



Further Technology Readiness of Real-Time Asphalt Mixture Compaction Monitoring

Product 0-6874-P4

Cooperative Research Program

TEXAS A&M TRANSPORTATION INSTITUTE
COLLEGE STATION, TEXAS

in cooperation with the
Federal Highway Administration and the
Texas Department of Transportation
<http://tti.tamu.edu/documents/0-6874-P4.pdf>



Further Technology Readiness of Real-Time Asphalt Mixture Compaction Monitoring

*TxDOT Project 0-6874 Develop Nondestructive Rapid Pavement Quality
Assurance/Quality Control Evaluation Test Methods and Supporting Technology
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Goals

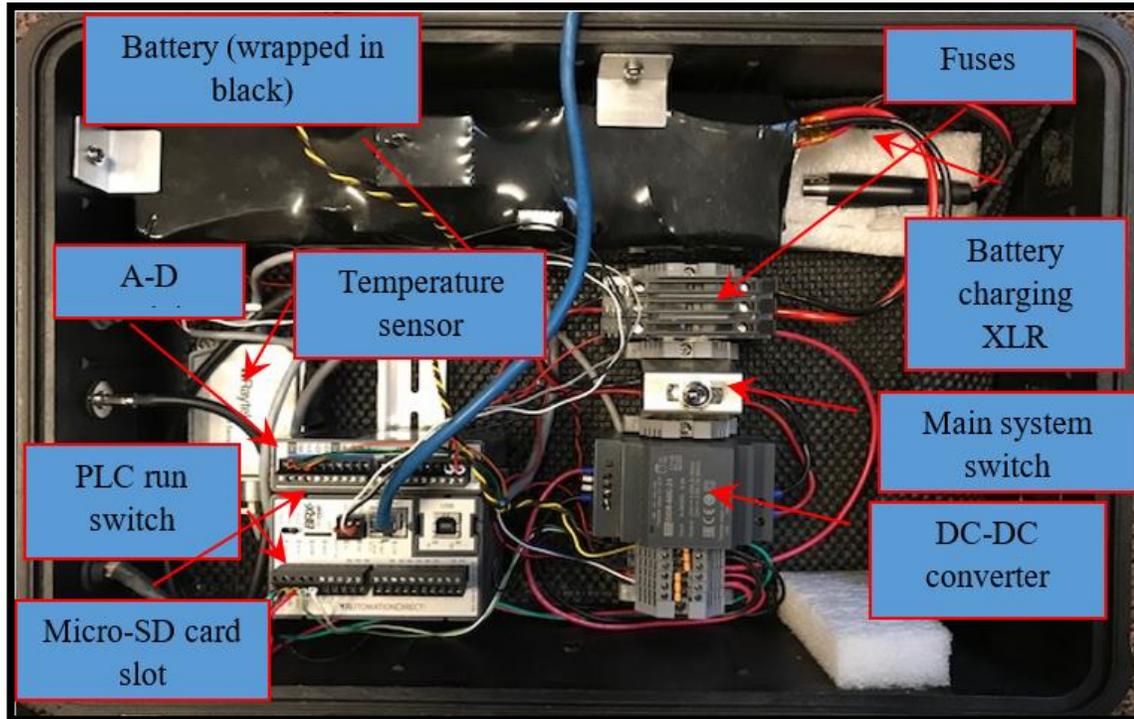
- Develop use of compaction monitoring system (CMS) for evaluating density under the breakdown roller
 - Using a compaction index (CI) concept
- Identify key factors influencing the CI model
- Develop updated factors, particularly for temperature and vibration
- Identify how CMS could be used for process control or assurance



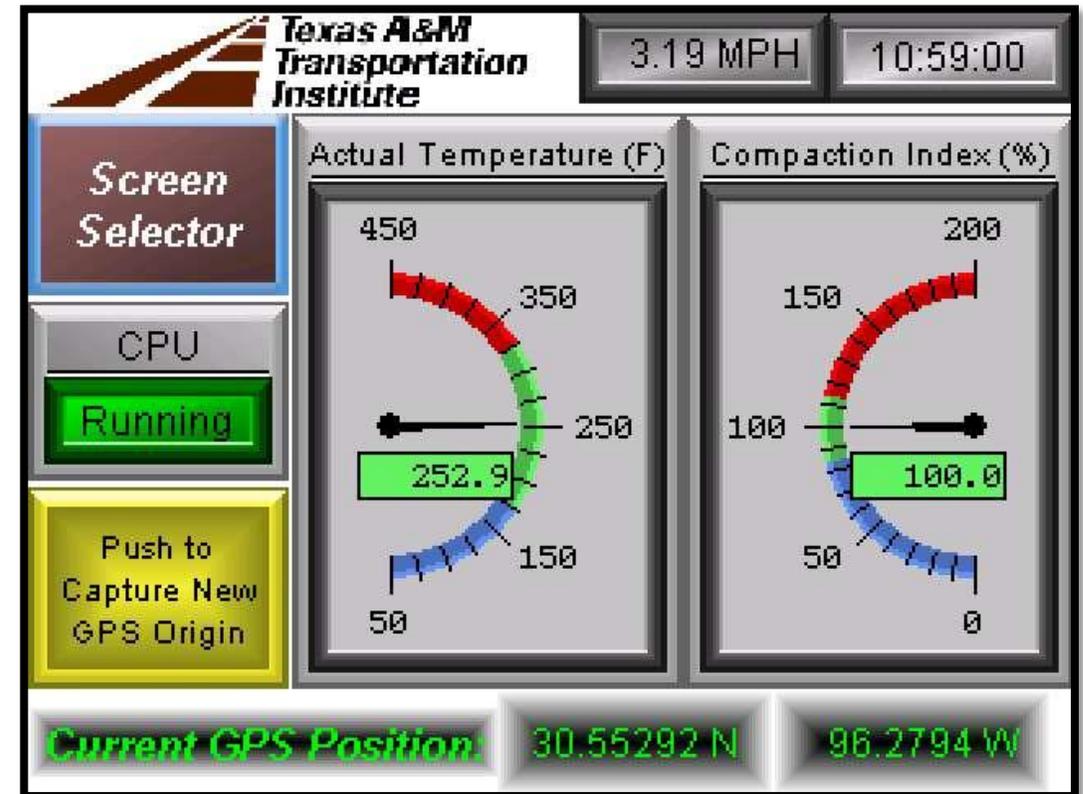
Key activities completed

- Developed PLC/HMI form factor
- Developed approaches for
 - Revised drum weighting factor
 - Temperature factor
 - Vibration factor
- Pilot testing on multiple projects

PLC / HMI Form Factor

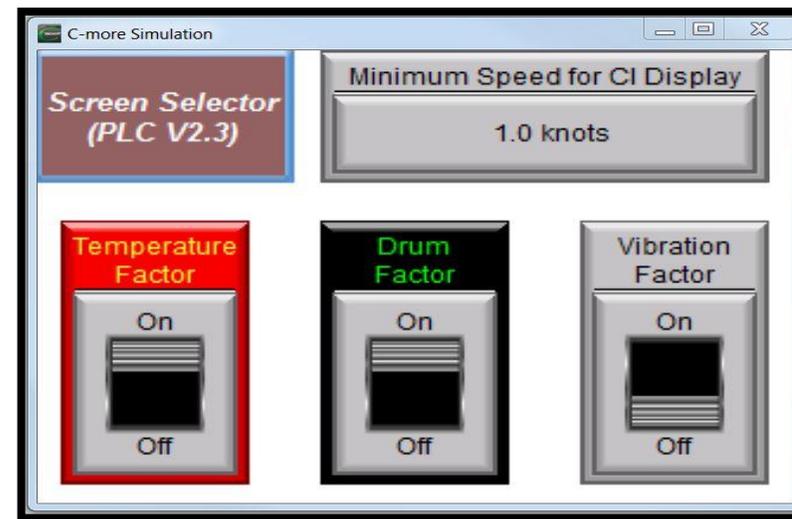
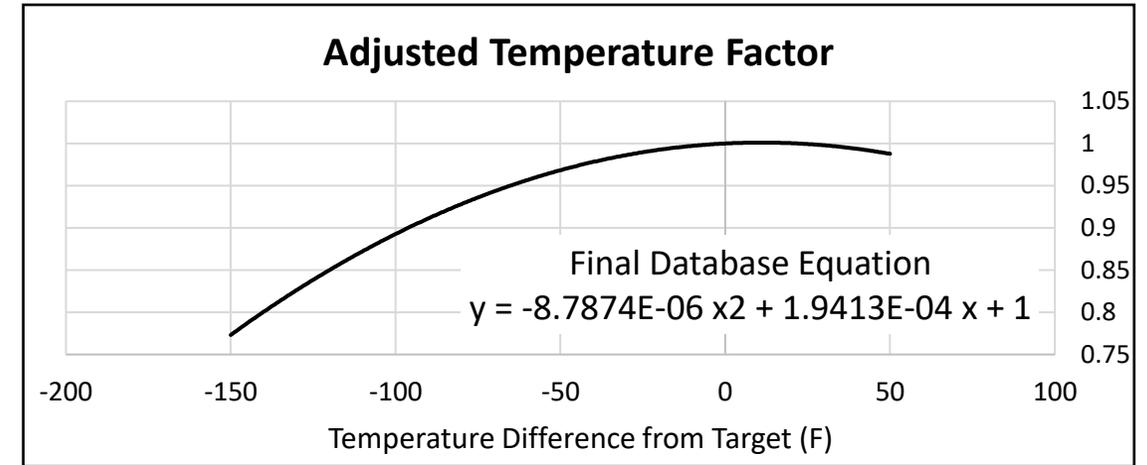
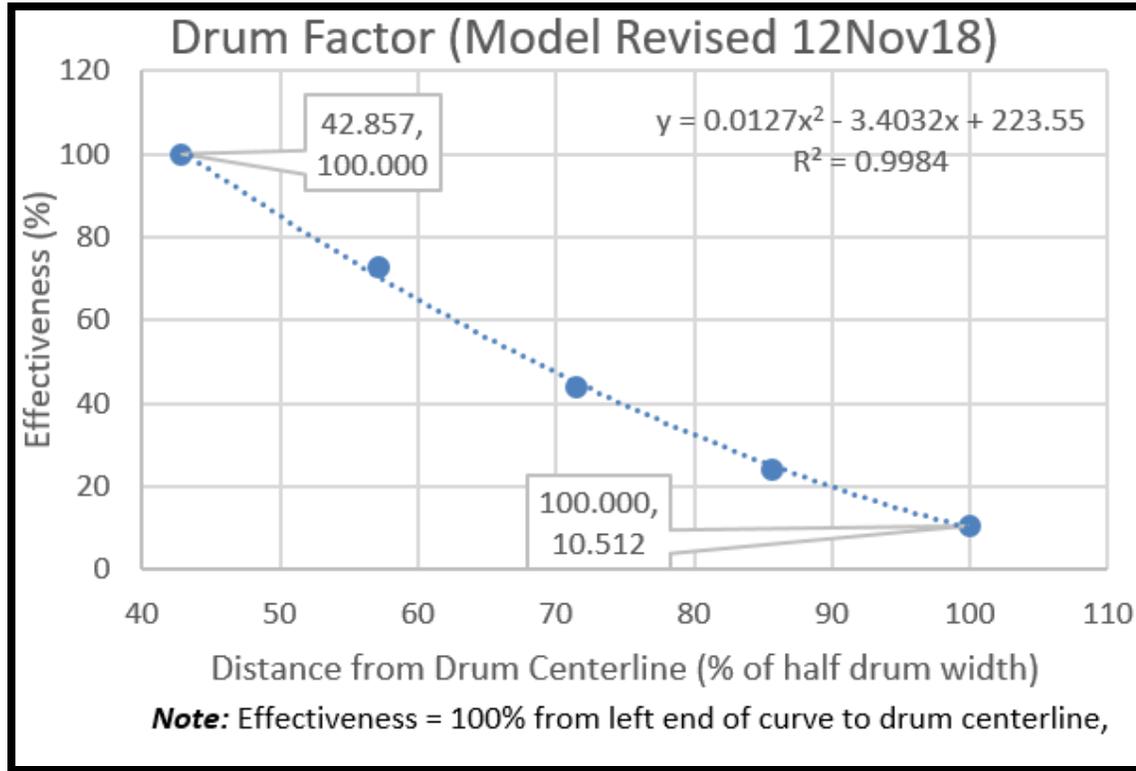


Internal view of PLC Control Box



Main Screen HMI Display

CI Factors



If all factors are off, compaction index equals the number of passes

General CMS Test Process



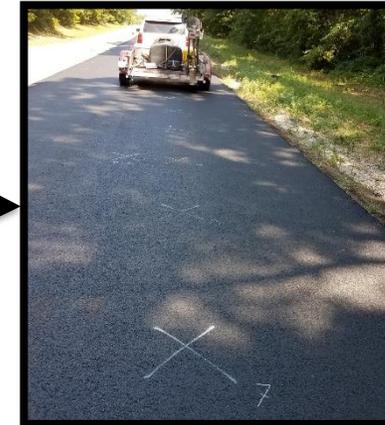
Install CMS



Construction



CMS Data Collection



Select Core Locations



Lab work



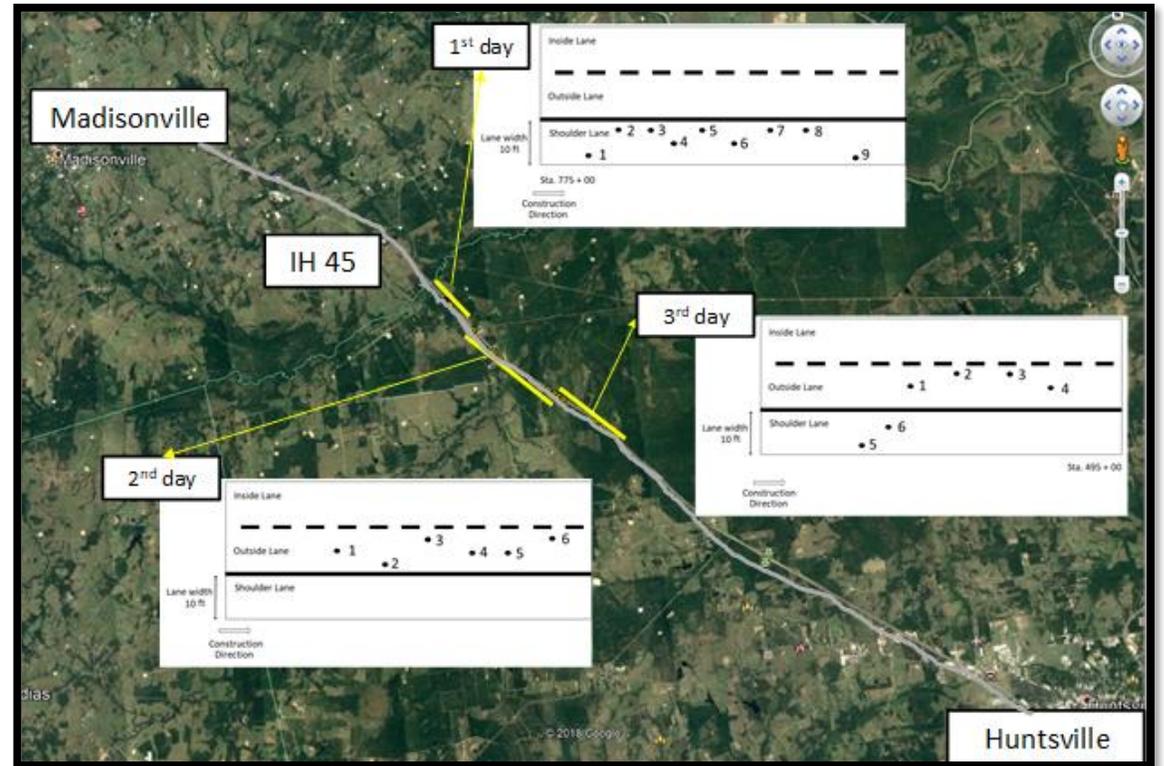
Measure GPS



Spot tests and coring

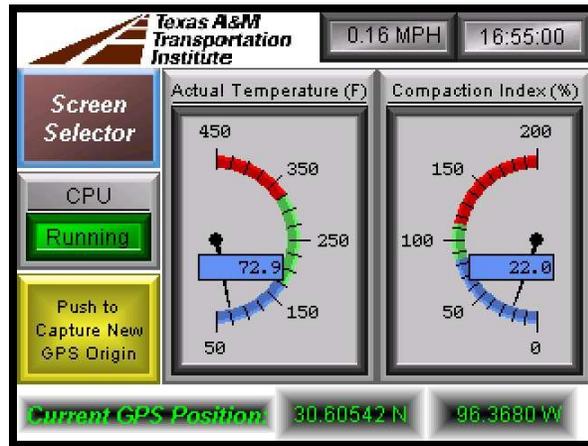
Example Field Process

- Deployed to:
 - RELLIS test site (TY D and TOM)
 - SH 77 (ATL) SP-D
 - IH 45 (BRY) SMA
 - FM 158 (BRY) SP-D
 - SH 40 (BRY) SP-C

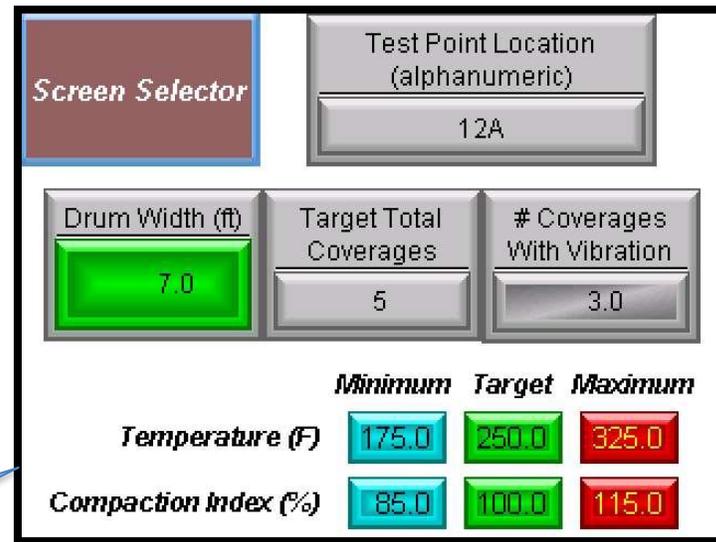


Test location summary – IH 45

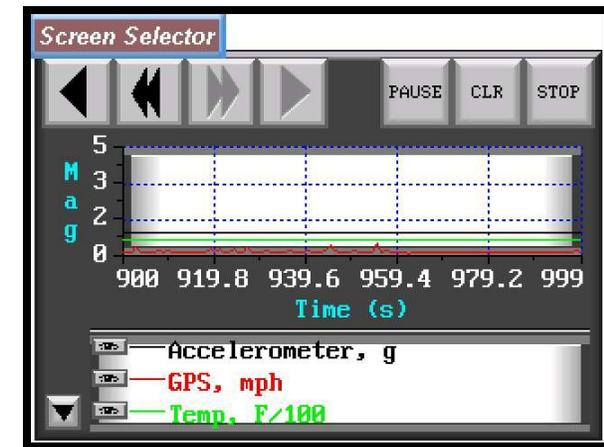
Setting up CMS Operational Parameters



Home Screen



Setup Screen

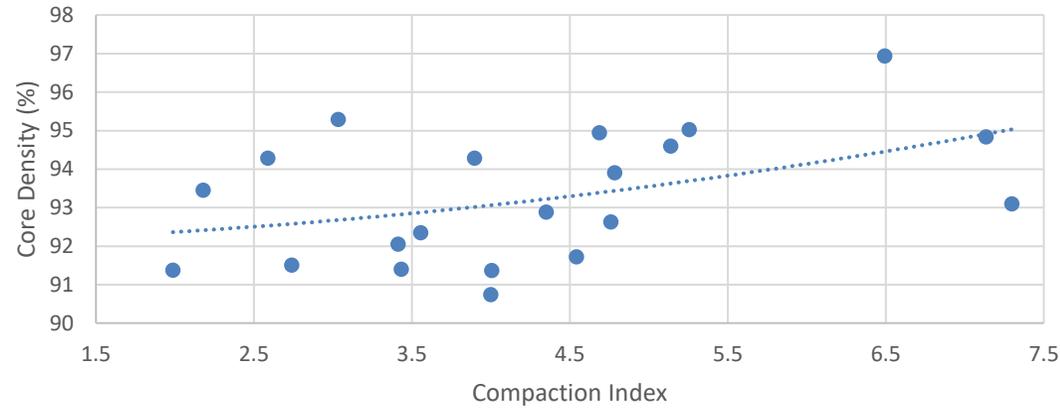


History Screen

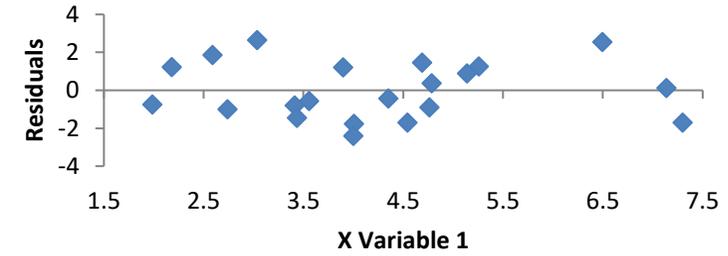
User inputs desired targets here

Example Data, IH 45

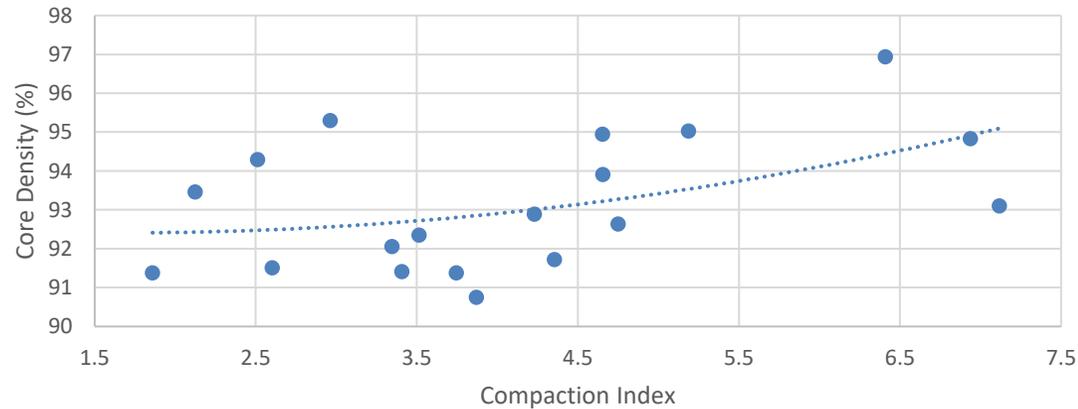
I-45 CMS CI (Drum Factor Only)



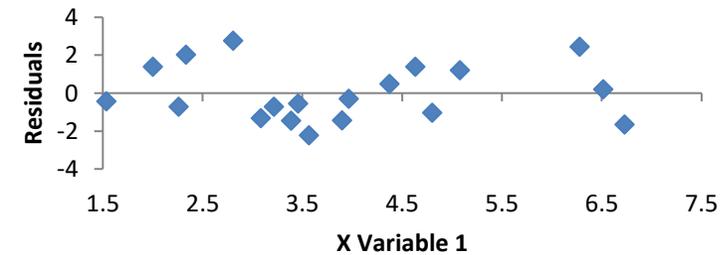
Residual Plot (linear fit)

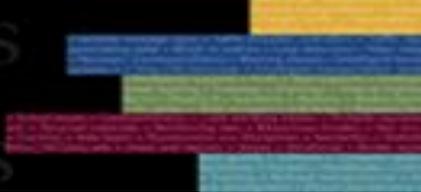


I-45 CMS CI (Drum & Temperature Factors)

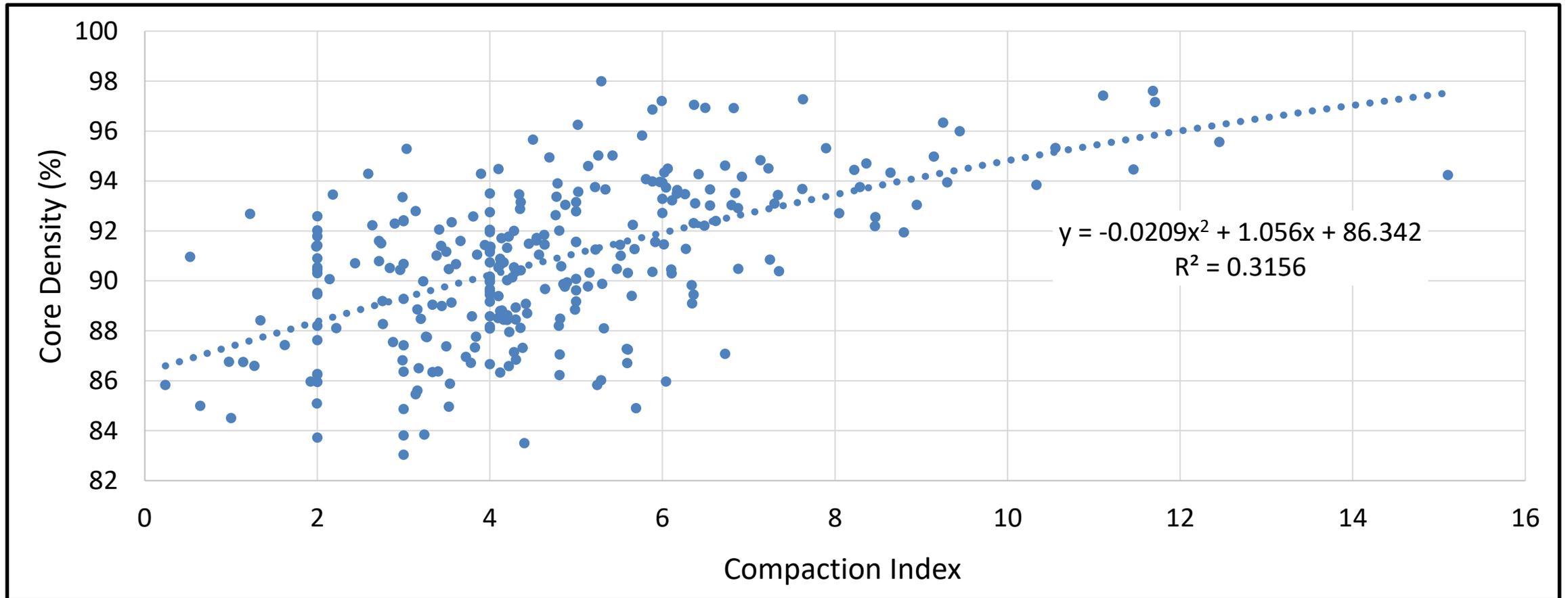


Residual Plot (linear fit)





Summary from all Projects Tested





Summary

- CMS can document if prescribed rolling pattern applied
- Reliably estimating density difficult with CMS model
 - Expanded factors in CI model still do not provide accurate enough measurements for applications other than general process control
- Best potential use is in process control for continuous feedback with far more testing coverage than routine use of a density gauge



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