

Project 3785: Evaluation of Intelligent Compaction Technology Based on Correlations to Relative Density

Abstract: Intelligent compaction (IC), whereby earthwork (soil) compaction quality control/quality assurance (QC/QA) is accomplished by monitoring roller-compactor drum vibrations and relating them to soil properties via mathematical modeling, is an established technology in Europe and is gaining traction in the road construction industry in the U.S. IC holds tremendous benefit for Reclamation as it has the potential to result in a higher quality and more uniform product.

The majority of IC research has been funded by the transportation industry. As pavement design is becoming increasingly mechanistic, the majority of IC research has focused on correlating IC-based measurements of soil properties (i.e., roller measured values [MVs]) to other in-situ, spot-test based measures of soil stiffness or modulus. The work that has been documented in the literature to correlate roller MVs to density has all been based on absolute density or relative level of compaction (i.e., percentage of maximum density). This work has shown correlations with density to be problematic as absolute density and relative compaction only change a few percent over the compaction process as soil is transformed from loose to dense. Correlating to such an insensitive parameter is difficult, and since these correlations form the underpinnings of IC, it has been difficult to implement IC based on traditional density criteria.

At the time this research was proposed, it was customary within Reclamation to use relative density instead of relative compaction for granular materials. Relative density is more sensitive often changing more than 50 percent during compaction, and the work here was aimed at evaluating IC in terms of relative density as this had not been done to date. However, shortly after this project started, Reclamation made the decision to abandon relative density in favor of the simpler and more common relative compaction. This decision removed the sole impetus for conducting this research. Accordingly, even though IC still holds many potential benefits for Reclamation, it was decided to cancel this project and put the funds to better use elsewhere.