

# 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>09/30/20                | CONTROL SECTION ID<br>82000 | JOB NUMBER<br>205935A, 207914A                | ROUTE NO. or STREET<br>Major Fed-Aid HMA Resurfacing    | GAUGE NO.<br>10959                                      |
| DENSITY INSPECTOR<br>Fred Innis | CERTIFICATION NO.<br>11215  | DENSITY INSPECTOR PHONE NO.<br>(313) 404-5184 | 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<br>OF<br>WORK<br>* |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  | LEFT                               | RIGHT |                                       |                         |
| 1        | 2       | 3                  | 4                                 | 5              | 6                  | 7                  | 8                    | 9                  | 10                 | 11                            | 12               | 13                                 | 14    | 15                                    | 16                      |
| 1        |         | 6                  | 90                                | 2,617          | 104.9              | 112.4              | 7.5                  | 7.1                | 109.0              | 96.2                          | *                | *                                  |       | 0.3                                   | S                       |
| 2        |         | 6                  | 55                                | 2,585          | 109.1              | 113.2              | 4.0                  | 3.7                | 109.0              | 100.1                         | *                | *                                  |       | 0.3                                   | S                       |
| 3        |         | 6                  | 100                               | 1,696          | 124.5              | 133.0              | 8.5                  | 6.8                | 128.1              | 97.2                          | *                | *                                  |       | 0.3                                   | S                       |
| 4        |         | 6                  | 121                               | 1,689          | 122.5              | 133.1              | 10.6                 | 8.6                | 128.1              | 95.6                          | *                | *                                  |       | 0.3                                   | S                       |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |
|          |         |                    |                                   |                |                    |                    |                      |                    |                    |                               |                  |                                    |       |                                       |                         |

| 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                                                   |          |
| 1        | 7.1                | .0459                        | 4,458                                         | 2,045     | 2,413         | 5.32            | 115.9                        | 109.0                 | 15.5                     | DENSITY                                                           | MOISTURE |
| 2        | 6.8                | .0459                        | 4,871                                         | 2,045     | 2,826         | 6.23            | 135.7                        | 128.1                 | 9.6                      | 2,126                                                             | 587      |
|          |                    |                              |                                               |           |               |                 |                              |                       |                          | 2,169                                                             | 609      |
|          |                    |                              |                                               |           |               |                 |                              |                       |                          | OPERATING STANDARDS                                               |          |
|          |                    |                              |                                               |           |               |                 |                              |                       |                          | DENSITY                                                           | MOISTURE |
|          |                    |                              |                                               |           |               |                 |                              |                       |                          | 2,138                                                             | 593      |

REMARKS  
NB Southfield Service drive intersection at Paul Dr

Test 1 performed NW quadrant of Paul St at Southfield Service Dr. Test 2 performed in SW quadrant Tes 3 performed in SE quadrant,

Test 4 performed in NE quadrant

|               |     |     |                                                                                               |                                                            |
|---------------|-----|-----|-----------------------------------------------------------------------------------------------|------------------------------------------------------------|
| 20/10 Weights | 1st | 2nd | DENSITY INSPECTOR'S SIGNATURE<br>Fred Innis<br>Sep 30 2020 1:40 PM<br><small>DocuSign</small> | AGENCY / COMPANY<br>Somat Engineering, Inc. (JN. 2019086C) |
| 3rd           | 4th | 5th |                                                                                               |                                                            |

**DENSITY REQUIREMENTS**

|                                                                                                                         | <b>MINIMUM %<br/>OF COMPACTION</b> | <b>ITEM OF<br/>WORK</b> | <b>DEPTH</b> |
|-------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------|--------------|
| <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