Rock Products Committee
SCOPING DOCUMENT
Intelligent Compaction for Soils and Aggregate Bases
March 1, 2015

Task Group

Foundations Task Group

Problem Process

☒ Annual

☐ Expedited

☐ Emerging Initiative

Title

Intelligent Compaction for Soils and Aggregate Bases

Issue/Problem Statement

Provide uniform density of the subgrade and layers of aggregate bases in the pavement structural section to ensure pavement performance. Provide a real time quality control tool that contractors can use to ensure density requirements are met.

Background

Poor in-place density has been identified as a major factor in premature pavement failure, improved density of pavement materials has obvious benefits. Compaction is one of the most important processes in roadway construction. It is necessary in order to attain high quality and uniformity of pavement materials, which in turn better ensure long-lasting performance. Pavement materials often possess optimum densities that ensure adequate support, stability, and strength – achieving these densities uniformly is key. Current procedures using conventional compaction equipment may result in inadequate and/or non-uniform material densities, which can be one of the major factors in premature pavement failure.

FHWA Every Day Counts (EDC) initiative is designed to identify and deploy innovation aimed at shortening project delivery, enhancing the safety of our roadways, and protecting the environment. Intelligent Compaction is one of thirteen EDC 2012 initiatives that FHWA is challenging State DOTs to implement. Intelligent Compaction (IC) refers to the compaction of road materials, such as soils, aggregate bases, or asphalt pavement materials, using modern vibratory rollers equipped with an integrated measurement system, an onboard computer reporting system, Global Positioning System (GPS) based mapping, and optional feedback control. IC rollers facilitate real-time compaction monitoring and timely adjustments to the compaction process by integrating measurement, documentation, and control systems. IC rollers also maintain a continuous record of color-coded plots, allowing the user to view plots of the precise location of the roller, the number of roller passes, and material stiffness measurements.

Utilizing the GPS based mapping and an onboard computer reporting system, IC roller operators can monitor in real-time and provide corrections to the compaction process. A continuous record

of color-coded plots records the number of roller passes, stiffness measurement values and the precise location of the roller. The system analyzes the data and compares the results of previous passes to determine whether adjustments are needed.

Intelligent compaction allows for both monitoring of the roller pattern established at the test strip and provides information on material stiffness that can be related to compaction to ensure a more uniform structural section. Changes in material stiffness can also indicate a change in material and therefore indicate a need for reconfirmation of roller pattern to ensure adequate compaction.

Intelligent compaction compliments automated machine guidance, another initiative that Caltrans is currently implementing. Starting in 2015 Caltrans will be providing contractors electronic design files that can be used to generate a 3D construction model. In 2016 Caltrans plans on providing contractors with the design 3D Engineered Model created by Caltrans for using automated machine guidance and intelligent compaction equipment.

Purpose

To provide uniform density of the subgrade that requires 95 percent relative compaction and the structural section layers of aggregate subbase and base so that pavement performance is increased. Intelligent compaction allows Caltrans to implement quality control requirements for uniform density for soils and base layers. Intelligent compaction requires contractor monitoring of required number of roller passes and intelligent compaction measurement value (ICMV) which is related to density. With the implementation of IC a permanent record of roller passes and material stiffness uniformity will be available.

Objectives/Deliverables

The objective is to develop an intelligent compaction specification that can be used on all projects that have earthwork and aggregate bases within the structural section.

The expected deliverables required for intelligent compaction are:

- Non-Standard Special Provision for use of Intelligent Compaction on soils and aggregate subbase and base
- Pilot projects using Intelligent compaction for soils and aggregate bases
- Training for Veta Software
- Standard Special Provision for Intelligent Compaction for soils and aggregate subbase and base
- Intelligent Compaction Guidance

Timeline

Deliverable	Description	Start Date	End Date
1. Draft Non-Standard Special Provision	Develop a NSSP for use of Intelligent Compaction on soils and aggregate subbase and base.	7/01/15	9/30/15
2. Pilot Projects (Target 6)	Use the NSSP on pilot projects. Analyze results from pilot projects to determine if any improvement in specification is necessary.	9/30/15	9/30/16
3. Training for using Veta Software	Provide training for using the Veta software.	7/30/15	9/30/16
4. Standard Special Provision or Revised Standard Specification	Finalize specification for using Intelligent Compaction on soils and aggregate subbase and base.	9/30/16	1/30/17
5. Intelligent Compaction Guidance	Provide Intelligent Compaction Guidance in Construction Manual Update	9/30/16	3/30/17

Benefits

The following benefits are to be obtained from an Intelligent Compaction specification:

- More uniform Density
- Increased Productivity
- Reduction of Highway Repair Costs
- Continuous Record of Roller Passes
- Record of material stiffness
- Identification of Non-Compacted Areas

Impacts

- Specifications
- New compaction equipment requirements
- Contractor must have quality control technician available on site
- Construction Guidance

Resource Requirements

Task	Caltrans Staff	Person Years
Development of Intelligent Compaction Non-Standard Special Provision (NSSP)	Pavement METS Construction Office Engineer	0.20 PY
Monitor Pilot Projects	Construction	0.40 PY
Training for using Veta Software	Construction	0.15 PY
Analyze Data from Pilot Projects to Improve Specification	Construction	0.20 PY
Intelligent Compaction Standard Special Provision (SSP)	Pavement METS Construction Office Engineer	0.20 PY
Guidance to be included in a Construction Manual Update	Construction	0.10 PY
	Total:	1.25 PY

Impediments to Completion of Deliverables

Having enough pilot projects available during the pilot project phase.

Recommendation and Approval

This scoping document for Intelligent Compaction for Soils and Aggregate Bases was prepared by Foundations Task Group to address a priority issue that has statewide significance and is within the Rock Products Committee mission. The Task Group Co-Chairs have determined the scope, resources required and timeline for delivery of this project to ensure that the deliverables are achievable in a timely manner.

Scoping Document Recommended for Approval by:

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Approval Date: 8/17/15