# **SECTION 200**

# **EARTHWORK**

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 201 Clearing -- 7 Pages

### **CLEARING**

#### 201-1 GENERAL

#### **REFERENCES**:

#### a. Construction Manual

Section 104.4.6 Utility Coordination Section 203 Earthwork Section 607 Fences

#### b. Standard Specifications

Section 104.3.11 Responsibility for Property of Others Section 104.3.12 Forest Protection and Laws Section 201 Clearing Right-of-Way Section 203.09 Preparation of the Embankment Area Section 607 Fences Section 717.07 Herbicide

This work shall consist of clear cutting, selective clearing and thinning, tree trimming, removing single trees and stumps, and disposing of all stumps and debris, as per plans, specifications, and/or as directed by the Resident.

#### 201-2 <u>RECOMMENDED GUIDELINES</u>

1. <u>Clearing</u>

a. Standard Specifications permit Clearing and Tree Removal work to be started prior to approval of the Schedule of Work, providing the method of operation does not establish a source of water pollution or cause soil erosion.

b. Layout of outside Clearing Limit Lines as indicated on the plans is done by the Contractor and verified by the Resident or the Inspector prior to any cutting. These limits may be marked as the Contractor desires, but in such a manner that there will be no mistake as to the limits intended. It is most important that the Clearing subcontractor and their workers fully understand the meaning of the markings used.

c. If it is necessary to clear areas not indicated on the plans, such areas will be designated by the Resident. A Contract Modification designating both a change in design and a change in quantity will be necessary for these additional areas.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

#### Section 201 Clearing -- 7 Pages

d. Inspection of clearing during the actual work consists of checking to make sure that the proper areas are being cleared. Prior to embankment construction, all cleared areas should be checked to be sure stumps are cut as close to the ground as possible, and that debris has been removed.

e. The Inspector shall assure that herbicides are applied to areas, as required, by Certified Pesticide Applicators only. All Herbicides shall be approved by a Department of Transportation landscape architect.

f. It is suggested that the contractor be encouraged to add a coloring agent to the herbicide so that continuous inspection may not be necessary.

g. For answers to any questions that arise in regard to spraying of herbicides, contact the landscape section of the Environmental Services Division.

EXHIBIT 201-A (Photograph of a cleared area.)



MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

Section 201 Clearing -- 7 Pages

#### 2. <u>Selective Clearing and Thinning</u>

a. Selective Clearing and Thinning is marked by personnel from the Landscape Section. At least two weeks notification should be given to them, through the Resident, that the Project is ready to be marked. The Contractor or their subcontractor should notify the Resident when they are about ready to do this work.

b. Specifications require that stumps and stubs that remain shall be cut off as close to the ground as practicable.

c. Selective clearing and thinning is best inspected from the finished or near finished roadbed unless this work is done prior to excavation. The traveling public will see the area from this vantage point. It is also important that dead trees, stubs and branches with in the R/W, and those that can be seen from the roadway be cleaned up.

EXHIBIT 201-B (Photographs of a scenic area before and after Selective Clearing.)



#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

Section 201 Clearing -- 7 Pages

#### 3. <u>Removing Single Trees and Stumps</u>

a. The marking of individual trees to be cut should be done by the Contractor and verified by the Inspector prior to removal. The method of marking of single trees should be clearly understood by the Inspector and by the Contractor. This is particularly important in urban areas where removal of the wrong tree may justifiably incur the wrath of an abutter.

b. If removal of a single tree is questionable, check with plans, R/W, and property owner to assure that removal is required.

c. Stumps designated on the plans to be removed shall be completely removed by the use of excavating equipment unless the use of such equipment will be detrimental to the adjacent property or to the Project. If such removal will be detrimental, it shall be done by the use of a chipper at the bid unit price for that equipment. Note that if a stump is cut out with a chipper it cannot be paid for as "Removing Stumps". It should be paid for at the hourly bid price for the chipper, an agreed price, or as Extra Work.

d. Where large stumps occur in urban areas they should be removed, or cut or chipped to below the level of lawns, even is such action is extra work.

e. Property adjacent to trees that are cut should be fully protected. The Contractor is responsible for damage to abutter's lawns and other property.

f. Removal of trees and trimming, necessary by public utilities, is discussed in Division 800, Utilities, of this Manual.

#### 201-3 MEASUREMENT, PAYMENT AND FIELD DOCUMENTATION

#### a. Field Documentation

Project Diary, Inspector's Diary/Inspector's Daily Report: The Resident or Inspector will keep notes describing the subcontractor's clearing and selective clearing operations; equipment, personnel, and station to station limits of work will be noted. Workers and equipment need not be recorded every day unless there are frequent changes.

The Contractor, or more commonly the clearing subcontractor, will take the clearing limits from the plans and flag them in the field. If the Resident makes substantial changes or if the limits are not shown on the plans, a clearing list will be made up by the Resident and a copy given to the Contractor.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 201 Clearing -- 7 Pages

The Inspector will note that Clearing is completed to limits shown on the plans; wording similar to the following is suggested: "Checked Clearing, Sta. 1+150 to Sta. 1+275 left and right and found it to be completed in accordance with Plans and Specifications." (Signed and Dated)

Entries will be made in the Inspectors Diary or in the Final Quantity Book.

Single trees and stumps removed as called for on the plans will be documented by individually recorded notation. Notes will include location, kind, size, date measured, and Inspector's initials and will preferably be made in the Final Quantity Book. If not possible, entries must be made in some other field book.

#### b. Measurement and Payment

Final quantity for payment can be plan quantity providing the estimated quantity is accurate and work is done as estimated. The Resident will adjust the plan quantity, upward or downward, according to changes made in the field.

Should the Resident find it necessary to establish new limits for the entire job, final pay quantity will be figured from these revised limits flagged in the field. A list of new limits will be made part of the project records.

Whether the Resident makes final payment based on plan quantity or based on a list of revised clearing limits, he/she must substantiate final payment by notes stating that clearing has been completed and accepted to limits flagged. These notes will be made in the Final Quantity Book or in the Construction Book.

Areas required to be cleared and not shown on the plans will be documented by length and width measurements. Measurements will be recorded in the Final Quantity Book, if possible, or in some other bound field book.

Clearing or removal of trees or stumps required to install fences shall be considered incidental to the appropriate fence items under Section 607 of the Standard Specifications.

Single trees and stumps required to be removed outside clearing areas will be field counted and entered directly in the Final Quantity Book for payment. All measurements will be signed and dated.

Final quantity for payment will be entered in the Final Quantity Book and labeled as such; reference to measurements, clearing limits flagged, and statements of inspection will be made as necessary. All calculations and data entries must be signed, dated, and checked; the checker must sign and date his/her work.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 201 Clearing -- 7 Pages

### EXHIBIT 201-C CONSTRUCTION BOOK OR INSPECTOR'S DIARY



### EXHIBIT 201-D FINAL QUANTITY BOOK

201.11	CLEI	ARING					Est	3	HA			
	QTY	REF	ENTBY	DATE								Т
	0.88	BKZR7	Illento	6-21-00								t
	1-20	BEZP 8	4	11	-							t
	0.94	BEZA 10	2Ant	6-30-00		1						T
Torac :	3.02	HA				-						T
			Ckh:	111-4	7-1-00	-]++++++			++++		+++	╀
			Vdby:	ARM	7-12-00	• • • • • • • • • • • • • • • • • • • •						+
				a.c.	/ 10 - 1				++++-		+++	H
									++++-		+++	+
						• +++++++			++++			+
						•	+++++		++++			+
						• ++++++			++++		+++	1
												Π
												H
										++++	+++	H
												Н
	0				/							Ц
INAL	PAY G	VANTI	7	3.0	HA							
				346	7-1-00							Π
			Vd Ly.	ARM	7-12-00							H
				0-1						++++		H

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 201 Clearing -- 7 Pages

### EXHIBIT 201-E FINAL QUANTITY BOOK

201.23	NEMOL	ING OIN	ble Thee	TOPO	vey		~ /	ZA
DATE	STATION	OFFSET	DESC.	DIA .	REF.	ENTBY	DATE ENT	REMARKS
3-01-01	5±100	6.5MLT	Maple	450 mm	BKZ Pg ZO	Ithank .	3/1/01	
"	5=160	7.0 H'LT	Oak	525 mm	11	1 11	1	
3-02-01	61200	TOIMLT	Pine	600 mm	BEZRZI	that	3/2/01	
3-03-01	8:455	6.0 H RT	Pine	575mm	BKZ Pg 22	Thil.	3/3/01	
11	81710	7.0 M RT	Maple	500 mm	11	11	~	
"	9\$120	6.5MRT	Oak	650 mm	11			
8-04-01	10+325	7.5MRT	Locust	450 mm	BEZR 23	Marts	3/4/01	
11	10:1800	6.0H BT	Mountain Ash	400 mm	11	14	"	
"	11=435	6.5HRT	Maple	575 mm	"		11	
3-18-01	41680	7.5MLT	Pine	600 mm	BLZP 37	Alla to	3/18/01	Added by Resident
					v			
F	P	^		10		0		
FINA	LIAY	GUANT	rity:	10	EA			
				Hart	> 7-7-01			
			Yd by:	JR.M.	7-10-01			

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 202 Removing Structures -- 3 Pages

### **REMOVING STRUCTURES AND OBSTRUCTIONS**

#### 202-1 GENERAL

References:

a. Standard Specifications

Section 202 Section 104.3.13 Section 203.05

b. Standard Details, Sheet 202[1]

c. Supplemental Specifications and Special Provisions

Building and structure demolition may be partially or entirely covered by Special Provisions or Supplementary Specifications; describing the scope of the work, disposition of materials, availability date and completion date.

#### 202-2 LAYOUT AND CONTROL

Building areas reserved for the owner until a specific date should be marked out. Pavement removal and rumble strips would be painted or marked by the Contractor or Subcontractor.

#### 202-4 CONSTRUCTION

a. Building removal

Right-of-Way personnel are usually responsible for arranging the removal of hazardous materials such as asbestos before the demolition is put out to contract, but sometimes the Resident has this duty along with ensuring the property is rodent-free.

The Contractor may salvage useable materials unless the Contract states a portion is to be retained by the State. Disposal of unwanted materials must be in accord with Maine Department of Environmental Protection and local rules. This usually means these materials must go to secure sites

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

licensed to handle demolition debris; especially materials such as asphalt shingles and asbestos. Burning of buildings is not currently allowed on or off the site.

Special Provisions and Specifications usually define the extent of the foundation removal; otherwise only the building would be removed and the foundation filled.

#### b. Bridge Removal

Removal of superstructures or portions of bridges is much the same as buildings. On Bridge Act projects, the Resident should advise the Town they have first refusal of the materials.

#### c. <u>Removal of Bituminous and Concrete Pavement</u>

Pavement millings often become property of the Contractor, unless the Special Provisions state they are to be retained by the State. Currently millings may go to a hot top plant or be used for gravel. Typical sections of the plans indicate the depth and grade of the milling. Butt joints and rumble strips are done as per the Standard Details.

Concrete Pavement is usually broken into manageable pieces before being excavated. It may be used as fill material to specifications or wasted in an area approved by the Resident.

#### 202-5 FIELD DOCUMENTATION, MEASUREMENT AND PAYMENT

As stated before, it is important that disposal of materials comply with environmental rules. The Resident must be informed of the destination of materials removed from the project. The work should be inspected for compliance to the contract terms or Extra Work Orders.

Project Diary, Inspector's Diary/Inspector's Daily Report: The Resident or Inspector will keep notes describing, for example, demolition of buildings, removal of bridge superstructures and substructures, removal of pavement and other obstructions for which there is a pay item in the contract. Station to station limits of work done by the Contractor, if appropriate, and disposal will be noted. Disposal of materials usually consists of hauling to a waste dump, turning over to a State or Town Official, or stockpiling for future use.

#### Measurement and Payment

Rumble strips are paid by the length. End stations and/or lengths must be recorded in a book.

Milling of bituminous pavement and concrete pavement removal are paid by the surface area. Milling may be to certain depths and/or slopes, requiring inspection of these details. Locations and measurements of surface areas

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 202 Removing Structures -- 3 Pages

should be in a book. Concrete pavement used in fills should be broken into pieces of size to meet embankment specification.

Building and bridge removals are usually paid lump sum. An entry in the Final Quantity Book with reference to diary entries of the work is sufficient documentation. Removal of bridge railing may be paid by the length, necessitating field measurements in a bound book. Special Provisions of the Contract may require that certain components of the existing bridge become property of the State or the Town. The Resident should obtain the signature of the individual receiving such materials.

Final quantity for payment will be entered in the Final Quantity Book and labeled as such.

For items to be paid plan quantity, such as removing existing pavement, the estimated quantity must be accurately figured and the actual work limits must be the same as those shown in the Engineer's Estimate. The Resident may have to adjust the estimated quantity to reflect field changes. As for lump sum items, the Resident will make references to Diary notes verifying that work has been done as estimated. These notes may be made directly in the Final Quantity Book. If the plan quantity is a "throw-in" quantity, i.e., has no basis other than a guess, the work in question will have to be field measured.

Removal of curb, fence, and guardrail will be incidental to the work in general. No separate payment will be made unless specific pay items exist in the contract for removal of these items.

All calculations and data entries must be signed, dated and checked; the checker must sign and date his/her work.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 203A Borrow & Section 203B Embankment -- 16 Pages

### **BORROW**

203A-1 GENERAL

References:

(1) Construction Manual, Section 203 - Excavation and Embankment Section 700 - Materials

(2) Standard Specifications, Section 203 - Excavation and Embankment

- (3) Special Provisions & Supplemental Specifications
- (4) Standard Details Highways & Bridges
- (5) Project Plans and Typical Sections
- (6) Construction Notes/General Notes

When there is not enough excavation material within the right of way to construct the embankments, it is necessary to obtain borrow. The Inspector should compare test results of the borrow with visual inspection of the same to see any obvious change. Make sure that all borrow from x-sectioned areas of the borrow pit is used in approved areas and not on haul roads, equipment yards, or for sanding of roads in winter. If material is used off the project, document the truck number, quantity, where it was used, and, if possible, obtain delivery slips in accordance with specification requirements. Prior approval for such use of materials is not to be given under any circumstances.

The restoration of pits is discussed in Section 105.8.6 of the Standard Specifications and is covered in Section 657 of this Manual and the Supplemental Specifications for individual projects.

In those situations where a Contractor has further use for a pit on State work, it may be possible to obtain a waiver by sending a letter to the Resident requesting deferment of the required rehabilitation until such time as the Commission may allow. A request of this nature must be by submitting a Change Order from the Project that originally had the rehabilitation specified and also a Change Order from the Project that intends to do the rehabilitation work. This can also be done even if more than one Contractor is involved, if letters from both parties indicate that the rehabilitation will be done by the last Contractor to work the pit.

There is the occasional situation where the Contractor desires to use material that exists within the Right of Way. The applicable specification is Subsection 104.05 of the Standard Specification and the policy

#### MAINE DEPARTMENT of TRANSPORTATION

#### Bureau of Project Development

April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

of the Department is discussed in Subsection 104.05 of this Manual. No charge for materials removed from within the right of way will be made against the Contractor.

Whenever a Contractor requests the use of material from within the Right of Way and beyond the excavation limits, this request must be presented to the Resident in writing. The Resident will supplement the Contractor's request by following Section 104.05 of this Manual. If permission is granted to use this material, the terms for final acceptance of the area will be established in writing to the Contractor.

Borrow pit quantities should be available to pit owners who request them after the quantities have been determined and checked. These final quantities are public records. The quantities should be given to the pit owner via letter with a copy to the prime contractor and also to any involved sub-contractors.

#### 203A-2 LAYOUT AND CONTROL

Borrow pits will be approved by the Resident, stripped by the Contractor, and then original x-sections should be taken. The Inspector should become familiar with the original location of the material taken from the pit. It is very important that control for x-sections (Permanent Bench Marks and ties to Base Lines, can be reproduced in order to insure accuracy of final sections in relation to original sections.

Although the Contractor is responsible, the Resident and Inspector should be aware of the location of property lines, municipal roads, and local ordinances regarding buffer zones and the proximity of property lines to the limits of excavation.

The area x-sectioned should be staked out. Limits should be clearly flagged and the Contractor's Supt. shown the stakes. Material removed beyond the staked limits may not be paid for if there is no reasonable way of determining the quantity. It should also be pointed out that the flagged stakes at the pit limits are to be preserved until final x-sections have been taken.

#### 203A-3 TESTING REQUIREMENTS

(1) Gradations: As per the project Minimum Testing Requirements; sampled in roadway as it is being placed.

(2) Compaction: As per the project Minimum Testing Requirements, each layer

(3) Preliminary samples taken in pits are informational only.

(4) Samples for testing of material designated for use as Underwater Backfill may be obtained from approved Granular Borrow Pits.

#### MAINE DEPARTMENT of TRANSPORTATION

#### Bureau of Project Development

April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

#### 203A-4 CONSTRUCTION

Following is a list of various circumstances under which Granular Borrow may be used:

- (1) At designated locations as shown on plans.
- (2) To maintain traffic.
- (3) To mix with excavation when it is too wet to use otherwise. (Sandwich Construction)
- (4) In undercut areas.
- (5) To backfill muck areas.
- (6) As backfill under water.
- (7) In muck areas prior to placing rock fill.
- (8) As foundation material for culvert pipes or other structures.

Granular Borrow should <u>NOT</u> be used under the following circumstances:

- (1) To stabilize common borrow.
- (2) With excavation that has become too wet to work on as a result of rain, snow, sleet or fog.

Information regarding other construction phases of borrow is covered in Section 203.3C, Embankment, of this Manual.

#### 203A-5 INSPECTION

The Inspector, after being assigned duties by the Resident, should become familiar with the Plans, Cross-Sections, Standard and Special Provisions before commencing inspection duties. The Inspector should clarify any questions or doubts they may have concerning the inspection work with the Resident.

The possibility of misuse of materials is to be checked constantly when more than one material is being used from one pit, or when one large pit is being used for more than one job. Contractors should not be allowed to use material from cross-sectioned areas for locations that are to be later measured in place or otherwise measured for quantity unless a Change Order has been submitted to change the method of measurement.

Pits that are operated during extremely cold weather must have a disposal area within the x-sectioned pit limits where frozen material can be placed so it will be measured in the final x-sections for the pit. A situation similar to that above is encountered in pits that have many large boulders to be removed at the pit. In this case the best practice is to have the Contractor bury them within the x-sectioned area. In this way the voids are essentially filled and there is no problem in determining the true volume of the unused boulders.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

The Inspector should be sure where the Resident Engineer has approved using haul roads and what agreements exist. They must always watch for misuse of materials on the project and check waste areas to see that usable material from the project or borrow is not being used by the Contractor to help build entrance roads/or roads to pits. This might happen after a heavy rain or when the roads get soft.

It sometimes becomes necessary to measure borrow or excavation by truck measure; in this case a delivery slip must accompany each load. Truck bodies must be measured to substantiate quantities paid. Measurement shall be to the nearest 0.1 ft. and shall be recorded on a page in the Inspector's Diary set aside for that purpose. If the truck has removable sideboards it should be so noted opposite the measurements.

Partial loads are not to be estimated by the number of cubic yards. The quantity for payment will be estimated by the fraction of the load used or remaining and noted on the slip by the Inspector, for example:  $\frac{1}{4}$  load, or  $\frac{1}{3}$  load used.

Length, width and depth measurements for measured in place materials should be recorded directly into the Final Quantity Book. If not feasible, such measurements may be recorded in a Construction Book or in the back portion of the Inspector's Diary. All measurements must be signed and dated. Borrow measured in place is limited to  $5,000 \text{ m}^3$  [ $6,500 \text{ yd}^3$ ] per project and must be swelled 15 percent. Refer to Section 203.18, Method of Measurement, of the Standard Specifications.

Unless it is absolutely necessary, materials should not be removed from x-sectioned areas of pits for use in locations that require in-place measurement or truck measurement of quantities. Materials for such use should be obtained from unsectioned areas of pits, unsectioned pits, or after final x-sections have been taken. If particular or emergency conditions dictate the necessity of taking these materials from a x-sectioned pit, the trucks involved must be measured as previously stated above and all pertinent facts such as date, time, truck number, destination and use must be recorded in the Inspector's Diary and/or in other appropriate project field books. Each load must also have a delivery slip signed by an Inspector at the point of delivery if possible. The above procedure is required due to the necessity of properly documenting these quantities so they may be deducted from the borrow pit quantity as determined by original and final x-sections.

Delivery slips are, of course, required for all truck measured materials, regardless of their source. Their use will also eliminate the complicated procedures of documentation, measurement and computations, when materials requiring other than pit measure are removed from x-sectioned pits.

#### 203A-6 BORROW - FIELD DOCUMENTATION, MEASUREMENT, AND PAYMENT

This subsection describes the record keeping necessary to document and measure borrow required to meet the fill requirements of the contract.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

<u>Field Documentation</u> Project Diary, Inspector's Diary/Inspector's Daily Report: Standard Specifications, Section 203.03 and 203.04, require that no excavation suitable for embankment construction be hauled off the Project. The Resident or the Inspector is to make note of wasted excavation and the nature of it, since the more excavation the Contractor removes from the project, whether authorized or not, the more borrow is needed to construct the embankments.

The Resident or the Inspector will keep daily notes in the Project Diary or the Inspector's Diary on the Contractor's operations. Name of the pit that borrow is being hauled from and station to station limits it is being placed, whether in the core of the embankment or in waste storage areas. These areas, which are beyond the 1:1 slope from the finish shoulder break, are to be reserved for the placement of grubbings or other excavation not suitable for constructing the core of the embankment. The Contractor is not allowed to place borrow in these areas if there is waste excavation available.

Ideally, the Contractor should complete all excavation operations prior to hauling borrow to the project. If borrow is placed on the job before all excavation is complete, the Resident should advise the Contractor that they are doing so at the risk of having some borrow deducted from the final pay quantity. No excavation is to be removed from the project if it can be placed either in the core of the embankment or in waste storage areas. The case may arise, usually because traffic has to be maintained on the existing road, where borrow has to hauled to the job before excavation is complete. The result is that good excavation is wasted; in this situation the Contractor is not penalized. Discussions relating to these matters must be noted in the Diaries.

Borrow diverted for the Contractor's own use must be documented as well; materials used to maintain a haul road or town road, or to grade the equipment yard is all to be deducted from borrow if the material comes from a sectioned pit.

<u>Grade Check Book:</u> As stated previously under Section 203.5 - Excavation, documentation of subgrade checks is a requirement of the Department, whether the operation is in a cut or in a fill. Refer to Section 203C-6, Grade Check Book, for further discussion of grade checks.

<u>Measurement and Payment</u> Borrow: Borrow cannot be paid plan quantity. An exception is when the plans require backfill behind abutments and around multi-plate pipes to be granular borrow or gravel borrow. Standard Specifications, Section 203, Method of Measurement, allow backfill around bridge structures to be paid plan quantity.

When the Designer estimates quantity of borrow required for the project, they make assumptions that may or may not be representative of field conditions, particularly on bridge projects. The quantity of excavation estimated to be available for fills is, to some extent, guesswork. Some of the excavation may or may not be suitable for embankment construction or a situation may exist on the job that makes excavation not available in a timely manner; an example would be traffic maintenance on the existing roadway. The result is that the actual quantity of borrow used on the job is usually not what is estimated.

MAINE DEPARTMENT of TRANSPORTATION

#### Bureau of Project Development

#### April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

For these reasons, final quantity of borrow must be determined from actual measurements. The Resident will use the following methods or a combination thereof:

<u>Cross Sections</u> By Standard Specification, the contract bid price for borrow is based on the material being measured in its original position, i.e., in the pit. If measured any other way, the quantity must be adjusted as explained below. Original cross-sections are taken in the pit after the Contractor has stripped the surface and before excavating and hauling operations begin. The Survey Crew should flag the pit limits to alert the equipment operators not to remove material beyond the outer limits of the original cross-sections. Final sections will be taken after the pit has been graded and before grubbings, loam, or other material that can support a growth of grass has been spread.

Borrow pushed up and beyond the edge of pit at its perimeter will be deducted from the overall quantity measured for payment. The Survey Section uses a "total station" computer program to take cross-sections and to compute quantities; a print-out of each cross-section is available.

<u>Load Count</u> It is frequently not practical to figure borrow quantities by cross-sectioning the source. Since nearly all borrow pits are commercial pits and therefore are available to the public, it is hard for the Contractor to guarantee or even assure the Resident that all material taken out of a sectioned pit will be hauled to the job.

Load count, providing the total quantity measured is less than 5,000 m<sup>3</sup> [6,500 yd<sup>3</sup>], offers an alternative to the cross-sectional method. There are two problems common to load counted material: trucks not being fully loaded and drivers reporting more trips than actually hauled. For these reasons, it is advisable to assign an Inspector or ticket taker to witness and to collect delivery slips for every load hauled. If, because of lack of personnel, this cannot be done, the Resident or Inspector assigned must do a random check of the Contractor's hauling operations. He/she should do a "time study", i.e., determine how long it takes for a driver, or more than one, to make a round trip from the pit to the site, and also to visually observe if the trucks are fully loaded.

Section 203.18, Method of Measurement, Standard Specifications, requires that borrow by load count must be reduced to 90 percent of the quantity so measured.

<u>In-Place-Measure</u> A third method of measuring borrow is to compute the quantity in its final position, more commonly called "in-place-measure". This method is particularly suited to bridge projects. The procedure to follow is to figure the total quantity in the embankment from the design template to original ground or to bottom of grubbing limits. The excavation placed in the fill would be deducted from the total embankment and the resulting figure would be swelled 15 percent for final payment.

If earth excavation that is placed in fills is measured in its original position, it will be shrunk 15 percent before being deducted from the total embankment quantity. If it is measured in its final position, i.e., in the embankment, it will be deducted at 100 percent of the quantity so measured. If it is measured load count, it will be shrunk 25 percent before deduction.

MAINE DEPARTMENT of TRANSPORTATION

#### Bureau of Project Development

#### April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

If rock excavation that is placed in fills is measured in its original position, it will be swelled 33 percent before being deducted from the total embankment quantity. If it measured in its final position or by load count, it will be deducted at 100 percent of the quantity so measured.

<u>Borrow Deductions</u> When the Resident computes the final pay quantity of borrow, he/she must determine if any of the material should be excluded from payment.

Unless directed by the Resident, all usable excavation will be placed in the core of the embankment and all waste excavation will be placed in waste storage areas, either as shown on the plan cross-sections or as directed in the field. Only excess excavation can be hauled offsite. Borrow diverted for the Contractor's own use or placed in unauthorized areas will be at his/her expense. Standard Specifications, Section 203.18 - Method of Measurement, states that material placed outside the embankment will not be eligible for payment.

For deduction purposes, the following situations are to be considered:

Borrow is placed ahead of excavation operations which results in a surplus of excavation: Common excavation and rock excavation wasted will be swelled 15 percent before deduction; reference is made to Section 203.04, Standard Specifications.

Excavation is hauled off the job instead of being placed in the embankment and then later replaced with borrow because of convenience and ease of operation to the Contractor: The quantity of excavation that could have been placed in the embankment will be deducted from borrow at 100 percent of the quantity so measured.

Excavation is placed in the embankment beyond the design template in concentrated areas as opposed to being distributed throughout all fills, thus creating "fat" slopes: Earth and rock excavation placed beyond the pay limits defined in Section 203.18, Standard Specifications, will be deducted from borrow at 100 percent of the quantity so measured.

Borrow is placed in embankments beyond the design template, the result being "fat" slopes: Quantity placed beyond the pay limits defined in Section 203.18 will be deducted from borrow. Deduction will be made at 100 percent of the quantity so measured.

Borrow is diverted for the Contractor's own use: Material used to dress the Contractor's equipment yard or a waste dump, or to upgrade a haul road or town road will not be included for payment. Deduction will be made at 115 percent of the quantity so measured; refer to Section 203.03.

Final quantity for payment will be entered in the Final Quantity Book. Subtotals, and deductions making up the final quantity for payment will be entered in the Final Quantity Book and referenced back to source. All calculations and data entries must be signed, dated, and checked; the checker must sign and date his/her work.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 203A Borrow & Section 203B Embankment -- 16 Pages

### **EMBANKMENT**

#### 203B-1 GENERAL

The success of an embankment depends upon proper preparation of the foundation, use of suitable materials and proper placement and compaction of materials.

The composition of the soil and its moisture content dictate the type of compaction equipment most suitable for use on embankments. Vibratory type equipment has proved most suitable for sandy soils and sheepsfoot rollers for clay or silty soils. Moisture content may be controlled either by adding water or by aerating and draining the material. At least ½ inch per foot pitch from center line to the outer edge of embankment, as required by specifications, will be necessary for adequate drainage.

Sometimes there are special controls for certain areas. For example, the embankment area within 15 m [50 ft] of a bridge abutment, a box culvert or a structural plate culvert is moisture-density controlled, where outside this area it may be layer method.

#### 203B-2 LAYOUT AND CONTROL

The Contractor is responsible for project layout. The resident should inspect any proposed benchmarks, location for grade and line, utility conflicts and drainage easements.

Additional easements of some nature or the right to work on somebody's property are required in certain cases. Sometimes unforeseen drainage runoffs or the flattening of sideslopes for stability make easements necessary. Reference section 104.2 of the Standard Specifications for information regarding Right of Way changes.

#### 203B-4 CONSTRUCTION

a. <u>Layer Method</u> The layer method will be used on all Projects unless otherwise specified. The material shall be deposited and spread upon compacted material in full width layers not more than 200 mm [8 in] in depth, loose measure. Clay or loam soils shall be compacted by use of sheepsfoot or tamping type roller having a minimum weight on each tamper, under working conditions, of 1725 kPa [250 psi] of cross sectional bearing area. Sand or gravel soils shall be compacted by vibratory type compaction equipment or by pneumatic tired equipment and, if necessary, by the addition of water. A combination of the above or other methods capable of producing equivalent results may be used. The compacting operations shall be continued until each layer is compacted to its full depth and width.

With approval, the Contractor may place layers in excess of 200 mm [8 in] and less than 600 mm [24 in], loose measure, providing the specified compaction requirements are obtained and the Contractor

#### MAINE DEPARTMENT of TRANSPORTATION

#### Bureau of Project Development

#### April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

agrees to make necessary test excavation for the Resident to determine density. The Contractor will be required to demonstrate that the compaction equipment and methods are obtaining satisfactory compaction.

Satisfactory compaction for the purpose of the demonstration is defined as not less than 90% of the maximum density. The maximum density shall be determined in accordance with AASHTO T180, Method C or D, corrected by the Soils Laboratory Adjustment Chart, available at the MDOT Central Laboratory, Bangor, Maine. Field density tests will be made in accordance with AASHTO T191, adjusted to include only the material passing a 19 mm [<sup>3</sup>/<sub>4</sub> inch] sieve or by an approved method using a calibrated nuclear device.

#### b. Moisture Density Controlled Embankments

The Resident should be aware of the problems that may be encountered in a moisture-density controlled embankment and has the responsibility of seeing that soils testing personnel are on the Project and that they keep up with the minimum density tests (compactions) required.

The basic theory of moisture-density control is that the dry density of the soil being tested is compared, on a percentage basis, to the density of a sample of the same soil that has been compacted under controlled conditions. This laboratory test is called a "Proctor Test". The lab tests are made on soils of varying moisture content and the results plotted on a graph. (See Figure 203-C, Typical Proctor Test) The resultant curve clearly indicates the maximum density at optimum moisture of the material being tested.

The field density test taken to compare with the Proctor is the practical application of the basic formula: (1) Density = Weight / Volume

Much of the difficulty that many Contractors have in obtaining compaction is directly related to lack of moisture in the material. The curve obtained by the Proctor tests clearly shows that maximum density is most easily obtained at, or near, the optimum moisture content. With moisture content at very much less than optimum, more compactive effort is necessary to compact the soil to a given density. The same is true for soils that are much above the optimum moisture with the additional fact that they often appear unstable, particularly fine grained soils. Soils that have a moisture content so high that all the voids are filled with water cannot be compacted and the moisture content must be reduced.

For most sandy type soils in well drained areas, it is nearly impossible to get too much water into them. Conversely, in silty or clay bearing soils, if optimum moisture content is greatly exceeded (over 3 or 4%), as it may be extremely difficult, or impractical to remove the excess water.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 203A Borrow & Section 203B Embankment -- 16 Pages



The Resident should watch compaction test results closely for a consistent pattern of under compaction or over compaction. Many things can cause this, but it is most likely that the material may have unknowingly or gradually changed so that the original Proctor is not valid. This most commonly will occur in a cut section where compaction tests are made on subgrade, or on materials subject to degradation from traffic. The Resident should never hesitate to have additional Proctor tests made if there is even a suggestion of a change in the material.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

Compaction tests should not be taken as valid if heavy or vibrating equipment is operating nearby nor should tests be taken in frozen soils. Such tests are almost always invalid, due in part at least, to frost buildup on soil particles and the resulting changes in volume and moisture content.

In cold weather, compaction tests must be made before the ground freezes. If the tests fail and the material freezes before additional compactive effort is applied, then the area is unacceptable and the work either must stop in that area or the frozen material must be removed before more fill can be placed. If frozen material is removed it must be placed beyond the  $1 \frac{1}{2}$  to 1 slopes or in other areas where uncompacted material may be used. The Contractor should not be allowed to place this material beyond the theoretical slope limits. If this is done, it must be deducted from final quantities on "Borrow" jobs.

When fill is placed over frozen material, either previously compacted embankment or original ground, the Specification criterion of allowing only 1.5 m [5 ft] of material including base courses and frozen ground will then govern the construction of the embankment. It must be remembered that each layer must be compacted to specifications even over the frozen ground. The depth of frost should be determined for the actual area involved, not assumed from other remote data.

Where embankment construction is on weak or unstable soils it is often placed over a specified period of time. This is done to allow underlying materials to gain enough strength to support the increasing load imposed by the fill by letting settlement and equalization of soil pressure occur gradually and to prevent sudden shear failures. Surcharges or overloaded embankments are often constructed the same way to speed up settlement. The Soils Report should be closely studied in this regard to make sure that surcharges are located in all locations recommended by the report.

In wet areas requiring fill the initial layer should be free draining granular material whether the specifications call for it or not. This will eliminate, or at least help to prevent, capillary rise of water up into the embankment and possible subsequent frost action due to excess moisture in the overlying fill. Rock fill can be used over the granular blanket, but caution is urged in the use of rock fill directly on wet old ground as this can cause point loading on soft material and result in rupturing or disturbing materials that would otherwise have carried the loads as designed.

On Projects requiring considerable quantities of borrow, the Contractor should be encouraged to leave long fill areas several feet below subgrade and to bring them up to subgrade entirely with borrow. This will provide more uniform material at and near subgrade and will result in a smoother road due to less differential frost action.

#### c. <u>Sandwich Construction</u>

A system of constructing alternate layers of wet clay excavation and granular material, called "Sandwich Construction", can be an effective means of overcoming harmful disadvantages of using entirely clay fill, such as excessive settlement, weak shear strength, and to utilize material that is otherwise too wet to use. This method has the effect of providing drainage to increase the rate of

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

consolidation and also providing stable working platforms for heavy construction equipment. Sandwiching utilizes clay materials without danger of over compacting or overstressing the soil. The granular layers, providing drainage faces to increase consolidation rates, should be built in sufficient thickness (usually 200 mm [8 in]) to adequately distribute wheel loads to underlying clay layers so as not to exceed the shear strength of the clay material. In some cases it may be possible to make the required density tests on the clay after the next layer of granular material is placed. When this system of construction is used, a Change Order to request a waiver of modification of the density requirements on the clay material is often necessary.

Sandwich construction must be done carefully with light weight equipment being used as much as possible in order to keep the clay layers uniform and relatively smooth. The system works best when there are at least two, and more if possible, areas to construct. This gives the clay layers time to drain and consolidate while the sand layer is being compacted in the alternate locations.

Another method of modified sandwich construction that has been successful, particularly when the clay material is more silty, is to place alternate 200 mm [8 in] deep layers with granular material on top and mix the material to a depth of 300 mm [12 in] with a large disc harrow or a pulvimixer. The mixing is paid for at the bid price for Item 631.09 Aerator. The depth of mixing must be carefully controlled, as much deviation will change the relative percentages of the two materials and will change the "Proctor" of the material being tested.

In either of the above cases the top layer of material should be clay. This is to seal the top and provide a smooth working surface that can be kept graded and properly drained. The bottom layer should be granular material to provide a relatively even working platform, as well as provide a layer for the water to drain through when the following layers are placed and compacted.

The economics of using sandwich construction should be considered well in advance as a large amount of granular type borrow will be required. These methods of sandwich construction are used only in those cases where the moisture content of the clay material is over optimum and when the clay material, which could not possibly be used alone, would otherwise be wasted.

Due to high moisture contents, sandwich fills may sometimes weave and roll under the compaction equipment. Unless the clay breaks through in "boils" this should not overly concern the Inspector. The "weaving" or "rolling" will usually disappear as the underlying layers drain out and consolidate.

#### d. Toe Loads

On some projects toe loads are designed to act as counterweights to the roadway embankment. The toe loads must be constructed at the same time as the embankment to the extent that the roadway core should not be constructed above the depth of the toe areas until the toe load areas are completed. This is to keep the underlying soils from becoming overstressed and resulting in a shear failure.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

#### Section 203A Borrow & Section 203B Embankment -- 16 Pages

The most important factor to keep in mind regarding toe loads is that they are designed for weight not for a specific elevation. The soils report will give the density of the material that was assumed for the toe load computations. The main thing to remember is that toe loads that have settled should not have material added to them just to keep them at or to construct them to a certain elevation. The elevation that is often indicated on the plans is informative only and should be used as a guide with the actual weight of the embankment as the controlling factor. Toe fill areas should always come into mind as waste disposal sites.

#### e. <u>Use of Soils</u>

Best possible use should be made of the excavations which are available on the project. Many soils are unsuitable because of their natural state. They can cause instability in the embankment or have some other detrimental effect. Underlying material that is about to shear can often be spotted by the alert Inspector. Leaning trees or a slight rise in the soil adjacent to an embankment are tell-tale signs of an impending shear failure. Also, obvious cracks in the embankment, particularly if the cracks follow a crescent shaped pattern on one side of the embankment are a sign of failure, either in the embankment itself or in the material underlying the embankment.

If any of the above situations occur, work in the area should be stopped immediately. The Inspector should notify the Resident who will take the necessary steps to combat or correct the situation. The solution may take any of several forms such as adding toe loads to counteract the possible impending failure; removing some of the material if it is possible; just keeping traffic and equipment off the area; or following the recommendations of the Soils Section of the Materials & Research Division.

Occasionally, soils will be encountered that were not evident when the soils report was made. If this occurs, this material may be considered for use in embankments as described for sandwich type construction if it is too wet for normal use, it may be used in toe fill are as, or if absolutely necessary the material may have to be wasted.

Backfill for muck areas should be pushed on, not end dumped, so that loose muck will be cleaned from the bottom of the excavation.

Winter construction of embankments presents numerous problems, particularly in regards to freezing of materials as previously discussed. During winter months, construction will have to be slowed considerably in order to meet the requirements of the Specifications. In some cases it may be necessary to suspend operations completely until more favorable weather occurs.

The use of granular borrow merely to enable the Contractor to continue working should not be done unless it is economically justified. If granular borrow costs no more than common borrow then there is no reason not to use it for this purpose.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 203A Borrow & Section 203B Embankment -- 16 Pages

#### 203B-5 INSPECTION

All embankments shall start in the lowest portion of the fill. Layers shall be placed longitudinal to the center line and full width. The Inspector should see that all requirements of each type of embankment are met.

Using the layer method, the Inspector should see that the layers are the correct depth before being compacted. The Inspector will check the depth by selecting a certain point and checking the elevation before and after the material has been placed and will check grades at center line and right and left of center line to see that a crown is being maintained. The Inspector will also be responsible for adherence to the minimum testing requirements for compaction and insure that the compaction equipment is producing the necessary density. He should also make sure that borrow material meets specifications, and that it is free from oversized rocks, frozen material, and foreign or organic matter. Compactive effort must be changed if the type of material used changes appreciably. It is generally accepted that soils which are not compacted to 90 percent of their maximum laboratory dry density will, in time, exhibit internal shrinkage and settlement.

After the Contractor has placed and compacted the initial layer (which may vary in thickness, depending on the type of terrain to be covered) and has established a uniform working platform, they then will proceed to place the first 200 mm [8 in] layer of embankment material over the entire area.

After this first layer is placed, suitable compaction equipment will proceed to compact this layer to its full depth and width. Once this compaction operation has commenced, the Inspector must count the number of passes that the compacting machinery makes over the entire layer. A density test is then taken and the results correlated with the number of passes. This density test is used as a guide for the determination of the number of passes which must be made by the compacting machinery on each layer to result in a density of 90%.

Once the number of passes has been determined, each successive layer shall be subjected to the same number of passes without any density tests. Should any appreciable changes in materials or source of material occur, the entire procedure must be repeated. A brief description of the observed compaction operations shall be noted in the diary. This account should include the date, type of material, type of equipment, moisture content, number of passes over each layer, and any other pertinent information.

When moisture and density controlled type of embankment construction is called for, compaction tests are required on the subgrade in the cut sections and on each layer of embankment material where applicable.

For moisture and control density method of compaction, the Inspector should check grade and depth of layers the same as with the layer method. The compaction requirements are met by taking density tests at random and at questionable locations.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 203A Borrow & Section 203B Embankment -- 16 Pages

To determine the laboratory density (Proctor), a sample from each excavated cut section and samples from each borrow source must be procured to determine their maximum dry density and optimum water contents. This procedure must be followed regardless of the type of embankment construction called for in the contract. (See 203-3 Testing Requirements)

The Inspector should know where on the Project rock fill can be placed. It should determined what the possible locations for guard rail are on the project so that no rock is placed in these areas where it will interfere with the guard rail posts. All rock is to be dumped on the layer being placed and then pushed into position. All voids in the surface of each layer should be filled so that earth fill or material placed on top of the rock fill does not drop into the voids at a later date. Use clay or cohesive type soils over the last layer of rock fill if possible. A fine sandy fill material can gradually filter down into the voids and cause future settlement.

Where pre-compacted embankments are constructed for the installation of culvert pipes, the material selected should be cohesive enough so that the specified trench width can be excavated without the sides of the excavation collapsing, thereby destroying the effectiveness of the design.

The preparation and protection of the subgrade is very important. The Inspector must see that all subgrade is properly graded, compacted, and kept free of ruts, pot holes, and free from continuous travel along the same wheel ruts, which would cause an uneven compaction. The placement and compaction of an embankment should not proceed in the presence of excessive moisture that is evident by rutting, pumping, cracking, or collapse. Operations should be halted and the material should either be allowed to dry, or be manipulated and aerated or if moisture is extensive, it may require the removal and replacement of the subgrade material by undercutting. If the subgrade moisture is excessive, then the use of a geotextile fabric (ref Section 620 of this manual) may be warranted to strengthen and separate subgrade material from the borrow material or the implementation of an underdrain system may be used to control the moisture and strengthen the embankment.

At the time the embankment is built, the Inspector can, with a hand level and rule, use elevations already established on rail grades or grades on riser stakes at the shoulder to check each section.

Frequent checks of the embankment or excavation by using the elevations on side hubs, which were set prior to work in this area, should be made by the Inspector. The same methods are used to check subgrade in cuts as are used for embankments.

Many Inspectors find it convenient to check subgrade elevations by using a field book set up for each Station showing distance below finish grade at the edge of pavement and at subgrade break points. Subgrade can usually be checked by hand level and rule, or with a string using graded risers.

Fill placed beyond the 150 mm [6 in] tolerance slope line, whether it is muck, grubbing, usable excavation or borrow must be authorized by the Resident by letter or a "Resident's Directive" to the Contractor. In the authorization the Resident should set forth stipulations such as limits to which loam and seed will be paid. In addition to the above letter or directive, the Inspector should note in their diary

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 203A Borrow & Section 203B Embankment -- 16 Pages

the nature of any material placed beyond designated embankment lines. This will permit future determinations to be made regarding whether or not deductions should be made from pit-measured materials.

Fill may be placed up to 300 mm [12 in] beyond the designated slope lines in waste storage areas when the area beyond the slope line is composed entirely of waste materials. There should be no deduction to borrow quantities in this instance.

In placing backfill around a structural unit such as an abutment or retaining wall, it is paramount that the backfill be placed simultaneously on each side to avoid creating unbalanced stresses in the unit. Backfill around a structural unit where an approach fill will be constructed for the support of a pavement requires placing and compacting in a manner to ensure against detrimental settlement.

It is required by the Standard Specifications that the Contractor provides and maintain drainage during the grading of the roadway. Keeping the grade smooth and slightly higher in the center for quick runoff of rain water and maintaining ditches open for free drainage will help to prevent saturated subgrades.

Where seepage is encountered in cut sections, immediate draining with temporary ditches will benefit working conditions. Observations should be made of the effects of the flow of surface water on backslopes. The points of water concentration should be noted and repaired. Ditches and channels should be kept in a well drained condition with no standing water.

### **Maine Department of Transportation - Contracts Division** Waste Area Permit

Project No: Town:		
	Upon receipt of written permission from	
		(Property Owner)
		is authorized to place waster material from this project at
	(Contractor)	-
		, in accordance with Sections 107 & 108, State of Maine,
	(Description of Waste Area)	-
Department	t of Transportation, Standard Specification	s Highways and Bridges, Revisions of December 2002.

If this waste area is located within a wooded area, a screen of trees (min. width of 30m (100 ft) shall be maintained between the near edge of the waste area and the Right of Way or Construction Limit Line. If the width of the entrance to the waste area in a wooded area exceeds 5m (16ft), this entrance shall be replanted with trees compatible with the adjacent area. These plantings shall extend for a length of 30m (100ft) along the entrance road. or as otherwise directed by the Engineer.

All waste areas and entrances to the waste area shall be uniformly graded to drain, loamed or covered with other earthly material that will support growth of grass, seeded and hay mulched.

All trees which are damaged, uprooted or otherwise moved as a result of the waste material, and trees which have had waste material placed around them to the extent that they will die, shall be cut and removed.

Grading, Loaming, Seeding and Hay Mulching shall not be paid directly, but shall be incidental to other items in the contract.

The contractor is responsible for relocating and disposing of waste, in accordance with the Department of Environmental Protection Regulations, Chapter 404 (Storage and Disposal of Inert Fill).

Approval: \_\_\_\_\_ Project Resident

Agreed:

Contractor's Representative

\*original copy to Contractor and additional copy for Resident's file.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 203C Excavation -- 10 Pages

### **EXCAVATION**

#### 203C-1 GENERAL

References:

(1) Construction Manual, Section 203 - Excavation and Embankment Section 700 - Materials

- (2) Standard Specifications, Section 203 Excavation and Embankment
- (3) Special Provisions & Supplemental Specifications
- (4) Standard Details Highways & Bridges
- (5) Project Plans and Typical Sections
- (6) Construction Notes/General Notes

#### 203C-2 DESCRIPTION

This work consists of the construction of a graded roadbed, upon which the base and wearing courses will be built, generally referred to as earthwork. Excavation is that part of the earthwork that is removed, suitable material is used to form the embankment portion of the roadbed, unsuitable material shall be disposed of as specified by the resident or standard specifications. Roadway excavation is obtained from within the right of way or construction limit lines exclusive of drainage channels and structural excavation. It may be comprised of earth, solid rock, loose rock or any combination of these materials. When there is insufficient excavation to complete the embankment to the required lines and grades, then the balance of the fill must be made up of borrow.

<u>B: Types of Excavation</u> The following terms used in this section are explained below.

- 1. <u>Muck Excavation</u> Muck excavation provides for the removal and disposal of saturated or unsaturated mixtures of soil and organic matter that is not suitable for embankment or foundation material
- 2. <u>Grubbing Excavation</u> Grubbing excavation consists of the removal and disposal of all stumps, roots, and other objectionable material when clearing is required.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

- 3. <u>Common Excavation</u> Common Excavation consist of the removal and disposal of muck excavation, grubbing excavation, rock excavation less than 2 m<sup>3</sup> [2 yd<sup>3</sup>] material encountered in excavating for permanent stream channel diversion, channel widening or straightening, or excavation that is not otherwise classified and paid for.
- 4. <u>Rock Excavation</u> Rock excavation shall consist of removing hard igneous, metamorphic and sedimentary rock which cannot be excavated without drilling and blasting or drilling and splitting and all boulders, solid mortared stone masonry, concrete masonry, each having a volume of 2 m<sup>3</sup> [2 yd<sup>3</sup>] or more.
- 5. <u>Unclassified Excavation</u> Unclassified excavation shall consist of common excavation and rock excavation as classified above and not measured separately.

#### 203C-3 LAYOUT AND CONTROL

The contractor is responsible for project layout. The Resident should inspect any proposed benchmarks, location for grade and line, utility conflicts and drainage easements.

#### 203C-4 TESTING REQUIREMENTS

Refer to the project Minimum Testing requirements

#### 203C-5 CONSTRUCTION

Before the start of any earthwork operation, the Resident should review the project with the Contractor on the subjects of layout, limits and scope of work, the use of excavated and excess material, the location and use of any potential waste areas, and establish a schedule and procedure in order to avoid any potential misunderstandings and delay to progress of the work is avoided.

The Standard Specifications 656 establishes the Contractor to submit a Soil Erosion and Water Pollution Control Plan (SEWPCP). The Resident should observe the area(s) of the earthwork that will be exposed to the elements, the length of exposure, as well as the contractor's operations in or adjacent to streams or other waterways. The Resident should be prepared to restrict the size of the exposed area and the length of exposure, or require changes in the Contractor's operation or SEWPCP to avoid or minimize contamination, siltation or obstruction of any waterway. It is essential that temporary soil and water pollution controls be coordinated and performed in conjunction with all earthwork operations to insure effective and continuous erosion and water pollution control.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

#### Section 203C Excavation -- 10 Pages

The Project Resident may determine that dust abatement is required during earthwork operations. The Resident should insure that it is done, either under provisions of the contract or by contract modification, using water or approved dust control materials. Liberal use these dust controls is encouraged to minimize air pollution, improve driving vision and retain subgrade quality.

When excavating, all suitable material for use as topsoil should be stripped and salvaged for use as loam. If areas especially designated on the plans as fields do not have usable topsoil, notes should be made in the Diary to this effect. All materials on the project should be used unless the Resident gives written authorization to waste them.

The existing ground underlying proposed embankments, within the limits of assumed one-to-one slopes extending outward and downward from the finished shoulder lines, should be prepared in a manner to provide a firm and unyielding support for the roadbed. All heavy sod, organic material, and unstable soils should be removed from the area and the foundation compacted to the extent necessary to support the embankment and to permit attainment of the required density. The stability of fills will be improved through the removal of silty solid or frost susceptible material and backfilling with selected material from the excavation or, if the contract so provides, with granular backfill material. The limits of such undercutting or excavation below subgrade should be carefully established by the Inspector.

Rounding of slopes should be done according to the plans. The slopes and banks of existing ditches and channels are to be rounded or modified to allow vehicles which have left the road to safely traverse such roadside features. The proper time to call this to the attention of the Contractor's Superintendent is at the beginning of the earth excavation, otherwise it may be harder to accomplish the desired results. See Exhibit 203C for slope rounding procedure.

On projects that have very deep cuts and/or relatively long flat slopes it is good practice to check the elevation of the existing ground at the ground slope intersection to make sure it agrees with the plan x-section. This is to make sure that the slope stakes are set correctly for the Contractor's use. It can be an expensive and time consuming process if the cut is wrong and has to be corrected. Diary notes of checks made are desirable.

Uniformity of materials in the top portion of the roadbed, or frost susceptible area, is a very important factor in road construction. When a pocket of material that is dissimilar to that surrounding it is found in a cut, the odd material should be removed to about 600 mm [2 ft] below subgrade and replaced with material similar to that surrounding the pocket. It makes no difference if it is a silt or clay pocket is in a gravel or sand cut or a sand pocket is in a clay cut.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 203C Excavation -- 10 Pages



Where X=5' or less, T=X; otherwise T=5'

Set string line high enough to clear the slope break, e.g. 36". Measure from string to breaking point, e.g. 20". Halve the difference and add to the orininal distance from string to slope break. This gives the required measurement from string to slope rounding.

Example: 36'' - 20'' = 16'' $16'' \div 2 = 8'''$ 20'' + 8'' = 28''

Solution: The measurement from the string to the rounding is 28".

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

Section 203C Excavation -- 10 Pages

When a very abrupt change from a cut to a fill area occurs and the materials differ, it may be well to consider the advantage of carrying the tapered end of the cut further into the cut area and backfill with embankment material to provide a longer wedge of transition. The removal of this material should be paid for as the type of excavation applicable to the cut area. Confirmation to the Contractor can be by a Resident's Directive.

It is not unusual to find either springs of seepage areas in cuts. These are sometimes associated with layers or pockets of granular materials in clay or silty areas. When these springs do occur and are too far from side underdrains or are too much for a side underdrain to handle, it is usually desirable to take positive steps to prevent local saturation of the subgrade and base. Again, uniformity of materials is essential. The recommended solution is to construct a bed of Type "B" Underdrain sand approximately 450 mm [18 in] thick 1.5 to 1.8 m [5 to 6 ft] below finish grade. Type "B" Underdrain pipe is embedded in the sand bed, in a herringbone or other pattern and outletted at the most convenient and practical location. The backfill over the sand bed should be the same type material as that in the surrounding area. The above situations should be strictly controlled. The necessary work can be paid for directly by unit bid prices through Change or Extra Work Orders, or by Force Account work if necessary.

The basic intent of undercutting is to stabilize the subgrade. If it is at all possible, one of the first considerations should be to drain the undercut area. Undercuts are generally backfilled either with subbase material, or with borrow or granular borrow. In most cases, aggregate subbase is the better choice. Many jobs do not have an item for Granular Borrow and often its cost is not much, if any, different than aggregate subbase material. If good Granular Borrow is available at a lesser price it should, or course, be used for this purpose. The Resident should keep in mind that heavy and continued trucking by the Contractor may disturb the subgrade to the point where normally stable areas may become completely unstable to the extent that undercutting appears to be necessary. This situation is most likely to occur during the winter period between November and May with the ground often alternately freezing and thawing. If this occurs, the Resident should not direct the undercutting of an area just for the convenience of the Contractor. It is the Resident's obligation, to stop or temporarily suspend the work and prevent any further disturbance of the subgrade. If work is stopped for this reason, the damaged subgrade must be corrected by the Contractor at their cost before resuming work in that area.

The bottom of undercuts should be reasonably smooth to provide uniform depth of backfill. The maximum width should be to the point where a 1:1 slope line from the outside shoulder edge intersects the bottom of the excavation.

Generally speaking it is the prerogative of the Contractor to place excavated material from a cut area wherever desired on the Project. It is possible however, for the Resident to make suggestions to the Contractor that certain materials are placed in certain locations. The following information is quite general in nature and is worthy of consideration on any project.

MAINE DEPARTMENT of TRANSPORTATION

#### Bureau of Project Development

#### April 1, 2003

Section 203C Excavation -- 10 Pages

Excavated clay or silt materials can be placed in relatively deep fills without fear of future problems. Again, uniformity of materials in the frost susceptible area is more important than having strictly non-frost susceptible materials.

On projects with extensive cuts and considerable borrow, the Inspector and the Resident should make sufficient checks to be sure the Contractor is leaving sufficient locations in which to place any material to clean up after the borrow has been placed. This is as much a problem when borrow is being placed as when the excavation is being done. Usable excavated material should not be wasted. This is basically the responsibility of the Contractor and, if necessary, it should be brought to the attention of the Contractor that an equivalent amount of borrow will be deducted from final quantities. The Inspector should keep a load count of any usable materials wasted on borrow jobs, as well as the dates, locations, and vehicle numbers.

In those cases where the Resident feels additional excavation beyond slope limits is authorized, such authorization shall be by a Contract Modification. Approval shall be obtained before doing the excavation work at the particular location, if this is at all possible.

Any rock that is encountered during excavation shall be measured and paid for as a separate item. The rock shall be completely or sufficiently cleared of overburden so that correct measurements of the rock can be made.

The excavation of rock is not usually a particular problem until it comes to cleaning up. In those cases where there is extensive cleanup of rock debris, it may be necessary to waste the material. It is important that the Inspector and Resident keep in mind the fact that there will be "Cleanup" and leave some specific locations where rock debris can be utilized in such a manner as to enhance the Project and save the use of "borrow".

Payment for the removal of rock beyond the neat lines indicated on the plans should always be authorized by Contract Modification and may be done for any one or several of the following reasons:

- a) To save opening up a borrow pit and the resulting rehabilitation costs.
- b) To keep from extending a shallow borrow pit over a large area.
- c) To make a safer more maintenance free project. This may be an extremely important consideration where rock cleavage planes lay so that pieces of the rock may slide off and become either a hazard or a maintenance problem.
- d) To increase snow storage space. This is most important in long rock cuts.

It is the practice on most construction projects involving grading work to utilize as much waste excavation material as possible to the benefit of the road. Such materials as grubbings, wet clay, muck, etc. are placed in slope areas where high supporting strength is not necessarily needed.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

#### Section 203C Excavation -- 10 Pages

When there is surplus excavation material on a project, it may be used to flatten slopes of the embankment or to improve the appearance of the project within the right of way. If this is done, the Resident should be fully aware of any other phases of the project that may be affected by this use of surplus excavation, such as culvert pipes and the consideration of the possible necessity of extending them and the extra loam, seed and hay mulch that may be required due to flattening slopes. These and other possible considerations should be ascertained and payment, if any, to the Contractor determined well ahead of the actual directive to the Contractor to proceed. This is particularly important in cases where there is no apparent benefit to the State, whereupon the Contractor will sometimes agree to do necessary appurtenant work at his own expense. All agreements of this nature must be agreed upon by the Contractor in writing either by letter or by signing a Contract Modification covering the work.

Should the Contractor construct slopes that are obviously bulging beyond the allowable maximum, they should immediately be instructed to remove the excess material. If, upon the receipt of such an order, the Contractor fails to move the material in question, they should be ordered in writing to remove it.

When waste material has to be taken to locations off the project, it is necessary that the Resident give written authorization to the Contractor for each location or each waste area.

Factors to be taken into consideration when approving a waste area are:

- 1) Surrounding terrain: Will this area blend with the rest of the country side when loamed and seeded or will it be obvious to passersby.
- 2) Entrances should be angled away from oncoming traffic when possible and should be no wider than one truck width-from the roadway to at least 30 m [100 ft] beyond the Right of Way or Construction Limit Line (whichever is farthest). This is to provide a natural screening effect for the waste area and also the access road, even after the area is selectively thinned.
- 3) Will the area tend to erode due to natural water courses and possibly present an unsightly appearance in the future?
- 4) Is there an adjacent waterway that may be subject to damage from erosion or slides?
- 5) All necessary permits shall be obtained by the Contractor before the Resident issues a permit.

The Inspector should make a note in the diary when materials are used on the Project in this manner. The Resident should make a point of finding suitable areas on the project within the neat lines of the fill slopes beyond the  $1\frac{1}{2}$  to 1 slope limit.

203C-6 <u>FIELD DOCUMENTATION, MEASUREMENT, AND PAYMENT</u> This subsection describes the recordkeeping necessary to document and measure excavation. It is recommended that you read Division 900 of this Manual to better acquaint yourself with general project record keeping.

a. <u>Field Documentation</u> Project Diary, Inspector's Diary/Inspector's Daily Report. By specification, the Contractor is required to place usable excavation within the slopes of the embankment; no excavation

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

Section 203C Excavation -- 10 Pages

can be hauled off the project without the Resident's approval. It is their responsibility to determine what material can be used on the job, or can be wasted, or stockpiled for future use. This becomes particularly important on a "borrow job" as the amount of wasted excavation directly affects the amount of borrow required. A project is a "borrow job" when material from off the project is required to meet the fill requirements of the contract.

The Resident, or the Inspector if one is assigned to cover excavation items, will keep daily notes of the Contractor's activities relative to earth and rock excavation. Entries will be made documenting station to station limits of material excavated and locations where placed. It is important to record such information as: material directed to be placed within the core of the embankment or in waste storage areas within embankment limits, or to be stockpiled for future use on the project, or hauled to waste dumps off the job.

Circumstances surrounding the hauling of excavation off the project must be explained, particularly if the project is a borrow job. Material suitable to be placed in the embankment but wasted without the Resident's permission will be deducted from borrow. Likewise, material only suitable to be placed in waste storage areas outside the core of the embankment but wasted without permission will also be deducted from borrow. Excess excavation, not required for embankment construction, will be hauled off the project and disposed in waste dumps or other locations approved by the Resident.

Excavation that the Contractor stockpiles away from the job for future use on the Project will or will not be measured for a second payment, depending on whether or not the Resident has allowed stockpiling. Standard Specifications, Section 203, Basis of Payment, allows payment for the rehandling of excavation when it is not possible for the Contractor to do otherwise.

Added undercuts, changes in ditches either in grade or offset, changes in backslopes, changes in excavation limits to the approaches and drives must also be noted and measured for payment.

<u>Grade Check Book</u> It is a requirement of the Department that the Resident or Inspector spot check the Contractor's grading operations to assure that fine-grading is done within construction tolerances stated in the Specifications. It is recommended, although not a requirement, that a "Grade Check Book" be made part of the project records. This book will serve as a convenient and ready reference for checking subgrade, sidewalks, ditches, and backslopes on mainline and side roads, and also for keeping track of what areas the Contractor has fine-graded and what areas have been spot checked. This book should be set up prior to the start of excavation and borrow operations so that the Resident, when in the process of figuring offsets and grades, will discover possible errors in the plans and will also become familiar with the geometrics of the job before work begins.

Whether or not the Resident uses a Grade Check Book, some written documentation must be entered in the project records that the Contractor's fine-grading operations have been checked and approved. These entries may be made in the Project Diary, Inspector's Diary, directly in the Final Quantity Book, or in the Grade Check Book if there is one.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 203C Excavation -- 10 Pages

#### b. Measurement and Payment

<u>Earth Excavation</u> Final quantity for payment can be the figure shown in the Schedule of Items in the contract, more frequently called the "plan quantity". The Resident may pay plan quantity as final payment but the following two conditions must be met: the quantity estimated (Engineer's Estimate), must be reasonably accurate, and the limits of excavation in the field must approximate those estimated. The plan quantity must be adjusted, upward or downward, because of changes made in the field and also because of increases or decreases in quantity of rock excavation estimated. The Engineer's Estimate must be reviewed to assure that rock is not included in the quantity of earth figured. Changes will be measured and recorded directly in the Final Quantity Book or in the Construction Book. Types of changes are described under Field Documentation, above.

Field changes and added work will be measured by load count, by length, width, and depth, or by original and final cross-sections. Load count will be reduced by 10 percent to arrive at a quantity equivalent to what would be measured in its original position. Computations may be done in the Final Quantity Book, in the Construction Book, or on computation sheets that are part of the Final Quantity Computations Book. If the Resident uses the computer program "Field Manager", the Item History to Date will be generated in lieu of a Final Quantity Book.

Wasting of excavation without the Resident's permission will be measured and deducted from borrow. Measurement will be by load count or by length, width, and depth. Load count excavation will be reduced to 90 percent for deduction purposes; excavation measured in-place off the project will be deducted at 100 percent of quantity so measured.

Muck and grubbing excavated beyond limits shown on the plans will not be measured for payment unless the Resident has authorized a change in the limits. Lateral excavation limits for muck excavation are determined by the intersection of the bottom of the excavation and a 1:1 slope line drawn down from the finish shoulder break. Borrow placed in overexcavated areas will not be deducted unless the excavation beyond lateral limits is deliberate or due to negligence by the Contractor.

<u>Rock Excavation</u> Unlike earth excavation, the actual quantity of rock excavated will not agree with the Engineer's Estimate. Since soundings are normally taken some distance apart, original ledge cross-sections drawn on the plans do not accurately describe top of ledge, particularly where there is earth overburden. Abrupt changes in elevations are not always detected and also, boulders may be mistaken for solid ledge. This lack of detailed information results in errors in the estimated quantity, and therefore the "plan quantity" cannot be used to make final payment. If earth is paid plan quantity, it must be adjusted according to actual quantity or rock paid.

Rock has to be re-sectioned before removal; but, if the Contractor does not want to strip ledge prior to blasting, top of ledge elevations can be determined, by recording from a known elevation, depth the drill rig has to go before hitting solid rock. Standard Specifications, Subsection 203.04 General, requires that

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

Section 203C Excavation -- 10 Pages

the Contractor remove overburden before original cross-sections are taken; it is the Resident's prerogative, therefore, whether or not to allow the Contractor to leave the earth in place before blasting.

Quantity of ledge for payment will be figured from "new" originals to the design cross-section if rock is removed to the construction limits described in Section 203.05 of the Standard Specifications. No payment will be made for rock removed beyond the design cross-sections unless the Resident has directed a change in design. Standard Specifications, Section 203.18 Method of Measurement, defines pay limits. Quantities will be computed by the average end area method.

Boulders, concrete, solidly mortared masonry, all defined in the Standard Specifications, Section 203.01(b), and small quantities of rock such as ledge nubbles, will be measured in three dimensions. Boulders encountered at subgrade during excavation operations will be measured as rock excavation and the portion estimated to be above subgrade will be deducted from earth excavation. A "pay" boulder is defined in Section 203.1(b) referred to above.

The situation may arise where ledge is not measured in its original position but is measured load count or in its final location as riprap or rock fill. The quantity so measured will be reduced to 75 percent to determine the amount of rock excavation for payment; the reason being that ledge swells after it is excavated. Measurements and sketches, if needed for clarification, will be entered in a bound field book, which would be the Construction Book or the Final Quantity Book.

If the job is bid "unclassified", the Resident should make note of the elevation of actual top of ledge where backslopes are designed on a  $\frac{1}{4}$ :1. In deep ledge cuts, pay limits of earth overburden have to be adjusted depending on the elevation of the ledge.

If the Contractor wastes rock without the Resident's permission and the result is an increase in the amount of borrow needed to meet the fill requirements of the contract, the quantity of rock wasted will be deducted from borrow at 100 percent of the quantity so measured. All measurements and load counts will be entered in a bound field book.

All quantities for payment will be entered in the Final Quantity Book and referenced to the source document. There must always be a trail of reference from the Final Quantity Book to the original record. The final quantity for payment must be labeled as such and signed, checked, and dated. All calculations and data entries must be signed, dated, and checked; the checker must sign and date his/her work.

Standard Specifications provide a mechanism for paying for specific items added to the contract without requiring a quote from the Contractor. The following is list of items commonly used and how to pay for them:

<u>To Pay For</u>	<u>Use item</u>	Unit Price
Rock Excavation	203.20 Common Exc	6 x Bid
Struct. Rock Exc – Drainage	203.20 Common Exc	16 X Bid
Excavation for Slope Blanket	203.20 Common Exc	2 X Bid

### **Maine Department of Transportation - Contracts Division** Waste Area Permit

Project No: Town:		
	Upon receipt of written permission from	
		(Property Owner)
		is authorized to place waster material from this project at
	(Contractor)	-
		, in accordance with Sections 107 & 108, State of Maine,
	(Description of Waste Area)	-
Department	t of Transportation, Standard Specification	s Highways and Bridges, Revisions of December 2002.

If this waste area is located within a wooded area, a screen of trees (min. width of 30m (100 ft) shall be maintained between the near edge of the waste area and the Right of Way or Construction Limit Line. If the width of the entrance to the waste area in a wooded area exceeds 5m (16ft), this entrance shall be replanted with trees compatible with the adjacent area. These plantings shall extend for a length of 30m (100ft) along the entrance road. or as otherwise directed by the Engineer.

All waste areas and entrances to the waste area shall be uniformly graded to drain, loamed or covered with other earthly material that will support growth of grass, seeded and hay mulched.

All trees which are damaged, uprooted or otherwise moved as a result of the waste material, and trees which have had waste material placed around them to the extent that they will die, shall be cut and removed.

Grading, Loaming, Seeding and Hay Mulching shall not be paid directly, but shall be incidental to other items in the contract.

The contractor is responsible for relocating and disposing of waste, in accordance with the Department of Environmental Protection Regulations, Chapter 404 (Storage and Disposal of Inert Fill).

Approval: \_\_\_\_\_ Project Resident

Agreed:

Contractor's Representative

\*original copy to Contractor and additional copy for Resident's file.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 204 Shoulder Rehabilitation -- 2 Pages

### **SHOULDER REHABILITATION**

#### 204-1 GENERAL

#### References:

- (1) Construction Manual, Section 700 Materials
- (2) Standard Specifications
- (3) Project Plans
- (4) Typicals
- (5) Construction Notes
- (6) General Notes

#### 204-2 <u>DESCRIPTION</u>

This work consists of rehabilitating existing shoulders by grading and compacting shoulders and furnishing, placing, grading and compacting new shoulder aggregate to required grade.

#### 204-3 LAYOUT AND CONTROL

The contractor, when necessary, does layout.

#### 204-4 TESTING REQUIREMENTS

Refer to the project Minimum Testing Requirements.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 204 Shoulder Rehabilitation -- 2 Pages

#### 204-5 CONSTRUCTION

The Inspector and the Contractor should do a site examination of the existing shoulder and determine what, if any, unsuitable materials such as sod, tar strips, high spots from winter sand, drives, etc should be removed before placing the new aggregate. After the removal of unsuitable materials, the surface of the existing shoulder should be graded and compacted approximately parallel to the proposed finished paved shoulder surface. This removes some of the winter sand buildup and places it on the outside of the shoulder, providing a firmer base to place the new aggregate. The Standard Specifications address the type and thickness of the new aggregate to be placed. After the new aggregate is placed and fine-graded to the specified tolerance, it is compacted to where it is suitable for paving at the time of paving.

#### 204-6 INSPECTION

Inspection of shoulder rehabilitation consists of monitoring the progress of the work daily for compliance with material requirements, proper cross slopes and adherence to the Standard Specifications. Measurement of rehabilitated existing shoulder will be the number of square meters [square yards] shown in the Schedule of Items in the contract, unless it has been added to or deducted from by the Resident. Field documentation will be made daily of areas worked, crew, and type of equipment, and entered in a bound book. It should also note all areas that have been accepted.

#### 204-7 FIELD DOCUMENTATION, MEASUREMENT AND PAYMENT

The subsection describes the record keeping necessary to document and measure shoulder rehabilitation.

<u>Field Documentation</u> Project Diary, Inspector's Diary or Daily Report: The project Resident or Inspector will keep notes describing the contractor's operations, such as; whether the Contractor grades existing material back or ahead to fill in low areas or hauls in new aggregate. Station to station limits of work done and the checking and acceptance of cross-slope will also be noted.

<u>Measurement and Payment</u> Final quantity for payment will be that shown in the schedule of items or adjusted as follows: changes are made to the station to station limits or width of work described in the contract, the Resident or Inspector will record these changes in the Final Quantity Book or in a Construction Book. **All calculations and measurements must be signed, dated and checked; the checker must sign and date their entries.** 

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 205 Shoulder Reconstruction -- 2 Pages

### **SHOULDER RECONSTRUCTION**

#### 205-1 GENERAL

#### References:

(1) Construction Manual, Section 203 - Excavation and Embankment

Section 700 - Materials

(2) Standard Specifications, Section 205 - Shoulder Reconstruction

- (3) Project Plans
- (4) Typicals
- (5) Construction Notes
- (6) General Notes

#### 205-2 DESCRIPTION

This work consists of reconstructing existing shoulders by excavating and furnishing, placing, grading and compacting new aggregate to the required cross slope.

#### 205-3 LAYOUT AND CONTROL

The contractor does layout.

#### 205-4 TESTING REQUIREMENTS

Refer to the project Minimum Testing requirements.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 205 Shoulder Reconstruction -- 2 Pages

#### 205-5 CONSTRUCTION

Excavation is done after the shim has been placed on the travelway. This is accomplished with an all-purpose excavator, which has the ability to cut to very accurate line and grade. After excavating to the required cross section, the new aggregate is placed, graded and compacted.

#### 205-6 INSPECTION

Inspection of shoulder reconstruction consists of monitoring the progress of the work daily for compliance with material requirements, proper cross slopes, depths and adherence to the Standard Specifications. Measurement of reconstructed shoulder will be the number of square meters (square feet) shown in the schedule of items in the contract, unless, it has been added to or deducted from, by the Resident. Field documentation will be made daily of areas worked, crew, and type of equipment, and entered in a bound book. It should also note all areas that have been accepted.

#### 205-7 FIELD DOCUMENTATION, MEASUREMENT AND PAYMENT

<u>Field Documentation</u> Project Diary, Inspector's Diary or Daily Report: The Resident or Inspector will keep notes describing the Contractor's progress of work in this item. Information recorded will be: removal and disposal of existing excavation, source of new material, comp active effort, checking cross-slope and area or work by station to station limits.

<u>Measurement and Payment</u> Final quantity for payment will be that shown in the schedule of items. If the Resident changes the station to station limits of work or width shown in the contract, they or the Inspector will record these changes in the Final "Quantity Book or in a Construction Book. Final Quantity will then be adjusted according to the changes. All calculations and measurements must be signed, dated and checked; the checker must sign and date their work.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 206 Structural Excavation -- 5 Pages

### **STRUCTURAL EXCAVATION**

#### 206-1 GENERAL

#### References:

(1) Construction Manual and Standard Specifications

Section 206 Section 603 Section 604 Section 605

- (2) Special Provisions and Supplemental Specifications
- (3) Standard Details Highways and Bridges
- (4) Project Plans
- (5) Construction Standard for Excavations

This section includes excavation for culverts, catch basins, manholes, underdrains and structures; below subgrade or below the design slopes. Excavation for inlet and outlet ditches is not included in this section. Earth excavation for drainage and minor structures is incidental except for excavation lower than 300 mm [12 in] below the pipe or structure. Earth excavation for major structures is usually paid as per schedule of items in the Contract, except for structural rock excavation.

#### 206-2 LAYOUT AND CONTROL

Layout is done by the Contractor, but the Resident should inspect the proposed location for grade and line, utility conflicts, and drainage easements.

#### 206-3 TESTING REQUIREMENTS

Compaction testing and graduation testing of stone and granular backfill are done as per the List of Minimum Testing Requirements.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 206 Structural Excavation -- 5 Pages

#### 206-4 CONSTRUCTION

Excavation should be as per OSHA's "Construction Standard for Excavations" as required by specifications. Suitable excavation should be utilized in the Project. Cross culverts should be backfilled with the original excavated material to lessen the chance of differential frost heave.

Underground utility locations should be located on the surface by the utility company, but care must be taken in digging in the vicinity, as the depth of the facility is seldom known.

Examination should be made of all excavated areas to insure the location, elevation, and dimensions are accurate; the foundation is firm and compacted with adequate bearing capacity; and it is dry.

In examining excavated footing areas, the material encountered should be compared with the borings shown on the plans. If the material encountered is sufficiently different, the Resident should be notified to determine if any changes in the design of the footing are warranted.

Unstable material, which will not provide a firm foundation for a pipe or structure, should be excavated and replaced with suitable excavation or granular material. Rock must be measured for payment in three dimensions or profiled with hand level and rule or instrument and rod. It may be necessary to undercut when in rock to provide a cushion under the culvert or structure as per plan or the Resident's direction. Undercut areas may be backfilled with broken rock, suitable excavation or granular material as directed.

Construction or installation of the facility will be as per Sections 509, 603, 604, or 605. Backfill must be per Specifications in 200 mm [8 in] lifts, except for the first lift on underdrains, which should be 300 mm [12 in] to protect the pipe from displacement or damage from compacting equipment.

Backfill density tests of drainage and minor structures are seldom taken, but it is the Inspector's prerogative to take tests if it is felt adequate compaction is not being achieved. Density tests of the backfill of major structures will be as per the testing schedule for the Project.

#### 206-5 INSPECTION

Inspection of the installation of culverts, catch basins, manholes and is covered in Section 600 of this manual. Documentation of the work and measurements are placed in a Drainage or Construction Book. Field Measurements can be entered directly in the Final Quantity Book.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 206 Structural Excavation -- 5 Pages

#### 206-7 FIELD DOCUMENTATION, MEASUREMENT, AND PAYMENT

This subsection describes the recordkeeping necessary to document and measure the excavation of earth and rock required to install culverts, bridge abutments, and other structures.

#### a. Field Documentation

Project Diary, Inspector's Diary/Daily Report, Drainage Book, and Construction Book: The Resident or Inspector will keep notes describing the Contractor's excavation operations required for the installation of drainage, bridges, and other structures. These notes will describe location and final disposition of the material, whether on the job or off the job.

Documentation of installation of culverts, underdrain, catch basins, and manholes will be entered in the Project Diary. If the drainage is extensive, a Drainage Book should be set up prior to the work being done and all notes pertaining to drainage work will be entered in the Drainage Book. Reference is made to Division 900 of this Manual for further explanation of the Drainage Book. Undercutting to provide a stable foundation, bedding, excavating rock, and material used to maintain traffic will be noted and measured for payment.

Documentation of excavation for bridge abutments, pier footings, wingwalls, retaining walls, multiplate pipes, and other major structures will be entered in the Project Diary or Construction Book. The Construction Book will be used if layout and/or field measurements and sketches are required. Typical measurements would be for rock excavation and undercutting. Division 900 of this Manual explains the Construction Book and how it is used.

Documentation of installation of other miscellaneous minor structures will be entered in the Project Diary or the Construction Book. The Construction Book will be used if layout and measurements for removal of rock or unstable foundation material are required.

#### b. Measurement and Payment

Drainage and Minor Structures Excavation for culverts, catch basins, and other minor structures is incidental down to 300 mm [12 in] below the flow line of the pipe or bottom of the base. Excavation required below that point for stable foundation or change in grade will be paid under the item "Structural Earth Excavation-Below Grade". That quantity will not be paid plan quantity; this figure is a "throw-in" and is not necessarily based on work anticipated to be done. Quantity for payment must be field measured. Measurements and sketches will be entered in the Drainage Book, signed and dated. Depth will be as directed by the Resident and the width will be the limits defined in Section 206.04 of the Standard Specifications and Sheet 605(1) of the Standard Details for underdrain.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 206 Structural Excavation -- 5 Pages

Rock excavation for drainage and other minor structures will be the quantity actually excavated to the pay limits defined in Section 206.04 of the Standard Specifications. Measurements and sketches will be entered in the Drainage Book, signed and dated.

Bedding material will be computed to the depth authorized beginning at the flow line of the pipe or bottom of the base in the case of catch basins; width will be as defined in the Standard Specifications.

<u>Major Structures</u> Section 206.04 of the Standard Specifications states that final payment for earth excavated for bridge abutments and piers will be the quantity shown on the plans unless the structure is founded on ledge. In this case, payment for earth and rock removed would be based on field measurements. Since top of ledge shown on the plans is typically inaccurate, new ledge originals would be needed. Original cross-sections will be taken at right angles to the centerline of bearing at close intervals.

Quantity of earth will be figured vertically from original ground or roadway subgrade to top of ledge and horizontally to pay limits shown on the plans or in Standard Specifications, Section 206.04. If the actual top of ledge is lower than the elevation shown on the plans, earth excavated below that elevation would be paid at  $1\frac{1}{2}$  times the bid price for structural earth excavation. Typically, the elevation of top of ledge is shown on the plans as, for example: 26 + -. Such a designation would be interpreted to mean that only earth excavated below elevation 25 would be paid at  $1\frac{1}{2}$  times the price. Also, if the elevation of bottom of the footing were lowered due to a change in design, excavation below the original elevation shown would also be paid at  $1\frac{1}{2}$  times the price.

If the plans call for excavating into ledge for a footing, the Contractor is allowed a pay tolerance of up to 300 mm [12 in] below the elevation of the bottom of the footing. Rock excavated and concrete placed below the 300 mm [12 in] tolerance will not be paid. If the Resident directs the Contractor to remove rock below the bottom of footing elevation because of a change in design or because of the soft nature of the ledge, it will be paid at  $1\frac{1}{2}$  times the bid price for structural rock excavation.

"Pay" boulders, defined in Section 203.01(b) of the Standard Specifications, that are found partly within the excavation limits for drainage and major structures will be measured and computed for payment as follows: that portion estimated to be within the structural excavation pay lines will be paid as Item 206.07, Structural Rock Excavation, and the remainder will be paid as Item 203.21, Rock Excavation.

There will be no payment for rehandling structural excavation; the bid price includes excavating, rehandling as many times as necessary, and placing in its final position, whether it is in embankments, waste storage areas, or off the Project.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

Section 206 Structural Excavation -- 5 Pages

Standard Specifications provide a mechanism for paying for specific items added to the contract without requiring a quote from the Contractor. The following is list of items commonly used and how to pay for them:

<u>To Pay For</u>	<u>Use item</u>	Unit Price
Struct Rock Exc-Major Structure	206.082 Struct Ea Exc – Maj Strucr	6 x Bid
Struct Ea Exc-Maj Struct, Below Grade	206.082 Struct Ea Exc – Maj Struct	1 ½ x Bid
Struct Rock Exc-Maj Str, Below Grade	206.082 Struct Ea Exc – Maj Struct	9 x Bid
Struct Rock Ex-Maj Str, Below Grade	206.082 Struct Rock Exc – Maj Struct	1 ½ Bid

Final quantities of structural earth excavation-below grade and structural rock excavation will be entered in the Final Quantity Book and labeled as such. References will be made, as appropriate, to the Drainage Book or Construction Book for measurements and computations or labeled as original entrees if the measurements are entered directly into the Final Quantity Book.

All calculations and data entries must be signed, dated, and checked; the checker must sign and date his/her work.

#### April 1, 2003

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 208 Sand Drains -- 2 Pages

### SAND DRAINS

#### 208-1 GENERAL

References:

- (1) Special Provisions and Supplemental Specifications
- (2) Construction Manual Section 200 Earthwork
- (3) Standard Specifications Section 200 Earthwork

Sand drains are vertical sand filled wells, placed to accelerate consolidation of soft soils under embankments by de-watering. The most common use has been in the proximity of bridges over soft soils where post-construction settlement is not acceptable. Jetted and augured sand drains have almost entirely been replaced by wick drains, due to environmental and economic concerns.

#### 208-2 LAYOUT AND CONTROL

Layout, staking and numbering, will done be by the Contractor or Subcontractor. The location should be within 150 mm [6 in] of the designated plan locations.

#### 208-3 TESTING REQUIREMENTS

Graduation tests on granular fill drainage layer and sand drain sand; testing of wash water to determine wash time. Submittals on equipment to be used and installation procedures.

#### 208-4 <u>CONSTRUCTION</u>

Site preparation might include clearing, grubbing, excavation and/or fill to allow for placement of the granular drainage fill or blanket. Various types of rigs and methods are used to construct the drains; auguring cranes, air or water jetting rigs, etc. A typical jetting operation would be a specially fitted crane using a heavy mandrel suspended on cable. The head of the mandrel has water jets fed by hosing on a mounted reel on the crane. First, a casing, long enough to go below the granular fill, is driven by the lift and drop of the mandrel. Once the casing is driven to depth, the driving collar is removed from the casing and the mandrel enters the casing, jetting

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

#### April 1, 2003

Section 208 Sand Drains -- 2 Pages

the hole to design depth. The mandrel is held at the bottom of the hole for a specified wash time to clear the hole.

After the mandrel is removed, the hole is filled with sand and the casing is removed. A dozer or loader is constantly moving the levee containing the jetting and wash water as drains in an area are completed.

An auguring operation might be used in areas of underground debris or obstructions.

Water from the drains is carried horizontally by a sand blanket layer or/and stone drains as the fill is loaded. Recent constraints might require the jetting water be treated.

#### 208-5 INSPECTION

Care must be used to not damage the drainage blanket, either by placing it too thick for the support or damaging it with equipment.

Trial drains are initially run for satisfactory completion. Once this is accomplished, inspection consists of recording locations and depths of each drain in a Sand Drain Book and observing procedures. The penetration rate of the mandrel would be specified along with the washing time for the area, requiring the attention of the inspector. Depth of drains should be randomly checked with a weighted tape, but the contractor should make provisions for determining the depth of penetration at any time.

#### 208-6 FIELD DOCUMENTATION, MEASUREMENT, AND PAYMENT

#### Field Documentation

<u>Sand Drain Book, Construction Book</u> The Resident or Inspector will keep notes describing the Contractor's progress on the item. Crew, equipment and which drains are being worked on will be made part of the entries. The Inspector should set up a grid chart or a progress chart in the office with each drain located and numbered, as each drain is accepted it should be identified on the chart.

#### Measurement and Payment

The Inspector will enter measurements in a Construction Book specifically set aside for sand drains and labeled as such. This book should be organized before the work is done. All calculations and measurements must be signed, dated and checked; the checker must sign and date their entries.

MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 209 Wick Drains -- 2 Pages

### WICK DRAINS

#### 209-1 GENERAL

References:

- (1) Special Provisions and Supplemental Specifications
- (2) Construction Manual Section 200 Earthwork
- (3) Standard Specifications Section 200- Earthwork

Wick drains are prefabricated vertical drains placed to decrease the settlement time of embankment over soft soils. The most common use is in the proximity of bridges over soft soils where post-construction settlement is not acceptable. The geotextile wrapped plastic core of the wick has channels, permitting the upward movement of water from soft soils, de-watering and consolidating as fill is placed. Jetted and augured sand drains have almost entirely been replaced by wick drains, due to environmental and economic concerns.

#### 209-2 LAYOUT AND CONTROL

Layout, staking and numbering, will done be by the Contractor or Subcontractor. The location should be within 150 mm [6 in] of the designated plan locations.

#### 209-3 TESTING REQUIREMENTS

Graduation tests on granular fill drainage layer. Submittals on equipment to be used and installation procedures.

#### 209-4 <u>CONSTRUCTION</u>

Site preparation might include clearing, grubbing, excavation and/or fill to allow for placement of the granular drainage fill or blanket. Various types of rigs and methods are used to install the wicks. A typical rig would be a specially fitted crane using a mandrel of diamond shaped cross-section, through which the wick passes; an anchor of steel rod or plate on the head of the mandrel prevents dirt from entering and anchors the wick when the mandrel is withdrawn. Penetration of the mandrel is accomplished in various ways: chain drive, cable

#### MAINE DEPARTMENT of TRANSPORTATION

#### Bureau of Project Development

#### April 1, 2003

Section 209 Wick Drains -- 2 Pages

pulldown, weight and vibration, vibratory hammer, etc. The contractor must provide means of determining the depth of the wick at any time.

When the wick is installed to the designated depth, the mandrel is withdrawn above grade, leaving the anchored wick material. The wick is cut off, leaving excess above the working surface. This procedure is repeated at the many locations. The granular drainage layer or drainage blanket provides for horizontal movement of water from the wicks, out of the fill area, as it is loaded.

#### 209-5 INSPECTION

Care must be used to not damage the drainage blanket, either by placing it too thick for the support or damaging it with equipment.

The drains are paid by the linear meter [foot]. Trial drains are initially run for satisfactory completion. Once this is accomplished, inspection consists of recording locations and depths of each drain in a drain Book and observing procedures.

#### 209-6 FIELD DOCUMENTATION, MEASUREMENT, AND PAYMENT

#### Field Documentation

<u>Wick Drain Book, Construction Book</u> The Resident or Inspector will keep notes describing the Contractor's work, crew equipment and which drains are being work on will be made part of the entries. It is recommended that the Inspector keep a grid chart or progress chart in the office with each drain located and numbered. As each drain or block of drains are accepted, they should be identified on the chart.

#### Measurement and Payment

The Inspector will enter measurements in a Construction Book. All calculations and measurements must be signed, dated and checked; the checker must sign and date their entries.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 211 Inslope & Ditch Excavation -- 2 Pages

### **INSLOPE AND DITCH EXCAVATION**

#### 211-1 GENERAL

#### References:

(1) Standard Specifications, Section 211 - Excavation and Embankment

- (2) Special Provisions
- (3) Project Plans
- (4) Typicals
- (5) Construction Notes
- (6) General Notes

#### 211-2 DESCRIPTION

The construction of Inslope and Ditch Excavation consists of removing winter sand buildup and other accumulated earth material form existing inslopes and ditches or creating new ditches to improve surface runoff. The type of equipment used is usually a rubber-tired all-purpose excavator. These machines have the control to cut to very accurate line and grade.

#### 211-3 LAYOUT AND CONTROL

Layout is done prior to construction by the Inspector. This is accomplished by spray painting on the existing pavement the limits of required inslope and ditching. These limits are taken from the Construction Notes and verified in the field. For new ditch excavation, the Inspector will layout the limits and the contractor will do the stakeout according to the New Ditch Typical.

#### MAINE DEPARTMENT of TRANSPORTATION

Bureau of Project Development

April 1, 2003

Section 211 Inslope & Ditch Excavation -- 2 Pages

#### 211-5 CONSTRUCTION

Excavation is usually done after the shim has been placed on existing paved shoulders, or, in the case of gravel shoulders, after mainline shim and new shoulder aggregate has been added. This establishes the control point at the edge of shoulder. Excavation may be designated for slope flattening in guardrail elimination areas or other areas noted in the Construction Notes or Plans; otherwise, it is hauled to an approved waste dump. It should be kept in mind that old or worked-out pits can be often utilized as suitable waste areas. In designated stone ditch areas, the ditch excavation is paid separately from the stone to the original ditch lines. All disturbed soil should receive immediate erosion control measures.

#### 211-6 INSPECTION

The Inspector, after being assigned their duties by the Resident, should become familiar with the Plans, Typicals and Special Provisions. The Inspector should clarify any questions or doubts concerning the inspection work with the Resident. Occasional checks should be made on grade and smoothness of the ditch and slope, flow of runoff, proper functioning of the drainage system, and cleanup of all areas disturbed, including waste disposal areas.

#### 211-7 FIELD DOCUMENTATION, MEASUREMENT, AND PAYMENT

#### Field Documentation

Project Diary, Inspector's Diary/Daily Report: The Inspector will keep notes relative to grade, smoothness, and acceptance. Conditions of acceptance are noted under <u>Inspection</u>.

#### Measurement and Payment

Measurements will be entered directly in the Final Quantity Book or in a Construction Book. All calculations and measurements must be signed, dated and checked; the checker must sign and date their entries.