Illinois Department of Transportation
2300 South Dirksen Parkway / Springfield, Illinois / 62764

Subject: **CONSTRUCTION MEMORANDUM No. 09-43**
Coring Policy for
Thickness Determination **Effective:** **January 1, 2009**
Sections 353, 354, 355, 356, 407
420, 421, 482 and 483 **Expires:** **Indefinite**

This memorandum supercedes Construction Memorandum 01-43/Operations Policy 11-1000, dated September 3, 2001 and Construction Memorandum No. 05-42 dated August 1, 2005. This policy applies to all contracts requiring coring to confirm thickness of pavements, base courses, base course widening and shoulder items paid on a square yard (square meter) basis.

GENERAL

Only those pay items containing at least 1000 contiguous sq yd (840 sq m), not paid by the ton (metric ton) are required to be cored. In addition, temporary pavement, temporary base course, temporary widening and variable width pavements, do not require coring. The District will have a representative present while the Contractor is coring the various pavement pay items. The Engineer will be responsible for determining the location of all random cores using one of the methods described below. Coring performed under this memorandum does not relieve construction staff of the need to make necessary progress depth checks for measurement per the Documentation Policy.

Coring is included in the cost of the various items to be cored, and consequently must be treated as any other work effort required by a specification if the contractor or Department seeks to alter these requirements.

CORING OPERATIONS

Both the Contractor and the Department's representative shall witness the entire coring operation including the measurement of each core. Each core shall be measured immediately upon removal from the core bit in a measuring device supplied by the Engineer. The Department's representative will record the core location and lengths on the Pavement Coring worksheet. Both the Department's representative and the Contractor shall sign the Pavement Coring Worksheet, attesting to the accuracy of location and lengths of the cores. Upon concurrence of length, the core samples may be discarded. If an agreement on the core measurement is not reached, the core will be placed in a container supplied by the Department's representative, sealed, labeled and stored by the District Bureau of Implementation/ Construction. The core length determined by the Department's representative will be used in the calculation for payment and or remedial action.

Cores are to be measured to the nearest 0.05 inch (1mm). When the coring operation produces a core that is not measurable, a replacement core is to be cut within 1 foot (0.5 meter) of the target location.

RIGHT OF DISCOVERY

If the Engineer has reason to believe that the random core selection process will not accurately represent the true conditions of the work, additional cores should be ordered by the Engineer. The Engineer will provide a written explanation to the Contractor for requiring additional cores. Right of Discovery cores are to be used to define areas where deficient pavement is believed to exist. Deficient pavement is pavement less than 90% of the plan thickness. If a Right of Discovery core is measured to be at least 90% of the plan thickness, the contractor is to be compensated for the cost of cutting the additional core. If the core is measured to be less than 90% of the plan thickness, additional cores are required to determine the limits of deficient pavement. The contractor is not to receive payment for either the initial core measuring less than 90% of plan thickness or additional cores required to define the limits of the deficient area. Right of Discovery cores are not to be used for any incentive or disincentive calculations. Right of Discovery is not the same as additional cores required to determine the extent of thin pavement.

FOR PAY ITEMS CORED IN ACCORDANCE WITH ARTICLE 407.10 (a)

In addition to the above general requirements, Individual areas less than 500 feet (150 m) in length will not require verification coring.

DETERMINATION OF LOTS AND SUBLOTS

The Resident Engineer/Technician (RESIDENT) will determine the locations of lots and sublots using as-built plan sheets.
The first step is to identify all items to be cored under Article 407.10 (a). Each pavement pay item is treated separately when determining the applicability of coring in accordance with article 407.10 and subsequent determining the size and limits of the Lots. For example, short sections of High Early Strength pavement should not be included in lots of otherwise similar pavement types. Because of the nature of HES pavements, it is uncommon for them to require coring.

When deciding if an area of pavement is contiguous, it must touch the same pavement pay item either longitudinally or transversely. A single lane of pavement 750 feet long by 12 feet wide is 1000 contiguous square yards of pavement. Two lanes of pavement touching transversely each 375 feet long by 12 feet wide, is also 1000 square yards, however does not meet the 500 lineal feet requirement and does not require coring under this provision.

It must be noted, however, that the lanes do not need to have been constructed within the same stage for the pay item area to be contiguous. Those areas not subject to coring per Article 407.10 (a) should then be evaluated to determine if they should be cored in accordance with the requirements of Article 407.10 (b).

Next, determine the number of lots which are required to be cored for each pay item.

First, divide the pay item into approximately equal lots not more than 5000 ft (1500 m) long. Short lengths of pavements less than 5000 ft (1500m) which otherwise meet the requirements for coring (i.e. ramps, side streets and turn lanes at least 500 feet (150m)) shall be grouped together.

To determine the number of lots, divide the total length of the pay item by 5000 feet (1500 meters). The number of lots is equal to this quotient rounded to the next whole number, unless it is already a whole number.

If more than one lot is required for any pay item, all lots for that pay item are to be of approximately equal length. For example, if 5380 feet of a pay item were constructed on a project, two lots are required. Those two lots should each be 2690 feet long. One lot of 5000 feet and a second lot of 380 feet is not acceptable, and will not provide a statistical equivalence when the lots are later evaluated for final pay factor.

If the pay item includes more than one lot, the area represented by the first lot shall extend from the beginning of the pay item and running in that lane to the end of the pay item or lot. If the entire distance represented by the lot is not covered before the end of the project, the remainder of the lot shall be continued in an adjacent lane until the full length of the lot is covered. To minimize confusion, it is encouraged to always work using increasing stations. Subsequent lots shall then be made up beginning at the end of the previous lot and proceed as described above. The width of a lot will be the width from the pavement edge to the adjacent lane line, from one lane line to the next or between pavement edges for single lane pavements.

Each lot must then be subdivided into 10 sublots of equal length. The statistical analysis is not correct if less than 10 equal sublots are cored for each lot. The width of each sublot equals the width of the lot. Although all sublots do not need to be cored at the same time, all 10 sublots MUST be cored before any analysis of the lot can be conducted.

DETERMINATION OF CORE LOCATIONS

District personnel (other than staff directly assigned to the contract) will determine a random core location for each sublot by multiplying a randomly generated number less than 1 by the length of the sub-lot. The core location is found by measuring this distance from the beginning of the lot.

The core locations are to be forwarded to and laid out by the RESIDENT or his/her designee.

CORING

The Contractor shall proceed to cut the cores at the locations directed by the Engineer.

If a random core is located within a drainage structure box out, pavement stripe, or feature other than smoothness corrective measure which will prevent securing a representative core of the sublot that is measurable, the Engineer should adjust the location of the core to one of close proximity, but missing the obstruction. During the coring operations if a core is measured to be less than 90% of the plan thickness, the contractor may decide to take 3 additional cores in accordance with Article 407.10(c). These cores will be averaged with the first core and an average core value calculated. This average core value is ONLY used to determine if the sublot is deficient and is used only for the purpose of remedial action treatment for the sublot. The original core length must be used in the lot analysis for determination of incentive or disincentive payment for the lot. The three additional core locations MUST BE RANDOMLY located in the sublot. The Resident may use any random number generator available to determine the locations of the three additional cores.

CORE ANALYSIS AND REMEDIAL ACTION

After the completion of the coring operation, the RESIDENT will analyze all core measurements.

The Contractor shall address any deficient sublots or deficient lots of pavement with the district. The coring operations shall be repeated for those previously deficient sublots which were corrected.

INCENTIVE AND DISINCENTIVE DETERMINATIONS

After addressing all deficiencies, The RESIDENT will calculate a separate pay factor for each lot. When determining incentives or disincentives, only those pavement areas included in lots will be included in the incentive or disincentive payments. (e.g. short sections of pavements, side roads less than 500 feet long and tapers, as well as other areas not included in lots, will not be included in the TOTPAVT (= Area of Pavement Subject to Coring) factor used to determine incentive or disincentive payments.) It is expected to be very rare that the entire quantity of pavement placed will be subject to either an incentive payment or disincentive.

All pay factors for each separate pavement pay item are to be averaged together to determine an average pay factor for the pay item. A copy of these results and the calculation of the pay factor(s) is to be provided to the Contractor with the original retained in the contract files. This pay factor will be in addition to any other pay factors incurred for this particular project. Using the final quantity of pavement placed and subject to coring, the district shall submit an authorization establishing an incentive/disincentive unit price calculated for each pay item and in accordance with Construction Memorandum No. 4.

AUTHORIZING THE INCENTIVE/DISINCENTIVE PAYMENT

The RESIDENT should determine what correct XXX incentive or disincentive pay item number to be used from Construction Memorandum 04. The quantity is total area subject to coring; the Unit price is the average of the Pay factor, not to exceed 0.02 (2%) times the Contract Unit Price for the pay Item.

FOR PAY ITEMS CORED IN ACCORDANCE WITH ARTICLE 407.10 (b)

In addition to the general requirements, individual areas less than 500 feet in length for Pavement, Base Course, 1000 ft for Widening and 2500 ft for shoulder items will not require verification coring. If the contiguous length of the item to be cored is not evenly divisible by 500 (2500 for shoulder items), prior to determining the random core locations, the Engineer is to determine the beginning station of the first unit. Subsequent units, if needed, will run continuously from the preceding unit.

PRIOR TO CORING

After determining which pay items and areas will be cored by this method, the District should generate chart(s) showing pay items to be cored, the required thickness of those items, and the locations of all required cores. It is preferred that coring of base courses will be accomplished prior to placement of the cover layers. If this is not possible, the plan overlay thickness in the area(s) to be cored is also required, and is to be subtracted from the measured thickness to determine the thickness of the item.

PROCEDURE FOR DETERMING RANDOM CORE LOCATIONS

The District, using staff other than that directly assigned to the contract, will determine where to cut the cores using the following procedure.

1. Determine the continuous lengths of items required to be cored by the appropriate specification.

2. Divide the pavement, base course and base course widening pay items into 500 foot (150 m) units. Divide Shoulders into 2500 foot (750m) units. If the pavement has already been partitioned into 500 foot units for other testing requirements (e.g. smoothness), the same unit delineations may be used, if the RESIDENT so chooses. If the length of a continuous strip of the item to be cored is not evenly divisible by 500 (2500 for shoulders) only the 500 foot long areas need to be cored. The start of the first unit to be cored is to be selected by the RESIDENT, and can be located at any distance from the beginning or end of the continuous strip of the item to be cored up to the length of the remainder of the unit. For example, a continuous strip of pavement 2400 feet long requires coring. Dividing by 500, 4 units are calculated with 400 feet of pavement left over. The RESIDENT may start the location of the first unit up to 400 feet from the beginning of the location to be cored. The four units then run continuously. Should the RESIDENT choose to start the first unit 125 feet from the beginning, the four units still run continuously, leaving an area 275 feet at the end of the strip. The location of the start of the first unit is to be determined prior to generating the random number or starting coring.

3. Generate a Random number less than 1.00 for each unit.

4. Cut one two-inch diameter core at the location represented by the random number multiplied by the length of the unit. Measure and record the length of the core, along with it's station and offset. The Engineer should immediately determine the need for additional cores.

DETERMING THE NEED FOR ADDITIONAL CORES

If cores indicate the unit is 10% or less deficient, no further cores or delineation of the unit is allowed.

If a core indicates the unit is more than 10% deficient, the contractor may elect to take additional cores at stations selected by the contractor until a core is encountered that measures 10% or less deficient. Additional cores required to delineate areas more than 10% deficient are not the same as Right of Discovery cores, and will be used to delineate areas more than 10% deficient and determine a deficiency deduction for areas of a unit to remain in place. The RESIDENT will determine a representative transverse location for the core. The entire area between the first cores encountered 10 % or less deficient on either side of the core more than 10% deficient will be considered unacceptable and removed and replaced.

In lieu of cutting additional cores in the unit, the contractor may elect to remove and replace the entire unit. Areas requiring removal and replacement will be re-evaluated in accordance with this policy.

For pavement, base course and base course widening pay items, if only a portion of the unit is removed, the remaining portions of the unit will be subject to the deficiency deduction. The deficiency deduction for area(s) on each side of any area removed and replaced will be determined in accordance with the chart in Article 407.11 (b)(6). The

area subject to the deficiency deduction is the entire area left in place, however, if two separate areas are left in place based on two non-deficient cores on either side of the deficient core, separate deficiency deductions evaluations for the two areas are required. The two cores will not be averaged to determine an average deduction for the area to remain in place.

For shoulder pay items, the first cores measuring at least 90% of plan thickness determine the limits of shoulder removal. Areas outside the limits of removal are considered acceptable.

DETERMING THE PAVEMENT THICKNESS DEFICIENCY DEDUCTION

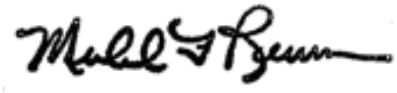
Shoulder items less than 10% deficient are acceptable, and no deduction is required.

Other Units 2% or less deficient require no deficiency deduction. If a core indicate the unit is more than 2%, but 10% or less deficient, a thickness deficiency deduction is required. The Unit Price for the deficient area is to be established by multiplying the Contract Unit Price for the deficient item by the percent deduction found in the chart in Article 407.10 (b)(6) corresponding to the percent the unit is deficient. Each Unit is treated separately. The RESIDENT is NOT to average the units together to determine an average deduction.

AUTHORIZING THE DEDUCTION

The entire area of the deficient unit and the calculated pavement deficiency deduction will be used to authorize the contract adjustment for the deficient area. The Resident should choose the correct XXX number and Pay Item Description for the pavement type from Construction Memorandum 04. The units are the same as the pay item units for the deficient item. The quantity is the entire area represented by the deficient unit. If an area of a unit was removed and replaced, the area will be retested and evaluated. The Unit Price is calculated per the preceding instructions, and the amount is to be submitted as a negative addition. It is possible that up to five Pavement Thickness Deficiency pay items may be required for each pavement, base course, widening and shoulder pay item subject to coring.

If the District determines that an area for which a core more than 10% deficient was measured is allowed to remain in place. No payment will be made for that area and a deduction equal to two times the cost of the thin item will be deducted from the compensation due the contractor. This should be done by authorizing a deficiency deduction for the area to remain in place with a Unit Price equal to 2 times the CUP (200%) of the pay item.



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EXAMPLES

1. Contract consists of two lanes of interstate pavement and bridge construction. The Full Depth HMA Pavement totals 2500 SY, 1500 SY west of the structure and 1000 SY of pavement east of the structure.

An analysis of the project indicates that coring is required under 407.10(a). The pavement on one side of the bridge is 562.5 feet in length, but only 375 feet on the other side. Only the side of the bridge longer than 500 feet is to be cored. Ten cores are required, so the lot is 1125 feet of pavement (two lanes 562.5 feet long) and each sublot will measure 112.5 feet. Once all cores are cut and analyzed, it was determined the overall pay factor for the project was 101.6%. A Unit Price of 0.016 x Contract Unit Price for the pay item is created using the following special item number and description: XXX20400 THK INC HMA PVT FD12. The quantity of pavement is 1500 SY, since the 1000 SY of pavement on one side of the structure was not eligible to be included in the lot.

2. Contract consists of two miles of two lanes of rural pavement reconstruction and new shoulders. There are two side road crossings, one extending 525 feet each direction and the other 225 feet in each direction. The Full-Depth HMA Pavement totals 32160 SY. Cross roads and entrances are located no closer than 2500 feet.

A review of the project indicates that coring is required under 407.10(a). However, since only those side roads longer than 500 feet are subject to coring, only 23,220 feet of pavement will require coring. 23220 divided by 5000 equals 4.64; thus requiring 5 lots. Each lot is 23220 divided by 5 or 4644 feet long, and with ten cores required for each lot, each sublot is 464.4 feet. It is NOT appropriate to have 4 lots at 5000 feet each with the remaining 3220 feet constituting the final lot, as this will skew the statistical evaluation following completion of coring. Once all cores are cut and analyzed, it was determined the pay factors for the each lot were 105.0, 105.0, 101.2, 102.0 and 97.0 resulting in a Total Pay Factor of 102 %. (The average was calculated to be 102.04 with a maximum TPF not to exceed 102%). A Unit Price for the incentive of 0.02 x Contract Unit Price for the pay item is created using the following special item number and description: XXX20400 THK INC HMA PVT FD14 (remember there is a maximum of 22 letters and spaces). The quantity of pavement is 30960 SY, again, since the 1200 SY of pavement at the shorter side road was not cored and thus not eligible to be included in the incentive payment. The shoulder will be similarly divided into 2500 foot lots and cored in accordance with Article 407.10 (b). Only those areas at least 2500 feet long will require coring. However, the Resident was concerned about one area along one side road, required a Right of Discovery core. The core for the 8” shoulder pay item was measured to be 7.5” thick. Since the Right of Discovery core was at least 90% of the specified thickness, the Department will pay for the core. In addition, one stretch of shoulder measured 4200 feet long. Divided by 2500 feet, only one unit is required. Prior to determining the random location for the core, the RESIDENT is to choose the beginning location of the unit to be cored up to 1700 feet from the beginning of the 4200 foot long shoulder area. Since no shoulders measured less than 90% of the plan thickness, no further action was required.