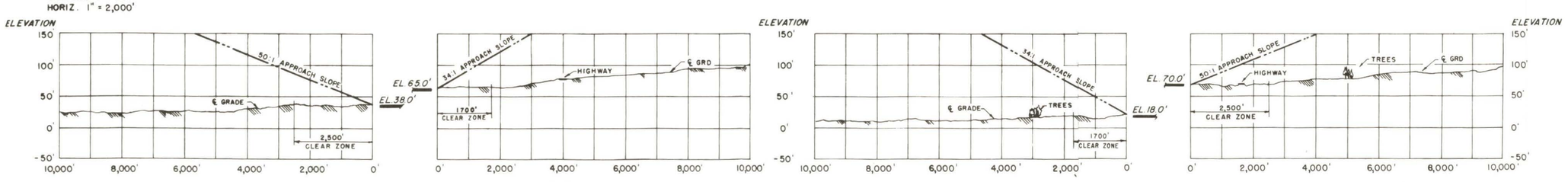
DESIGNED BY: ____ DATE: ____	TRACED BY: ____ DATE: ____
DRAWN BY: ____ DATE: ____	CHECKED BY: ____ DATE: ____
DRAWING NO. 4322 - AB 3	SCALE AS SHOWN
	SHEET 2 OF 2

FIGURE 9-2



SCALES OF R/W PROFILES

VERTICAL 1" = 100'
HORIZ. 1" = 2,000'



SUBMITTED
E. E
CONS
API

est therein, this should be noted. Important, from an FAA perspective, are obligations that stem from a Federal grant or obligations under FAA-administered land transfer programs such as surplus property programs.

In cases where interests are uncomplicated and where ownership information can be shown on the ALP, a separate property map will not be necessary.

d. *Master Utility Drawing.* Preparation of a master drawing showing the type, size and routing of utilities on and serving the airport will prove highly useful to the airport operator as well as in follow-on planning.

e. *Airport Layout Plan Approval.* Regardless of the existence of a comprehensive master planning study, the airport operator must have an FAA approved ALP in order to receive financial assistance under the terms of the Airport and Airway Improvement Act of 1982 (AIP). The maintenance of an up-to-date plan and conformity to the plan are obligations at an airport on which Federal funds have been expended under the AIP and the previous airport development programs, the 1970 Airport Development Aid Program (ADAP) and Federal Aid Airports Program (FAAP) of 1946, as amended.

While ALP's are not required for airports other than those developed with assistance under the aforementioned Federal programs, their utility justifies their preparation.

f. *Airport Layout Plan Examples.* An example of an ALP for a commercial service airport is shown in Figure 9-1. Figure 9-2 shows a typical approach and runway clear zone drawing. It should be emphasized that these are guides only, and an ALP should be tailored to meet the individual airport study requirements. For an example of an ALP for a utility airport consult the AC 150/5300-4B. Utility Airports - Air Access to National Transportation.

3. **TERMINAL AREA PLAN.** Airport terminal area plans should be limited to conceptual drawings. This will include the basic sizing of overall areas on ALP's and, for the higher activity commercial service airports, the development of schematic drawings adequate for delineating basic flows of passengers, baggage, cargo and vehicles. This will include movement from car parking areas or curb space to aircraft and back again. The development of details which are required in construction drawings and specifications should not be included in the airport master plan. Concept drawings should not be so definitive as to preclude important changes which will evolve with the development of detailed plans. Such changes are inevitable as an airport project moves through final design and construction.

Terminal area plans for the higher activity commercial service airport should first provide an overall view of the terminal area (scale of 1″ = 500′ to 1″ = 1000′) and should then provide large scale drawings (scale of 1″ = 50′ to 1″ = 100′) of important segments within the overall plan. Thus, large scale views should be provided of terminal building areas, including aircraft parking and maneuvering areas, cargo building areas, hangar areas, airport motel sites, service facilities, and airport entrance and service roads, as appropriate to the particular airport.

4. **AIRPORT ACCESS PLANS.** This element of the airport master plan should indicate proposed or existing routes from the airport to central business districts and to points of connection with existing or planned ground transportation arteries and beltways. All modes of access should be considered including highways, rapid transit, and access by helicopters. The airport access plan should be of a general nature since detailed plans of access outside the boundaries of the airport will be developed by highway departments, transit authorities, and comprehensive planning bodies. Special studies of access systems beyond the airport boundary will normally not be included in a master plan effort. For general aviation airports and all but the high activity commercial service airports, it will only be necessary to show existing and planned access systems on the airport layout plan and vicinity map.

5. **NOISE COMPATIBILITY PLAN.** The airport operator is encouraged to undertake a noise compatibility planning program, i.e., develop noise exposure maps and noise compatibility programs, under the provisions of the Aviation Safety and Noise Abatement Act of 1979. This voluntary program, for airports with existing or potential noise

problems, is carried out by the airport operator in conjunction with local and state officials, following the guidelines contained in FAR Part 150 and elaborated on in AC 150/5020-1, "Noise Control and Compatibility Planning for Airports."

The FAR provides for the airport operator to submit to the FAA a noise exposure map and noise compatibility program which outlines noise control and land use planning strategies to minimize noise impacts. Financial assistance for the planning is available under the Airport and Airway Improvement Act of 1982 (AIP). Projects to carry out elements of approved noise compatibility programs are eligible for Federal participation under the AIP.

Noise compatibility planning should be accomplished at the same time as the master plan because of the interrelationship of the two.

Should the master planning precede the noise compatibility planning or should special noise compatibility planning not be anticipated, it may be necessary to prepare noise contours as a part of the master planning study. These noise contours, overlayed on existing land use maps, should be used to identify existing and potential noise sensitive land uses. For high activity airports, or for airports where existing or potential land uses may be a problem, it will be necessary to develop an off-airport land use plan. This plan should display recommended land use compatibility actions where such actions may be achievable. Coordination with local land use authorities is a must.

For a complex airport, the noise contours should be developed using an FAA-approved computer-based mathematical model, such as the FAA's Integrated Noise Model (INM). The standard Ldn metric should be used with land use planning recommendations given for areas exposed to an Ldn level of 65 or higher. Guidelines for determining land use compatibility with various noise levels are contained in a number of publications, including the AC 150/5020-1.

For the general aviation airport or low activity commercial service airport, where noise problems are minimal, the preparation of an individual land use plan will not be necessary.

Reference should be made to FAA Order 5050.4, "Airport Environmental Handbook" which defines the conditions under which noise may be a problem and where off-airport land use planning may be needed.

CHAPTER 10 PLAN IMPLEMENTATION

Remote gate, Tampa International

1. **GENERAL.** There should be reasonable assurance prior to undertaking the master plan study and during the organizational phase that the airport operator generally will have the financial capability to undertake airport development. Also, as stated earlier, there should be repeated testing of the financial feasibility of development concepts throughout the requirements analysis and site selection activities.

After the implementation schedule has been adopted, it must be periodically subjected to economic analysis to ascertain whether the financial considerations upon which it is predicated remain reasonably on target.

The financial planning in support of the implementation schedule involves the strategies for obtaining capital financing and the identification and projection of current and future revenues to cover all or part of the cost of capital financing and airport operations.

2. **IMPLEMENTATION SCHEDULE.** The implementation schedule and cost estimates will evolve from technical and financial considerations. The technical considerations include the time it will take to acquire land, develop the engineering design and complete construction. This assumes all necessary approvals and prerequisites, such as the environ-

mental impact statement, have been completed. For a new airport there may be organizational activities required such as the enactment of enabling legislation.

The financial considerations which may affect the schedule relate to the availability and timing of capital financing. Federal and state aid may be limited, current indebtedness could delay early debt incurrence, or the financial market may not be suitable for debt financing. Therefore, there may be some adjustment in scheduling priorities. For example, a secondary priority obstacle clearance project may appear in the short-term capital improvement program in lieu of a higher priority runway extension due to short term financial limitations.

The participation of the airport operator in developing the implementation schedule is critical in that the operator, rather than the consultant, is able to ascertain and adjust priorities.

Schedules should be based on short (up to 5 year), intermediate (10 year) and long term (20 year) development requirements. Capacity oriented development which relates directly to demand levels should be scheduled at the occurrence of these demand thresholds rather than at a specific point in time. This would not normally apply to the near term improvements where forecasts are likely to be met.

The long-range plan identifies the ultimate role of the airport, airport design type and the concept for accommodating ultimate facility requirements. The intermediate-range plan is a more detailed description for sizing airport requirements and layout. The short-term plan is an immediate action program which recognizes realistic local, state and federal funding levels. The immediate action program should be a useful document for FAA's AIP program formulation and should not overlook such items as pavement rehabilitation, obstruction removal, safety areas and other items.

The master plan should include a drawing, or drawings, showing the development phases (see Figures 10-1, 10-2, 10-3) which in turn should be keyed to a schedule and descriptive narrative (see Tables 10-1, 10-2, 10-3). For the low activity airports with an uncomplicated development schedule, it may suffice to display the development phases on the airport layout plan.

Total development costs should be shown in constant dollars. Costs should include a percentage for engineering, inspection, legal and administration and a percentage for contingencies. Land acquisition should include relocation, legal and any other relevant costs. If costs are to be financed with revenue bonds, they should be grouped by functional area, insofar as possible, to facilitate cost allocations for financial planning.

3. **FINANCIAL PLAN.** The financial plan in support of the implementation schedule will vary, according to the type and activity level of the airport and its ability to generate revenue.

Low activity commercial service airports and general aviation airports historically have operated without operating revenue surplus. Thus, without sufficient revenue to support both operations and capital improvement programs, the municipalities must rely on Federal and State assistance with the local share derived from municipal operating funds or general obligation bonds.

Master planning for the low activity airport should recognize the dependence on Federal and state aid for improvements but should not place reliance on availability. Instead, optional financial plans should be considered which propose alternative strategies for developing financing. The master plan should discuss realistically the investment requirements and the cost effectiveness and benefits that may result from the proposed development so that the airport operator can make practical decisions predicated on availability of funds and community public investment priorities.

AC 150/5300-4B, "Utility Airports - Air Access to National Transportation," provides some useful information regarding financial considerations for low activity general aviation airports.

On the other end of the scale, the high activity commercial service airports usually generate sufficient revenue to support revenue bond financing for capital improvements. The requirement to supplement bond financing with Federal aid will vary in degree, usually in relation to activity levels.

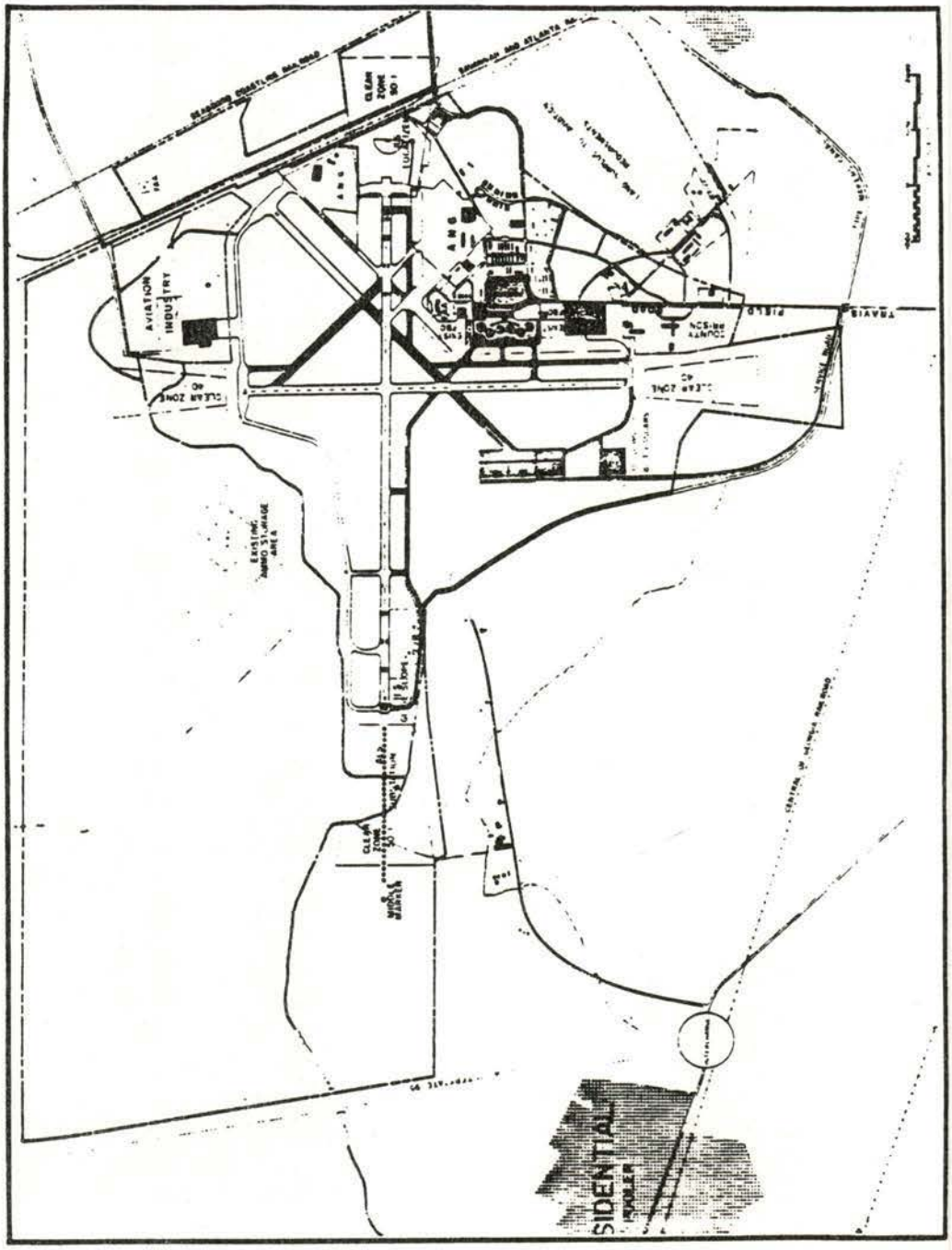


FIGURE 10-1. FIRST STAGE DEVELOPMENT

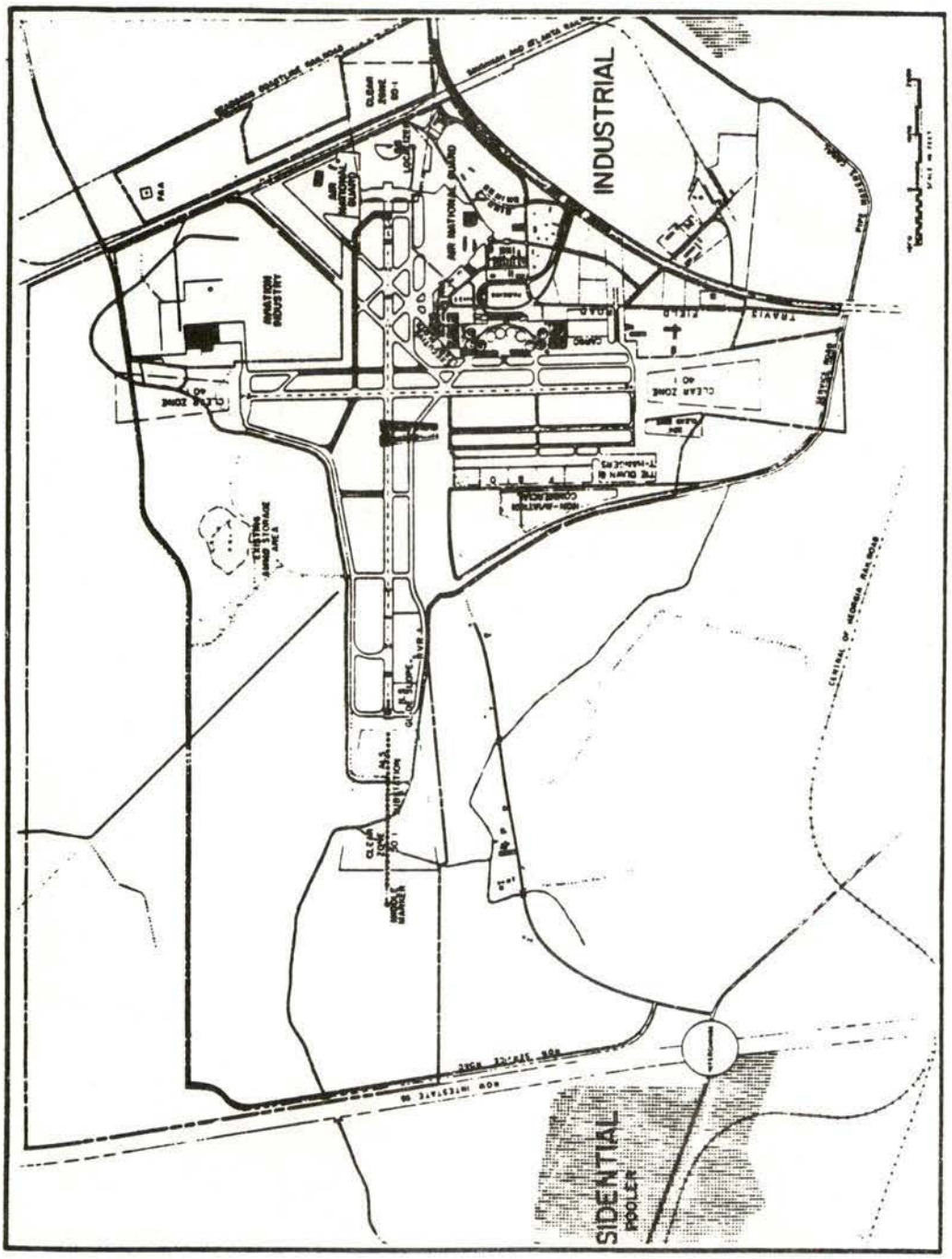


FIGURE 10-2. SECOND STAGE DEVELOPMENT

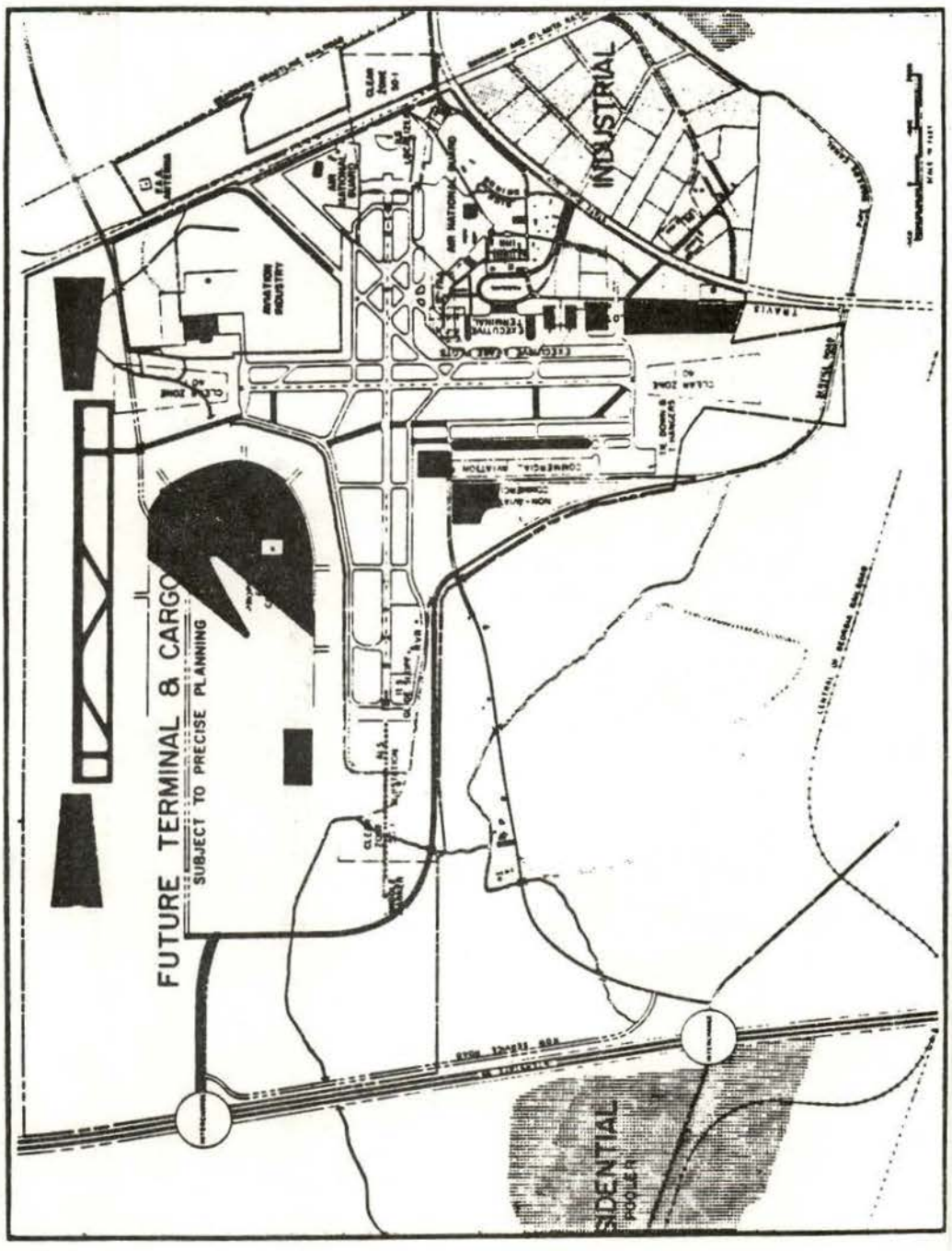


FIGURE 10-3. THIRD STAGE DEVELOPMENT

TABLE 10-1 - First stage preliminary project cost estimate* (1985-1989)

	1985	1986	1987	1988	1989	Total Costs
Paving						
Airfield: (includes lights						
Runway			460,000	568,000		1,028,000
Taxiways			575,000	600,000	429,000	1,604,000
Aprons			205,000	197,000		402,000
Roads:						
Terminal and service			236,000	236,000		472,000
Parking lot		120,000				120,000
Buildings						
Expansion of existing terminal		374,000	656,000	1,140,000	463,000	2,633,000
Relocation						
Fixed base operator		204,000	253,000			457,000
National Guard		105,000				105,000
Airport maintenance	87,000					87,000
Miscellaneous						
Electrical			40,000	120,000	125,000	285,000
Utilities					128,000	128,000
Drainage			86,000			86,000
Fencing					31,000	31,000
Site preparation	137,000	220,000	380,000			737,000
TOTAL	224,000	1.023,000	2,891,000	2,861,000	1,176,000	8,175,000

* Constant Dollars including 20% for engineering, legal, administrative and 10% contingencies

TABLE 10-2 - Second stage preliminary project cost estimate* (1990-1994)

Paving	
Airfield: (includes lights)	
Runways	$ 240,000
Taxiways	950,000
Aprons	378,000
Roads:	
Terminal and service	365,000
Buildings	
Expansion of existing terminal	787,000
Relocation	
National Guard	225,000
Miscellaneous	
Electrical	65,000
Drainage	45,000
Site preparation	$ 292,000
TOTAL	$ 3,347,000

Note: Develop 18R-36L, including taxiways, aprons to serve annual level of 200,000 operations.

TABLE 10-3 - Third stage preliminary project cost estimate* (1995+)

Paving	
Airfield: (includes lights)	
Runways	$ 2,798,000
Taxiways	2,240,000
Aprons	1,980,000
Roads:	
Terminal and service	1,550,000
Parking lot	302,000
Buildings	
New Terminal	12,737,000
Fire/crash	298,000
Airport maintenance	340,000
Miscellaneous	
Electrical	202,000
Utilities	475,000
Drainage	375,000
Landscaping	402,000
Fencing	86,000
Site preparation	1,204,000
TOTAL	$ 24,989,000

Note: Develop new runway 9L-27R and North terminal complex to serve total annual passenger level of 2,500,000.

*In constant (1984) dollars, adjusted for 20% engineering, legal, administrative and 10% contingencies.

Because the high activity commercial service airports are self-sufficient, the offsetting of costs with revenues is figured on a break even basis with costs allocated to revenue producing areas and a balance achieved through revenue or cost adjustments.

a. *Cost allocation*. For the high activity commercial service airport, where revenue bond financing instruments are applicable, it is necessary to assure that the individual components of the airport are generating an appropriate portion of the revenue. Therefore, the airport is divided into cost centers to allow allocation of costs following generally acceptable cost accounting principles. Of course, if there is current capital indebtedness, new costs are added on to them. Capital costs for non-revenue areas must be allocated to various operations based on a logical relationship to service requirements.

Projected expenses for operations (including maintenance and administration) should be developed for each cost center based on unit costs for direct expenses. For non-revenue areas these expenses must be distributed to various airport operations.

These cost allocation procedures would not necessarily be productive for airports with low overall operating revenues.

b. *Financing mechanisms*. There are many ways in which financing of airport development can be accomplished. Financing may flow directly from the municipal operating budget, or through bank loans, general obligation and revenue bonds, nonprofit corporation bonding, industrial development bonds, private financing, Federal and state aid, or a combination of these.

(1) *General obligation bonds*, backed by the municipality's creditworthiness and taxing power, have been the most common funding mechanism. They usually bear relatively low interest rates, possibly 1 to 1.5 percent lower than revenue bonds, because of their high degree of security. However, as a municipality's overall debt is limited by state law, competition from other community financing requirements could preclude availability for an airport project. In some states, there is an allowance to the debt limitation rule for general obligation bonds which are for a revenue producing enterprise. The general obligation bond is sold in the open market, usually by banks.

(2) *Revenue bonds assume* payoff on the basis of revenues from the particular facility being constructed. This type of financing instrument is popular because it does not burden the taxpayer. However, its use is limited to those airports with sufficient operating surplus to cover their debt servicing. Projected revenues must exceed debt service requirements by as high as 2 to 1. Interest rates may be dependent on the ratio, but in any case will be higher than general obligation bonds. Interest rates can be favorably affected by airline backing by which the airlines guarantee that landing fees and space rentals will be sufficient to cover debt service, even if adjustments are required.

(3) *Non-profit corporation bonding* is backed by special use taxes. In some instances the law provides for the formation of non-profit corporations for financing improvements, with the improvements reverting to the local government agency when the bonds are retired. This method of funding can be used for such facilities as maintenance hangars and air cargo terminals. Interest rates usually are lower than for revenue bonds.

(4) *Industrial development authority bonds* can be issued and underwritten by a corporation locating at an airport.

(5) *Private financing* of facilities such as hangars, hotels, fuel distribution systems and, possibly, terminals on land leased from the airport relieves the municipality of responsibility for raising capital. Creative financing of airport landside facilities, based on favorable tax implications, may prove to be an interesting alternative.

The Airport Operators Council International (AOCI) may prove a helpful source for information on financing trends at air carrier airports.

c. *Revenue sources*. For the high activity commercial service airports with operating surplus, the sum of operating and debt service expenses should establish a break-even revenue requirement for each cost center and for the airport as a whole. Revenues are projected based on current fee schedules and anticipated activity changes with adjustments made in fee schedules and leases based on break-even revenue requirements.

For the lower activity airports with no operating surplus, it will not be possible to balance operating revenues with debt service and operating costs. There should be an attempt, however, to improve the revenue situation by a comprehensive review and possible realignment of revenue arrangements, such as leases. A goal should be to relieve the municipal operating budget as much as possible from airport related expenses.

Revenue producing areas are listed for a typical high activity commercial service airport. Many of these revenue producing facilities would not be applicable to a low activity airport. Of interest is that about one-third of an air carrier airports' revenue comes from the landing area, including aircraft parking and aprons. However, for the low activity general aviation airport where landing fees are usually not assessed, landing area revenues, primarily from fuel flowage charges, account for less than 20 percent of the airport revenue. Building and ground rentals form the principal sources of revenue.

(1) *Landing Area.* This area includes runways and related taxiways and circulation taxiways. Landing fee revenues are collected from among scheduled airlines, other commercial service users, and general aviation. Landing fees should provide sufficient revenues to cover the landing area break-even need if cost allocation procedures are used.

(2) *Aircraft Aprons and Parking Areas.* Fees for the use of airline terminal aprons and cargo aprons are assigned to the scheduled airlines. Fees for the use of general aviation ramps are assigned to private aircraft. The fees are established to provide sufficient revenues to cover the break-even needs for specific aircraft aprons and parking areas.

(3) *Airline Terminal Buildings.* Revenues from concessionaires and ground transportation services are usually based on a percentage of gross income with a fixed-rate minimum for each type of service. Space for scheduled airlines and other users is paid for on a fixed rental. In order to establish rental rates, forecasts of potential revenue from concessions and ground transportation must be established. Rental rates are based on the break-even need of the terminal building, after giving credit for forecasted revenues from concessions and ground transportation services.

(4) *Public Parking Areas.* Public parking is usually operated on a concessionaire basis with revenues obtained from rentals based on a percentage of gross income with a fixed-rate minimum. The revenue amount required to meet break-even needs will depend on whether parking facilities are constructed by the airport owner or under provisions of the concessionaire contract. These revenues apply to public parking for both airline and general aviation terminals. Revenues in excess of the break-even need for public parking are allocated to the break-even need for the airport as a whole.

(5) *Cargo Buildings.* Rentals are usually charged on a rate per square foot and cover investments in employee parking, truck unloading docks, as well as building space. Rates are established to meet break-even needs.

(6) *Aviation Fuel.* Fees charged to aviation fuel handling concessionaires cover the costs of fuel storage areas and associated pumping, piping, and hydrant systems.

(7) *Hangars.* Rentals are usually based on a rate per square foot and cover investments in associated aircraft apron space and hangar related employee parking. Hangar office space is charged on a similar basis and covers office related employee parking.

(8) *Commercial Facilities.* Airport office buildings, industrial facilities, and hotels are usually operated on a lessee-management basis with revenues obtained from rentals on a square foot basis. The facilities are often financed by private capital. Revenues in excess of the break-even need are allocated to the break-even need of the airport as a whole.

(9) *Other Usable Areas.* Various uses of ground space for activities such as gasoline stations, service facilities for rental car operators, and bus and limousine operators usually obtain revenues on a flat rate basis. Those facilities are often financed by private capital. Revenues in excess of the break-even need are allocated to the break-even need of the airport as a whole.

4. **FINANCIAL FEASIBILITY AND ECONOMIC ANALYSIS.** The general tests of financial feasibility applied at the outset and throughout the planning process measure the ability of the airport operator

to cover the potential costs of alternative development concepts and schedules.

The ability to support development costs is based on the likelihood of obtaining Federal and state aid, the willingness to engage a financial instrument to generate a share of the costs and the amount of revenue attributable to airport operations.

a. For the high activity commercial service airports, the analysis of financial feasibility is straightforward. Applying the break-even concept, the revenue bond requirements can be balanced with readily projectable revenues to shape the development schedule. Periodic economic analysis of the development plan may require its adjustment if revenues and costs and Federal aid are not on track. Should the analysis show, for example, that the projects' cost effectiveness has changed then the scope or timing of the project may require adjustment.

b. For airports without sufficient revenues to support operations costs and provide adequate coverage for revenue bond financing of capital improvements, the Federal/state aid levels and public willingness to issue general obligation bonds are significant issues. The willingness of the community to support general obligation bond financing may be a critical issue. The argument that a general aviation airport is a public utility and a necessary element in the community's public service infrastructure with unquantifiable indirect benefits, may not be convincing. At least it will not be as convincing as the argument in support of an airport which provides scheduled service.

A traditional cost-benefit analysis may not necessarily provide the required measure of support because it may not withstand critical scrutiny due to the subjectivity and difficulty of quantification. However, a return on investment analysis which quantifies all sources of revenue such as tax accruals from net property and sales tax may prove useful in showing a point during the period of debt service when total revenues begin to exceed total outlays. For the low activity airport this point may not occur early and total costs over the debt service period may exceed revenues, even with a maximum of Federal and state aid. Nevertheless, a more acceptable balancing of costs and revenues than anticipated may be demonstrated.

For the high activity general aviation airport, such as a reliever, the return on investment analysis may show that total revenues (including sales and net property taxes) do exceed costs for the debt service period, even with less than maximum Federal and state aid. Of course, reliever airports have the added economic benefit of reducing the marginal capacity costs at the busy commercial service airports.

c. In performing return on investment analysis one should not be bound to consider the Federal and state funds as investments requiring revenue coverage. The purpose of the governmental assistance programs is to meet overall system needs where it has been determined that such needs cannot be achieved through local revenue sources alone. Instead, the individual airports share in the revenues (user taxes) collected at the national and state levels.

APPENDIX 1 BIBLIOGRAPHY

1. The latest issuance of the following AC's may be obtained from the Department of Transportation, Publications Section, M-442.32, Washington, D.C. 20590. AC 00-2, updated tri-annually, contains the listing of all current issuances of these AC's and changes thereto.

a. 150/5300-2D, Airport Design Standards-Site Requirements for Terminal Navigational Facilities. Provides information regarding the relative location and siting requirements for the terminal navigation facilities located on or close to an airport.

b. 150/5300-4B, Utility Airports—Air Access to National Transportation. Establishes design standards for utility airports which are constructed for and intended to be used by airplanes with approach speeds of less than 121 knots.

c. 150/5300-12, Airport Design Standards, Transport Airports. Provides recommended design criteria for the development of larger than utility airports.

d. 150/5325-5, Aircraft Data. Presents a listing of aircraft and data pertinent to airport design.

e. 150/5325-3, Background Information on Aircraft Performance Curves for Large Airplanes. Gives background infor mation on performance curves to assist in interpretation.

f. 150/5325-4, Runway Length Requirements for Airport Design. Give performance curves and standards for determining runway lengths for design and planning.

g. 150/5390-1C, Heliport Design Guide. Contains general and technical information pertaining to the establishment or improvement of heliports.

h. 150/5060-5, Airport Capacity and Delay. Explains how to compute airport capacity and aircraft delay for airport planning and design.

i. 150/5360-7A, Planning and Design Guidelines for Airport Terminal Facilities. Consolidates existing FAA guidance on the subject.

j. 150/5360-9, Planning and Design of Airport Terminal Facilities at Non-hub Locations. Provides guidance material for terminal facilities at low activity airports.

k. 150/5190-4, a Model Zoning Ordinance to Limit Height of Objects Around Airports. Provides guidance in controlling heights of objects around airports.

l. 150/5020-1, Noise Control and Compatibility Planning for Airports. Provides guidance for airports under FAR-Part 150 and the Aviation Safety and Noise Abatement Act of 1979.

m. Airport Environmental Handbook (Order 5050.4). Contains information needed to meet procedural and substantive environmental requirements for airport related actions. (This is the text of Appendix 6 of FAA Order 1050.1C, Policies and Procedures for Considering Environmental Impacts, which covers the broad range of FAA programs.)

n. 150/5100-14, Architectural, Engineering and Planning Consultant Services for Airport Grant Projects. Provides guidance for airport sponsors in the selection and employment of architectural, engineering and planning consultants.

o. United States Standards for Terminal Instrument Procedures (TERPS), Order 8260.3B. Contains criteria for instrument approach and departure procedures.

p. 90-66, Recommended Standard Traffic Patterns for Airplane Operations at Uncontrolled Airports. Explains regulatory requirements for airplane operations at uncontrolled airports, including traffic patterns.

q. 70-2D, Airspace Utilization Considerations in the Proposed Construction, Alteration, Activation and Deactivation of Airports. Advises on notification requirements and some of the airspace utilization factors which should be considered in plans for construction, alteration, activtion and deactivation of civil and joint use airports.

r. 70/7460-2G, Proposed Construction or Alteration of Objects that may Affect the Navigable Airspace. Advises of notification requirements.

s. 150/5395-1, Seaplane Bases. Contains guidance pertaining to the establishment or improvement of seaplane bases.

2. The following Government reports are for sale and may be obtained from the National Technical Information Service (NTIS), Springfield, Virginia 22151. The number in brackets following the report title represents the NTIS ordering number.

a. FAA-RD-73-82, The Apron-Terminal Complex (AD-771 186).

b. FAA-RD-75-191, The Apron and Terminal Building Planning Report (AD-A018 120).

c. FAA A5-75-1, Developing Noise Exposure Contours for General Aviation Airports.

d. FAA-EE-82-21, Air Quality Procedures for Civilian Airports and Air Force Bases.

e. Access to Commercial Service Airports, contract DTFA 01-83-D 88004.

f. Airfield Delay Simulation Model (ADSIM) User's Guide DOT/FAA/PM-84/2.

g. FAA-APO-85-7, Statistical Sampling of Aircraft Operations at Non Towered Airports.

3. The following publications are available from the U.S. Government Printing Office, Washington, D.C.

a. U.S. Department of Transportation, Federal Aviation Administration, Office of Aviation Policy and Plans, *Aircraft Operations Sampling Handbook* (1984).

b. *FAA Aviation Forecasts* (annually).

c. *FAA Terminal Area Forecasts* (annually).

d. Federal Aviation Regulation, Part 150, Airport Noise Compatibility Planning, January 1981.

e. Airport System Development, Office of Technology Assessment (U.S. Government Printing Office, Wash. D.C. 20402 Stock No. 052-003-00957-9).

4. The following publications are available as noted below.

a. Airports — U.S.A. and Preclearance, Facilities Guidelines for Federal Inspection Services. This document is free and can be ordered from the U.S. Customs Service, 1301 Constitution Avenue, N.W., Washington, D.C. 20229.

b. Airline Aircraft Gates and Passenger Terminal Space Approximations. Available from the Air Transport Association of America, 1079 New York Avenue, N.W., Washington, D.C. 20006.

c. Airport Terminals Reference Manual. Available from the International Air Transport Association, P.O. Box 550, 1000 Sherbrooke Street West, Montreal, Quebec, Canada H3A 2R4.

d. Horonjeff & McKelvey, Planning and Design of Airports (McGraw-Hill).

e. Howard, George P. (ed.), *Airport Economic Planning* (Cambridge: MIT Press, 1974)

f. Makridakis, Spyros and Wheelwright, Steven C., *Interactive Forecasting* (San Francisco: Holden-Day, 1973)

g. National Bureau of Economic Research, *Economic Forecasts and Expectations* (New York: Columbia University Press, 1969)

h. Nelson, Charles R., *Applied Time Series Analysis for Managerial Forecasting* (San Francisco: Holden-Day, 1973)

i. Theil, Henri, *Applied Economic Forecasting* (Amsterdam: North Holland Publishing Co., 1966)

j. Wiley, John R., *Airport Administration* (Eno Foundation for Transportation Planning, Westport, Connecticut, 1981)

k. Economic Benefits and Financing of General Aviation Airports (Transportation Research Board Circular 259, 1983; TRB 2101 Constitution Ave., N.W., Washington, D.C. 20418)

l. deNeufville, Dr. Richard, Air Cargo in the 1980's and Beyond (Transportation Systems Center Contract DTRS-57-83-C-00065)

m. Norman Ashford & Paul Wright, Airport Engineering (John Wiley & Son)

5. ICAO Documents - Available from ICAO, Attn: Distribution Officer, P.O. BOx 400, Place de l'Aviation internationial, 100 Sherbrooke St. West, Montreal, Quebec, Canada, H3A-2R2.

a. Annex 14 - Aerodromes

b. Annex 16 - Environmental Protection

c. Construction of Visual and Instrument Flight Procedures (PANS-OPS)

d. Airport Planning Manual

Part 1 - Master Planning

Part 2- Land Use and Environmental Control

e. Stolport Manual

AIRPORT MASTER PLANNING QUESTIONNAIRE

AIRPORT _____ DATE _____
AIRLINE _____ PREPARED BY _____
ADDRESS _____ PHONE _____
_____ _____
_____ _____
_____ _____

A. FORECAST OF PASSENGER ACTIVITY

	Base Year 19 __	FORECAST 5 Year 19 __	10 Year 19 __	20 Year 19____
1. PASSENGER ENPLANEMENTS				
• Annual				
• Average Day - Peak Month (AD - PM)				
• Peak Hour (AD - PM)				
2. PASSENGER DEPLANEMENTS				
• Peak Hour (AD-PM)				
3. OTHER				
• Percent of Transfer Passengers				
• 19 __ Peak Month is ____				
• Time of Day for Peak Hour Enplanements ____ and Deplanements ____				

B. FORECAST OF AIRCRAFT DEPARTURES

	Base Year 19 __	FORECAST 5 Year 19 __	10 Year 19 __	20 Year 19____
1. AVERAGE DAY - PEAK MONTH (By Type of Aircraft)				
_____				
_____				
_____				
_____				
TOTAL				
2. PEAK HOUR (AD-PM) (By Type of Aircraft)				
_____				
_____				
TOTAL				

C. FORECAST OF REQUIRED AIRCRAFT PARKING POSITIONS (GATES)

	Base Year 19 __	FORECAST 5 Year 19 __	10 Year 19 __	20 Year 19_____
TYPE OF AIRCRAFT AND PARKING METHOD (POWER OUT, POWER BACK OR PUSH BACK)				
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
NUMBER OF OVERNIGHT PARKING POSITIONS	_____	_____	_____	_____

D. FORECAST OF PASSENGER TERMINAL BUILDING FACILITIES

	Base Year 19 __	FORECAST 5 Year 19 __	10 Year 19 __	20 Year 19_____
1. ATO COUNTER - L.F.	_____	_____	_____	_____
2. ATO OFFICES (INCL. COUNTER AREA) S.F.	_____	_____	_____	_____
3. OPERATIONS OFFICES - S.F.	_____	_____	_____	_____
4. BAGGABE MAKE-UP - S.F.	_____	_____	_____	_____
5. BAGGAGE CLAIM (MOVING) DEVICE - L.F.	_____	_____	_____	_____
6. DEPARTURE LOUNGES NUMBER/ AREA - S.F.	_____	_____	_____	_____
7. OTHERS (DESCRIBE)	_____	_____	_____	_____

_____

_____

_____

_____

_____

8. ANY REMARKS INCLUDING LOCATION OF ABOVE FACILITIES (MAIN TERMINAL, CONCOURSES, ETC.)

_____

_____

_____

_____