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AIRPORT SITE SELECTION



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DEPARTMENT OF TRANSPORTATION
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AIRPORTS

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SUBJECT : AIRPORT SITE SELECTION

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1. PURPOSE. This circular, for public and private airport sponsor use, contains recommended procedures and guidance for analyzing potential airport sites. It is intended to assist in ensuring that all facets of aviation which directly affect the airport and its environs are considered at the formulative stage of development, thus reducing the need for making costly alterations later.
 2. REFERENCES. Copies of the publications listed in a and b below may be obtained from the Federal Aviation Administration, Distribution Unit, HQ-438, Washington, D. C., 20590. The publications are available at no cost unless indicated otherwise.
 - a. Advisory Circulars.
 - (1) 150/5060-1, "Airport Capacity Criteria Used In Preparing the National Airport Plan," dated August 1966.
 - (2) 150/5070-2, "Planning the Metropolitan Airport System," dated September 17, 1965.
 - (3) 150/5090-1, "Regional Air Carrier Airport Planning," dated February 2, 1967.
 - (4) 150/5100-1, "Information on Federal-aid Airport Program," (FAAP) dated April 15, 1965.
 - (5) 150/5190-3, "Model Airport Zoning Ordinance," dated January 1967.
 - (6) 150/5310-1, "Preparation of Airport Layout Plans," dated September 9, 1965.
 - (7) 150/5320-5A, "Airport Drainage," dated January 18, 1966.
 - (8) 150/5320-6, "Airport Paving," dated June 10, 1964.
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- (9) 150/5325-4, "Runway Length Requirements for Airport Design," dated August 5, 1967.
- (10) 150/5325-5, "Aircraft Data," dated April 1965.
- (11) 150/5370-1, "Standard Specifications for Construction of Airports," dated June 1, 1959. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price \$2.75 Supplement \$.15

b. Federal Aviation Regulations.

- (1) Part 77, "Objects Affecting Navigable Airspace," dated May 1, 1965. Price - \$.35 per copy.
- (2) Part 151, "Federal Aid to Airports," dated May 19, 1966. Price - \$.45 per copy.
- (3) Part 157, "Notice of Construction, Alteration, Activation, and Deactivation of Airports," dated March 2, 1966. Price - \$.15 per copy.

c. Other References.

- (1) "A Report on Airport Requirements and Sites In the Metropolitan New Jersey - New York Region," May 1961, by Port of New York Authority, 111 Eighth Avenue, at 15th Street, New York 11, New York, 10011. Price unknown.
- (2) "Land Use Planning Relating to Aircraft Noise," Bolt, Beranek & Newman Reports, AD 615015 and AD 617954, dated October, 1964 -- Available through the Federal Aviation Administration, Distribution Unit, HQ-438, Washington, D. C. 20590. Price unknown.
- (3) "National Airport Plan," prepared annually by FAA -- Available through the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Price \$1.25.
- (4) "Compatible Land Use Planning On and Around Airports," and "Aids Available for Compatible Land Use Planning Around Airports," dated June 1966, by Transportation Consultants, Inc., Washington, D. C. Copies may be obtained from the Clearinghouse for Federal Scientific and Technical Information, U.S. Department of Commerce, Springfield, Virginia, 22151. Price - \$3.00 Each.

3. SCOPE. This material covers site selection responsibilities under the Federal-aid Airport Program (FAAP) and suggested procedures to employ in analyzing all civil airport sites. Sample formats, sketches, and general considerations are included in the Appendix.
4. HOW TO GET THIS PUBLICATION. Additional copies of this publication may be obtained from the Federal Aviation Administration, Distribution Unit, HQ-438, Washington, D. C. 20590.



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1. INTRODUCTION. The success or failure of a new airport is dependent, to a large degree, upon the selection of the proper site. There is a temptation to select a site where the land can be easily acquired at a relatively low cost without fully considering other vital factors such as accessibility to users, construction costs, future expansion, obstructions, proximity to other airports and many other essential items, each of which is discussed in this circular.

In general, the airport site must meet existing and future airport needs in a convenient and economic manner. Sponsors may vary from private owners to multijurisdictional public bodies, thus varying the size and complexity of the airport and the problems associated with finding a suitable location. Consideration should be given to development of a site that will serve more than one community.

In cases where a substantial expansion of an existing airport is contemplated, a new site should be considered when excessive noise problems, land or construction costs or airspace conflicts are anticipated.

The recommended site selection procedures in paragraph 3 are generally applicable to all airport sizes. However, the analysis of factors which influence site selection should be tailored to the community-airport needs. The information listed in Appendix 1 is intended to be used in a comprehensive analysis of influencing factors and will accommodate a very complex airport. For small airports proposed for general aviation use only, the degree of detail on this analysis may be greatly reduced. It may be that the majority of the field work is done by a consulting firm hired by the airport sponsor. Therefore, the term "airport sponsor" as used herein is intended to include the duly authorized representative of the sponsor.

2. RESPONSIBILITY. It is essential to understand the roles of the airport sponsors and the Federal government in civil airport site selection in order to know what is expected of the parties involved.
 - a. Proposed Federal-aid Airport Program (FAAP) Airports. The initial investigation and location of airport sites is a local responsibility. The airport sponsor (i.e., state, city, or other public body) should present recommendations to the Federal Aviation Administration (FAA) and should obtain endorsement by the FAA of the airport site prior to submitting an application for Federal aid under the FAAP. In any case, FAA endorsement must be obtained by the Sponsor prior to issuance of a tentative allocation under the FAAP. Even though FAAP request is not initially submitted (or approved), if future Federal aid is contemplated, it is advisable to obtain FAA endorsement

prior to construction. Once the appropriate FAA office has been contacted, Administration personnel will confer with local sponsor officials and conduct a detailed review of the sites investigated by the sponsor and of the entire proposal. It is possible that this detailed review may disclose additional sites which should be studied by the sponsor. At the conclusion of the FAA review, an official FAA position on the sponsor's choice of sites (or more detailed report, if necessary) will be issued in writing to the sponsor. Refer to FAR Part 151 for an outline of procedures to follow in requesting FAAP assistance.

- b. Non-FAAP Public and Private Airports. The investigation and location of an airport site is a local responsibility, but advice and guidance may be obtained from appropriate FAA personnel. The prime contact in the FAA for such guidance is the Area Office Airports Branch Chief. No official endorsement by the FAA is necessary for a public or private use airport if no Federal funds are requested or contemplated. However, a sponsor of a non-FAAP airport must apply for airspace review prior to construction.
- c. Airspace Action. Federal Aviation Regulation, Part 157, "Notice of Construction, Alteration, Activation and Deactivation of Airports," revised March 2, 1966, requires notification to the nearest FAA Area or Regional office of construction or establishment of a new airport before work is started. This action is required for all new civil airports. A review of the effect of the new airport on navigable airspace will be conducted by the FAA and the sponsor informed of the results of the aeronautical study. After receiving these results the sponsor may determine that a more suitable site - due to airspace problems - should be selected. Additional information on this action may be obtained from the regulation, FAR Part 157.

In summary, the airport sponsor - either public or private - reviews and selects the airport site. When requested, the FAA will offer assistance in determining the most desirable airport site and, when Federal funds are involved, the FAA must investigate and take official action on the site. It can be presumed that any existing airport with a Federal agreement has been granted site endorsement. Sponsors of all proposed new non-FAAP civil airports, public or private, must notify the FAA in advance of construction to permit a study on considerations of the safe and efficient use of airspace by aircraft (the few exceptions to this general rule are outlined in FAR, Part 157).

3. PROCEDURE. This paragraph outlines recommended procedure to follow in selecting an airport site. Individual situations may vary, but the general approach should apply to most site selection studies.
- a. Determine Needs. Determine the present and potential aeronautical needs of the community and area to be served. In analyzing airport needs, include such factors as estimates of present and future based aircraft, types of aircraft anticipated, estimate of forecast operations, type of forecast usage (i.e., business, commercial passenger and freight, pleasure, instructional, etc.) as well as factors concerning size of community to be served and economic and population growth trends. A forecast period of at least 5 years for airports where no airline use is anticipated and at least 10 years for airports anticipating airline use is recommended. For convenience in recording these data, a sample format is outlined in Appendix 1, Figure 1.

The current National Airport Plan (NAP), which is prepared annually by the FAA, lists by community the airport development recommended for the ensuing 5-year period for the national system of airports. ^{1/} The NAP only lists FAAP-eligible items of development and a location must first be included in the NAP before being considered for Federal funds. The NAP may be a useful tool in determining basic airport needs, but items such as hangars and terminal buildings are not included in the NAP. At this point it is very desirable to consult with the FAA to obtain advisory assistance on specific airport recommendations.

- b. Desk Study of Area. Once the size and type of airport needed has been determined, additional data should be compiled and studied prior to making an actual field investigation in order to save time in the field. The major components of this desk study are:
- (1) Review existing comprehensive land use plans and other existing community and area plans.
 - (2) Analyze available wind data and determine the desired runway orientation (consult FAA regarding recommendations for cross-wind runway).

^{1/} The NAP does not represent a commitment of Federal funds nor does it represent ability or intent of the Federal government or local sponsor to proceed with construction.

- (3) Study USC&GS quadrangle sheets, county road maps and aeronautical charts to select tentative sites to be evaluated during the field investigation. Note proximity to other airports in the area and existing and future transportation facilities.
 - (4) Study general land costs and existing and planned land uses of the areas involved.
 - (5) Note major obstructions (i.e., large buildings, tall towers, pole lines) topographical features, recreational areas, and primary population distribution.
 - (6) Review general engineering factors such as availability of construction materials, general soil (soils information may be obtained from the Soils Conservation Service of Department of Agriculture or from the Bureau of Public Roads) and geological features.
 - (7) Sites in proximity to bird habitats (i.e., wildlife refuges, nearby lakes, rivers and coastal sites, have substantial numbers of water fowl, etc.) should be avoided. Potential bird hazards are of special importance where faster, larger piston aircraft and jet aircraft use is contemplated. Engine failures due to ingestion of birds and impact problems have been the cause of numerous fatalities. A site with nearby bird habitats may require extensive work such as filling ponds, closing of dumps, and other measures to insure that birds would not be hazards to aircraft operations.
 - (8) Review items peculiar to the area involved. This would include proximity to smoke, snow, glare, or fog conditions; status of zoning legislation; possible noise problems; and other items.
- c. Group Effort. The local interested groups such as flying clubs, aircraft owners associations, airline representatives, local and regional planning groups, civic groups, and others as well as official representatives of the airport sponsor (city council members, city engineer, state aviation officials) should be made aware of the plans for selecting an airport site. It may be desirable to form an aviation committee if one is not already in existence.

- d. Physical Inspection. The actual field inspection of potential sites will usually be at least two-part - preliminary and final. Unless requested, an agency representative will not normally be present on the preliminary field inspection. On airports where Federal funds are contemplated, the final field inspection will usually be a desirable time for the FAA representative to accompany the sponsor on the physical inspection of the sponsor's recommended site(s) and of the general area.
- (1) Preliminary. This should be a joint inspection by sponsor representatives of all existing airports and potential sites. Sample formats of information generally applicable to all sites and of information relating to each site inspected are given in Appendix 1, Figures 1 and 2. During this preliminary inspection physically cover as much of each site as possible. All pertinent data should be tabulated for the sites visited and brief sketches should be prepared for each site. Notes on the rough field sketches should contain enough detail that a more formal sketch (see Appendix 1, Figure 3) may be prepared later. Photographs taken of the sites are also recommended.

Representatives on the inspection should reach general agreement on approximate unit costs of land and construction items. After the selection has narrowed to a reasonable number of sites, the completed sketch and tabulated information should be assembled and analyzed for each site. The number will vary depending on the complexity of the airport under study; for example, a site to serve a metropolitan area may require further study on as many as fifteen possible sites whereas a small community may narrow their review to three sites. An overall sketch which shows all sites under consideration should be prepared (see Appendix 1, Figure 4) and the sites should be numbered or named for ease of reference.

An aerial inspection of the potential sites is very desirable. On an aerial inspection each site's approaches should be closely simulated and photographs taken if possible.

For professional aerial photographs contact the Aerial Photograph Division, Agricultural Stabilization and Conservation Service, Department of Agriculture. These photographs may be used in preparing sketches and in determining location of roads, drainage, wooded areas, and for estimating costs of site development.

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- (2) Final. This should also be a joint inspection, and if FAAP funds are involved, an FAA Airports representative from the nearest FAA area office should accompany the group. Potential sites selected during the preliminary field visits will be analyzed first. It is quite possible, however, that entirely new site(s) may be discovered requiring additional information for later evaluation and comparison.

e. Evaluation and Recommendations. A final report will be prepared listing the sites in order of preference and giving a short explanation of the advantages and disadvantages of each site. This final report will be the official recommendations of the sponsor. It is recommended that the following actions be taken to assist in writing the report:

- (1) Organize all information collected on the field visits. Keep in mind that quantitative comparisons should be made if possible.
- (2) Prepare a rough initial cost estimate of each site which shows the following suggested breakdown:

<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT COST</u>	<u>TOTAL COST</u>
Land - Fee Title			
Land - Easements			
Paving			
Obstruction Clearing			
Lighting and Marking			
Grading and Drainage			
Other Site Preparation (Turving, Mulching, etc.)			
Miscellaneous (Fencing Utilities, Access road, etc.)			

- (3) Tabulate each site's accessibility and distance to users (time-wise).
- (4) For each site, review: (a) expansion possibilities; (b) engineering considerations; and (c) informal airspace considerations (if applicable).
- (5) Prepare a rating sheet similar to that shown: 2/

SAMPLE RATING SHEET

<u>Site No.</u>	<u>Initial Cost</u>	<u>Expansion Cost</u>	<u>Accessibility to Users</u>	<u>Engineering Features</u>	<u>Obstructions</u>	<u>Noise</u>	<u>Airspace Status</u>	<u>Remarks</u>
1.								
2.								
3.								
etc.								

- (6) Prepare the final report which lists the airport sites investigated in order of preference and has a short explanation of the advantages and disadvantages of each site. All data that can be used for site justification should be attached to the report.

When the final site is selected, if no Federal funds are involved, airspace action should be initiated immediately. The airport sponsor may contact the nearest FAA area or regional office for further information on proceeding with airspace handling.

4. SPECIAL ACTION ON POTENTIAL FAAP AIRPORTS. In the case of potential FAAP airports, the FAA will review and prepare a brief analysis of the recommendations (more than one site may be suitable for development). The FAA and Sponsor should reach a mutual agreement on the best choice:

- 2/ Note that this rating sheet may contain many other factors and is only recommended as a convenient method for comparing important features of each site. All data gathered and shown in a manner similar to the sample formats in Appendix 1, Figures 1 & 2 should be considered in the evaluation.

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of sites. FAA endorsement normally will be limited to the best available site on a cost/benefit basis. In more complex cases, the FAA representative may deem it necessary to prepare a separate evaluation which will be made in accordance with the guidelines of this circular. Additionally, the FAA, in its coordinated review, will look at airspace aspects (including existing airports and operational activity), navaid needs, FAAP standards, and other FAA-oriented areas of consideration before endorsement or non-endorsement of a proposed site is rendered. This written endorsement of the site by the FAA will normally be contingent upon approval of the final airport layout plan. The endorsement does not imply a commitment of Federal funds, but is a necessary step in obtaining Federal funds under FAAP. The endorsement will normally have an expiration date of one year contingent upon development of the airport. This date may be extended upon request toward the end of the one year period if no major changes have taken place in the interim.

5. ADDITIONAL ACTION. In some cases, facts uncovered after the final selection has been made will necessitate further study of the potential airport sites. For example, a formal airspace review of the "best" site (from the standpoints of economics, expansion, usability, etc.) may indicate that severe operational restrictions would be imposed on the particular site. As another example, a detailed noise study of this "best" site may show that community response to the site would be highly unfavorable. Also, it may be that undesirable condemnation proceedings would have to be instigated to obtain the airport property at a reasonable cost.

If such major difficulties arise, then a complete restudy of the sites originally considered should be made. In the restudy it should be determined which sites will not have the same major problem encountered at the first choice of sites. Another field inspection may be desirable to ensure complete coverage of facts on the new choice of sites.

APPENDIX I.

ANALYZING THE AIRPORT SITE

Material presented in this portion of the Appendix is not intended to supplant expert guidance in specialized areas of engineering, planning, economics and the like, but rather is intended as a guide in helping to ensure that the major aspects of airport site selection are considered. Consultation with experts in various subjects concerning airport sites is encouraged, and it is, in fact, a normal procedure for public airport sponsors to make arrangements with engineering/planning firms for preparation of an airport site study or to make use of their own engineering/planning specialists.

No particular order of relative importance of the eleven major factors influencing airport site selection is intimated in the choice of the discussions shown below since the degree of importance of these factors will vary considerably from one location to another. Additional detail on each of these factors may be obtained by consulting the applicable references listed at the beginning of this circular.

1. CONVENIENCE TO USERS. The airport should be convenient to users in terms of time and distance. Convenience is a relative term depending upon the size and type of airport under study and the type of airport user to be served. What is "convenient" to a small aircraft owner who intends to use an airport to base his pleasure-use aircraft may not be "convenient" to a commercial airline passenger on important business flights.

The two basic tangible measures of convenience are (1) accessibility in terms of time and (2) cost of the transportation mode to the airport. In measuring accessibility, the controlling consideration is the time it takes for the users to get to the airport. Based upon the anticipated mode of travel to the airport, time contours may be established in relation to the center of the potential users. For example, consider automobile transportation only and note the various speed limits of the roads from the center of the prime concentration of users; then plot time contours in minutes on convenient increments (e.g., 10, 20, 30 minutes).

As a rule of thumb, nonair carrier airports planned to serve communities of less than 50,000 population should be located so that the majority of potential users are located within a 30-minute time contour.

In a recent study made by the Civil Aeronautics Board, it was learned that if the percent of the distance to the airport to the total journey was 25%, an airport could anticipate a 50% loss of potential origin/

destination traffic. For airport distances to total journey of less than 10% or greater than 40%, there would be a corresponding 0% or 100% loss in origin/destination traffic anticipated. Thus, the airport location with respect to the users greatly influences the amount of use which will be made of the airport.

If time is about equal on the best airport site candidates, then the distance in miles may also be a factor. Comfort of the traveller is another consideration, although it is harder to determine in measurable quantities.^{1/} The "comfort" of a six-lane, limited access highway as opposed to a two-lane road which has many stoplights and heavy traffic is fairly obvious but difficult to quantify.

Since any airport is dependent upon surface transportation to connect with the points of user origin and destination, convenience to the major highway network of the area and in some cases to the rail or waterway system is important.

The costs of the various modes of transportation to be used in airport access should be studied. In addition to the normal private auto transportation means, larger airports are also concerned with public conveyance possibilities including bus, limousine, taxi, rail, and in some cases waterways and V/STOL.

The use to be made of the airport must also be kept in mind. For example, air cargo may be an important use of an airport, and convenience to various industries should be studied. As another example, an airport may be planned for the purpose of providing relief of general aviation traffic from a congested air carrier airport. The reliever airport should be located in such a manner that surface origins and destinations of users are equal or closer, timewise, to the reliever airport than to the relieved (air carrier) airport.

2. DESIGN AND LAYOUT OF THE AIRPORT. The basic layout of the airport should remain essentially constant on all sites studied. Major variations in the prototype layout of the airport to fit a particular site should be viewed as major drawbacks to the site. For example, the primary runway direction to satisfy wind conditions is north-south but the primary runway for a site under study can only be built, with suitable length, in an east-west direction -- an obvious major limitation of this site. Some minor variations or changes in methods can be employed. A variation of ± 10 degrees in runway alignment from direction of prevailing winds may be permissible in some cases. Different types of construction materials may be required due to site location. The apron configuration may be

^{1/} According to a study made by the consulting firm of Landrum and Brown in their input in the New York-New Jersey Airport Requirements, the effect of airport accessibility is roughly three times more important to residents than to nonresidents.

altered due to large earthwork construction problems or the building area relocated for improved drainage conditions on particular sites. However, a change such as relocating the building area may make the layout less desirable from increased taxiing distance, poorer visibility of runway ends, or other reasons.

In general, runways should be so oriented that aircraft may land at least 95% of the time with cross wind components not exceeding 15 miles per hour. Normally, the primary runway should be aligned as closely as possible in the direction of the prevailing^{2/} wind.

For information on standard airport design, layout and construction, consult the FAA references in the bibliography of AC 150/5310-1, "Preparation of Airport Layout Plans."

3. AIRSPACE AND OBSTRUCTIONS. The effect of a new airport site upon the navigable airspace depends upon the existing use of the airspace and the proposed use of the new airport. In a highly developed terminal complex, locating an airport requires extensive analysis from an airspace standpoint. Aircraft operating under instrument flight rules (IFR) consume enormous segments of the airspace, and airports must be located so that traffic of one in no way interferes with traffic of another. It is not possible to outline all of the situations which will develop when an airspace analysis is conducted. In certain cases, a sponsor may obtain an informal airspace review by the FAA to get an idea of the problems that may be associated with a proposed airport site.

The most current airspace criteria on recommended separation of airports, structures of the airways, effects of navigational aids, and other matters, may be obtained by contacting the nearest FAA Area Office (see Appendix 2).

Obstructions to the safe use of the airport site are an integral part of the airspace study. The number and type of obstructions should be tabulated for each site. The obstructions vary in degree of importance in accordance with removal, lowering, or a combination of relocating and lowering. Rerouting a highway, running a pole line underground, cutting trees and relocating towers are some examples of ways in which obstructions are remedied and costs of accomplishing these actions must be analyzed in each site evaluation. Criteria contained in Federal Aviation Regulation, Part 77, "Objects Affecting Navigable Airspace," should be consulted prior to beginning the site selection process. Enactment of local zoning to protect the airport approaches and other imaginary surfaces is highly desirable. Information on this type of zoning may be

- 2/ When wind data have not been recorded for a new area, nearby USWB measuring stations should be consulted. Care in using data from these nearby sources must be emphasized when terrain between the site and the source of wind data is hilly or mountainous since wind patterns may vary greatly.

found in AC 150/5190-3, "Model Airport Zoning Ordinance," dated January 1967.

4. AIRPORT CAPACITY. In planning the future expansion of the airport (and for major airports, the initial layout), it is vital to consider the capacity of the airport. In Advisory Circular 150/5060-1, dated August 1966, "Airport Capacity Criteria Used in Preparing the National Airport Plan," guidance is given on determining airport runway capacity and when runway capacity should be increased depending on cost of development. This publication will not usually need to be consulted unless it is forecast that the proposed new airport will reach a total of 90,000 operations or that delays to departures average 4 minutes during the normal peak two-adjacent-hour period of the week. The 90,000 annual operation figure represents 60% of the probable lower limit of capacity of a single-runway airport configuration and additional runways to enhance capacity may need to be planned if costs are nominal. The 4-minute delay figure is used in NAP preparation to determine capacity and at specific runways used by small aircraft only, this departure delay level is 2 minutes for the peak hour of the week. When capacity is a factor in airport site selection, many details must be analyzed including: mixture of the types of aircraft operating at the airport; runway layout in terms of length and entrance/exit taxiways; ratio of arrivals to departures in the hours to be analyzed; the operating techniques of air traffic control; details of the IFR approach system; and any restrictions placed on airport operations.
5. ENGINEERING FACTORS. The major engineering factors to consider in selecting the airport site are drainage, topography, soil, clearing and grubbing, turfing, and availability of construction materials. Design and layout considerations overlap into these engineering considerations in many areas such as runway strength, maximum and minimum grades, amount of area to be prepared, etc.

Some important items to remember on the engineering aspects of airport site selection are:

- a. Water courses through the site are undesirable, but there should be adequate runoff to a nearby outfall. Water should not be allowed to cross a completed runway or taxiway and drainage structures should be planned accordingly. The site should not be subject to flooding.
- b. In reviewing the topography of a site, include the site itself and the surrounding territory (hills, mountains, etc.). Look at all existing topographical maps for general ideas of the area.

- c. Laboratory tests should be run to determine soil classifications. Rock excavation should be avoided if possible. Looking at the strata from nearby highway cuts may be advantageous.
 - d. Good construction materials such as gravel, sand, limestone, etc., should be within a reasonable distance of the site, if possible. Existence of batch plants and availability of portland cement concrete and asphalt near the sites should be ascertained. Also turf, fertilizer and irrigation requirements must be considered on each airport site.
 - e. The site should be relatively free of heavy timber which requires extensive clearing and grubbing. The ease with which eventual landscaping of the airport can be accomplished is another consideration.
6. UTILITIES. The site's accessibility to existing utilities is an important factor. Nearby transformers and substations may be a consideration of some sites. The size and type of services needed (i.e., size of water mains, electrical service, gas lines, telephone, etc.) should be calculated in advance.
7. LAND COSTS AND OTHER LAND REQUIREMENTS. The local records of recent land sales in the general areas under consideration for airport sites should be reviewed to obtain an idea of "normal" prices. Desirable airport site land is usually in demand for other purposes, since the qualities of a good airport site are generally applicable to many types of development (e.g., highway frontage land).

Clear zones of an airport are trapezoidal areas just beyond the end of each runway. The clear zones are the most critical safety areas in the approach-departure paths and control of the clear zones is therefore needed on all airports. The clear zone land should be purchased in fee title if possible, but if fee title can't be obtained, aviation easements permitting the right of flight over the clear zone area are satisfactory. Information on clear zone dimensions may be obtained from the nearest FAA area or regional office.

Initial land acquisition should also include consideration of purchasing additional land for expansion of the landing area facilities (see item 11 of this Appendix) and to acquiring enough land for future building area development. Too often, a desirable close-in airport site must be abandoned due to limitations in aircraft operations from an unexpandable runway or inadequate area for aircraft or passenger handling.

Existing encumbrances on potential airport land should also be ascertained and considered in the evaluation process.

3/ Clear zone acquisition is a requirement on all FAAP airports.

8. METROPOLITAN AIRPORT SITES. It is desirable to plan each airport in a metropolitan area as a part of a system of airports in order to obtain the most efficient traffic flow and the most effective use of facilities.

In ascertaining the need for airports in metropolitan areas, it is necessary that the individual airport requirements be determined in conjunction with the requirements of the entire metropolitan area. Planning for major commercial airports and small general aviation airports must be coordinated and integrated (see AC 150/5070-2, "Planning the Metropolitan Airport System").

9. REGIONAL AIRPORTS. For cities of less than 50,000 population, the development of regional airports to serve two or more adjacent communities is highly desirable. If a single airport can be located within reasonable access to several communities, a potential duplication of facilities is avoided. Also, the pooling of resources and higher degree of utilization will result in a more economically self-sufficient airport operation. AC 150/5090-1, "Regional Air Carrier Airport Planning," contains guidance which is useful in identifying when it is desirable to consider development of one air carrier airport to serve two or more adjacent communities.
10. SOCIAL FACTORS. An airport should be "acceptable" to its neighbors. In determining the proper location for an airport, the existing and proposed development of the property surrounding a potential site is extremely important. The airport site should avoid proximity to schools, churches, and residential areas, and special attention should be paid to orientation of the runways on the site so that location of these buildings is not in the immediate approach-departure paths. It is desirable to locate an airport in a relatively undeveloped area, then enact land use zoning legislation to protect the airport investment and negate future social problems.

The major social problem of an airport site is the community's response to aircraft noise. It is vital that all reasonable measures be taken to encourage the use of land in the vicinity of airports in a manner compatible with expected noise levels. The Bolt, Beranek and Newman (BB&N) Report entitled "Land Use Planning Relating to Aircraft Noise" may be useful to a land-use planner, and represents the most advanced state of the art on analyzing composite noise ratings.

If comprehensive land-use planning has been accomplished or is proposed, then the plans for the airport should be consistent with the comprehensive plan. A comprehensive plan may apply to a municipality, a county,

or large metropolitan area and it may provide a vehicle for obtaining a useful, economical airport site that is adequately protected and compatible with future area development.

11. CONSIDERATIONS OF AIRPORT SIZE. In determining the size of the airport, the primary consideration is the amount and type of anticipated usage the airport is to accommodate. The specific aircraft or aircraft grouping which is determined to have "substantial" use of the airport and which will require the longest runway length should be analyzed first. For air carrier airports which are planned for transport type aircraft, substantial use may be considered as a forecast of 20 operations/week and procedures outlined in AC 150/5325-4, "Runway Length Requirements for Airport Design," should be followed. Other factors influencing the runway length are elevation of the airport site, temperature, and longitudinal gradient. In general, for specific aircraft computations, the FAA recommends increasing a runway length 7 percent for every 1,000 feet of elevation above mean sea level and recommends further increases in length to compensate for variations in longitudinal grades and high temperatures. AC 150/5325-4 gives information on applying gradient standards, and the nomograph curves in this publication for each aircraft take temperature into consideration. The anticipated longest length of haul for transport type aircraft is a necessary determination which must be made before calculating the runway length.

For airports to be used only by general aviation aircraft, the FAA has recommended grouping of these aircraft into utility categories which are: Basic, Stage I and II, and General. As 75 percent of the general aviation fleet can be accommodated at the Basic, Stage I, size airport, the extent of activity analysis in determining runway length is minimal. Basic, Stage II, size airport accommodates about 95% of the general aviation fleet and there should be at least 200 annual forecast operations of the larger general aviation aircraft to support justifying a Stage II length. For General Utility airports, there should be a forecast of 500 annual itinerant operations by aircraft over 8,000 pounds gross weight in order to justify this type of runway length development. For further information on utility airport runway lengths, dimensions and other details, consult AC 150/5100-1, "Information on Federal-aid Airport Program (FAAP)."

Further considerations of airport size are space for terminal and cargo buildings, hangars, maintenance facilities and other building development, access roads and parking facilities.

(FINAL/PRELIMINARY) REPORT OF
AIRPORT SITE INVESTIGATION

1. City _____ County _____ State _____
Sponsor _____

2. Interested Local Officials and Organizations
NAME _____
TITLE _____
ORGANIZATION _____

3. Reason for Site Investigation _____

4. Airport Activity a. No. of Aircraft Owners _____ (Attach list of names,
addresses and business)
b. Forecast Based Aircraft single _____ c. Forecast Aircraft Using
multi _____ Longest Runway _____
d. Length and Destination Longest Haul _____
e. Forecast Runway Length _____ (NAP, Est.) f. Type of Airport _____
g. Forecast Annual Operations Day _____ h. Forecast Instrument Operations
Night _____

5. Comprehensive Community Plan Available? (if so, show type) _____
Coordination Accomplished _____

6. Population of City 1960 _____ Population of (County, Community,
1950 _____ Metropolitan Area) Served 1960 _____
1940 _____ 1950 _____
1940 _____

7. Types of Businesses _____

8. Types of Industries _____

9. Community Served by a. Railroads _____ b. Buslines _____
c. Airlines _____ d. Air Taxis _____ e. Highways _____

10. General Topographic Features of Areas within Ten Miles of Business Center

11. Identification and No. of Airport Sites to be Investigated _____

12. Names of Persons in Inspection Party _____

13. Date(s) of Investigation _____ Date Report Completed _____

14. Prepared by _____ Reviewed by _____

15. Remarks (indicate aeronautical history) _____

FIGURE 1. SAMPLE FORMAT FOR RECORDING INFORMATION GENERALLY APPLICABLE TO ALL SITES STUDIED.

AIRPORT SITE INVESTIGATION

SITE NO. _____

General

1. City _____ County _____ State _____
2. Located _____ miles _____ of center of business district and _____ miles of city limits.
3. Distance and direction to existing/proposed airports in area _____
4. Airport property legal description (indicate if estimated) _____
5. Ground access (road and travel time to city center) _____
6. Quad sheet _____, Sectional chart _____
7. Latitude _____, Longitude _____, Elevation _____
8. Prevailing wind _____ Wind data source _____
9. General topography _____
10. Distance from site to nearest utilities: Telephone _____, Power _____, Gas _____, Water _____

Planning

1. Compatibility with existing area plans _____
2. Existing land-use zoning? _____
3. Obstructions and recommended corrective measures by runway end _____
4. Maximum runway length for 20:1 _____ 40:1 _____
5. Character and availability of clear zones by runway end _____
6. Total land area - Initial _____ Expansion _____
7. Present use of land _____ Estimated cost per acre _____
8. Existing utility and other easements _____
9. Noise problem (discuss) _____
10. Nav aids required and existing (contact FAA) _____

Engineering

1. Type of soil _____ FAA subgrade classification _____
2. Best native grass _____ Fertilizer required _____
3. Local plating season _____ Irrigation required _____
4. Annual rainfall _____ Annual snowfall _____
5. Source of paving materials: Base _____; Surface _____
6. Estimated earthwork quantities _____ (cubic yards)
7. Clearing _____ Off-site Construction _____
8. Contour map available _____ Soils map _____

Special Features

1. Discuss and problems of fog, smake, glare, flood, snow, bird habitats, etc. _____
2. Special construction features (include drainage) _____
3. Other remarks _____

Priority of this Site _____ Recommended _____
Date of Investigation _____ Date of Report _____
Prepared by _____

FIGURE 2. SAMPLE FORMAT FOR RECORDING INFORMATION APPLICABLE TO INDIVIDUAL SITES.

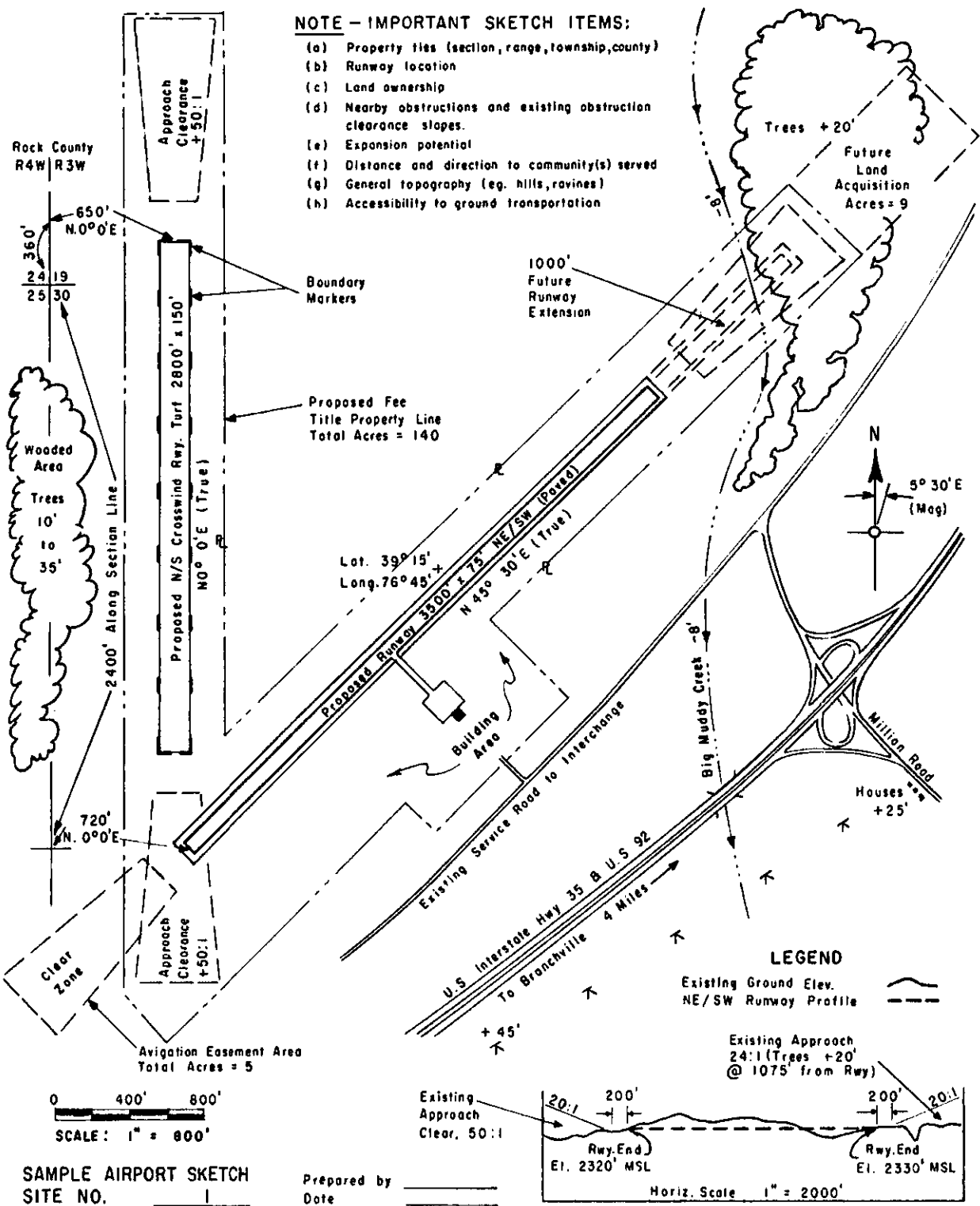
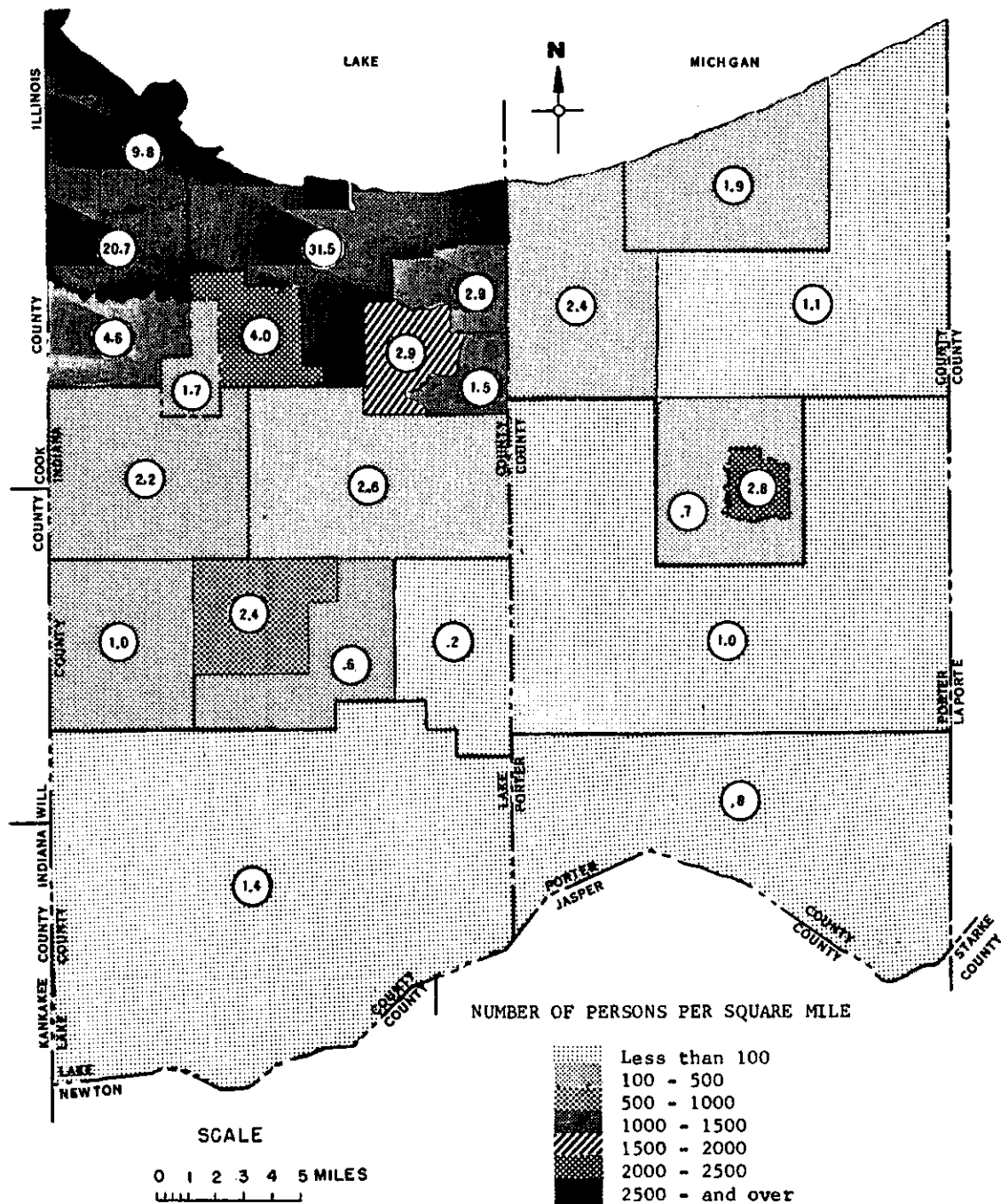


FIGURE 3. SAMPLE SKETCH OF INDIVIDUAL AIRPORT SITE.



SOURCE: U. S. CENSUS OF POPULATION
AND HOUSING - 1960 CENSUS TRACT OF
GARY - HAMMOND - EAST CHICAGO,
INDIANA.

FIGURE 5. CENSUS TRACT MAP SHOWING POP/SQ. MI. DISTRIBUTION.

FEDERAL AVIATION ADMINISTRATION
AIRPORTS SERVICE
Regional, Area, and District Office Addresses
Eastern Region

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Chief, Airports Division
Federal Aviation Administration
Federal Building - Room 327
John F. Kennedy International Airport
Jamaica, New York 11430

Mail: Federal Building
John F. Kennedy Int'l Airport
Jamaica, New York 11430
Local Tel. No.: 995-8543
FTS No.: 212-995-8543

<p><u>N. Y. CITY METRO. ^{1/}, N. J., DELAWARE</u> <u>EASTERN PENNSYLVANIA ^{2/}</u></p> <p>Airports Branch Chief Federal Aviation Administration Federal Building - Room 368 John F. Kennedy International Airport Jamaica, New York 11430</p> <p>Telephone: 212-995-9528</p>	<p><u>MAINE, N. H., VERMONT, MASSACHUSETTS,</u> <u>RHODE ISLAND, CONN., N. Y. (except</u> <u>NYC metro area)</u></p> <p>Airports Branch Chief Federal Aviation Administration General Aviation Admin. Building * Logan International Airport East Boston, Massachusetts 02128</p> <p>Telephone: 617-223-2271</p> <p><u>MARYLAND, VIRGINIA, WEST VIRGINIA,</u> <u>DISTRICT OF COLUMBIA</u></p> <p>Airports Branch Chief Federal Aviation Administration 900 South Washington Street Falls Church, Virginia 22046</p> <p>Telephone: 703-521-7161</p>	<p><u>OHIO, KENTUCKY, W. PENNSYLVANIA ^{3/}</u></p> <p>Airports Branch Chief Federal Aviation Administration West View Building 21010 Center Ridge Road Rocky River, Ohio 44116</p> <p>Telephone: 216-333-6431 FTS: 216-522-4321</p>
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* Area Office Address: Northwest Industrial Park, Second Avenue, Burlington, Massachusetts 01804

^{1/}N. Y. Metro. area includes NYC and counties of Nassau, Suffolk, Westchester, Rockland, Orange, Putnam, Dutchess, Ulster, and Sullivan.

^{2/}Eastern Pennsylvania includes counties of Tioga, Clinton, Center, Huntington, Franklin, and all counties east thereof.

^{3/}Western Pennsylvania includes counties of Potter, Cameron, Clearfield, Blair, Bedford, Fulton, and all counties west thereof.

SOUTHERN REGION

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- ^{1/} NE Texas includes counties of Harrison, Gregg, Smith, Henderson, Anderson, Freestone, Limestone, Falls McLennan, Coryell, Mills, Brown, Coleman, Runnels, Taylor, Jones, Haskell, Knox, Foard, Hardeman, and all counties north and east thereof.
- ^{2/} South Texas includes counties of Panola, Rusk, Cherokee, Houston, Leon, Robertson, Milam, Bell, Lampasas, San Saba, McCulloch, Concho, Menard, Kimble, Edwards, Val Verde, and all counties south and east thereof.
- ^{3/} West Texas includes counties of Terrell, Crockett, Sutton, Schleicher, Tom Green, Coke, Nolan, Fisher, Stonewall, King, Cottle, Childress, Corlinsworth, Wheeler, Hemphill, Lipscomb, and all counties west thereof.

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^{1/} Southern California includes the counties of Santa Barbara, Kern, Inyo, and all counties south thereof.

NORTHERN CALIFORNIA ^{2/}

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^{2/} Northern California includes the counties of San Luis Obispo, Kings, Tulare, Fresno, Mono, and all counties north thereof.

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