CHANGE

AC NO: 150/5325-8

DATE: 5/8/69

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: COMPASS CALIBRATION PAD

---

1. PURPOSE. This advisory circular provides guidelines for the design, location on the airport, and construction of a compass calibration pad and basic information concerning its use in determining the deviation error in an aircraft magnetic compass.

2. REFERENCES. The publications identified below should be used, as appropriate, in conjunction with this advisory circular.

   a. Additional copies of this circular and AC 150/5300-2, Airport Design Requirements for Terminal Navigational Aids, and AC 150/5320-6A, Airport Paving, may be obtained from the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D.C. 20590.

   b. AC 150/5370-1A, Standard Specifications for Construction of Airports ($3.50) may be obtained from the Superintendent of Documents, United States Government Printing Office, Washington, D.C. 20402. (No c.o.d. orders are accepted. Enclose with your request a check or money order made payable to the Superintendent of Documents.)

3. BACKGROUND.

   a. An aircraft magnetic compass is a navigation instrument with certain inherent errors resulting from the nature of its construction. All types of magnetic compasses are designed to indicate direction with respect to the earth's magnetic field. This is true even for the gyro-stabilized and/or fluxgate compasses. Aircraft navigation is based on applying the appropriate angular corrections to the magnetic reading in order to obtain the true heading.

Initiated by: AS-560

b. The aircraft magnetic compass should be checked following pertinent aircraft modifications and on a frequent, routine schedule. One method of calibrating the compass is to use a compass calibration pad to align the aircraft on known magnetic headings and making adjustments to the compass and/or placard markings to indicate the required corrections. There are other methods available for calibrating a magnetic compass,but for small aircraft the method outlined herein is normally used.

4. APPLICATION.

a. The process of aligning an aircraft on known magnetic headings for the purpose of determining the degree of error in the magnetic compass is commonly referred to as "swinging the compass." The technique which should be used is as follows:

(1) Place the aircraft on a compass calibration pad.

(2) Place the aircraft in level flying position.

(3) Remove compensating magnets from chambers or reset the fixed compensating magnets to neutral position, whichever is applicable, before swinging.

(4) Check indicator for fluid level and cleanliness. If fluid is required, the compass is defective.

(5) Check the pivot friction of the indicator by deflecting the card with a small magnet. The card should rotate freely in a horizontal plane.

(6) If radio is used in the aircraft, there should be corrections noted for "radio on" and "radio off" conditions.

(7) Align the aircraft with the north magnetic heading and make the indicated reading correspond to the actual magnetic reading by use of the compensating magnets. Repeat for the east magnetic heading. Then place on south and west magnetic headings and remove half of indicated error by adjusting compensators. Engine(s) should be running.

(8) Turn the aircraft on successive 30-degree headings through 360 degrees. Placards should be marked to indicate correction at each 30-degree heading showing "radio on" and "radio off" corrections.

b. Calibration and adjustment of remote indicating gyro compasses, polar path compasses, and other systems of this type should be accomplished by a qualified instrument technician.

5. DESIGN OF COMPASS CALIBRATION PAD. The design details shown in this advisory circular should be considered as guidance only and variations of these designs are acceptable provided the general requirements are met.

a. The compass calibration pad provides a series of 12 radials, either painted on with nonmetallic paint or inlaid in the surface of the calibration pad, extending toward predetermined magnetic directions every 30 degrees beginning with magnetic north. Each radial should be marked with three separate magnetic headings ; one at the end of the radial indicating the direction along which each line lies ; and one on each side of the line which indicates the magnetic heading of the aircraft when it is oriented at 90 degrees to the radial. Markings facing the pilot must correspond to the airplane's heading when traveling in that direction. The markings must be large enough to be easily read from the aircraft cockpit as the radial is being approached. The last zero may be dropped from the heading designation. A layout of markings to be used is shown in Figure 1.

b. Suggested types of calibration pads are depicted in Figures 2 and 3. Type I, as shown in Figure 2, can be constructed using either rigid or flexible pavement. Type II, as shown in Figure 3, is applicable only to rigid pavements. The pavement thickness of either type shall be as required to support the user aircraft in a critical area in accordance with AC 150/5320-6A .
With concrete pavements the joint type and spacing shall conform to standard practices, except that no magnetic materials are to be used and, therefore, dowels (where required) shall be of aluminum, brass, or bronze, rather than steel.

c. Make the size of the calibration pad compatible with the requirements of the user aircraft. For small airplanes make the radius of the pad 50 feet; for basic transports make the radius 60 feet; for large two- and three-engine jets, other than basic transports, and all large propeller driven airplanes make the radius 80 feet; and for large four-engine jets, other than basic transports, make the radius 110 feet. For aircraft placed in service after the date of this publication, an analysis of the turning area required for the aircraft will be necessary to determine adaptability to the dimensions specified herein.

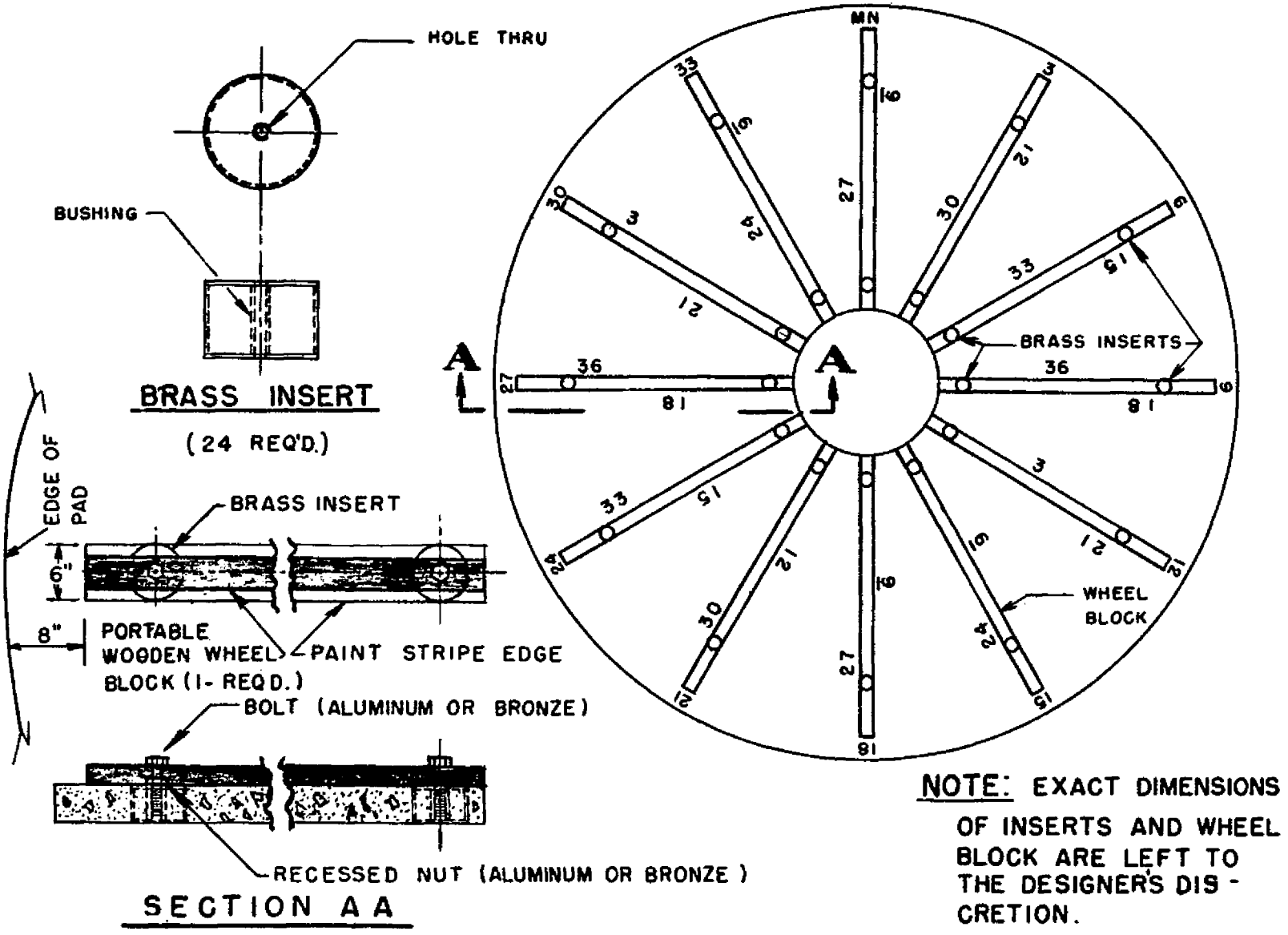
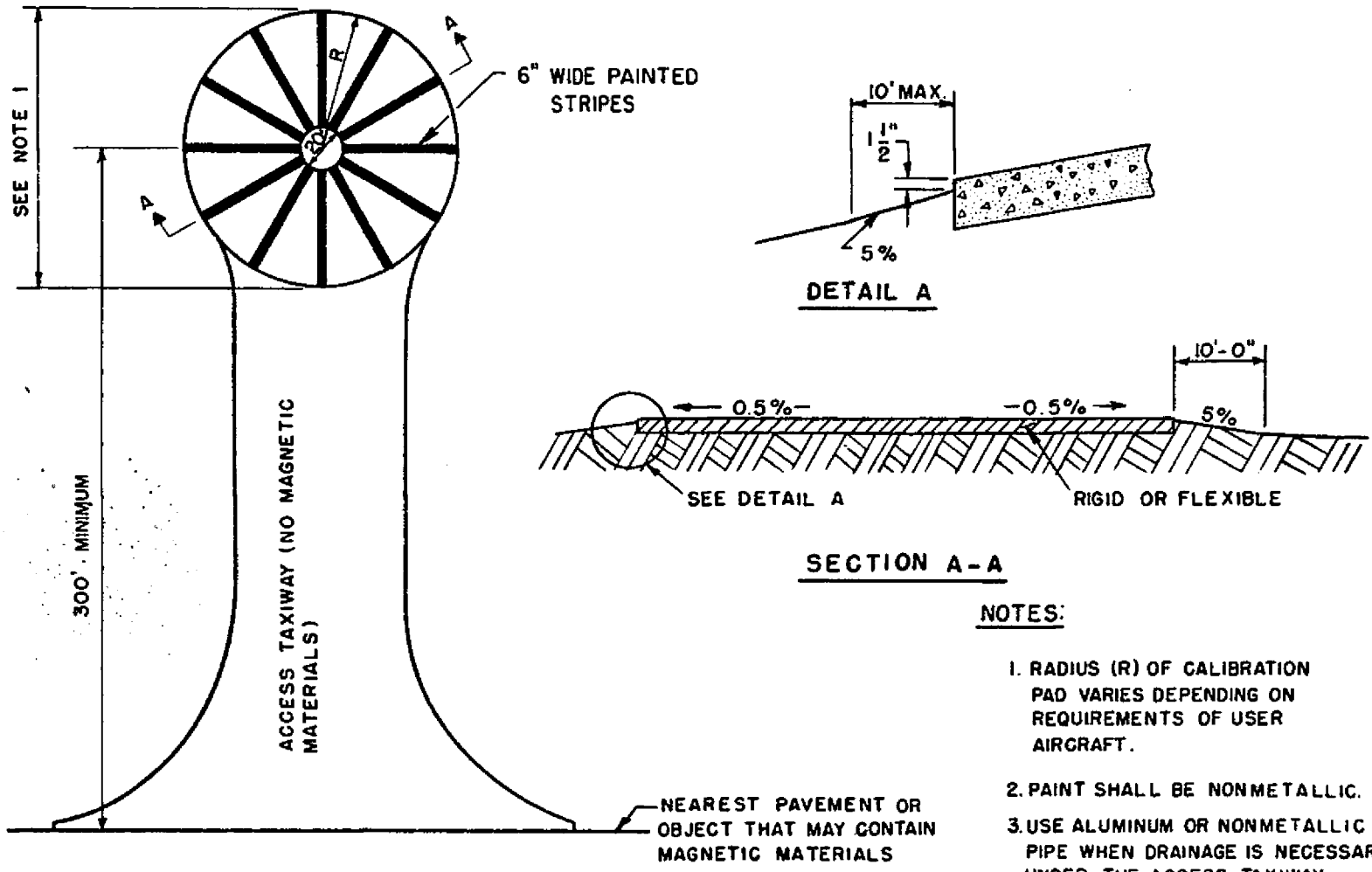


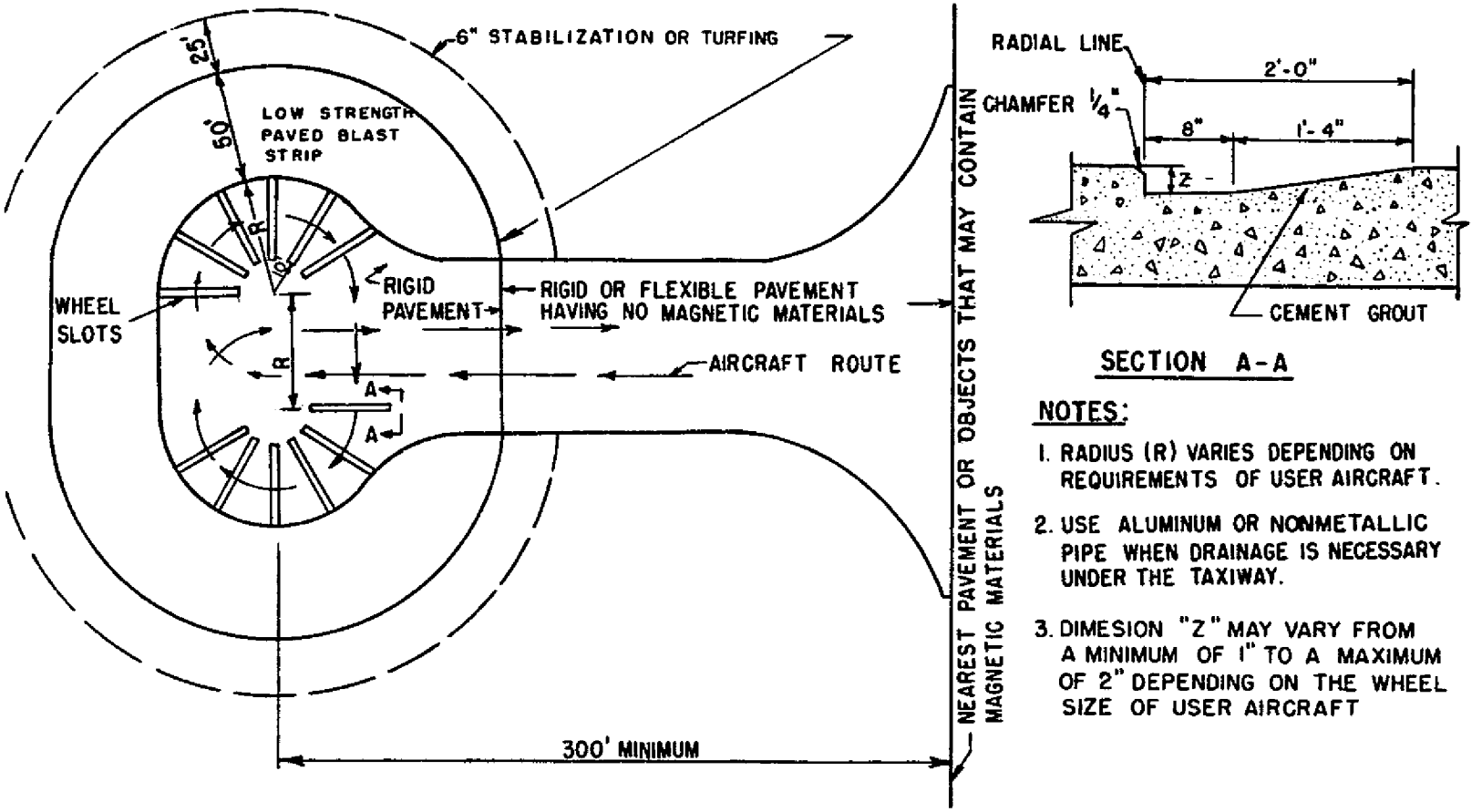
FIGURE 1. MARKING LAYOUT AND DETAILS OF WHEEL BLOCK.



NOTES:

1. RADIUS (R) OF CALIBRATION PAD VARIES DEPENDING ON REQUIREMENTS OF USER AIRCRAFT.
2. PAINT SHALL BE NONMETALLIC.
3. USE ALUMINUM OR NONMETALLIC PIPE WHEN DRAINAGE IS NECESSARY UNDER THE ACCESS TAXIWAY.

FIGURE 2. TYPE I. COMPASS CALIBRATION PAD.



NOTES:

1. RADIUS (R) VARIES DEPENDING ON REQUIREMENTS OF USER AIRCRAFT.
2. USE ALUMINUM OR NONMETALLIC PIPE WHEN DRAINAGE IS NECESSARY UNDER THE TAXIWAY.
3. DIMESION "Z" MAY VARY FROM A MINIMUM OF 1" TO A MAXIMUM OF 2" DEPENDING ON THE WHEEL SIZE OF USER AIRCRAFT

FIGURE 3. TYPE II. COMPASS CALIBRATION PAD.

d. The Type II compass calibration pad shown in Figure 3 provides wheel slots to assist in true alignment of aircraft normal to each radial. It may be desirable to construct a special device for use in obtaining true alignment when the calibration pad shown in Figure 2 is constructed. One method which may be used is to establish control points consisting of hollow shell non-magnetic inserts along each radial. A wooden block with aluminum or bronze bolts to fit into the center hold of the brass insert can then be used to provide an accurate alignment of the aircraft wheels. Design details of this system are shown in Figure 1.

e. There are many satisfactory ways of providing a device to wheel-block an aircraft to obtain the required alignment, and the exact method is left to the discretion of the design engineer. The method detailed in Figure 1 is one suggestion. One alternative which comes to mind is the possibility of forming holes in the concrete with some form of removable dowel, rather than constructing the specially built brass inserts.

6. LOCATION OF COMPASS CALIBRATION PAD. The requirements specified herein have been determined through consultation with instrument calibration specialists, fixed base operators, and persons in the Coast and Geodetic Survey with considerable experience in performing surveys of compass calibration pads.

a. Locate the site at least 300 feet from power and communication cables (both above and below ground) or from other aircraft. Locate the site at least 600 feet from large magnetic objects such as buildings, railroad tracks, high voltage electrical transmission lines, or cables carrying direct current (either above or below ground). In order to prevent interference with electronic navigational aid facilities located on the airport, make sure that the required clearances are maintained as specified in AC 150/5300-2. Control cables, runway and taxiway light bases or sign fixtures, pipelines, ducts, grates for drainage, distance remaining signs, and aircraft arresting gear should be avoided when they contain ferrous materials.

b. The compass calibration pad must be located off the side of a taxiway or runway a sufficient distance to satisfy the runway/taxiway widths and clearances applicable to the airport on which it is located.

c. After tentative selection of a site through visual application of appropriate criteria contained herein, make a thorough magnetic

survey of the site. This is necessary because many sites which meet all visually applied criteria regarding distances from structures, etc., still are unsatisfactory because of locally generated or natural magnetic anomalies. At locations near heavy industrial areas, intermittent magnetic variations may be experienced and sufficient surveys at various periods of time are necessary to ascertain if this situation exists.

d. The difference between magnetic and true north must be uniform in the vicinity of the site. Make sufficient surveys to determine that the angular difference between true and magnetic north measured at any point does not differ from the angular difference measured at any other point by more than one-half degree within a space between 2 and 10 feet above the surface of the base and extending over an area within a 250-foot radius from the center.

7. CONSTRUCTION OF COMPASS CALIBRATION PAD. For pavement construction, the applicable portions of AC 150/5370-1A should be used. The following additional items are considered important:

a. Do not use magnetic materials, such as reinforcing steel or ferrous aggregate, in the construction of the calibration pad or of any pavement within a 300-foot radius of the center of the site. If drainage pipe is required within 300 feet of the site, use non-metallic or aluminum culvert. Appropriate quality control procedures must be employed during the construction phase to insure that only nonferrous materials are used throughout.

b. Each of the radials must be oriented within one minute of the magnetic bearing indicated by its markings.

c. Mark the date of observation and any annual change in direction of magnetic north durably and legibly on the surface of the calibration pad near the magnetic north mark. It would be well to establish a permanent monument at some remote location on the true north radial for future reference.

d. The U.S. Coast and Geodetic Survey of the Department of Commerce is available to conduct the necessary surveys to determine the difference between true and magnetic north and the uniformity of this difference. The cost for this service is that necessary to cover the expense to the Coast and Geodetic Survey. Requests for this service should be made to the following: Director, U.S. Coast and Geodetic Survey,

Montrose Road and Old Georgetown Road, Rockville, Maryland 20852, telephone 301 656-4088. There are also many other competent registered surveyors or engineers who are capable of performing these surveys. It is recommended that a qualified engineer be employed to layout the work in the field and to design the pavement for the critical aircraft that can reasonably be expected to use the pad.

e. After all construction work on the compass pad is completed, it is advisable to have the pad magnetically resurveyed to guard against the possibility of objectionable magnetic materials being introduced during the construction.

f. Magnetic surveys of existing compass calibration pads should be performed at regular intervals of five years or less. Additional surveys should be performed after major construction of utility lines, buildings, or any other structures within 600 feet of the center of the pad.

Chester G. Bowers
Director, Airports Service

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Washington, D.C. 20590

Official Business

POSTAGE AND FEES PAID
FEDERAL AVIATION ADMINISTRATION