Webinar
July 18, 2023

NETC Project 21-1: Quality Review and Assessment of Pavement Condition Survey Vehicle Data Across New England

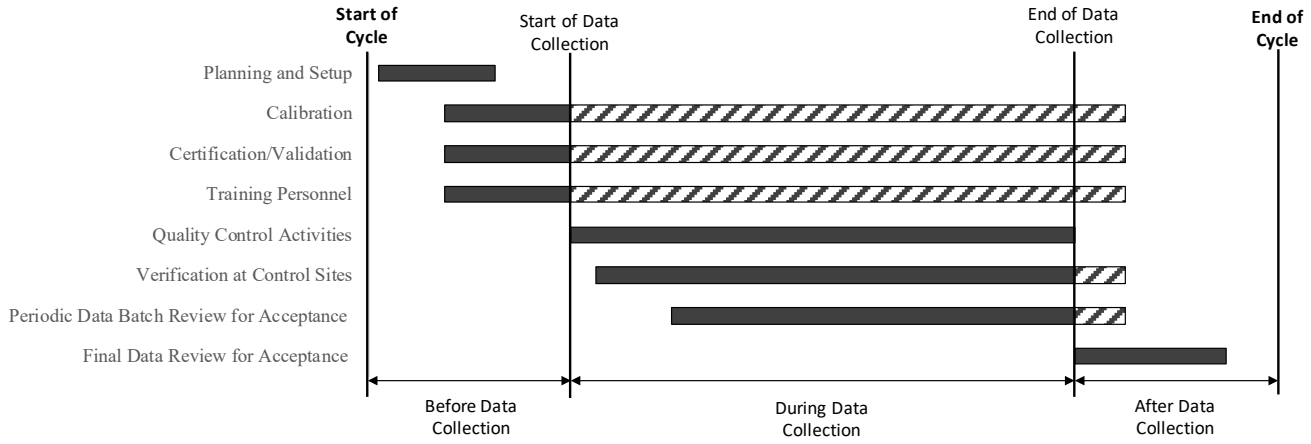
Gonzalo Rada, Ph.D., P.E., Amy Simpson, Ph.D., P.E. and Connor Bruce
WSP USA Environment & Infrastructure Inc.

Agenda

- Problem statement
- Objectives
- Approach, findings, and outcomes
- Summary, deliverables, and benefits

Problem Statement

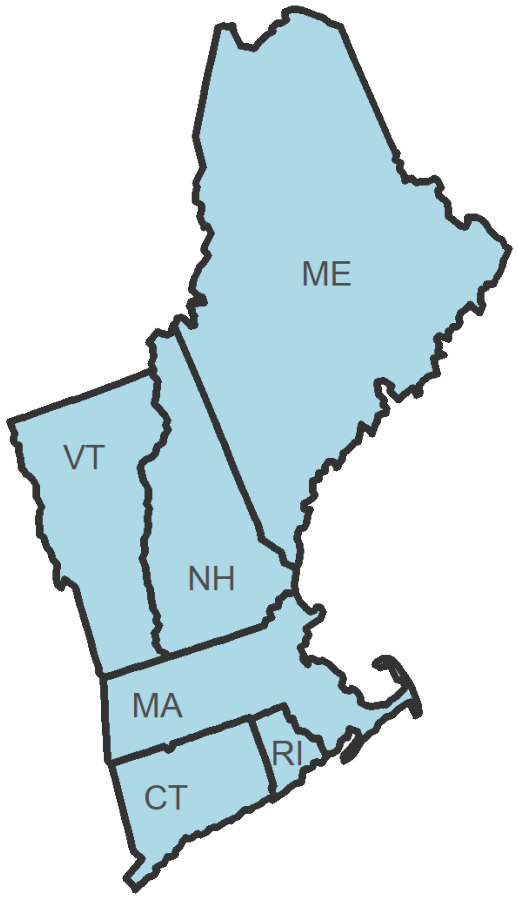
- NETC members spend significant time and resources collecting pavement surface data to support reporting and decision-making functions.
- Pavement networks represent large assets and significant M&R budgets.
- Data quality and management are critical to stated functions.
- DQMPs mandated by Congress in 23 CFR 490.319(c) provide means to assist in QC and QA over the entire data collection life cycle.



Specific steps not clear; guidelines needed

Objectives

- Review NETC pavement surface condition DQMPs.
- Summarize control sites used in NETC region with potential for inter-agency sharing.
- Develop recommendations for regional efficiencies in collection and analysis of QC/QA data.
- Develop recommendations to assist NETC members with data reporting requirements for compliance with FHWA-approved DQMPs.



Information Gathering: Considerations

1. Gather, review, and analyze latest DQMPs and work-in-progress updates from NETC members.
2. Identify how each NETC member organizes control sites and provide recommendations for potential future changes to control sites setup.
3. Identify regional efficiencies in collection and analysis of validation/ control QC/QA data.
4. Develop standard terminology that can potentially be used among NETC members.

National DQMP Scoresheets Summary

Groups	Overall	Equipment Calibration and Certification	Certification Process for Persons	QC Before and During Data Collection	Data Sampling, Review, and Checking	Error Resolution Procedures and Data Acceptance Criteria
Division1-New England	63%	62%	38%	68%	71%	54%
Division2-Middle Atlantic	62%	59%	21%	71%	75%	53%
Division3-East North Central	34%	34%	13%	33%	53%	42%
Division4-West North Central	50%	38%	26%	64%	54%	55%
Division5-South Atlantic	53%	57%	21%	54%	61%	38%
Division6-East South Central	34%	27%	00%	45%	46%	49%
Division7-West South Central	59%	38%	47%	78%	81%	68%
Division8-Mountain	56%	45%	26%	70%	71%	66%
Division9-Pacific	34%	35%	28%	32%	54%	35%

FHWA-RC-20-0007, *Successful Practices for Quality Management of Pavement Surface Condition Data Collection and Analysis*

NETC DQMP Scoresheets Summary

DOT	Overall	Equipment Calibration and Certification	Certification Process for Persons	QC Before and During Data Collection	Data Sampling, Review, and Checking	Error Resolution Procedures and Data Acceptance Criteria
State 1	75%	74%	60%	80%	75%	67%
State 2	49%	27%	00%	68%	58%	33%
State 3	47%	48%	09%	61%	42%	40%
State 4	79%	82%	50%	88%	100%	40%
State 5	48%	69%	44%	24%	75%	75%
State 6	78%	74%	63%	89%	75%	67%

Spreadsheet used in FHWA-RC-20-0007 and NECT 21-1 projects to arrive at *individual and overall scores in above table has been provided to the New England states.*

Information Gathering: Findings

- NETC member DQMPs ranked well when compared to peers.
  - Especially strong in QC before and after data collection and data sampling, review, and checking.
- Four NETC members had well-rated equipment and calibration practices within DQMPs.
  - Strengths of NETC members can be leveraged to improve other two members practices.
- Control site properties and definitions vary between NETC members.
  - Limited information on level of processing and data format for all States.

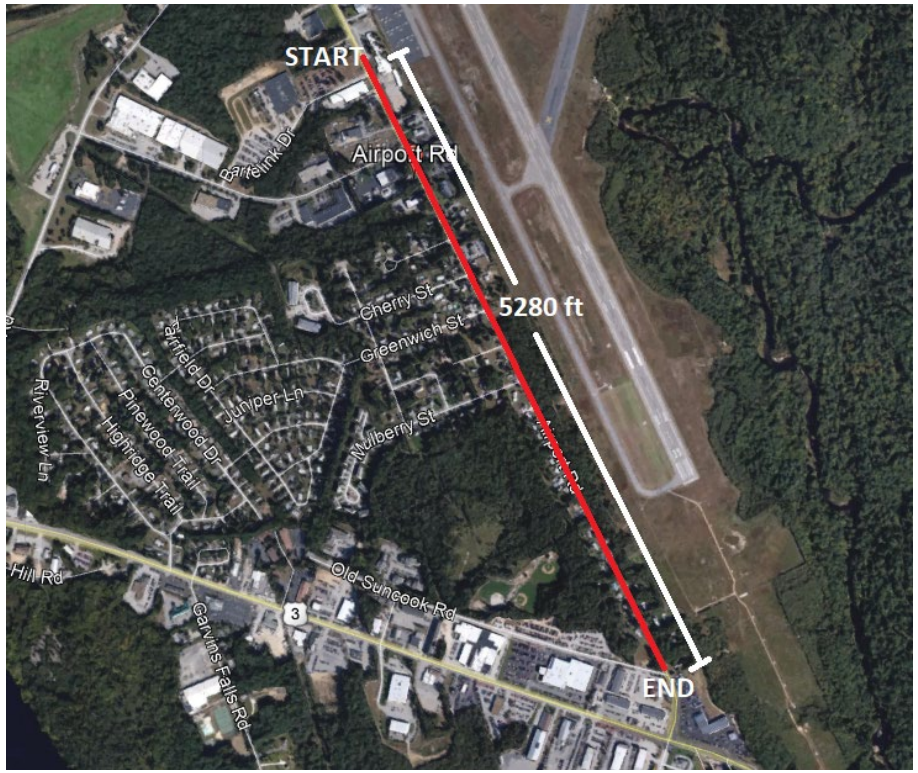
Information Gathering: Outcomes

DQMPs

- Strengths
- Weaknesses
- Needs

Terminology

- Calibration
- Certification
- Validation
- Verification
- Quality Control
- Quality Assurance
- Control Site



Control Site (also known as certification, validation or verification sites) – locations with known length and condition values used to calibrate, validate, or verify the equipment and operators.

Control Sites: Characteristics and Locations

Control sites are important to agency's pavement performance data collection efforts

- Goes to heart of data quality (garbage in, garbage out)

Control sites have requirements to meet

- Metrics and needs (certification/validation/verification)

Control sites should meet certain desirable characteristics

- Safety, representative of network, state control, etc.

Control sites are not permanent because conditions change over time

- Need to periodically replace them

Goal is to reduce number of control sites while meeting requirements and desired characteristics

- Sharing of sites and automating identification of potential sites is way to go

Control Site Requirements

- AASHTO protocols and successful practices were used to develop a matrix of requirement factors recommended for control site selection.
- Key elements:
  - Metric type – IRI, DMI, rutting, or cracking
  - Test type – certification, validation, or verification.
  - Guidance type – established standards (i.e., AASHTO R56) or NETC member practices
- Matrix also provides overview of equipment needed, site requirements (e.g., surface condition and length), test requirements, and NETC members for which different tests are applicable

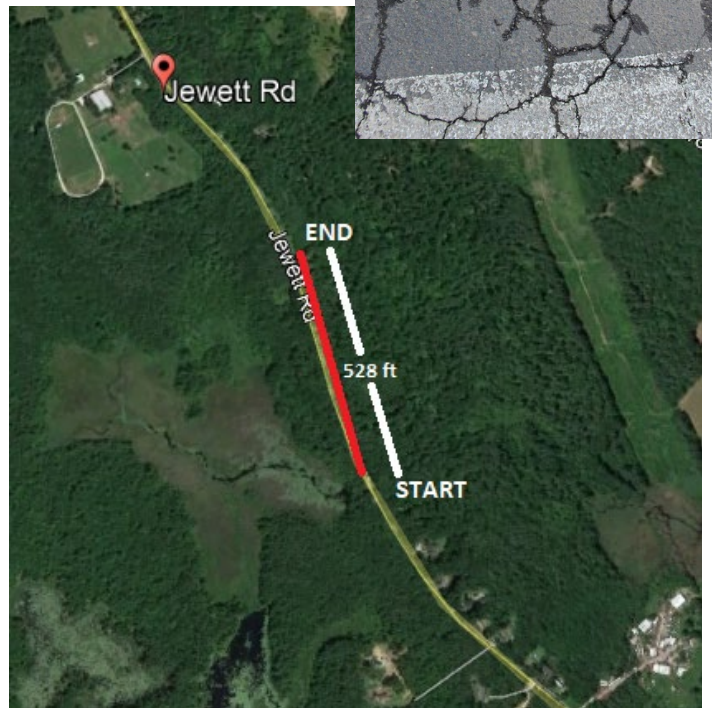
Control Site Requirements

Test Type	Protocol/ Field Testing	Section #	Surface Type	Distress Level	Section Length
Certification	AASHTO R56	1	AC/Composite	Smooth (30-75 in/mile)	≥ 528' with lead-in & stopping distance
Certification	AASHTO R56	2	AC/Composite	Medium-Smooth (90-135 in/mile)	≥ 528' with lead-in & stopping distance
Certification	AASHTO R56	3	AC/Composite	Medium-Rough (<200 in/mile)	≥ 528' with lead-in & stopping distance

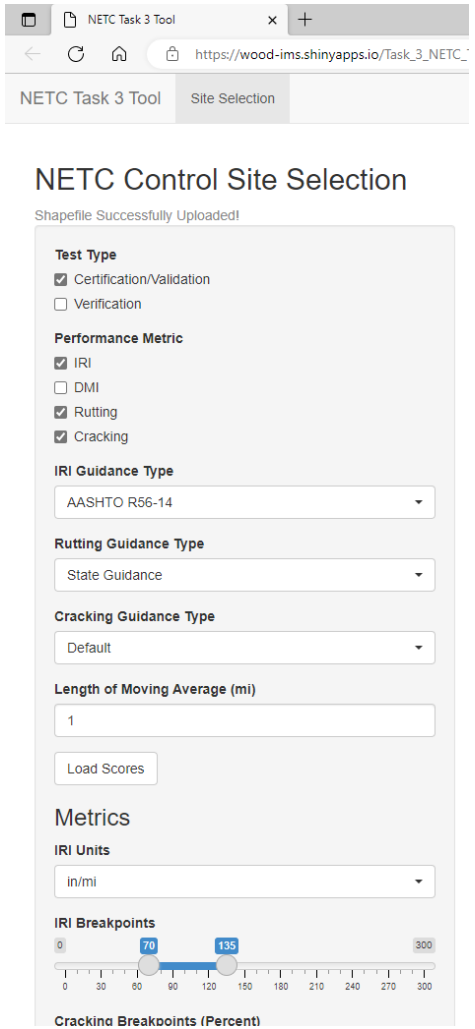
Metric	Equipment	Test Type	Protocol / Field Testing	Sec #	Site/Section Requirements								Test Requirements			Applicable to					
					Surface Type	Distress Level	Section Length	Section Width	Geometry	Surface Macrotexture	Traffic Control	Field/ Garage	Nr Passes/ Rep Meas	Test Speeds	Reference Data	CT	MA	ME	NH	RI	VT
IRI	Inertial Profiler	Certification	AASHTO R56	1	AC/ Composite	Smooth (30-75 in/mile)	≥ 528' with lead-in & stopping distance	N/A	avoid: (1) significant grade or grade change; (2) significant horizontal curvature or superelevation	Representative of pavements in States' highways network. Coarse preferred	Yes	Field	5 per speed	2 speeds: maximum operation speed and minimum operation speed	SurPRO profiler	X	X	X	X	X	X

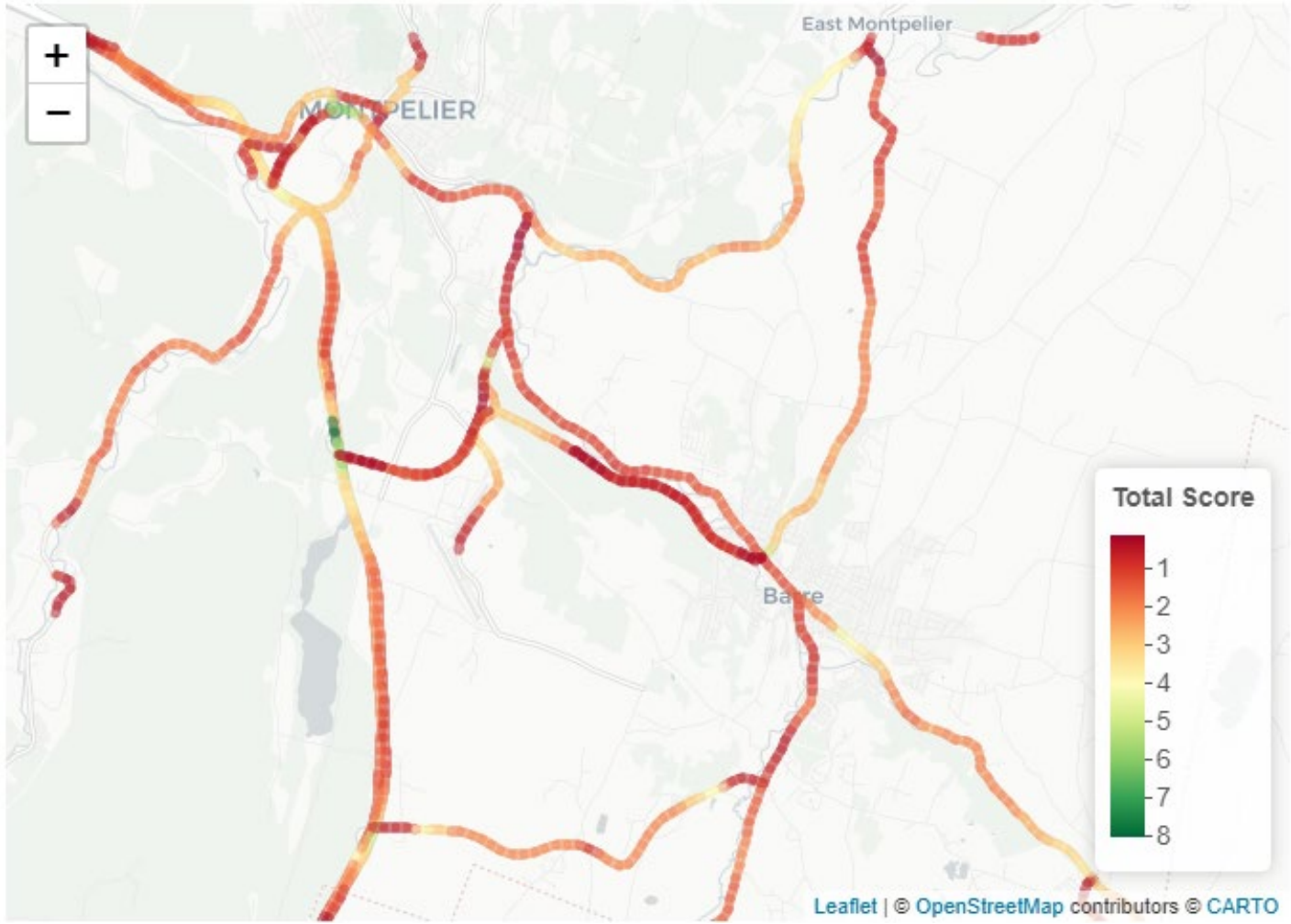
Control Site Characteristics

- Safety
  - Low impact of traffic control, rural area, low AADT (e.g., < 2,000), good sight distance, etc.
- Pavement Performance
  - Multiple severity levels, multiple distress types, variable, representative of network, etc.
- Geometry
  - Not on curve, minimal grade changes, away from intersection, not on ramp/bridge/ tunnel, consistent speed, etc.



Control Site Selection Tool





Control Site Sharing

Option	Advantages/ Disadvantages
1. Annual rodeos where host agency establishes locations, marking, and collection of reference data, while other NETC member agencies participate in rodeo.	• Distributed workload between NETC members and shared efficiency/lessons learned. • Requires upfront resources and higher amounts of travel.
2. Each agency performs all activities by itself, independent from other five agencies.	• More control over timing/location of testing and no travel for NETC members. • No gained efficiencies in control site selection/setup and requires control sites be selected each year.
3. Combination of Options 1 and 2	• Shared efficiency/lessons learned and equally distributed workload between NETC members than Option 2. • Requires upfront resources and may require higher amounts of travel but less than Option 1.

Other Control Site Considerations

Guidance Area	Successful Practices
Control Sites	• Reasonably represent pavement types in network. • Include range and variety of IRI and distresses typically encountered in network. • Include all data metrics collected and used during DOT decision-making processes. • Are of sufficient length to gather enough data for certification processes. • Have adequate ground reference data established so that accuracy of data being collected can be checked.
Ground reference data	• Are established during similar environmental conditions to certification of data collection equipment.
Data collection procedures	• Allow for enough repeat runs. • Performed at same speeds that data is collected at in field. • Verify calibrations of sensors and other associate systems.
Acceptance criteria	• Have been established so that data collection equipment can be rated as pass or fail.

Other Guidelines

- Certification, validation and verification frequency
- Accuracy and repeatability
- Error resolution
- Process improvement

Condition Metric	Certification / Validation		Verification
	Accuracy	Repeatability	Repeatability
IRI	Cross-Correlation ≥ 90%	Cross-Correlation ≥ 92%	Coefficient of Variation of IRI < 5%
DMI	Average Absolute Difference < 0.15%	Average Absolute Difference < 0.15%	Average Absolute Difference < 0.15%
Rutting	±0.08 in	Values within ±0.08 in at 90% confidence	Average Absolute Difference < 0.04 in
Cracking	±30%	Values within ±30% at 90% confidence	Coefficient of Variation < 15%

Technology Transfer Tools

- Report
- Guidelines
- PPT presentation and webinar
- One-page fact sheet
- Project poster

Webinar
Month Day, Year

NETC Project 21-1:

Quality Review and Assessment of Pavement Condition Survey Vehicle Data Across New England

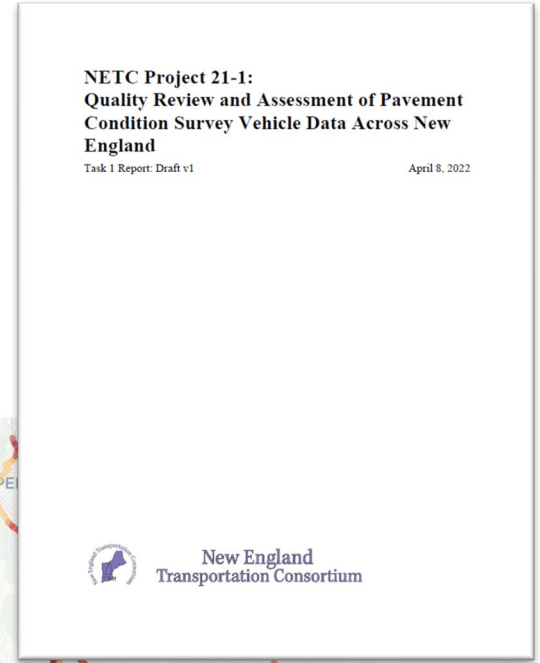
Summary

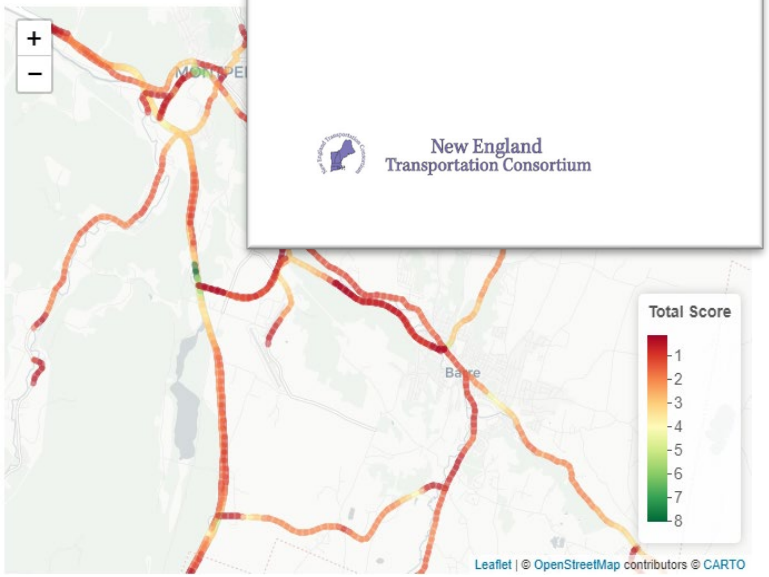
- Quality pavement surface condition data critical to NETC members; “garbage in, garbage out.”
- Federal-mandated DQMPs provide means to assist NETC members, but specific steps not clear; guidelines needed.
- DQMPs were reviewed to better understand strengths and weaknesses of NETC data quality management practices.
- Interviews held with NETC member staff, with focus on identification/selection of control sites to establish reference values.
- Reference measurements obtained at certification, validation, and verification control sites are at the heart of establishing data quality.

Deliverables

Information gathered during project used to develop:

- Common terminology to facilitate clear and concise data quality-related communications between the NETC members.
- Guidelines and supporting tool for identification and selection of control sites, which consider site requirements and characteristics.
- Recommendations for control site inter-agency sharing options to spread resource requirements amongst NETC members.
- Other recommendations and guidelines, such as certification, validation, and verification frequency, accuracy and repeatability acceptance limits, and error resolution.


NETC Project 21-1:
Quality Review and Assessment of Pavement Condition Survey Vehicle Data Across New England
Task 1 Report: Draft v1
April 8, 2022
New England Transportation Consortium



Benefits

Adoption of recommendations and guidelines will lead to several benefits:

- Common terminology will improve data quality-related communications.
- Improved control site identification and selection process will lead to better reference data.
- Inter-agency sharing of control sites will lead to improved regional efficiencies.
- Recommendations and guidelines will assist with compliance of federal-mandated DQMPs data reporting requirements.

Terminology
Calibration
Certification
Validation
Verification
Quality Control
Quality Assurance
Control Site

Sharing Option
1. Annual rodeos with host member establishes locations, marking, and collection of reference data; other members participate in rodeo
2. Each agency performs all activities, independent from others
3. Combination of Options 1 and 2

Thank you!

wsp.com