DS-23049
(New)

DEVELOPMENTAL SPECIFICATIONS FOR PCC PAVEMENT NON-DESTRUCTIVE THICKNESS DETERMINATION CONTRACTOR QUALITY CONTROL AND ACCEPTANCE FOR LOCAL SYSTEMS (NON-FEDERAL AID)

Effective Date
January 17, 2024

THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

Replace Article 2301.04, A, 2 with the following.

2. Requirements for thickness do not apply to detour pavements, paved drives, and temporary pavements. The thickness of pavement constructed will be determined as follows:

a. The division of sections, lots, and thickness measurement locations will be ~~determined by the Engineer according to Materials I.M. 346~~ according to Appendix A.

b. ~~For Interstate and Primary projects, evaluate pavement thickness for sections of the same design thickness more than 3500 square yards using non-destructive testing according to Materials I.M. 346 Method A.~~ At locations determined by the Engineer.

~~**c.** For non-Primary projects evaluate pavement thickness for sections of the same design thickness more than 3500 square yards by coring according to Materials I.M. 346 Method B. The specification will be adopted in its entirety.~~

~~**d**~~ **c.** Determine thickness for sections of the same design thickness 3500 square yards or less, by probing plastic concrete in accordance with Materials I.M. 396.

~~**e**~~ **d.** Only sections which are evaluated for thickness will be included in the thickness index determination. Areas not evaluated for thickness will be paid for at the contract unit price.

APPENDIX A
EVALUATING PORTLAND CEMENT
CONCRETE PAVEMENT THICKNESS

SCOPE

Thickness measurements will be taken on Portland Cement Concrete (PCC) pavement, to determine the pavement thickness and the thickness index for each section. Refer to Specification DS-15xxx.

APPARATUS

1. An MIT Scan T2 or T3 gauge will be used to perform thickness measures.
2. Steel Targets will be 11.81 inches in diameter, 24 gauge, meeting ASTM A 653, commercial steel with a G90 coating (about 275 g/m^2 total both sides).

DEFINITIONS

Section: All Portland Cement Concrete in a project of the same bid item. Irregular areas, as defined herein, of the same bid item shall form a separate section. On multiple year projects, a separate section will be formed for each year. If less than 20,000 square yards are placed in one year, that section will be grouped with a previous or subsequent year.

Lot: A portion of a section normally 200 feet in length and 2 traffic lanes wide.

Regular area pavement sections:

- All mainline pavement for normal travel lanes. Includes middle (both direction) turn lanes
- Paved shoulder – if same thickness as pavement and part of pavement bid item include with pavement. If separate bid item, treat as separate section.
- Paved median - if same thickness as pavement and part of pavement bid item, and longer than 300 feet, include with pavement.
- Auxiliary lanes of full width longer 300 feet.
- Widening greater than 6 feet.

Irregular areas:

- Widening less than 6 feet.
- Side street connections.
- Ramps, including gore areas, and collector distributor roads.
- Deceleration and acceleration lanes.
- Turn lanes, including taper sections.
- Tapers.
- Radiuses.
- Median crossovers

PROCEDURES

The Engineer will determine the location of each lot, the random location of each metal target, and the random thickness measuring scheme for each section using an Iowa DOT developed MSExcel spreadsheet. Immediately prior to paving, the Engineer will place the target or observe the contractor place the target.

A. Target Location for Regular Areas

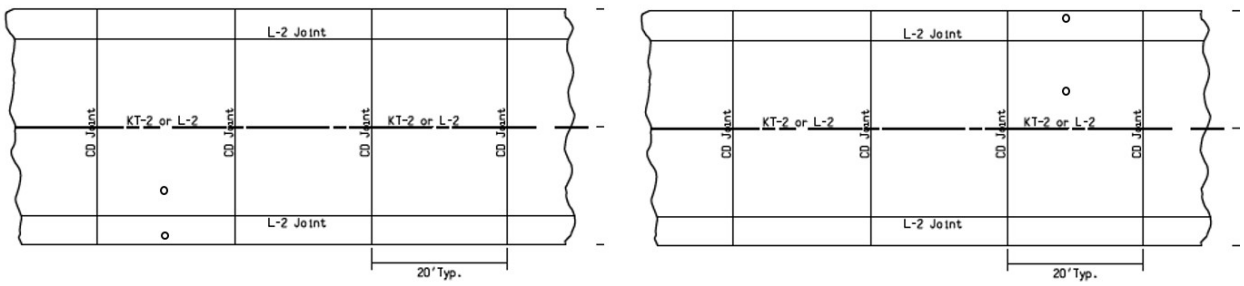
1. Divide the section longitudinally into 2000 square yard lots. One target will be located in each lot based on the spreadsheet selection. Beginning with the first station at +00, place a target from the edge of the pavement half way between dowel baskets~~)~~. See Figure 1. If the +00 station falls on a basket, move the target location ahead halfway between the dowel baskets. A minimum of ten targets will be tested. If a target location falls on a bridge or in an approach section, it will be eliminated.

2. The transverse location of the targets will be randomly determined by the spreadsheet program. The random locations will be 4 foot from edge of pavement, left or right. For ease of measuring, plates may be placed 18 inches from the edge if there is no tie steel or a work bridge is not available.

3. The program will randomly determine which targets to measure. If a measurement location falls on a bridge or bridge approach pavement, it will be eliminated and the next closest target not in the original random selection will be used for measurement.

4. Shoulders. Divide the section into 800 foot long lots including both shoulders. Beginning with the first station at +00, locate a target every 400 feet, alternating between the inside and outside shoulder (or every 800 feet on one side). On 6 foot shoulders or wider, the targets should be 4 feet from the edge of the pavement. On 4 foot shoulders, the targets should be 3 feet from the edge of the pavement.

Figure1. Target Location



B. Target Location for Irregular Areas

1. All irregular areas of the same design thickness will be grouped together for determining the number of lots. The Engineer may waive sections of the same design thickness that total less than 5000 square yards.

2. Place targets randomly in all irregular areas larger than 100 square yards. One target will be randomly located in each selected irregular area For irregular areas greater than 1000 square yards, randomly place a minimum of two targets. Targets must be placed at least 2 feet away from tie steel and 4 feet from dowel bars. A minimum of ten targets will be tested to represent each section of irregular areas. For projects with less than ten irregular areas larger than 100 square yards, select a minimum of three areas to place targets. All targets will be measured. If more than 20 targets are located in irregular areas, randomly select 50% to be tested.

C. Testing

Follow the manufacturer's instructions for operating the thickness gauge. It is important to avoid testing close to any steel including vehicles, equipment, steel toed shoes as well as tie bars, dowel bars and baskets, and manhole covers. When wearing steel toed shoes, always keep both toes at least 2 feet from the gauge during the test. Three total repeat readings will be taken. The readings should all be within 4 mm (0.15 in.) of each other.

D. Section Evaluation

1. Use the following formula to determine the mean thickness for the section:

$$\overline{X} = \frac{\sum X}{n}$$

Where: $\overline{X}$ = mean length for the section

$\sum X$ = sum of core lengths for the section

n = number of cores taken within the section

Round the mean thickness to two decimal places.

2. Use the following formula to determine the sample standard deviation of the thickness of the section:

$$S = \sqrt{\frac{\sum \left(X - \overline{X}\right)^2}{n - 1}}$$

Where:

S = thickness standard deviation for the section.
$\overline{X}$ = mean thickness for the section
X = individual thickness values for the section.
n = number of tests representing the section.

$\sum$ = sign indicating the sum of all values of $(X - \overline{X})^2$

Round the sample standard deviation to two decimal places.

NOTE: Calculations of the standard deviation are best made with an electronic calculator with standard deviation capability that uses the formula containing the quantity (n-1).

3. Use the following formula to determine the thickness index for the section of pavement thickness.

$$TI = (\overline{X} - S) - T$$

Where:

TI = thickness index for the section
$\overline{X}$ = mean thickness length for the section
T = design thickness, including subbase adjustment in IM 346
S = measurement thickness standard deviation (of the sample) for the section

Round the thickness index to two decimal places.

NOTE: If the mean thickness minus the standard deviation is less than T of the section, the thickness index will be a negative number.

4. Basis of Payment. Payment for the quantities of pavement in square yards in each section will be as shown in Article 2301.05 of the Standard Specifications and based on the thickness index as determined in accordance with these instructions.

E. Quality Assurance Testing
The Engineer will perform quality assurance testing by probing.

1. Probing – The Engineer may probe a minimum of one (1) test per seven (7) plates at random locations during paving operations in accordance with Materials IM 396. Plates may be moved to 18 inches from the edge of the pavement to allow easier testing.

2. The Engineer may utilize a MIT SCAN T2 or T3 gage, other than the one used by the contractor, to test a minimum of ten random locations.

3. The Engineer may also survey, to a minimum of 0.005 foot, on the plate prior to paving and on top of the pavement directly over the plate after placement to determine an accurate thickness verification.

F. Deficient Areas

1. If any measurement is deficient from T by 1 inch or more, the measurement should be rechecked to confirm the reading and the equipment. If the repeat measurement is also 1 inch or more below T, mark the location directly over the target. The Contractor shall drill a 4.0 inch diameter core at that location. If the core length confirms the pavement is deficient by 1 inch or more, continue to drill cores as described below.

2. Deficient areas, represented by cores deficient in length by 1 inch or more from design thickness, are to be replaced. These areas will be determined by drilling a core 60 feet in each direction longitudinally at the

same transverse location from the deficient core. Drilling will be continued at 60 feet intervals until a core is obtained which is not deficient by 1 inch or more from design thickness. Interpolate between this core and the adjacent core to determine the limits of the deficient area. This is the area to be removed and replaced at contractor's expense. These additional cores are to be used to define the deficient area and will not be used in the thickness index calculation. When an obstruction, such as a bridge, intersection, previous work, etc., prevents drilling a core at the required 60 feet interval in either direction longitudinally, continue the balance of the distance on the other side of the obstruction.

3. Any readings taken in the area for removal will be eliminated from the analysis for the entire section. A minimum of two plates will be placed on alternate sides prior to placement. After replacement, the contractor measure the thickness using the MIT SCAN to verify the thickness. The engineer will witness the measurement.

G. Final Pavement Thickness Measurement

1. Include all MIT SCAN measurements and probe measurements. The final pavement thickness will be determined by one of the following:
    a. If all the probe measurements are within ±0.25" of the MIT SCAN measurements, the MIT SCAN measurements will be considered validated. The Engineer will determine final thickness based on the average MIT SCAN measurements.
    b. If at any one location, the probe measurements are greater than ±0.25" difference from the MIT SCAN measurements, the contractor will core at the plate location and 2 feet away from the plate location. If the core at the plate location indicates that it has moved during placement, use the core thickness from the core taken two feet away as the pavement thickness. The Engineer will replace the MIT SCAN thickness at the location with the core thickness taken two feet away along with the average MIT SCAN measurements as final pavement thickness.
    c. If all of the probe measurements are greater than ±0.25" difference from the MIT SCAN measurements, the Engineer will randomly select a minimum of 10 random locations, at two feet from the plate location, for coring by the contractor. The Engineer will use the average core thickness, tested in accordance with IM 346, to determine final pavement thickness.