

## CHAPTER 11

# STRUCTURAL ITEMS REVIEW

### 11.1 PURPOSE

To reinforce the prescribed methods of reviewing structural construction items in order to verify final pay quantities in compliance with the **Specifications**, **Special Provisions** and pertinent Directives. The methods of measurements and the basis of payment for those items of work covered by **Sections 400 through 470 of the Specifications** and related **Special Provisions** will be treated in this procedure.

### 11.2 PROCEDURE

#### 11.2.1 Major Concrete Structures: **Sections 346**, and **400** of the **Specifications**

- (A) Concrete: The quantities to be paid for under this item shall be the volume, in cubic yards, of the various classes of concrete as shown in the plans, completed and accepted, and as designated in **Section 346** of the **Specifications**, based on plan quantity subject to **Section 9-3.2** of the **Specifications**. When review is required, spot-check at least one component per structure (i.e., one end bent, one pier, and one slab) using the following criteria:
- (1) Check if the final pay volume conforms to the plan dimensions within the neat lines of the components of the structure as shown in the plans.
  - (2) Check plans and notes for possible changes in footing elevations or dimensions.
  - (3) Check that no deductions are made for weep holes, deck drains, or encroachment of inlets and pipes in box culverts and check that no chamfers, scorings, fillets, or radii  $1 \frac{1}{2}$  in<sup>2</sup> or less, in cross sectional areas, are taken into account.
  - (4) Check that the volume displaced by embedded pile, structural steel, and prestressed units and materials, other than reinforcing steel, are deducted from the final quantity.
  - (5) For traffic railing pay items, transitional sections and end

sections are included in plan quantity.

- (6) Check that concrete for build-up over beams is added to the superstructure concrete quantity. These calculations are based on plan dimensions, unless plan dimensions are in error or were redesigned.
  - (7) Verify that authorized concrete placed below plan depth in seals or footings 5 feet or less below the elevation of bottom of seal or footing as shown in the plans are paid for at the Contract unit price set forth in the proposal under the pay items for substructure concrete.
  - (8) When computing the volume of concrete in deck girders and beam spans, ensure that the thickness of the slab is taken as the nominal thickness shown on the drawings and that the width is taken as the horizontal distance measured across the roadway. The volume of haunches over the beams will be included in the volume to be paid for.
  - (9) Refer to the electronic delivery reports to assist in checking final quantities of concrete items that may be questionable.
  - (10) The quantities for web walls should be carefully checked. Be sure that end blocks at the end bent are included when applicable.
  - (11) Ensure that Sketches or "Crack Maps" have been provided documenting all cracks within the structures as outlined in the **CPAM, Section 10.3.5**.
- (B) Concrete Traffic Railing: See **Sections 521** and **450** of the **Specifications**. The quantity in linear feet is paid for on the basis of plan quantity, subject to **Section 9-3.2** of the **Specifications**.
- (C) Precast Anchor Beams: See **Section 400** of the **Specifications**. This item is paid for at the contract unit price "per each" and is a final measured quantity, with no separate price for the various types of anchor beams.
- (D) Counterweight Concrete: The volume, in cubic yards for this item is generally calculated by the bridge consultant and submitted with the

shop drawing details. It is a plan quantity pay item subject to **Section 9-3.2** of the **Specifications**. When reviewing is required:

- (1) Verify shop drawings' dimensions and calculations. Compute if not submitted.
  - (2) Confirm that the volume displaced by structural steel, balance block wells, and other applicable materials are deducted from the final pay quantity of concrete.
  - (3) If the consultant has deducted the reinforcing steel volume, ensure that it is added back to the final pay volume.
  - (4) Check that the concrete volume and quantity of steel included in the balance blocks is added to the pay volume. Ensure that a sufficient number of balance blocks are furnished (5% of the calculated weight of the counterweight).
- (E) Cofferdam Bascule Piers: See **Section 400** of the **Specifications**. This pay item is paid for "Per each" and is a plan quantity item subject to **Section 9-3.2** of the **Specifications**.
- (F) Reinforcing Steel: See **Section 415** of the **Specifications**. The unit of weight for reinforcing steel is in pounds (Lbs) and is a plan quantity pay item subject to **Section 9-3.2** of the **Specifications**. Review by spot-checking components as follows:
- (1) The lengths used in the calculations are detailed length of bars shown in the plans.
  - (2) The unit weights to be used are per the Concrete Reinforcing Steel Institute (CRSI)'s Standard Reinforcing Steel Bar Weights.
  - (3) Review reinforcing steel required using the detailed drawings, bar diagram sheets and steel summary tables provided.
  - (4) When steel summary is done using the Department's Engineering Quantities Programs, the output shall be carefully checked for keypunch errors, for completeness and that bars of varying lengths are properly compared.
  - (5) Check to see that the bars detailed for a single component are

not included in other components by mistake.

- (6) No deductions will be made from reinforcing steel quantities for encroachment of inlets and pipes in box culverts.
- (7) Spot-check at random individual bar marks for correct lengths, total numbers, weights, and mathematical extensions of total quantity.
- (8) Using the Standard Index Sheets, review the summarization of reinforcing steel for all box culverts.
- (9) Do not pay for steel lap-spliced that plans do not call for.

### 11.3 INLETS, MANHOLES, JUNCTION BOXES AND YARD DRAINS

See **Section 425** of the **Specifications**.

- (A) New Structures: The quantities to be paid for under these items shall be the number of each type of structure completed and accepted in accordance with the current **Specifications** and **Special Provisions**.
  - (1) Check plan-profile sheets, Drainage Summary Sheets, and Drainage Structure Detail Sheets for agreement on structures completed.
  - (2) Verify by actual count the number built. The quantities should be summarized on the appropriate plan summary sheets or summary boxes.
  - (3) Confirm construction by using Daily work reports and/or Test reports, or other back up documentation if structure count or locations are questionable.
- (B) Adjusting Structures: When this item is included in a contract it provides, in general, for the payment of adjusting all common structure types.
  - (1) When the specific type is not shown, payment is made under the item of Adjusting Miscellaneous Structures.
  - (2) Verify by actual count the number of the various structures which were satisfactorily adjusted.

## 11.4 DRAINAGE STRUCTURES

- (A) Pipe Culverts: See **Section 430** of the **Specifications**. The quantities to be paid for shall be the plan quantity subject to **Section 9-3.2** of the **Specifications** of the kind and size shown in the proposal, including the optional kinds specified as being permissible under the items of Cross Drain Pipe, Side Drain Pipe, Gutter Drain and Storm Drain Pipe Culvert completed and accepted. When reviewing is required:
- (1) The Project Engineer (PE) or Project Administrator (PA) will submit justification if appreciable changes are made in the overall drainage system as designed. Appreciable is defined as follows for cross and storm drain pipe, storm drain trench, and requires adjustment to plan quantity: (1) Authorized plan revisions or (2) Plan errors more than 5% of original plan quantity or \$5000.00 with supporting documentation.
  - (2) Cross check and compare all side drain pipes shown on the summary with the location of paved or stabilized turnouts on the plan profile sheets, ditch grades, and cross section sheets.
  - (3) Verify that trench excavation is paid in accordance with the **Section 125** of the **Specifications** on excavation for structures and pipes.
  - (4) If excavation for structures is provided in the proposal, confirm that it does not include quantities shown on the plans to be paid for as regular, subsoil, lateral ditch or channel excavation.
  - (5) Check excavation for structures below plan grade in accordance with **Section 125-14.3** of the **Specifications**.
    - (a) If the pay item is in cubic yards, the material excavated below plan grade will be included in the measurement for this item, whether shown on the plans or authorized by the PE/PA.
    - (b) If the pay item is a Lump Sum item all material within the limits shown on the plans will be included in the Lump Sum price. Any material authorized by the PE/PA to be excavated outside or below these limits will be paid for as extra work.
  - (6) Check the proposal, when no direct payment is provided on excavating, except that specifically stipulated in **Sections 125-14.3** through **125-14.7** of the **Specifications**, shall be included in the

- contract price for concrete or other items covering the applicable structure.
- (7) Since there are several factors involved in final pay for backfill, be sure to check the field records, explanations of overruns and underruns, Work Orders, Supplemental Agreements, and Extra Work records to ascertain that payment is in compliance with the **Specifications**.
  - (8) Pavement, curb, sidewalk, etc., removed only for the purpose of constructing pipe culvert, will be included in the contract unit price of the pipe culvert and will be replaced at no cost to the Department.
  - (9) Verify that the volume of concrete and weight of reinforcing steel bars in baffles are included in the final pay quantities when they are called for in the plans.
  - (10) Check that special pipe sections required under railroads are in accordance with the **Design Standards, Index No. 280 "Miscellaneous Drainage Details"** Check Plans, and **Special Provisions** as required.
  - (11) Verify the volume of concrete for Endwalls, by checking the type and size of pipe used at each location versus the quantities shown on the index drawings, plans, and summary sheets or boxes.
- (B) Structural Plate Steel Pipe and Pipe Arch Culverts: **Section 435** of the **Specifications**. The quantities to be paid for shall be plan quantity subject to **Section 9-3** of the **Specifications**. When review is required, spot check as follows:
- (1) Verify size, length, and location, showing changes in the final measurement field book or drainage summary sheets in the final As-Built plans.
  - (2) Excavation and backfilling will be checked in accordance with the guidelines outlined under **Sections 125** and **430** of the **Specification** for Pipe Culverts and Storm Sewers.
  - (3) Plan length calculations will be on center line of structures, from end to end of metal for full section structures.
  - (4) Plan length calculations will be average end to end at top and bottom for beveled end structures.

- (C) Underdrains and French Drains: The quantities to be paid for shall be the linear feet measured in place, along the completed accepted work.
  - (1) Verify the final quantities of under drain and French drain, using the summary sheets and detailed records, shown in the Final As- Built plans.

## 11.5 PRESTRESSED CONSTRUCTION

See **Section 450** of the *Specifications*

- (A) Prestressed Beams and Slab Units: These are plan quantity pay items and subject to provisions under **Section 9-3.2** of the *Specifications*. Unit of Measure is per foot. When review is required:
  - (1) Verify that pay lengths agree with casting lengths, as detailed on the plans. Verify final quantities, changes with back up documentation, etc.

## 11.6 ALL PILING

See **Section 455** of the *Specifications*

- (A) Treated-Timber Piling: This is a final measured pay item and measured in linear feet.
  - (1) The above payment includes furnishing all materials, including collars or bands, metal shoes, copper cover sheets, copper wire, and preservatives.
  - (2) No build-ups allowed on timber piles. Timber piles will have to be extracted if driven below plan elevation.
  - (3) Review the level notes, pile driving records for pile elevations, and authorized pile lengths.
- (B) Prestressed Concrete Pilings: The final quantity for this item will be based on prestressed concrete piling furnished, driven and accepted according to the authorized length list including any additions and excluding any deletion as authorized and approved by the Engineer. .This is a final measured pay

item measured in linear feet. It will be essential that the field records clearly document the following to support the submitted quantity.

- (1) Check pile records for completeness for all additional activity shown. Make sure that all build-ups, splices, driving of splices, cut-offs, etc., are clearly documented
- (2) Review level notes, pile driving records, lengths, pile elevations, and authorized pile lengths.
- (3) Check if splices were authorized and added to piling quantity. If splice is added, check redrive records for additional compensation.
- (4) Check Specifications for set-checks, and track documentation. Check redrive records if authorized for pay and that the proper amount is added as compensation.
- (5) Concrete used for build-ups 2 feet or less below the elevation of cut-off, may be cast with the cap. The Contractor will be compensated 9 feet of pre-stressed concrete piling as compensation for drilling, grouting, reinforcing steel and concrete used for the build-up.
- (6) Check the authorized lengths issued by the Engineer and compare with piling furnished.
- (7) When cutoffs are transported to another bridge site under the same contract, as buildups or permanent piles, check that they are not paid for again.
- (8) Review piling lengths to determine if satisfactory bearing was obtained and measured from cut-off elevation to tip of pile.
- (9) Check to see if a pile is driven below cut-off, and satisfactory bearing is not obtained, and additional driving is required after construction of a satisfactory splice, that an additional 10 feet will be added to production concrete piling as compensation for the additional driving, plus the authorized splice lengths.
- (10) There will be no compensation for concrete pile cut-off.
- (11) Concrete pile splices authorized by the Engineer will be made as 30 feet of additional concrete production piling.



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- (12) Check receipt tickets from maintenance to ensure that all salvaged cutoffs are delivered to the maintenance yard or disposition is otherwise documented by the PE.
- (C) Concrete Test Piling: Price and payment will be full compensation for all work necessary to complete driving to reach bearing under the test pile pay item including driving the pile and all other related costs, but excluding splices, build-ups, pile extractions and performed pile holes authorized by the Engineer. It will be essential that the field records clearly document these activities to support the submitted quantity.
- (1) Check documentation for completeness for all additional activity shown.
  - (2) Verify that test piles, left in place as permanent piles are paid for only as test piling.
  - (3) Buildups made only to incorporate test pile into the structure as permanent pile shall be included in the quantities of production piling, not as test piling.
  - (4) Review the level notes, pile driving records lengths, pile elevations, and authorized pile lengths.
  - (5) Check that length of splices > 2 feet, not driven are compensated for under Production Piles, and splices that were driven for test purposes are compensated for under test piles. The Contractor will also be compensated for the material & labor for these splices mentioned; compensation of 30 feet will be added to production concrete piles.
- (D) Steel Piling: Price and payment will be included for furnishing all labor, equipment, and materials required to furnish and install steel piles, including welding, painting, predrilling pile holes, cost of sand or concrete fill and reinforcing steel in pipe piles. This pay item is also a final measured item paid for in linear feet. It will be essential that the field records clearly document these activities to support the submitted quantity.
- (1) Review level notes, pile driving records lengths, pile elevations, and authorized pile lengths.
  - (2) Ensure that Contractor did not splice to obtain authorized length less than 40 feet and will not require splice except when shown on Plans. The Engineer can approve splicing to obtain authorized lengths

- between 40 and 60 feet. The Engineer will permit splicing to obtain authorized lengths in excess of 60 feet of additional steel pile.
- (3) Compensation for each steel splice authorized by the engineer will be 20 feet added to the production steel pile.
  - (4) There will be no compensation for cut-off on steel piling.
  - (5) Point protectors will be paid per each protector authorized, furnished, and properly installed under pay item 455-120- .
  - (6) Check Specifications for set-checks, compensation and when ordered by the Engineer for pile redrives, Payment of 10 feet will be compensated for additional piling. Check pile redrive records if authorized for pay and the proper amount is added as compensation.
  - (7) Check receipt tickets from maintenance to ensure that all salvaged cutoffs (20 feet or longer) are delivered to the nearest maintenance yard and are not damaged. Any steel pile cut offs less than 20 feet are to be removed from the project by the Contractor, disposed of and documented.
- (E) Replacing Piles: All remarks in field records concerning piling that required pulling and/or replacing shall be checked.
- (1) Verify there is no duplication of payment for the quantity of pile when cutoffs are transported to another bridge site under the same contract for use as buildups or permanent piles.
  - (2) Ensure that in the event a pile is broken or otherwise damaged by the Contractor to the extent that the damage is irreparable, in the opinion of the Engineer, the Contractor shall extract and replace the pile at no additional expense to the Department.
  - (3) Also, in the event that a pile is mislocated by the Contractor, the Contractor shall extract and replace the pile at no expense to the Department except when a design change proposed by the Contractor is approved by the Department as provided in **Section 455-5.15.5** of the **Specifications**.
  - (4) Ensure that in the event that a pile is driven below cut-off without obtaining the required bearing, and the Engineer elects to have the pile pulled and a longer pile substituted, it will be paid for as Unforeseeable Work.

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- (5) Verify that there is no duplication of payment. If the extracted pile is undamaged and driven elsewhere, the pile will be paid for at 30% of the Contract unit price for Piling.
  - (6) Ensure that in the event a pile is damaged or mislocated, and the damage or mislocation is determined to be the Department's responsibility, the Engineer may elect to have the pile extracted, and it will be paid for as Unforeseeable Work.
  - (7) In the event that the contract does not have an item for pulling piles, the work will be handled as unforeseen work.
  - (8) Review the level notes, pile driving records, lengths, pile elevations, and authorized pile lengths.
- (F) Steel Sheet Piling: The Quantity to be paid for will be the plan quantity area, in square feet completed and accepted. It is calculated from top of the pile elevation to the bottom of pile elevation and beginning and end wall limits as shown in the plans with no allowance for variable depth surface profiles. When review is required:
- (1) Verify the changes, lengths and widths shown in the final measurement field book or the plan details.
  - (2) Check the standard unit weights and mathematics of the computed pay quantities.
  - (3) Approved alternate support structures are paid for as plan quantity computed for sheet pile. Sheet piling used in cofferdams and to incorporate the contractor's specific means and methods not ordered by the engineer are paid per **Section 125** of the **Specifications**.
  - (4) Review the level notes, pile driving records for pile elevations, and authorized pile lengths.
- (G) Concrete Sheet Piling: This is a final measure pay item, measured in linear feet. The total quantity for pay under this item is the product of the number of such piles satisfactory completed, in place, times their lengths in feet as shown in the plans or authorized by the Engineer.

- (1) Ensure that payment under this item includes furnishing all materials, including reinforcing steel, grouting, plastic filter fabric, preformed holes and installation.
  - (2) Verify that this pay quantity is based upon piles 2-1/2 feet wide. However, if the Engineer approves, the Contractor may furnish the concrete sheet piling in widths wider than shown in the Plans; then the number of piles will be the actual number of units completed times the width used divided by the width in the Plans.
  - (3) Review the level notes, pile driving records for pile elevations and authorized pile lengths.
- (H) Drill Shaft Excavation - Linear Foot: Verify the length to be paid for as the distance from natural ground elevation at the center of the shaft prior to excavation to the final bottom of shaft excavation as authorized and accepted. Extra Depth Drilling - Linear Foot: Verify the length to be paid for as the distance from the plan elevation of the bottom of the shaft to the final authorized elevation of the bottom of the shaft, completed and accepted.

Where casing is provided with an inside diameter smaller than the specified drilled shaft diameter, the Contractor is required to provide an additional length of drilled shaft at no cost to the Department. The additional length required is determined by the following relationship.

additional length =  $(D_1 - D_2)L \div D_2$  Where:  $D_1$  = Casing inside diameter specified = Shaft Diameter Specified  $D_2$  = Casing inside diameter provided ( $D_2 = D_1$  minus twice the wall thickness)

$L$  = Authorized Drilled Shaft Length below ground for temporary casing methods or below casing for permanent casing methods.

In the above situation dealing with smaller inside diameter than is specified, the measured amount will be multiplied by a factor (F) determined below; this is necessary to compensate for smaller shafts:

$$F = \frac{2(D_2 - D_1)}{D_2}$$

Where:  $F$  = factor to adjust pay quantities to compensate for smaller shafts.  
 $D_1$  = casing inside diameter specified - shaft diameter specified.

D2 = casing inside diameter provided (D2 = D1 minus twice the wall thickness).

Drill Shaft Records shall be kept with the Final "As-Built" Plan set and once the project has been moved to the "Pass Status" these records should be provided to the District Structures Maintenance Engineer for their use.

## 11.7 STRUCTURAL STEEL

Structural Steel and Miscellaneous Metals: See **Section 460** of the **Specifications**. The pay items in this section are measured in pounds, square yards, feet, and per each shall be paid for as plan quantity, subject to **Section 9-3.2** of the **Specifications** or paid at the contract lump sum price.

Ensure that final quantities and documentation display that the following items are included under Structural Steel and Miscellaneous Metals for purpose of payment:

- (1) Shear connectors.
- (2) Welding and welds: fastener assemblies not designated as high-strength such as: anchor rods, nuts, bolts and associated washers.
- (3) Transporting, handling and erection.
- (4) Shims and Fill Plates: the weight quantities are included in determining the weight of the completed structure to determine quantity paid, but not for a lump sum.
- (5) Preparation, application, clean-up and the consumables used in the coating process.
- (6) Preparation, handling, and/or clean up of weathering steel or the 'rust' marks on other items (concrete units, etc.) caused by the development of the patina.
- (7) Jacking of substructure units of adjacent fixed piers required to set bearing in accordance with contract documents.

## 11.8 TIMBER STRUCTURES

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See **Section 470** of the **Specifications**.

- (A) Treated Timber Structures: The quantities shall be paid for as plan quantity, in feet board measure subject to **Section 9-3.2** of the **Specifications**. When review is required, spot check as follows:
- (1) Check the nominal commercial sizes shown in the plans or ordered by the PE were used to calculate quantities.
  - (2) The lengths shall be the overall lengths of the pieces as shown in the plans, or the lengths actually incorporated in the structure are less than those shown in the plans.

## 11.9 STEEL GRID FLOORS

See **Section 504** of the **Specifications**. Quantities to be paid for shall be plan quantity, subject to **Section 9-3.2** of the **Specifications**. The quantities consist of the area, in square feet, installed, completed and accepted. The item consists of furnishing and erecting open type steel grid roadway and sidewalk floors on the movable spans of bridges and at other locations shown in the plans. When review is required, spot - check as follows:

- (1) Check the dimensions and notes shown in the plans to verify quantities.
- (2) Station to station lengths and widths may be used in the calculation of the dimensions actually constructed within the limits designated by the PE/PA.
- (3) Determine that the proper deduction has been made for open joints in the floor as required.

## 11.10 NO FIGURES FOLLOWING THIS CHAPTER