

Refer to: HSA-10/SS-108

Mr. Jack F. Glen, Jr.
Glenncast Inc.
4401 Acworth Industrial Drive
Acworth, Georgia 30101

Dear Mr. Glen

Thank you for your letter of March 12 and facsimile transmission of July 18 requesting Federal Highway Administration (FHWA) acceptance of your company's aluminum sign poles with decorative castings at the base as breakaway sign support systems for use on the National Highway System (NHS). Accompanying your letter was a report from the Southwest Research Institute and videos of the pendulum tests. You requested that we find the combination STOP sign and street name sign devices acceptable for use on the NHS under the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features." You also provided additional drawings per our request on September 25.

Introduction

Testing of the supports was in compliance with the guidelines contained in the NCHRP Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features. Requirements for breakaway supports are those in the American Association of State Highway and Transportation Officials' Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

The sign systems as tested can be described as a stop sign and street name sign mounted on an aluminum pole with a decorative casting at the base. The tested support poles ranged from 14.3 ft to 15.8 ft in length. The poles were embedded in NCHRP Report 350 Standard (strong) soil. The 32-inch octagonal shaped, cast aluminum stop sign blank was mounted 7 ft from the bottom of the sign to grade in all cases. Two street name sign frames with blank fillers were mounted at 90 degrees to each other near the top of the pole. Five variations were crash tested using the 820 kg bogie. These variations are:

- A. The post was a 4" x 4" x 0.156" square aluminum tube with a 5" x 4 1/2" x 0.159" decorative channel at the base. The 4" x 4" tube was embedded directly into a 36-inch deep concrete foundation that had a diameter of 8 inches.

B. The design tested in “A” was modified with the addition of an aluminum plate butt welded on the bottom. This plate was 4 ½” x 4 ½” x ¼” thick with a 4” x 4” x 0.156” thick wall square tube butt welded to it.

C. Post “A” is a round steel post with an outside diameter of 2.375 inches and a wall thickness of 0.125 inches. Post “B” has an OD of 2.875 inches and a 0.19 inch wall thickness. The decorative base has a 4 ¾ inch OD at the top and 7 ½ inches at the bottom.

D. The design tested in “C” was modified by welding a 6 ½ inch OD x 3/8 inch thick plate to the bottom of the decorative base. A 2.375 inch OD x 0.125 inch wall aluminum pipe is welded to this plate.

E. The cast aluminum post is 4 ½ x 4 ½ inches x 3/8 inches thick, with a 4 ¼ x 4 ¼ inch x ¼ inch thick plate welded on the bottom. A 4 inch OD x ¼ inch wall pipe is butt welded to this plate.

Testing

Pendulum testing was conducted on your company’s devices. The mass of the pendulum bogie was 820 kg in all tests. It was equipped with a 10-stage crushable honeycomb nose section. The complete signposts and breakaway castings as tested are shown in the Enclosures.

Test #	NCHRP 350 Test #	Speed	Test article description	Velocity change
A	3-60	35 km/hr	4x4” x 0.156” square aluminum tube. 5 x 4 1/2” decorative channel at base	1.3 m/s
(A100)	Extrapolation	100 km/hr		0.73 m/s
B	3-60	35 km/hr	4x4” x 0.156” square al. tube. 5 x 4 1/2” decorative channel at base. Al. Plate & pipe butt welded on bottom	0.70 m/s
(B100)	Extrapolation	100 km/hr		0.65 m/s
C	3-60	35 km/hr	2.375” x 0.125” round al. tube. 2.875” x 0.19 “ round al. tube. Decorative base at bottom.	0.85 m/s
(C100)	Extrapolation	100 km/hr		0.57 m/s
D	3-60	35 km/hr	2.375” x 0.125” round al. tube. 2.875” x 0.19 “ round al. tube. Decorative base at bottom, with plate and al. pipe welded to bottom.	0.49 m/s
(D100)	Extrapolation	100 km/hr		0.59 m/s
E	3-60	35 km/hr	Cast al. post 4 ½ x 4 ½ x 3/8 “ with a 4 ¼ x 4 ¼ plate welded to the bottom, and a 4” OD pipe welded below.	1.08 m/s
(E100)	Extrapolation	100 km/hr		1.88 m/s

Note: The support used in test “A” failed due to excessive stub height. No drawing of this design is included with this letter.

Findings

Velocity changes for the low-speed pendulum tests and the high-speed extrapolations were all within acceptable limits. All supports fractured at the ground line with the exception of Test A. In that test the fracture occurred at the top of the decorative collar, approximately 24 inches above the ground. The remaining post stub bent over in the soil, but remained well in excess of 4 inches. In light of the fact that you modified the design and retested it (Test B), and that this modified design both broke away cleanly at the groundline leaving no stub and resulted in lower velocity change, we find the unmodified version unacceptable.

Except as noted above the results of testing met the FHWA requirements and, therefore, the devices described above which were tested in impacts B, C, D, and E, and which are shown in the enclosed drawings for reference are acceptable for use as Test Level 3 devices on the NHS under the range of conditions tested, when proposed by a State.

Please note the following standard provisions that apply to FHWA letters of acceptance:

- Our acceptance is limited to the crashworthiness characteristics of the devices and does not cover their structural features, nor conformity with the Manual on Uniform Traffic Control Devices.
- Any changes that may adversely influence the crashworthiness of the device will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that they will meet the crashworthiness requirements of FHWA and NCHRP Report 350.
- To prevent misunderstanding by others, this letter of acceptance, designated as number SS-108 shall not be reproduced except in full. As this letter and the supporting documentation which support it become public information, it will be available for inspection at our office by interested parties.

Sincerely yours,

Carol H. Jacoby, P.E.
Director, Office of Safety Design

Enclosures

GREENCAST INC

3

4x4x.156"

ALUM SQ TUBE

148"

5x2 1/4 channel

ALUM PLATE & TUBE BUTT

WELDED ON BOTTOM

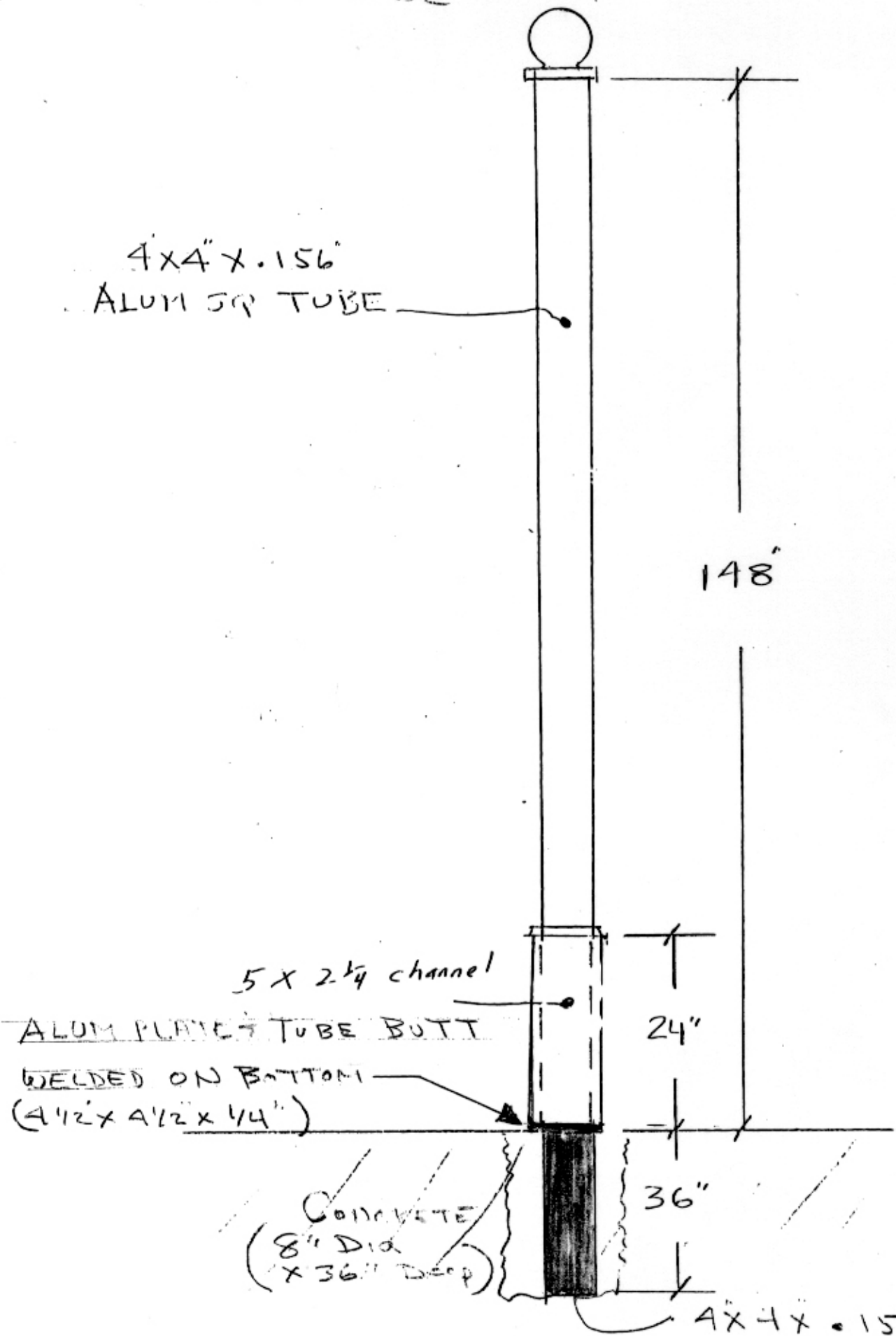
(4 1/2" x 4 1/2" x 1/4")

24"

36"

CONCRETE
(8" DIA
X 36" DEEP)

4x4x.156"





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4 3/4" ϕ

(C)

WELD TO JOIN "B"
TO PIPE. HERE

STREET SIGN POST
BASE ASSEMBLY DWG
OPTION TWO

PIPE "A" FROM BELOW
GROUND TO 6" ABOVE
CAST BASE, FOR
BEND EFFECT.
TOP POST "B" (LARGER
DIA) WELDED OVER
POST "A".

POST A = 2.375" OD
WITH 0.125" WALL

POST B = 2.878" OD
WITH 0.19" WALL

7/2" ϕ

INSTALL PIPE
IN CONCRETE
IN GROUND

24"

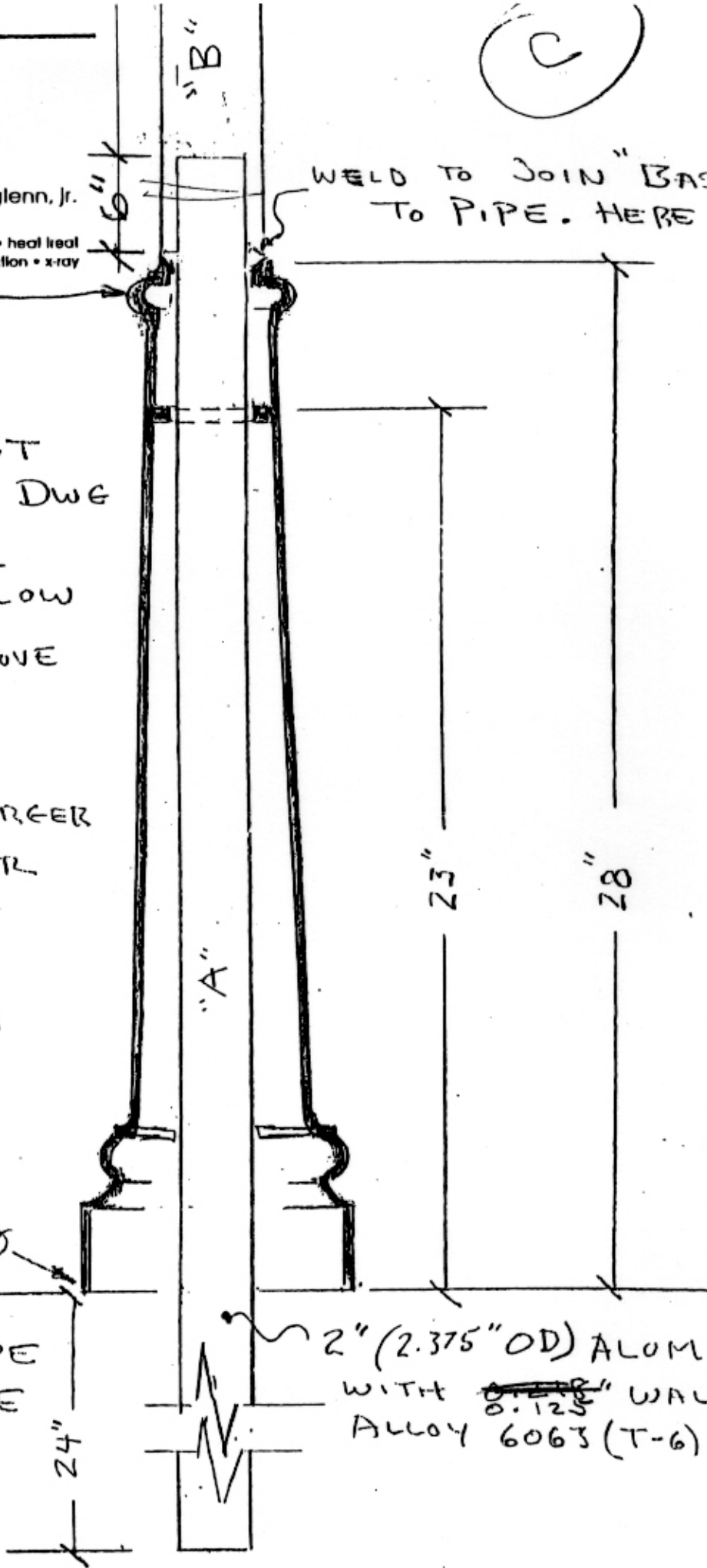
2" (2.375" OD) ALUM
WITH ~~0.125"~~ 0.125" WALL
ALLOY 6063 (T-6)

23"

28"

"B"

"A"





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WELD TO JOIN "BASE"
TO PIPE. HERE ON

STREET SIGN POST
BASE ASSEMBLY DWG
OPTION TWO

PIPE "A" FROM BELOW
GROUND TO 6" ABOVE
CAST BASE, FOR
BEND EFFECT.
TOP POST "B" (LARGER
DIA) WELDED OVER
POST "A".

Post A 2.375" OD
with 0.125" wall

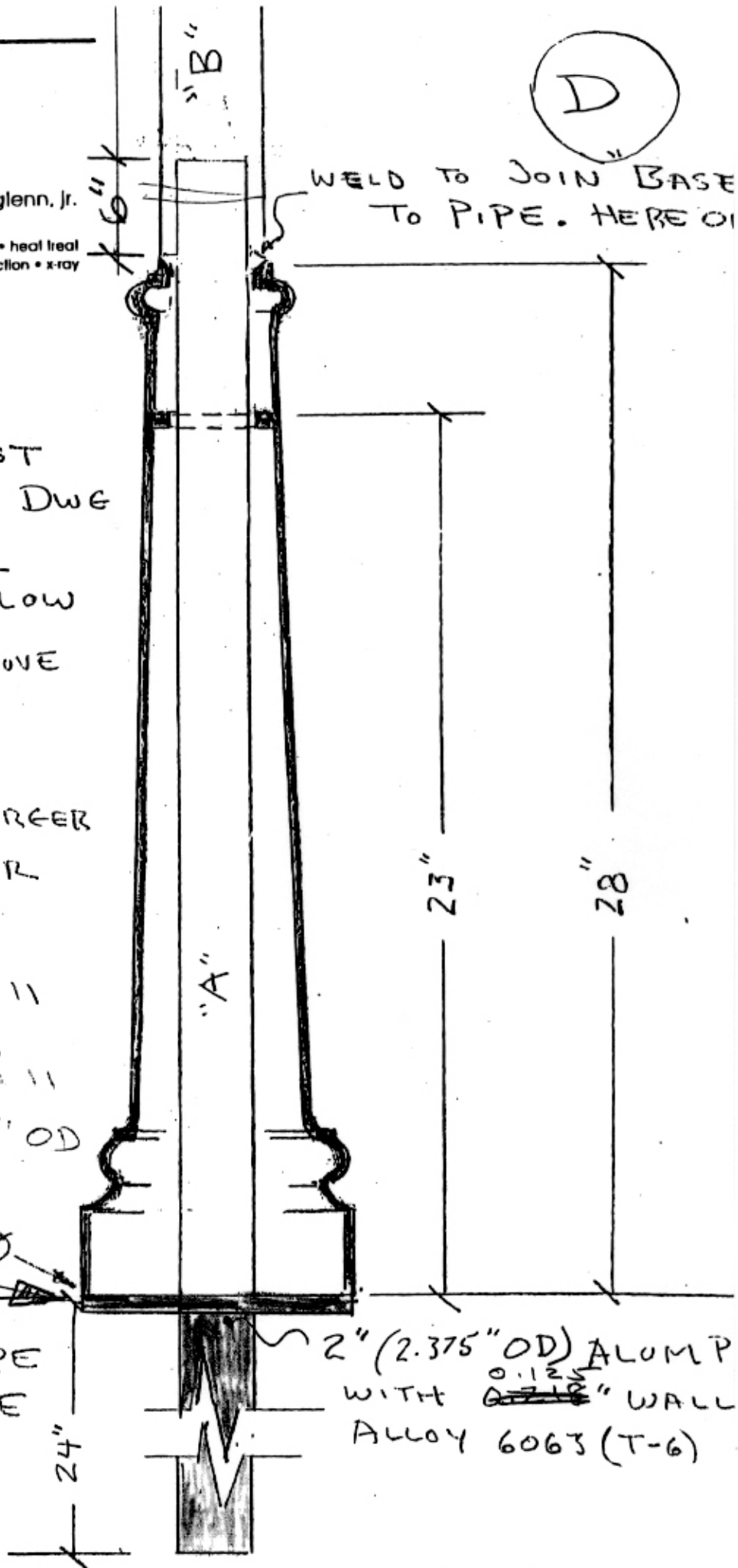
Post B 2.878" OD
with 0.19" wall

Base Plate 6 1/2" OD
X 3/8" thick

7 1/2" Ø

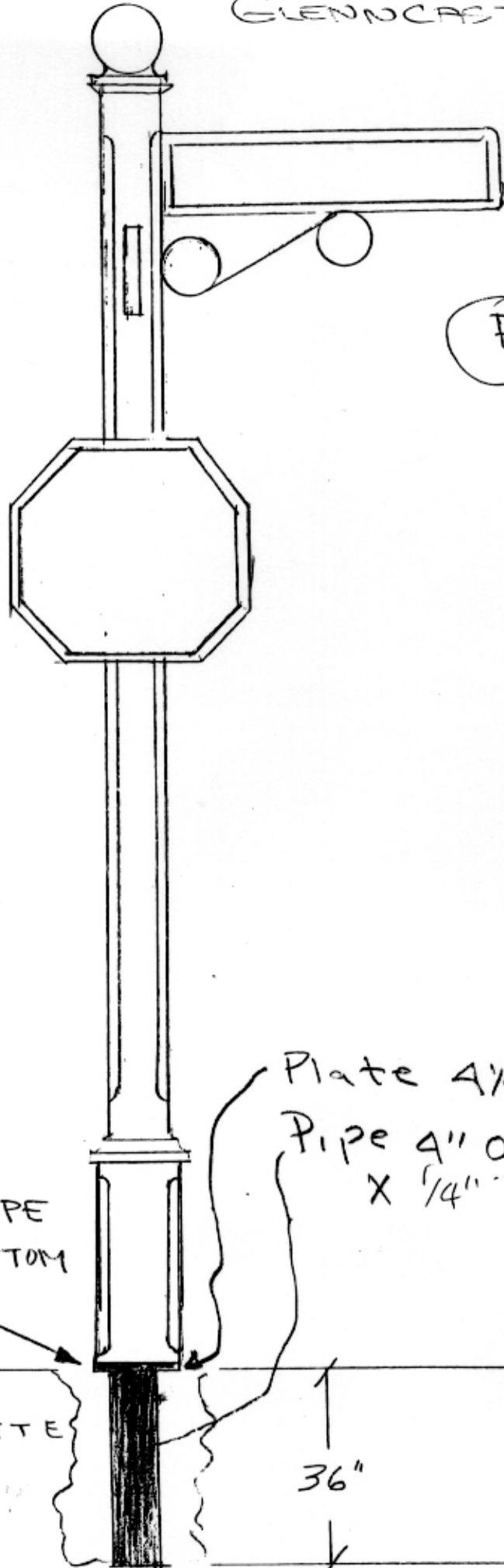
INSTALL PIPE
IN CONCRETE
IN GROUND

2" (2.375" OD) ALUM P
WITH 0.125" WALL
ALLOY 6063 (T-6)



E

E



ALUM. PLATE $\frac{1}{2}$ PIPE
 BUTT WELDED ON BOTTOM
 OF CAST ALUM POST

Plate 4 1/4" x 4 1/4"
 Pipe 4" OD
 X 1/4" wall

8" CONCRETE
 X 36" DIA

36"