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INSPECTOR'S HANDBOOK

HIGHWAY SIGNING



IOWA STATE HIGHWAY COMMISSION

AMES, IOWA

1969

HIGHWAY SIGNING

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INTRODUCTION

This handbook is an inspector's aid. It was written by an inspector to bring together all of the most-often-needed information involved in his work.

Much care has been taken to detail each phase of construction, with particular attention to the requirements and limitations of specifications. All applicable specification interpretations in Instructions to Resident Engineers have been included.

The beginning inspector should look to the handbook as a reference for standards of good practice. The Standard Specifications and Special Provisions should not, however, be overlooked as the basic sources of information on requirements and restrictions concerning workmanship and materials.

TABLE OF CONTENTS

Location	Page 1
Post Length	1
The Overhead Sign	2
Drawings	3
Materials	3
Placement of Posts	4
Breakaway Signs	4
Erection of Signs	5
Overhead Signs	5
Ground-Mounted Signs	6
Class B Signs	6
Delineators and Milepost Markers	6
Records	7

HIGHWAY SIGNING

Signing is a highly specialized aspect of highway construction. Each contract has its specialized, individual problems. The inspector, therefore, has to thoroughly familiarize himself with all plans and special provisions peculiar to a particular situation. He should never assume that two projects embody the same provisions, even though they might have been let at the same time.

Location

The first step in highway signing is to determine whether or not the signs required can be placed at the locations shown on the plans. This is done through field inspection and review of construction plans. The factors which must be considered are:

- 1) underground facilities
- 2) overhead facilities
- 3) clearances for driveways, intersecting roads, and ramps
- 4) intakes and manholes
- 5) other signs and lightpoles
- 6) other location features that might affect sign placement

Signs must be fully visible to the motoring public from the roadway. No obstructions should be allowed to obscure visual access to official signs.

It is extremely difficult to visualize a highway sign at a particular location until paving and shouldering have been completed. Care taken in reviewing the planned location in the field will help eliminate costly moves later, after a sign has been constructed and erected.

The location of posts or post footings in relation to pavement or shoulder edge must be determined as shown on Standard Plan RD-25.

Post Length

Most contractors request information on the length of signposts before anything else. In current practice, the contractor verifies all plan post lengths in the field before

any shop drawings are provided. Whatever the plans or provisions stipulate, however, the inspector is not relieved of the responsibility of making sure that posts are of sufficient length to obtain:

- 1) specified height
- 2) specified length in the ground

Post lengths should be determined in the field from the best information available. The ground elevation differential between two or more posts on any individual sign is the first and most critical calculation. It is mandatory for all types of posts. Cross sections must be taken at the sign location to determine this differential for breakaway signposts, and, in many cases, for wood posts. It is possible to estimate many wood sign post lengths by approximating the difference in ground elevation at the post location.

When paving and shouldering are not completed, it is necessary to plot the proposed cross section. This will determine the final ground elevation. After the ground elevation differential is determined--and the breakaway posts are ordered--it is important to maintain the same differential during placement of the sign post bases.

Wood sign posts are normally ordered to the nearest foot or two. Excess beyond the required length can be buried.

The Overhead Sign

For overhead signs, it is necessary to make one additional measurement: the 'L' distance for each overhead sign support structure footing. The 'L' distance is the straight portion of the pedestal above the footing to the point where taper begins. It is necessary to plot a final cross-section of each footing, showing the final pavement grade and shouldering. Then the overhead sign support footing is drawn in, allowing the minimum cover shown in the plans.

In most cases, the contractor will have to determine the skew of the bridge in relation to the roadway under the bridge.

The inspector should check bridge-mounted overhead sign brackets for correct angle. Due to the design of the brackets, they often will not mount over a light blister

without clearance modifications. Also, current designs do not provide for tilting signs on bridge-mounted brackets. If a glare-preventing tilt is necessary, it must be obtained either by modifying the bracket during fabrication or by using shims at the erection site.

Drawings

The proper number of copies of all shop drawings must be submitted to the Highway Commission Design Department for approval. Adequate time must be allowed for approval before materials are ordered and work begins. The inspector should study approved shop drawings, and verify that all items covered in the approved drawings are constructed exactly as they should be. Approved drawings are not to be changed. The Materials Department tests and/or checks all project materials for approval and compliance with approved shop drawings. Items are either corrected or rejected if there is any discrepancy between approved drawings and submitted articles.

Materials

Signing contracts involve many assorted materials, all of which must be approved. This includes everything from the longest structural members to the nuts, bolts, and washers. The inspector should develop a complete, accurate, detailed estimate of all project material quantities, including hardware items. The estimate should be completed as soon as possible to insure control of project materials submitted for approval. Nothing is officially approved until the inspector has the approval from the Materials Department.

The contractor must schedule his operation so that the the Materials Department has ample time to test and approve before materials are incorporated in a job. A generous supply of extra nuts, bolts, and hardware must be provided for samples.

Presently, and for some time in the future, the Highway Commission does not accept anchor bolts on certification. Therefore, the contractor must provide samples which will not be returned. In the case of certified materials, the Materials Department reserves the right to sample.

The inspector must satisfy himself, the Resident Engineer, and the Bureau of Public Roads that rejected materials are removed from the job. They must not inadvertently slip back into the project. Furthermore, the disposition of rejected materials must be noted in the project field book for future reference.

Placement of Posts

During construction, it is necessary for the inspector to measure each wood post as it is placed. He must verify that it gets placed at the proper depth in the ground. In some cases, the contractor may prefer burying excess length to obtaining a shorter post. No cut-offs are allowed. Under current practice, longer posts buried deeper than specified are paid for only on the basis of the specified length. The final pay length is the length above ground plus the specified buried length.

When setting Type A and Type B wood sign posts, keep in mind that it is necessary that all posts of a given sign be plumb, and that the pre-drilled bolt holes of all the posts match horizontally. For Type A signs, exact spacing between posts is essential so the bolt holes in the posts match those in the fabricated sign.

Fuse plates must be installed in the exact manner specified. Care should be taken to insure that residual tension is truly obtained. In many cases, it is possible to get a false torque reading if bolt threads or nut threads are not clean, if the nut seizes on the bolt, or if the nut is cross-threaded on the bolt. It is a good idea to run a tap through a galvanized nut, cleaning out any excess galvanizing. It also works well to run the nut down snug, remove it, and clean out the threads before final tensioning. All nuts in the fuse plate assembly and the breakaway base assembly must be center-punched to burr the threads and prevent loosening.

Breakaway Signs

Breakaway posts and assemblies must be ordered individually for each installation. The base installation must be checked to see that:

- 1) the top of the concrete has the proper slope
- 2) the breakaway base unit is placed at the proper height above the concrete footing

The diameter of the footing must be suitable for the size of WF beam used, and reinforcing must be racked properly to prevent shifting when the concrete is placed and vibrated. The elevation differential between the post bases on breakaway sign assemblies must be maintained once it is established and the posts ordered.

The beveled notch on a breakaway post base must be correctly oriented on each installation, as shown on Standard Plan RD-21. The exact amount of torque specified in the plans should be used for installing breakaway assemblies. Instruction for bedding the washers and shims, and for cleaning bolt threads before retightening should be followed. The torque specified for each installation should be applied in a systematic order and recorded in the field book.

Erection of Signs

When signs are erected, it is necessary to check the height and length at each installation. All height and length information must appear in the field book for record and payment. All hardware used in mounting should be:

- 1) the type specified
- 2) officially approved
- 3) installed as detailed in plans and specifications

Overhead Signs

Inspection of overhead sign support structures begins with the footings. Footings must be located at the specified depth, and with the size and shape indicated on the plans. Amount and placement of steel should be checked. Forming for the vertical portion of the footing should be braced, with all chamfer strips installed. All vertical steel, anchor bolts, bars, and electrical conduits must be racked and secured against vibration. Concrete should be tested for air content and slump, and cured in

the prescribed manner. After forms are removed, the exposed portion must be rubbed to produce the desired finish. The steel portion of the sign support structure should be built according to the detailed shop drawings and erected as shown in the plans.

The inspector and the Material Department must inspect structural members, making sure that they are fabricated as shown in approved shop drawings. The location, size, spacing, and legend of all signs erected on the structure should be checked. The sign face of overhead signs shall be plumb or tilted as required by the special provisions.

Ground-Mounted Signs

The inspector should check all ground-(shoulder) mounted Type A and Type B signs to verify that the vertical axis is plumb and the horizontal axis is at an angle of 93° away from the lane of traffic being served. Ground-mounted signs not located on the shoulder should be plumb and at 90° to the road. After sign installation, a night inspection should be made to see if any specular reflection is apparent. If such condition exists, the contractor must adjust the positioning to eliminate or minimize it.

Class B Signs

The inspector should maintain a continuous check on the fabrication and assembly of all Class B regulatory signs to insure that the size and spacing of letters and numerals, panel dimensions, and general workmanship comply with plans, special provisions, and approved shop drawings. All Type B signs should be checked for correct panel assembly and tightening of all bolts. The specified type and number of sign clips must be installed at the required spacing. The sign legend should be checked for nicks, scratches, and/or dirt. Size and other necessary information should be recorded in the field book, noting the measured and payment quantities.

Delineators and Milepost Markers

The inspector must make certain that all delineators and milepost markers are located as specified on

project plans. All posts, reflector units, frames, and hardware should be approved by the Materials Lab. Appropriate entries — done in adequate number and type detail to permit partial or final payment — must be made in the quantity field book.

Records

The record of construction kept in a field book is a permanent documentation of work done. It stands alone in any audit of a project. Sample field book pages for the various phases of signing work should be used as guides. Field notes must be in a form that can be translated into a final payment (or any intermediate payment) with a minimum of duplication and summarizing. The format should be readily workable so the inspector can use it and keep it current. No guesswork should be involved in items placed in a record for payment. Actual measurements and tests must be recorded and initialed each day to accurately document the work performed and materials used.

The inspector's daily log (diary) should include the weather and other conditions affecting work on the project, and specific actions taken by the contractor in the performance of his contract work schedule. Notices of suspension or resumption of work (Form No. 806) should be used by the inspector when necessitated by weather or other conditions.

APPENDIX
SAMPLE RECORD PAGES

ITEM No.	Type	Size	Type	Start Area (sq ft)	Recovery	Line
	Location	Size	Type			
	Measured at	Measured	Area			
# N13	5-2-59 (Camp)	1200x800	FT	20 SF	RECOVERED	CR

METHOD OF MEASUREMENT
 ART. ---
 BASIS OF PAYMENT
 ART. ---

5-2-59	Curt	Chic Cool					
	Coat-Check	Mount to Pipe					
	A US 59	Plank cur- BS					
	#N13	R-10 Spaced on Pile					
	wood	Placed 4 inch					
		has been placed at this					
		has been under 50 work					
		can last 120 R-10 stud					
		and Rots will be turned					
		over to I S H C Materials					
		For Credit	Est. 5-				

ITEM No. 2		POSTS FOR TYPE A or B		SIGNS 4" BY 4" WOOD		
DATE SET	LOCATION	"B" SIGN NUMBER	"A" SIGN TYPE	LIMIT FOR PAYMENT	REMARKS	INITIALS
5-2-63	Map A 128010 Map A 128010		R1-11	15		GR
METHOD OF MEASUREMENT ART.						
BASIS OF PAYMENT						
ART - - -						

ITEM No. 3		POSTS FOR TYPE A or B		B SIGNS, 4" BY 6" BY 6" WOOD		
DATE SET	LOCATION	"B" SIGN NUMBER	"A" SIGN TYPE	LIMIT FOR PAYMENT	REMARKS	INITIALS
5-2-63	Map A 128010		W1-03	15" = 35		GR
5-2-63	Map A 128010		R1-10	REPT = 34	REPAINT	GR
5-3-63	Map A 128150	80-78-500		REPT = 40	SEE SIGNAGE-11905 CTR	GR
METHOD OF MEASUREMENT						
BASIS OF PAYMENT						
ART - - -						

ITEM No. <u>4</u>			TYPE	B	STATIONS		ALLOWED GROUND MOUNTED	
DATE	LOCATION	SLIP						
Month Day, Yr.	MOUNTAIN SECTION	NUMBER						
5-6-45	MOUNTAIN 198520	80-78-510					347' = 56.6 ft	2077.5' ± 1.50 54 <i>[Signature]</i>
5-8-45	MOUNTAIN 198520	80-78-490						

METHOD OF MEASUREMENT
ART. BY PAYMENT
BASIS OF PAYMENT
ART.

ITEM No. <u>5</u> TYPE B STATIONS							ALLOWED GROUND MOUNTED
DATE	LOCATION	SLIP					
Month Day, Yr.	MOUNTAIN SECTION	NUMBER					
6-5-49	MOUNTAIN 250120	80-78-510				297.5' = 68.50 ft	758.6 ± 1.50 54 <i>[Signature]</i>
6-5-49	MOUNTAIN 250120	80-78-511					

METHOD OF MEASUREMENT
ART.
BASIS OF PAYMENT
ART.

ITEM No. 6		POSTS, STEEL BREAK- AWAY FOR TYPE B SLABS - 8LUF 20	
Date	Location	"B" Size	
5-8-23	1387mm 1300mm	00-70-430	
<u>METHOD OF MEASUREMENT</u>			
ART. - - - -			
<u>BASIS OF PAYMENT</u>			
ART. - - - -			

Quantity	Unit Price	Amount	Remarks
11.17	70	781.90	5-8-23

ITEM No. 7		CONCRETE FOR TYPE B BREAKAWAY SLAB	
Date	Location	"B" Size	
5-8-23	1387mm 1300mm	00-70-430	
<u>METHOD OF MEASUREMENT</u>			
ART. - - - -			
<u>BASIS OF PAYMENT</u>			
ART. - - - -			

Quantity	Unit Price	Amount	Remarks
2.45	70	171.50	5-8-23

ITEM NO. 8		OVERHEAD GALVANIZED		SIGN SUPPORT STRUCTURE	
Date Erected	Location	Date	Remarks	Remarks	Top
6-6-53	4th Street	8-21-52		300- 200	OK

METHOD OF MEASUREMENT
APR --
BASIS OF PAYMENT
PR --

ITEM NO. 9		EXCAVATIONS		REINFORCING STEEL		Total	Spoke	Top
Date	Location	Comp. No.	Year	Comp. No.	Year	CY		Top
5-21-54	Manum 6.58723	23.28726	19.6	383-2	30	12.83		OK
5-24-54	Manum 6.58923	21.41474	21.4	385-2	30	21.43		OK

METHOD OF MEASUREMENT
APR --
BASIS OF PAYMENT
PR --

CALCULATIONS FOR

CLASS 23 EXCAVATION

Location Sta. 658123 Upper Runo Line At Side.

$$\text{East End Area} = \frac{15.5 \times 6}{2} = 28.0 \text{ SF}$$

$$\text{West End Area} = \frac{15.5 \times 6}{2} = 30.0 \text{ SF}$$

$$\text{Average Area} = \frac{30 + 28.0}{2} = 29.25 \text{ SF}$$

$$\text{Volume} = 29.25 \times 16 = 468 \text{ CF}$$

$$\text{CY} = \frac{468}{27} = 17.33 \text{ CY}$$

Location Sta. 658123 West Runo Line At Side

$$\text{East End Area} = \frac{50 \times 22 \times 6}{2} = 36 \text{ SF}$$

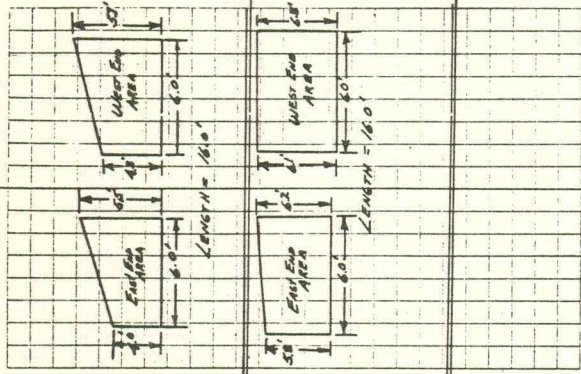
$$\text{West End Area} = \frac{14.3 \times 6}{2} = 37.2 \text{ SF}$$

$$\text{Average Area} = \frac{36 + 37.2}{2} = 36.6 \text{ SF}$$

$$\text{Volume} = 36.6 \times 16 = 585.6 \text{ CF}$$

$$\text{CY} = \frac{585.6}{27} = 21.6 \text{ CY}$$

30



ITEM No. 10 Concrete Structural

Date	Location	Slump	Air
	Reced. Base of Structure		
5-13-60	Manure 658123	3 in	6.2%
5-15-60	Manure 658123	3 in	5.8%
5-15-60	Manure 658123	2 in	5.9%

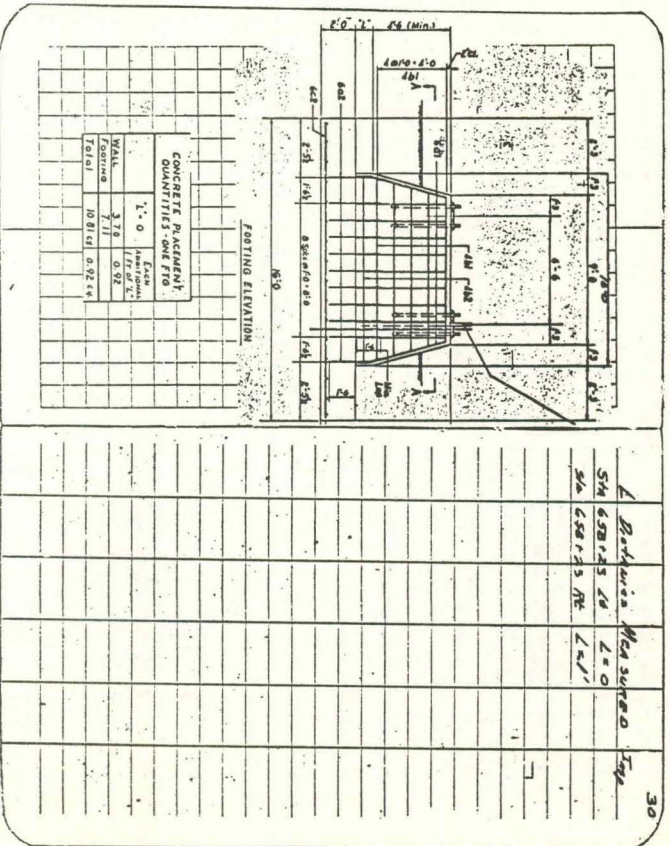
METHOD OF MEASUREMENT

ART -

BASIS OF PAYMENT

ART -

Comp. Per 100 cu yd	Volume of concrete	CY Areas	Area
80%	7.25	10.00	24
30%	4.0	10.00	24
10.0%	0.92	14.0	10.00



REPORT OF PROPORTIONS

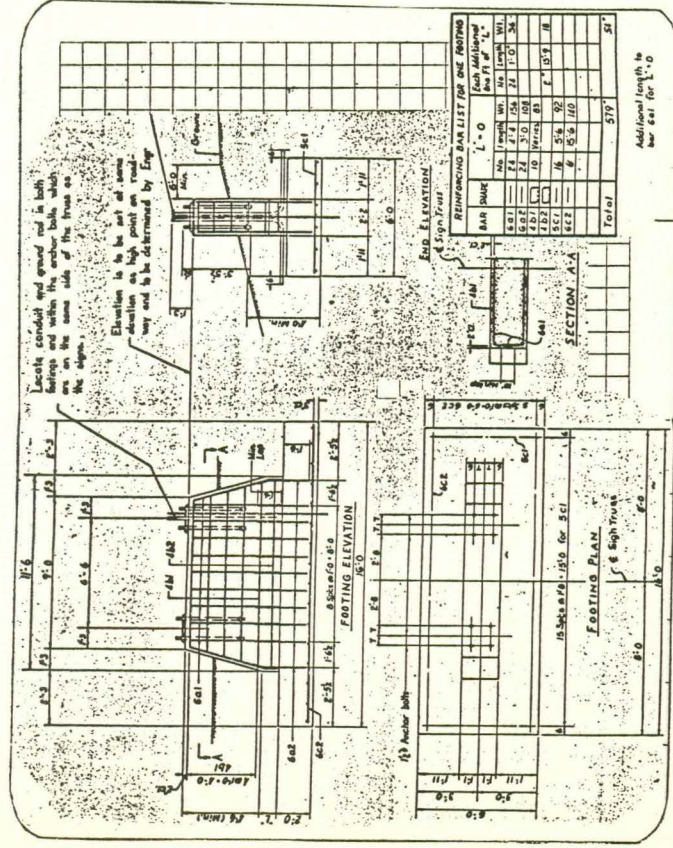
Part	Wt.	Vol.	Part	Wt.	Vol.
Water	1.0	0.01	Gravel	1.0	0.01
Weld	3.78	0.02	Gravel	1.0	0.01
Forming	7.11	0.02	Gravel	1.0	0.01
Total	108.89	0.92	Gravel	1.0	0.01

Part	Wt.	Vol.	Part	Wt.	Vol.
Water	1.0	0.01	Gravel	1.0	0.01
Weld	3.78	0.02	Gravel	1.0	0.01
Forming	7.11	0.02	Gravel	1.0	0.01
Total	108.89	0.92	Gravel	1.0	0.01

ADDITIONAL TREATMENT OF CONCRETE

- S Heated water only with no protection
 T Heated materials with no protection
 U Heated materials with admixtures
 V Heated materials and protected concrete
 W Heated used in concrete

ITEM No. <u>11</u> STEEL REINFORCING		REINFORCING		REMARKS		DATE	
DATE	LOCATION	ASPH. 2	ASPH. 2	QUANTITY	REMARKS	DATE	REMARKS
REQ. BY	LOCATED	AMOUNT	AMOUNT	REMARKS	DATE	REMARKS	DATE
5-13-41	Manure 658723	Fast line only					
5-10-41	Manure 658723	L = 0					
5-15-41	Manure 658723	L = 1					
METHOD OF MEASUREMENT							
ART. ---							
BASIS OF PAYMENT							
ART. ---							



NOTES

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