TO:

Malcolm D. Graham
Chief Engineer
Bldg. 5, Rm. 401

SUPERSEDED BY EI 77-031 EFFECTIVE 5/1/1977

ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: STANDARD DETAILS FOR HIGHWAY BRIDGES, REVISION TO

Subject Code: 7.35-1

Sup 77-50

Distribution: ☐ Main Office ☐ Regions ☒ Special

Code: EI 75-26

Date: 4/7/75

Supersedes:

APPROVED: R. M. Kamp
Deputy Chief Engineer (Structures)

The attached pages are revisions to Standard Details for Highway Bridges and should be immediately inserted in the Manual.

PAGE

7	Deleted paragraphs numbered 2, 3, and 4, under ABUTMENTS.
8	No change.
9	Revised paragraph numbered 4 under MISCELLANEOUS. Deleted paragraph numbered 5.
10	No change.
11	No change.
12	Deleted portion of note under SOLID PIERS - "Only 4" Fascia Pedestals..... is below top of pier"
15	No change.
16	Deleted word SEMISTUB in paragraph numbered 7.
17	Revised and retyped due to EI 74-81.
18	No change
19	Article 21,5.2 deleted "Monolithic Slabs" and added "Concrete Slab for Box Beams".
20	No change.
21	Revised and retyped due to EI 74-81. In last paragraph revised 20 gallons to 5 gallons.
21-1	Added due to retyping.
25	Article 21.9.2, Paragraph 2 - Revised. Deleted Article 21.10 and 21.10.1 from this page.
26	Article 21.10 (Formerly on page 25). Article 21.10.1 Revised Article 21.10.2 Last sentence added.
27	Article 21.10.3, Sub-item 2 - Revised Article 21,10.3, Sub-item 3 - Deleted Article 21.10.4, Sub-items 2 and 3 - Rewritten to eliminate redundancy. Added reference to "ELEVATION A-A" after Sub-item 3. Articles 21.11 and 21.12 - No change.
28	Article 21.14 - Revised Articles 21.13, 21.15 and 21.16 - No change
29,30,30-1,30-2	Articles 21.16.1 thru 21.16.3 - No change - pages retyped.
49	Sub-item G3 - Revised to reflect proper item name.
50	No change.
59	Sub-item SUB 1-B changed dry density to 95 percent.

60 No change.
65 No change.
66 SUB 11- Piers with Columns - Revised
SUB 12 - Moved to page 67.
67 SUB 12 and SUB 13 - No change.
68 Blank page added.
79 Article 23.1 - First sentence rewritten.
80- No change.
85 No change.
86 Article 24.6 - Corrected spelling "Berms".
88A No change.
89 Article 24.15 - Revised.
Article 24.16 - Deleted.
90 Article 24.17 - Deleted "SOLID" from title
91 Article 24.18.3 - Last paragraph - Revised.
93,93-1,93-2,93-3, and 94 - Article 25.1 - Revised
94-1 Blank page.
94-2 Formerly page 93A - No change.
94-3 Article 25.3 - Revised cover from 2" to 3¼" for Top of Slab with Integral Wearing Surface.
95 Article 25.4 - Revised.
96 Continuation of Article 25.4 - new page.
97 Articles 25.5 and 25.6 - Revised.
98 Continuation of Article 25.6.
Article 25.7 - No change.
101 Article 26.6 - Revised.
102 No change.
105 Article 27.6 - Added last sentence.
106 No change.
107 No change.
108 Article 27.9 - Revised to make reference to maximum and minimum fillet welds.
109 Article 27.10 - Revised referenced Article to read 27.17.
Article 27.11 - Revised same as
Article 27.9 on page 108.
110 No change.
120 Appendix D - Revised.
120A This form deleted.
120-1,120-2,120-3 - New forms to replace 120A. Back of each page blank.
22A Revised (Insert in regular page sequence).

ABUTMENTS:

Aesthetic treatment of abutments is usually of a basic nature. Often simple scoring or surface texture treatment of the concrete will be sufficient.

AESTHETICS FOR WALLS:

1. Basic aesthetic treatment of long or high walls is "scoring of some type" ("V" grooves or corrugated recesses made by form inserts). Naturally, the deeper the scoring the darker the shadow effect and more pronounced the result.
2. More complex and expensive treatments are brick or split-faced block, decorative block, precast panels, etc. Special permission is required for the use of these decorative veneers. Again, samples and photographs are available in the Main Office, Structures Subdivision, for the designer's use. Assistance is also available. Keep in mind, using these veneers, it is particularly important that the result is not a look of artificiality.

STRINGERS AND GIRDERS:

1. Eliminate as far as possible any abrupt changes in fascia depth.
2. Vertical stiffeners on the outside face of fascia girders can be tolerated although the overall appearance of the structure is much cleaner if the stiffeners are hidden.

DRAIN PIPES AND DOWNSPOUTS:

1. If downspouts and drain pipes are used, they should be removed from the view of the motorist, if at all possible. Placing the downspout inside the pier columns or on the side of the pier columns away from the travel lane and painting them grey is usually sufficient. Do not put downspouts on travel lane side of piers or paint them green as has been done in the past on numerous jobs.

COLORS:

1. Presently, we are varying the colors of the painted steel on I-88 (Susquehanna Expressway). This is not to be inferred as normal practice from this date. Although we have five (5) additional approved colors, our present Sage Green is still the best all-around color for steel bridges. Special structures throughout the State may be painted different approved colors in the future but only with the approval of the Deputy Chief Engineer (Structures).

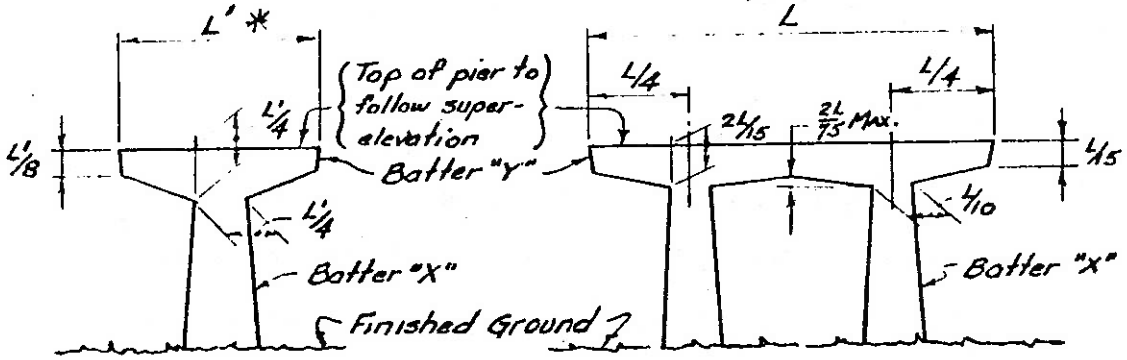
2. We do not use coloring agents in the concrete for piers, wingwalls, etc. because of complicated quality control and the high cost of materials, but the idea has not been discounted completely.
3. In the future, demonstration projects will be performed with coloring agents and concrete products such as dry block paving, decorative block, etc. to evaluate construction procedures and visual impact.

MISCELLANEOUS:

1. Longer spans are preferred to multiple short spans. An attempt should be made to avoid the "Forest of Piers" effect caused by multiple short spans.
2. Short spans should not be sandwiched between longer spans if it is at all avoidable.
3. Make an attempt to obtain an open airy type structure by avoiding high abutments with short spans.
4. Minimum height of pedestals is 6 inches. The lowest fascia pedestal on each abutment and pier should be set at 6 inches. If the difference in height between fascia pedestals is 6 inches or more, a sloping bridge seat should be used with both fascia pedestals set at 6 inches.

FIGURE I
HAMMERHEAD & TT PIERS

Note:
The shortest length of TT pier leg is approx. Cap beam depth + 2'±.



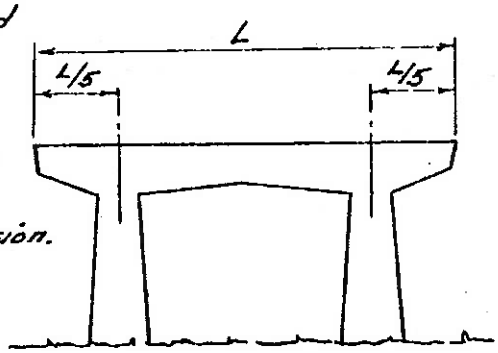
HAMMERHEAD

TT PIER
(Odd Number of Stringers)

* The higher the pier the longer L' may be and still look good.

Batter "X" = 12 on 1 to 60 on 1 depending upon height of leg.

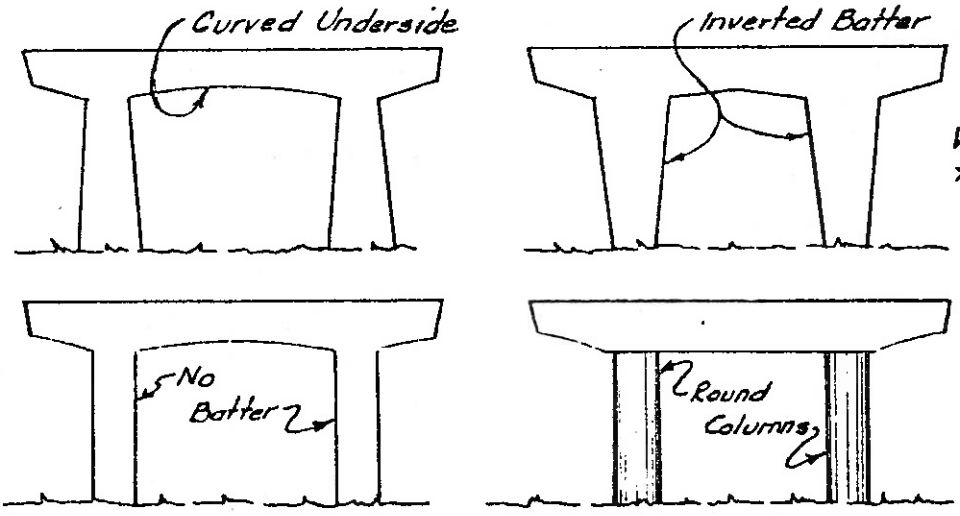
Batter "Y" = 10 on 1 or nearest even dimension.



TT PIER
(Even Number of Stringers)

Proportions not indicated are similiar to those above.

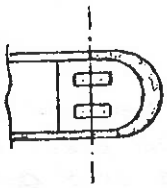
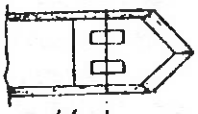
VARIATIONS FOR TT PIERS

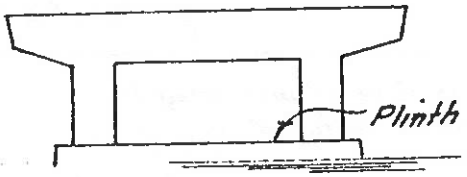


Combinations & Variations of aesthetic treatment is acceptable.

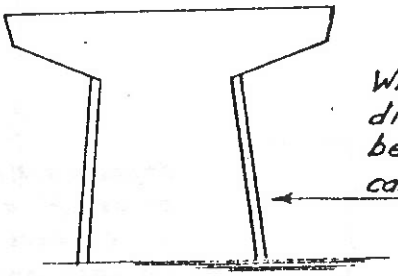
FIGURE I (CONTINUED)

RIVER OR STREAM PIERS

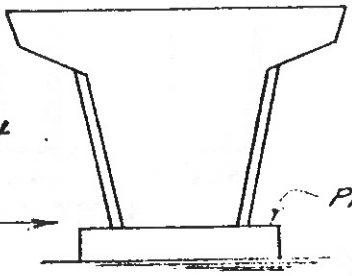
In addition to the standard Bullnose Pier  and Pointed End Pier  any of the piers indicated on the previous sheet can be used as waterway piers provided under clearance will permit a substantial leg above a plinth as shown here:



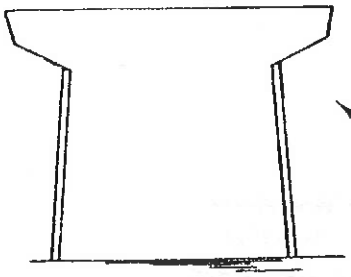
River piers should have thick stems if not completely solid from footing to bearings. Some suggestions are shown here:



When stem is battered in this direction an attempt should be made to increase the cantilever.



Shorter cantilever is not objectionable when used with inverted batter.



The stubby appearance of a short cantilever can easily be relieved by simply extending the bottom lines of the cantilever

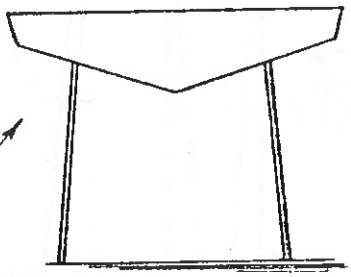
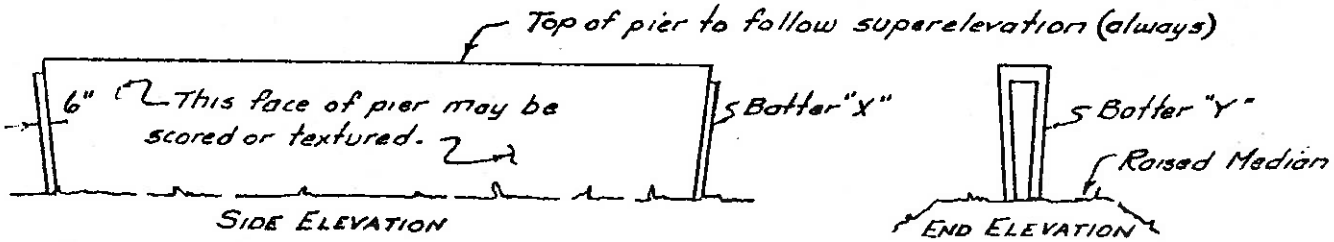


FIGURE I (CONTINUED)

SOLID PIERS

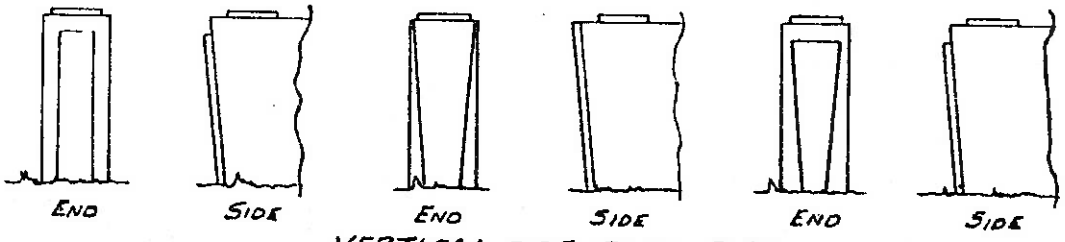
Solid piers have been used primarily as river or stream piers but on occasion solid piers have been used on grade separations. Raised medians and cut sections have, in some cases, created low clearances at pier locations. Some types of solid piers which could be used are shown:



Batter "X" = 6 on 1 Max.
Batter "Y" = 12 on 1 Min.

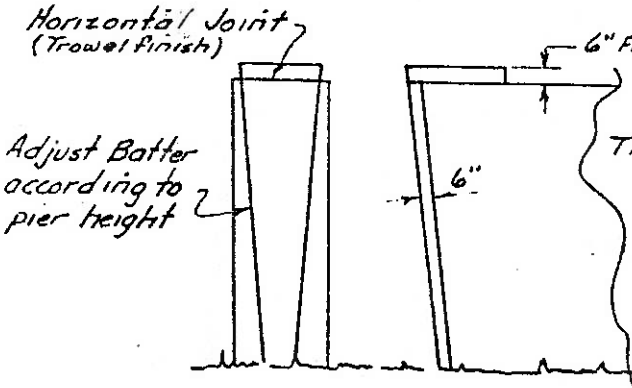
The maximum height of this pier should be in the neighborhood of 9' above finished ground.

TAPERED SIDE SOLID PIER



These piers may be as high as 15'-16' above finished ground if necessary

VERTICAL SIDE SOLID PIERS



This particular pier differs from those shown above in that a 6" fascia pedestal may be used as a continuation of end treatment.

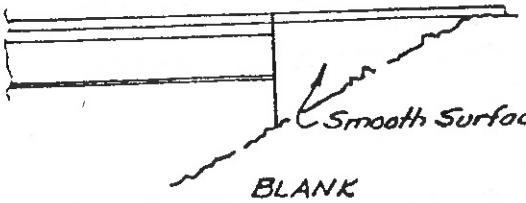
Only a slight modification is necessary to completely hide bearings.

Variations of end treatments are only limited by the engineers imagination and good judgment.

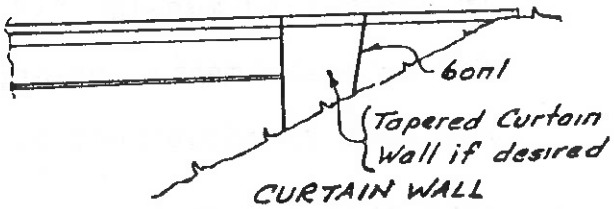
FIGURE III

ABUTMENT TYPES

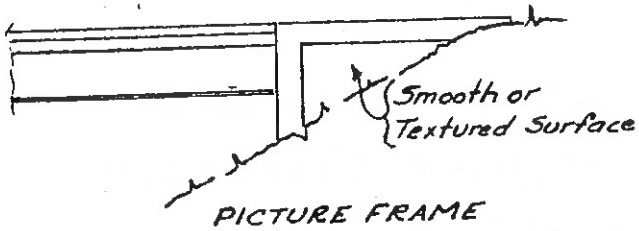
Note:
Railings not shown



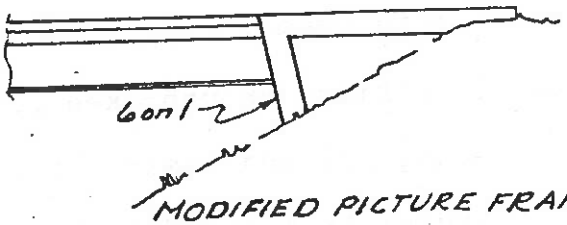
BLANK



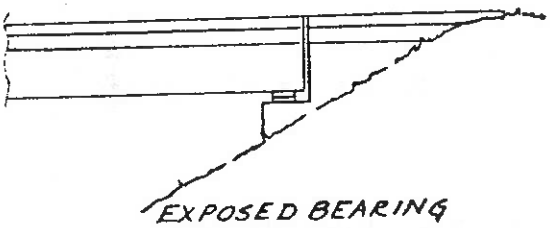
CURTAIN WALL



PICTURE FRAME



MODIFIED PICTURE FRAME



EXPOSED BEARING

The examples shown here are in no way meant to limit the engineers creativity but only to indicate some of the variations already proposed or in use.

Acceptable combinations or modifications of those shown could be considered.

Revised April 1975

SPECIAL ABUTMENT DETAILS FOR FIGURE II

1. The face edge of the bridge seat shall be a straight line fascia to fascia.
2. In general, dimension "A" shall be the same or nearly so for both abutments and approximately constant for each abutment by adjustment of embankment slopes.
3. Four-inch pedestals and low bearings shall be used at the fascia beams.
4. To achieve an unbroken line at the face of the bridge seat, all pedestals shall be set back a minimum of four inches from the face edge of bridge seat.
5. The ends of the fascia beams, their end stiffeners and that portion of the backwall adjustment to the ends of the fascia beams shall have the same slope as the abutment face (see sketch).
6. The exposed abutment facing shall be in one plane exclusive of surface treatment.
7. In cases where a combination of grades, superelevation, exposed rock footings, etc., result in a considerable variation in dimension "A" from fascia to fascia, a vertical face abutment incorporating details 1 through 6 shall be used.

21.5 BRIDGE ESTIMATES

All estimates shall be divided into separate columns for substructure, superstructure and miscellaneous (See Estimate of Quantities table following page 22A).

Separate quantity estimates for companion bridges with an open median are to be placed on the plans and separate cost estimates are to be made for each structure. If the structures have a connecting wall, the dividing line for estimating shall be the center line of the median.

Bridges with a closed median are to have one quantity estimate on the plans and one cost estimate.

Every component of a structure shall be identified on the plans by a payment item.

Where more than one type of structural steel is used, a table shall be placed on the estimate sheet listing the various types.

For all bridges which support utilities, breakdown estimates may be required. Refer to Section 21.20. The estimate table put on the plans shall show the estimated quantities for both the State and utility shares. In addition, the table shall include a blank column entitled FINAL for field use.

21.5.1 PRELIMINARY COMPARATIVE COST ESTIMATES:

Comparative cost estimates shall generally be based on the latest edition of

New York State
Department of Transportation
Division of Design and Construction
Weighted Average Bid Prices

Generally, the average bid prices for the Region in which the structure is located shall be used for items with the following exceptions:

In estimating structural steel, the Statewide average bid price for this item shall be used as a basis for estimating all structures using the following procedures:

PROCEDURE FOR ADJUSTING STATEWIDE AVERAGE BID PRICES

TYPE OF DESIGN	ADJUSTMENT TO AVERAGE
Rolled Beam Steel (less than 50 ksi)	Deduct 2¢ per pound
A36 Plate Girder Steel	Use Average
A588 Rolled Beam	" "
A441 Plate Girder Steel	Increase 2¢ per pound
A588 Plate Girder Steel	Increase 3¢ per pound

PROCEDURE FOR INCREASING ABOVE ADJUSTMENTS FOR CURVED GIRDERS

RADIUS OF CURVATURE	INCREASE ABOVE ADJUSTMENTS
2000 ft. and Greater	0
Less than 2000 ft to 1500 ft	1/2¢ per pound
Less than 1500 ft to 1000 ft	1¢ per pound
Less than 1000 ft to 500 ft	2¢ per pound
Less than 500 ft*	5¢ per pound

*Note: Flame cutting of flanges to required radius becomes more desirable as flange size increases. This note applies only to radii less than 500 feet.

21.5.2 BREAKDOWN OF CONCRETE ITEMS ON CONTRACT PLANS

The following items will be used for various components of the structure and will be so indicated on the Contract Plans:

Description	1962 Item No.	1973 Item No.
Mass. Concrete - Abutments, Solid Piers and Retaining Walls	20	601.02
Pier Footings	20	601.02
Pier Columns, Caps and Beams	18	601.01
Structural Slabs	18	601.01
Concrete Deck Slabs	18MB	601.0301
Concrete Slab For Box Beams	18MB	601.0302
All Pedestals	18	601.01
Sidewalks (superstructure and substructure)	18	601.01
Malls and Abutment Headers	18	601.01
Cement Concrete Pavement.....	47B	502.02
Cement Concrete Approach Slab	18	601.01
Cast-in-Place Concrete Piles	85C	629.07
Heavily Reinforced Section (Steel Spacing Less Than 6 Inches)	18	601.01

In order to facilitate the preparation of field estimates for the various portions of the subject items as they are constructed, the Contract Plans shall clearly state the volume of structural Class A and B concrete to the nearest hundredth of a cubic yard. The area of surface of the structural slab shall be indicated to the nearest square foot. The weight of reinforcement in each pour shall be indicated to the nearest pound, either on the appropriate plan sheet or as a part of the bar list.

The estimate for each unit, such as an abutment, pier, slab, parapet, curb and sidewalk per span shall be broken down by pours.

For simple spans, each span shall be considered as a unit and the quantities for the concrete and bar reinforcement items indicated for that unit. For continuous beams, each separate pour as indicated in the pouring sequence shall be considered as a unit.

The quantities in the pedestals in any one substructure unit may be listed in the table as the total for all the pedestals instead of listing the quantities in each pedestal.

21.5.3 ESTIMATE OF QUANTITIES TABLE

The Estimate of Quantities Table shown on the plans shall agree with the table shown on page 22A.

The "Estimated" quantity shall be the quantity obtained directely from the estimate computations. This "Estimated" quantity is to be our best estimate of what we anticipate the final pay quantity will be. If this involves some professional Engineering judgment in addition to routine calculations, that is acceptable. However, in no case should we change (usually increase) a quantity merely because it might be convenient for someone. Our estimated quantities should be such that they can be, if necessary, testified to in a claims case as our most realistic appraisal of what will actually be paid.

Rounding of the raw quantity to obtain the "Estimated" quantity should be made to the next highest unit of ten to facilitate extensions, except when the raw quantity is small or not subject to change.

The "Final" quantities shall be left blank on the plans. The quantities shall be filled in by the Regional Office on the "As-Built Plans" at the completion of the Contract.

To estimate the volume of water required for sod, use the value of 5 gallons per square yard. The number computed in M/Gals shall be placed in the estimated column of the Bridge Estimate of Quantities.

The raw estimated total quantity for the Structural Steel Item shall be increased 3 percent and then rounded off to no more than four significant figures to obtain the "Estimated" quantity. This rounding of 3 percent is to take care of welding and bolts.

Canal Bridges, and Structures over Streams and Navigable Waters, shall be shown and the point to which these minimum clearances prevail shall be indicated on plan and elevation. A location plan shall be shown on the layout drawing to a scale of 1" = 2000'.

21.9.2 SUBSURFACE PROFILE DRAWINGS

The subsurface profile drawings prepared by the Soil Mechanics Bureau shall be reviewed, but no changes whatsoever may be made which would alter the location, borings, or general notes and symbols pertaining thereto. Any change affecting the existing soil conditions must be made by the Soil Mechanics Bureau.

Changes affecting only the depicting of the structure may be made by the Design Unit. Such changes must be reported by the Project Engineer, through the Foundation Construction Unit, to the Soil Mechanics Bureau and, if requested, a copy of the changed drawing must be made available to the Soil Mechanics Bureau in order that they may update their original drawing. Changes in final footing elevations shall be reported to the Foundation Construction Unit if they exceed the difference permitted in the Foundation Design Report.

21.10 WATERWAY CROSSINGS

21.10.1 HYDRAULIC DATA

The Preliminary Structure Plan for any bridge structure spanning a waterway must contain the following tabular information.

	Basic Flood	Design Flood
Recurrency Interval	100 year	50 year
Peak Discharge		
High Water Elevation		

(If the flood of record exceeds the basic flood, the plans should also indicate the peak discharge, high water elevation, and data of occurrence of the record flood.)

This information must also appear on the Final Contract Plans

21.10.2 CLEARANCES (General)

1. Whenever possible a minimum freeboard of two feet above design high water elevation shall be provided at all stream crossings. A three foot minimum underclearance or a one foot minimum above a 100 year flow, may be required by the Corps of Engineers for waterway crossings where a flood control project is involved. This information should be included on the "ELEVATION A-A" detail of the preliminary plan.

21.10.3 CLEARANCES OVER NAVIGABLE WATERWAYS

1. Horizontal and vertical clearances as shown on the Coast Guard Permit Application shall be shown in plan and elevation as noted in 21.9.1, Layout Drawings.
2. Vertical clearances will be shown above maximum navigable water surface for bridges over the Barge Canal, and over mean (ordinary) high water elevation for others.

21.10.4 WATER ELEVATIONS

Except for the table described in Article 21.10.1, only the following water elevations are to be shown on the plans:

1. Design High Water Elevation for all waterway crossings except where the waterway elevations are completely controlled.
2. Normal pool elevation and maximum navigable water surface for all canal crossings.
3. All water elevations indicated on the Coast Guard Permit.

   (All elevations are to be shown and identified on the "ELEVATION A-A" detail of the preliminary plan.)

21.11 REINFORCED CONCRETE APPROACH SLABS

All bridges shall be provided with a reinforced concrete approach slab. (See current BDD Sheets.)

21.12 DEPTH OF CONCRETE FASCIA ON MULTIPLE SPAN STRUCTURES

On multiple span structures, it is desirable that a uniform depth of concrete fascia be kept for the full length of the exposed fascia. To accomplish this will require that all fascia beams be set so that the bottom of the top flanges will be aligned.

21.13 GRANITE CURBS

Granite curbs shall be used on all bridges where curbs are required and should be so shown on the plans.

21.14 SIDEWALKS ON BRIDGES

When required, raised sidewalks shall have a minimum clear width of 4 feet. Sidewalks on or adjacent to walls, may be jointly supported on the embankment and walls.

21.15 DETAILS OF RAILINGS

Complete plan or elevation of railing shall be detailed. These views may be schematic. The location of the railing shall be set by tying in one or more posts to the end of slab or end of wingwall. Location of special posts and rail expansion joints shall be shown.

21.16 BRIDGE DRAINAGE

The spacing of bridge drains shall be based on a 5-minute storm of a 10-year frequency. Bridge drains are to be provided to maintain a maximum puddle width determined by the following conditions:

a. Maximum puddle width is limited to 12 feet.

b. Maximum puddle depth is one-half inch less than the curb height.

c. Lane width clear of puddle must be a minimum of 8 feet.

Recommended design practice for hydraulic computations shall be those of the Federal Highway Administration as published in Circular HEC No. 12 - Drainage of Highway Pavements, March 1969.

Bridge drains on stream bridges with curbs shall be located midway between diaphragms or crossframes and shall discharge directly into the stream in such a way that no part of the superstructure can be affected.

For bridge drains on bridges over land, horizontal runs of drain pipe shall be avoided whenever a reasonable modification of the design scupper spacing will permit placement of drains adjacent to piers at the low end of spans. Scuppers shall not be discharged on embankments or ungrouted block paved slopes.

Drainage from bridge superstructure or embankments shall not discharge onto or drain across a railroad right-of-way without the approval of the railroad company.

21.16.1 BRIDGES - ENDS

At the ends of all curbed bridges, where curbs are not used on the approaches, granite curbs shall be installed as indicated on the appropriate bridge design data sheet. Sod gutters shall be provided where required for drainage.

On the downgrade end of a curbed bridge, where the computed flow from the high point or nearest bridge drain exceeds the allowable, provide a catch basin located in front of the flared granite curb as shown on the appropriate bridge data sheet. The allowable flow for curbed approaches is based on the puddle width. When there are no curbs on approaches, the allowable is 2 cfs or the flow from the puddle width, whichever is smaller. An 8-inch diameter C.M. pipe shall be used to drain catch basins down slopes. The size of pipe under the pavement, leading from

one catch basin to another, shall be eighteen inches (18") diameter paved invert C.M. pipe with a minimum grade of one percent. The bottom of the catch basin shall be approximately one foot (1') below the bottom of the eighteen-inch (18") diameter pipe.

21.16.2 BRIDGES - UPGRADE ENDS WITH CURB APPROACHES

At the upgrade end of all bridges, when the approach pavement is curbed, a catch basin located in front of the curb should be provided approximately ten feet (10') from end of the bridge wingwall or reinforced concrete approach slab, whichever is farther from the bridge, in order to collect the highway drainage before it reaches the bridge. A granite curb shall be used between this point and the bridge.

21.16.3 - DOWNSPOUTS

Except as noted below, all downspouts shall be PVC pipe, and preferably shall be encased in concrete. When encased in concrete, they shall be provided with a one-inch compressible protective covering between the pipe and the concrete to accommodate expansion of the pipe and shrinkage of the concrete.

If downspouts must be exposed, in urban areas, where there is a danger of malicious damage, steel pipe may be used.

Revised April 1975

Downspouts may be connected to an underground drainage system or outletted approximately one (1) foot above finished grade by using a long radius elbow. Downspouts shall be placed at the least objectionable location and the surface below the outfall shall be protected by the use of a stone, concrete slab, or grouted block paving.

Revised April 1975

Blank page due to revisions

21.21.2 - GENERAL NOTES: (To be placed on Plans.)

G1 Design Specifications: Current New York State Department of Transportation Standard Specifications for Highway Bridges.

Live Load: HS20-44 or two 24,000-lb. axles spaced 4' - 0" on centers.

Note: The latter loading is to be noted only for the bridges carrying either the main line of Interstate highways or the Southern Tier Expressway.

G2 Material and Construction Specifications: Specifications of New York State Department of Transportation dated January 2, 1973, with current additions and modifications.

G3 The cost of furnishing and placing water used for Select Structural Fill, Item 203.21, will be paid for under Item 203.15 and 203.16 of the highway portion of the Contract.

G4 The cost of furnishing and placing water used for sod gutters will be paid for under Item 615.03 included in the bridge estimate.

NOTE: The quantity of sodding of 500 square yards given on page 355 of the Standard Specifications is based on an aggregate amount, which includes both the Highway and Bridge shares. The quantity of sodding in the Highway share should be checked with the Regional Office and if the aggregate amount of the Bridge share and the Highway share does not

exceed 500 square yards, the cost of watering the sod should be included in the sodding item which is 612.01. The sodded areas shall be watered at a rate of 5 gallons per square yard.

G5 The cost of all joint material will be included in the price bid for the various items of the Contract, except as otherwise specified.

G6 Stress graded lumber and timber has been designed for the following allowable stresses and the type used must meet these minimum requirements:

Extreme fiber in bending and tension parallel to grain . . . . . .

Compression perpendicular to grain . . . . . .

Modulus of elasticity . . . . . .

G7 All concrete anchor studs which are attached to the various steel details shall meet the requirements listed in Subsection 709-05, Stud Shear Connectors. Payment for furnishing and placing the concrete anchors will be included in the unit price bid for the item to which the anchors are attached.

21.21.4 - SUBSTRUCTURE NOTES

SUB 1-A - All sod, topsoil and unsuitable material under the substructure embankment shall be removed as specified under Section 203, Excavation and Embankment, and replaced by the same item as the layer of embankment adjacent and above as shown on the plans.

SUB 1-B - All embankments of Select Structure Fill, Item 203.21 shall be compacted to a minimum dry density of 100 percent of Maximum Density as defined under Subsection 203-3.12 - Compaction,

(Use the paragraph below if applicable.)

Where piles are to be placed through the embankment, a minimum dry density of 95 percent of the Maximum Density will be required.

SUB 1-C - The Contractor shall place and compact all fill for bridges between the final toes of slope in accordance with the plans and specifications in a manner satisfactory to the Deputy Chief Engineer (Structures).

Use one of the following applicable paragraphs.

1. The embankment constructed to the required grade shall be allowed to stand a maximum of _____ days or for a period of time as determined by the Deputy Chief Engineer (Structures) prior to any substructure construction.
2. The embankment shall be allowed to stand for a period of time satisfactory to the Deputy Chief Engineer (Structures) prior to any substructure construction.

SUB 1-D. Items 203.03 and 203.21 shall be placed simultaneously, in contact, on both sides of the vertical payment line. Sheeting or other means shall not be used to separate the two materials.

SUB 1-E. The installation of Select Structure Fill, Item 203.21, as shown on the structural plans, shall be completed immediately following the completion of abutments or walls.

SUB 1-F. ALL FOOTINGS ON ROCK: All disintegrated or shattered material shall be removed to the lines and levels ordered by the Engineer. Where sound rock is found two feet or less below the planned levels of the bottom of the footing, backfill of Class B Concrete shall be installed to the levels shown on the plans. Where sound rock is found to be more than two feet below the planned

SUB 7 The following note shall be placed on the Contract Plans when cofferdams are to be used at a structure with batter piles except in cases where the cofferdam has been designed and is detailed on the plans.

"It shall be the Contractor's responsibility to place the cofferdam so that it will not interfere with the batter piles. Pay lines for cofferdam shall be as shown on these plans."

SUB 8 Existing substructures shall be removed to within the limits shown on the plans under Item _____ in the _____ quantities. (Insert either HIGHWAY or BRIDGE in last blank space.)

SUB 9 Top of backwalls on which asbestos sheet packing Subsection (728-06) is to be placed shall be steel-trowel finished.

SUB 10 Bituminous material, Item 622.01 shall be applied to the backs of all abutments and wingwalls above top of footings where fill is in contact with the walls.

SUB 11 Epoxy protective coating for concrete, Item 621.01, shall be applied to the following surfaces:

ABUTMENTS All exposed pedestal surfaces, bridge seats, including the area under the bearings, exposed vertical surfaces of backwall and curtain walls facing the superstructure.

SOLID PIERS All pedestal surfaces including the area under the bearings, and the top surface of pier between pedestals including the edge chamfer at top edge of pier.

PIERS WITH COLUMNS

1. Piers with deck joints

   Top, sides and ends of pier beams and pedestals including the surfaces under the bearings.

2. Piers without deck joints

   All pedestal surfaces including the area under the bearings and the top surface of pier between pedestals including the edge chamfer at top edge of pier.

SUB 12 When round columns, which may be constructed with the use of fiber forms, are provided on a project, the following note shall be placed on the plans:

"The use of fiber forms will be permitted only if the interior surface of the forms has been treated in such a manner as to prevent helical corrugation marks on the finished concrete surface."

Forms are not to be removed in a manner that will damage the concrete.

SUB 13 The Contractor, with the permission of the Deputy Chief Engineer (Structures), may elect to introduce construction joints in the abutments at locations not shown on the plans. These construction joints shall be provided with shear keys and waterstops. Vertical construction joints introduced in the backwall should preferably be placed midway between the pedestals.

Added April 1975

Blank Page

SECTION 23 - DECK SLABS

23.1 - CONCRETE DECK SLABS - (ON STEEL BRIDGES, PRESTRESSED I-BEAMS AND SPREAD BOXES)

Structural concrete deck slabs shall have a thickness of $9\frac{1}{4}$" including a monolithic wearing surface. The top $2\frac{1}{4}$ inches of the concrete shall be neglected in the design. The cover on the top steel shall be $3\frac{1}{4}$ inches and on the bottom steel, one inch.

The structural deck slab shall be placed under the Monolithic Slab, Item 601.0301.

23.2 - REINFORCEMENT IN DECK SLABS

For skews up to and including 30°, the reinforcement shall be placed parallel to the skew. For skews over 30°, the reinforcement shall be placed normal to the beams or girders.

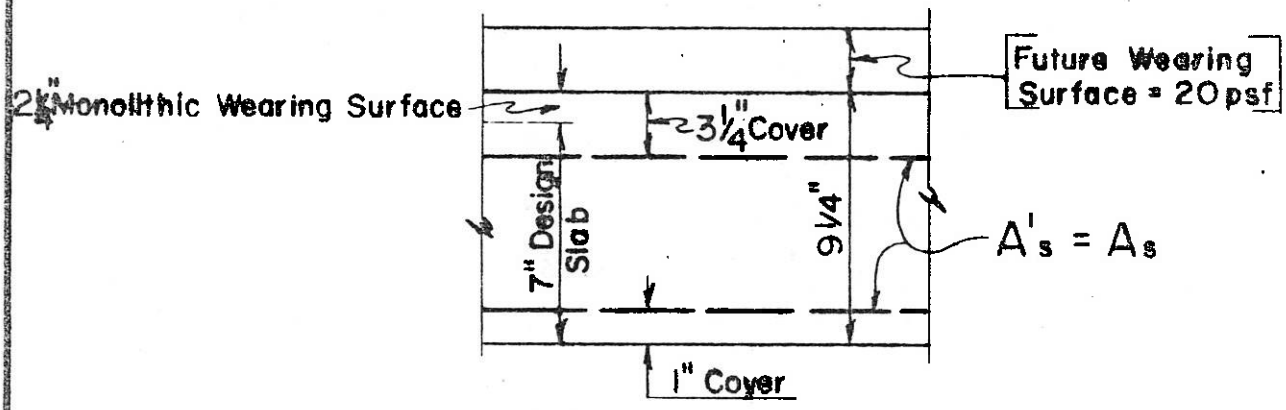
Design span is defined as the distance between stringers less one-half the width of the top flange, these distances being measured along the longitudinal axis of the bar.

Longitudinal reinforcement on top of slab and bottom of slab outside the middle half of the bay shall be No. 5 bars at 1'-6" centers, except that no steel need be placed in the bottom of the slab over supporting members.

SLAB DESIGN TABLE

CONCRETE REINFORCEMENT ASTM A615 GRADE 60

$f_s = 24{,}000$ psi $f_c = 1{,}200$ psi $n = 10$



BAR SIZE AND SPACING	MAXIMUM DESIGN SPAN		MAXIMUM OVERHANG	
	BARS ⊥ TRAFFIC	BARS ∥ TRAFFIC	TYPES I, II, III, VII SECTIONS	TYPES IV & VI SECTIONS
#6 @ 5"	10'-3"	7'-7"	4'-0"	3'-9"
#6 @ 5¼"	10'-1"	7'-5"	3'-11"	3'-8"
#6 @ 5½"	9'-10"	7'-3"	3'-11"	3'-8"
#6 @ 5¾"	9'-8"	7'-2"	3'-10"	3'-7"
#6 @ 6"	9'-6"	7'-0"	3'-10"	3'-7"
#6 @ 6¼"	9'-4"	6'-10"	3'-9"	3'-6"
#6 @ 6½"	9'-2"	6'-9"	3'-9"	3'-6"
#5 @ 5"	9'-1"	6'-8"	3'-9"	3'-6"
#5 @ 5¼"	8'-10"	6'-6"	3'-8"	3'-5"
#5 @ 5½"	8'-8"	6'-5"	3'-8"	3'-5"
#5 @ 5¾"	8'-5"	6'-2"	3'-7"	3'-4"
#5 @ 6"	8'-1"	6'-0"	3'-6"	3'-4"
#5 @ 6¼"	7'-9"	5'-9"	3'-6"	3'-3"
#5 @ 6½"	7'-6"	5'-6"	3'-5"	3'-3"
#5 @ 6¾"	7'-2"	5'-4"	3'-4"	3'-2"
#5 @ 7"	6'-11"	5'-2"	3'-4"	3'-2"
#5 @ 7¼"	6'-9"	5'-0"	3'-4"	3'-1"
#5 @ 7½"	6'-6"	4'-10"	3'-3"	3'-1"
#4 @ 5"	6'-4"	4'-9"	3'-3"	3'-1"

TYPES I, II, III, IV, VI & VII SECTIONS ARE SHOWN ON BDD 73-70.

MAXIMUM OVERHANG SHALL BE MEASURED FROM CENTER LINE OF WEB OF FASCIA STRINGER.

REINFORCEMENT PLACED ON A SKEW SHALL HAVE ITS ⊥ SPACING REDUCED BY THE COSINE SQUARED OF THE SKEW ANGLE.

SECTION 24 - SUBSTRUCTURE AND RETAINING WALLS

24.1 - ROCK LINES

Rock lines shall be shown only where footings are on or in rock or where tubular cast-in-place concrete piles are socketed into the rock.

The rock lines shall be as shown on the "Subsurface Profile Sheet" which is prepared by the Soil Mechanics Bureau. The Subsurface Profile Sheet shall be included in the Contract Plans.

All rock lines shown shall be marked "Assumed Rock Surface" and no elevations of the rock are to be shown on the plans.

When it is planned to place the footings on or in rock, the plans shall show the top-of-footing elevation and the minimum depth of footing. This will enable adjustments to be made in the depth of footing, keeping the top-of-footing elevation constant, where the actual rock line varies from that assumed during design.

24.2 - SHEETING AND COFFERDAMS:

Payment lines for each item shall be as shown on the applicable BDD and BR Sheets and as called for in the specification for the item. Sheeting used to sustain railroad tracks, highways, or structures shall be fully detailed, showing the size and limits of the sheeting and all necessary waling, bracing and deadmen.

Where cofferdams are required on the water side, but not on the land side, use the cofferdam item all the way around.

24.3 - COFFERDAMS (WATER DISCHARGE CONTROL)

Item 628.07 is to be used only when the criteria of the Department of Environmental Conservation requires that sheeting be used for cofferdams.

24.4 - SAFE OPERATION SHEET PILING

Safe Operation Sheet Piling shall be used when the depth of excavation exceeds five feet and the Department has no reason to prefer a specific type of sheeting or sheeting detail. Payment lines for this item shall be as shown on the applicable BDD Sheet and as called for in the specification for this item (This item number is subject to change. Check Final Plan Review for current number to use).

24.5 - EXCAVATION AND BACKFILL AT STRUCTURES

The details and payment lines shall be shown on all Contract Plans and shall conform to the details shown on the applicable BDD Sheet, and as described in the foundation design report.

24.6 - BERMS

A wash of one inch per foot shall be used on the top of all earth berms (paved or not paved).

24.7 - SLOPE PROTECTION

The preliminary drawing for each bridge over a highway shall show concrete block paving, six-inch poured slab, or other slope protection, to be used on all fill side slopes under the structure. The slope protection shall extend a minimum of three feet beyond the fascia lines of the structure.

24.10 - PIER NOSE:

If an ice breaker is required, the pier nose shall be protected with a steel angle or other metal nosing, effectively secured to the masonry by means of suitable anchors.

24.11 - REINFORCEMENT FOR TEMPERATURE:

All faces of abutments, walls and piers, not otherwise reinforced, shall be reinforced with No. 5 bars placed horizontally at one foot centers and No. 5 bars placed vertically at 2 feet centers to resist the formation of temperature and shrinkage cracks. Temperature steel need not be doweled into the footing unless required due to wind forces against the unbackfilled section.

24.12 - DRAINAGE OF STRUCTURE BACKFILL:

Porous drainage aggregate shall be placed against the back of all abutments, walls, arches and rigid frames.

Six-inch perforated corrugated metal pipe underdrains shall be used to provide drainage of the porous drainage aggregate.

In addition, 6-inch diameter outlets through the structure should be provided at approximately 30 feet on centers. These outlets shall be outletted through

the berm in front of the structure, except in the case of stream bridges, where they will be outletted 6 inches above low water. Outlets will not be provided in cases of wingwalls when the finished grade in front of the wall is less than 5 feet below the top of wall.

24.13 - LOCATION OF PEDESTALS ON ABUTMENTS:

On all abutments with pedestals on a bridge seat, the front face of the pedestal shall be flush with the front face of the abutment at the bridge seat, except for those special cases as noted in the aesthetic section.

24.14 - CANTILEVERED ENDS OF WALLS:

Cantilevered ends of walls shall not be used.

24.15 - STEPPED FOOTINGS:

Refer to "Design Criteria for Bridges," 75-1, Stepped Footings issued by EI 75-5, dated February 5, 1975.

24.16 - STUB ABUTMENTS-DELETED

24.17 ABUTMENTS AND SOLID PIERS

Revised April 1975

The bridge seat of solid abutments and the top of solid piers shall be reinforced with No. 8 bars at 6 inches plus or minus on centers minimum. Check reinforcement by assuming that the section is an inverted T-beam.

24.18 SUBSTRUCTURE, GENERAL SHAPE

24.18.1 - GENERAL

Generally, the material cost of the concrete is the cheapest part of the total cost of concrete items. The forming, concrete placement, and labor constitute the major portion of the cost. Therefore, the shape of the concrete substructure should be made as simple as possible. The shape should be such that large flat forms and large pours may be employed.

24.18.2 - PROTRUDING FILLETED SEATS:

Protruding filleted seats for headers and/or joint details on backwalls should be avoided. The form work for these details is very costly. If the filleted seats are used, the toe and/or heel of the footing should be made wide enough so that if the Contractor elects to pour the wall solid to eliminate the protrusion, the wall will fit on the footing. Also, to facilitate the forming, the distance from the top of the footing to the bottom of the protruding fillets should be made constant, rather than having the fillets parallel to the top of the header. The variation in the height of the backwall can be made between the fillet and top of the header.

24.18.3 - BATTERED WALLS

Battered forms are more expensive than vertical forms and should be avoided whenever possible, especially on short wingwalls. If battered forms are used, the batter should always remain constant and the width of the wall at the top of the batter should be wide enough so the form can be extended beyond the top of the batter and still have enough room between the front and rear forms to easily place the concrete.

Batters that extend only part way up a wall should be avoided. If partial batters are used, the height of the battered portion should always be made a constant height. If the height of the wall varies the height of the battered portion should be constant with respect to the top of the footing and the variation in height be made up in the upper vertical portion of the wall. This will allow the battered forms to be reused.

The intersection of a battered wingwall with a battered backwall is extremely difficult to form and should definitely be avoided.

24.18.4 - CURVED WINGWALLS

Curved wingwalls should be avoided whenever possible and curved wingwalls should never be battered, since the shape of the form must be dish-shaped and is extremely difficult to form.

If it is absolutely necessary to provide a curved wingwall, it is best to place the footing and the wall on a chord and curve only the top portion of the wall.

SECTION 25 - REINFORCING STEEL

25.1 MINIMUM ANCHORAGE, LAP AND EMBEDMENT

Basic Development Lengths for Bars (inches)*

Compression Bars

Size	
#4	12
#5	14
#6	17
#7	20
#8	22
#9	25
#10	28
#11	31
#14	37
#18	50

Tension Bars (other than Top Bars)

Size	Spacing 6" or less	Spacing > 6"
#4	12	10
#5	15	12
#6	18	15
#7	27	22
#8	35	28
#9	44	36
#10	56	45
#11	69	56

Tension Bars (Top Bars)

Size	Spacing 6" or less	Spacing > 6"
#4	17	14
#5	21	17
#6	26	21
#7	38	31
#8	49	40
#9	62	51
#10	79	63
#11	97	79

* When the area of steel provided is greater than that required to develop the ultimate moment capacity of the section, the basic development length indicated above may be reduced by the ratio: As(req'd)/As(provided).

Revised April 1975

Equivalent Development Length of Standard Hooks (inches)

Size	Top Bars	Other Than Top Bars
#4	6	6
#5	7	7
#6	8	10
#7	9	13
#8	11	17
#9	14	22
#10	18	24
#11	23	26

Length of Splices in Tension Bars (inches)

Tension Tie Member (Class D)*

	Top Bars		Other Than Top Bars	
Size	Spacing 6" or less	Spacing over 6"	Spacing 6" or less	Spacing over 6"
#4	34	28	24	20
#5	42	34	30	24
#6	52	42	36	30
#7	76	62	54	44
#8	98	80	70	56
#9	124	102	88	72
#10	158	126	112	90
#11	194	158	138	112

* In addition to the development length indicated above, splices of this type shall be enclosed within a spiral meeting the requirements of Art. 1.5.14(4), and bars larger than #4 shall be provided with a standard hook.

Other Member -
In regions of high tensile stress - where the area of steel provided is less than or equal to twice that required to develop the ultimate moment capacity of the section.
When more than one half the bars are spliced within the lap length. (Class C)

	Top Bars		Other Than Top Bars	
Size	Spacing 6" or less	Spacing over 6"	Spacing 6" or less	Spacing over 6"
#4	29	24	21	17
#5	36	29	26	21
#6	45	36	31	26
#7	65	53	46	38
#8	84	68	60	48
#9	106	87	75	62
#10	135	108	96	77
#11	165	135	118	96

When no more than one half the bars are spliced within the lap length. (Class B)

	Top Bars		Other Than Top Bars	
Size	Spacing 6" or less	Spacing over 6"	Spacing 6" or less	Spacing over 6"
#4	23	19	16	13
#5	28	23	20	16
#6	34	28	24	20
#7	50	41	36	29
#8	64	52	46	37
#9	81	67	58	47
#10	103	82	73	59
#11	127	103	90	73

Other Members -
In regions of low tensile stress - where the area of steel provided is more than twice that required to develop the ultimate moment capacity of the section. When more than three-quarters of the bars are spliced within the lap length. (Class B)

	Top Bars		Other Than Top Bars	
Size	Spacing 6" or less	Spacing over 6"	Spacing 6" or less	Spacing over 6"
#4	23	19	16	13
#5	28	23	20	16
#6	34	28	24	20
#7	50	41	36	29
#8	64	52	46	37
#9	81	67	58	47
#10	103	82	73	59
#11	127	103	90	73

When no more than three-quarters of the bars are spliced within the lap length. (Class A)

	Top Bars		Other Than Top Bars	
Size	Spacing 6" or less	Spacing over 6"	Spacing 6" or less	Spacing over 6"
#4	17	14	12	10
#5	21	17	15	12
#6	26	21	18	15
#7	38	31	27	22
#8	49	40	35	28
#9	62	51	44	36
#10	79	63	56	45
#11	97	79	69	56

Length of Splices in Compression Bars

Size	Beams	Tied Columns	Spiral Columns
#4	15	12	12
#5	19	16	15
#6	23	20	18
#7	27	23	21
#8	30	25	23
#9	34	29	26
#10	39	33	30
#11	43	36	33

No. 5 bars used solely as temperature reinforcement in the exposed face of an abutment or wall are not required to be doweled into the footing.

Transverse reinforcement in footings will be provided only where required by design (generally bottom of toe and top of heel).

Hoops are required only where embedment length to develop bars beyond point of maximum moment is not adequate.

Vertical dowels No. 6 or smaller may be straight if depth of footing permits sufficient embedment, i.e., minimum embedment of dowels used to develop tension bars, as shown in the table on pages 93, 93-1, 93-2, and 93-3. Otherwise, dowels may be hooked and/or bent into toe of footing to provide toe reinforcement or a portion thereof.

Longitudinal reinforcement in footings shall be No. 5 bars at 2'-0" maximum spacing adjacent to all transverse reinforcement and dowels to form mats, unless a larger area of steel is required by design.

Revised April 1975

Blank page due to revisions

ACI STANDARD HOOKS

Revised April 1975

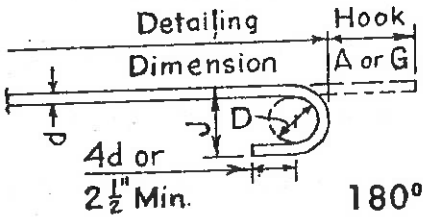
All specific sizes recommended by CRSI below meet requirements of ACI 318-71

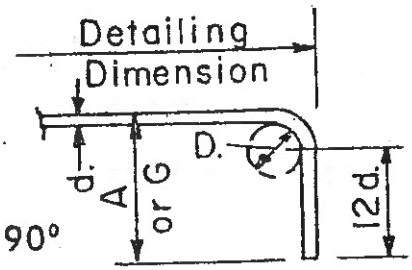
RECOMMENDED END HOOKS
All Grades

D = 6d for #3 through #8
D = 8d for #9, #10, and #11
D = 10d for #14 and #18

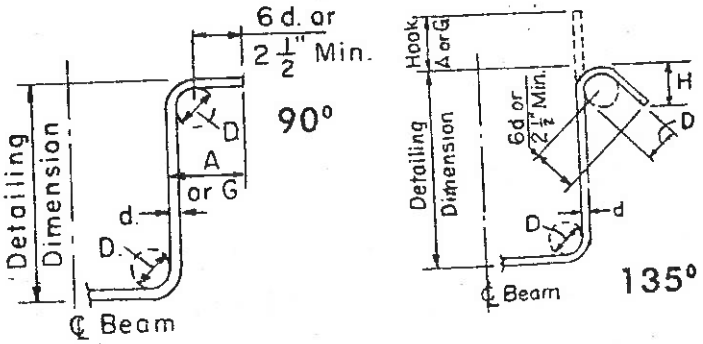
Bar Size	180° HOOKS*		90° HOOKS
	A or G	J	A or G
#3	5	3	6
#4	6	4	8
#5	7	5	10
#6	8	6	1-0
#7	10	7	1-2
#8	11	8	1-4
#9	1-3	11¼	1-7
#10	1-5	1-0¾	1-10
#11	1-7	1-2¼	2-0
#14	2-2	1-8½	2-7
#18	2-11	2-3	3-5

*With Grade 40 only, where available depth is limited, bars may be bent with D = 5d for #3 through #11.





STIRRUP AND TIE HOOKS



STIRRUPS
(TIES SIMILAR)

STIRRUP AND TIE HOOK DIMENSIONS
Grades 40-50-60 ksi

Bar Size	D (in.)	90° Hook	135° Hook	
		Hook A or G	Hook A or G	H Approx.
#3	1½	4	4	2½
#4	2	4½	4½	3
#5	2½	6	5½	3¾

25.2 - SPACING

Except as noted in Sections 24.11 and 25.11, the clear distance between parallel bars shall not be more than 18 inches, nor less than 1-1/2 times the nominal diameter of the bars, 1-1/2 times the maximum size of the coarse aggregate, nor 1-1/2 inch.

The maximum spacing of design reinforcement in the back of walls and abutments shall be 2'-0".

Where reinforcement in beams or girders is placed in two or more layers, the bars in the upper layers shall be placed directly above those in the bottom layer.

The clear distance between bars shall also apply to the clear distance between the contact splice and adjacent splices or bars.

25.3 - COVERING

The following cover shall be used:

Structural Deck Slabs on Beams or Stringers

Top of slab with separate wearing surface ..... 1 in.

Top of slab with integral wearing surface .....3½ in.

Bottom of slab ..... 1 in.

Beams and columns ..... 2 in.

Walls and piers above footings (including those adjacent to water) ..... 2 in.

Footings (including unformed bottom) ..... 3 in.
This may be increased to accommodate piles when necessary.

Face of culverts in contact with earth . . . . . 2 in.

Bottom of bottom slab of culvert . . . . . 3 in.

Bottom of top slab of culverts and low rise rigid frames . . . . . 1-½ in.

Arches, introdos and extrados. . . . . 2 in.

Precast and cast-in-place piles. . . . . 2 in.

Precast piles exposed to sea water . . . . . 3 in.

All other surfaces exposed to sea water. . . . . 4 in.

Top of sidewalk slabs. . . . . 1-½ in.

Pedestal . . . . . 2 in.

25.4 MAXIMUM BAR LENGTHS

Most Reinforcing Bar Plants in the United States produce bars in a standard length of 60 feet. Therefore, our plans should not include any straight bars or bent bars with a projected length in excess of 60 feet.

A. Reinforcing Bars in Deck Slabs:

1. Top bars 30 feet or less in projected length may be hooked at both ends.
2. Bottom bars, which will be straight, may be up to 60 feet long.
3. Due to fabrication shop limitations, there is a sizable cost extra for bars over 30 feet long with hooks on both ends. Therefore, if the projected length of a hooked top bar exceeds 30 feet, it shall be replaced with two spliced bars, each with a hook on one end.
   a. When top bars are spliced, the splices shall be staggered such that not more than 50 percent of the bars are spliced at one location. The splices shall be located midway between girders.

b. When it is necessary to splice bottom bars, the splices shall also be staggered, but shall be located directly over girders.

B. Reinforcing Bars in Pier Caps:

1. Straight bars may be up to 60 feet long.

2. In spite of the cost extra described above, due to the small number of bars involved and the clearance and spacing requirements, hooked bars may have a projected length of up to 60 feet. However, consideration should be given to the total weight of each bar for ease of handling in the fabrication shop and in the field. In some cases, it may be more economical to limit the length of a hooked bar to 30 feet and avoid the cost extra for bending.

a. When it is necessary to splice top bars, the splices shall be staggered so that not more than 50 percent of the bars are spliced at one location. These splices shall be located in areas of low negative moment, to minimize splice lengths.

b. When it is necessary to splice bottom bars, the splices shall also be staggered, but shall be located directly over columns.

c. When pier cap bars are spliced, these splices shall be attained by lapping the bars in a vertical plane so that the bars will be in the proper position for attachment to stirrups. To accommodate this type of splice, where more than one layer of reinforcement is required, it may be necessary to increase the distance between the layers of reinforcement.

25.5 - SPLICING VERTICAL REINFORCEMENT IN WALLS **Revised April 1975**

For bar sizes 5, 6 and 7, splices between main vertical reinforcement and the reinforcement emerging from the footing may be made directly over the footing. In some cases, it may be practical to eliminate splices by extending the bars emerging from the footing to the top of wall. No. 8 and larger bars emerging from the footing shall be extended to a distance above the footing where bars of smaller diameter may be spliced to them. The lap length required for such splices shall be based on the smaller bar.

25.6 - MARKING OF BARS

Bars should be marked consecutively, beginning with the number one (1), throughout each concrete subdivision. For example, abutment footing bars might be marked 5AFT1 through 7AFV9, while stem bars in the same abutment would be marked 5ASH10. Similarly, backwall and header bars would also each have a bar marked...(1). Generally, the rule will be to change the mark numbering back to (1) when the second letter of the bar mark changes.

It should be noted that if a subdivision is divided into several pours (e.g. an abutment stem), the bars should continue in numerical sequence through the several pours.

All subdivision numbering is repeated when the structural unit is changed (e.g. North Abut., South Abut., Pier 1, etc.). A note should be placed in the plans indicating that all bar marks shall be prefixed with marks a structure unit identification.

When a bar is embedded in two or more subdivisions (such as a dowel) the bar mark shall be controlled by the subdivision in which it is initially embedded.

In applying the bar marks where two or more structure units are involved, such as two or more similar abutments, piers, spans, etc., it is desirable that the same bar marks be applied to bars in similar locations in the structure unit. The fact that two bars lying in different structure units may have the same bar mark but have different lengths, or they may have the same length but have different sizes, or any combination of these factors will not be confusing to the fabricator due to our practice of providing a separate bar list, properly titled, for each structure unit.

Any deviation from the above system of marking bars must have the approval of the Deputy Chief Engineer (Structures).

For varying length bars, give minimum, maximum and average lengths and number of sets of bars.

25.7 - TIED COLUMNS

1. Longitudinal Reinforcement: The longitudinal reinforcement shall consist of at least four bars and, when only four bars are used, they shall be placed at the corners of the section. Bars shall be placed at each intersection of column faces. The bars shall be not less than No. 5 bars.
2. Hoops and Lateral Ties: Continuous hoops shall surround the longitudinal reinforcement. They shall be not less than No. 4 bars and shall be spaced not more than 12 inches apart except that this spacing may be increased in the case of pier shafts or columns having a larger cross section than required by conditions of loading. Adequate auxiliary ties shall be provided to support intermediate longitudinal bars whose distance from any tied bar exceeds 2 feet.

26.5 - WIDTH OF BOX BEAMS

Widths of box beams shall be detailed as 4'-0" or 3'-0". The beam deck shall consist of (1) multiples of 4'-0" beams, or (2) multiples of 3'-0" beams, or (3) as combination of 4'-0" beams and a minimum number of 3'-0" beams. The beam deck shall be selected in the order listed. The overall beam deck width shall be the sum of the nominal beam widths plus 1/2" per joint.

E.G. (to be shown on plans)

11 beams @ 4'-0" nominal = 44'-5"

26.6 - CONCRETE SLAB FOR BOX BEAMS

Concrete slab on prestressed concrete box beams shall be a minimum of 6 inches thick (normally at center line of span) and made composite with the beams.

The top $2\frac{1}{4}$ inches shall be neglected in the design. The cover on the steel shall be $3\frac{1}{4}$ inches.

The wearing surface shall be placed under the Monolithic Slab, Item 601.0302.

Fabric reinforcement shall be 0 gauge wire at 6 inches center to center in both the transverse and longitudinal direction. At splices the reinforcement shall lap 1'-0". Additional bar reinforcement may be required to attain continuity over piers. Fabric Reinforcement shall be paid for under Item Number 602.01. Wire gauge and spacing shall be noted in the plans.

26.7 - MISCELLANEOUS

On box beams, transverse tendons shall be placed as close to the mid-depth of the section as possible.

The area of transverse tendon anchor plate shall be at least 20 square inches.

Box beams shall not be used when the skew angle is greater than 30° unless it is allowed by the Deputy Chief Engineer (Structures).

Make sure on box beam structures that the transverse tendon void in all beams and the transverse tendon blockout on the fascia beams do not interfere with the longitudinal prestressing strand and bar reinforcement.

Unless prohibited by the nature of the foundation material, all multispan box beam and I-beam structures shall be designed for continuity under live load. A constant depth of section is preferable for all spans.

Bearing pads shall be placed perpendicular to the longitudinal axis of the beams.

27.6 DESIGNATION OF TENSION ZONES

For other than simple spans, the Contract Plans shall clearly indicate the limits of the flanges of all stringers which are subject to tensile stresses; see Appendix C. This shall be done to facilitate radiographic inspection and the control of welding during fabrication and erection. This requirement shall apply to reconstruction projects, which require new deck slabs, as well as to new structures.

27.7 COMBINATION OF DIFFERENT TYPES OF STRUCTURAL STEEL

In general, when more than one type of steel, such as A36, A441 or A588 is used in one contract, the types used shall be clearly described in the plans. The payment for furnishing and placing these steels shall be made under the current structural steel item.

A table shall be placed on the plans, adjacent to the estimate table, indicating the neat quantities of each type of steel.

27.8 CAMBER

A. Simple Spans. The Contract Plans shall show the design cambers for structural steel, concrete and superimposed dead load, vertical curve and total dead load plus vertical curve at the centerpoint of each stringer for spans under 125 feet and at quarter points for spans over 125 feet.

B. Continuous and Cantilever Spans. The Contract Plans shall show the design cambers for structural steel, concrete and superimposed dead load, vertical curve and total dead load plus vertical curve at inflection points and at

tenth point of spans.

See Appendix A on page 113 for an example of a camber table for a continuous girder.

C. Sag Cambers. Because of the objectional appearance of a sag camber in a stringer, sag or negative cambers should be avoided. The following are a few guidelines on possible means of avoiding the necessity of having to call for a negative camber in a stringer: (1) Avoid sag vertical curves on bridges. (2) Never begin or end a superelevation transition or runoff in the middle of a span. Always begin or end transitions off the structure or, if this is impossible, begin or end the transition at a centerline of bearings or a centerline of pier. (3) Never place a sag camber in a straight stringer on a curved roadway in order to accommodate the variation in the theoretical bottom of slab elevations. The variation should be taken up in the haunch. (4) In the case of a continuous girder where the spans are enough unequal to cause some area of upward dead load deflection, thought should be given to specifying less than the full negative camber calculated to offset all of the anticipated upward deflection. This is suggested because of the possibility of not all of the negative camber coming out of the girder upon the application of the dead load, thereby leaving an objectionable sag in the girder.

2. Simple spans over 125 feet - bottom of slab elevations shall be shown over each stringer at centerlines of bearings and at the quarter points of span.

3. Continuous and cantilever spans - bottom of slab elevations shall be shown over each stringer at centerlines of bearings, inflection points and at tenth points of spans.

B. Spans with constant widths (partially or fully curved) and horizontally curved stringers.

1. Fully curved stringers - bottom of slab elevations shall be shown over each stringer at centerlines of bearings and at tenth points of span.

2. Partially curved stringers - bottom of slab elevations shall be shown over each stringer at centerlines of bearings, at tenth points of span and at each point of change of horizontal alignment.

C. Spans with variable widths.

1. Straight stringers - bottom of slab elevations shall be shown over each stringer as indicated in Section A.

2. Partially or fully curved stringers - bottom of slab elevations shall be shown over each stringer as indicated in Section B and also at intervals not exceeding 20 feet unless a smaller interval is required by the limitations indicated in Section B.

27.8.2 STRINGER HAUNCH

When stringers or floor beams are supported by steel beams, girders or trusses, the stringer haunch shall be increased by

the deflection of each of these latter structural units due to superimposed dead loads.

27.9 TRANSVERSE INTERMEDIATE STIFFENERS

Intermediate stiffeners for plate girders shall consist of single plates welded to one side of the plate girder web at each location and to the flange which is in compression at that point. They shall be placed perpendicular to the top flange at each location. On interior stringers, they shall be located on alternate sides of the web except where they are used in conjunction with a longitudinal stiffener on the other side. On fascia stringers and girders, they shall preferably be placed on the side of the web that is not exposed to view. Maximum fillet weld sizes shall be in accordance with Art. 1.7.27 of the Standard Specifications.

Minimum fillet weld sizes shall be in accordance with Article 27.17. Transverse Intermediate Stiffeners may be attached to fascia stringers with 1/4 fillet welds provided the web thickness does not exceed 5/8 inches.

27.10 LONGITUDINAL STIFFENERS

The details should be prepared to show that longitudinal stiffeners shall be placed on one side of the web only. On fascia girders they shall be placed on the web surface exposed to view. The intermediate stiffeners shall be placed on the opposite side of the web. Transverse connection plates intersecting longitudinal stiffeners shall be notched or interrupted to fit around the longitudinal stiffener. The longitudinal stiffeners will be attached

to the web plate with full length continuous fillet welds that meet the requirements of Article 27.17.

27.11 - BEARING STIFFENER

Bearing sitffeners shall be attached to the flange through which they receive their reaction by full penetration groove welds or in the case of straight girders that may be milled to bear. The bearing stiffeners shall be fillet welded to the web and either fillet welded to the opposite flange or placed tight against the opposite flange unless that flange is in tension, in which case they shall be placed tight against the flange without the fillet weld. The bearing stiffeners shall be vertical. Minimum fillet weld sizes are to be in accordance with Article 27.17.
Maximum fillet weld sizes shall be in accordance with Art. 1.7.27 of the Standard Specifications.

If it is desirable to slope exposed vertical bearing stiffeners on the fascia stringers for aesthetic reasons, approval must be obtained from the Deputy Chief Engineer (Structures).

27.12 - Item deleted.

27.13 - FLANGE SPLICES AT THICKNESS CHANGES:

The thickness ratio of two flange plates at a joint shall not exceed two to one and the transition in thickness between flanges of different thicknesses shall have a slope not greater than 1 on 2-1/2.

27.14 FASTENERS

27.14.1 SIZE OF FASTENERS (HIGH STRENGTH BOLTS)

Fasteners shall be of the size shown on the drawings, but generally shall be 3/4 inch or 7/8 inch in diameter. Fasteners 5/8 inch in diameter shall not be used in members carrying calculated stress except in 2-1/2 inch legs of angles and in flanges of sections requiring 5/8 inch fasteners.

The diameter of fasteners in angles carrying calculated stress shall not exceed 1/4 the width of the leg in which they are placed.

In angles whose size is not determined by calculated stress, 5/8 inch fasteners may be used in 2 inch legs, 3/4 inch fasteners in 2-1/2 inch legs, 7/8 inch fasteners in 3 inch legs, and 1 inch fasteners in 3-1/2 inch legs.

Structural shapes which do not admit the use of 5/8 inch diameter fasteners shall not be used except in handrails.

27.14.2 SPACING OF FASTENERS

The pitch of fasteners is the distance along the line of principal stress, in inches, between centers of adjacent fasteners, measured along one or more fastener lines. The gage of fasteners is the distance in inches between adjacent lines of fasteners or the distance from the back of angle or other shape to the first line of fasteners. The pitch of fasteners shall be governed by the requirements for sealing.

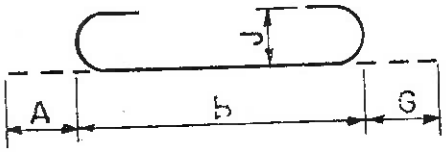
Revised April 1975

APPENDIX D

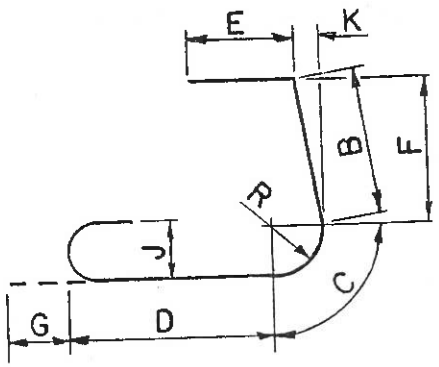
Bar Bending Diagrams and Legends

BD 145-1 (12/74)

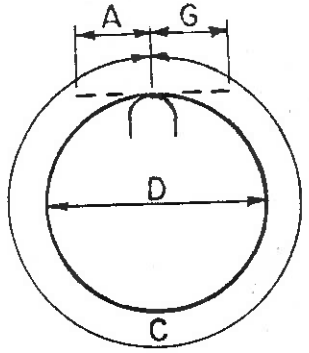
BAR BENDING DIAGRAMS



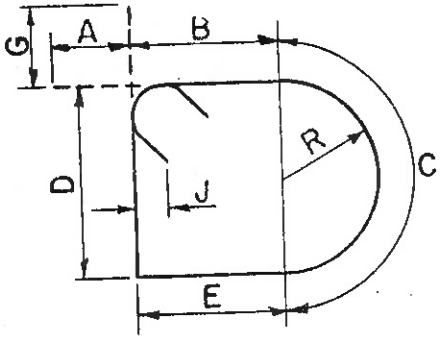
TYPE 1



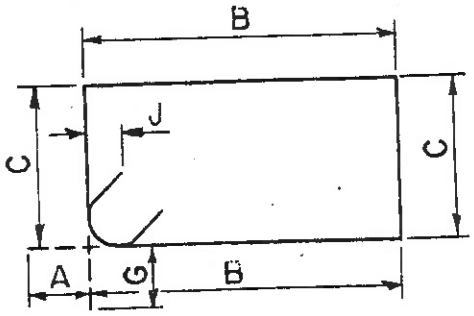
TYPE 2



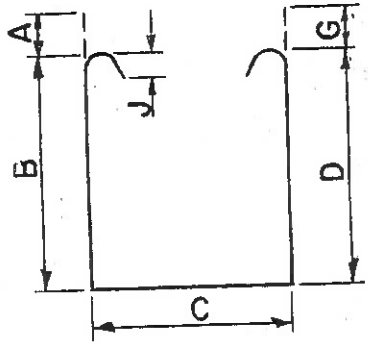
TYPE 3



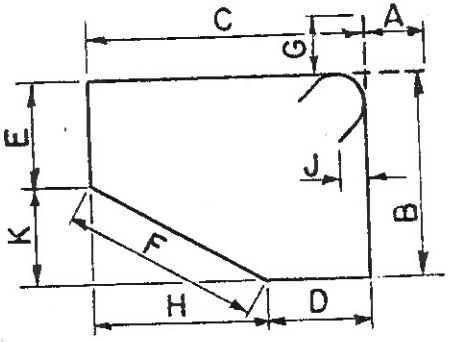
TYPE 4



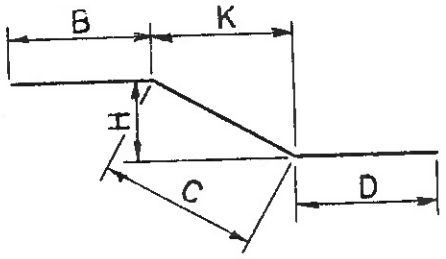
TYPE 5



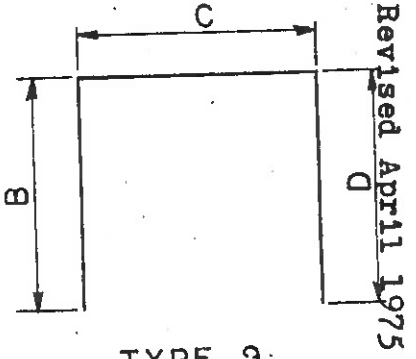
TYPE 6



TYPE 7



TYPE 8



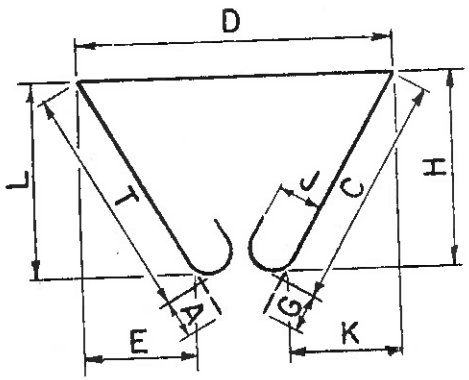
TYPE 9

120-1

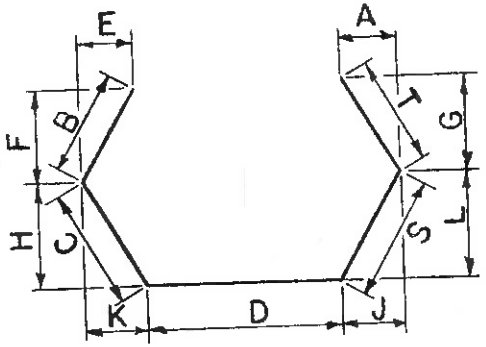
Revised April 1975

BD 145-2 (12/74)

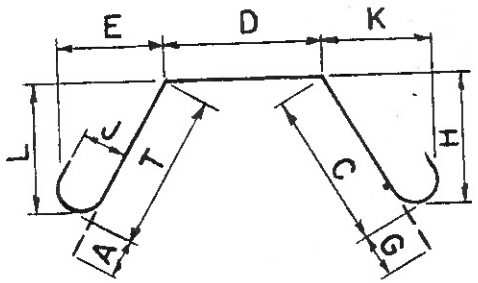
BAR BENDING DIAGRAMS



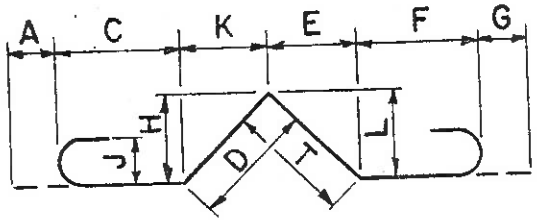
TYPE 10



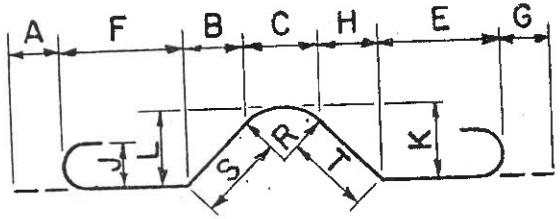
TYPE 11



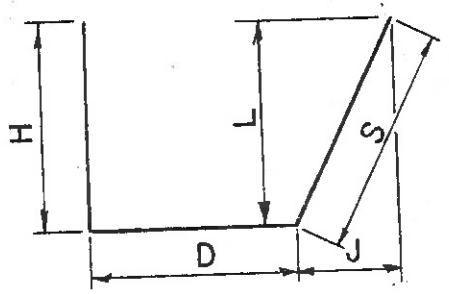
TYPE 12



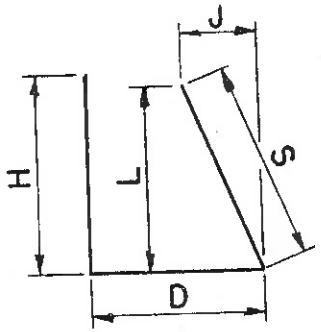
TYPE 13



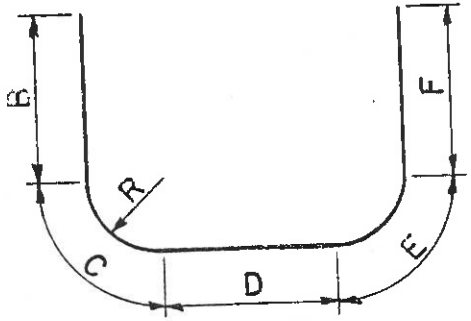
TYPE 14



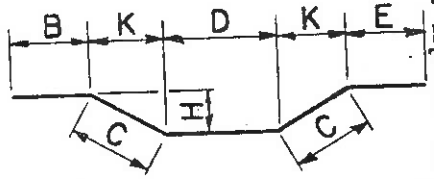
TYPE 15



TYPE 16



TYPE 17

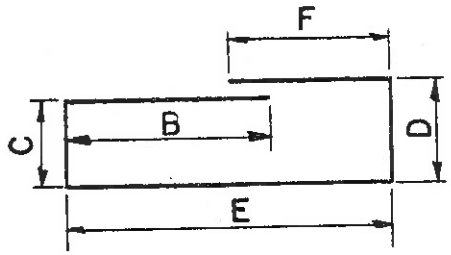


TYPE 18

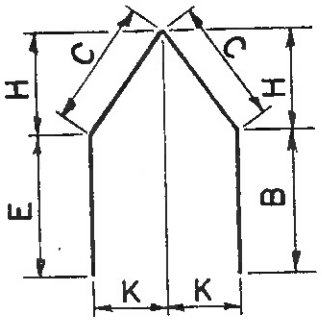
120-2

Revised April 1975

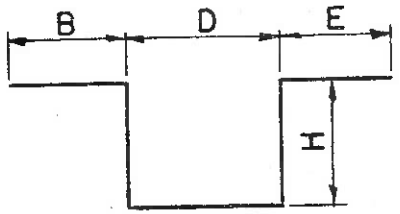
BAR BENDINGS DIAGRAMS



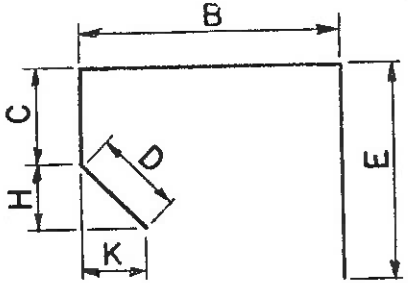
TYPE 19



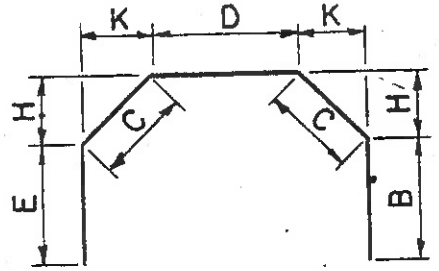
TYPE 22



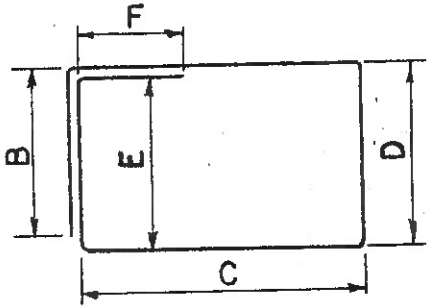
TYPE 20



TYPE 23



TYPE 21



TYPE 24

STRUCTURE UNIT

A-Abutment
C-Culvert
F-Foundation Pile
H-Highway Approach Slab
P-Pier
R-Rigid Frame Arch
S-Superstructure
W-Wall (Isolated)

SUB-DIVISION

A-Apron of Culvert (Including Cut-off Wall)
B-Backwall, Beam, Barrel
Bottom Slab of Culvert (Including Cut-off Wall)
C-Column, Curb, Safety Walk, Sidewalk
D-Diapragms (with concrete Beams)
E-Extrados
F-Footing
H-Header
I-Intrados
P-Parapet, Pedestals, Piles
S-Shaft, Slab, Stem, Plinth
T-Top of Slab of Culvert (Including Headwall)
W-Wingwall above Footing or Wall above Stem
1-Leg

LOCATION OR FUNCTION

D-Diagonal
H-Horizontal
L-Longitudinal
S-Stirrups, Ties
T-Transverse
V-Vertical

Revised April 1975

FED. RD. REG. NO.	STATE	FEDERAL AID PROJECT NO.	SHEET NO.	TOTAL SHEETS
	NEW YORK			
CAPITAL PROJECT IDENTIFICATION NO.				

ESTIMATE OF QUANTITIES

ITEM NO.	DESCRIPTION	UNIT	SUBSTR. EST	SUPER. EST	MISC. EST	ESTIMATED TOTALS	FINAL
203.21	Select Structure Fill	C.Y.			489	490	
206.01	Structure Excavation	C.Y.	1,220			1,220	
601.01	Class A Concrete for Structures	C.Y.	200	18	* 152	370	
601.02	Class B Concrete for Structures	C.Y.	690			690	
601.0301	Class A Concrete for Structures (Monolithic						
	Slab - Bottom Formwork Required)	S.F.		24,443		24,443	
601.04	Class B Concrete for Structures Deposited						
	Under Water	C.Y.	180			180	
602.02	Bar Reinforcement for Structures	Lb.	86,154	226,079	* 27,855	340,090	
602.03	Stud Shear Connectors for Bridges	Ea.		3,618		3,618	
605.0701	Perforated Corrugated Steel Pipe						
	Underdrain, 6" Diameter - 18 Gauge.	L.F.			170	170	
605.11	Underdrain Filters Type C @ Structures	C.Y.			80	80	
609.0301	Stone Curb (Bridge Type)	L.F.		1,595		1,595	
612.01	Sodding	S.Y.			100	100	
615.03	Watering Plants and Sod	M.Gals			2	2	
616.01	Structural Steel	Lb.		1,145,300		1,145,300	
617.02	Split Faced Concrete Masonry	S.F.	1,060			1,060	
620.09	Concrete Block Paving	S.Y.			120	120	
621.01	Epoxy Protective Coating	S.F.		130		130	
622.01	Bituminous Material	S.F.	2,100			2,100	
15628.0501	Safe Operation Sheet Piling	S.F.	1,720			1,720	
636.31	Bridge Bearing, Type CEI (Expansion with PTFE)	Ea.		10		10	
636.32	Bridge Bearing, Type CF (Fixed with PTFE)	Ea.		5		5	
642.10	Steel Bridge Railing (Two Rail)	L.F.		1,453		1,453	
15653.23	Elastomeric Expansion Joint System, Type 200	L.F.		50		50	
15653.32	Elastomeric Expansion Joint System, Type 650	L.F.		50		50	
→ 635.01_	Cleaning and Priming New Structural Steel	L.S.		Nec.		Nec.	
→ 635.02_	Painting New Structural Steel	L.S.		Nec.		Nec.	

* Items marked with an asterisk are those Items necessary for the construction of the Approach Pavement.

→ Items marked with an arrow are those Items listed out of numerical sequence.

The designer will please note that this sheet has been prepared to show the desired system for presenting the estimate breakdown and should not be used as an example of item numbers and description.

DATE MADE_____
PROJECT ENGINEER_____
IN CHARGE OF_____
DESIGNED BY_____
DESIGN CHECKED BY_____
DETAILED BY_____
DETAIL CHECKED BY_____

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION
DIVISION OF CONSTRUCTION

ESTIMATE OF QUANTITIES

DRAWING NO. OF