

# QUALITY ASSURANCE FOR SHRP2 R06C TECHNOLOGIES

JULY 31, 2018

DENNIS DVORAK

FHWA RESOURCE CENTER



# *Material*



# *Process*



# *Sampling*



# *Testing*



**Material**

**Process**

**Sampling**

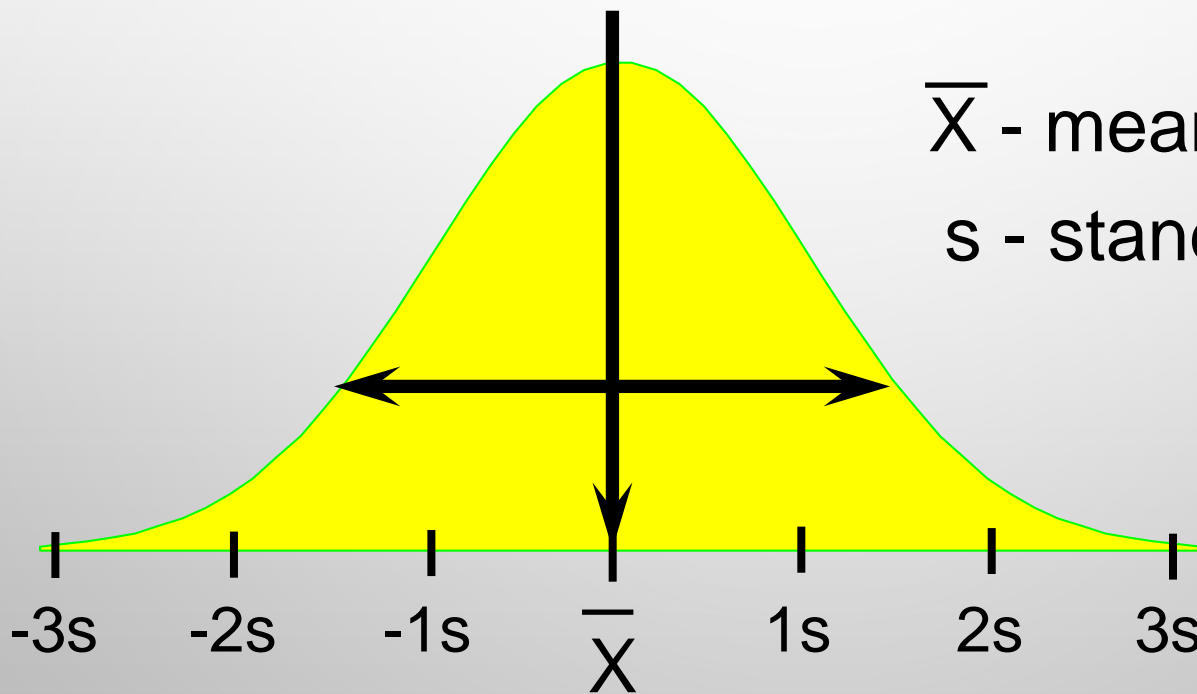
**Testing**

**Composite  
Variability**



# PERCENT WITHIN LIMITS

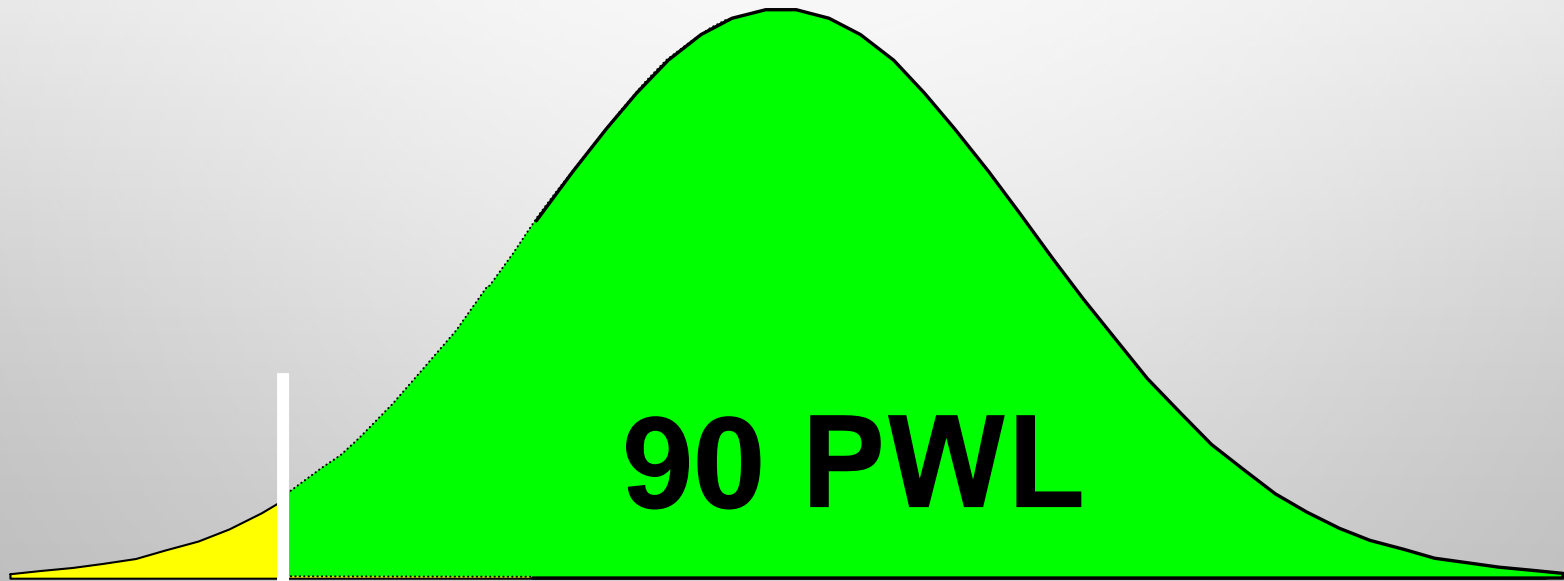
- EFFICIENTLY CAPTURES MEAN AND STANDARD DEVIATION IN ONE QUALITY MEASURE



$\bar{X}$  - mean

$s$  - standard deviation

# PERCENT WITHIN LIMITS



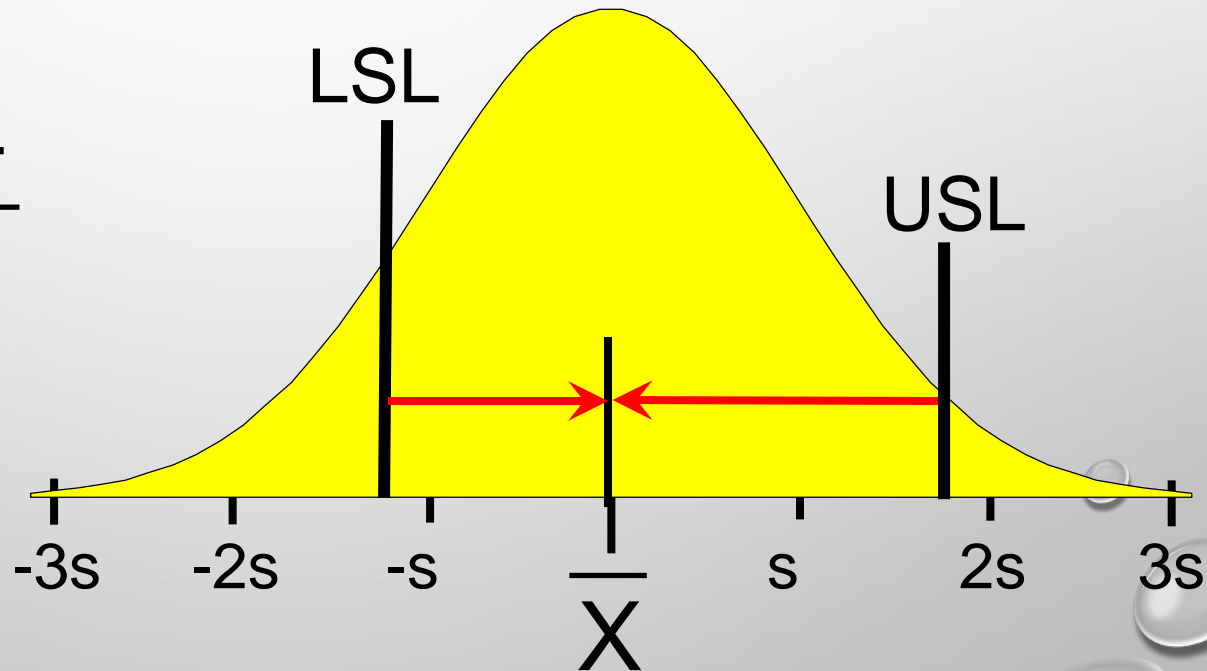
# STEPS FOR ESTIMATING PWL

1. OBTAIN RANDOM SAMPLES
2. COMPUTE
  - MEAN ( $\bar{X}$ )
  - STANDARD DEVIATION (S)
3. **COMPUTE QUALITY INDEX (Q)**
4. CONVERT Q TO “ESTIMATED” PWL

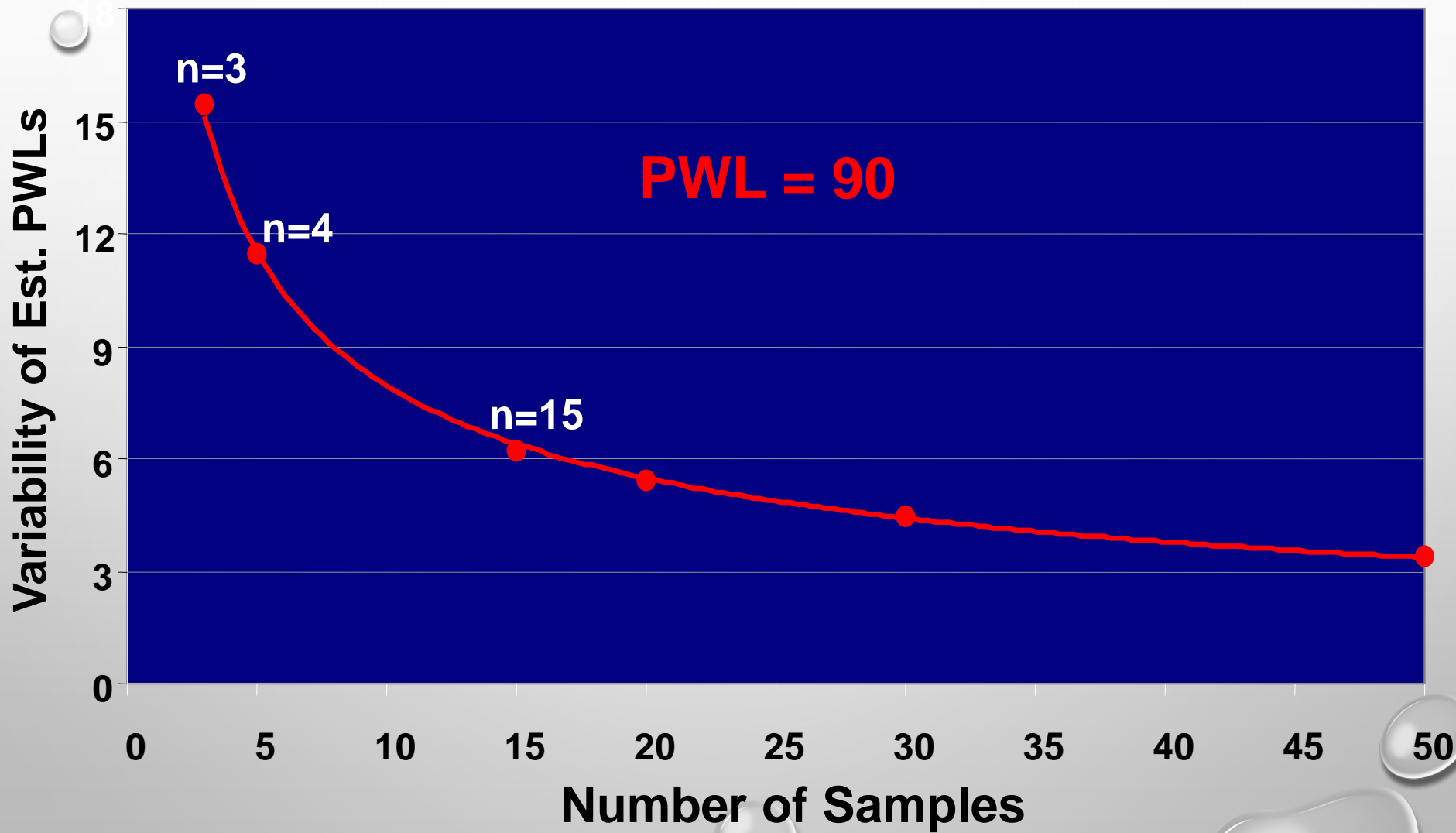
### 3. COMPUTE QUALITY INDEX

$$Q_U = \frac{USL - \bar{X}}{s}$$

$$Q_L = \frac{\bar{X} - LSL}{s}$$



# OPTIMAL SAMPLE SIZE

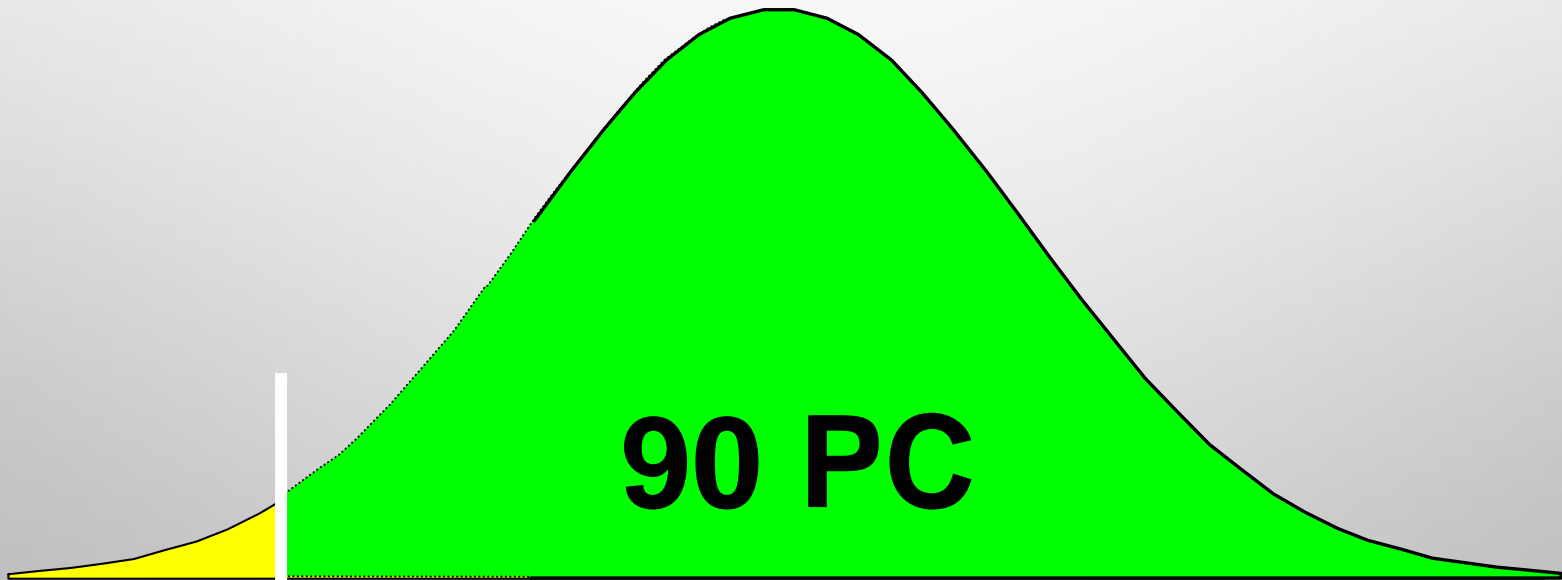




# PERCENT CONFORMING

- FOR ATTRIBUTES ACCEPTANCE PLANS, THE PERCENTAGE OF UNITS HAVING NO DEPARTURE OF AN ATTRIBUTE FROM ITS INTENDED LEVEL.

\*E-C173 TRB Glossary of Quality Assurance Terms



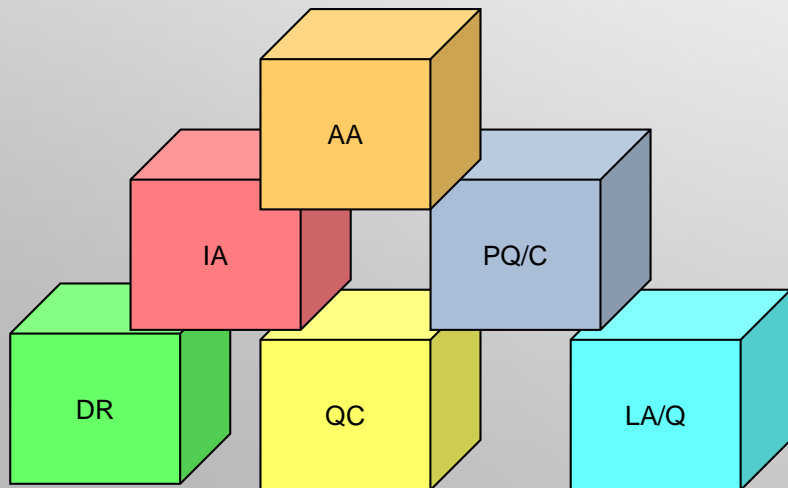
# AASHTO PAY EQUATION

- $PF = 55 + 0.5 * PWL$
- $PF = 55 + 0.5 * PC$

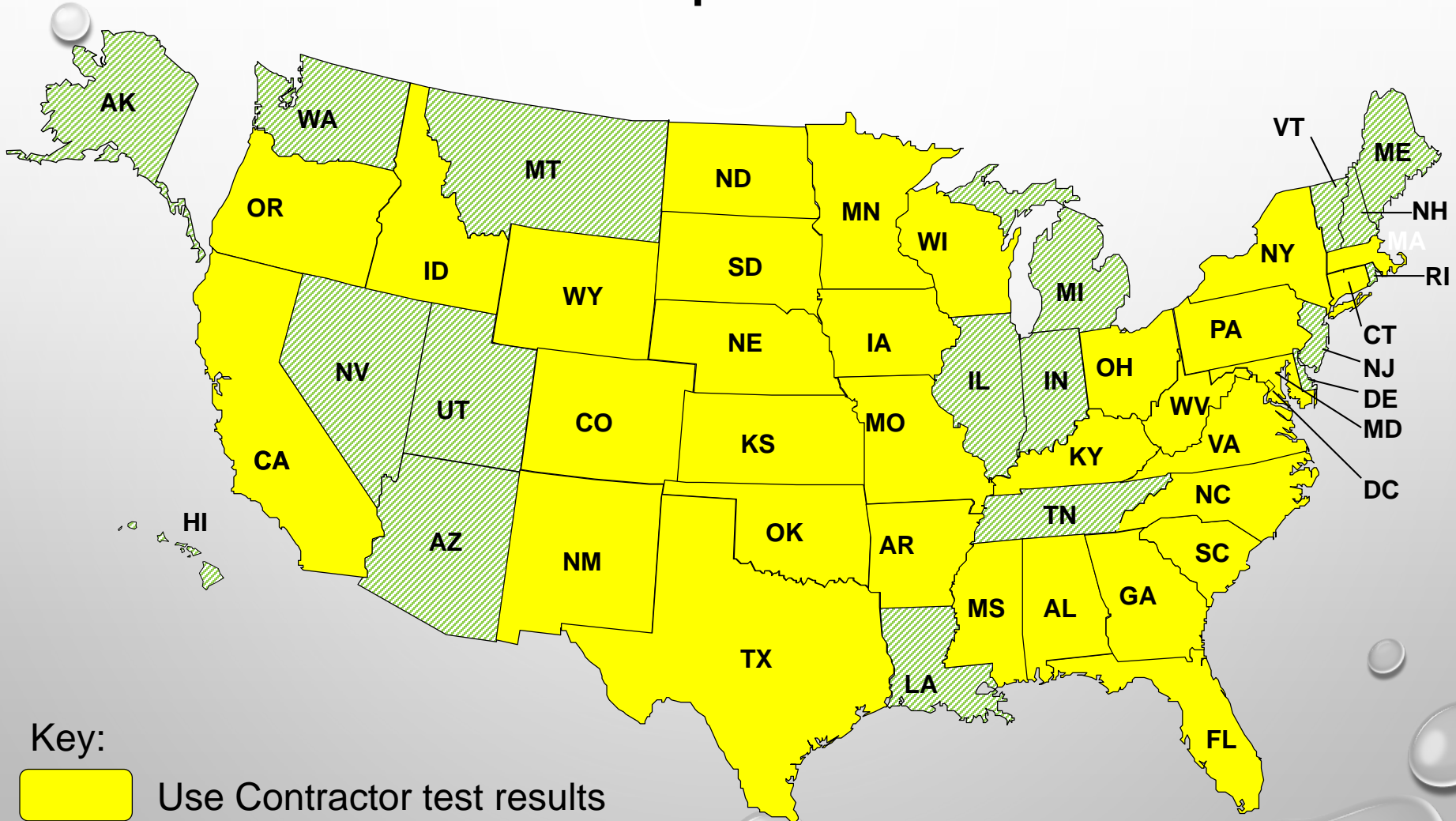
\*AASHTO R9-05 (2018)  
Standard Practice for Acceptance Sampling  
Plans for Highway Construction

# 23 CFR 637

- APPROPRIATE PAYMENT
- CONTRACTOR FRAUD



# 32 States use Contractor test results in the Acceptance Decision



Key:



Use Contractor test results

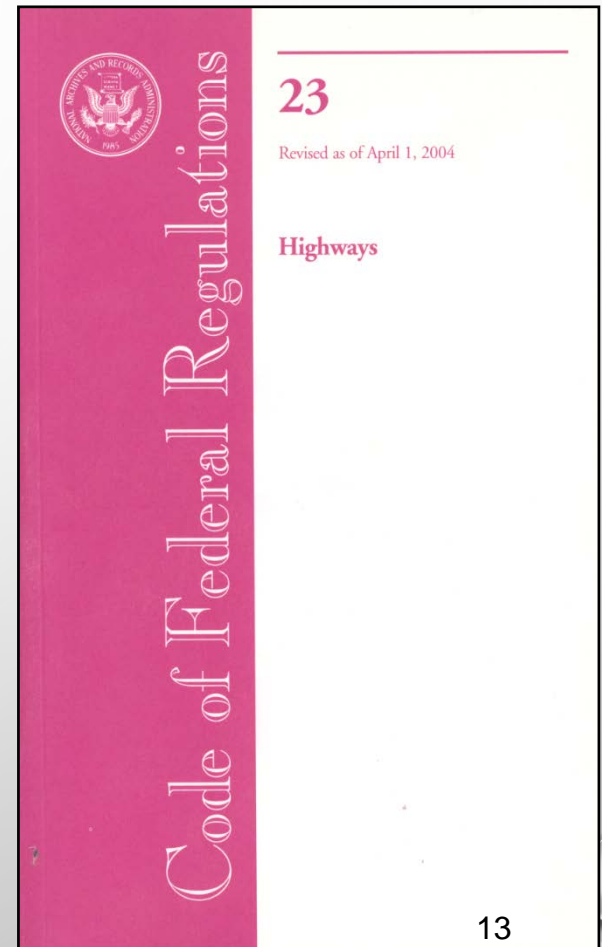


Use State Tests for Acceptance

Source: 2014 Update  
FHWA QA Assessment

Code of Federal Regulations:  
23 CFR 637 Subpart B -  
Quality Assurance  
Procedures for Construction

Policy: Quality Assurance  
(Non-Regulatory Supplement  
to 23 CFR 637) July 2006



# 23 CFR 637.207

## INDEPENDENT VERIFICATION

QUALITY CONTROL SAMPLING AND TESTING RESULTS MAY BE USED AS PART OF THE ACCEPTANCE DECISION PROVIDED THAT THE QUALITY OF THE MATERIAL HAS BEEN VALIDATED BY THE VERIFICATION SAMPLING AND TESTING. THE VERIFICATION TESTING SHALL BE PERFORMED ON SAMPLES THAT ARE TAKEN INDEPENDENTLY OF THE QUALITY CONTROL SAMPLES.

\*TITLE 23 CODE OF FEDERAL REGULATIONS PART 637 SUBPART B – QUALITY ASSURANCE PROCEDURES FOR CONSTRUCTION (23 CFR 637.207 (A)(1)(II)(B)).

# APPLICATION

- SURFACE DIELECTRIC PROFILING SYSTEM USING GROUND PENETRATING RADAR
- INTELLIGENT COMPACTION (IC)
- PAVER MOUNTED THERMAL PROFILING
- FEDERAL-AID FUNDS SHOULD NOT BE USED FOR PAY ADJUSTMENTS SINCE PAYMENT IS BASED ON CONTACTOR EQUIPMENT

# QUALITY ASSURANCE PROGRAM





# QUALITY ASSURANCE PROGRAM

- CONTRACTOR QUALITY CONTROL (QC)
  - MATERIALS SAMPLING & TESTING
  - IF PART OF ACCEPTANCE DECISION
    - INDEPENDENT OF AGENCY VERIFICATION
    - QUALIFIED TECHNICIANS
    - QUALIFIED LABORATORIES
    - INDEPENDENT ASSURANCE EVALUATION

Note: Contractor QC may be included if sampling & testing meets certain requirements [23 CFR 637.207(a)(1)(ii)].

# QUALITY ASSURANCE PROGRAM

- AGENCY ACCEPTANCE
  - VERIFICATION SAMPLING & TESTING
  - QUALITY EVALUATION
  - ACCEPTANCE & PAYMENT
    - MAY INCLUDE CONTRACTOR TEST RESULTS IF VALIDATED

Note: See 23 CFR 637.205(d) and 637.207(a)(1)(ii)(B) for specific requirements.

# QUALITY ASSURANCE PROGRAM

- **TECHNICIAN QUALIFICATION**
  - **REQUIRED FOR ALL SAMPLING & TESTING IN ACCEPTANCE DECISION**
  - **QUALIFICATION PROGRAMS**
    - **STATE PROGRAMS**
    - **REGIONAL PARTNERSHIPS**
    - **NATIONAL PROGRAMS**

Note: Technician qualification requirement can be found at 23 CFR 637.209(b).



# QUALITY ASSURANCE PROGRAM

- LABORATORY ACCREDITATION/QUALIFICATION  
[23 CFR 637.209(A)]
  - ACCREDITATION REQUIRED
    - AGENCY CENTRAL LAB
    - CONSULTANT DISPUTE RESOLUTION LABS
    - CONSULTANT INDEPENDENT ASSURANCE LABS
  - QUALIFICATION REQUIRED
    - TESTING LABS USED IN ACCEPTANCE DECISION
      - AGENCY VERIFICATION TESTING
      - CONTRACTOR QC TESTING

# QUALITY ASSURANCE PROGRAM

- INDEPENDENT ASSURANCE (IA)
  - EVALUATE ALL ACCEPTANCE SAMPLING & TESTING
  - SEPARATE FROM ACCEPTANCE TESTING
  - TECHNICIAN PROCEDURE EVALUATION
  - TESTING EQUIPMENT EVALUATION



Note: See 23 CFR 637.207(a)(2) and 637.209(b) for specific requirements.

# QUALITY ASSURANCE PROGRAM

- MATERIALS TESTING DISPUTE RESOLUTION
  - REQUIRED WHEN CONTRACTOR DATA USED IN ACCEPTANCE DECISION
  - DOCUMENTED PROCESS
  - ADDRESS DISCREPANCIES
    - AGENCY VERIFICATION TESTING
    - CONTRACTOR QC



Note: See 23 CFR 637.207(a)(1)(iii) and 23 CFR 637.205(a) for more information.

# QUESTIONS

