

**NORTH DAKOTA DEPARTMENT OF TRANSPORTATION**

**SPECIAL PROVISION**

**INTELLIGENT COMPACTION**

**SS-5-012(036)000 - PCN 17417**

**Description:** The purpose of this Special Provision is to describe additional work (materials, equipment, and operators) by the Contractor to support this research project, which will be conducted during placement and compaction of subgrade soils and aggregate base materials. The purpose of the research study is to demonstrate Intelligent Compaction (IC) technology, to evaluate the benefits of IC technology for compaction of subgrade soils and aggregate base materials compared to conventional compaction equipment/practices, to accelerate the development of IC specifications and to identify/prioritize needed improvements and research in IC equipment. The IC test results will not be used for approval or rejection of the materials but will be used to support the research study.

The research study will be performed for a period of 5 to 6 consecutive working days during normal construction of this project. The research team will provide IC roller(s) and roller operators at no charge. The Contractor shall support the research by providing equipment and operator(s) to prepare "Calibration Areas" and "Test Sections" of uncompacted subgrade soils and aggregate base materials for the research team at locations determined at an IC planning meeting. Three separate Calibration Areas will be selected for the subgrade soils and one area for the aggregate base. For each Calibration Area there will be a corresponding Test Section.

Calibration Areas are defined as 150 ft long, 20 ft wide specially prepared sections out of the way of active earthwork construction. Test Sections are defined as 1500 ft long, full earthwork width (e.g., 30 ft or more) areas where production compaction is taking place. The Test Sections are prepared to meet plan construction requirements. Details of the Calibration Areas and Test Section preparation are described below.

**I. Time Frame**

The research team will be conducting research/experiments for approximately 5 to 6 consecutive working days (Monday through Saturday). The consecutive working days do not include days when work cannot occur due to weather conditions. The specific dates that the support work is needed will be established during an IC planning meeting held at least two weeks in advance of the Intelligent Compaction research project.

**II. Equipment**

The research team will provide the IC roller(s) and roller operator(s) at no cost to Department or to the Contractor. The Contractor shall have 300 gallons of diesel fuel available for the IC rollers operations. At the beginning of the research test section, the IC roller will be delivered by the manufacturer to a location designated by the Contractor, near the project. During the research period, the Contractor shall provide project related transportation of the roller from one location to another if required.

#### **a. Calibration Area Preparation**

During Calibration Area preparation, equipment provided by the Contractor shall consist of sufficient haul trucks, water truck, grader and disc (if deemed necessary) to place the materials, to introduce and blend sufficient water into the materials to obtain uniform moisture content and to level the materials in uniform lifts at the thickness designated by the research team. Where possible, the equipment used on the area in which we are conducting the research will be the same equipment used on the remainder of the project. The Contractor's equipment and operators will generally be needed for approximately two to three hours per day, however if needed, the Contractor's equipment and operators shall remain as long as necessary.. For the remainder of the day, the Contractor may use the equipment on the remainder of the project. The research team will compact the materials placed by the Contractor.

#### **b. Test Section Preparation**

During Test Section construction, there will be no additional equipment needs from the Contractor. Placement, moisture conditioning and grading of the materials in the Test Sections will be performed with equipment and methods per Contract requirements. The Contractor's rollers and roller operators will not be needed during compaction of the Test Section materials. Compaction of the Test Section material will be performed by the research team equipment and operators.

### **III. Equipment Operators**

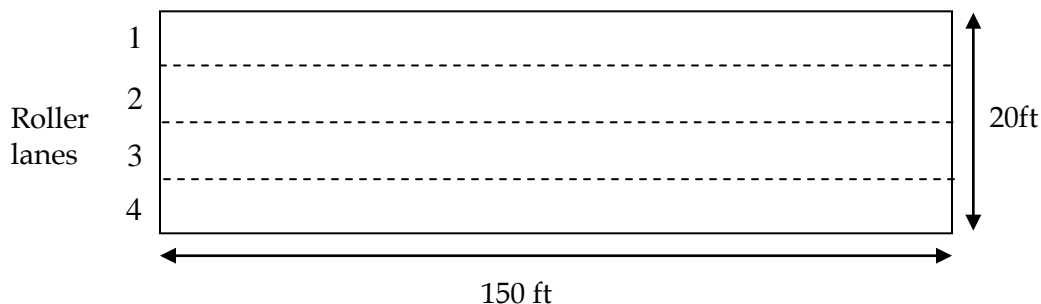
Operators provided by the Contractor will consist of qualified and skilled individuals that are familiar with the operation of the equipment assigned to them. The Contractor shall coordinate with the research team during placement of the Calibration Areas to ensure that material types, percentage and uniformity of moisture content and lift thickness are satisfactory.

### **IV. Communication with Research Team**

At least once a day, the Contractor shall meet with the research team to plan and coordinate the support work. At the time of the meeting, the research team will provide clear instructions on the locations, material types, desired moisture content, lift thickness and other details of the preparation of the Calibration Areas, Test Sections and/or other types of preparation.

### **V. Calibration Area Construction**

The research team will perform compaction of the materials within the Calibration Area. The size of the Calibration Areas shall be 20 feet in width and 150 ft in length and will consist of a single lift of subgrade, or base material (see Figure 1). The Contractor shall place these materials and mix carefully to meet specific lift thickness and moisture contents. Various moisture contents will be specified by the research team between optimum – 4% and optimum + 4%. The tolerances on specified mixing depths are  $\pm 2$  inch.



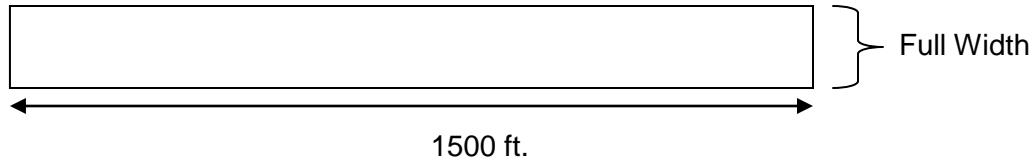
*Fig.1 Layout of Calibration Areas. Contractor place material to desired thickness and moisture condition material to optimum – 4% and optimum + 4% and values in between and mix with discs*

The location of the Calibration Areas will be established at the IC planning meeting. Calibration Area locations will be selected to be out of the way of normal contractor operations and at a location suitable for parking the Iowa State University Mobile Lab. During the construction of the Calibration Areas, the research team will work with Contractor to verify the material type, to measure lift depth and to determine the percentage and uniformity of moisture content in a timely manner. The research team will place in-ground instrumentation prior to the placement of Calibration Area materials. The research team will approve the Calibration Area placement before the equipment is removed from the Calibration Area.

At the completion of the research project, the test beds may be left in place at the discretion of the Engineer. The research team will not be responsible for meeting any of the specified project material, density or moisture content requirements in the Contract.

## **VI. Test Section Construction**

During Test Section construction, the research team will perform normal compaction operations on three areas of selected subgrade, and one area of base course using IC rollers. In these sections, the Contractor will not be required to provide rollers or roller operators to perform the compaction. The research team will compact test areas of subgrade material and aggregate base course (full earthwork width by 1500 ft long) as shown in Fig. 2. The Contractor shall place the material to meet the QC/QA requirements of the project (e.g., lift thickness, moisture). The research team will perform IC roller calibration over a 100 ft long section where nuclear gage moisture-density (and other) data is compared to roller measurement, followed by compaction of the remainder of the 1000-2000 ft long section. The research team will perform moisture, density and other spot testing in the calibration area (10-20 points) and in the larger section (10-20 points). The general locations of the Test Sections will be established in the IC planning meeting. If possible, the research team will compact multiple lifts of subgrade and/or aggregate base courses in each Test Section.



*Fig. 2 Plan view of Test Sections. Contractor prepares 1500 ft section of embankment or base per plan requirements. Research team will compact the 1500 ft area using the IC roller. Research team performs additional density testing on 1500 ft area.*

The research team will be responsible for compaction of these sections. The research team, however, will not be responsible for meeting any of the specified project material, density or moisture content requirements.

### **VII. ISU Mobile Testing Laboratory**

Some lab testing will be performed in a mobile field laboratory owned by Iowa State University (ISU). The trailer will be moved onto the project and set up in a location designated by the Engineer prior to the research beginning. The lab trailer will remain in that location for the duration of the research activities. The Contractor shall provide a suitable location with a solid platform approximately 100 feet long and 50 feet wide for the mobile laboratory location. The exact location will be selected during the IC planning meeting. The research team will also have several support vehicles on the project and will park them in the same area as the mobile lab.

### **VIII. Method of Measurement**

Intelligent Compaction will be measured as Lump Sum completed and accepted by the research program and Engineer.

All materials will be measured according to the Contract Unit complete, in place, and accepted.

Additional discing to control moisture content will be measured according to the Contract Unit for Subgrade Preparation prepared and accepted, measured along the centerline of the road.

### **IX. Basis of Payment**

Payment for Intelligent Compaction will be made at the Contract Unit Price for:

<u>Pay Item</u>	<u>Pay Unit</u>
Intelligent Compaction	Lump Sum

Payment will be full compensation for equipment, and operators, and delay during testing program, site preparation, diesel fuel, water tank, or any other services required for progress of the Intelligent Compaction research program.

Payment for materials will be made at the Contract Unit Prices for those items.

Additional discing to control moisture content will be made at the Contract Unit Price for "Subgrade Preparation".