Understanding Testing Variability

by

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Understanding Testing Variability

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Understanding Testing Variability

Introduction

- Many factors can affect test results; equipments, Manufacturer, Human, Lab management, Test procedure, etc
- Statistical analysis is used to verify acceptable test variations
- It is also used to indicate the probability that an error has occurred
Repeatability / Reproducibility Standards

ASTM Standards for Measures of Test Precision

- Single Operator Precision
- Multi-Batch Precision
- Single-operator-apparatus
- Multi-day precision; or multi-operator
- Single-day apparatus precision
Repeatability / Reproducibility Standards

ASTM Standards for Measures of Test Precision

- Repeatability/Single Operator Precision: greatest acceptable difference between results of two tests conducted on same material by the same operator
- If two determinations or test results by the same operator differ by more than 2 standard deviations, there is a high probability that an error has occurred and retests should be made
Repeatability / Reproducibility Standards

ASTM Standards for Measures of Test Precision

- Multilaboratory Precision/Reproducibility: greatest acceptable difference between results of two tests conducted on same material by two different operators at two different laboratories on material that is as close as possible to being the same

- If two determinations or test results differ by more than 2 standard deviations, there is a high probability that one or both labs are in error or that a difference in the characteristics of the test specimens used for the tests
Repeatability / Reproducibility
Factors Affecting Test Results

Human Factors affecting test results (not in order)

- Number of technicians performing the test – one or more
- Following out-of-date procedure
- Following improper testing practice
- Making short cuts
- Technicians follow what they’ve taught (Vs. instructions in test procedure)

..........................
Repeatability / Reproducibility
Factors Affecting Test Results

Lab Management factors affecting test results (not in order)

- Shortage of lab staff
- Lack of quality system or lack of following it
- Lack of trained/certified technicians in the lab
- Lack of technician training programs
- High turnover of staff
- ....................
Repeatability / Reproducibility
Factors Affecting Test Results

Other Factors (not in any order)
- Equipment maintenance and calibrations
- Use of scheduled equipment checks to ensure specification/tolerance requirements
- Equipment manufacturer
- Test procedure vagueness in areas
- Samples techniques/Non-representative sample
- Regular use of control samples
- ..................
Lab Certification – How It Relates to Testing Variability

Regular lab inspections and annual proficiency testing significantly reduce test variability; It ensures:

- Equipments are Calibrated and maintained
- Uniform and Up-to-date test procedure are used
- Testing is done by qualified staff
- Encourage Technician certification/training
- Reduces test variations and potential for job interruptions and/or contract disputes
### CCIL Certification Program Make-up Asphalts and Aggregate Materials

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<thead>
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# CCIL Certification Program; % AC – Ignition Correlation Results

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CCIL Certification Program: Mix Compliance Correlation Results

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Absorption of Coarse Aggregate

Pre 1998
Post 1997
ASTM C 127
Avg. 98 - 04
Standard Deviation
Mean Value
ASTM C 127 Precision
Post 1997 Average, 0.09
Summary and Conclusions

To minimize test variations
- Follow proper test procedure & practices,
- Ensure adequate staffing
- Ensure adequate training
- Ensure equipment maintenance, scheduled tolerance checks, scheduled calibration and regular use of control samples
- Follow your Quality Manual
- Carry Out Regular Internal Audits
- Lab certification & participation in Proficiency Testing Significantly Reduce Testing Variability
Summary and Conclusions

Regular lab auditing & participation in Proficiency
- Ensures Up-to-date & uniform test procedures
- Ensures testing is by qualified and trained staff
- Ensures equipment are calibrated and maintained
- Encourage technician training/certification
- Improves standard of excellence in testing
- Increases confidence in test results
- Reduces test variations and potential for job interruptions and contract disputes
Summary and Conclusions

Lab Certification is a win-win to all

- Regulators: the assurance that regulation is supported by valid test data
- Owners: the assurance that the project is built in accordance with the specified test requirements
- Contractors, producers, consultants & testing laboratories: improved confidence in testing results and reduced potential for job interruptions, construction delays and contract disputes
2016 CCIL Laboratory Certification Programs Update

Thank you

Questions?