

## 105.00 -- MEASUREMENT AND PAYMENT

### 105.01 GENERAL

The Project Manager may elect to pay the plan quantity for items like pavement when the item is built to plan geometrics. Measurements are not always required when the item is constructed to plan and specification requirements.

If the item of work does not conform to the specification requirements, a new item of work must be added as extra work. Example: On guard rail, if it is necessary to leave out a post because of a drainage structure and use a double safety beam section, this section of guard rail must be paid for as extra work as it does not conform to the specification requirements for guard rail.

### 105.02 MEASUREMENT OF QUANTITIES AND COMPENSATION FOR ALTERED QUANTITIES

@ All standard items of work listed in the contract are to be measured for payment using **English (metric)** System of measurement. A list of standard contract items and their units of measurement is available at each field headquarters and on Lotus Notes or the NDR Web Page. Inspectors or survey parties concerned with measuring and/or recording contract items will need to be informed of proper procedures to be followed.

The contractor may request that materials hauled to the project and paid for by the cubic meter (cubic yard) be measured and a mass conversion factor be used for determining the cubic meters (cubic yards) of material delivered. When the Project Manager approves this procedure, the mass of the material must be obtained on approved scales, the material must be hauled approximately the average haul to the point of delivery, and then the volume of the material must be determined. The mass of the material in kilograms (tons) divided by the volume of the material in cubic meters (cubic yards) will be the mass conversion factor. The cubic meters (cubic yards) of material used may be determined by dividing the total mass delivered by the mass conversion factor.

The Project Manager will determine the frequency for establishing mass conversion factors. The frequency will be dependent on the quantity of material delivered, on variations in the material's characteristics (moisture content, gradation, etc.), and on variations in the length of haul.

The final record for the contracted work must include all records and computations used in determining the mass conversion factors.

If provision is made that payment of any contract item is to be made as an "established quantity", payment will be made on the established quantity listed unless authorized alterations are made. Established quantities are often listed with prescribed tolerances set forth to allow for minor construction changes without requiring that final measurement be made. Authorized alterations are considered to be substantial changes in construction items which would usually be authorized by revised plans or

specifications, and may be listed in two categories. (See *SSHC Subsections 104.02, 109.01 and 109.04.*)

- The first type would be an alteration of a minor item and does not involve supplemental agreements. In this case, payment will be made at the contract unit price for the actual total.
- The second type is an alteration of a major item involving an increase or decrease of more than 25 percent of the item. This situation may involve a supplemental agreement stipulating changes in the actual quantities of the work and establishing (if necessary) a new price per unit price for such work. If there is an overrun, the original contract quantity plus 25% is paid for at the bid price. The extra quantity above 125% is paid for at the new negotiated cost. If there is an underrun, the entire quantity is paid for at the new negotiated price per unit. Payment would then be made at the new unit price for the increased orders and quantity.

#### **105.03 CANCELLED ITEMS (MATERIALS FURNISHED BY CONTRACTOR AND NOT USED DUE TO CHANGES IN PLANS)**

The Department will, if the contractor desires, take over unused material at the cost delivered to the location at which it is accepted by the Department.

It will be necessary for the District Engineer or the Project Manager to initiate a change order providing for payment for such materials. The item included in this agreement shall include the phrase, "delivered but not incorporated in the work", in order to specifically identify such materials. The unit price established for items of material furnished by the contractor and not used because of a change in plans will usually be based on the actual cost of the materials, plus 10 percent to cover overhead, handling, other costs and profit. To substantiate the unit price established, the Project Manager should obtain a copy of the receipted invoice for the material and attach it to the supplemental agreement.

@ **Change Order/Supplemental Agreement must be created to pay this.** It will also be necessary for the Project Manager to include an explanation of the transaction in **the Change Order/Supplemental Agreement**. Complete information regarding the disposal made of the material, such as the supply base to which it is delivered or the project on which it is used, is essential. The party to whom it is delivered should prepare a DR Form 329, "Imprest Inventory", providing for the proper transfer of the charges for the material.

Payment for such materials must be included in the final estimate as a nonparticipating contingency.

#### **105.04 PARTIAL PAYMENT**

The contractor is to be paid once a month for satisfactory progress on the basis of work completed during that month. The Project Manager prepares a contractor's estimate in the computer stating the estimated quantities for items of completed work to date. This

document is forwarded to Lincoln through the District Engineer's office for processing and payment via E-mail.

When the value of the work completed during the first half of the contractor's pay month exceeds the amount stipulated in the specifications (usually \$10,000.00), a semi-monthly contractor's estimate is prepared. All partial payments are made on satisfactory work and materials only, as evidenced by complete certifications or test results as required. Defective work or material shall not be included for payment until the defect has been remedied.

## 105.05 FIELD MEASUREMENT AND PAYMENT

**Photographs and Video Tapes** - Documentation on film can save many questions and provide critical answers. Take a picture any time it may be helpful.

**Field Records - General** - Payment for most contract items is based on the plan quantities. Final measurements should be avoided as long as the specifications permit and the contractor does not dispute the quantities. Their construction should, however, be documented as described under "Inspection Notebooks" with the statement (if applicable) "Constructed as per plans" and substantiating data or measurements, if necessary, also entered in the record.

Field records must be properly kept to substantiate that the contractor has conformed to the requirements of the plans, specifications, and Special Provisions both as to quantity, usually involving measurements, and quality, usually involving tests, of the work or material items used on the project.

Instructions and examples of preparation of specific records may be found in this manual in *Appendix 3*.

- @ **Field SiteManager Entries or SiteManager Item Documentation** - Field measurements made for pay items of work and records of placement of materials shall be entered directly in SiteManager.
- @ Field and lab test results on quality of materials will be entered into SiteManager. Record and document tests using approved Material Sampling Guide and SiteManager procedures.
- @ The item documentation records should indicate the stationing used, date placed or constructed, and sketches with dimensions if necessary to give clear understanding of the placement and material used. The names of the party or engineer making the measurements and dates performed must be entered in SiteManager or included with the supporting documentation. Materials used in the construction of the project for which no direct payment is made but are considered subsidiary to other pay items should also be documented in SiteManager, Materials Management Section.

@ **SiteManager** should contain a detailed summary of all shipments received for the project, including the kind of material, the identification number, net mass, date received, delivery point and, if possible, the point of origin. Include distribution to the proper group of the contract and information on material received but not used on the project.

The laydown inspector shall **enter in SiteManager** the activities required in the performance of his/her job. This would normally include such items as types of equipment being used, equipment checks, tonnage checks, thickness checks, temperature checks of mixture, etc. **All entries are to be dated**. Also, we would like to bring to your attention that the inspectors are to sign the scale ticket on receipt and acceptance of the material. Base all entries on facts, not opinions.

@ Final computations shall be entered directly into **SiteManager or other approved recording and documentation methods used in conjunction with SiteManager**. Operations of performing computations and checking computations shall be identified on each page of computations by operation, date, and the name or initials of the individual.

@ Plans, tables, and sketches provide supplementary details necessary to clarify **SiteManager entries** for pay items. Any such plan or sketch shall be **saved electronically in the project files**. Supplementary plans and sketches are sometimes necessary to define the extent of a pay item sufficiently enough to remove any doubt as to its limits.

@ 

- A good technique is to build the sketch or table in the computer and then **save it electronically**.

Supplementary sketches are sometimes necessary to show measurements of irregular areas for both pavement removal and the construction of new pavement.

@ Computation **spread**sheets **should be** used where detailed computations are necessary to determine pay quantities. These computations are made from **SiteManager**, cross section, or sketch information and should be fully referenced in **SiteManager**. It is necessary that all computations **be referenced in SiteManager or saved electronically in a project folder (Read Only Access)** so that the computations can be checked for correctness of method and accuracy.

**Scale Tickets** - Scale tickets are used to substantiate quantities of materials which are paid for by mass. The original copies (white) should be submitted with the final records of the project to the District Final Reviewer. Preparation of scale tickets and distribution is discussed in the section pertaining to asphaltic concrete inspection (Subsection 507.12 in this manual).

105.06 CONTRACTOR'S ESTIMATES

*SSHC Subsection 109.07* allows payments to the contractor if satisfactory progress is being made. These contractor's estimates will include quantities and amounts for items of work completed to the date of the estimate.

@ Progress estimates are completed in **SiteManager** by the Project Manager and signed electronically. It is the District Engineer's responsibility to review and approve the estimate in a timely manner, sign it electronically, and forward it electronically to the Controller.

Upon receipt by the Controller, the estimate is processed further by the Construction and Controller Divisions before it is released for payment.

@ On all Federal-Aid projects, it is necessary to separate participating and nonparticipating items of work on the progress estimate form by dividing them into separate summaries for each project in a contract. Each line is properly divided by the Controller Division when the item is loaded in **SiteManager**. This procedure is done to comply with our agreement with the Federal Highway Administration regarding procedures for current billing and current audits. Items which are added to the contract should be included in the proper group in the participating or nonparticipating summary as applicable. Items added by change order-supplemental agreement should be considered as participating unless the agreement form is marked "nonparticipating" when returned from the Lincoln Office. The District Office should be consulted for further information on any item for which there is some uncertainty regarding its status.

For contracts which include wage rates, progress estimates shall not be released by the Project Manager until the contractor and subcontractor have submitted all delinquent payrolls and Forms WH-348. These reports shall be considered delinquent when they are not in the Project Manager's hands by the seventh day after the date on which the employees are paid. Notify the contractor by letter, with a copy to the Construction Division, of any delinquent payrolls and WH-348's in advance of the estimate date. The estimate should be prepared at the regular time and forwarded immediately upon the receipt of the payrolls.

**Estimate Preparation**

Please remember to update Line 2 (current quantity) on the estimate for all items added by plan revision or supplemental agreement. This adjustment should be made as soon as you receive the plan revision or supplemental agreement.

The Controller Division depends on Line 2 being accurate so they can allocate sufficient funding to each project.

DISTRICT ESTIMATE SCHEDULE		
District No.	Regular Estimate Date (Only if money due contractor)	Alternate Estimate Date (\$10,000 or more must be paid)
*1	1st Saturday of Month	3rd Saturday of Month
2	2nd Saturday of Month	4th Saturday of Month
*3	1st Saturday of Month	3rd Saturday of Month
4	2nd Saturday of Month	4th Saturday of Month
5	4th Saturday of Month	2nd Saturday of Month
6	3rd Saturday of Month	1st Saturday of Month
7	4th Saturday of Month	2nd Saturday of Month
8	4th Saturday of Month	2nd Saturday of Month

\* Districts 1 and 3 use the 5th Saturday of the month instead of the 1st Saturday of the future month as Primary Cutoff day when there are 5 Saturdays in a month.

**Stockpiling:**

*SSHC Subsection 109.07*, Paragraph 4. provides that estimates may also be allowed for acceptable nonperishable materials meeting the requirements of the plans and specifications and delivered in the vicinity of the project or stored in acceptable storage places. This will generally apply to aggregates, structural and reinforcing steel, metal specialty items delivered but not incorporated in the work, and other materials which cannot be used for extended periods of time because of delays beyond the contractor's control. The amount included in the estimate will be determined by the PM, but in no case shall it exceed 100-percent of the value of the materials as shown by copies of receipted invoices or costs. Partial payments shall be listed under the stockpiling category with an "800" series number.

As the material is used, the payment for this material should be reduced accordingly in the stockpile item on the estimate.

Payment for stockpiled material is "permissive", and it should not be interpreted to be a requirement in cases where the material will remain in storage a comparatively short time (less than one month). When there is a question as to the inclusion of a material for payment, the District Construction Engineer should be consulted for instructions.

*SSHC Subsection 106.02* states that:

All materials are subject to and will be inspected, tested, and accepted by the Project Manager before incorporation in the work.

*SSHC Subsection 1001.02* requires:

Materials which must be documented by a certificate of compliance, certified test, or test reports shall not be incorporated into the work until such certificates have been delivered to the Department and verified for compliance.

It follows from the above that material items which have not been tested and accepted, or for which appropriate certification, as defined in the Materials and Research Manual, has not been delivered to the State, should not be included on an estimate for payment. Likewise, no material item which has been stored in accordance with Paragraph 4. of Subsection 109.07 of the Specifications should be included on an estimate for payment unless the appropriate test data or certifications for compliance with the specified requirements are in the files of the Project Manager and documented in SiteManager.

@

The Project Manager shall maintain documentation of progress estimate quantities.

**Types of Contractor Estimates** – SiteManager has only three types of estimates:

- **Progress** – all estimates prior to the “Final Estimate.”
- **Final** – generated once District has completed its review and is ready to forward the project to Lincoln for “Finaling.”
- **Supplemental** – all estimates generated to change the “Final Estimate.” Additional estimates are obsolete in SiteManager. However, the PM must notify the Construction Division when a project is complete – which used to be the purpose of the additional estimate. In SiteManager, the PM must send a Lotus note to “DOR-CONST-COMPLETION NOTIFICATION.” The Finaling Manual explains what must be included in the “note.”

**Processing Estimates** – Each District should direct a copy of signed estimates to the Construction Division printer (CON1) as soon as possible after affixing the electronic signature.

Each District is encouraged to sign and print estimates as often as possible. The uniform and steady arrival of estimates in Lincoln is encouraged and appreciated by both the Construction Office and the Controller Division.

**Contractor's Statement of Compliance (Form WH-348)** - Form WH-348 shall be submitted for each weekly payroll period by each contractor and subcontractor on all projects financed by Federal Funds. (Form WH-348 is not required on other than Federal-Aid projects.) The WH-348 form should be attached to and submitted to the

Project Manager with the contractor's payrolls and kept in the District. The Project Manager should maintain a record of WH-348s and payrolls received. The WH-348 for the last week of work shall clearly indicate that it is the final report.

The contractor and subcontractor are required to submit the payrolls with Form WH-348 weekly. Payrolls shall be considered delinquent when they are not in the Project Manager's hands by the seventh day after the date on which the employees are paid. The Project Manager shall defer the release of progress estimates until contractors comply with this rule. The Project Manager shall notify the contractor by letter of any delinquent payrolls or Forms WH-348 in advance of the estimate date.

**Contractor's Statement of Materials and Labor - (Form FHWA-47).** Form FHWA-47, "Statement of Materials and Labor", shall be submitted by the contractor as required and explained in Section VI, Record of Materials, Supplies and Labor, Form FHWA-1273 (Rev. 4-93). The FHWA-1273 is included in every Federal Aid project. The contractor shall submit one copy of this report to the Lincoln Construction Division. If this report has not been received when the final records are sent to the Lincoln Office, the Construction Division shall withhold release of the final estimate until the Form FHWA-47 is received.

#### **105.07 FIELD COMPUTATIONS FOR FINAL PAYMENT**

**General** - The quantity of each item of work on the project shall be computed and checked by the Project Manager and his/her assistants. Computations must be complete so that each step may be easily followed without completely checking the mathematics. The date and initials of persons performing computations and verifications should be shown on each sheet of the field notes, cross sections, and computations. Unless this information is shown, it will be necessary for the work to be duplicated in the District Office.

All computations will then be reviewed in the District Office to determine the correctness of the method used in computing the quantities of the various items. Sufficient checks of the mathematics should be made to determine the care and accuracy used in preparing the computations. A check should be made to determine if all necessary, supplemental and force account agreements have been executed. Considerable discretion must be exercised during the District review in order to ascertain the accuracy of final computations and yet eliminate needless rechecking.

The Construction Division will not check all projects. Only random audits will be performed.

**Roadway Excavation** - Final earthwork quantities may be computed by either of two methods or a combination of the two methods.

- A. **Data Collector** - When the preliminary survey was entered in a Data Collector, then all survey data during and after construction can be modeled with GeoPak. Final cross sections are computed by GeoPak once the final surface shots are input in the Data Collector. Cross sections can be taken at any location by GeoPak.

- B. **Planimeter Method** - After the final cross sections have been plotted and checked, the areas of excavation which are enclosed by the original and final cross sections are measured by the planimeter. In using the planimeter, for areas plotted 60 mm (5 feet) to 1 mm (1") horizontally and vertically, each area should be circumscribed twice. The reading at the end of the second circuit should be twice the reading at the end of the first circuit. The planimeter shall be set so that the reading at the end of the second circuit is in square meters (square yards) of end area. Without changing the planimeter setting, areas may also be determined for cross sections plotted vertically 60 mm (5 feet) to 1 mm (1") and horizontally 120 mm (10 feet) to 1 mm (1"). The reading at the end of the second circuit should be twice the reading at the end of the first circuit. The reading at the end of the second circuit should then be divided by 2 for the area in square meters (square yards).

Planimeters shall be checked frequently by running around 4 squares of the cross section paper. Different individuals and different cross section sheets often require different settings of the planimeter arm, and the machine should be checked when changing operators or cross section sheets. Each area should be checked by another person. In checking areas, the following shall be the allowable error:

<u>ALLOWABLE AREA ERROR</u> (metric)		
Areas of 3 to 38 m <sup>2</sup>		1 m <sup>2</sup>
Areas of 39 to 50 m <sup>2</sup>	not over	2 m <sup>2</sup>
Areas of 51 to 99 m <sup>2</sup>	not over	3 m <sup>2</sup>
Areas of 100 to 250 m <sup>2</sup>	not over	4 m <sup>2</sup>
Areas of 251 to 500 m <sup>2</sup>	not over	5 m <sup>2</sup>
Areas over 500 m <sup>2</sup>		1 percent

<u>ALLOWABLE AREA ERROR</u> (English)		
Areas of 32 to 400 ft <sup>2</sup>		10 ft <sup>2</sup>
Areas of 400 to 550 ft <sup>2</sup>	not over	20 ft <sup>2</sup>
Areas of 550 to 1075 ft <sup>2</sup>	not over	30 ft <sup>2</sup>
Areas of 1075 to 2700 ft <sup>2</sup>	not over	40 ft <sup>2</sup>
Areas of 2700 to 5400 ft <sup>2</sup>	not over	50 ft <sup>2</sup>
Areas over 5400 ft <sup>2</sup>		1 percent

All excavation cross sections shall be inspected for closure and, if necessary, a "field check" made. Sections must close in order that the end area may be accurately determined.

If any excavation area occurs on a horizontal curve, it must be corrected for curvature. This correction will be a reduction in area size on the inside of the curve and an addition to the area size on the outside of the curve. If the entire area is a cut section, the correction may be either a subtraction or an addition to the original area size depending on the location of the center of gravity of the cross section. The formula and an example of end area curvature correction for both simple and spiral curves is shown here:

### INSTRUCTIONS FOR CORRECTING EARTHWORK AREAS FOR CURVATURE

Excavation areas of cross sections on horizontal curves shall be corrected for curvature using the formula  $C = \frac{Ae}{R}$  where:

- A = the area of the cross section
- e = the eccentricity
- R = the centerline radius of the curve

The area A is the area of the section determined with a planimeter. The eccentricity is the distance between the centerline or base line of the cross section and the center of gravity of the cross section, and is a positive number when the center of gravity falls outside the centerline, and a negative number when the center of gravity falls inside the centerline. The correction is positive or negative depending upon the sign of the eccentricity.

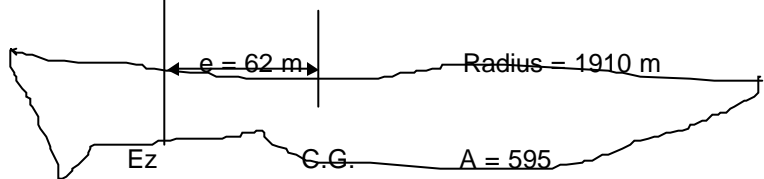
The center of gravity of the cross section in most cases can be determined by inspection. If the area and the eccentricity are large and the radius small, it may be necessary to determine the center of gravity of the section by the moment arm method, after determining the center of gravity of the smaller portions of the section by inspection.

In determining the center of gravity, it must be remembered that the center of area falls at the center of gravity only when the area is rectangular in shape.

All computations for the correction for curvature may be made with a slide rule.

#### EXAMPLE

Assume a three degree curve to the left with the following cross section on the curve at Station 100+00.



StaM 100+00

$$C = 595 + 19 = 614$$

$$F = 0$$

$$\text{Then, } C = \frac{595 \times 62}{1910} = 19$$

#### RADIUS COMPUTATION FOR AREAS IN SPIRAL CURVE

When the above area falls in a spiral curve, the radius must be computed for each station and plus using the formula  $r = \frac{RL}{1}$  where:

- r = Radius at Required Station on the Spiral
- R = Radius of Main Curve
- L = Length of Spiral
- 1 = Distance from T.S. to Required Station

If the above Station 100+00 is 150 m from the T.S. and given a 300 m spiral, then  $r = \frac{(1910)(300)}{150} = 3820$  m, the radius at Station 100+00.

After the excavation areas have been carefully checked, they are transferred to earthwork computation sheets (DR Form 99) and the volumes of cut areas computed. These need be computed only as far as the fifth column (Sum End Areas Corrected for Distance). The total of this column may be converted to cubic meters (square yards) by multiplying it by the factor 50 (in English units use factor 1.8518519.) Earthwork computations shall be computed to one decimal place (0.1 m<sup>3</sup>) (0.1 cy). Sheet totals to the nearest cubic meter (cubic yard) should be summarized on DR Form 205.

**Overhaul** - Overhaul will be computed in the Lincoln Office using the mass diagram. When overhaul is involved, the following procedures should be followed by field personnel (See *SSHC Section 209*):

1. Recheck balance to determine that all plan excavation has been incorporated.
2. Recheck embankment to insure that undue swelling or slope flattening has not occurred.
3. Locate additional excavation within the balance if possible.
4. Inform the District Office of the existing conditions and shortages.
5. Take embankment sub final cross sections over the entire area where embankment is deficient. Correlate this area to the project centerline.
6. Take preconstruction cross sections of the new borrow area and correlate it to the project centerline. Should the borrow originate in an adjoining balance, subfinal cross sections should be taken to complete the separation of the two balances. Upon completion of the excavation and placement in embankment, final cross sections over both areas (excavation and embankment) are necessary to measure the quantity of excavation moved and in order to compute the overhaul, if any. A diagram of the source and final deposit area with "measured distances" will be very helpful in making the final computations.
7. Transmit all notes, plotted cross sections and computations (DR Form 99), diagrams, and pertinent information to the Lincoln Office for analysis and overhaul computations.
8. The Project Manager will be advised of the quantity for payment and all notes, diagrams, computations, and pertinent information will be returned.

**Foundation Course** - Foundation course may be of several types. It will be noted that *SSHC Subsection 307.04* provides that Foundation Course will be measured for payment by the square meter (square yard) or Megagram (ton) as defined in the Bid Item Schedule. When Foundation Course is measured by determining the mass, it is important that the moisture content be maintained within the limits shown in the

specifications in order to avoid payment for extra water in the material. Frequent moisture tests should be made at the time of measurement.

*SSHC Subsection 307.04* says moisture content at time of measurement shall be between optimum and 3 percent below optimum.

**Gravel Surfacing** - Gravel surfacing computations should be submitted on DR Form 264.

Since the payment the contractor receives for gravel depends on test results and computations shown on this form, it is extremely important that both the testing and the arithmetic be accurate. Placing information shall be shown in the field books.

"Truck Capacity Computations", Form DR-101, are necessary when trucks are hauling such items as gravel, sand, filler, etc. and payment is to be on a cubic meter (cubic yard) basis. This form shall be prepared promptly at the beginning of the work and submitted to the District Office. The type of material being hauled shall be noted on the form.

If trucks are transferred to another project under the inspection of the same Project Manager or inspector during the construction season, it is not necessary to remeasure the trucks or submit DR Form 101. However, always inform the District Office of the transfer.

This information should include the name of the owner and license number, capacity of the truck, original project number on which the truck was measured, and the new project number.

**Prime Coat and Tack Coat** - (See *SSHC Sections 504 and 517*) - Asphaltic materials for prime coat and tack coat shall be measured in liters, corrected to 15°C (60°F). If the material is delivered in tank cars, the quantity is usually determined by measuring the mass or metering at the source. If this is not done at the source, the mass of the material must be measured at the point of delivery.

When material is transported directly to the work in trucks, the mass shall be measured on scales.

If the material has been metered, the volume at 15°C (60°F) shall be determined. (Contact Materials & Tests Division for proper conversion factors.) Any material that is lost, wasted, used on private work, or transferred to other projects shall be deducted. Tank cars and trucks shall be checked to verify that they have been entirely emptied before returning to the refinery.

When asphaltic material is transferred from the project, the Project Manager shall measure the material before it leaves the project and immediately notify the Materials and Research Division that the material is being transferred. The Construction Division and the District Engineer(s) should also be notified. The notice shall be by the DR Form 193, Transfer of Asphaltic Material. If possible, it is advantageous for a copy of this report to accompany the transferred asphaltic material.

**Asphaltic Concrete Surface Course and Base Course** - Tickets may be furnished by the Department or by the contractor. The contractor may furnish the tickets if he/she wishes to use automatic printing equipment. If the contractor desires a copy of the scale tickets, they should be prepared in triplicate. The original should be received by the laydown inspector. The first copy is the contractor's copy, and the second copy is for the project records.

The liters of asphaltic cement shall be measured as shown in *SSHC Subsection 503.05*. (HINT: A common final computation error is the failure to deduct asphalt cement used in wasted asphaltic concrete from the final pay quantity.)

**Concrete Pavement** - The number of square meters (square yards) of concrete pavement to be paid for will be the plan quantity. Widths and lengths of irregular areas built other than as shown in the plans shall be measured and recorded in a data collector and the areas computed, or computations made from staking data providing no changes occurred during the actual construction. Quite often the plans indicate the quantity (square meters) (square yards) involved in intersections, driveways, and the more complex sections of the projects. In these instances, the quantity indicated on the plans for a given area may be used as the final pay quantity, provided that no geometric changes have been made from those shown on the plans and that a rough check of the quantity shown has been made to determine if any apparent errors exist.

In determining the final quantities for concrete pavement or base course on an area basis, deductions will be made for fixtures in the roadway having an area greater than 1.0 m<sup>2</sup> in accordance with *SSHC Subsection 109.01, Paragraph 1.b*.

When municipal paving projects involve several items of work for which payment is made on an area or length basis, such as sidewalk, curb, curb and gutter, driveways, pavement, etc., it is suggested that complete sketches be prepared in Microstation or on cross section paper to show the actual work performed as well as the computations for the pay quantities. As a general rule, two complete sets of sketches should be prepared. One set should show the removal items and the other set should show the new work. The measurements and dimensions included with these sketches should be clearly identified as to whether they are actual field measurements or computed dimensions. The computations should always be shown on, or accompany, such sketches.

When municipal paving projects contain various radii curves at street intersections, concrete paving area measurements and computations may be based on the chord and rise method. Dimensions used for final payment will be as staked dimensions. (This assumes any difference is a contractor error.) The only exception would be if the area was constructed smaller than it was staked.

Combination curb and gutter is measured for payment by the meter (linear foot). (*SSHC Section 606*)

**Removal of Existing Structures and Preparation of Existing Structures**  
(*SSHC Section 203*)

- A. **Removal of Existing Structures** - Unless the contract contains a unit bid for the removal of an old structure, the excavation necessary for such removal is paid

for by the cubic meter (cubic yard). Preconstruction cross sections shall be taken for all removals.

Pipe removal excavation limits are shown in the *SSHC* in *Figure 701.01*. Headwalls and box culverts may be removed on a unit basis and any removal excavation will be subsidiary. The volume occupied by them within the limits of the new work shall be included for payment as culvert excavation. However, deductions will be made for openings in structures, other than pipe and pipe-arch culverts, if the openings have an average cross sectional area over 2.0 m<sup>2</sup> (21.5 square feet). This means the nominal opening of the old concrete box regardless of the accumulated silt and debris. On old structures without paved floors, the PM shall measure and compute the average cross sectional area of the opening. (See *SSHC Subsection 702.04*.)

In the case of removal of old pipe and headwalls, where the headwall is removed on a unit price basis, the excavation limits for the old pipe removal will extend 500 mm (18 inches) beyond the end of the pipe the same as would be applicable if no headwalls were involved. Any necessary excavation for removing the old headwalls outside the pipe excavation limits would still be subsidiary. (See *SSHC Subsections 702.04* and *702.05*)

- B. Preparation of Existing Box Culverts** - When the contractor has the option of breaking the box culvert back 600 mm (2 feet) or drilling dowel holes to insure a structural tie, the concrete and excavation pay item quantities shall be only the volume from the vertical plane that would be necessary for the doweling procedure. When the plans stipulate or the Project Manager orders removal of 600 mm (2 feet) of the box culvert barrel then the pay quantities shall be computed from the vertical plane 600 mm (2 feet) into the existing structure.

The excavation limits are to be computed as shown in *SSHC* in *Figure 701.01*.

### **Excavation for Structures**

- A. Excavation for Bridges** - Excavation for bridges is computed in the Bridge Division at the time the plans are prepared. Payment is a lump sum for all abutments, piers and/or bents. No further computations need be made on this item unless the station location of the bridge or the depth of the footings is changed. The Project Manager should not change the location of any bridge without first consulting with the District Engineer, and the Bridge Division.

If it is decided that a change in location is necessary, any required information should be forwarded to the Bridge Division, via the Construction Division, for use in redetermining the excavation quantity.

- B. Concrete Seal Course** - The construction of concrete seal course or removal of unsuitable material is extra work (see *SSHC Subsection 702.05*). These amounts shall be listed in the field book. The concrete seal course quantities shall be negotiated before the contractor begins the work.

The cubic meters (cubic yards) of concrete in the seal course shall be paid for as indicated in *SSHC Subsection 704.05*.

**C. Excavation for Culverts**

1. **General** - The Project Manager should be thoroughly familiar with *SSHC Section 702*, "Excavation for Structures", before measuring or computing the contractor's culvert quantities.

Following are listed some of the various classes of culvert excavation listed for payment in State contracts: "Excavation for Pipe Culverts and Headwalls", "Excavation for Box Culverts", "Excavation for Inlets and Junction Boxes", "Excavation for Sewers", etc. Since these are separate items in the contract, they should be kept separated in the field notebooks and computations. Include sufficient information in the field notebook so this separation may be checked during final review. If the plan data calls for removing a pipe culvert and building a box culvert at the same location, the excavation for removing the pipe culvert and headwalls would be determined as if no box culvert were to be built at the removal location. Any duplicated or overlapping excavation would be deducted from the volume of excavation for the new box culvert.

2. **Typical Channel Section** - When the plans show a typical channel section through a culvert site, the separation of grading and culvert excavation should be handled as follows:

Slope stake the typical channel section through the culvert site.

Take final cross sections after the channel dirt is removed.

Do not pay for any of the excavation twice.

3. Excavation for New Structures.

Field Measured Culvert Excavation - In general, the Project Manager shall bear in mind that:

There shall be no duplication of excavation when headwalls are constructed.

No additional excavation will be allowed for concrete elbows. This is a minor amount and since the kind of pipe is usually optional with the contractor, the excavation quantity will be based on the use of corrugated metal pipe.

The contractor is entitled to payment to the excavation limits specified even though he/she may not actually remove the soil to those limits. However, in all cases, the contractor should be held to a width adequate for proper compaction of the backfill beneath the lowest 90 degrees of pipe culverts and adjacent to all pipe-arch culverts at the widest

dimension. If slope is not properly laid back, other safety precautions must be taken to protect people from a cave-in.

Following are the excavation limits to be used in computing the contractor's culvert excavation. Since these limits are fixed by the specifications, final computations may be completed at any time after taking the preconstruction cross sections.

Box Culverts - 450 mm (18 inches) outside of the neat lines of the concrete to the bottom of the box floor or footings. On box curtain walls below the bottom of the floor and the footing beneath the lower break of broken back boxes, the excavation shall be the same as the neat lines of the concrete curtain wall or footing.

Pipe Culverts - the nominal inside diameter of the pipe plus 1 meter (3 feet), and 450 mm (18 inches) beyond the end of the pipe and to the flowline of the pipe.

Pipe Arches - the maximum nominal inside clear span dimension on the arch plus 900 mm (3 feet), and 450 mm (18 inches) beyond the end of the pipe and to the flowline of the pipe.

Concrete Headwalls - 450 mm (18 inches) outside the neat lines of the concrete and to the bottom of the headwall. If it is necessary to construct compacted embankment to the flowline elevation before laying the pipe, headwall excavation shall be allowed from the flowline of the pipe to the bottom of the headwall.

Concrete Elbows, Collars, and Collars with Bend - the excavation limits for elbows and collars is the same as for pipe culverts without elbows, collars or collars with bend.

All the above limits are increased when flowline is more than 1.25 m (4 feet) below natural ground. There is an additional allowance for safe excavation. See *SSHC Specification Figure 701.01*.

### **Piles and Pile Driving**

The Project Manager shall measure all piling to  $\pm 30$  mm (0.10 foot) before they are placed in the leads by the contractor. Cutoffs shall also be measured to  $\pm 30$  mm (0.10 foot).

**Sheet Piling** - The quantity to be paid the contractor for this item is the number of square meters (square yards) of piling remaining in the completed structure, except that no payment shall be made for lengths in excess of those ordered by the Project Manager.

For steel sheet piling, the computation width shall be the manufacturer's nominal driving width of each sheet, in accordance with *SSHC Subsection 703.04*. This has been interpreted to mean in the case of bent sections for corners, the nominal width of the

sheet before bending regardless of angle of bend. The quantity of steel sheet piling cutoff to be paid for shall be in accordance with *SSHC Subsection 703.05* and shall be verified by the inspector in the bridge book.

The computation width for concrete and timber sheet piling shall be the nominal width shown on the plans. For timber sheet piling in sloping wingwalls, the contractor shall be allowed payment for the square meters (square yards) of piling remaining in the completed wingwall, plus payment as cutoff for the square meters (square yards) cutoff to make the slope. The combined length of pile and cutoff shall not be in excess of the plan order length or revised length ordered by the Project Manager.

In order to determine the final pay quantity for these items, it is essential that the total length, the length of cutoff and the net length remaining in place be shown in the field notebook for each sheet pile. All measurements shall be  $\pm 30$  mm (0.10 foot) and in the case of wing piling cutoff on the slope, the length of cutoff should be the average of the long and short sides.

The field notebook for the bridges shall include definite information as to the final quantities for all contract items even though a number of the items may have the same final quantity as listed in the contract. Final quantities shall be summarized in the field notebook. This eliminates questions on the part of the reviewer as to the correct final quantity.

**Concrete Construction and Reinforcement** - Pay quantities for these two items are computed from tables found on the standard plans. Plans for special structures also contain this information.

The Project Manager shall not make a deduction from the concrete quantity shown on the standard headwall plan when the pipe enters the headwall on a vertical (broken back pipe) skew.

In computations for concrete quantities for junction boxes and inlets, the deductions for pipe openings shall be computed on the basis of right angle openings even though the actual opening may be on a skew. No correction shall be made for shell thickness of concrete pipe culverts.

### **Culverts**

- A. **Concrete Pipe Culverts** - The contractor's payment for concrete pipe is based on a measurement of the actual length of pipe in place, but in no case will a length greater than order length be submitted for payment.

When elbows are required, the measurement shall be continuous through the elbow. The additional allowance for elbows is provided in *SSHC Subsection 718.04*.

When either prefabricated or field constructed elbows connect two sections of new pipe, the pay length of the elbow will be the measured length on the longitudinal axis of the pipe (average of the long and short sides), plus the allowance (depending on the diameter) listed in the specifications or as amended

by the Special Provisions. No payment is allowed for the concrete and reinforcing steel used to construct the elbow.

If the elbow, poured in place, connects old and new pipe, it will be considered as a collar with a bend and no payment will be included for the elbow as such. In lieu thereof the concrete and steel required for the elbow will be included for payment under the items of concrete and reinforcing steel for collars.

The measurement for payment of all the types of culvert pipe is based on the number of linear meters (linear feet) in place and accepted. This is interpreted to mean that culverts are to be measured after material has been cut off for skewed ends. Thus payment is not made for waste resulting from skew angle cuts on either one or both ends of a culvert.

**B. Corrugated Metal Pipe and Pipe Arch Culverts (SSHC Subsection 718.04)**

**Corrugated Metal Pipe** - The contractor's payment for corrugated metal pipe is based on a measurement along the longitudinal axis of the pipe and payment will not be made for lengths greater than order length.

When elbows are required, the measurement shall be continuous through the elbow. To the measured length of each elbow shall be added the additional allowance provided in *SSHC Subsection 718.04*. The pay length of the elbow will be based on the centerline distance.

If field connections are required for the extension of existing corrugated metal pipe, the contractor shall receive payment for the necessary connecting band. When the Project Manager makes changes in his/her original pipe order after it has been fabricated, the contractor shall receive payment for any connecting bands made necessary by such changes. (See *SSHC Subsection 718.04*)

**Corrugated Metal Pipe Arches** - Corrugated Metal Pipe Arches shall be measured for payment in the same manner as corrugated metal pipe culverts along the flowline of the pipe-arch. Include elbow and skewed end dimension sketches in the notebook.

**Pipe Ordered But Not Used** - The quantity of various pipe items is shown on the Project Manager's field checked culvert list, the testing laboratory's delivery records and in the final summary. These three records should be in agreement or any differences fully explained before submitting the final estimate.

If any pipe is delivered but not installed, due to a change in plans, this should be recorded in the notebook and the project records shall show the final disposition of the pipe. If the pipe is transferred to the maintenance department, it shall be included for payment on the final estimate under "Contingencies" nonparticipating.

For roadway pipe and driveway culvert pipe, payment shall be made to the contractor on the basis of his/her actual delivered cost to the project plus a handling charge of 10 percent. A supplemental agreement shall be executed to

establish this price which must be substantiated by a copy of the contractor's invoice attached to the agreement.

Notify the District Office or the Maintenance Superintendent who will arrange to pick up the pipe and issue a requisition crediting the project and charging the supply base. Advise the person issuing the credit requisition of the name of the contractor and unit price to be used in making the credit and charge.

- C. **Culvert Pipe** - Some pipe items are "required" in the sense that the contractor must furnish definite types and sizes of pipe if stipulated in the plan and in the bidding proposal. A required pipe is one that the plan definitely states the type and size of pipe to be furnished. This may be an extension of an existing pipe so that the contractor must furnish the same type and diameter. The plans may definitely require a corrugated metal pipe - arch at some location due to low head clearance under the project road, or any type or size necessary due to some special construction feature of the project.

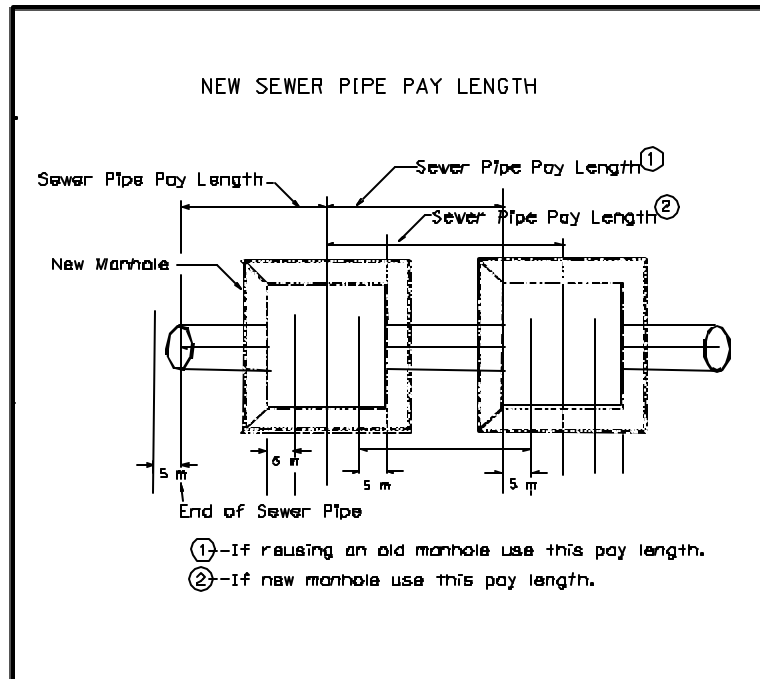
All other pipes are listed in the bidding proposal as "Culvert Pipe". The contractor may furnish any of the types of pipe listed in *SSHC Subsection 718.02*.

Quantities of pipe that are "required" by the plans or are "culvert pipe" shall be separated in the notebook and computations. "Required" and "culvert pipe" prices may be interchanged to some extent. For example, if the contract contains a bid price for 600 mm (2 feet) culvert pipe and it develops that an existing 600 mm (2 feet) pipe must be extended, it will be permissible to include the extension for payment under the contract item for 600 mm (2 feet) culvert pipe, provided the extension is the same type of pipe the contractor has chosen to furnish. This interchange of prices is not permissible between roadway and driveway pipe items.

Flared end sections which are called for in the plans on either concrete or metal pipe shall be furnished, installed, measured and paid for in accordance with *SSHC Section 723*.

**Sewers** (*SSHC Section 722*)

- A. **Excavation** - Sewer excavation is subsidiary to the sewer pipe pay item.
- B. **Pipe Computations** - Sewer pipe is measured for payment as described in *SSHC Subsection 722.04*.



**Guardrail** - The contractor shall be allowed payment for linear meters (linear feet) of guardrail complete in place measured from center to center of end posts (*SSHC Section 902*).

**Seeding and Slope Protection** - Example field book records for Cover Crop Seeding, Seeding, and Slope Protection are in *Appendix 3*.

**105.08 BORROW AND LOCAL PIT MATERIALS OBTAINED BY THE CONTRACTOR**

Under State Option - All amounts to be paid by the contractor for royalty and borrow costs, to comply with the terms listed in the option block shown in the plans, will be deducted from the payment due on the final estimate. Such amounts will also be included in the retention in the additional estimate. This Department will make payment directly to the owner. Before such payment can be made, it will be necessary to obtain concurrence from the contractor as to the quantities and amounts in order to eliminate the possibility of overpayment to the owner. For this purpose, the Project Manager shall

@ prepare and forward a letter to the contractor, substantially in accordance with the example included in *Appendix 2*.

The receipt of such letters from the Project Manager and contractor, plus the required releases from the pit owners, will complete the records required by the Right of Way Division to enable them to make payment to the owners of local pits. In the case of borrow, taken on an acreage basis, sketches are to be prepared showing the dimensions of the individual pits, the name of the owner, the description of the land subdivision, ties with the project centerline and computations for the acreage included in the letter to the contractor. Such sketches shall be forwarded to the Right of Way Division together with their copy of the letter to the contractor.

When the option block in the plans for the local pit includes payment for incidental items such as temporary fencing, reseeding, crop damage, payment for haul road, etc., the consideration for such incidental items will normally be on a lump sum basis and the lump sum payment for such items shall be included in the letter to the contractor. If payment is stipulated in the option block, for such incidental items, on other than a lump sum basis, the Project Manager shall request the Right of Way Division to advise the proper method of handling the item.

When work is to be suspended for the winter season, or for any other reason, for a considerable length of time and it is desirable to make partial payment to the landowners, the necessary information to authorize partial payment shall be forwarded to the Right of Way Division and, in such cases, it is not necessary to advise the contractor. In the event that a section of the project, involving optional borrow pits, is completed or the work is completed on some of the local pits, the normal letter to the contractor should be prepared in which it shall be noted that information will be forwarded at a later date for the remaining borrow or material pits.

In order to complete the records and eliminate any questions, the Project Manager's letter to the contractor must cover all optional borrow and local pits shown in the plans, regardless of whether they are actually used.

There have been some cases where a pit under state option does not appear on the plans for a particular project but does on an adjacent project. The contractor, if he/she uses this pit, must still be responsible for royalty payments.

Royalty payments for local pit material will normally be made on a cubic meter (cubic yard) basis and such quantities may be determined by preconstruction and final cross sections. In cases where payment to the contractor is based on truck measurement the royalty payment may be based on the same measurement, or by using weight conversion factors where payment to the contractor is based on units of mass.

**Borrow and Local Pit Materials Furnished by the State or County and Not Involving the Contractor** - When borrow or local pit materials are purchased from the owner directly by the Department or County, and no option requirements involving the contractor are included in the plans, substantially the same information must be forwarded to the Right of Way Division. However, no letter need be written to the contractor. The PM must obtain a site release from the landowner on these Department obtained borrow sites.

@

## 105.09 SUMMARY OF FINAL QUANTITIES

Project Managers are required to use only black lead pencils in the original preparation and checking of all field records and final computations in the field offices. The District Office review should be indicated by red check marks, initials and dates. Corrections shall be made with red pencil. If any further changes or corrections are found necessary in the Lincoln Office, they will be made in blue or green pencil. This method will eliminate any question at some future date as to where changes or corrections in the records originated.

@ **Each pay item in the contract must be summarized in [SiteManager or other approved documentation.](#)**

## 105.10 MOBILIZATION (*SSHC Section 112*)

### Method of Measurement and Basis of Payment

The percent of payment for mobilization under a group of work is based on the percent of work completed on the original contract group amount. Accordingly, when two or more projects are included in the contract and work has been performed on only one project the quantity for mobilization should be paid to all projects based on the percent of work completed on the original contract group amount. In this case mobilization may be paid on a project when no work has been performed on the project.

## 105.11 SALVAGED PROJECT MATERIALS REPORTING

Many project plans indicate that some removal items shall be stockpiled or salvaged to a nearby maintenance facility. To accomplish documentation of these times, a DR 147a, "Stock Returned for Credit" form has been developed.

The form shall be completely filled out any time project materials are salvaged to a maintenance facility. The form needs the signature and initials of the project inspector and the maintenance employee who received the material.

@ Distribute a copy of the completed form to the Project Manager, District Maintenance Superintendent, [Logistics Division](#), project file, and the contractor. Purchasing & Supply will add the salvaged items to the appropriate stock inventory for the maintenance facility that received these materials. Include a copy of the completed form in the final payment packet for the project.