

# **CHAPTER 10 ESTIMATING**

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## 10.2 Computation of Quantities

### 201 - CLEARING (AC)

Clearing limits shall be parallel to and 5 feet (15 feet for FAI fills without guardrail and FAI low cut slopes) from the toe of slope or to the Right of Way line if it is inside the above limits.

Quantities less than 0.5 acre are incidental to contract items.

Quantities between 0.5 and 1.0 acre are rounded to 1.0 acre

### 202 - Removal Of Concrete Bridge Rail (LF)

Concrete railing shall be estimated as linear feet to be removed, out to out of the section(s) to be removed, and shall not be included in the deck or superstructure concrete removal item.

### 203 - Earthwork Quantities

#### General Methods

Use the most expedient method to measure areas (CADD cross-sections, etc.). Volumes are to be calculated by average end area method. Consideration should be given to unbalanced sections on sharp curves by using the length between sections at the centers of gravity.

♪ Increase all borrow volumes 15 percent for shrinkage.

#### Units:

Don't use Truck Measure

#### Common Excavation

Common excavation used to offset common borrow requirements should be credited at no more than 85 percent of its original volume.

#### Common Borrow

Increase Common Borrow volume 15 percent for shrinkage.

#### Granular Borrow

Increase Granular Borrow volume 15 percent for shrinkage.

#### Aggregate Subbase Course Gravel

#### Overhaul

Overhaul shall not be used on any projects.

## **202 - Removing Existing Bridge (LS/CY)**

This item is under consideration currently. The depth of detail required to estimate the volume and/or weight of the structure is being debated. Ask before estimating.

## **206 - Structural Excavation Quantities**

### **Pay Limits**

Excavation for concrete structures shall be to vertical planes 18" outside the neat lines of the footing, or the bottom of the battered sections if there is no footing.

For abutments, box culverts and structural plate structures the limits shall be to the dimensions shown on the plans for granular borrow or French Drains if those limits are more than 18" outside the structure.

When excavation for a structure is specified to be carried beyond the customary 18" neat line, the additional excavation must be designated as "Structural Excavation" and modified structural excavation limits should be clearly identified on the plans.

For pipe culverts and drains the limits are 15" outside the pipe.

Excavation for footings placed as a seal shall be the same area as that used for payment for the footings.

Structural Rock Excavation should be estimated 6" below the minimum elevation indicated on the plans if excavation is definitely anticipated.

### **Methods**

When calculating structural earth quantities adjacent to abutments with battered back faces the prismatic formula may be required.

Extremely small quantities of excavation should be avoided by estimating 5 or 10 cubic yards to procure a reasonable bid price. Items for rock excavation may be eliminated when the quantity is very small, since there are provisions to pay for such rock excavation at six times the earth excavation price.

## **403 - Hot Mix Asphalt (T)**

Hot Mix Asphalt shall be paid for by the Ton of each grading specified calculated at 110#/SY/inch of pavement thickness.

## **501 - Steel H Beam Piles (LF)**

The estimated quantities shall be as indicated on the plans with no allowance for cut offs, splices or pile points.

### 502 - Structural Concrete (LS/CY)

Quantities for structures that are not supported on ledge shall be calculated exactly. Rounding shall be to the nearest 1 cubic yard.

Quantities for structures that are supported on ledge shall be calculated exactly to the top of footing or reference plane for dimensions. The best information available shall be used for quantities below those planes. In the case that ledge excavation is called for on the plans, estimate to 6" below the minimum depth of footing called for.

Quantities estimated for items paid on a lump sum basis may be rounded as per design policy for rounding.

The volumes of mass pier shafts, abutments, or other elements with more than two battered faces should be calculated using the prismatic formula as follows:

$$V=h/6*(A_1+A_2+4*A_3)$$

h=height of element.

A<sub>1</sub> & A<sub>2</sub> are the areas of the top and bottom, parallel surfaces.

A<sub>3</sub> is the area of a section cut at mid-height, parallel with the bases.

### 502 - Concrete Wearing Surface (LS/CY)

On new structures and other structures where the quantity of concrete can be accurately determined, payment for Structural Concrete Wearing Surface will be on a lump sum basis. Quantity shall be rounded to the nearest 1 c.y.

No separate payment will be made for the 1" Integral Concrete Wearing Surface, but payment will be made as part of the structural concrete slab.

### 503 - Reinforcing Steel (LB)

Quantities shall be calculated from the detailed schedule, using theoretical weights, per linear foot, and rounded to the nearest 100 pounds. A spreadsheet is available for calculating quantities. The results should be checked for agreement with the reinforcing schedule.

If precast deck panels are used, superstructure rebar is incidental to superstructure concrete and should not be included in the estimate.

**ⓘ Results should be corrected for late changes in the schedule.**

### 504 - Structural Steel (LS/LB)

Theoretical weights shall be used for all structural steel computations. The extreme length of members shall be used. Weight of welds, bolts, and plate over run shall not be included. No deductions shall be made for any copes, cuts, clips, or bevels on any members. For haunched sections of welded girders, the average of the maximum and minimum depths of web shall be used. Weight of standard bearing pedestals shall be as listed in the Bridge Design Manual.

### 505 - Shear Connectors (LS/EA)

The total number as detailed on the plans shall be estimated without rounding. A 5" x 7/8" diameter stud shall be considered to weigh 1.0 pound for estimates only.

### 507 - Bridge Railing (LF)

The length as detailed on the plans, including rail overhang, shall be estimated and rounded to the nearest 1 foot.

When Type 3-Single Rail-Bridge Mounted rail is used, include Item 609.247 to pay for the precast concrete transition curb. Also, add 12.5 feet of Type 3 GR at each corner of the bridge to account for the nested beam and extra posts beyond the bridge mounted GR as per Standard Detail 606(20).

### 508 - Membrane Waterproofing (LS/SY)

The total deck area between curbs and between end dams shall be estimated with no allowance for membrane turned up at edges and no deduction for obstructions such as drains.

### 509 - Structural Plate Structures (LS/LB)

#### Overview

Structural plate pipes, plate pipe arches and plate arches are paid for by lump sum/pound and plate box culverts are paid for by lump sum. The difference is that the weight of a pipe, pipe arch and arch can be estimated using the plate thicknesses and lengths specified on the drawings and unit weights published in manufacturer's catalogs but the weight of box culverts can not because the plate thicknesses are designed by the manufacturer.

Multiple plates are required to create one ring of the structure. The curved length of each plate is in multiples of  $\pi$ . Why  $\pi$ ? Remember the circumference of a pipe is equal to  $\pi$  times its diameter ( $c = \pi*d$ ). For example, the circumference of a 60" diameter pipe is  $60\pi$ . Thus it takes four  $15\pi$  plates to construct a 60" diameter pipe ( $4*15\pi = 60\pi$ ).

Steel structures typically use combinations of  $9\pi$ ,  $15\pi$ ,  $18\pi$ ,  $21\pi$  and  $24\pi$  plates to create the available plate structures. For example, a 7'-0" span by 5'-1" rise plate pipe arch with a peripheral length of  $75\pi$  is constructed from two  $9\pi$ , two  $18\pi$  and one  $21\pi$  plates ( $2*9\pi + 2*18\pi + 21\pi = 75\pi$ ). The steel manufacturer's catalog details the location of each plate in the structure as bottom, top or corner.

Aluminum structures are slightly different and give plate arc lengths in terms of N instead of  $\pi$  where N is approximately equal to  $3\pi$ . The circumference of a 60" diameter aluminum pipe is  $20N$  ( $20*3\pi = 60\pi$ ). Standard aluminum plate lengths are 8N, 9N, 10N, 11N, 12N, 13N and 14N. The longer plates result in fewer plates per ring. For example, a 6'-7" span by 5'-8" rise pipe arch with a total N of 25 ( $75\pi$ ) is constructed from 2 plates compared to five plates in the above steel example. Thus to form the pipe arch shape, each aluminum plate will have multiple radii. Aluminum structures also use the nomenclature of invert, crown and haunch arc lengths instead of bottom, top and corner plates.

### Other Considerations

- Typically aluminum structures use one plate thickness throughout but steel structures use two. The plates below ordinary high water are two sizes heavier for increased abrasion and corrosion protection. The plate thicknesses are specified in the Structural Plate Notes on the drawings.
- Use manufacturer's catalogs that include the weight of nuts and bolts in their unit weight tables.
- Reinforcement at the ends of aluminum structures is considered incidental to the pay item.
- Ignore skewed ends and use the centerline length of the structure in weight computations. The impacts of skewed ends are generally small in comparison to the total quantity.
- Do not include the weight of reinforcing ribs in the estimate of aluminum structures.

### Example Estimate for an Aluminum Plate Pipe Arch

Given: 12'-11" span x 7'-6" rise aluminum plate pipe arch, 80' centerline length, 62'-6" top centerline length, 0.15" plates and 2'-6" vertical step cut.

Step 1. From the *Pipe Arch Details Table* in a manufacturer's catalog:

Arc Length for crown = 17N, haunch = 7N and invert = 11N

Total = 42N

Crown arc length 1 x 17N = 17N

Haunch arc length 2 x 7N = 14N

Invert arc length 1 x 11N = 11N

42N total peripheral length

Assume vertical cut occurs at the top of the 7N haunch arcs. The arc length of the vertical end cut is  $11N + 2(7N) = 25N$ .

Step 3 From the *Approximate Handling Weight of Structure Table* in a manufacturer's catalog:

Approximate Weight for 0.15" plates and 42N structure = 110 plf

Step 4 Weight of vertical cut invert and haunch plates =  $(25N)/42N * 110 \text{ plf} * 80'$  = 5238#

Weight of bevel cut crown plate =  $17N/42N * 110 \text{ plf} * (62.5' + 80')/2$  = 3172#

Total weight of structure = 8410#

Step 5 Rounding

Total weight of structure = 8450#



### Example Estimate for a Steel Plate Pipe Arch

Note: Typically in steel plate pipe arches with beveled ends the transition in plate sizes occurs at the top of corner plates. This example illustrates how to estimate the weight of a pipe arch for the slightly more complicated situation when the plate thickness transition occurs between top plates.

Given: 12'-6" span x 7'-11" rise steel plate pipe arch, 80' bottom centerline length, 62' top centerline length, the uppermost top plate shall be 0.138" thick, all other plates shall be 0.188" thick and 2'-8" vertical step cut.

Step 1. From the *Plate Arrangement and Approximate Weight per foot for Multi-Plate Pipe-Arch Table* in a manufacturer's catalog:

$$\text{Corner Plate } 2 \times 9\pi = 18\pi$$

$$\text{Bottom Plate } 1 \times 18\pi = 18\pi$$

$$\text{Bottom Plate } 1 \times 21\pi = 21\pi$$

$$\text{Top Plate } 1 \times 21\pi = 21\pi \text{ (0.138" plate)}$$

$$\text{Top Plate } \underline{2 \times 24\pi = 48\pi}$$

$$7 \text{ total } \quad 126\pi \text{ total peripheral length}$$

$$\text{Approximate weight for 0.138" plate structure} = 277\text{plf}$$

$$\text{Approximate weight for 0.188" plate structure} = 373\text{plf}$$

Step 2. From the *Multi-Plate Pipe-Arch Table* in a manufacturer's catalog,

$$\text{Radius of top plates} = 76''$$

B, vertical distance to top of corner plates = 2'-8" (Note for pipe arches the manufacturer recommends locating the vertical step cut at the top of the corner plates)

Step 3. Determine length of beveled cut plates

$$\text{Total height of bevel cut} = 7'-11'' - 2'-8'' = 5'-3''$$

$$\text{Total length of bevel cut} = (80' - 62')/2 = 9'-0''$$

$$\text{Height of top plate in bevel cut, } h = r - r \cdot \cos[(s/2r) \cdot (360/2\pi)], \text{ where}$$

$r$  = radius of top plate

$s$  = arc length

$$360/2\pi = \text{Conversion factor from radians to degrees}$$

$$h = 76'' - 76'' \cos [(21\pi/2 \cdot 76'') \cdot (360/2\pi)] = 7.05'' \text{ or } 0.5873'$$

$$\text{Length of top plate in bevel cut} = (9'-0''/5'-3'') \cdot 0.5873' = 1.0'$$

$$\text{Overall length of top plate} = 62' + 2 \cdot 1.0' = 64'$$

$$\text{Step 4. Weight of } 21\pi \text{ top plate} = 21\pi/126\pi \cdot 277\text{plf} \cdot (62' + 64')/2 = 2,909\#$$

$$\text{Weight of } 24\pi \text{ top plates} = (24\pi + 24\pi) / 126\pi \cdot 373\text{plf} \cdot (64' + 80')/2 = 10,231\#$$

$$\text{Weight of corner and bottom plates} = (18\pi + 18\pi + 21\pi) / 126\pi \cdot 373\text{plf} \cdot 80' = \underline{13,499\#}$$

Total weight of structure	= 26,638#
Step 5 Rounding	
Total weight of structure	= 26,700#

### **511 - Cofferdams (EA)**

Where cofferdams are required there shall be a cofferdam pay item for each substructure unit within a bridge or rigid frame. A concrete box culvert with a bottom slab shall be considered to have one substructure unit. A cofferdam unit is to be included for structural plate pipes and structural plate pipe arches when applicable.

### **513 - Slope Protection (SY)**

Slope protection is generally fully detailed on the plans. Areas should be rounded to the nearest 1 square yard.

### **526 – Temporary Concrete Barriers (LF or LS/LF)**

Use 526.301 (LS) for multiple moves of temporary barrier, such as staged construction. Use 526.30 (LF) for one placement, such as road closing.

### **603 - Culverts (LF)**

Quantity shall be the total called for on the plans. Total for each size and type should, in general, be in multiples of 2 feet. Do not round unless the actual quantity is indeterminate.

### **606 - Guardrail (LF)**

Total shall be as called for on the plans. Beam guardrail shall be in multiples of 12.5 feet, to the nearest 1 foot.

### **606 - Low Volume Guardrail End (EA)**

Terminal ends are included in Item 606.78 and are not a separate pay item.

### **618 - Seeding (UN)**

#### **Rules of Thumb**

Seeding, Method No. 2 is used for all seeding except for areas that are to be mowed regularly. This type seeding should also be specified for mowed areas when the area is less than 20 percent of the total seeding requirement.

Seeding should be estimated for all cut and fill slopes, including toe fills, from the edge of shoulder to the toe of fill or top of cut except that no seeding shall be estimated for ledge slopes shown on a 1/4:1 slope, and riprapped areas.

In addition to the above described quantity, on rural projects an additional 5 feet width shall be added to all Method No. 2 areas to provide for additional disturbed areas beyond the slope lines and the unavoidable extra areas seeded.

The quantity of these items is to be estimated as measured along the slope of the finished ground in units of 1,000 square feet.

### Calculating Side Slope Area

Areas as measured on the plan need to be increased to account for the slope of the ground to be seeded. Use the following factors at the side slopes specified:

1:4	1.031
1:3	1.054
1:2.5	1.077
1:2	1.118
1:1.75	1.152

### 619 - Mulch, Erosion Control Mix

Mulch is used on all seeded areas.

No deduction in the estimated quantity shall be made for small areas of sod or erosion control mesh used in ditches, etc., since these will be unavoidably mulched with the remainder of the slopes.

Estimate one Unit of Mulch (Item 619.1201) for each Unit of Seeding.

When loam and seed cannot be applied at project completion and erosion control must be provided over a winter, estimate 2 CY of Erosion Control Mix (Item 619.1401) for each CY of Loam.

### 627 – Pavement Markings

The accepted quantity of permanent pavement marking lines will be paid for at the contract unit price per foot.

When estimating for temporary traffic control items on bridge projects be sure to compensate for removal of existing striping, temporary striping, and re-striping the approaches where traffic lanes are temporarily changed.

### 629, 631 - Labor And Equipment Items (HR)

Do not show labor and equipment rental items on any project (in the estimate or on quantity sheet) unless some work is specifically spelled out on the contract plans which is to be paid for by specific labor and equipment rental items. Since Contractors frequently unbalance the bid prices on labor equipment items, in anticipation of large overruns on these items, it may be advisable to default to the "Blue Book" prices even when there is work that could be paid for

by specific labor and equipment rental items. Group Leaders will decide on the best method to use in each individual case.

### **637 - Dust Control (LS)**

This item should be included when traffic will be maintained on unpaved roadway in close proximity to businesses or dwellings in waterway crossing projects.

### **652 - Work Zone Traffic Control (LS)**

Item 526.301, Temporary Concrete Barrier Type 1, Item 643.72 Temporary Traffic Signal and Item 652.38, Flagger are not included in this item and must be paid separately. Type I, II, and III barricades are included in this item and do not need to be paid for separately.

### **652 - Maintenance Of Traffic Items**

For each project a Traffic Control Plan shall be requested from the Engineer of Traffic and the appropriate pay items shall be included in the estimate. Special detours shall be used where applicable.

### **656 - Temp. Soil Erosion and Pollution Control (LS)**

Erosion control is paid for lump sum.

### **659 - Mobilization (LS)**

This item is to be used on all projects to allow payment to a Contractor for establishing himself on the project. Typical cost will be 5 percent to 6 percent of the projects estimated cost.

### 10.3 Sample Item Lists

#### Simple Span, Precast, Prestressed Voided Slab on Integral Abutments

<b>Item #</b>	<b>Description</b>	<b>Units</b>
202.19	Removing Existing Bridge	LS
203.20	Common Excavation	m <sup>3</sup>
203.24	Common Borrow	m <sup>3</sup>
203.25	Granular Borrow	m <sup>3</sup>
204.41	Rehab Of Existing Shoulders, Plan Qty	m <sup>2</sup>
206.082	Str Earth Excavation-Major Structures	m <sup>3</sup>
304.10	Aggregate Subbase Course - Gravel	m <sup>3</sup>
403.208	Hot Mix Asphalt, 12.5 mm, Surface	Mg
403.210	Hot Mix Asphalt, 9.5 mm	Mg
403.213	Hot Mix Asphalt 12.5 mm Nominal Max. Size, Base	Mg
409.15	Bituminous Tack Coat, Applied	L
501.231	Dynamic Loading Test	EA
501.46	Steel H-Beam Piles 109 kg/m, Delivered	m
501.461	Steel H-Beam Piles 109 kg/m, In Place	m
501.90	Pile Tips	EA
501.92	Pile Driving Equipment Mobilization	LS
502.21	Structural Concrete Abuts & Ret Walls	m <sup>3</sup>
502.25	Str Conc Superstr Slab	LS
502.49	Structural Concrete Curbs and Sidewalks	LS
503.12	Reinforcing Steel, Fab & Del	kg
503.13	Reinforcing Steel, Placing	kg
508.13	Membrane Waterproofing	LS
510.10	Special Detour, 4.8 m Roadway Width	LS
511.07	Cofferdam: Abutment No. 1	LS
511.07	Cofferdam: Abutment No. 2	LS
512.081	French Drains	LS
514.06	Curing Box for Concrete Cylinders	EA
515.21	Protective Coating for Concrete Surfaces	LS
526.301	Temporary Concrete Barrier Type I	LS
535.60	Prestressed Str Conc Slab	LS
604.18	Adjust Manhole Or Cb To Grade	EA

606.35	Guardrail Delineator Post	EA
606.55	Guardrail Type 3 - Single Rail	m
606.74	Gr Tp 3 - Single Rail Bridge Mounted	m
606.78	Low Volume Guardrail End - Type 3	EA
609.247	Terminal Curb Type 2 - 2.1 m	EA
610.08	Plain Riprap	m <sup>3</sup>
610.16	Heavy Riprap	m <sup>3</sup>
613.319	Erosion Control Blanket	m <sup>2</sup>
615.07	Loam	m <sup>3</sup>
618.1411	Seeding Method Number 3 - Plan Quantity	UN
619.1201	Mulch - Plan Quantity	UN
619.1301	Bark Mulch - Plan Quantity	UN
620.58	Erosion Control Geotextile	m <sup>2</sup>
622.10	Transplanting Shrub	EA
627.711	White or Yellow Pvt Marking Line - Plan Quantity	m
627.76	Temp Pvt Marking Line, White or Yellow	LS
629.05	Hand Labor, Straight Time	MH
631.12	All-Purpose Excavator (Inc Operator)	HR
631.14	Grader (Including Operator)	HR
631.15	Roller Earth Base Crs (Inc Op)	HR
631.172	Truck-Large (Inc Operator)	HR
631.22	Front End Loader (Inc Oper)	HR
637.071	Dust Control	LS
639.19	Field Office Type B	EA
652.312	Type III Barricade	EA
652.39	Work Zone Traffic Control	LS
656.75	Temp. Soil Erosion and Pollution Control	LS
659.10	Mobilization	LS

### Low Profile Steel Box Culvert

Item #	Description	Units
203.20	Common Excavation	m <sup>3</sup>
203.24	Common Borrow	m <sup>3</sup>
203.25	Granular Borrow	m <sup>3</sup>

204.41	Rehab Of Existing Shoulders, Plan Qty	m <sup>2</sup>
206.061	Str Earth Excavaion Below Grade Str	m <sup>3</sup>
304.10	Aggregate Subbase Course - Gravel	m <sup>3</sup>
403.208	Hot Mix Asphalt, 12.5 mm	Mg
403.213	Hot Mix Asphalt 12.5 mm Nominal Max. Size, Base	Mg
409.15	Bituminous Tack Coat, Applied	l
509.43	Metal Structural Plate Box Culvert	LS
510.10	Special Detour, 4.6 m Roadway Width	LS
511.07	Cofferdam: Upstream	LS
511.07	Cofferdam: Downstream	LS
526.301	Temporary Concrete Barrier Type I	LS
606.265	Terminal End- Single Rail- Galv Steel	EA
606.35	Guardrail Delineator Post	EA
606.55	Guardrail Type 3 - Single Rail	m
606.60	Guardrail Type 3 - Over 4.5 m Radius	m
606.76	Modified Eccentric Loader Terminal	EA
610.08	Plain Riprap	m <sup>3</sup>
613.319	Erosion Control Blanket	m <sup>2</sup>
615.07	Loam	m <sup>3</sup>
618.1411	Seeding Method Number 3, Plan Quantity	UN
619.1201	Mulch - Plan Quantity	UN
620.54	Stabilization/Reinforcement Geotextile	m <sup>2</sup>
620.58	Non-woven Geotextile	m <sup>2</sup>
627.711	White or Yellow Pavement Marking Line, Plan Quantity	m
629.05	Hand Labor, Straight Time	MH
631.12	All-Purpose Excavator (Inc Operator)	HR
631.14	Grader (Including Operator)	HR
631.15	Roller Earth Base Crs (Inc Op)	HR
631.171	Truck-Small (Inc Operator)	HR
637.071	Dust Control	LS
639.19	Field Office Type B	EA
652.39	Work Zone Traffic Control	LS
656.75	Temp. Soil Erosion and Pollution Control	LS
659.10	Mobilization	LS

## Two Span, Precast, Prestressed Butted Box Beams on Deep Abutments and Mass Pier

<b>Item #</b>	<b>Description</b>	<b>Unit</b>
202.19	Removing Existing Bridge	LS
203.20	Common Excavation	m <sup>3</sup>
203.24	Common Borrow	m <sup>3</sup>
203.25	Granular Borrow	m <sup>3</sup>
206.082	Str Earth Excavation-Major Structures	m <sup>3</sup>
206.092	Str Rk Exc- Major Structures	m <sup>3</sup>
206.10	Str Earth Exc - Piers	m <sup>3</sup>
206.11	Str Rock Exc - Piers	m <sup>3</sup>
304.10	Aggregate Subbase Course - Gravel	m <sup>3</sup>
403.209	Hot Mix Asphalt, 9.5 mm(Swks, etc.)	Mg
403.210	Hot Mix Asphalt, 9.5 mm	Mg
403.213	Hot Mix Asphalt 12.5 mm Nominal Max. Size, Base	Mg
409.15	Bituminous Tack Coat, Applied	l
502.21	Structural Concrete Abuts & Ret Walls	m <sup>3</sup>
502.22	Str Conc Abut & Ret Wall Uw	m <sup>3</sup>
502.23	Structural Concrete Piers	m <sup>3</sup>
502.24	Str Conc Piers Uw	m <sup>3</sup>
502.25	Str Conc Superstr Slab	LS
502.31	Structural Concrete Approach Slab	LS
502.49	Structural Concrete Curbs and Sidewalks	LS
503.12	Reinforcing Steel, Fab & Del	kg
503.13	Reinforcing Steel, Placing	kg
508.14	High Performance Membrane Waterproofing	LS
510.11	Spec Det Ped Tr Only	LS
511.07	Cofferdam: Abutment No. 1	LS
511.07	Cofferdam: Abutment No. 2	LS
511.07	Cofferdam: Pier	LS
512.081	French Drains	LS
514.06	Curing Box for Concrete Cylinders	EA
515.21	Protective Coating for Concrete Surfaces	LS
526.323	Texas Classic Rail	LS
535.62	Prestressed Str Conc Box Beam	LS



603.169	375 mm Culvert Pipe Option III	m
603.179	450 mm Culvert Pipe Option III	m
604.072	Catch Basin Type A1-C	EA
604.164	Rebuilding Catch Basin	EA
606.172	Bridge Transition Type 1	EA
606.18	Gr Tp 3b - Double Rail	m
606.265	Terminal End- Single Rail- Galv Steel	EA
606.35	Guardrail Delineator Post	EA
606.55	Guardrail Type 3 - Single Rail	m
606.59	Gr Tp 3 -4.5m Radius & Less	m
606.76	Modified Eccentric Loader Terminal	EA
609.11	Vert Curb Type 1	m
609.237	Terminal Curb Type 1 - 2.1 m	EA
610.08	Plain Riprap	m <sup>3</sup>
610.09	Hand Laid Riprap	m <sup>3</sup>
613.319	Erosion Control Blanket	m <sup>2</sup>
615.07	Loam	m <sup>3</sup>
618.1301	Seeding Method Number 1, Plan Quantity	UN
618.1411	Seeding Method Number 3, Plan Quantity	UN
619.1201	Mulch - Plan Quantity	UN
619.1401	Erosion Control Mix	m <sup>3</sup>
620.58	Erosion Control Geotextile	m <sup>2</sup>
627.711	White or Yellow Pvt. Marking Line, Plan Quantity	m
629.05	Hand Labor, Straight Time	MH
631.12	All-Purpose Excavator (Inc Operator)	HR
631.14	Grader (Including Operator)	HR
631.15	Roller Earth Base Crs (Inc Op)	HR
631.172	Truck-Large (Inc Operator)	HR
631.22	Front End Loader (Inc Oper)	HR
635.14	Prefabricated Concrete Modular Gravity Wall	m <sup>2</sup>
637.071	Dust Control	LS
639.18	Field Office Type A	EA
643.72	Temporary Traffic Signal	LS
652.361	Maint Of Traff Control Dev	LS
652.38	Flagger	MH

652.39	Work Zone Traffic Control	LS
656.75	Temp. Soil Erosion and Water Pollution Control	LS
659.10	Mobilization	LS
660.21	On-The-Job Training (Bid)	MH
845	Structural Steel Utility Support (Portland Water District)	LS

## Deck Replacement

<b>Item #</b>	<b>Description</b>	<b>Unit</b>
202.10	Rem Exist Superstrs Prop Contr	LS
202.12	Rem Exist Structural Concrete	m <sup>3</sup>
203.20	Common Excavation	m <sup>3</sup>
304.10	Aggregate Subbase Course - Gravel	m <sup>3</sup>
403.210	Hot Mix Asphalt, 9.5 mm	Mg
403.213	Hot Mix Asphalt 12.5 mm Nominal Max. Size, Base	Mg
409.15	Bituminous Tack Coat, Applied	l
502.219	Struc Conc, Abut & Ret Wall	LS
502.26	Str Concrete Rd&Sw Slab On Steel Bridges	LS
503.12	Reinforcing Steel, Fab & Del	kg
503.13	Reinforcing Steel, Placing	kg
503.14	Epoxy Coat Rein Steel Fab&Del	kg
503.15	Epoxy Coat Rein Steel Plac	kg
503.17	Mechanical Welded Splice	EA
505.08	Shear Connectors	LS
507.0848	Barrier Mounted Steel Bridge Rail, 2 Bar	LS
508.13	Membrane Waterproofing	LS
515.21	Protective Coating for Concrete Surfaces	LS
521.23	Exp Device - Finger Joint	EA
521.41	Fabric Curtain - Finger Joint	EA
523.07	Elastomeric Bridge Bearing - Laminated	EA
526.301	Temporary Concrete Barrier Type I	LS/m
526.321	Permanent Concrete Barrier Type IIIA	m
606.15	Gr Tp 3a - Sgl Rail	m
606.1721	Bridge Transition Type 1	EA
606.36	Gr Removed And Reset	m

615.07	Loam	m <sup>3</sup>
617.30	Composted Bark Mix	m <sup>3</sup>
618.1411	Seeding Method Number 3 - Plan Quantity	UN
618.15	Temporary Seeding	kg
618.25	Applied Water	m <sup>3</sup>
629.05	Hand Labor, Straight Time	MH
631.12	All-Purpose Excavator (Inc Operator)	HR
631.132	Small Bulldozer (Inc Operator)	HR
631.14	Grader (Including Operator)	HR
631.15	Roller Earth Base Crs (Inc Op)	HR
631.172	Truck-Large (Inc Operator)	HR
637.071	Dust Control	LS
639.18	Field Office Type A	EA
645.13	Guide Sign - Overpass Mounted	LS
652.33	Drum	EA
652.34	Cone	EA
652.39	Work Zone Traffic Control	LS
656.75	Temp. Soil Erosion and Pollution Control	LS
659.10	Mobilization	LS

## 10.4 Rounding

### Quantity Types

There are two types of quantities, quantities arrived at by counting (trees, catch basins, single posts, etc.) and quantities arrived at by calculations (excavation, portland cement concrete and summation of linear footage such as guardrail and culvert pipe.)

### Counted Items

For counted items, the estimated quantity shall be the actual total count as taken from the plans.

### Rounding Calculated Items

For calculated quantities the following rules shall apply (except as provided in Rounding Exceptions, section 0.5, below).

- A. Total quantities less than 1.0 may be rounded upward not more than 0.1 unit.
- B. Total quantities of 1 and over and less than 10 may be rounded upward not more than 0.5 unit.
- C. Total quantities of 10 and over and less than 100 may be rounded upward not more than 1 unit.
- D. Total quantities of 100 and over and less than 1,000 may be rounded upward not more than 10 units.
- E. Total quantities of 1,000 and over and less than 10,000 may be rounded upward not more than 50 units.
- F. Total quantities over 10,000 shall be rounded to the nearest third significant figure.

### Rounding Exceptions

- A. Structural Concrete quantities, when not on ledge rock, shall be rounded to the nearest 1 cubic yard.
- B. Reinforcing steel quantities shall be rounded to the nearest 100 pounds.
- C. Bridge Railing and Vertical Bridge Curb quantities shall be rounded to the nearest 1 linear foot.