



CHAPTER FOURTEEN
ESTIMATING QUANTITIES

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Chapter Fourteen

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Chapter Fourteen

ESTIMATING QUANTITIES

14-1 GENERAL

14-1.01 Objective

One of the most important responsibilities of the designer is to compile an accurate estimate of the project construction quantities. This information leads directly to the Engineer's Estimate, which consists of two elements: 1) computed quantities of work, and 2) the estimated unit bid prices expected. An accurate estimate of quantities is critical to prospective contractors interested in submitting a bid on the project.

Chapter Fourteen presents detailed information on estimating quantities for highway construction projects. The designer should recognize that most information available from the Department is public information and should not be withheld from anyone making a reasonable request. However, the Engineer's Estimate must remain *CONFIDENTIAL* as designated by Maine Statute. All personnel are advised not to reveal the total estimated cost of projects with anyone outside the Department before or after bid opening.

14-1.02 Estimates for Pay Items

Section 14-2 presents detailed information for estimating quantities for construction pay items. Section 14-3 presents rounding and adjustment factors specifically for calculating the quantities for the pay items. The following also applies to estimating quantities:

1. All items should be cross checked against the *Standard Specifications* and Supplemental Specifications to ensure that the appropriate pay items, methods of measurement and bases of payment are used.
2. In preparing the preliminary estimate computations, a separate sheet should be included for each item used on the project, although the quantity may be computed in another section of the estimate with some related item. In this case, a cross reference to the location of the computations is needed.

3. The quantity of any item shown on the estimate form should check exactly with the figure shown on the computation sheet. Any rounding of the raw estimated figures should be indicated on the computation sheets. *See Section - 14-1.03 #5 below.*
4. Some projects will require two or more estimates, representing the work done under various financing arrangements. Thus, work performed for a town (e.g., sewers, sidewalks) under the contract and according to a "Town Agreement" will be on a separate estimate. Similarly, separate estimates will be prepared for "Non-Federal" work and for work on each highway system on the project. Specific instructions regarding the several estimates required will be obtained from the Group Leader. A combined estimate should also be made with total quantities for the project when two or more estimates are required.
5. Each item within the estimate computations should have a separate page. Items which require more than one page should have a one page summary listing the sheet totals and quantity totals for the appropriate item. This summary page should index the other pages for the item.

14-1.03 Engineer's Estimate Form

The designer should follow these procedures in preparing the Engineer's Estimate Form (see Appendix 14A):

1. Use only the standard ESTIMATOR estimate form. The estimate is entered into the computer; therefore, the information must be provided in a consistent manner.
2. Complete the top of the Estimate Form as completely as possible, including route and highway numbers, towns, county, estimator, PIN and Federal project number.
3. Be sure the project number is correct. This includes not only the numerical digits but also the prefix letter, if needed.
4. Make sure that the official project length agrees with the plan title sheet.
5. Be realistic when entering quantities and prices. Use the "Rules for Rounding" in Section 14-3 for estimated quantities. Avoid amounts in the "cents" column, if possible.

6. Small quantities of rock excavation may be a separate bid item or paid at six times the earth excavation price and included as a non-bid computer item.
7. For lump-sum items used on several estimates, prorate the share for each in accordance with monetary value. For example, A Field Offices≡ should be prorated in accordance with the total cost, whereas A Testing Facilities, Bituminous Mixes≡ should be prorated in accordance with the value of the bituminous items used.
8. Be sure quantity and price extensions are mathematical. For example, L.S. x \$25,000 does not equal \$25,000; show as 1 x \$25,000. Also, 33 percent x 3,000 does not equal 990; show as 0.33 x 3,000 = 990. Show to two decimals only.
9. Be sure items are listed in numerical order by item number.
10. Be sure the **writing** is **legible** and **dark** enough so that the estimate can be photocopied.
11. The following will apply to lump-sum items:
 - a) When a lump-sum item has an underlying quantity that can be computed, enter the underlying quantity and the unit price to extend out to the lump-sum price.
Example:

Item No.	Description	Unit	Quantity	Unit Price	Amount
202.19	REMOVING EXISTING BRIDGE	LS/CY	200	\$ 200	\$ 40,000
502.31	STRUC CONC APPROACH SLAB	LS/CY	21	\$ 280	\$ 5,880
504.71	STRUCTURAL STEEL ERECTION	LS/LB	200,000	\$ 0.10	\$ 20,000

- b) If a lump-sum item's underlying quantity cannot be estimated or consists of several items with a known quantity (such as removal of a bridge with 100 tons of structural steel and 160 yards of concrete), then enter a quantity of 1 with the unit price equal to the lump-sum price. Example:

Item No.	Description	Unit	Quantity	Unit Price	Amount
202.19	REMOVING EXISTING BRIDGE	LS/CY	1	\$50,000	\$ 50,000

- c. When a lump-sum item does not have an underlying quantity, the quantity should be entered as 1 with the unit price equal to the lump-sum price. Example:

Item No.	Description	Unit	Quantity	Unit Price	Amount
659.10	MOBILIZATION	LS	1	\$30,000	\$ 30,000

- d. When a lump-sum item is used more than once on a project, repeat the item number and append a supplemental description. Example:

Item No.	Description	Unit	Quantity	Unit Price	Amount
202.08	REMOVE BUILDING #1	LS	1	\$ 500	\$ 500
202.08	REMOVE BUILDING #2	LS	1	\$ 2,000	\$ 2,000
506.18	CONTAIN & POLLUT CONTROL <u>BR#1</u>	LS/LB	100,000	\$ 0.10	\$ 10,000
506.18	CONTAIN & POLLUT CONTROL <u>BR#2</u>	LS/LB	100,000	\$ 0.10	\$ 10,000

14-2 PROCEDURES

This Section presents the procedures the designer should follow for estimating construction quantities for pay items. The designer should also note that many references to plan notations will be found throughout this section. In general, notations should not be duplicated; for example, clearing notes (Station to Station and side) should be placed only on the sheet where the particular clearing area begins. Notations for the item and location of work on the plans should be the same as in the estimate to facilitate cross-reference. Unusual notations should be presented in the General Notes not on the plans.

201.11 Clearing - Acres

The designer should follow these procedures:

1. Clearing shall be estimated for all wooded areas bounded by clearing lines.
2. Clearing lines may be defined as a line showing the break between a wooded area and a clearing or as a line showing the limit of a wooded area to be cleared.
3. Clearing areas shall be designated during the final field inspection.
4. Outside clearing lines shall be placed parallel to and 10 feet (15 feet for freeways in non-guardrail fills and low cut slopes) from the slope lines. Clearing lines may extend beyond the R/W line with easements.
5. Thin windrows or unprotected clumps of trees created as a result of standard clearing designations should be reviewed for inclusion in the clearing areas.
6. All clearing lines, except those defined by a general note to be parallel to the slope lines, shall be clearly shown and labeled on the plans.
7. Clearing areas shall be noted on the plans with the beginning and end stations and side shown. Beginning and end stations should be the actual point of beginning or ending at right angles to centerline regardless of skew. An exception to this may be taken on some projects when the clearing is spotty and/or overlapping, if full clearing lines and some type of delineation like hatching or shading is used.
8. When no item for clearing is included in the contract, any necessary clearing is paid under Subsection 109.3, unless otherwise noted in the General Notes.

9. The estimated quantity of clearing shall be determined by any of the following methods:
 - a. average width and length,
 - b. planimeter, and
 - c. computer program.
10. When clearing is less than 0.5 acres, it will be considered incidental to the contract and so designated in the General Notes.

201.12 Selective Clearing and Thinning - Acres

The designer should follow these procedures:

1. Selective clearing and thinning may be designated for the following areas:
 - a. the area between the clearing lines and the R/W lines,
 - b. the median area between clearing lines on divided highways,
 - c. areas beyond clearing lines of ramp gores, and
 - d. special areas requested by the Landscape Architect, including areas outside the R/W, where landscaping work easements have been obtained.
2. Any designation of selective clearing and thinning areas must have the approval of the Project Manager.
3. When selective clearing and thinning is used, the width of the area shall be limited to 100 feet unless otherwise requested by the Landscape Architect and approved by the Project Manager.
4. All selective clearing and thinning lines, except those defined by a general note to be parallel to the clearing lines, shall be clearly shown and labeled on the plans.
5. Selective clearing and thinning areas shall be noted on the plans with the beginning and end stations and side shown. Beginning and end stations should be the actual point of beginning or ending at right angles to the centerline regardless of skew. An exception to this may be taken on some projects when the selective clearing is spotty and/or

overlapping, if full selective clearing lines and some type of delineation like hatching or shading is used.

6. The estimated quantity of selective clearing and thinning shall be determined by any of the following methods:
 - a. average width and length,
 - b. planimeter,
 - c. computer program.

7. Certain areas outside the R/W lines, such as areas adjacent to muck storage areas, may be designated for clean-up. If so, they shall be noted on the plans, and the work required will be paid for under Item No.629.05, Hand Labor Straight Time, Item No. 631.18, Chain Saw Rental (including operator) and other applicable equipment rental items. Selective clearing and thinning should not be used for this purpose. NOTE: This work should be noted on the plans as Equipment Rental, or the work will be Blue Book Rates.

201.23 Removing Single Tree Top Only - Each

Trees less than 1-foot in diameter will not be considered as trees under this item. Trees in clearing areas will be paid for as clearing.

201.24 Removing Stump - Each

The designer should follow these procedures:

1. Refer to Subsection 201.09 of the *Standard Specifications* for the method of measurement for multiple trunk trees. Stumps are considered to be such if less than 5 feet in height.

2. A tree which will be removed entirely will be estimated under both the item for "Removing Single Tree Top Only" and "Removing Stump".

3. Trees and stumps to be removed shall be marked "Remove" on the plans. Details, such as whether or not the stump is also to be removed, are to be omitted from this note because this information is given in the table in No. 4.

4. Tree and stump removal are to be listed in tabular form in the profile portion of the plans with stumps, if any, listed opposite the corresponding tree.

STA.	OFFSET	TREE	STUMP
520 + 10	51' Lt.	20" Oak	20"
521 + 80	40' Lt.		12"
521 + 90	35' Lt.	14" Pine	*

* Indicates that stump removal not required.

5. All stumps in grubbing and excavation areas, which are located outside of designated clearing areas and have resulted from a tree removal on the project must be estimated for removal under the stump removal item. Other stumps should be removed, as necessary, to allow the project to be satisfactorily completed.
6. Removal of stumps in areas where disruption to the surrounding ground is not desired may be done under and paid for by Item 631.20, Stump Chipper Rental (incl. operator). The Project Manager shall determine when to use Stump Chipper Rental instead of Stump Removal.
7. All bushes, shrubs and non-pay trees outside clearing or selective clearing and thinning areas should be noted to be removed.

202.0801 Removal of Building No. 1 Lump Sum

202.0802 Removal of Building No. 2 Lump Sum

202..... Removal of Building No. . . Lump Sum

The designer should follow these procedures:

1. The disposition of all private property (buildings, gas pumps, underground tanks, appurtenances, etc.) shall be determined by the Chief of R/W Operations and shall be noted on the plans.

2. In general, a group of buildings under one ownership, such as a house, barn and garage, shall be estimated as separate bid items, one for each building. This procedure will allow the property owner the option of removing one building only for salvage value and leaving the other buildings without interrupting the Contractor's bid.
3. Each building to be removed shall be clearly noted adjacent to the subject building as to station, side, item number and description.

Example: Sta. 24 + 10 Lt., Item No. 202.0801, Removal of Building No. 1, 1½ story house.

4. It should be noted that the standard pay item for removal of buildings includes only that portion of the building above the foundation and does not include filling the foundation cavity or removal of the foundation, when required. The filling, or removal, of foundations, therefore, should be estimated under normal earthwork items, unless this work has been specifically included in any special provision written concerning the removal of a particular building.
5. Building removal items, reserve limit lines and dates of availability should be reviewed with the R/W Division just prior to advertising the project.

202.11 Removing Portland Cement Concrete Pavement - Square Yard

The amount of concrete pavement that shall be estimated to be removed shall be that amount noted on the plans and cross sections. In general, concrete pavement shall be removed when the depth from finished grade to the top of the concrete pavement is 3 feet or less.

202.12 Removing Existing Structural Concrete - Cubic Yard

The designer should follow these procedures:

1. This item is normally used in bridge work but may be used when a highway designer wishes to remove portions of foundations, retaining walls, etc. The estimated quantity should be the cubic yards of structural concrete to be removed.
2. The designer also has the option to use rock excavation (structural or common) either as a bid item or non-bid item to get this type of work done, but he is cautioned that he must note how any remaining portions of the structure should be left and that there will be no separate payment for the necessary trimming work.

202.13 Removing Existing Railings (Retained by Department) – Linear Foot**202.14 Removing Existing Railings (Property of Contractor) – Linear Foot**

These items are normally used in bridge work but may be used by the highway designer when he wishes to salvage hand rails, ornamental rails, special protective rails, etc., and/or when the removal and disposal of an existing rail will be a costly operation for the Contractor. The estimated quantity is the number of linear feet of rail from outside to outside of end posts measured along the grade and line of the rail.

202.15 Removing Manhole or Catch Basin - Each

This work shall consist of the removing and demolishing of existing catch basins, manholes, or end walls necessary for successful project completion. These items shall be clearly noted to be removed on the plans.

202.202 Removing Pavement Surface - Square Yard

The following will apply:

1. This item should be used on partial-depth, bituminous pavement grinding only.
2. Use common excavation for removing bituminous pavement over portland cement concrete pavement.

202.203 Pavement Butt Joints - Square Yard**203.20 Common Excavation - Cubic Yard****Sum of Common Excavation Quantity**

The amount of "Common Excavation" to be estimated for a project shall be the cumulative summary of the following items that shall be considered on all projects:

1. **Common Excavation from Cross Sections.** This item shall consist of all earth removal shown on the cross sections including grubbing and muck excavation. This quantity will

be determined by use of the computer or planimeter. Volumes shall be computed by the average end area method or by other methods generally recognized as conforming to good engineering practice.

2. **Drives.** This item shall consist of all common excavation required to construct the drives as shown on the cross sections. This quantity shall generally be determined by the use of width, length and depth measurements.
3. **Removing Existing Roadways.** If not otherwise accomplished through the use of equipment rental items, this work shall consist of the earth excavation required to remove old pavement from designated areas outside the embankment area to prepare these areas for loaming and seeding. Obliteration of old roadways is to be noted on the plans. The material so removed will be considered available for the embankment construction process. Removing old concrete pavement may be done as common excavation but, normally, it will be done under Item 202.11 Removing Portland Cement Concrete pavement.

Removing existing bituminous pavement within or outside embankment areas must be salvaged, and the quantity will be estimated in cubic yards and paid for as Common Excavation.

4. **Grubbing in Fill Sections.** When the depth of an embankment (measured vertically below subgrade) is 5 feet or less, the area upon which the embankment will be placed shall be grubbed to remove all trees and stumps less than 12 inches, roots, bushes, grass, turf or other objectionable material. The outside grubbing limit shall be established as follows:
 - a. When the depth of embankment below subgrade is 5 feet or less but greater than 2 feet, the outside grubbing limit shall be constant. This constant offset shall be determined by intersecting a 1:1 slope from the shoulder edge with the old ground based upon a normal roadway section that measures 5 feet from old ground to subgrade.
 - b. When the depth of embankment is less than 2 feet, the outside grubbing limit shall be the subgrade slope/side slope intercept unless the distance from the subgrade slope/side slope intercept to the beginning of the ditch excavation is less than 10 feet, and greater than 5 feet. If this width is less than 10 feet, grubbing shall extend to the beginning of the excavation.

In areas where the vertical distance from subgrade to old ground is irregular and exceeds 5 feet for short distances, grubbing shall be continuous to avoid small ungrubbed areas and sharp breaks in the grubbing lines.

Grubbing in fill areas shall be shown on the cross sections and the estimated quantity indicated as a station-to-station quantity in cubic yards (G 27 CY).

When grubbing is required beyond the toe and/or top of slopes to remove objects that would be hazardous if struck by out-of-control vehicles, it shall be estimated and paid for under the applicable equipment rental which shall be included in the Schedule of Items, as so noted in the General Notes.

If specific information concerning the depth of grubbing is not available from soils reports or other sources, grubbing depths for projects located in maintenance regions 4 and 5 (Aroostook, Hancock, Penobscot, Piscataquis and Washington Counties) shall be 15 inches for clearing areas and 9 inches for other areas. Grubbing depths for projects located elsewhere shall be 12 inches for clearing areas and 6 inches for other areas. This is summarized below:

Maintenance Region	Woods	Other Areas
4 & 5	15"	9"
All Others	12"	6"

5. Benching. When fills are placed on hillsides or existing embankments with slopes steeper than 2:1, benching must be indicated on the cross sections. Generally, benches should be a minimum of 10 feet in width and be designed so that a bulldozer can cut them in a continuous manner from one station to another. The payment of benching shall be incidental to item 203.20, Common Excavation.
6. Salvaged Topsoil. This item shall consist of that amount of excavation required in embankment areas to salvage topsoil from embankment areas.
7. Overlays. On overlay projects when a culvert pipe is replaced, the quantity of excavation in the trench down to a theoretical subgrade line is paid for as Common Excavation.
8. Waste Storage. Waste storage will be estimated and used only on borrow projects, and the area must be shown on the cross sections as detailed in the Standard Detail Book. In culvert locations, waste storage must not be placed within 5 feet of the outside diameter of the proposed culverts.

Waste storage areas must be shown on the cross sections and the estimated quantity indicated as a station-to-station quantity in cubic yards (WS 27 CY).

Excavation for Slope Blanket - cubic yard

For non-bid item, use number 203.2009 for computer input. Excavation for slope blanket shall be estimated for those areas where there is a possibility of unstable backslopes. These areas will generally be specified in the Soils Report. The total bid quantity of excavation for slope blanket shall be shown in the Engineer's Estimate as a non-bid item and the unit price established as twice the unit price of common excavation. The notation of excavation for slope blanket should be similar to the following:

Sta. 25+30 to Sta. 27+20 Lt
Excavation for Slope Blanket
Aggregate Subbase for Slope Blanket
Estimated Quantity = 130 CY
Depth: 18"

Muck Excavation - Cubic Yard

The designer should follow these procedures:

1. The amount of muck excavation to be estimated shall be the entire amount of muck shown on the cross sections.
2. The muck excavation limit lines and the embankment areas designated for the disposal of waste materials shall be determined as shown in Standard Detail Book page 203(01).
3. Plot the depth and horizontal dimensions of muck excavation on the cross section and note the station-to-station volume in cubic yards (example M 369 CY).
4. Plot the depth of muck on the profile and note the station-to-station limits on the cross section.
5. In disposing of the muck, every effort shall be made to provide muck storage within the highway embankments adjacent to the excavation area.
6. The width will be determined by a 1:1 slope from the edge of the shoulder to the bottom of the muck excavation or to the toe of fill slope, whichever produces the smaller width

203.21 Rock Excavation - Cubic Yard

The designer should follow these procedures:

1. The amount of "Rock Excavation" estimated for a project shall be the cumulative sum of the applicable items as follows:
 - a. Rock Excavation from Cross Sections: This shall consist of all rock excavation shown on the cross sections and as detailed in the typical sections for removal. It should be noted that rock excavation will be paid to the neat lines shown and that no over breakage is to be estimated.
 - b. Boulders: This shall consist of all boulders (exposed or subsurface) requiring removal which have a volume of 2 cubic yards or more. If the quantity of boulders is extensive, an attempt should be made to determine the amount involved, and consider bidding the excavation unclassified.
2. When the volume of rock excavation is less than 1000 yards and is also less than 5 percent of the common excavation volume, the quantity will be shown as a non-bid item and the unit price established as 6 times the common excavation unit price.
3. Pay to the 4:1 backslope.
4. The estimated quantity of rock excavation shall be shown on the cross sections as a station-to-station quantity in cubic yards (Example: R 59 CY).

203.211 Presplitting Rock – Linear Feet

Place holes 18 inches apart along the plane of fracture to the bottom of the proposed cut.

203.22 Unclassified Excavation - Cubic Yard

The designer should follow these procedures:

1. On certain projects where the excavation consists of a high percentage of boulders and/or soft ledge, unclassified excavation may be used in lieu of classifying the excavation.

2. In order that the Contractor can intelligently bid on the project and an accurate estimate of the total excavation can be made, rock excavation shall be shown on the cross sections as outlined under Subsection 203.21 of this Chapter.
3. Because the price per cubic yard of unclassified excavation will be higher than that for common excavation, extra care should be used in estimating this item.

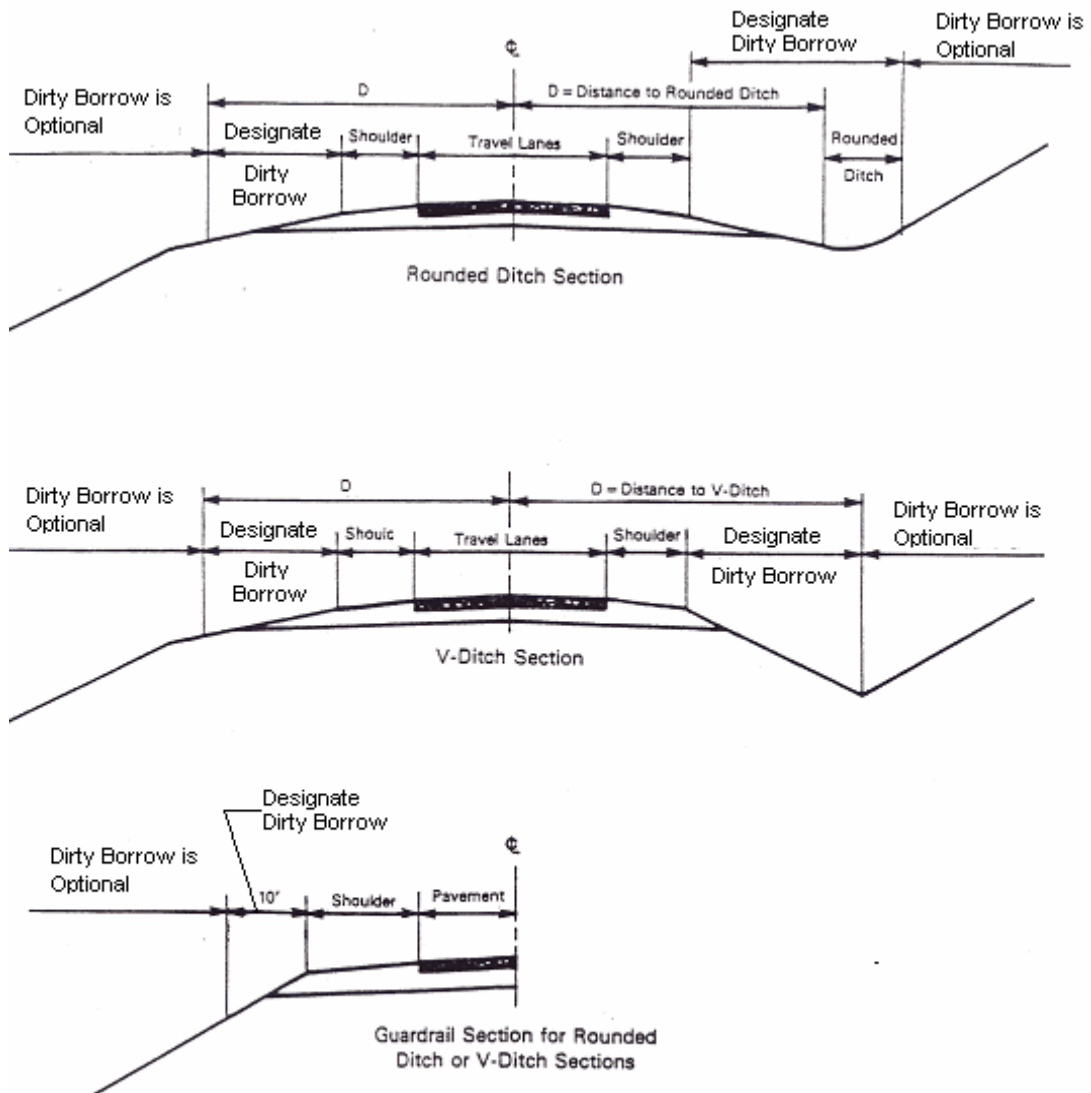
203.24 Common Borrow - Cubic Yard

The designer should follow these procedures:

1. This item shall be used to provide fill material as necessary to complete the embankments on a project.
2. To determine the estimated quantity of common borrow, a summary of the project earthwork should be prepared as outlined on the standard form for Computation of Preliminary Quantities, Appendix 2D.

203.24 Dirty Borrow - Cubic Yard

The amount of Dirty Borrow to be estimated for a project shall be that amount required under Seeding Method #2 and areas specified on the Plans and/or Cross Sections measured in place. The depth of Dirty Borrow shall be estimated at 2" unless specified differently. See Figure 14-1.



POLICY ON LOAMING HIGHWAY SLOPES

Figure 14-1

203.25 Granular Borrow - Cubic Yard

The amount of granular borrow to be estimated for a project shall be the sum of the applicable possible usages of granular borrow as described:

1. **Granular borrow to replace muck.** In general, all removed muck shall be replaced with granular borrow. Rock excavation should be used to replace muck only when the available quantities of embankment materials would require the wasting of rock excavation unless it were used to replace muck or when the estimated cost of granular borrow would appear to be excessive. Whenever rock excavation will be used, a 2-foot minimum depth initial layer of granular borrow should be specified.
2. **Granular borrow for use in low, wet areas.** Granular borrow shall generally be estimated for the bottom (2-foot) of embankments in low, wet areas. The width of this initial layer should be limited to that area inside the waste area storage lines. The locations and depths required for this usage can generally be determined from the soils report and/or the field inspection. In addition, when grubbing or muck excavation is replaced with granular borrow, the granular borrow shall be brought to a minimum of 1-foot above water level.
3. **Granular borrow for embankment construction near bridges and box culverts.** The limits of the granular borrow embankments for this usage will be determined by the Bridge Design Division and shall be appropriately defined on the highway plans.
4. **Granular borrow for maintenance of traffic.** The specifications for most projects that are required to carry traffic during construction will generally require a minimum roadway width of 20 feet two lanes of traffic. In many instances, this specification will cause the widening of the existing roadway or the topping of partially completed embankments to provide the required width. In both instances granular borrow will be used to accomplish the desired results.

On overlay projects, include this item as Truck Measure.

5. **Granular borrow for culvert bedding.** If granular borrow is used for this purpose, a general note should be made on the plan stating that payment will be made as granular borrow and that the material meets the requirements of granular borrow for underwater backfill.

6. **Granular borrow for general embankment construction.** The following applies:
- a. On some projects a certain percentage of the borrow requirements will be estimated as granular borrow to aid in the construction of embankments by allowing alternate layers of granular material and excavated material to be placed.
 - b. On some projects when a large supply of granular borrow is readily available, the entire borrow requirements may be estimated as granular borrow. If this decision is made, the estimating procedure described under Item 203.24 Common Borrow should be followed.
 - c. On some projects, if required by the nature of common excavation or by seasonal variations, granular borrow should be blended with excavated material in the embankments to facilitate construction and maintenance of traffic.

A summary of the granular borrow requirements shall be made, and this summary shall be shown on the earthwork summary.

203.26 Gravel Borrow - Cubic Yard

203.261 Gravel Borrow (I.P.M.) - Cubic Yard

Gravel borrow is most frequently used for construction near bridges and box culverts and is now often being replaced by granular borrow. The limits of the gravel borrow and the method of measurement will normally be determined by the Bridge Design Division and shall be appropriately defined on the highway plan.

203.27 Rock Borrow - Cubic Yard

The designer should follow these procedures:

1. Whenever the amount of rock fill, rock for slope protection, or other rock uses exceeds the amount of available rock excavation, rock borrow shall be estimated.
2. The required locations of rock fill shall be shown and noted on the profile and cross sections, and rock for slope protection shall be noted on the plans and cross sections and shown on the typical sections and/or cross sections.
3. Care should be taken to ensure that the required amount of rock borrow estimated in place is shrunk 25 percent prior to being placed on the Engineer's Estimate as rock borrow.

203.29 Selected Granular Material - Cubic Yard

This item is an open-graded granular material which is normally used only for Interstate subbase construction. The quantity for the estimate and payment is computed in place measured from the typical sections and/or height, width and length measurements where applicable. Use of this item will be determined by the Project Manager at the time that the typical sections are being developed.

203.30 Lightweight Borrow - Cubic Yard**203.31 Lightweight Borrow - Ton**

The designer should follow these procedures:

1. This item is a lightweight (less than 65± lbs per cubic foot) expanded shale or slate fill material which may be used where it is necessary to decrease soil weight to be able to construct a fill to the planned grades.
2. Other methods to accomplish similar results should also be considered:
 - a. toe fill counterweights,
 - b. staged embankment construction and time,
 - c. sand drains and time,
 - d. stabilization geotextiles
 - e. plastic lightweight embankment,
 - f. excavation and replacement of sensitive material, and
 - g. various combinations of the above as recommended by the Soils Engineer.
3. Lightweight borrow is measured in cubic yards completed in place. The dimensions used for measurements will be those shown on the plans as normally provided by the Soils Section.

204.41 Rehabilitation of Existing Shoulder, Plan Quantity - Square Yard

The amount of shoulder rehabilitation shall be that amount as measured from the plans in square yards. This item should be used on resurfacing type projects with gravel shoulders only.

205.51 Widening of Existing Shoulder - Square Yard**206. Structural Earth Excavation Drainage and Minor Structures - Cubic Yard**

Structural earth excavation shall be estimated as required for all drainage systems on a project. It shall be estimated for culverts, underdrains and catch basins. Payment is incidental to the structure. The total quantity should be listed in the general notes. Ditches at inlets and outlets of culverts, special ditches and channel excavation will be paid under Item 203.20.

Because of the desire for uniformity between projects the following guides must be used by all designers in estimating structural earth excavation drainage:

1. **Underdrain.** Structural earth excavation drainage for underdrain shall be estimated for the widths specified in the standard details and for a length and depth as shown on the plans. When underdrains are connected to a catch basin, structural earth excavation drainage shall be estimated to within 18 inches of the outside wall of the catch basin.
2. **Culverts.** Culverts are normally installed as positive projecting conduits. The quantity of structural excavation estimated shall be based upon the length, width and depth of excavation (include only material not otherwise removed) necessary to place the pipe to the proposed line and grade and width of 30 inches plus the outside diameter of the pipe. The wall thickness of rigid pipes should be used in computing the quantity of structural excavation. Wall thickness equals in inches:

$$\frac{\text{size of pipe in inches}}{12} + 1$$

When culverts will be installed as zero projecting conduits or by imperfect (induced) trench method, the quantity of structural earth excavation estimated shall be the volume determined from the special details shown on the plans or cross sections.

When culverts are connected to catch basins, structural earth excavation drainage shall be estimated to within 18 inches of the outside wall of the catch basin.

3. **Catch Basins.** In excavation areas the quantity of "structural earth excavation drainage" to be estimated is that volume below subgrade that must be removed to vertical planes (circular or flat) 18 inches outside the neat lines of the base as shown on the plans.

If the catch basin has a culvert connected to it that will be installed as a zero projecting conduit, the depth of structural earth excavation drainage estimated shall be based upon a depth from the top of the trench for the culvert to the bottom of the catch basin base.

In fills, structural excavation for underdrain, catch basins, manholes and interconnecting pipes within a closed drainage system should be estimated from the subgrade elevation.

206.061 Structural Earth Excavation - Drainage and Minor Structures, Below Grade – Cubic Yard

This item is structural excavation which has been limited to below a plane parallel with and 12 inches below the bottom of drainage structures. Computation of the quantity is the same as for Standard Structural Excavation within the limits set in the 206 Items. Add 50 CY for undetermined locations.

206.07 Structural Rock Excavation - Drainage and Minor Structures - Cubic Yard

The designer should follow these procedures:

1. When rock is encountered, structural rock excavation-drainage shall be estimated using the same criteria and the same horizontal excavation limits as in structural earth excavation. The depth for measurement will be the actual depth required.
2. Estimate 12 inches below the bottom of the pipe for culvert pipes and Underdrain Types "B" and "C".
3. Estimate 6 inches below the bottom of catch basins and manholes.
4. If the total quantity of structural rock excavation is less than approximately 100 CY, the quantity will be shown as a non-bid item and the unit price established as six times the Structural Earth Excavation, Drainage and Minor Structures Below Grade unit price.
5. Use number 206.0707 for computer input when treating this item as a non-bid item.

206.14 Special Backfill - Cubic Yard

Special backfill is only estimated for those locations called for on the plans and is normally specified by the Bridge Program for use with larger structure. It can be called for in any location where circumstances dictate the use of a material having special properties which need to be defined.

304 Aggregate Base and Subbase

Element	Depths (typical)
Driveways	14-inch Aggregate Subbase (Unpaved) 12-inch Aggregate Subbase (Paved)
Sidewalks	12-inch Aggregate Subbase (Paved) 10-inch Aggregate Subbase (Concrete)
Foundations	2 feet
Slope Blanket	18 inches

304.08 Aggregate Base Course - Screened - Cubic Yard**304.09 Aggregate Base Course - Crushed - Cubic Yard****304.10 Aggregate Subbase Course - Gravel - Cubic Yard****304.11 Aggregate Subbase Course - Granular - Cubic Yard****304.12 Aggregate Subbase Course - Sand - Cubic Yard**

Note: The method of measurement of each of the above items may be changed by adding .001, .002 or .003 to the item numbers. .001 indicates Lump Sum Measure; .002 indicates Pit measure; .003 indicates Truck Measure. Example: Item 304.102 Aggregate Subbase Course - Gravel - cubic yard (Pit Measure).

The designer should follow these procedures:

1. The major portion of the total amount of aggregate base or subbase course of the type specified to be estimated for a project may be derived from the quantities shown on the typical sections. These quantities must be calculated in conformity with the standard procedure for typical section calculations.

2. In addition to the typical section quantities, the following areas should be considered for a base or subbase course quantity:
 - a. Driveways and sidewalks estimated by length, width and depth.
 - b. Non-standard areas where typical sections do not apply generally estimated by length, width and depth, or plan area and depth.
 - c. Variable depth bases and base shims these are generally estimated by using cross section areas and average end area volume computations methods.

3. Base and subbase depths and station-to-station limits must be shown on the typical section sheet. In addition, the station-to-station limits for each depth shall be shown on the cross sections.

4. The quantity of foundation material to be estimated for a project shall be determined in the following manner:
 - a. From the soils report, field inspection plans, or general knowledge of the area involved, select the drainage structures that may warrant the use of foundation aggregate.
 - b. Calculate the volume required using the length of culvert, maximum allowable trench width and a depth of 24 inches below the bottom of the pipe, unless known conditions require the use of a different depth.
 - c. An equal amount of structural excavation should be estimated to provide a place for this material.
 - d. Calculate the volume required for concrete steps as shown in the standard details and the volume required for slab walls or any other special usage.

Slope Blanket Protection

The quantity of aggregate for slope blanket is estimated to equal excavation for slope gravel blanket in cubic yards. Refer to Subsection 304.07, *Standard Specifications*, for basis of payment. It authorizes the use of aggregate base or subbase for slope blanket protection, bedding under drainage structures and other foundations, at twice the contract unit price for the respective material used. The Engineer's Estimate should separate these various uses and show them as a non-bid item. Call for aggregate subbase course of the type used on the project for roadway subbase material.

307. Full Depth Recycled Pavement - Square Yard**403.206 to 403.213 Hot Mix Asphalt - Ton (except as noted)**

The designer should follow these procedures:

1. The type and thickness of pavement courses will be determined by the Geotechnical Engineer in cooperation with the 403 Specification Coordinator, based on traffic data and the design methods given in AASHTO Guide for Design of Pavement Structures.
2. The quantities of the various materials used are determined from the dimensions shown on the plans or ARAN output. There are 110 lbs/sy/inch of compacted depth (i.e., 1.98 ton/cy). If paving is done over two construction seasons, estimate 50 tons of shim per mile of lane.
3. The designer will make a written request to the 403 Specification Coordinator for the various types of materials to be used. This request shall also include a copy of the typical sections, which shall indicate the various depths and widths.
 - 3a. The Project manager will make a written request to the Planning Division, Research, for ARAN to Geotech for FWD data.
4. On overlay projects, estimate a 6-foot taper to match existing paved drives.
5. On overlay projects, estimate 3 foot x 1 inch quantity at all gravel driveways and entrance locations.
6. On non-overlay projects, estimate 3' foot x 2 inch quantity at all gravel driveways and entrance locations.

403.211 Hot Mix Asphalt, (Shimming) – Ton

Estimate 50 tons per mile per two lanes, undetermined location, for projects with hot mix asphalt when the paving will be done in two construction seasons. This item may also be used at varying rates on certain overlay projects.

409.15 Bituminous Tack Coat, Applied - Gallon

Emulsified Asphalt, Applied. The tack coat rate is specified in the Pavement Mix Design form furnished by the 403 Specification Coordinator.

410. Bituminous Surface Treatment

The type of bituminous surface treatment will be determined by the Project Manager. The quantities of the various materials used shall be determined from the dimensions and notes shown on the plans.

411.09 Untreated Aggregate Surface Course - Cubic Yard**411.10 Untreated Aggregate Surface Course, Truck Measure - Cubic Yard**

The quantity of these items to be estimated shall be done in the same manner as aggregate base course. The item is normally used on resurfacing projects for shoulder and entrance grading. When estimating, increase the I.P.M. quantity by 15 percent to obtain the estimated Truck Measure quantity.

502.46 Structural Concrete Culvert Connection - Cubic Yard

The estimated volume shall be determined by the height, width and depth dimensions on the plans or in the special detail.

502.4711 Silica Fume Additive - Lump Sum

50 pounds per cubic yard concrete.

507.084 Steel Pipe Hand Railing – Lump Sum

Hand rail should be specified for each set of five or more steps. The quantity to be estimated shall be the total amount required as shown on the plans. Use the following table:

Required Length for the Number of Steps

No. of Step Risers	Length of Hand Rail (ft) Step Rise Ratio	
	<i>12" Step/6" Rise</i>	<i>12" Step/8" Rise</i>
5	5.5	5.8
6	6.6	7.0
7	7.7	8.2
8	8.8	9.4
9	9.9	10.6
10	11.1	11.8
11	12.2	13.0
12	13.3	14.2
13	14.4	15.4

509.11 to 509.411 Structural Plate Pipes and Pipe Arches - Lump Sum

The estimated cost of these items shall be determined by computing the mass of the structure as detailed on the plans and using a price per pound approved by the Bridge Design Section. The approximate mass of the structure in pounds shall be noted on the plans.

514.06 Curing Box for Concrete Cylinders - Each

This item should be considered but not automatically estimated whenever structural concrete is used on a project. The designer should check with the Bridge Design Division to see if the quantity of concrete and tests needed make this item necessary.

526.30 Temporary Concrete Barrier Type I – Linear Foot

526.301 Temporary Concrete Barrier Type I - Lump Sum

526.40 Resetting Temporary Concrete Barrier Type I – Linear Foot

These items will be estimated with assistance from the Design as part of the Traffic Control Plan (TCP).

601. Gabions and Mattresses - Cubic Yard

601.21 Gabions, Galvanized - Cubic Yard

601.22 Gabions, PVC Coated - Cubic Yard**601.221 Gabions, PVC Coated and Hand Filled - Cubic Yard****601.23 Mattresses, Galvanized - Cubic Yard****601.24 Mattresses, PVC Coated - Cubic Yard**

The use of these items is normally recommended by the Design Division if a major drainage diversion is planned, a severe erosion potential exists, or minor earth retainments are needed. Details concerning proper placement should be obtained from the Bridge Design Division.

603. Pipe Culverts and Storm Drains – Linear Foot

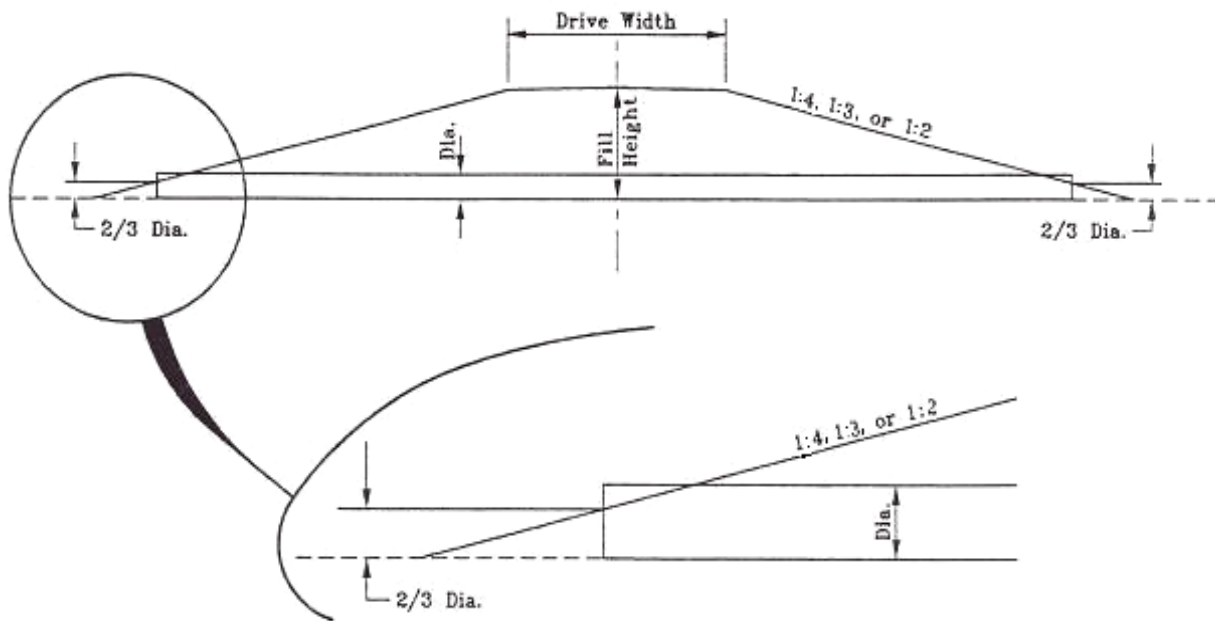
Prior to making the estimate for pipe culverts, the designer should determine what options, if any, will be allowed the Contractor. The current available options and their intended usages are listed below.

For all fills of 10 feet or more from finished grade, reinforced concrete pipe shall be used. Adjacent to railroads, coated or non-coated corrugated metal which is one thickness greater than the thickness DOT would normally be used for the same installation. These heavier thickness pipes for R/R use should be given a separate pay item.

The designer should follow these procedures:

1. **Culvert Option I.** Under this option the Contractor may furnish any of the following types of pipe: Corrugated Steel, Metallic Coated Pipe; Reinforced Concrete Pipe; or any pipe allowed under Option III. The usage of this option is intended to be for entrance culverts only. See Figure 14-1 for typical culvert installation at entrances.
2. **Culvert Option III.** Under this option the Contractor may furnish any of the following types of pipe: Fiber-bonded Corrugated Steel Pipes, Corrugated Aluminum Alloy Pipe, Polyvinyl chloride (PVC) Pipe, Polymer Precoated Galvanized Corrugated Steel Pipe, or Reinforced Concrete Pipe. The usage of this option is intended to be for roadway culverts and other drainage structures. Estimate in increments of 4 feet.
3. **Length (Option I).** This shall be estimated in increments of 2 feet.

4. **Length (Option III).** This shall be estimated in increments of 4 feet, except when used in closed drainage systems. In closed drainage systems, the actual lengths should be measured to the nearest 1-foot from inside wall to inside wall of catch basins.
5. **Temporary Culverts.** These shall be estimated under the appropriate contract item, usually Pipe Option I. When removed under the same contract, it will become the property of the Contractor. The plans shall be noted to show whether it will be removed under the contract being estimated.
6. **Induced Trench.** Whenever the "Induced Trench" method of culvert installation is specified, an appropriate note on the cross sections should be added to make the cost of the trench backfill material incidental to the culvert.
7. **Item Nos./Sizes.** The designer should refer to the Special Provisions to obtain the item numbers and pipe sized for the various pipe options.
8. **Skewed Pipes.** Particular care should be taken when estimating the length of skewed pipes under flat-sloped fills because the pipe and locations vary considerably with relatively small changes in the existing ground/or the template.
9. **Strength/Class.** The strength and class of each pipe should be checked and all special class pipes should be under individual pay items not under a standard culvert option.
10. **Flexible Pipes.** Flexible pipes 48 inches and larger on 2:1 slopes shall have ends cut to a partial bevel as shown in the Standard Details. Payment length for these pipes is the length along the invert of the installed pipe.
11. **Elbows, Tees, Wyes.** When elbows, tees, wyes or other special fittings are required in underdrain, or storm drain each fitting shall be included for payment as three additional linear feet of the largest pipe line involved.



- Notes:**
1. For estimate of culvert lengths, use 2-foot increments.
 2. Maximum length of culvert shall not exceed 90 feet for 15"-diameter culverts.
 3. For culvert lengths over 90 feet, use 18" to 24"-diameter culverts.

TYPICAL CULVERT INSTALLATION AT ENTRANCES

Figure 14-2

603.73 Remove and Relay Metal Pipe: (inch) Linear Foot**603.74 Remove and Relay Concrete Pipe: (inch) Linear Foot**

The designer should follow these procedures:

1. The amount of metal pipe or concrete pipe to be estimated to be removed and relayed shall be that amount shown and noted on the plans and cross sections. The note on the plans and cross sections shall include both the station from which the culvert will be removed and the station where it is to be relayed.
2. The amount of culvert to be removed and relayed shall also be noted in the Drainage Summary Sheet.
3. Note that common excavation should be estimated for the removal of the culvert when the excavation is not covered by other items.

603.76 to 603.82 Inch Inlet Grate Unit – Each

The quantity of these items to be estimated for a project shall be the number of the required sizes that are shown and noted on the plans and cross sections. Inlet grates are normally used on basin stub pipes located where the unprotected stubs might create a hazard to the public.

604.072 to 604.15 & 604.242 to 604.262 Manholes and Catch Basins - Each

The designer should follow these procedures:

1. The number of manholes and catch basins of the applicable types to be estimated for a project shall be determined by the number shown and noted on the plans and cross sections. The designer should refer to the standard details and the specifications to obtain the item numbers and names for the various basins and manholes.
2. Each catch basin and manhole having a depth up to 8 feet from the top of the grate or cover to the top of the floor, measured to the nearest foot, will be one unit. One-eighth of a unit will be added for each additional foot over 8 feet measured to the nearest foot.
3. The location and type of each manhole or catch basin shall also be shown in the Drainage Summary Sheet.

604.16 Altering Catch Basins to Manholes - Each**604.161 Altering Catch Basin - Each****604.164 Rebuilding Catch Basin - Each****604.166 Rebuilding Manhole - Each****-604.17 Altering Manholes to Catch Basins - Each****604.18 Adjusting Manhole or Catch Basin to Grade - Each****604.182 Clean Existing Catch Basin and Manhole - Each**

The designer should follow these procedures:

1. The quantity of these items to be estimated for a project shall be the number of the catch basins or manholes that are so noted on the plans and cross sections.
2. Pay items 604.16 and 604.17 provide for alternating from one type structure to the other. Adjustment to a new grade can be included in the required work. Care should be taken to specify the desired frame and grate when using item 604.17.
3. Pay item 604.161 provides for the alteration of a catch basin to a different type frame and grate. Adjustment to a new grade is included in the required work.
4. Pay item 604.164 and 604.166 provide for removing and replacing frame, grate and cone.
5. Pay item 604.18 provides only for the adjustment of a catch basin or a manhole to a different grade.
6. Pay item 604.182 provides only for the cleaning of existing catch basins and manholes that will not be altered, adjusted or rebuilt. Payment for cleaning altered, adjusted or rebuilt catch basins is incidental to each respective pay item.

604.19 to 604.22 Inch Trap - Each

The quantity of these items to be estimated for a project shall be the number of the required sizes that are shown and noted on the cross sections. Traps should be used whenever the Department's

storm drainage system empties into the drainage systems of others, if that other system carries sewage or if the owner of the other system requests trap protection for his system.

604.23 Step - Each

The quantity of steps to be estimated for a project shall be the number that is noted on the cross sections to be installed in the specified catch basins or manholes. In general, the use of steps should be considered in any catch basin that is greater than 8 feet deep and in any manhole. The decision to use steps in either case shall be made by the Project Manager in conjunction with the Maintenance Division or local municipality.

Install steps 16 inches on center if CB or MH is over 8 feet in depth.

605.09 6-Inch Underdrain, Type "B" – Linear Foot

1. The quantity of underdrain, Type "B" to be estimated for a project shall be that amount shown and noted on the cross sections.
2. Underdrain locations shall be determined from the soils report, field inspection plans and Engineer's knowledge of the project being designed.
3. In addition to being shown and noted on the cross sections, underdrain shall be noted in the Drainage Summary Sheet.
4. The designer should be aware that not all municipalities allow all the various types of underdrain pipe that the Department does.
5. A quantity in addition to that required at known locations may be included in the estimate. This quantity should be estimated at about 50 percent of the length required to complete any "possible" underdrain locations as specified in the soils report. This added quantity should be designated as "undetermined location" on the quantity sheet.
6. Underdrain and underdrain outlets will be measured by the length in linear feet along the centerline of underdrains and underdrain outlets of the types and sizes completed and accepted.
7. When elbows, tees, wyes or other special fittings are required in underdrain, each fitting shall be included for payment as three additional feet of the largest pipe line involved.
8. Structural excavation shall be computed for the earthwork summary and general note.

605.10 6-Inch Underdrain Outlet – Linear Foot

The quantity of this item shall be estimated as required on the plans for outletting "B" U.D. For estimating the quantity in "Undetermined Locations," the quantity should be 8 percent of the length of Underdrain Type "B" designated "Undetermined Location" (see Item 605.09). Underdrain outlets are metal and require one delineator post each, clearly marked with a whole U.D. on a blue background.

605.11 12-Inch Underdrain, Type C – Linear Foot**605.12 15-Inch Underdrain, Type C – Linear Foot****605.13 18-Inch Underdrain, Type C – Linear Foot****605.14 21-Inch Underdrain, Type C – Linear Foot****605.15 24-Inch Underdrain, Type C – Linear Foot****605.17 30-Inch Underdrain, Type C – Linear Foot****605.18 36-Inch Underdrain, Type C – Linear Foot**

The designer should follow these procedures:

1. The quantity of the various sizes of "Underdrain, Type C" to be estimated for a project shall be that amount shown and noted on the cross sections.
2. Underdrain locations shall be determined from the soils report, field inspection plans and the requirements of the storm water drainage system
3. In addition to being shown and noted on the cross sections, Underdrain Type "C" shall be noted in the Drainage Summary Sheet.
4. Outlet pipe for Type "C" Underdrain shall be estimated and noted as "Culvert Pipe, Option III" of the applicable size under Section 603.
5. The pipe for underdrains placed under or adjacent to railroads shall be coated or uncoated corrugated metal, which is one thickness greater than the thickness the Department

normally specified. This underdrain using heavier thickness pipe should be given a separate pay item.

Example: 605.111 12" Underdrain Type "C" – 0.079-inch Thick – linear foot

6. Comments concerning railroads and Type "B" U.D. also apply to Type "C" U.D. (see Item 605.09).

606.35 Underdrain Delineator Post - Each

This is a metal post to be installed at each Type B underdrain outlet location. The quantity estimated should be that number which is enough to provide posts as required by the project General Notes and/or as specifically noted on the plans.

606.353 Reflectorized Flexible Guardrail Marker – Each

This post to be installed at each guardrail installation. Two guardrail delineator posts shall be installed at each guardrail end. The quantity estimated should be that number which is enough to provide posts as required by the project General Notes and/or as specifically noted on the plans.

606.47 Single Wood Post - Each

606.51 - Multiple Mailbox Support - Each

These items will be used to provide mailbox posts for various field situations as shown in the standard details or as noted on the plan by the designer. The number of single posts for mailbox supports and the number of mailbox multiple supports shall be that number designated on the plans or general notes.

606 Guardrail – Linear Foot

- 606.15** Guardrail Type 3a - Single Rail
- 606.151** Guardrail Type 3aa - Single Rail
- 606.17** Guardrail Type 3b - Single Rail
- 606.171** Guardrail Type 3b - Single Rail with Rub Rail
- 606.19** Guardrail Type 3a - 15-Foot Radius and less
- 606.191** Guardrail Type 3aa - 15-Foot Radius and less
- 606.20** Guardrail Type 3a - Over 15-Foot Radius

606.201	Guardrail Type 3aa - Over 15-Foot Radius
606.21	Guardrail Type 3b - 15-Foot Radius and less
606.22	Guardrail Type 3b - Over 15-Foot Radius
606.23	Guardrail Type 3c - Single Rail
606.24	Guardrail Type 3d - Single Rail
606.55	Guardrail Type 3 - Single Rail
606.551	Guardrail Type 3 - Single Rail with Rub Rail
606.59	Guardrail Type 3 - 15-Foot Radius and less
606.60	Guardrail Type 3 - Over 15-Foot Radius

The designer should follow these procedures:

1. Currently, most projects call for Guardrail Type 3, which allows an option on the type of post and blocking to be used. If for some reason a top of rail mounting height of more than 27-inches is required, a rub rail should be added. (The designer is cautioned that a rub rail adds approximately 50 percent to the cost of the guardrail). Type 3aa Guardrail should be used if a rustic appearing steel beam guardrail is warranted.
2. The amount of guardrail of the above types to be estimated for a project shall be that amount shown and noted on the profile. Straight rail sections shall be called for and estimated in increments of 12.5 feet, when possible.
3. The amount of "Guardrail - Circular" to be estimated for a project shall be that amount shown and noted on the profile. "Beam Type Guardrail," when placed on a curve of 150-foot radius or less, is designated and estimated as "Circular." When "Guardrail - Circular" is noted on the profile, the following information must be noted:
 - a. station and offset to radius points,
 - b. radius of curve required, and
 - c. length of rail required.

The radius of beam-type guardrail is 15 feet desirable and 10 feet minimum.

4. To make a 90 degree turn using guardrail, two 12.5-foot lengths of 16-foot radius does the job neatly.
5. When beam type guardrail will be connected to a bridge structure or bridge rail, the designer should refer to the bridge plans and the standard details for the correct guardrail layout.

- 606.16** Guardrail Type 3a - Double Rail
- 606.18** Guardrail Type 3b - Double Rail
- 606.181** Guardrail Type 3b - Double Rail with Rub Rail
- 606.56** Guardrail Type 3 - Double Rail
- 606.561** Guardrail Type 3 - Double Rail with Rub Rail

The designer should follow these procedures:

1. The amount of "Guardrail - Double Rail" to be estimated for a project shall be that amount noted on the plans.
2. In general, "Double Rail Guardrail" shall be used only in narrow medians.

- 606.173** Bridge Connection - Each
- 606.265** Terminal End - Single Rail - Galvanized Steel - Each
- 606.266** Terminal End - Single Rail - Corrosion Resistant Steel - Each
- 606.275** Terminal End - Double Rail - Galvanized Steel - Each
- 606.276** Terminal End - Double Rail - Corrosion Resistant Steel - Each

The designer should follow these procedures:

1. The number of "Terminal Ends" to be estimated shall be that number noted on the plans.
2. The "350 Terminal" is the usual guardrail end treatment. The other end treatments are normally used in special situations where the 350 is not used.

- 606.64** Guardrail Thrie Beam - Double Rail
- 606.65** Guardrail Thrie Beam - Single Rail
- 606.66** Terminal End Thrie Beam
- 606.67** Buffer End Thrie Beam
- 606.68** Buffer End Thrie Beam Modified
- 606.69** Flared End Thrie Beam
- 606.70** Transition Section - Thrie Beam
- 606.71** Guardrail Thrie Beam - 15-Foot Radius and less
- 606.72** Guardrail Thrie Beam - Greater than 15-Foot Radius

The amount of "Guardrail - Thrie Beam" to be estimated for a project shall be that amount noted on the profile sheets.

606.752 Widen Shoulder for Modified Eccentric Loader Terminal - Each

The amount of shoulder widening to be estimated for a project shall be that amount noted on the profile and cross section sheets. This item is normally used on overlay type projects. See Standard Detail Book page 606(19).

606.754 Guardrail - 350 Flared Terminal - Each

606.76 Modified Eccentric Loader Terminal - Each

606.79 Guardrail - 350 Flared Terminal

606.36 Guardrail - Removed and Reset - Linear Foot

606.362 Guardrail - Adjusted - Linear Foot

606.363 Guardrail - Remove and Dispose - Linear Foot

606.364 Guardrail - Remove, Modify and Reset, Type 3b - Linear Foot

The designer should follow these procedures:

1. Existing Steel Beam Guardrail in good condition may be considered for removal and resetting, adjusting, or removal, modifying and resetting.
2. The amount of guardrail to be estimated for these items shall be that amount noted on the profile and cross sections. The notes shall include both the removal stationing and, if applicable, the resetting station.
3. A Special Provision shall be written to cover the particular situation. All work anticipated for the completion of these items should be included, such as guardrail hardware, terminal ends, etc., as appropriate.

607. Fences

New Fencing - Controlled Access and Limited Access Freeways, Arterials and Collectors

The designer should follow these procedures:

1. In rural areas, fencing should be of the woven wire type on metal posts. Fences are required where the right of way passes through open field and pastures, farmland and intermittent wooded and brushy areas. Where woods roads occur in deeply wooded areas, guardrail should be installed across the entire traveled way portion of the roads in addition to fencing.
2. Public highways that have been severed should be fenced for a minimum distance of 200 feet from the highway in either direction, regardless of type of vegetation. Guardrail should be installed across the entire traveled way portion of the road in addition to fencing.
3. Utility right of way and trails used by rough terrain type vehicles shall be fenced for a minimum distance of 200 feet from the trail or utility right of way line.
4. In urban areas, six-foot chain link fence shall be installed where the right of way is adjacent to developed properties such as buildings, yards, playgrounds, residential areas and areas where people utilize the land routinely. Four-foot chain link fence shall be installed on controlled access facilities where pedestrian/bicycle use is permitted.
5. Station-to-station limits and side should be shown on the profile portion of the plan sheet.

Replacement Fencing

Replacement fencing for that which will be removed during the construction process will be provided on most projects.

Replacement installations should use the same type as now exists. Chain link fencing will be used in built-up urban areas. Station-to-station limits and side should be shown on the profile portion of the plan sheet.

607.08 Woven Wire Fence - Wood Posts - Linear Foot

607.09 Woven Wire Fence - Metal Posts - Linear Foot

607.10 Barbed Wire Fence - Wood Posts - Linear Foot

607.11 Barbed Wire Fence - Metal Posts - Linear Foot

607.12 Barway - Wood Posts - Each**607.13 Barway - Metal Posts - Each****607.14 Walk Gateway 4 Foot - Metal - Each****607.15 Drive Gateway 16 Foot - Metal - Each**

The designer should follow these procedures:

1. The above items shall be called for on a replacement-in-kind basis.
2. "Drive Gateways, 16-foot, Metal" shall be called for in controlled access situations.
3. Note all gateway and barway locations on the profile portion of plan sheet.
4. The designer may call for a non-standard size, single or double swing gates, if for some good reason the standard 16-foot double swing gate can not be used. A special provision and pay item shall be developed if this is done.

607.16 Chain Link Fence – 4 Foot - Linear Foot**607.163 Chain Link Fence – 4 Foot, PVC Coated - Linear Foot****607.165 Chain Link Fence – 4 Foot, without Top Rail - Linear Foot****607.17 Chain Link Fence – 6 Foot - Linear Foot****607.173 Chain Link Fence – 6 Foot, PVC Coated -Linear Foot****607.175 Chain Link Fence – 6 Foot, without Top Rail - Linear Foot**

The designer should follow these procedures:

1. The amount of chain link fence, of the applicable size, to be estimated for a project shall be that amount noted on the profile portion of a plan sheet.

2. On controlled access, high-volume urban highways which do not have sidewalks, the controlled right of way is normally fenced with 6-foot chain link fence, while on urban projects with no control of access, chain link fence is used for special areas as determined by the designer. An example of this special usage would be in front of a house on top of a long steep cut slope.
3. In medians and in clear zones, the top rail shall be omitted and be replaced with a galvanized steel wire.

607.22 Cedar Rail Fence - Linear Foot

The amount of Cedar Rail Fence to be estimated shall be that amount noted on the profile portion of the plans. This item will generally be used only for scenic turnouts, picnic areas and replacement in kind.

607.2311 through 607.2339 Chain Link Fence Gate - Each

The number of chain link fence gates to be estimated shall be that number of specific sizes noted on the profile portion of the plans. Normally, the designer should use a standard 4-, 6-, 8-, 10-, 12- or 14-foot wide gate. If for some good reason none of these standard widths can be used, the designer may call for some other width by special provision and pay for it under a special pay item. For 6-foot chain link fence, a 20-foot wide gate is available. For 8-foot chain link fence, a 20-foot and 24-foot wide gate is available.

607.24 Remove and Reset Fence - Linear Foot

607.25 Remove and Reset Chain Link Fence - Linear Foot

The designer should follow these procedures:

1. The amount of fencing to be estimated to be removed and reset shall be that amount noted on the plans. The notes on the plans shall include both the removal stations as well as the resetting stations.
2. The use of Item 629.05, Labor, Straight Time, may be used instead of this item. This decision will be made by the Project Manager.

607.30 Bracing Assembly, Type I - Wood Posts - Each**607.31 Bracing Assembly, Type II - Wood Posts - Each****607.32 Bracing Assembly, Type I - Metal Posts - Each****607.33 Bracing Assembly, Type II - Metal Posts - Each**

The designer should follow these procedures:

1. At changes in horizontal and vertical alignment in excess of 30 degrees, bracing will be required. At changes in horizontal and vertical alignment of 15 degrees to 30 degrees, bracing may be called for on the plans or required by the Engineer. At changes in horizontal and vertical alignment angles of less than 15 degrees, bracing will not be required, except at intervals of 660 feet.
2. In depressions where tension in the fencing may cause lifting, the post will require bracing.
3. End, corner, gate, barway and intermediate posts shall be braced and anchored as shown in the Standard Detail book.
4. Note that when "Gateways - Metal" are used, the adjacent bracing assemblies shall be metal regardless of the post type used for the fencing.

607.34 Bracing Assembly, Chain Link Fence - Each**607.35 Bracing Assembly, Chain Link Fence - PVC Coated - Each**

The designer should follow these procedures:

1. Fences less than 6-foot in height that are installed with a top rail shall not require any brace rails. Fences less than 6-foot in height installed without a top rail and all fences with heights of 6-foot or more shall have brace rails installed midway between the top and bottom of the fabric as shown on the plans. At changes in horizontal alignment of less than 15 degrees, bracing will not be required, except at intervals of 330 feet. At changes in alignment of 15 degrees to 30 degrees, bracing may be required. At changes in alignment in excess of 30 degrees, bracing will be required for all fencing.

2. One brace assembly shall be furnished with each end or gate post and two assemblies with each corner or intermediate post and at grade changes specified above.

608.07 Plain Concrete Sidewalk - Square Yard

608.08 Reinforced Concrete Sidewalk - Square Yard

The designer should follow these procedures:

1. The use of these items shall generally be limited to the replacement of existing facilities in urban areas.
2. The width and length shall be noted on the plans and cross sections.
3. All necessary excavation and aggregate base material should be estimated under the applicable item.

608.XXX Truncated Domes - Square Feet

Detectable Warning Field shall be placed in Pedestrian Ramp and/or an Entrance with sufficient traffic. Detectable Warning Field will be measured by actual in place dimensions.

609.11 to 609.35 Curbing - General (Types 1, 3 and 5) - Linear Foot

Normal usage is as follows:

1. Type 1 (vertical granite curb) is used on well developed urban highways which carry moderate to heavy traffic volume, at locations adjacent to sidewalks, edges of paved shoulders or travel lanes, and for side street approach radii. Also, sometimes Type 1 is used in places where bituminous curb is otherwise warranted, but it is felt that the bituminous curb would not be able to withstand possibly expected hard usage.
2. Type 3 (bituminous curb) is used for box sections built in rural areas with low to moderate traffic volumes; on the low side of a banked curve in guardrail sections; and to delineate islands, sidewalks and parking areas where the usage is expected to be light duty. In general, mold 1 is used adjacent to sidewalks and mold 2 elsewhere. The minimum radius for Type 3 curb is 5 feet.

3. Type 5 (sloped granite curb) is used in moderate to heavy duty usage areas for traffic islands, raised medians, speed change lane edge delineation, island nose delineation, loop ramps with less than a 300-foot radius, ramp terminals and channelized intersections.
4. Reference should be made to the *Standard Specifications* and Standard Details to ensure that the proper type of curb, transition sections, terminal curbs and circular curb called for in the estimate are properly classified.
5. The quantity of curb of the applicable types to be estimated for a project is that amount shown and noted on the plans.
6. When a long run of curb is broken at frequent intervals by drives and entrances, it will not be necessary to station each curb break. It will be sufficient to station the long run of curb and, then, in the Engineer's Estimate subtract entrance openings, terminal transition, catch basin header curb and curb-cut ramp openings on the plans.
7. Vertical Curb Type 1 placed on a radius of 60 feet or less, will be paid for as Vertical Curb Type 1 - Circular.
8. Curb, Type 5, placed on a radius of 30 feet or less, will be paid for as Curb Type 5-Circular.
9. Circular curb must be detailed with the following information:
 - a. station and offset of radius point, and of the beginning and end, accurately computed;
 - b. radius of curve; and
 - c. length of curve, to be computed accurately, is very important in all cases, and even more so in the case of islands involving compound curves.
10. Terminal curb should be listed on the plans.

609.38, 609.39 and 609.40 Resetting Curb - Linear Foot

The designer should follow these procedures:

1. These items include the quantity of removing and resetting existing curb of the type shown on the plans. The plans must be noted (profile section) with the location from which the curb will be removed and the location where it will be reset.
2. In addition to curb reset due to dislocation, it may be advisable to estimate a reasonable quantity for adjacent side streets where base and/or pavement is being matched. In many cases stone curbing on these side streets is in good material condition but badly out of line, and it would spoil the effect of the new work unless corrected.

610.07 Stone Fill - Cubic Yard

610.08 Plain Riprap - Cubic Yard

The designer should follow these procedures:

1. The amount of plain riprap to be estimated for a project shall be that amount required for the usages specified on the plans and cross sections.
2. Riprap shall be estimated for all culvert inlets and outlets except entrance culverts when erosion control measures are required. The amount of riprap to be estimated for culvert end protection may be found in Tables 14-1 and 14-2. The amount to be estimated for U.D. outlets is a pad 3-foot square.
3. Use of riprap shall generally be confined to drainage ways where the slope is steep (over six percent with substantial flow) such as downspouts, roadway ditches going abruptly from cut to fill, culvert outlets which are much steeper than the culvert grade, and at the outlets of culvert on relatively steep grades.
4. The locations where plain riprap is required, except as noted in the general project notes and shown in the standard details, shall be noted on the plans.
5. The depth of plain riprap shall be estimated as 18 inches.

610.09 Hand Laid Riprap - Cubic Yard

The designer should follow these procedures:

1. The amount of hand laid riprap to be estimated for a project shall be that amount required for usages specified on the plans and cross sections.
2. This item will generally be used in special cases as approved by the Project Manager.

610.16 Heavy Riprap - Cubic Yard

The designer should follow these procedures:

1. These items may be used to provide embankment protection in tidal areas and along sides of rivers and streams where the potential for erosion is probable. Stone fill should be used in place of plain riprap when the designer desires stones of a larger size than required for plain riprap.

Note: Larger stones are less subject to dislodgment by ice, debris and swift moving water.

2. Normal stone fill installations will be 3 feet to 5 feet thick and should have a 2-foot thick filter of gravel borrow placed between the stone fill and the embankment to prevent the loss of embankment material due to water action.
3. Estimate cubic yard in place measure (I.P.M.) as shown on the plans and cross sections.

Culvert Diameter (inches)	Riprapped End (Cubic Yards)
12	0.97
15	1.09
18	1.19
21	1.29
24	1.43
30	1.65
36	1.90
42	2.15
48	2.40
54	2.66
60	2.90

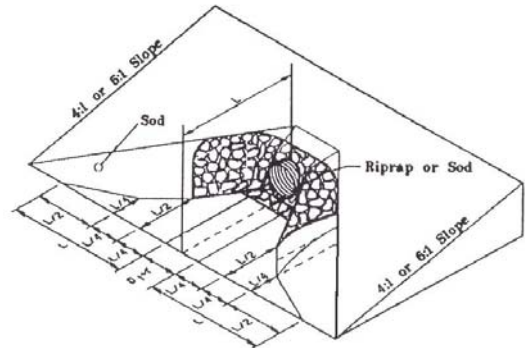
Note: Quantities are for one end of culvert.

**FACTORS FOR ESTIMATING CULVERT END PROTECTION
(1:2 Slope)**

Table 14-1

Culvert Diameter (inches)	Cubic Yards Riprap		
	1:6 Slope	1:4 Slope	1:3 Slope
18	3.11	2.44	2.19
21	3.17	2.56	2.26
24	3.27	2.70	2.41
30	3.89	3.33	3.06
36	4.89	4.33	4.05
42	6.11	5.56	5.28
48	7.73	7.12	6.81
54	9.44	8.89	8.62
60	11.67	10.78	10.33
66	13.72	13.00	12.65
72	16.33	14.63	13.79
84	21.22	19.11	18.06

- Notes:**
1. Quantities are for one end of culvert.
 2. Riprapped area is on slopes 1:1 and steeper.
 3. See Standard Detail Book page 800(22) for more information.



**FACTORS FOR ESTIMATING CULVERT END PROTECTION
(Riprapped Ends)**

Table 14-2

610.18 Stone Ditch Protection - Cubic Yard

The designer should follow these procedures:

1. The amount of stone ditch protection to be estimated for a project shall be that amount required on the plan and cross sections, except as noted in the General Notes. The depth of stone shall be estimated at one foot.
2. The locations where stone ditch protection will generally be is in roadside ditches that are on a six percent or greater grade, with a high concentration of runoff.

611.161 Segmental Retaining Wall - Square Yard**613. Erosion Control Blankets**

0 to 2% - Use an erosion control blanket in high flow.

2 to 6% - Use an erosion control blanket.

613.319 Temporary Erosion Control Blanket - Square Yard**613.329 Extended Use Erosion Control Blankets - Square Yard**

These items should be used in ditches where the slope of the ditch is less than six percent. The amount to be estimated will be by the square yard, based on the width and length of the roll of blanket prior to installation. Item 613.329 is used only when called for by the Landscape Section.

614.18 Applying Fertilizer To Existing Grassed Areas

Use of this item shall be recommended by Landscape.

615.07 Loam - Cubic Yard

The designer should follow these procedures:

1. The amount of loam to be estimated for a project shall be that amount required to loam lawn areas specified on the plans and/or cross sections measured in place. The depth of loam shall be estimated at four inches unless specified differently.
2. Optional areas such as cut backslopes and fill slopes will be reviewed by the Highway Program, in conjunction with the Landscape Architect (utilize soils report), to determine as accurately as possible where any additional loam will be used. All definite areas should be so noted on the plans. Because it will be impossible to accurately pinpoint all loamed or unloamed areas, it will probably be necessary to estimate some loam for undetermined locations.
3. The designer's attention is directed to that portion of Section 615 of the *Standard Specifications* which states that, when designated on the plans or directed, the Contractor shall salvage loam within the lines of improvement in both excavation and embankment areas. Areas from which salvaged topsoil will be estimated will be determined by the Project Manager during the final field inspection.
4. Those areas from which topsoil will be salvaged shall be designated in the General Notes. Salvaged topsoil depths shall be assumed to be the same as the depths estimated for grubbing as specified in Section 203.20 of this Section and paid for as Common Excavation.

618.13 Seeding, Method Number 1 - Unit**618.14 Seeding, Method Number 2 - Unit****618.141 Seeding, Method Number 3 - Unit**

The designer should follow these procedures:

1. Seeding Method No. 1 will be used on lawns, large traffic islands and developed medians.
2. Seeding Method No. 2 will be used on all non-guardrail foreslopes from the edge of shoulder to the ditch line or toe of fill.

3. Seeding Method No. 3 will be used on all 2:1 backslopes and on all guardrail fill slopes.
4. Seeding should be estimated for all earth cut and fill slopes that are not going to be covered by other erosion control methods.
5. The quantity of these items is to be estimated as measured along the slope of the finished ground in units of 1000 square feet.
6. 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.

618.17 Reed Canary Grass Seed - Pounds

618.191 Birdsfoot Trefoil Seed - Pounds

The designer should follow these procedures:

1. These items are used to supplement mixture Method No. 2 and should only be used when requested by the Landscape Section.
2. The amount to be estimated per unit of seeding (1000 square feet) is as follows:

Crown Vetch Seed – 1.5 lbs/unit

Reed Canary Grass Seed – 0.5 lbs/unit

Birdsfoot Trefoil Seed – 1.5 lbs/unit

618.19 Refertilization - pounds

The designer should follow these procedures:

1. This item is used to strengthen existing grass growth on a project and should only be estimated as requested by the Department's Landscape Section.
2. The amount to be estimated is 8 lbs/unit for 20 percent of Seeding No. 1, No. 2 and No.3 quantities.

618.20 Annual Rye - pounds

Estimate 0.5 lbs/unit for 25% of the Seeding No. 2 and No. 3 quantities.

618.25 Applied Water - Cubic Yard

Estimate 45 gal/unit for 10% of the Seeding No. 1, No. 2 and No. 3 quantities. If calculated quantity is less than 500 gallons, do not include item in contract. If calculated quantity is greater than 500 gallons, round up to the Engineer's Estimate minimum quantity of 1 M.G.

619.12 Mulch - Unit

The designer should follow these procedures:

1. Mulch is used on all areas seeded by Methods No. 1, No. 2 and No. 3. Mulch for seeding pits and temporary seeding should also be estimated.
2. Estimate one unit for each 1000 square feet.
3. For extra mulch for temporary use, estimate an extra 25% of the Seeding No. 1, No. 2 and No. 3 quantities, when requested by Landscape.

620. Geotextiles

The designer should follow these procedures. The amount to be estimated will be by the square yard.

620.54 Stabilization Geotextile - Square Yard

For use to stabilize subgrade. Its use will be designated by the Department's Geotechnical Section in the Soils Report.

620.56 Drainage Geotextile - Square Yard

For use in underdrain trenches. Its use will be designated by the Department's Geotechnical Section in the Soils Report.

620.58 Erosion Control Geotextile - Square Yard

For use under all riprap.

621. Landscaping

The designer should follow these procedures:

1. Whenever items under Section 621 will be used on highway construction, the designer shall consult with the Department's Landscape Section before completing the design to review specifications, item numbers and item description.
2. The quantity to be estimated shall be that amount of the respective items noted on the plans.

622.09 Transplanting Hedge - Linear Foot**622.10 Transplanting Shrub - Each****622.11 Transplanting Tree - Each**

The designer should follow these procedures:

1. All hedges, shrubs and small trees shown on the plans outside the existing right-of-way lines which are in good condition and in the way of construction should normally be considered for transplanting.
2. Prior to estimating any hedge, shrub or tree to be transplanted, the Department's Landscape Section should be consulted to obtain their recommendations as to the feasibility of the transplant under consideration and, if their recommendation is positive, the Right-of-Way Division should be consulted to determine its opinion of the owner's desires in the matter.
3. The classification of the transplanted item (e.g., hedge, shrub or tree) must be clearly shown on the plans to avoid any confusion in the basis of payment to the Contractor.

623. and 624. Monuments and Markers - Each

These items are still available in the specifications but are not used on projects unless directed to do so.

625.08 -Inch Copper Tubing - Linear Foot**625.10 -Inch Non-Metallic Pipe (flexible) - Linear Foot****625.14 -Inch Pipe Sleeve - Linear Foot**

The designer should follow these procedures:

1. These items singly or in combination are used to replace, sleeve, repair or provide new water service lines when directed by the Project Manager, as requested by the Right of Way Team Member.
2. The designer is cautioned to notify the Right-of-Way Team Member of all existing pipes, which will be disturbed by the proposed construction.
3. The amount to be estimated shall be that amount noted on the plans. Because the use of these items is generally requested by the Right-of-Way Team Member, coordination between Divisions is necessary.

626.11 - 626.38 Foundations, Conduit and Junction Boxes for Highway Signing, Lighting and Signals

These items should be used when signing, lighting or traffic signals will be used on the project. The estimate and design of the above work will be supplied by the Traffic Engineering Division.

627. Pavement Markings

Pavement markings will be included on all projects. The estimate for this work shall be done by the Project Manager with help from the Traffic Engineering Division.

629.05 Labor - Straight Time - Man-Hour

This item will **only** be estimated for work as called for on the plans. There appears to be no possible way to accurately estimate the amount of this item that will be required for a particular project. Therefore, the estimated quantity for this item will be determined on a project-by-project basis by the Project Manager and reviewed by the Construction Team Member.

When using Temporary Silt Fence on a project, estimate 25 MH per mile for removing the silt and sediment.

Equipment Rental - Per Hour

- 631.09** Aerator (Including Operator and Hauler) - Hour
- 631.10** Air Compressor (Including Operator) - Hour
- 631.11** Air Tool (Including Operator) - Hour
- 631.12** All Purpose Excavator (Including Operator) - Hour
- 631.121** Heavy Duty All Purpose Excavator (Including Operator) - Hour
- 631.13** Bulldozer (Including Operator) - Hour
- 631.132** Small Bulldozer (Including Operator) - Hour
- 631.14** Grader (Including Operator) - Hour
- 631.15** Roller, Earth & Base Course (Including Operator) - Hour
- 631.16** Roller, Pavement (Including Operator) - Hour
- 631.171** Truck - Small (Including Operator) - Hour
- 631.172** Truck - Large (Including Operator) - Hour
- 631.18** Chain Saw Rental (Including Operator) - Hour
- 631.20** Stump Chipper Rental (Including Operator) - Hour
- 631.21** Road Broom (Including Operator and Hauler) - Hour
- 631.22** Front End Loader (Including Operator) - Hour
- 631.221** Small Front End Loader (Including Operator) - Hour
- 631.29** Rototiller (Including Operator) - Hour
- 631.32** Culvert Cleaner (Including Operator) - Hour
- 631.36** Foreman - Hour

The designer should follow these procedures:

1. These items will **only** be estimated for work as called for on the plans. Unforeseen work will be taken care of on a Force Account basis using "Blue Book" rates.

2. The estimated quantity will be that amount to complete the work as called for on the plans as determined by the Project Manager and reviewed by the Construction Team Member.
3. When using Temporary Silt Fence on a project, use the following items and factors to estimate quantities: 10 hrs per mile for Item 631.12 and 15 hrs per mile for Item 631.172.

634. Highway Lighting**635. Prefabricated Bin Type Retaining Wall****635.10 Concrete Bin Type Retaining Wall, Closed Face - Square Yard****635.11 Concrete Bin Type Retaining Wall, Open Face - Square Yard****635.12 Galvanized Metal Bin Type Retaining Wall - Square Yard****635.13 Galvanized Metal Bin Type Retaining Wall with Fiber Coating - Square Yard**

These items are used to provide earth retainment when directed by the Project Manager as recommended by the Bridge Team Member. The Bridge Program will normally provide the necessary detailed designs and estimated quantities involved when these items are used.

636. Reinforced Soil Wall**639.18 Field Office Type "A" - Each****639.19 Field Office Type "B" - Each**

The Construction Team Member will recommend to the Project Manager the requirement of providing or not providing a field office on the project. If a field office is required, the following is a guide in selecting the type:

1. **Type A.** Use when there is a bridge on a highway project and when a computer is required on the project.
2. **Type B.** Use when a computer is not required on a highway project.

The Construction Division has adopted the following rules for determining if computers are required on a project. Use a computer when:

1. electricity is available,
2. the duration of the project is over 3 months (60 working days),
3. there are at least 30 pay items in the Contract, and
4. the total estimated cost of the project is:
 - a. highway reconstruction/rehabilitation: over \$250,000
 - b. resurfacing: over \$350,000
 - c. bridge construction/rehabilitation: over \$350,000
 - d. miscellaneous: over \$1,000,000

Note: All four criteria must be met.

639.21 Testing Facilities, Soils - Lump Sum

Required whenever the aggregate material (excluding common borrow and excavation) exceeds 20,000 cubic yards or 15,000 cubic yards when there are 2 or more types of aggregate requiring gradations.

639.23 Testing Facilities, Concrete - Lump Sum

Required whenever a) the total quantity of structural concrete exceeds 10 cubic yards, or b) the estimated number of foundations (summation of items 626.31, 626.32 and 626.33) exceeds 10.

642.12 Wooden Steps - Each

642.15 Precast Concrete Steps - Each

642.17 Cast-in-place Concrete Steps - Cubic Yard

The designer should follow these procedures:

1. These specialty items shall be used when directed by the Project Manager as normally requested by the Right-of-Way Team Member as a property settlement.
2. The width, rise ratio, and number of steps will be noted on the plans. Tables 14-3 and 14-4 provide the estimated quantities from Standard Detail Book page 642(01). Non-standard designs should be referred to the Bridge Design Program for design details

and, if the volume of concrete is less than 5 CY \pm , a non-standard design may be bid on a lump-sum basis including all materials and work.

3. Other related items to be estimated for steps, except when bid Lump Sum, will be:
 - a. aggregate subbase for foundation or granular borrow, and
 - b. estimate bedding material volume to the limits given for structural excavation.

No. of Intersteps	Width of Steps (ft)									
	3	4	5	6	7	8	9	10	11	12
Footer/Header	0.25	0.31	0.37	0.43	0.49	0.55	0.61	0.67	0.73	0.79
1	0.38	0.47	0.56	0.65	0.74	0.83	0.92	1.01	1.10	1.19
2	0.51	0.63	0.75	0.87	0.99	1.11	1.23	1.35	1.47	1.59
3	0.64	0.79	0.94	1.09	1.24	1.39	1.54	1.69	1.84	1.99
4	0.77	0.95	1.13	1.31	1.49	1.67	1.85	2.03	2.21	2.39
5	0.90	1.11	1.32	1.53	1.74	1.95	2.16	2.37	2.58	2.79
6	1.03	1.27	1.51	1.75	1.99	2.23	2.47	2.71	2.95	3.19
7	1.16	1.43	1.70	1.97	2.24	2.51	2.78	3.05	3.32	3.59
8	1.29	1.59	1.89	2.19	2.49	2.79	3.09	3.39	3.69	3.99
9	1.42	1.75	2.08	2.41	2.74	3.07	3.40	3.73	4.06	4.39
10	1.55	1.91	2.27	2.63	2.99	3.35	3.71	4.07	4.43	4.79
11	1.68	2.07	2.46	2.85	3.24	3.63	4.02	4.41	4.80	5.19
12	1.81	2.23	2.65	3.07	3.49	3.91	4.33	4.75	5.17	5.59
13	1.94	2.39	2.84	3.29	3.74	4.19	4.64	5.09	5.54	5.99
14	2.07	2.55	3.03	3.51	3.99	4.47	4.95	5.43	5.91	6.39
15	2.20	2.71	3.22	3.73	4.24	4.75	5.26	5.77	6.28	6.79

VOLUME FOR CONCRETE STEPS (ft³)
(1:2 Slope ~ 12" Step/6" Rise)

Table 14-3

No. of Intersteps	Width of Steps (ft)									
	3	4	5	6	7	8	9	10	11	12
<i>Footer/Header</i>	0.29	0.36	0.43	0.50	0.57	0.64	0.71	0.78	0.85	0.92
1	0.45	0.55	0.66	0.76	0.87	0.97	1.08	1.18	1.29	1.39
2	0.60	0.74	0.88	1.02	1.16	1.30	1.44	1.58	1.72	1.86
3	0.75	0.93	1.10	1.28	1.45	1.63	1.80	1.98	2.15	2.33
4	0.91	1.12	1.33	1.54	1.75	1.96	2.17	2.38	2.59	2.80
5	1.06	1.30	1.55	1.79	2.04	2.28	2.53	2.77	3.02	3.26
6	1.21	1.49	1.77	2.05	2.33	2.61	2.89	3.17	3.45	3.73
7	1.37	1.68	2.00	2.31	2.63	2.94	3.26	3.57	3.89	4.20
8	1.52	1.87	2.22	2.57	2.92	3.27	3.62	3.97	4.32	4.67
9	1.67	2.06	2.44	2.83	3.21	3.60	3.98	4.37	4.75	5.14
10	1.82	2.24	2.66	3.08	3.50	3.92	4.34	4.76	5.18	5.60
11	1.98	2.43	2.89	3.34	3.80	4.25	4.71	5.16	5.62	6.07
12	2.13	2.62	3.11	3.60	4.09	4.58	5.07	5.56	6.05	6.54
13	2.28	2.81	3.33	3.86	4.38	4.91	5.43	5.96	6.48	7.01
14	2.44	3.00	3.56	4.12	4.68	5.24	5.80	6.36	6.92	7.48
15	2.59	3.18	3.78	4.37	4.97	5.56	6.16	6.75	7.35	7.94

VOLUME FOR CONCRETE STEPS (cy³)
(1.15:1 Slope ~ 12" Step/8" Rise)

Table 14-4

643. Traffic Signals**645. Highway Signing**

The Traffic Engineering Division will prepare the design of the required installations and will provide the required specifications. Reference should be made to the project specifications and the details furnished by the Traffic Engineering Division for correct item numbers, item names, methods of measurement and basis of payment.

Note: The designer should be careful to check the location of the proposed installations to determine if there is any conflict with the proposed curbs, drainage, islands, etc.

652. Maintenance of Traffic**652.30 Flashing Arrow Board - Each****652.31 Type I Barricades - Each****652.311 Type II Barricades - Each****652.312 Type III Barricades - Each****652.32 Battery Operated Light - Each****652.33 Drum - Each****652.34 Cone - Each****652.35 Construction Signs - Square Yard****652.36 Maintenance of Traffic Control Devices - Calendar Day****652.361 Maintenance of Traffic Control Devices - Lump Sum****652.37 Warning Lights - Group****652.38 Flaggers - Man-Hours****653.20 1 inch Polystyrene Plastic Insulation - Square Yard****653.21 1 ½ inch Polystyrene Plastic Insulation - Square Yard****653.22 2 inch Polystyrene Plastic Insulation - Square Yard**

653.23 3 inch Polystyrene Plastic Insulation - Square Yard

These items will be estimated for a project only when designated by the Project Manager in cooperation with the Geotechnical Section. When used, these items shall be shown on the typical sections, and the proposed locations noted on the plans. The quantity to be estimated shall be that amount shown on the plans.

Ditch Type	Typical Number Per Installation	
	Hay Bales	Sand Bags
4:1-2:1 V Ditches	3	3
6:1-3:1 V Ditches	4	3
6:1-3:1 Circular Ditches	5	3

Percent Grade of Ditch	Typical Spacing Along The Ditch
< 3%	100 ft
3.5 %	75 ft
> 5%	50 ft

656.75 Temporary Soil Erosion and Water Pollution Control – Lump Sum

This item shall be estimated on all projects that require a Temporary Soil Erosion and Water Pollution Control Plan (SEWPCP).

657.24 Seeding Pits - Unit

This item is used to rehabilitate pits, sod fields and loam borrow areas. The Project Manager will review the quantity of this item and determine if this item will be a bid item or made incidental to the contract. The current Engineer's Estimate factors used to compute this item are:

1. Loam borrow areas: 1 unit/20 yards of loam removed (based on 6.5" depth)
2. Aggregate borrow areas: Estimated average 10-foot pit depth.

658.20 Acrylic Latex Color Finish, Green - Square Yard

This item is used to place a green colored finish on asphalt surfaces such as medians, islands, etc. The amount to be estimated shall be the number of square yards of area to be treated, as designated on the plans and/or in the General Notes. Care should be taken to deduct the area of the curbs.

659.10 Mobilization - Lump Sum

This item will be used on all projects to allow payment to a Contractor for moving onto the project. The Project Manager should confer with the Construction Team Member when estimating this item.

660.21 On-the-Job Training (bid) - Man-Hour

This item will be used as estimated and directed by the Contracts Section.

14-3 RULES FOR ROUNDING

This section presents rounding and adjustment factors (not covered in Section 14-2) which apply to estimating construction quantities.

1. **Types.** There are two types of quantities:
 - a. Quantities from Counting: Examples include trees, single posts, etc.
 - b. Quantities from Calculations: Examples include excavation, portland cement concrete, loam, etc.
2. **Counted Items.** The estimated quantity shall be the actual total count as taken from the plans.
3. **Calculated Quantities.** The following rules shall apply:
 - a. Total quantities less than 1.0 may be rounded upward not more than 0.1 unit.
 - b. Total quantities of 1 but less than 10 may be rounded upward not more than 0.5 unit.
 - c. Total quantities of 10 but less than 100 may be rounded upward not more than 1 unit.
 - d. Total quantities of 100 but less than 1,000 may be rounded upward not more than 10 units.
 - e. Total quantities of 1,000 but less than 10,000 may be rounded upward not more than 50 units.
 - f. Total quantities of 10,000 shall be rounded to the nearest third significant figure.

Appendix 14A

ENGINEER'S ESTIMATE WORKSHEET

MDOT

ENGINEER'S ESTIMATE WORKSHEET

TOWN OR CITY _____

CONSTR. PROJECT NO. _____ P.I.N. _____

COUNTY _____ ROUTE NO. _____

ESTIMATE BY _____

LENGTH _____ MILES

1. PARTICIPATING - NON PARTICIPATING

2. HIGHWAY ITEMS

2. BRIDGE ITEMS _____ BRIDGE LENGTH _____ FEET
(NAME) (BACK TO BACK OF BACKWALL)

2. _____ ITEMS

2. _____ ITEMS

SHEET TOTAL _____