

TAD494.6

AC NO: 150/5300-10

DATE: July 21, 1975



ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

SUBJECT: FEDERAL AVIATION ADMINISTRATION FUNDED STUDY--ANALYSIS OF GENERAL
AVIATION AIRPORTS DEVELOPED WITH & WITHOUT FEDERAL FINANCIAL
ASSISTANCE

1. **PURPOSE.** This advisory circular transmits the recommendations and conclusions of the study by Burns & McDonnell, Engineers-Architects-Consultants, of Kansas City, Missouri. It also informs the public on the availability of the three Summary Reports and the Final Report.
2. **BACKGROUND.** The Federal Aviation Administration (FAA) administers the Airport Development Aid Program which provides financial assistance to governmental entities sponsoring the development of a publicly owned airport. The study was made to determine how the FAA could improve its design and construction standards and programming procedures to minimize the costs and delays experienced in developing general aviation airports intended to serve propellered aircraft of 12,500 pounds, or less, takeoff weights.
3. **RECOMMENDATIONS AND CONCLUSIONS.** The recommendations and conclusions contained in Appendix 1 of this circular are those of the contractor. They are based on the following contractor efforts: (1) the analysis of design and construction standards and programming procedures published by the FAA and the responding State agencies; (2) an in-depth inspection of 22 airports in various locations throughout the 48 contiguous states (Alaska and Hawaii were excluded) representing the application of either the Federal or State standards; and (3) in-depth interviews with airport and airport program officials at the Federal, State and local level. The 22 airports comprising the data base for the study were paired as follows:

Federally Aided Airport

Mason County, Point Pleasant, W.V.

El Monte, El Monte, Calif.

State Aided Airport

Gallia-Meigs Regional,
Gallipolis, Ohio

Corona Mun., Corona, Calif.

7/21/75

Floydada Mun., Floydada, Texas	Haskell Mun., Haskell, Texas
	Mooreland Mun., Mooreland, Okla.
Gladwin, Gladwin, Mich.	Harbor Springs, Harbor Springs, Mich.
Rountree Field, Hartselle, Ala.	Perry County, Linden, Tenn.
Marshalltown Mun., Marshalltown, Iowa	Olivia Mun., Olivia, Minn.
	Cassville, Mun., Cassville, Wis.
Chesterfield County, Chesterfield, Va.	Hanover County Mun., Ashland, Va.
Columbiana County, East Liverpool, Ohio	Wayne County, Wooster, Ohio
Mountain Home Mun., Mountain Home, Ida.	Jerome County, Jerome, Ida.
Gila Bend Mun., Gila Bend, Ariz.	Firebaugh Mun., Firebaugh, Calif.

4. REPORTS. The contractor developed reports covering the various tasks identified in the project as follows:

R 75040-3

- a. Summary Report--Task I (Reference No. AD-A-011-540). This report covers the assembling and analysis of published design and construction standards and programming procedures. It develops criteria for comparing these standards and procedures, identifies standards that may provide significant information, and it identifies airport pairings that appear to exemplify the application of Federal and State standards and procedures. (61 pages)
- b. Summary Report--Task II (Reference No. AD-A-011-541). This report covers the in-depth inspections at the 22 airports selected for the study. Each airport pairing is presented in some detail. A general evaluation of the entire sample is presented. (317 pages)
- c. Summary Report--Task III (Reference No. AD-A-011-542). This report covers the evaluation of FAA standards and program requirements. It identifies the major factors in the Federal program with respect to their effectiveness. It identifies possible modifications or changes that could improve the Federal airport programs. It also points out standards which are effective in providing guidance and in achieving a desirable end product. (83 pages)
- d. Final Report (Reference No. AD-A-011-543). This report summarizes the previous task evaluations and discusses in general terms their findings affecting individual airport development programs. (24 pages)

5. HOW TO OBTAIN THIS CIRCULAR AND OTHER MATERIAL REFERRED TO IN THIS CIRCULAR.

- a. Additional copies of this advisory circular may be obtained free of charge from the Department of Transportation, Publications Section, TAD-443.1, Washington, D.C. 20590.
- b. Summary Report--Task I (Reference No. AD-A-011-540), Summary Report--Task II (Reference No. AD-A-011-541)^{8,25}, Summary Report Task--III (Reference No. AD-A-011-542)^{4,25}, and Final Report (Reference No. AD-A-011-543)^{3,25} may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161. The cost of these reports should be obtained from the National Technical Information Service prior to ordering (Telephone No. 703-321-8543). Make check or money order payable to the National Technical Information Service.



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7/21/75

AC 150/5300-10
Appendix 1

APPENDIX 1. RECOMMENDATIONS AND CONCLUSIONS

DRAWN FROM THE

ANALYSIS OF GENERAL AVIATION AIRPORTS DEVELOPED WITH

AND WITHOUT FEDERAL FINANCIAL ASSISTANCE

The recommendations that follow are numbered and titled to correspond to the Summary Report--Task III "Evaluation of Federal Standards and Program Procedures." Sections 1, 2, and 3 of Task III report do not involve recommendations; therefore, the numbering system begins with Section 4, "Procedures."

It is to be noted that the recommendations and conclusions contained in this appendix are those of the contractor, Burns & McDonnell, and do not necessarily reflect the views of the Federal Aviation Administration.

RECOMMENDATIONS AND CONCLUSIONS
DRAWN FROM THE
ANALYSIS OF GENERAL AVIATION AIRPORTS DEVELOPED WITH
AND WITHOUT FEDERAL FINANCIAL ASSISTANCE

4. PROCEDURES

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4.1 PRE-APPLICATION ASSISTANCE

4.1.1 ADVISORY CIRCULARS

All pertinent Advisory Circulars should be given to sponsors directly by FAA field representatives and discussed in detail during the initial contact meetings. Major items included in these circulars should be emphasized and pointed out. Depending upon existing circumstances at the time of these meetings, some circulars are more important than others and these facts also should be pointed out. Sponsors should always be able to obtain the necessary information especially advisory circulars from one source . . . the FAA field representative with whom they deal on a daily basis. Sponsors should not have to order advisory circulars or Federal Aviation Regulations from the Government Printing Office.

4.1.2. GUIDELINES

- A. Expedite the revision and distribution of Advisory Circular 150/5100-3A-"ADAP". Procedures Guide for Sponsors.
- B. Encourage the development of "Guides for Sponsors" similar to that developed by the Northwest Region.
- C. Distribute copies of Federal Aviation Regulation Part 152 to sponsors until the new circular is available.
- D. Consider the inclusion of the following items into any guide developed or proposed.
 1. A very simple general outline of the entire program:
 - a. that briefly describes the requirements of each processing step
 - b. that graphically illustrates the procedures involved between sponsors and the FAA, preferably in the form of a flow chart
 - c. that indicate the normal time factors involved in processing each step.
 2. Provide complete listings of eligible and ineligible items of development.
 3. Include complete listings, addresses, and telephone numbers of agencies requiring notification on A-95 requirements. (This should be done individually by each area office.)
 4. Provide samples of all required forms, filled out hypothetically and the instructions with information on where and how to obtain the necessary data.

Analysis of General Aviation Airports

-2-

5. A brief chronological outline of requirements that most often cause problems, the type of problems, and suggestions on how to circumvent each problem.
6. A complete listing of available circulars with emphasis on those of most significant value to the sponsor. The list and the circulars should be given to sponsors during initial contacts and discussed in detail.

4.1.3. PERSONAL ATTENTION

Sponsors must develop confidence in the FAA field office representative responsible for that project. A great deal of personal attention is essential to program efficiency, especially in the early stages. Frequent visits to the sponsoring community should be emphasized. Problems should be anticipated as procedural steps are approached and the associated requirements must be made clear to the sponsor. FAA field office personnel should encourage sponsors to include them into all phases of development at the local level.

4.2 ADMINISTRATION OF THE PROGRAM4.2.1. REQUIREMENTS

The number of requirements should be reduced to the absolute minimum necessary to develop airports. This would require a complete review of all of the existing requirements under the ADAP. The review should place an emphasis on the elimination of all nonessential requirements, reducing the number of volumes necessary to convey them, and for separating utility airport requirements and standards entirely from other types of airport development.

4.2.2. RATIONALE

The origin, basis and intent should be included with critical standards so that uniform interpretations can be made. The inclusion of this background information will also help to facilitate future revisions. Relatively few of the standards will require detailed background information, but those where rigid compliance is required are in need of additional guidelines.

4.2.3. INTERPRETATIONS

Where variations in interpretations are necessary, the intended flexibility of compliance should be explained in detail so that the limits are well defined. Proper interpretations can only be made if all parties fully understand the requirements.

4.2.4. INTERNAL ORDERS

Internal orders are necessary and beneficial as far as expediting new information and changes is concerned. The existing method of distributing those orders outside the agency appears to be quite satisfactory and should be continued. No specific changes to this procedure are being recommended.

Analysis of General Aviation Airports

-3-

4.2.5. STATE CHANNELING ACTS

State Aviation Agencies should be encouraged to work together with the FAA on all ADAP projects. It appears as though sponsors derive major benefits from the additional assistance. Normally, the state will not have the authority for this type of involvement unless the state is also participating through its program or a state channeling act has been passed by the legislature. These channeling acts appear to benefit both the state and federal agencies involved as well as the sponsor and their adoption should be encouraged.

4.2.6. EXPEDITING PROCEDURES

Concentrated efforts should be made to develop procedures that expedite the three primary delay causing procedures, namely:

- A. Preapplication procedures
- B. Environmental impact assessments
- C. Final payment procedures.

4.2.7. REVIEWS AND APPROVALS

- A. Formal detailed reviews in the procedures for each project may not always be necessary in light of unique factors involved. These requirements should be suspended, reduced, and expedited whenever possible.
- B. Consideration should be given to conduct necessary reviews involving time consuming approvals after the fact as a check rather than holding up subsequent procedures. More personal involvement by FAA personnel during planning stages can reduce the need for formal reviews. If FAA suggestions have been followed the review process can be informal and quick.

4.2.8. APPROVAL AUTHORITY

- A. There is an apparent need for some type of organizational chart or outline illustrating the responsibilities of FAA field office personnel. Smooth administration of the program can be significantly improved if everyone utilizing the program understands who is responsible for certain decisions. Sponsors frequently commented that a great deal of time was lost trying to find out who had the authority to answer their questions directly.
- B. It will facilitate processing if approval authority is delegated to the lowest level possible.

4.2.9. POLICY CHANGES

Changes in policy that may affect those sponsors developing by way of staged construction who are not under grant at the time of the change should not be imposed without consideration. Guidelines on the flexibility necessary in these cases need to be defined in the program, in addition to those provided to sponsors who are under grant.

Analysis of General Aviation Airports

-4-

4.2.10. FUNDING AVAILABILITY GAPS

- A. No recommendation for change is being made with respect to this phenomenon--it is merely being pointed out as a factor affecting the efficiency of the program. Costs are increased where subjected to delays of this type, but savings are also derived by granting the entire allocation early. These trade-offs are a matter of policy.
- B. It is important to assure that sponsors and state agencies are informed that projects will not be funded because of these gaps and not for other reasons. Several states allocate state aid to these projects and development funding can be tied up and lost for that year if not officially released because matching funds will not be granted for that period.

4.3. INDIVIDUAL PROCEDURES4.3.1. NASP REQUIREMENTS

It does not appear that the NASP has given adequate consideration to State Systems Plans in the past and should incorporate them as much as possible in the future.

4.3.2. SITE SELECTION

- A. The necessity for a full-blown detailed site selection study should be evaluated for each project being proposed. These studies are time consuming and expensive and are not always necessary.
- B. When site studies are determined to be necessary the FAA field office should take the initiative in advising the sponsor about the detail required, and more importantly, the detail that will not be required.

4.3.3. LAND ACQUISITION

- A. The new Advisory Circular 150/5100-11 should significantly help to reduce the problems associated with land acquisition.
- B. The format of the new circular should be further simplified by including a checklist for sponsors to follow in their efforts to meet the requirements.

4.3.4. ENVIRONMENTAL IMPACT ASSESSMENT

- A. A specific guideline for environmental impact assessments should be developed utilizing a very simple format.
- B. Sample copies of the type of statement required outlining each requirement, how it is normally accomplished, and how and where the information can be obtained should be included.
- C. A checklist of items to be considered for utility airports should be provided.
- D. The FAA should consider taking advantage of the newly developed expertise in environmental areas and contract the environmental impact reviews, and development of the draft and final environmental impact assessments to qualified consultants during peak periods.

Analysis of General Aviation Airports

-5-

- E. It would also reduce misunderstandings if the evaluative criteria now contained in Order 5050.2A were made available to sponsors starting an environmental impact assessment.

4.3.5. SPONSOR RESPONSIBILITIES

- A. Sponsors should be advised early of their upcoming responsibilities and the importance of those responsibilities to the processing of the project.
- B. Advisory Circular 150/5380-1 "Airport Maintenance" should be revised and updated to include:
 - 1. An outline of the sponsors' responsibility to adequately maintain the airport.
 - 2. A discussion of the consequences of not maintaining the airport with respect to the resulting deterioration and its cost and to its affect on the sponsors' future eligibility for program assistance.
 - 3. A checklist on how to inspect the airport and how often, like the one presently included.
 - 4. An outline of the normal solutions to problems sponsors may encounter.
 - 5. Recommendations on how to perform the maintenance and a listing of the best materials to use.
- C. Present the Airport Maintenance circular directly to sponsors as a matter of standard procedure when the final inspection is made on the project.

4.3.6. GRANT AGREEMENT

- A. Incorporate a sample copy of the grant agreement into the Procedures Guide to Sponsors with explanations of its contents. All special provisions that may be included should also be discussed in detail.
- B. FAA field offices should be assured that the contents of the grant agreement are understood by the sponsor prior to its formal presentation.

4.3.7. AUDIT

- A. The auditing procedures outlined under the program should be made flexible enough to address the capabilities of small sponsors.
- B. The program should require that audits be made within six months from the date of the approval of "As-Built" plans or the title assurances where land acquisition is involved.
- C. The existing auditing staff appears to be insufficient to serve the needs of the program and should be increased.
- D. In lieu of increasing the auditing staff, certified public accountants should be approved to perform the audits, or audits performed by state auditors on combined federal-state projects should be accepted.

Analysis of General Aviation Airports

-6-

4.3.8. FINAL PAYMENT

- A. The series of procedures involved in making final payments should be extensively reviewed for methods to expedite them.
- B. The new A-102 provisions can be utilized to make final payments in lieu of audit and should be utilized whenever possible.

5. GENERAL STANDARDS

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- 5.1 A definite need exists for separate utility airport standards for developing general aviation airports. Separate standards and procedures should be developed for all phases of development from preapplication to final payment, especially in paving and lighting specifications. Standards that pertain to all types of airports should contain specific directions on their applicability to utility and air carrier airports.

5.2 DIMENSIONAL CRITERIA

These standards are well accepted and utilized for development even outside the program. A majority of the State Aviation Agencies have incorporated these standards verbatim into their own development programs. For this reason, no recommendation for change is being made for the existing dimensional criteria. It does appear that this criteria has been adjusted when necessary to consider the state of the art and will be in the future if required.

5.3 FACILITIES JUSTIFICATION

- A. Justification for additional facilities should be modified to emphasize peak periods of aircraft operations on an airport.
- B. Turnarounds where taxiways to runway ends are not provided should be developed on all utility airports without extensive justification requirements.

6. CONSTRUCTION SPECIFICATIONS

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6.1 POLICY6.1.1. PRECONSTRUCTION CONFERENCES

- A. A conference format should be established that outlines the items of particular importance that should be covered. Administrative requirements are important but the conference should be directed now toward the important technical aspects of the federal specifications.

Analysis of General Aviation Airports

-7-

- B. Checklists of the important items to be discussed at pre-construction conferences should be developed.
- C. Preconstruction Conference checklists should be mailed to the contractor, consultant, sponsor and any other individual who will attend so that advance preparation can be made.

6.1.2. SUBSTITUTIONS

- A. State Highway Specifications for each individual State should be approved for use on all general aviation airports of less than 30,000-pound rating. Once the specification has been approved, it should be allowed for all projects in that State without having to justify them on a case by case basis.
- B. Because P-401 was designed for loading conditions in excess of 30,000 pounds it should be excluded from use on utility airports unless justifiably applicable.

6.1.3. AUTHORITY TO APPROVE SUBSTITUTIONS

- A. A separate specification should be developed for utility airports under 30,000 pounds rated loading. This appears to be necessary because of the difficulty encountered by sponsors to obtain approval for designs other than high quality, top performance specifications intended for air carrier airports.
- B. Decisions to alter specifications must be made at a level no higher than the District Office or Regional Office if no District Office exists. A workable method to appeal decisions made at this level should also be established and should be the only reason to require decisions from higher levels.
- C. All FAA field representatives who have the authority to approve modifications to the specifications should be made totally aware of those responsibilities.
- D. The wording in Advisory Circular 150/5370-10 "Standards for Specifying Construction of Airports" should be revised to make this authority clearly understood. Specifically:
 - 1. The section entitled "Notice to Users," page V, paragraph 2, should read "the assigned state engineer" or whatever title is given to the individual rather than "certain field representatives of the FAA." In effect, the statement should point out specifically where that responsibility lies so that everyone understands.
 - 2. The second sentence in that paragraph also represents a major change in policy and cannot be over emphasized. The word "MUST" should be capitalized to emphasize the possible fallibility of the specifications and their application without modification.

6.1.4. INTERPRETATION OF SPECIFICATIONS

FAA field offices and other users of the specifications should have more of the background information concerning the application of federal specifications.

Analysis of General Aviation Airports

-8-

6.1.5. CURRENT SPECIFICATIONS

- A. The entire "Standards for Specifying the Construction of Airports" should be revised and updated as soon as possible.
- B. The Federal Aviation Administration should consider obtaining competent outside help to expedite the revision. A firm capable of assigning full-time personnel to researching and writing these specifications can be awarded the required contract. Although the FAA would dictate the format and standards utilized in new specifications the contractor could perform all of the necessary research and development necessary. The revision should include ideas and opinions from experts in the field such as:
 - The Asphalt Institute
 - The Asphalt Paving Association
 - The Portland Cement Association
 - Associated General Contractorsas well as including the ASTM and AASHTO representatives and their standards where applicable.

6.1.6. MAINTENANCE

- A. A positive certification program should be instituted to assure that maintenance is being performed on an annual basis.
- B. Certified maintenance should be a factor in determining eligibility for further federal participation especially for projects involving overlays.
- C. The certification program should be explained in detail to the sponsors early and repeatedly in the program and should under no circumstances be first announced to sponsors as a special provision to the grant agreement.

6.2 PAVEMENT SECTION DESIGN CRITERIA6.2.1. DESIGN CURVES

Reevaluate present design curves considering alternate methods of design including C.B.R. and plate bearing tests.

6.2.2. MINIMUM SURFACE THICKNESS

Consideration should be given to increasing the FAA minimum surface thickness criteria to 2 inches. This would actually induce the "optimum" in terms of economical construction and significantly influence the performance and service life of the pavement. The thicker lift would also hold heat longer and coupled with a 50 blow marshal make density requirements more readily obtainable. This should only apply to those pavements placed directly on granular base courses.

6.2.3. EQUIVALENCY FACTORS

The FAA should follow the recommendations of the Asphalt Institute and allow 2:1 substitution ratio for high quality specifications such as P-209 and 2:1 to 2.7:1 for other lower quality base materials.

Analysis of General Aviation Airports

-9-

6.2.4. FULL DEPTH ASPHALT

FAA field offices should encourage engineers and sponsors to investigate the merits of full depth asphalt. Emphasis should be placed on long-term effects such as maintenance costs and extended pavement service.

6.2.5. TRANSVERSE SLOPES

Transverse slopes for utility airports should be studied to determine the maximum allowable slope for pavements. These slopes should be separated from those pertaining to air carrier airports so that no confusion can exist.

6.3 MIX DESIGN CRITERIA

6.3.1. MARSHALL DESIGN PROCEDURES

The 75-blow Marshall Mix design should be decreased to a 50-blow Marshall Mix Design for utility airports. The 1000 stability factor should also be reduced to 500 to conform more with accepted practice.

6.3.2. AIR VOIDS AND EFFECTIVE ASPHALT CONTENT

- A. Air voids in pavement mixtures should be allowed to go down to 2 percent.
- B. The bulk specific gravity, with an allowance for the portion of asphalt binder lost by absorption into aggregates particles (effective asphalt content), be the basis for calculating air voids in a compacted asphalt paving mixture.

6.3.3. AGGREGATE GRADATIONS

- A. The use of any gradation specifically designed for a particular geological area should receive precedence over the broad FAA gradation requirement.
- B. The final Job Mix formula tolerance percentages should be changed to the following:

Aggregate passing sieve No. 4 and larger	±3%
Aggregate passing sieve No. 10, 40 and 80	±2%
Aggregate passing sieve No. 200	±1%
Asphalt cement	±0.5%
Temperature of mixing and placing	20° F

6.4 TESTING SPECIFICATIONS

6.4.1. DENSITY

Recommend density requirements for asphaltic base and surface courses be changed to 96% of laboratory density based on the 50 blow marshall mix design.

6.5 CONSTRUCTION SPECIFICATIONS

6.5.1. SPECIFICATION REDUNDANCIES

The specifications should be revised to eliminate the redundancies they contain, especially with regard to items P-201, P-401, and P-408. These sections as well as many others also need to have their content updated and simplified.

Analysis of General Aviation Airports

-10-

6.5.2. PLANT MIX DESIGN TEMPERATURE

Recommend clarification of the specifications, Paragraph 401-3.2 in that they not only require a "single temperature at which the mixture is to be delivered at the point of discharge," but that they say how this temperature is to be arrived at (such as temperature/viscosity curves) and that the $\pm 20^{\circ}$ F tolerance applies to this temperature for plant mixture regardless of its location.

6.5.3. CONSTRUCTION SPECIFICATIONS

- A. The FAA specifications should be revised to contain the following sampling and testing methods.
 - 1. AASHTO T230-68 for obtaining samples of compacted bituminous paving mixture.
 - 2. AASHTO T-164-74 for use in determining the percent of bitumen in a bituminous paving mixture.
 - 3. AASHTO T-30-74 for mechanical analysis of extracted aggregate.
 - 4. Sampling method T-168-55 for material use in testing for ASTM D-1559 (Marshall) requirements.
- B. The specifications should be clarified to specifically point out which aggregate gradation test constitutes the acceptance test, the combined hot-bin gradation or the extracted aggregate gradation.
- C. Paragraph 401-4.10 of the specifications should be clarified similar to the following example: "and a density of at least 98% of a laboratory specimen prepared by the appropriate Marshall or Hveem test method from a sample taken at the plant, or from a truck delivering mixture to the jobsite."

6.5.4. PAVEMENT TESTING

The specifications should be revised to allow Nuclear Moisture Density Gauges to be used to test soils, granular bases, and bituminous bases, and that these test results be admitted for both job control and acceptance control. These tests should stand on their own and not be required in conjunction with other test methods.

6.5.5. TEST VERIFICATION

A standard procedure for test verification should be developed by the FAA that includes the following:

- 1. Standard checklists for required tests.
- 2. Standard log sheets upon which to record quantities and qualities of tests.
- 3. Hot-mix design work sheets.
- 4. Job control requirement checklists.

6.5.6. CONSTRUCTION INSPECTION

Full-time supervision and inspection should be required on all federal airport development projects.

Analysis of General Aviation Airports

-11-

7. ELECTRICAL SPECIFICATIONS

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7.1 RUNWAY LIGHTING SYSTEMS

7.1.1. APPROVED MEDIUM-INTENSITY RUNWAY LIGHTING

- A. The requirement that the currently approved MIRL system be the sole system eligible for ADAP participation should be modified. Specific requirements for justification of installation of this highly refined design should be developed.
- B. The requirement for the mandatory inclusion of a VASI system as a component of a MIRL system should be deleted. Certain conditions may require some sort of vertical visual guidance. Specific guidelines should be developed indicating under what conditions a VASI need be installed.

7.1.2. LOW-COST MEDIUM-INTENSITY RUNWAY LIGHTING

- A. Specifications should be developed for a low-cost MIRL system utilizing the cost-saving design features of currently available "off-the-shelf" systems. This system should be eligible for ADAP funding and utilized where the currently approved system is not specifically required.

7.1.3. LOW-INTENSITY RUNWAY LIGHTING

- A. Currently available low-intensity systems that have a substantiated history of economical performance should be considered for ADAP funding under certain circumstances.
- B. Specific limitations should be established on the conditions necessary to justify installation of such a minimal system.

7.2 COMPONENTS

7.2.1. FIXTURE LENS

- A. Simplified requirements need to be established for manufacturer approval for lenses for the low-cost MIRL system.
- B. The lens and lens mounting base should be modified so the lens cannot be oriented improperly on the base.

7.2.2. LAMPS AND SOCKETS

- A. The currently approved lamp should be redesigned to provide longer life and minimize the early bulb blackening.
- B. The lamp base and socket should be redesigned as a screw-type base.

7.2.3. FIXTURE SUPPORTS

- A. The frangible coupling should be redesigned to simplify manufacture and lower cost.
- B. Grooved conduit or similar weakened plane fixture support should be permitted when it can be demonstrated that the breaking load is no greater than the frangible coupling. Although these items theoretically meet the frangibility specifications as far as breaking loads are concerned, they are seldom approved for use by FAA field offices.

analysis of General Aviation Airports

-12-

7.2.4. WIRING SYSTEMS AND CABLE

- A. The present specification for 19-strand cross-linked polyethylene insulated cable be changed to seven-stranded conductor.
- B. Commercially available cable that closely matches L-824 type should be approved for installation by brand name and number without having the cable as "FAA Approved."
- C. The bare copper counterpoise ground wire should be eliminated as an item of installation. Local experience with the effectiveness of this type of grounding should serve as a basis for optional installation.

7.2.5. TRANSFORMERS

Current specifications and equipment are satisfactory.

7.2.6. VISUAL APPROACH SLOPE INDICATORS

- A. The currently approved VASI units should be redesigned to eliminate the short lamp life and to eliminate the rapid-sequential burn-out of remaining lamps when the first lamp fails.
- B. The SAVASI should be approved at any installation as a reduced cost substitute for the 3-lamp VASI and not used only as a load limiting device.
- C. Consideration should be given to developing a less sophisticated system applicable to utility airport requirements rather than the current system which is scaled down from air carrier aircraft requirements.

7.2.7. RUNWAY END IDENTIFIER LIGHTS

Current specifications and equipment are satisfactory.

7.2.8. BEACONS

Current specifications and equipment are satisfactory.

7.2.9. CONTROL SYSTEMS

- A. Guidelines must be established for pilot activated radio control of lighting systems that standardize frequency and microphone manipulation needed for specific control functions.
- B. Frequency and microphone manipulation information should be published on the aeronautical charts in order to achieve safe and beneficial use of this system.

7.3 INSTALLATION METHODS7.3.1. LIGHTING FIXTURES

Optional mounting height of fixtures within specified limits should be permitted to meet local conditions.

Appendix 1

Analysis of General Aviation Airports

-13-

7.3.2. CIRCUIT CABLE

Modern plowing techniques for cable installation as used by many utility companies should be allowed when conditions permit. Specifications should be developed following current technology and equipment. Current specifications for plowing equipment and techniques are considerably more restrictive than those being used by most power companies for cable installation.

7.3.3. VISUAL APPROACH INDICATORS7.3.4. RUNWAY END IDENTIFIER LIGHTS7.3.5. BEACONS7.3.6. CONTROL SYSTEMS

Current installation methods for VASI systems, REIL systems, beacons and control systems are satisfactory.

7.4 MAINTENANCE

Maintenance of all air field lighting equipment and systems should be made part of the sponsor's assurances for any ADAP project. Some minimum level of maintenance should be specified with compliance tied to future eligibility and/or qualification for instrument procedure approval.

Finally, we feel that future emphasis should be placed on recording and evaluating life cycle costs on all specified items of eligibility. The data may also be more beneficial if field tests rather than laboratory testing is used for the evaluation based on actual operating conditions. A wealth of information can be developed within ten years that will serve to provide answers to performance questions that cannot be obtained today.

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