

# MOISTURE AND DENSITY DETERMINATION

## NUCLEAR METHOD

Clear Form

**DISTRIBUTION:** ORIGINAL – Construction Engineer, COPIES – Area Density Specialist, Density Technology Unit (Lansing).

\* SEE REVERSE SIDE

|                                      |                                 |                                               |                                                         |                                                         |
|--------------------------------------|---------------------------------|-----------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|
| DATE<br>06/29/20                     | CONTROL SECTION ID<br>82000     | JOB NUMBER<br>205935A, 207914A                | ROUTE NO. or STREET<br>Major Fed-Aid HMA Resurfacing    | GAUGE NO.                                               |
| DENSITY INSPECTOR<br>Garrett Hineman | CERTIFICATION NO.<br>12331-0625 | DENSITY INSPECTOR PHONE NO.<br>(313) 819-0982 | CONSTRUCTION ENG. (MDOT)<br>Andrea Wilcox - Detroit TSC | ASST. CON.ENG. / CONSULTANT ENG.<br>Kevin Surhigh (HRC) |

| TEST     |         |                    | DETERMINATION OF IN-PLACE DENSITY |                |                    |                    |                      |                    |                    |                               | LOCATION OF TEST |                                    |       |                                       |                      |
|----------|---------|--------------------|-----------------------------------|----------------|--------------------|--------------------|----------------------|--------------------|--------------------|-------------------------------|------------------|------------------------------------|-------|---------------------------------------|----------------------|
| ORIGINAL | RECHECK | TEST DEPTH<br>inch | COUNTS<br>(MC)                    | COUNTS<br>(DC) | DRY DENSITY<br>PCF | WET DENSITY<br>PCF | MOIS-<br>TURE<br>PCF | MOIS-<br>TURE<br>% | MAX DENSITY<br>PCF | PERCENT<br>OF COM-<br>PACTION | STATION          | DISTANCE FROM C <sub>L</sub><br>ft |       | DEPTH<br>BELOW<br>PLAN<br>GRADE<br>ft | ITEM OF<br>WORK<br>* |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  | LEFT                               | RIGHT |                                       |                      |
| 1        | 2       | 3                  | 4                                 | 5              | 6                  | 7                  | 8                    | 9                  | 10                 | 11                            | 12               | 13                                 | 14    | 15                                    | 16                   |
| 25       |         | BS                 | 57                                | 785            |                    | 147.1              | 6.7                  | 4.8                | 158.1              | 93.0                          | remarks          | 4                                  |       | 0.0                                   | BT                   |
| 26       |         | BS                 | 56                                | 782            |                    | 147.4              | 6.5                  | 4.8                | 158.1              | 93.3                          | remarks          |                                    | 4     | 0.0                                   | BT                   |
| 27       |         | BS                 | 51                                | 791            |                    | 146.6              | 5.9                  | 4.2                | 158.1              | 92.7                          | remarks          | 5                                  |       | 0.0                                   | BT                   |
| 28       |         | BS                 | 61                                | 746            |                    | 151.0              | 7.3                  | 5.1                | 158.1              | 95.5                          | remarks          |                                    | 5     | 0.0                                   | BT                   |
| 29       |         | BS                 | 53                                | 785            |                    | 147.1              | 6.2                  | 4.4                | 158.1              | 93.1                          | remarks          | 6                                  |       | 0.0                                   | BT                   |
| 30       |         | BS                 | 59                                | 795            |                    | 146.1              | 7.0                  | 5.0                | 158.1              | 92.4                          | remarks          |                                    | 6     | 0.0                                   | BT                   |
| 31       |         | BS                 | 54                                | 792            |                    | 146.4              | 6.3                  | 4.5                | 158.1              | 92.6                          | remarks          | 7                                  |       | 0.0                                   | BT                   |
| 32       |         | BS                 | 55                                | 798            |                    | 145.9              | 6.5                  | 4.6                | 158.1              | 92.3                          | remarks          |                                    | 7     | 0.0                                   | BT                   |
| 33       |         | BS                 | 67                                | 778            |                    | 147.7              | 8.1                  | 5.8                | 158.1              | 93.4                          | remarks          | 4                                  |       | 0.0                                   | BT                   |
| 34       |         | BS                 | 60                                | 755            |                    | 150.1              | 7.2                  | 5.0                | 158.1              | 94.9                          | remarks          |                                    | 6     | 0.0                                   | BT                   |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                      |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                      |

| TEST NO. | MOIS-<br>TURE<br>% | VOLUME OF<br>MOLD<br>CU. FT. | DETERMINATION OF MAXIMUM DENSITY (SOIL & HMA) |           |               |                 |                              |                       |                          | NOTE:<br>To convert (g) to (lbs):<br>Wt. (g) ÷ 453.59 = Wt. (lbs) |          |
|----------|--------------------|------------------------------|-----------------------------------------------|-----------|---------------|-----------------|------------------------------|-----------------------|--------------------------|-------------------------------------------------------------------|----------|
|          |                    |                              | WET SOIL<br>+ MOLD<br>g                       | MOLD<br>g | WET SOIL<br>g | WET SOIL<br>lbs | COMPACTED<br>SOIL WET<br>PCF | MAX<br>DENSITY<br>PCF | OPTIMUM<br>MOISTURE<br>% |                                                                   |          |
| A        | B                  | C                            | D                                             | E         | F             | G               | H                            | I                     | J                        | CHART STANDARDS                                                   |          |
| 4E3      |                    |                              |                                               |           |               |                 |                              | 158.1                 |                          | DENSITY                                                           | MOISTURE |
|          |                    |                              |                                               |           |               |                 |                              |                       |                          | 2,957                                                             | 438      |
|          |                    |                              |                                               |           |               |                 |                              |                       |                          | 3,017                                                             | 454      |
|          |                    |                              |                                               |           |               |                 |                              |                       |                          | OPERATING STANDARDS                                               |          |
|          |                    |                              |                                               |           |               |                 |                              |                       |                          | DENSITY                                                           | MOISTURE |
|          |                    |                              |                                               |           |               |                 |                              |                       |                          | 3,007                                                             | 441      |

REMARKS

Tests locations: 25&26.) 42.4085, - 83.2142 27&28.) 42.4085, - 83.2152 29&30.) 42.4084, -83.2164 31&32.) 42.4084, - 83.2175

33&34.) 42.4084, - 83.2164

|               |     |     |                                                                                                    |                                                            |
|---------------|-----|-----|----------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| 20/10 Weights | 1st | 2nd | DENSITY INSPECTOR'S SIGNATURE<br>Garrett Hineman<br>Jul 7 2020 11:51 AM<br><small>DocuSign</small> | AGENCY / COMPANY<br>Somat Engineering, Inc. (JN. 2019086C) |
| 3rd           | 4th | 5th |                                                                                                    |                                                            |

## DENSITY REQUIREMENTS

|                                                                                                                         | MINIMUM %<br>OF COMPACTION | ITEM OF<br>WORK | DEPTH |
|-------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------|-------|
| <b>Original Ground</b>                                                                                                  |                            |                 |       |
| Road Embankment Areas (if specified on the plans) .....                                                                 | 90.0                       | OG              | 9"    |
| Bridges – as shown on the plans .....                                                                                   | 95.0                       | OG              | 9"    |
| <b>Cut Areas</b>                                                                                                        |                            |                 |       |
| Cuts requiring Sand Subbase .....                                                                                       | 95.0                       | CS              | 9"    |
| Cuts not requiring Sand Subbase .....                                                                                   | 95.0                       | CN              | 12"   |
| Subgrade for HMA Base, Aggregate Base and Concrete Widening .....                                                       | 95.0                       | SG              | 9"    |
| <b>Embankments</b>                                                                                                      |                            |                 |       |
| Regular .....                                                                                                           | 95.0                       | E               |       |
| Abutments with Piling .....                                                                                             | 95.0                       | AP              |       |
| Abutments without Piling – within the limits for Structure Embankment<br>as shown on the plans .....                    | 100.0                      | AN              |       |
| <b>Backfill</b>                                                                                                         |                            |                 |       |
| Foundation Undercut Backfill for Retaining Walls, Grade Separation or<br>Bridges .....                                  | 100.0                      | FB              |       |
| Backfill for Bridges, Culverts, Sewers, Water Main, Manholes, Catch Basins,<br>Edge Drains and Subgrade Undercuts ..... | 95.0                       | B               |       |
| <b>Pavement Structure</b>                                                                                               |                            |                 |       |
| Subbase .....                                                                                                           | 95.0                       | S               |       |
| Subbase for Slope Paving .....                                                                                          | 90.0                       | SP              |       |
| Aggregate Base-used under Concrete Pavement .....                                                                       | 95.0                       | SS              |       |
| Aggregate Base-used under HMA Pavement .....                                                                            | 98.0                       | AB              |       |
| OGDC – used under Concrete and HMA Pavement .....                                                                       | 95.0                       | OGDC            |       |
| OGDC – used under Concrete and HMA Pavement (recycled material) .....                                                   | 95.0                       | OGR             |       |
| HMA Aggregate Base (pulverized HMA used as Aggregate Base) .....                                                        | 98.0                       | BAB             |       |
| Aggregate Base – used under Concrete Pavement (recycled material) .....                                                 | 95.0                       | CAC             |       |
| Aggregate Base – used under HMA Pavement (recycled material) .....                                                      | 98.0                       | CAB             |       |
| OGDC – Sleeper slab footprint and approach area .....                                                                   | 95.0                       | SLO             |       |
| OGDC – Sleeper slab footprint and approach area (recycled material) .....                                               | 95.0                       | SLOR            |       |
| Aggregate Base – Sleeper slab footprint and approach area .....                                                         | 98.0                       | SLA             |       |
| Trenching – under concrete pavement .....                                                                               | 95.0                       | TC              |       |
| Trenching – under HMA pavement .....                                                                                    | 98.0                       | TB              |       |
| Shoulders – Class I .....                                                                                               | 98.0                       | SAA             |       |
| Shoulders – Class II and III .....                                                                                      | 95.0                       | SA              |       |
| HMA Stabilization .....                                                                                                 | 98.0                       | BS              |       |
| HMA Paving – Base Course .....                                                                                          | 92.0*                      | BB              |       |
| HMA Paving – Leveling Course .....                                                                                      | 92.0*                      | BL              |       |
| HMA Paving – Top Course .....                                                                                           | 92.0*                      | BT              |       |

See JMF (form 1911) for  $G_{mm}$  value for target density value.  $TMD = G_{mm} \times 62.4$

\*Minimum % compaction of JMF TMD