



Federal Aviation Administration

Memorandum

Date: December 13, 2017

To: All Regional Division Managers

From: 
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Subject: INFORMATION: Guidance for the Assembly and Installation of
Temporary Orange Construction Signs

This Engineering Brief (EB) provides guidance about materials, methods of assembly and installation of temporary orange construction signs.

Attachments



ENGINEERING BRIEF #93

Guidance for the Assembly and Installation of Temporary Orange Construction Signs

I. Purpose.

This Engineering Brief (EB) provides guidance about materials, methods of assembly and installation of temporary orange construction signs.

II. Background.

Construction projects on airports have challenges when construction activities are in the airport operations area (AOA). (See Advisory Circular (AC) 150/5370-2, *Operational Safety on Airports during Construction*, for AOA definition.) An airport might need to close a runway or displace the existing runway threshold due to the construction activity. Construction sometimes requires the closure of a taxiway, shift a taxiway center line, or change the taxiway routes aircraft would normally follow.

III. Application.

This EB specifies readily available materials to construct temporary orange construction signs. The airport operator may choose to include temporary orange construction signs as additional safety mitigation for a construction project to provide additional guidance to pilots near areas under construction. See AC 150/5370-2 for applicability of temporary signs.

IV. Effective date.

This EB is effective after signature by the Manager, FAA Airport Engineering Division, AAS-100.

V. Coordination.

Include all information (i.e. location and message type) about temporary orange construction signs in the construction safety and phasing plan. No further coordination is required.

VI. Applicable documents.

FAA Advisory Circulars:

AC 150/5220-23 *Frangible Connections*

AC 150/5300-13 *Airport Design*

AC 150/5340-18 *Standards for Airport Sign Systems*

AC 150/5345-44 *Specification for Runway and Taxiway Signs*

AC 150/5345-46 *Specification for Runway and Taxiway Light Fixtures*

AC 150/5370-2 *Operational Safety on Airports during Construction*

1.0 General.

Temporary orange construction signs must meet the standards in Advisory Circular (AC) 150/5345-44, *Specification for Runway and Taxiway Signs*, for Mode 1 unlighted signs except as noted in this engineering brief. Certification under the Airport Lighting Equipment Certification Program is not required.

2.0 Wind Load and Frangibility.

The design wind load is based on national codes and local conditions. A sign must withstand 100 mph winds (equivalent to 0.23 psi) and jet blast/prop wash from aircraft without bending or changing shape. It must, however, break before reaching an applied static load over the legend panel of 0.9 psi. Where jet blast is a concern, signs should be constructed to withstand 200 mph winds.

Signs that need to be located in airfield safety areas (such as runway safety areas (RSAs) or taxiway safety areas (TSAs), as specified in AC 150/5300-13), must be mounted on frangible supports to ensure the structure will break, distort, or yield in the event of an accidental impact by an aircraft. General requirements on frangibility and material selections can be found in AC 150/5220-23, *Frangible Connections*.

3.0 Materials.

Sign panels must be constructed of materials of durability appropriate for the length of time the sign is to be used and meeting the requirements of the manufacturer of the retroreflective sheeting to be used. Sign panels must be covered with retroreflective sheeting meeting the requirements of AC 150/5345-44.

4.0 Color.

The background color of signs must be fluorescent orange, meeting the requirements of ASTM D4956, *Specification for Retroreflective Sheeting for Traffic Control*, for Type III or Type IV sheeting. See the table below for the daytime color CIE 1931 x, y chromaticity limits of the reflective sheeting.

x y	x y	x y	x y
0.583 0.416	0.535 0.400	0.595 0.351	0.645 0.355

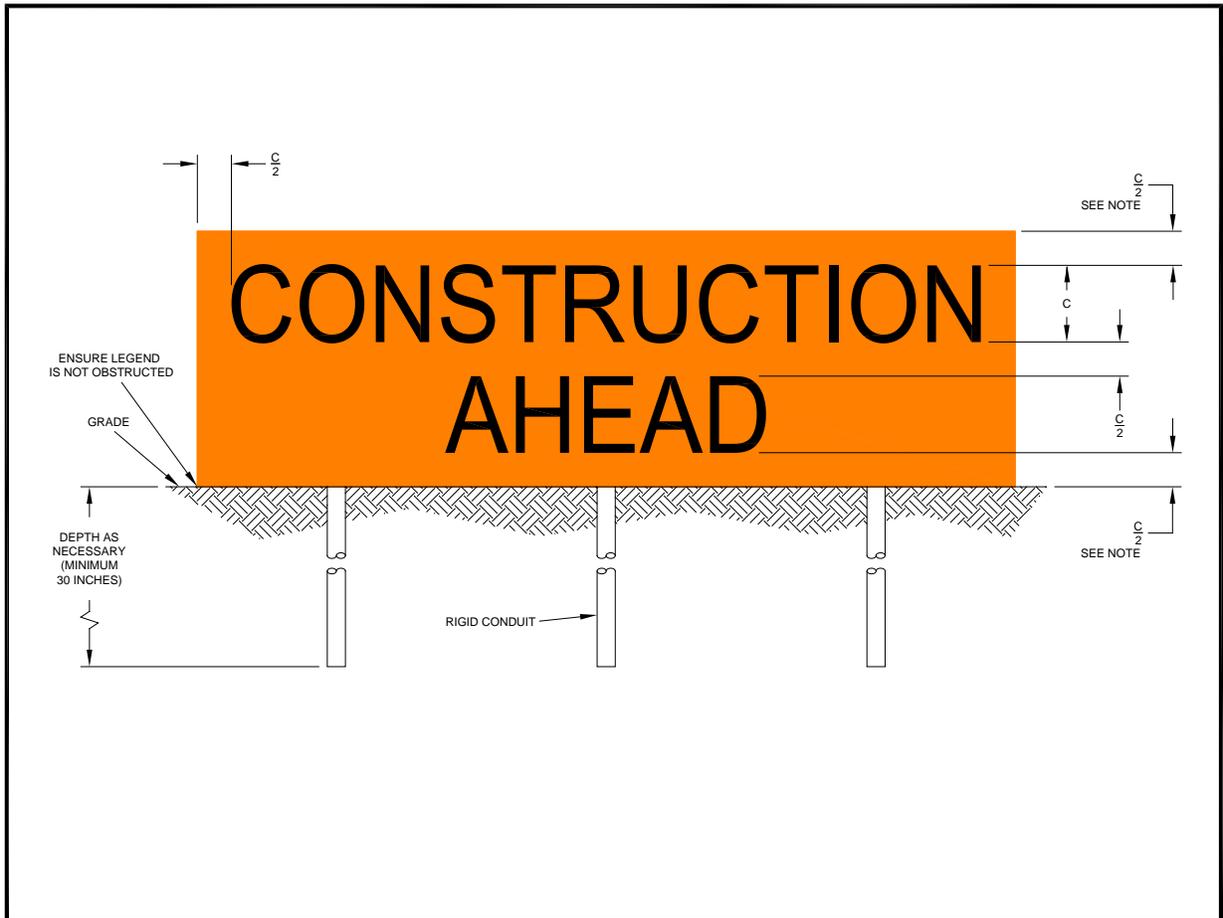
5.0 Legend.

Legends must be black and read as shown in Figure 1, Figure 2, and Figure 3, applied by direct applied character or screen process. AC 150/5345-44 provides additional guidance. Use the formula:

$$X = C \div 8$$

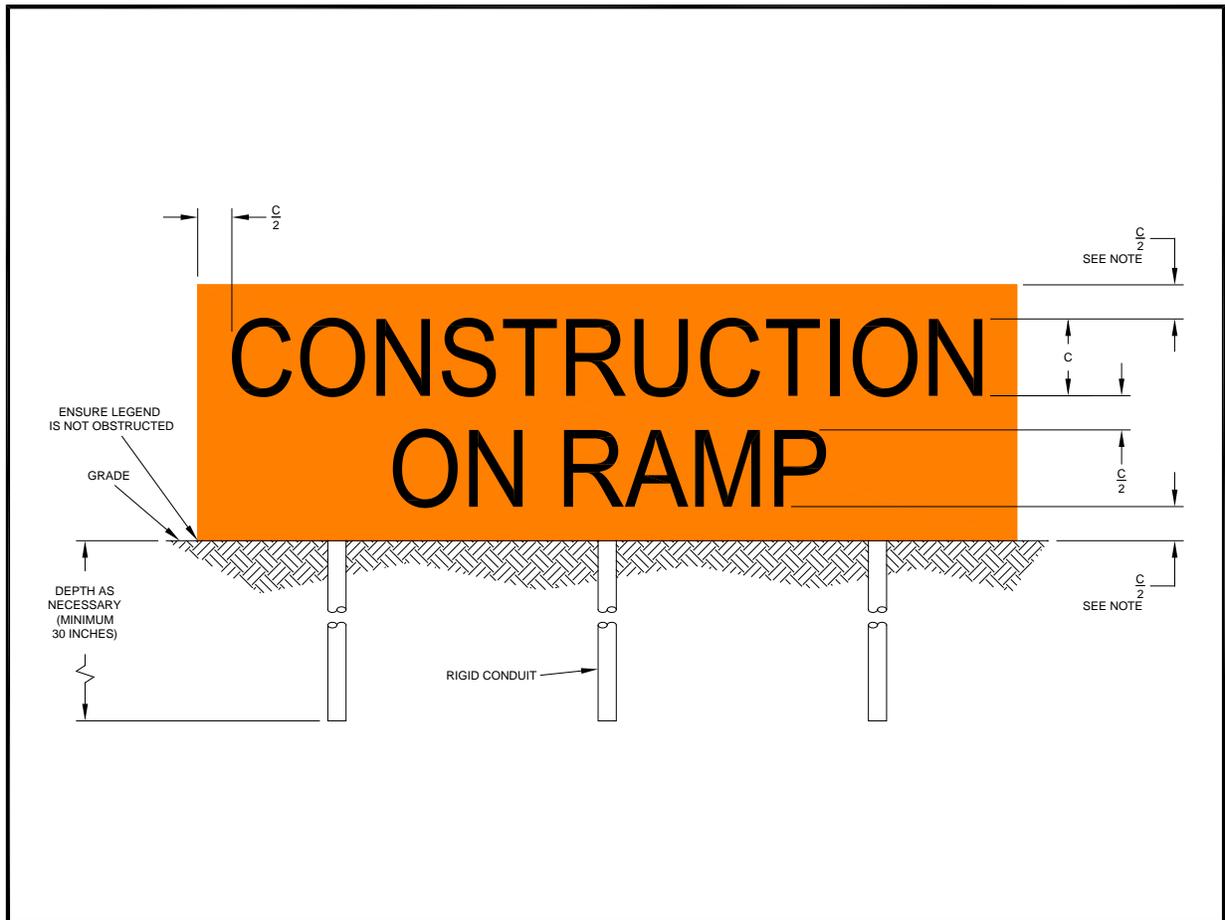
to determine the grid square dimension X in AC 150/5345-44, Appendix A, Figures 2 through 6, to determine exact character details where C is the character height.

Figure 1. Details for CONSTRUCTION AHEAD Sign



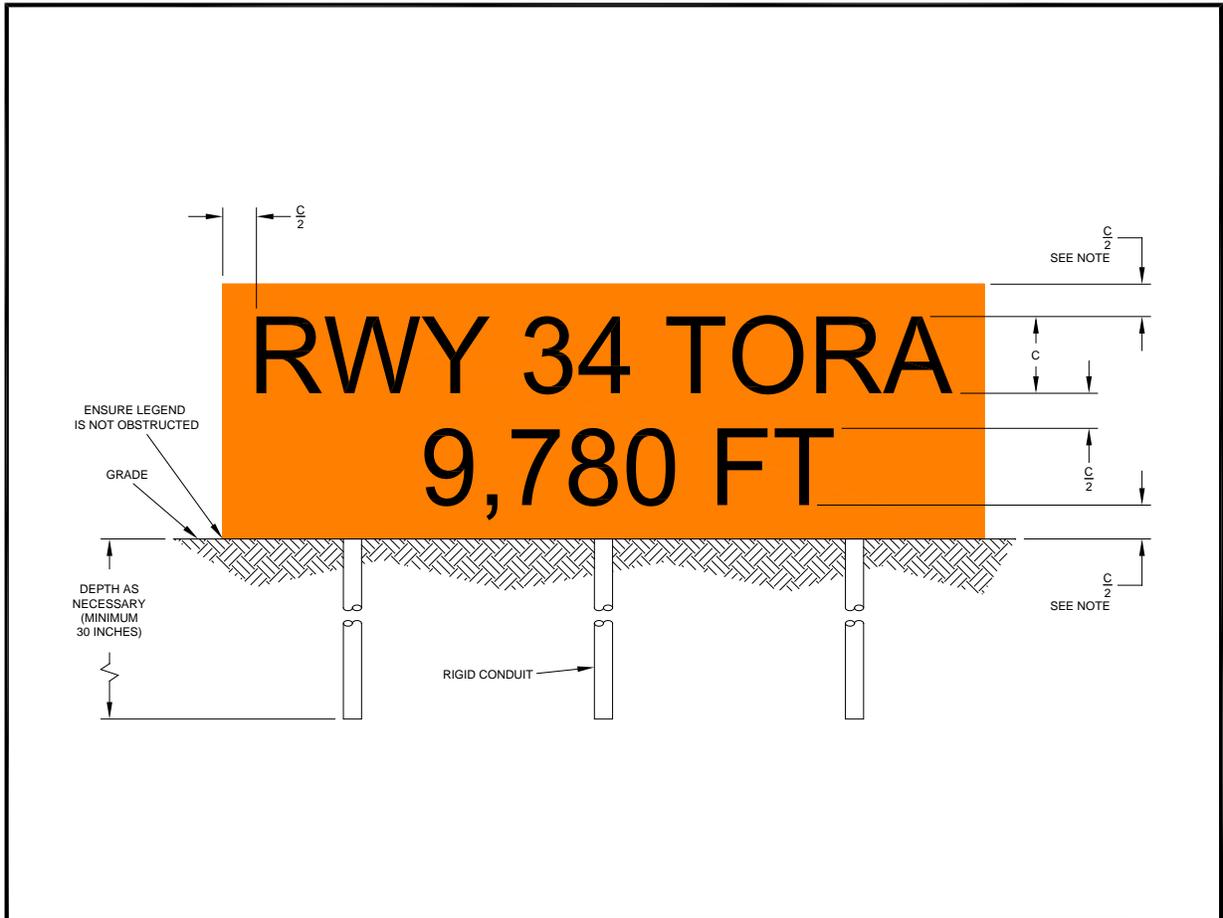
Note: For 9-inch characters, reduce top and bottom borders by 3/4-inch so the height of the sign face equals 30 inches.

Figure 2. Details for CONSTRUCTION ON RAMP Sign



Note: For 9-inch characters, reduce top and bottom borders by 3/4-inch so the height of the sign face equals 30 inches.

Figure 3. Details for TAKEOFF RUN AVAILABLE Sign



Note: For 9-inch characters, reduce top and bottom borders by 3/4-inch so the height of the sign face equals 30 inches.

6.0 Mounting.

Sign panels may be secured to supports using U-bolts and aluminum angle iron, as shown in Figure 4. Mount signs as low to the ground as possible.

Figure 4. Mounting of Sign Panels to Sign Supports



6.1 Signs that do not need to be moved.

A suggested method for mounting signs that will not need to be moved is shown in [Figure 1](#), [Figure 2](#), and [Figure 3](#). Posts are driven to a minimum depth of 30 inches to maintain the sign in a vertical position. The number and depth of supports will depend on soil conditions.

6.2 Moveable Signs.

A suggested method for mounting movable signs is shown in [Figure 5](#). Sign supports are secured to bases consisting of galvanized floor flanges bolted to 2×8 pressure treated lumber, weighted by low-profile construction barriers. The number of barricades needed is dependent upon the weight of the barricades, the length of the bases, and the desired design wind load. To determine the total number of barricades B needed on each side of the sign, arranged in a single layer at the ends of the 2x8 bases, use the following formula:

$$B = \frac{W \times H \times WIND \times \left(\frac{H}{2} + G\right)}{M \times L}$$

Where W is the width of the sign in inches, H is the height of the sign face in inches, WIND is the design wind load in pounds per square inch (PSI), M is the weight of each barricade in pounds and L is the length of the bases in inches.

For example, the number of 175 lb. barricades needed on each side for a 30-inch × 96-inch sign mounted 9 inches above grade, using bases 72 inches long is:

$$B = \frac{96 \times 30 \times 0.23 \times \left(\frac{30}{2} + 9\right)}{175 \times 72} = 1.3$$

Round the result up to the next whole number, so use 2 barricades on each side, located at the ends of the bases.

As another example, the number of 250 lb. barricades needed on each side for 30-inch × 140-inch signs mounted 8 inches above grade, using bases 96 inches long is:

$$B = \frac{140 \times 30 \times 0.23 \times \left(\frac{30}{2} + 8\right)}{250 \times 96} = 0.9$$

Round the result up to the next whole number, so use 1 barricade on each side, located at the ends of the bases.

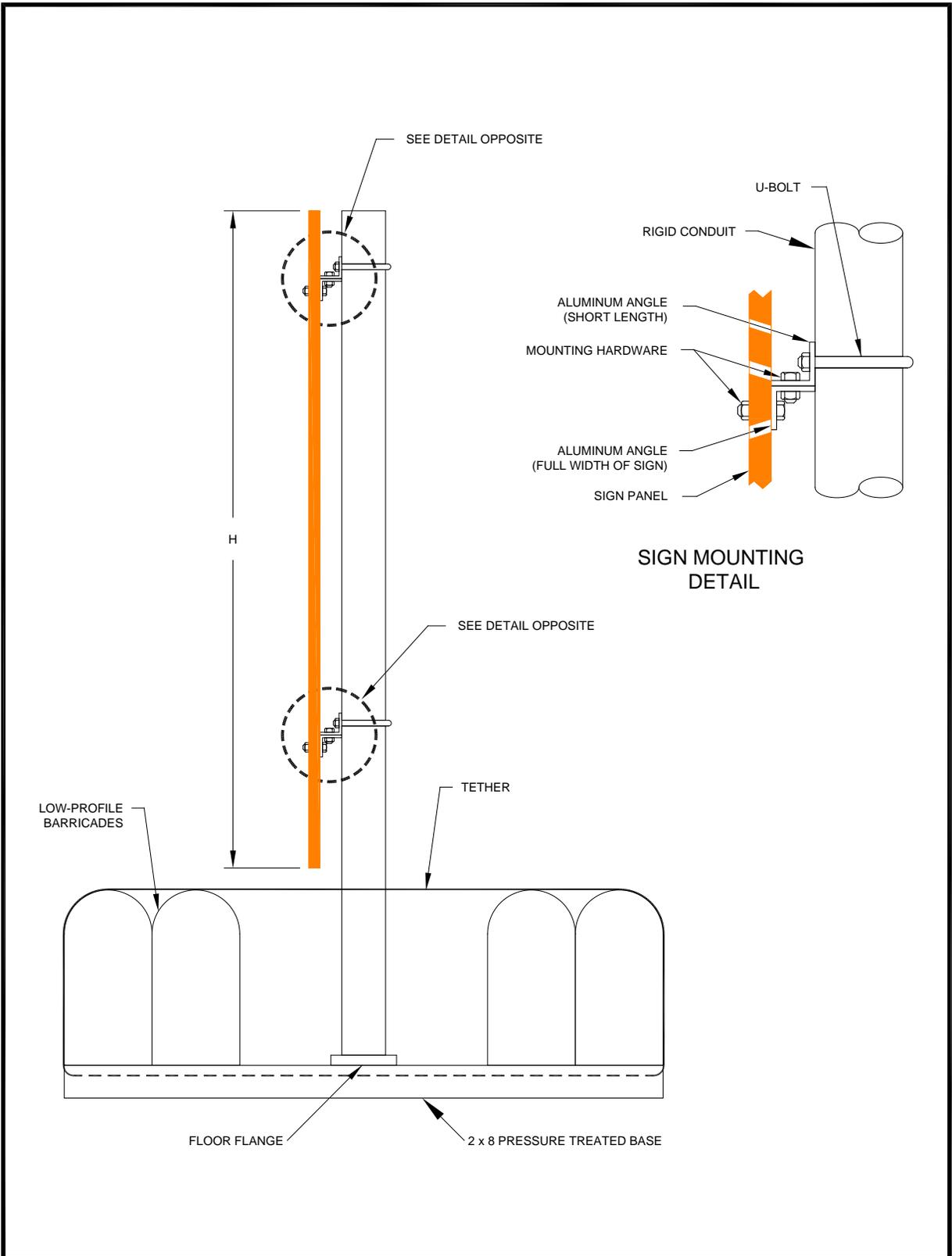
Conversely, if using a certain number of barricades, the length of bases needed for signs may be determined by the formula:

$$L = \frac{W \times H \times WIND \times \left(\frac{H}{2} + G\right)}{M \times B}$$

When using this method, tether the barricades to the bases, as shown in [Figure 5](#).

See [Appendix A Formula Derivation](#) for an explanation of how these formulae were derived.

Figure 5. End View of Sign Secured by Low Profile Barricades



7.0 Location.

7.1 Frangible Signs.

Frangible signs may be considered “Size 3” signs per AC 150/5340-18, and comply with location, overall height, and frangibility guidance in that AC. When constructing a Size 3 frangible sign, mount the sign no more than 6 inches from the bottom of the sign to grade, and use one frangible coupling meeting the requirements of AC 150/5345-46 per foot of sign width. Use 9-inch characters and reduce the top and bottom borders by 3/4-inch to result in a sign face of 30 inches high.

7.2 Non-Frangible Signs.

Non-frangible signs must not be located within the RSA or TSA. Signs located inside the Taxiway Object Free Area must provide either 12 inches of horizontal clearance or 12 inches of vertical clearance between the sign and any part of the most critical aircraft using, or expected to use, the taxiway when the aircraft’s wheels are at the defined, load bearing, pavement edge. Horizontal clearance can be determined by the following formula:

$$\text{Distance from pavement edge to sign} = \frac{WS - MGW}{2}$$

where WS is the wingspan and MGW is the Main Gear Width of the airplane with the maximum difference between WS and MGW using the taxiway. Vertical clearance is to be assessed based on a fully loaded aircraft, resulting in the aircraft’s height at a minimum value.

Table 1 may be used when basing sign location on horizontal clearance. It was developed using a database of 125 known airplanes. It is the airport operator’s responsibility, however, to confirm the required clearances.

Table 1. Sign Details and Location

	ADG II	ADG III	ADG IV	ADG V	ADG VI
Distance from pavement to sign (ft.)	32	49	69	95	109

The required character height C in inches may be determined using the formula:

$$C = 0.124 \times D$$

where D is the distance in feet from the taxiway centerline to the near edge of the sign. The minimum character height is 9 inches. The overall height of the sign must meet the requirements of AC 150/5340-18.

Appendix A Formula Derivation

A-1. Derivation of the calculation for the number of weighted barricades needed.

To simulate a 100-mph wind, use 0.23 psi per AC 150/5345-44. The force on the sign panel in pounds is:

$$W \times H \times WIND$$

where W is the width of the sign in inches, H is the height of the sign face in inches, and WIND is the design wind load in pounds per square inch (PSI).

The overturning moment of the sign in pound-inches is equal to:

$$W \times H \times WIND \times \left(\frac{H}{2} + G \right)$$

Where G is the distance from the bottom of the sign to the base. See figure 6.

The resistance to overturning must be equal to at least the overturning moment. The resisting moment to overturning in the figure below is:

$$(M \times B) \times \left(\frac{B \times w}{2} \right) + (M \times B) \times \left(L - \left(\frac{B \times w}{2} \right) \right)$$

Where M is the weight of each barricade in pounds, B is the number of barricades symmetrically positioned at the ends of the bases, L is the length of the bases in inches, and w is the width of each barricade. (The width of each barricade will not be a factor in the final formula, so the units for w do not matter.)

OR:

$$(M \times B) \times \left(\left(\frac{B \times w}{2} \right) + L - \left(\frac{B \times w}{2} \right) \right)$$

OR:

$$M \times B \times L$$

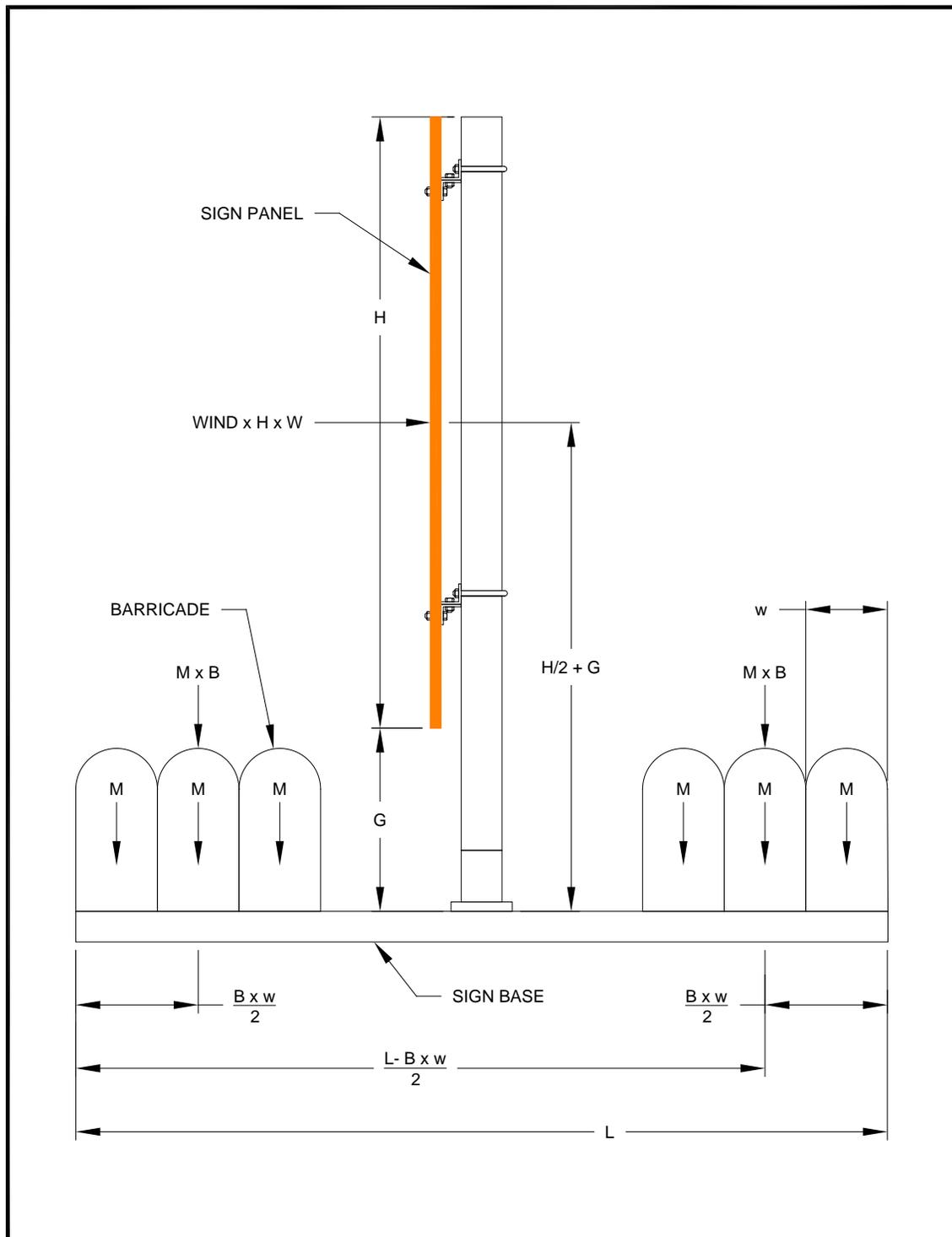
SO:

$$H \times \left(\frac{H}{2} + G \right) \times W \times WIND = M \times B \times L$$

OR:

$$B = \frac{W \times H \times WIND \times \left(\frac{H}{2} + G \right)}{M \times L}$$

Figure 6. Dimensions for Derivation of Formula



A-2. Derivation of Character Height for Non-Frangible Signs.

Testing of orange construction signs used signs with 9-inch characters located at 35 feet from the edge of a 75-foot wide taxiway. This puts the distance from the pilot's eye to the sign at 35 feet + 37.5 feet = 72.5 feet.

Thus, to maintain a proportional character height, the tested 9-inch characters are multiplied by the ratio of the distance from the pilot's eye to the sign location divided by the tested distance of 72.5 feet.

Therefore, the required character height C in inches = $9 \times D \div 72.5$

OR:

$$C = 0.124D$$

where D is the distance in feet from the taxiway centerline to the sign.