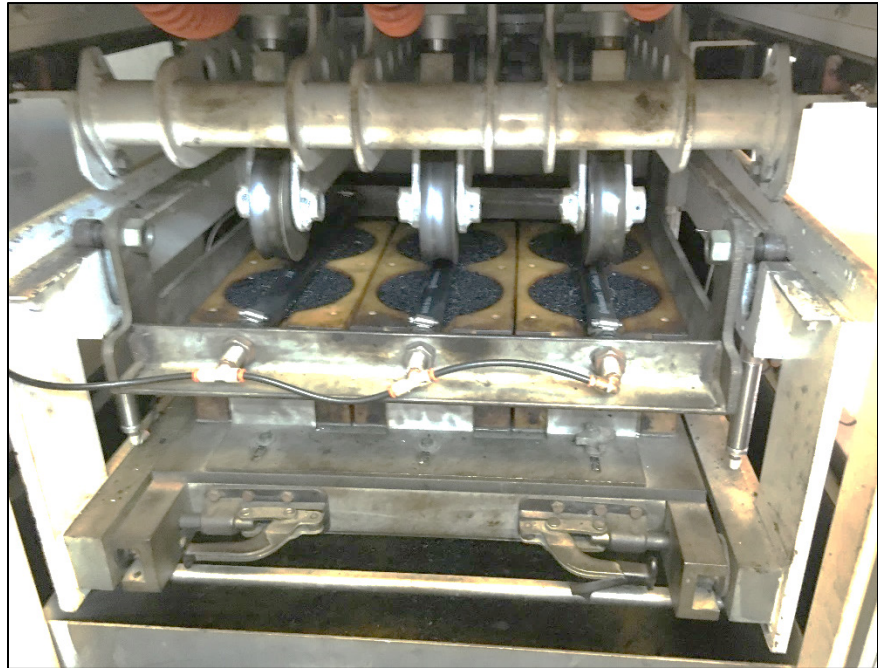


Documenting FHWA Quality Assurance Assessment 2022

Summary Report



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Federal Highway Administration

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16. Abstract In 2008, the FHWA Office of Infrastructure and the FHWA Resource Center developed the initial Quality Assurance (QA) Assessment evaluation tool to address the six QA program elements: agency acceptance, dispute resolution, technician certification/qualification, qualified/accredited laboratories, independent assurance, and contractor quality control processes. Additional assessments were conducted in 2010, 2012, 2014, and 2018 with the FHWA refining the process over time to improve the quality of the data collected. The assessments contained items on effective practices by State departments of transportation (DOTs) as well as how State DOT's QA programs addressed 23 CFR 637 Subpart B requirements. The QA Assessment was developed as a risk evaluation tool for both the FHWA and the State DOTs although the QA Assessment does not evaluate material quality or compliance with Federal laws or regulations. This report provides the results of the 2022 QA Assessment along with a trend analysis of the common topics evaluated since the initial 2008 QA Assessment.			
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TABLE OF CONTENTS

CHAPTER 1. BACKGROUND.....	1
Background	1
Report Organization.....	2
CHAPTER 2. SCOPE.....	3
Introduction.....	3
Scope	3
CHAPTER 3. 2022 QA ASSESSMENT PROCEDURES	5
Introduction.....	5
2022 QA Assessment.....	5
Revisions from the 2018 QA Assessment.....	5
2022 QA Assessment Completion Process	6
CHAPTER 4. 2022 QA ASSESSMENT RESULTS	9
Introduction.....	9
Normalized Rating Results	9
Individual Question Results.....	10
CHAPTER 5. TIME SERIES QA ASSESSMENT RESULTS	33
Introduction.....	33
Crosswalk	33
Temporal Trends	33
CHAPTER 6. LESSONS LEARNED	59
Introduction.....	59
Clarifications for Future QA Assessments	59
Outstanding Issues.....	59
CHAPTER 7. CONCLUSIONS.....	61
REFERENCES.....	63
APPENDIX A QUALITY ASSURANCE ASSESSMENT 2022	65

LIST OF FIGURES

Figure 1. QA program data spreadsheet completion flowchart.	6
Figure 2. Histogram of Normalized Rating distribution for the 52 QA programs.	10
Figure 3. Number of FHWA Division Offices that had formally approved revisions to the State DOT’s QA program within the past 3 years.	11
Figure 4. Number of State DOT QA programs that used an electronic materials management system that included all test results (State and contractor) used in the acceptance decision.	11
Figure 5. Number of State DOT QA programs that have a documented process for controlling the location of random verification (agency acceptance) sampling.	12
Figure 6. State DOTs that had a standard specification for PCC pavement construction.	13
Figure 7. Number of State DOT QA programs with a documented process to ensure sample security for agency acceptance samples for the four listed material categories (asphalt pavement mixture, asphalt pavement density, PCC pavement, and PCC structural).	14
Figure 8. State DOTs that predominantly sampled asphalt paving mixture after discharge from the hauling vehicle (before or after the paver).	15
Figure 9. State DOTs that required a portion of the structural PCC to be sampled from the end of the pump line.	15
Figure 10. State DOTs that required a portion of the pavement PCC to be sampled from ahead of the paver on the grade.	16
Figure 11. Quality characteristics used by the State DOTs for asphalt pavement acceptance.	17
Figure 12. Quality characteristics used by the State DOTs for PCC pavement acceptance.	18
Figure 13. Quality characteristics used by the State DOTs for structural PCC acceptance.	19
Figure 14. State DOTs that used PWL or PD to determine payment for the asphalt mixture.	20
Figure 15. State DOTs that used PWL or PD to determine payment for asphalt pavement density.	20
Figure 16. State DOTs that used PWL or PD to determine payment for the PCC pavement.	21
Figure 17. State DOTs that used PWL or PD to determine payment for the structural PCC.	21
Figure 18. State DOTs that used contractor test results in the acceptance decision for asphalt pavements.	22
Figure 19. State DOTs that used contractor test results in the acceptance decision for PCC pavements.	23
Figure 20. Number of State DOTs that used F- and t-tests with the recommended sample sizes to statistically verify the contractor’s test results for acceptance.	24
Figure 21. Number of State DOTs that used pay equations for at least one quality characteristic.	24
Figure 22. Number of State DOTs that had reevaluated specification limits and IA tolerances in the past 5 years.	25

Figure 23. Number of State DOTs that used information from the NTPEP when developing qualified product lists.....	26
Figure 24. State DOT’s approach to independent assurance.....	26
Figure 25. Number of State DOTs that had a system-based IA analysis of program coverage for its testing technicians during the previous year. The NO response was indicative of either no system-based analysis or less than 75 percent coverage.	27
Figure 26. Number of State DOTs that had a formal dispute resolution process that ensured sample security and unbiased testing.	28
Figure 27. Number of State DOTs that used qualified non-project personnel to review and approve field laboratories used for acceptance testing by the contractor or State DOT.....	29
Figure 28. Number of State DOTs with a technician qualification procedure that included the characteristics listed in Question 19 for the three primary material types.....	30
Figure 29. State DOTs with a standardized QA program for alternate project delivery projects.....	31
Figure 30. Number of State DOTs with a standardized QA program for Federal-aid LPA projects.....	32
Figure 31. Changes in the number of FHWA Division Offices that had formally approved revisions to the State DOT’s QA program within the past 3 years.....	33
Figure 32. Changes in the number of State DOT QA programs that used an electronic materials management system that included all test results (State and contractor) used in the acceptance decision.....	34
Figure 33. Changes in the number of State DOT QA programs that have a documented process for controlling the location of random verification (agency acceptance) sampling.....	34
Figure 34. Changes in the number of State DOTs that predominantly sampled asphalt paving mixture after discharge from the hauling vehicle (before or after the paver).....	35
Figure 35. Changes in the number of State DOTs that required a portion of the structural PCC to be sampled from the end of the pump line.....	35
Figure 36. Changes in the number of State DOTs that use V_a or P_b as an asphalt mixture quality characteristic. The YES answer was separated into PAY FACTOR and PRODUCTION CONTROL in 2018.....	36
Figure 37. Changes in the number of State DOTs that used density as an asphalt pavement quality characteristic. The YES answer was separated into PAY FACTOR and PRODUCTION CONTROL in 2018.....	37
Figure 38. Changes in the number of State DOTs that used pavement smoothness measured by IRI or PI as an asphalt pavement quality characteristic. The YES answer was separated into PAY FACTOR and PRODUCTION CONTROL in 2018.....	37
Figure 39. Changes in the number of State DOTs that used VMA as an asphalt mixture quality characteristic. The YES answer was separated into PAY FACTOR and PRODUCTION CONTROL in 2018.....	38
Figure 40. Changes in the number of State DOTs that used a mixture performance test as an asphalt pavement quality characteristic.....	38

Figure 41. Changes in the number of State DOTs that measured as-constructed pavement thickness as a quality characteristic by either coring or using an MIT-Scan-T2/T3 for PCC pavement.....	39
Figure 42. Changes in the number of State DOTs that used the entrained air content as a quality characteristic for PCC pavements.....	40
Figure 43. Changes in the number of State DOTs that used smoothness measured with either IRI or PI as a quality characteristic for PCC pavements.....	40
Figure 44. Changes in the number of State DOTs that used optimized gradation as a quality characteristic for PCC pavements.....	41
Figure 45. Changes in the number of State DOTs that measured the dowel bar alignment after the concrete was placed as a quality characteristic for PCC pavements.....	41
Figure 46. Changes in the number of State DOTs that used permeability as a quality characteristic for PCC pavements.....	42
Figure 47. Changes in the number of State DOTs that used compressive or flexural strength as a quality characteristic for PCC pavements.....	42
Figure 48. Changes in the number of State DOTs that used compressive or flexural strength as a quality characteristic for structural PCC.....	43
Figure 49. Changes in the number of State DOTs that used the entrained air content as a quality characteristic for structural PCC.....	44
Figure 50. Changes in the number of State DOTs that used permeability (including resistivity) as a quality characteristic for structural PCC.....	44
Figure 51. Changes in the number of State DOTs that used smoothness measured with either IRI or PI as a quality characteristic for bridge decks.....	45
Figure 52. Changes in the number of State DOTs that used the depth of concrete cover over the reinforcing steel as a quality characteristic for bridge decks.....	45
Figure 53. Changes in the number of State DOTs that used PWL/PD specifications for determining the payment for asphalt pavements.....	46
Figure 54. Changes in the number of State DOTs that used PWL/PD specifications for determining the payment for PCC pavements.....	47
Figure 55. Changes in the number of State DOTs that used PWL/PD specifications for determining the payment for structural PCC.....	47
Figure 56. Changes in the number of State DOTs that used F- and t-tests to verify the contractor's test results with the recommended sample sizes for asphalt pavements.....	48
Figure 57. Changes in the number of State DOTs that used F- and t-tests to verify the contractor's test results with the recommended sample sizes for PCC pavements.....	48
Figure 58. Changes in the number of State DOTs that used equations for payment adjustments on asphalt pavements.....	49
Figure 59. Changes in the number of State DOTs that used equations for payment adjustments on PCC pavements.....	49

Figure 60. Changes in the number of State DOTs that had evaluated their asphalt pavement specification limits in the past 5 years.	50
Figure 61. Changes in the number of State DOTs that had evaluated their PCC pavement or structural PCC specification limits.	50
Figure 62. Changes in the number of State DOTs that had evaluated their IA tolerances.	51
Figure 63. Changes in the number of State DOTs that had used the NTPEP when developing qualified product lists.	51
Figure 64. Changes for the IA approach used by State DOTs since 2008.....	52
Figure 65. Changes for the system-based analysis of IA coverage of State DOTs since 2008....	52
Figure 66. Changes in the number of State DOTs that had a formal dispute resolution process that included custody of the samples by the State DOT and test results analyzed in an unbiased manner.	53
Figure 67. Changes in the number of State DOTs that used non-project personnel from a higher organization level that was responsible for the review and approval of the field laboratories used by the State DOT and contractors.	54
Figure 68. Changes in the number of State DOTs that qualified sampling and testing personnel for asphalt pavement using the characteristics listed in Question 19.....	55
Figure 69. Changes in the number of State DOTs that qualified sampling and testing personnel for PCC using the characteristics listed in Question 19.	55
Figure 70. Changes in the number of State DOTs that qualified sampling and testing personnel for soils and aggregates using the characteristics listed in Question 19.....	56
Figure 71. Changes in the number of State DOTs that have a standardized QA program for alternate project delivery projects.	56
Figure 72. The trend in the number of State DOTs that have a standardized QA program for Federal-aid projects administered by LPAs.	57

LIST OF TABLES

Table 1. 2022 QA Assessment questions and ratings. 66

CHAPTER 1. BACKGROUND

Background

Federal-aid highway program requirements for material sampling and testing programs for the State Departments of Transportation (DOTs) have existed since the early 1960s. The latest major revision to the Federal Highway Administration's (FHWA) sampling and testing regulations, titled "Quality Assurance Procedures for Construction," was published on June 29, 1995, as 23 CFR 637 Subpart B.

The regulation (23 CFR 637.205(a)) requires each State DOT to maintain an FHWA-approved quality assurance (QA) program for materials used in Federal-aid highway construction projects on the National Highway System (NHS). The requirements were designed to ensure that materials incorporated into Federal-aid highway projects on the NHS meet the project plans and specifications. The FHWA established six QA program elements in 23 CFR 637 Subpart B:

- Agency acceptance. (23 CFR 637.207(a)(1)).
- Dispute resolution. (23 CFR 637.207(a)(1)(iii)).
- Technician certification/qualification. (23 CFR 637.209(b)).
- Qualified/accredited laboratories. (23 CFR 637.209(a)).
- Independent assurance (IA). (23 CFR 637.207(a)(2)).
- Contractor quality control processes. (23 CFR 637.207(a)(1)(ii)).

These regulations allow significant flexibility in each State-specific QA program including the use of contractor quality control (QC) test results in the agency acceptance decision provided that proper validation procedures are in place. Within the flexibility afforded by the regulation, the structure and details of each State DOT's QA program may vary to address potential risks to materials quality in that State. The FHWA provides support to State DOTs to assist agencies in mitigating these risks consistent with the regulations.

The FHWA reviews the 52 State DOTs (including Puerto Rico and the District of Columbia) QA programs for compliance with the six elements above. The FHWA Office of Infrastructure conducts four to six Quality Assurance Stewardship Reviews of State DOTs annually in cooperation with the local FHWA Division Office. These detailed reviews provide the State DOT and FHWA Division Office with a summary of the State DOT's QA program from the FHWA headquarters perspective based on:

- Program Strengths—noteworthy areas where a State DOT's QA program was employing nationally recognized, effective processes and procedures to evaluate materials and minimize program risks.
- Opportunities for Improvement—significant concerns in a State DOT's QA program and its implementation including noncompliance with regulations.
- Effective Practice Suggestions—based on processes and procedures that were observed in prior reviews of other State DOTs and could help an agency reduce their materials acceptance risks.

In 2008, FHWA developed a QA Assessment evaluation tool about the six QA program elements. The evaluation tool was developed based on the findings and suggestions found in sources, including the Quality Assurance Stewardship Reviews; the U.S. Government Accountability Office (GAO) report on *Federal-Aid Highways—Increased Reliance on Contractors Can Pose Oversight Challenges for Federal and State Officials* (GAO 2008); and the FHWA national review, *Quality Assurance in Materials and Construction* (McLaury et al. 2007).

Additional assessments were conducted in 2010, 2012, 2014, and 2018 with the FHWA refining the topics to improve the quality of the data collected. The assessments gathered information on effective practices by State DOTs as well as how State DOT QA programs addressed 23 CFR 637 Subpart B requirements. The QA Assessment was developed as a risk evaluation tool for both the FHWA and the State DOTs although the QA Assessment does not evaluate material quality or a State DOT's or FHWA Division Office's compliance with Federal laws or regulations.

Report Organization

The report is organized into seven chapters and one appendix:

- Chapter 1: Background—This chapter provides background on the FHWA QA processes and QA Assessment.
- Chapter 2: Scope—This chapter summarizes the purpose and scope of the project.
- Chapter 3: 2022 QA Assessment Procedures—This chapter presents the procedures that were used to update and conduct the QA Assessment.
- Chapter 4: 2022 QA Assessment Results—This chapter summarizes the results of the QA Assessment conducted for 2022.
- Chapter 5: Time Series QA Assessment Results—This chapter presents the temporal trends for the questions that were part of the 2022 QA Assessment and were used in previous QA Assessments.
- Chapter 6: Lessons Learned—This chapter discusses potential clarifications to the questions and other topics for consideration in future QA Assessments.
- Chapter 7: Conclusions—The final chapter highlights some of the key findings from the 2022 QA Assessment.
- Appendix A: 2022 QA Assessment—This appendix contains a copy of the 2022 QA Assessment.

CHAPTER 2. SCOPE

Introduction

This chapter outlines the scope of this project to complete the 2022 FHWA QA Assessment. The FHWA QA assessment provides information on current trends in national QA practices.

Scope

The assessment was completed in four phases.

Phase 1: Kick-Off and Finalize Assessment

The 2018 QA Assessment items and rating criteria were reviewed and minor updates were made to improve clarity for the 2022 QA Assessment. The FHWA completed a significant review and update of the assessment in the 2018 assessment to address long-term changes in QA program risk factors since the assessment was initiated in 2008. To facilitate trend analysis from 2018 onward there was a benefit in minimizing continuous changes to the assessment items. However, some specific updates to improve clarity were necessary as were some changes to the rating protocols.

Phase 2: Gather Information on State DOT QA Programs

The status of each state-level QA program was gathered based on information on the State DOT's websites. The documents included construction specifications, materials manuals, construction manuals, and technician certification program manuals. Phase 2 covered each of the 52 state-level QA programs. For assessment items consistent between the 2018 and 2022 assessments, the 2018 data was used as a starting point for the 2022 information. The standard operating procedures for each QA program were documented with the QA Assessment. Interim policies implemented in 2020 or 2021 to address any modified agency operations at that time were not generally included and if interim policies were used, they were documented as such. The document title, section/page numbers, and a weblink to the referenced documents were recorded. Items that were unavailable or unclear based on publicly available sources were noted for follow-up with FHWA Division Offices in Phase 3.

Phase 3: Validate and Compile Assessment Information

Validation meetings were scheduled with each of the 52 FHWA Division Offices. Division Office staff members received the data gathered about their State's QA program in advance. The purpose of the validation meetings was to facilitate the clarification and completion of any missing or incomplete information from Phase 2. At the end of each meeting, the respective information was updated for each state-level QA program including reference document notations. A spreadsheet combining all assessment responses was created along with the 52 State QA program spreadsheets.

Phase 4: Identify Trends and Document Assessment Results

The 2022 QA Assessment results were evaluated along with previous assessment data to:

- Summarize the information nationally.
- Identify trends from the 2008 QA Assessment through the 2022 QA Assessment.

CHAPTER 3. 2022 QA ASSESSMENT PROCEDURES

Introduction

This chapter provides details on the procedures used to review and update 2018 QA Assessment topics and criteria and complete the 2022 QA Assessment covering the 52 State DOT QA programs.

2022 QA Assessment

The FHWA used the QA Assessment as a risk evaluation tool to assist FHWA and State DOTs in evaluating QA program risks and benchmarking each program nationally against common QA practices. The QA Assessment has been used since 2008 with several revisions made to items and the rating procedures from assessment to assessment. The FHWA completed a significant review and update of the assessment in 2018 to address long-term changes in the national QA program risk factors since the assessment was initiated in 2008. The primary QA Assessment work group was composed of FHWA Headquarters and Resource Center pavement and materials engineers.

Revisions from the 2018 QA Assessment

Several revisions were made to the items and rating procedures after reviewing the 2018 QA Assessment, its results, and current trends in the administration of QA programs around the country. In particular, two questions were deleted from the QA Assessment:

- Question 9 on payment lot sizes for asphalt and portland cement concrete (PCC) pavement.
- Question 14 on verification of any contractor test results used in the acceptance decision.

Placeholders for the two deleted questions were inserted into the 2022 QA Assessment to assist in comparing answers from the 2018 QA Assessment. The reader will note that there are no questions 9 and 14 in the 2022 QA Assessment.

QA Assessment rating methods and weights were also revised for several questions, including:

- Question 4 on sample security revised the rating to consider sample security individually for asphalt mixture, asphalt pavement density, PCC pavement, and structural PCC. Previously, the question only captured if any major material item had adequate sample security.
- Question 5 on sampling location revised the rating to individually consider, asphalt mixture, PCC pavement, and structural PCC.
- Question 6 on asphalt quality characteristics modified the list of characteristics and their rating.
- Question 11 on F- and t-testing modified the rating based on whether the State DOT had a standard specification for PCC pavement and if contractor testing was not used for both asphalt and PCC pavements.
- Question 12 on continuous equations was clarified to only address pavements (asphalt and PCC).

- Question 13 on the evaluation of specification limits was clarified to include both structural PCC and PCC pavement.
- Question 19 on qualified sampling and testing personnel modified the rating if the criteria were met for any of the three material types.
- Question 20 on a standardized QA program for alternate project delivery methods was broadened outside of just design-build (D-B) applications.
- Question 21 on the QA program for Federal-aid projects administered by local public agencies (LPA) was revised to replace the option for LPAs with a tiered approach.

Appendix A contains the final 2022 QA Assessment.

2022 QA Assessment Completion Process

Figure 1 provides a flowchart of the process used to complete the 52 individual QA program data spreadsheets.

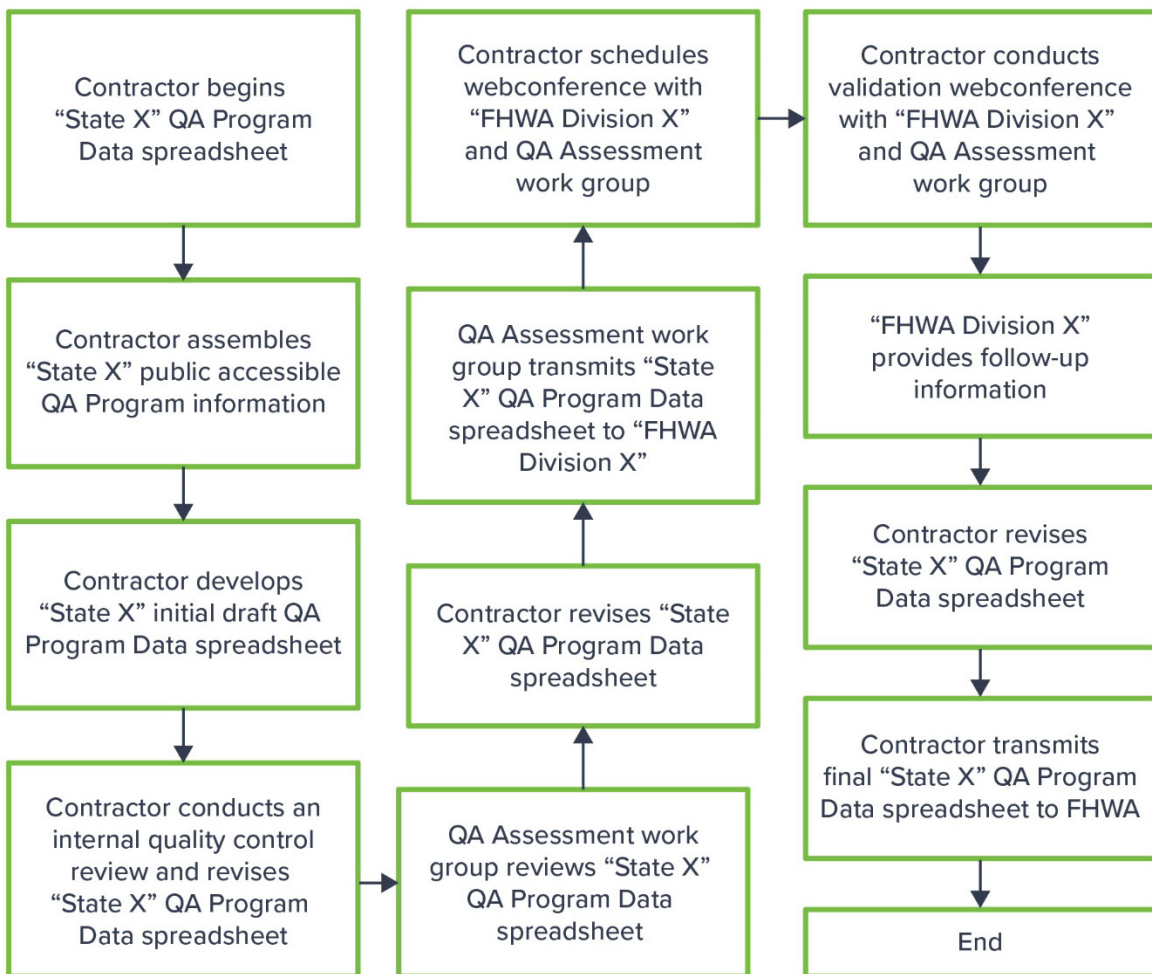


Figure 1. QA program data spreadsheet completion flowchart.

An initial review was completed for each State using publicly available information from the State DOT's website. The generic titles of the typical documents reviewed to prepare the initial draft included:

- Standard Specifications.
- Supplemental Specifications.
- Standard Special Provisions.
- Quality Assurance Program Manual.
- Independent Assurance Program Manual.
- Minimum Sampling and Testing Guide.
- Construction Manual.
- Inspection Guidelines.
- Design-Build Manual.
- Local Public Agency Quality Assurance Manual.
- Local Public Agency Program Manual.

For some State DOTs, additional sources included published research reports, local pavement association websites, and technician certification program websites administered by others.

Since many States had multiple standard specifications, supplemental specifications, and special provisions for the same materials, the QA Assessment answer was based on the specification that was determined to be the predominant practice. For the 2022 QA Assessment, predominant practice was defined as when a specification was used to specify and pay for more than 50 percent of the quantity (tons, square yards, cubic yards, etc.) for a given material (asphalt pavement, PCC pavement, PCC for structural applications, etc.) let by the State DOT. Using three hypothetical examples, a QA program used:

- A smoothness specification for bridge decks, but it was only applied on bridge decks longer than 700 ft. Since this was less than 10 percent of the structural PCC cubic yardage quantity for the previous year, it was not considered the predominant practice.
- Contractor test results in the acceptance decision on asphalt pavement rehabilitation projects for the Interstate, but not for the rest of its system. The tonnage of asphalt mixture produced and paid for under this specification was less than 25 percent of the asphalt mixture tonnage for the previous year and this specification was not considered the predominant practice.
- Optimized gradation was used on PCC pavement where the quality management specification was applied. A check of quantities showed this specification was used on 78 percent of the square yards of PCC pavement constructed during the previous year even though it was only used on two of the nine projects that used PCC paving. This was determined as the predominant practice for this QA program.

The completed 2018 QA program data spreadsheet was consulted to compare answers and for potential reference sources. There were several questions (1, 2, 13, 16, 20, and 21) that could not typically be answered from the publicly available material. These responses were populated during the validation meeting with the respective FHWA Division Office.

In addition to the answers, references to the source document were provided for review by FHWA. The references included page or section references as well as a Uniform Resource Locator (URL) address where available.

The initial draft QA program data spreadsheet (version V1) was reviewed by a member of the QA Assessment work group. After revisions based on the feedback from the work group, the QA program data spreadsheet (version V2) was sent to the respective FHWA Division Office and a web conference was scheduled with the materials quality assurance specialist from the FHWA Division Office and the QA Assessment work group.

The web conference was used to validate or modify the version V2 QA program data spreadsheet answers and populate the missing answers. In some cases, this involved additional research by the FHWA Division Office personnel to determine the answer and appropriate reference.

The final QA program data spreadsheet (version V3) for each State was then transmitted to the QA Assessment work group.

CHAPTER 4. 2022 QA ASSESSMENT RESULTS

Introduction

This chapter provides a summary of the findings of the 2022 QA Assessment using a series of graphs and maps. The first section discusses the Total Rating results of the QA Assessment while the second section discusses the results from the individual questions.

Normalized Rating Results

For each State QA program, the answer to each QA Assessment question was converted to a rating and a potential rating for that question. As an example, using Question 4—Does the State DOT have a documented process to take immediate possession of verification (agency acceptance) samples or to maintain the security of the samples for asphalt pavement mixture, asphalt pavement density, PCC pavement, and PCC structural applications, the following rating definitions apply:

- Potential rating—For State X, the potential rating for this question is 7 if the State has a standard specification for PCC pavement and 5 if they do not. Since State X has a PCC pavement standard specification the potential rating for Question 4 is 7.
- Actual rating—State X met the criteria outlined in Question 4 for two material categories, a rating of 3 for the question.
- Partial credit—State X received partial credit for Question 4 with a rating of 3 out of the possible 7.

The weight and partial credit values assigned to questions and answers were based on the relative risk to the overall Federal-Aid Highway Program (FAHP). For example, with Question 11 on the use of F- and t-testing to verify contractor test results has a maximum potential rating of 7 while Question 12 on the use of equations for pay factors has a maximum potential rating of 3 reflecting the relative risk of these items to the FAHP.

The actual rating and potential rating were then summed for the 21 questions in the QA Assessment. A Normalized Rating (expressed as a percentage) for each QA program was then calculated by dividing the Total Rating by the Total Potential Rating. The Total Potential Rating is not a single fixed value for all QA programs but instead varied depending on the State DOT's use of:

- A PCC pavement standard specification.
- Contractor test results in the acceptance decision.
- Alternate project delivery methods.

Total Potential Ratings for the 52 QA programs ranged from 65 to 89 due to these variations in QA program practices. In this way, questions that do not apply to a QA program are not factored into the rating for that State. For the hypothetical QA program X, the Total Rating was 55 and the Total Potential Rating was 75 with a calculated Normalized Rating of 73 percent.

Figure 2 provides a histogram of the Normalized Rating for the 52 QA programs. The mean Normalized Rating was 75 percent with values ranging from 51 to 94 percent.

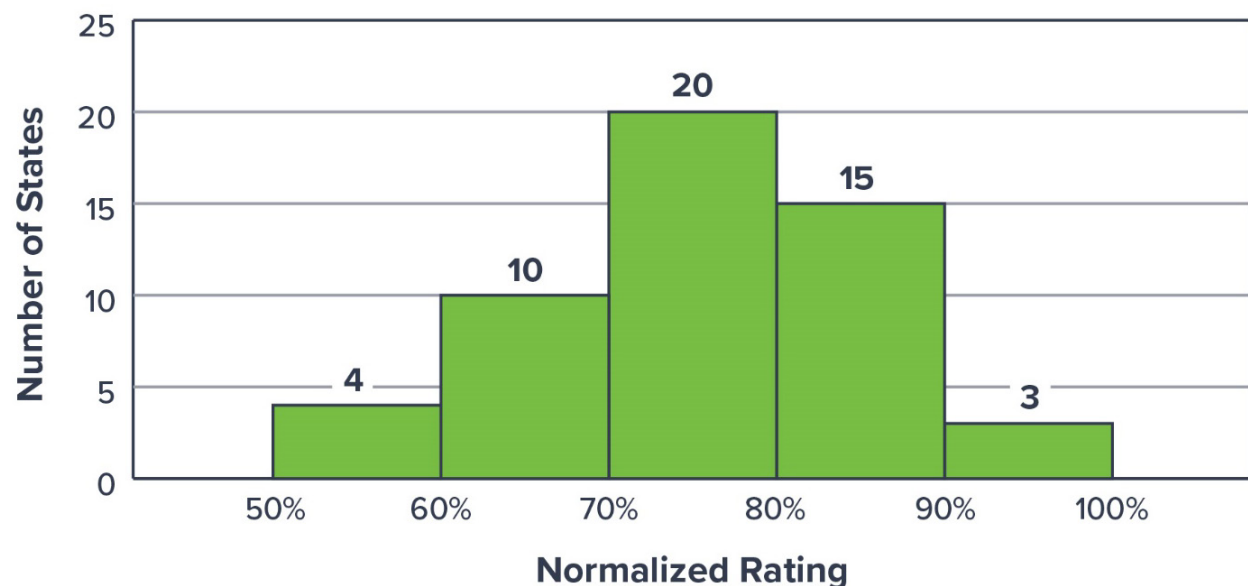


Figure 2. Histogram of Normalized Rating distribution for the 52 QA programs.

Individual Question Results

This section discusses the results of the individual questions. This section also has the results for three items that were not direct questions, but the answers were obtained as part of the research into related questions. These three items were:

- State DOTs that did not have a standard specification for PCC pavement.
- Use of contractor test results in the acceptance decision.
- State DOTs approach to independent assurance.

Question 1. Has your Division Office formally approved revisions to the State DOT's QA program within the past 3 years?

Figure 3 provides the results of Question 1 where 48 of the 52 FHWA Division Offices had formally approved a portion or all of the State DOT's QA Program within the past 3 years. To reduce risk to the Federal-aid program, the FHWA Division Office should routinely review and formally approve changes to the State DOT's QA Program. The FHWA Division Offices that responded with a NO rating for this item were still involved in the QA Program process, but may not have had a QA program update requiring formal approval within the past 3 years.

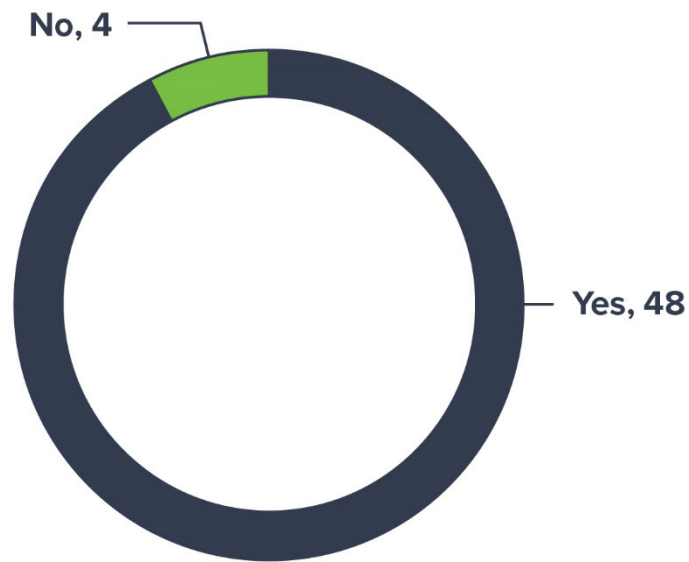


Figure 3. Number of FHWA Division Offices that had formally approved revisions to the State DOT’s QA program within the past 3 years.

Question 2. Does the State DOT use an electronic materials management system that includes all test results (State and contractor) that are used in the acceptance decision?

Figure 4 shows that 33 of the 52 State DOTs used an electronic materials management system that included all the test results. An effective electronic materials management system can be used as a risk mitigation. The electronic materials management system can store and analyze data that may be used to develop and modify specification limits. When all project test results used in the acceptance decision are included in one system, evaluating specification limits can be accomplished efficiently. Separate databases can be effective for different materials but attempting to query multiple spreadsheets for one material can involve a significant level of effort to complete an analysis.



Figure 4. Number of State DOT QA programs that used an electronic materials management system that included all test results (State and contractor) used in the acceptance decision.

For several of the NO responses, the State DOT had an electronic system in place but did not collect and store the contractor's test results; in other cases, the NO response was due to project-level data that was stored in individual spreadsheets.

Question 3. Does the State DOT have a documented process for controlling the location of random verification (agency acceptance) sampling?

Fifty-one State DOT QA programs had a documented process for controlling the random location for agency acceptance samples as shown in figure 5. To receive a YES response, the State DOT's process controlled the random sampling locations for acceptance testing for at least one material type. In addition, the process:

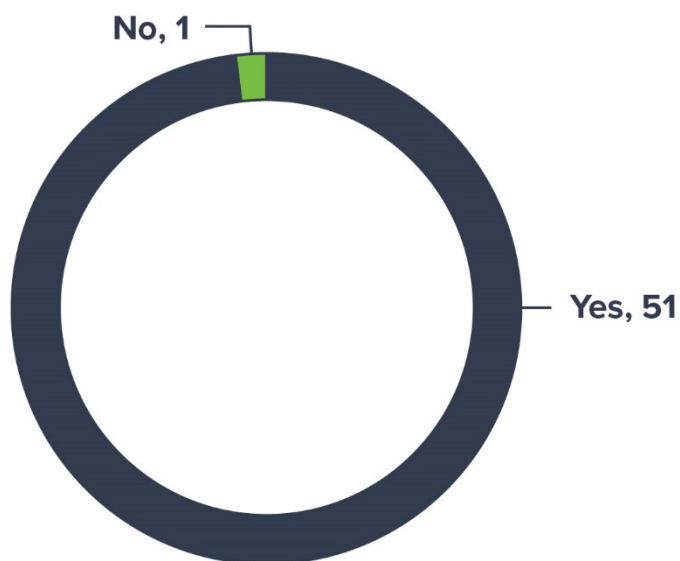


Figure 5. Number of State DOT QA programs that have a documented process for controlling the location of random verification (agency acceptance) sampling.

- Included the use of random numbers to determine the sampling locations.
- Indicated that the State DOT personnel determined and controlled the locations.
- Indicated that the contractor was not notified of the location until the verification sampling was conducted.

State DOTs that did not have a standard specification for PCC pavement

After the first set of three questions, the next section of the assessment deals with specific items in the QA program that are related to asphalt pavement, PCC pavement, and structural PCC. Five State DOTs did not have a standard specification for the construction of concrete pavement. These State DOTs were Alaska, Maine, New Hampshire, Rhode Island, and Vermont as shown in figure 6. These five States were excluded from the rating of questions or parts of questions that dealt with PCC pavements.

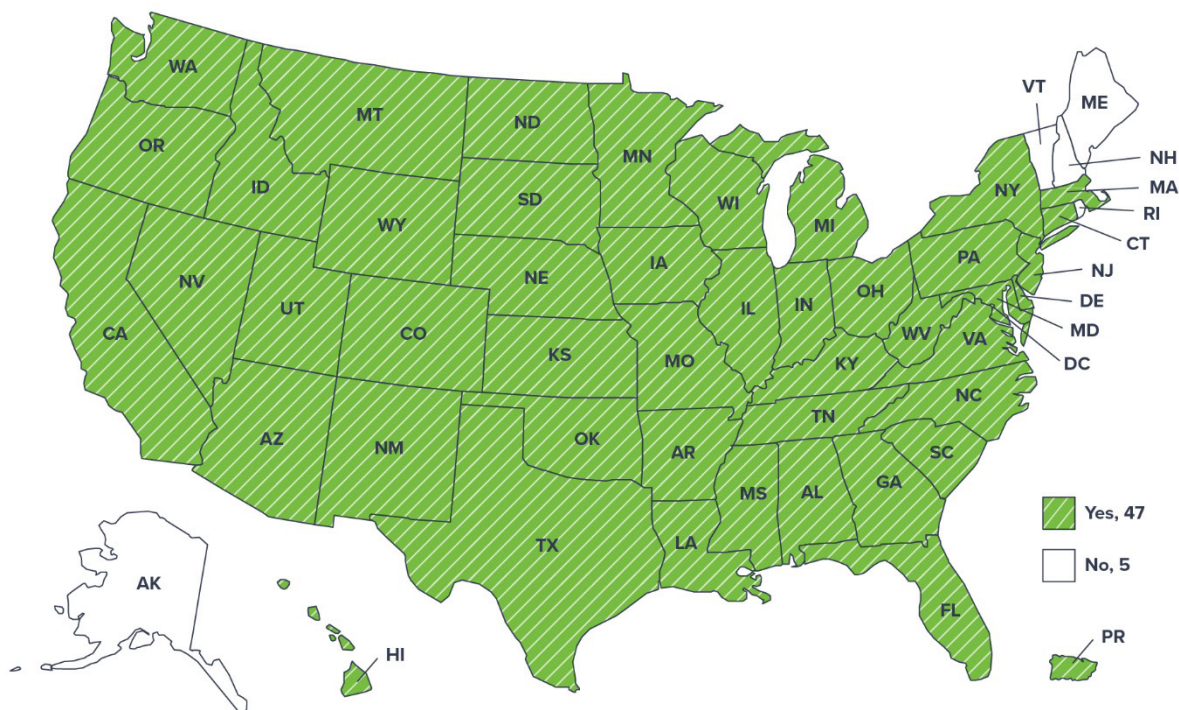


Figure 6. State DOTs that had a standard specification for PCC pavement construction.

Question 4. Does the State DOT have a documented process to take immediate possession of verification (agency acceptance) samples or to maintain the security of the samples for asphalt pavement mixture, asphalt pavement density, PCC pavement, and PCC structural applications?

Maintaining the security of the verification samples is essential to ensure the integrity of those samples for the State DOT acceptance testing. This question was rated based on the four material sample types listed except for the five State DOTs that did not have a PCC pavement specification. A YES response indicated that the State DOT had a documented process to take and maintain immediate possession of the sample or to maintain the security of the sample from the time it was taken until it was tested. Some States received a YES response since they were using only agency personnel for sampling and transportation and they had long-standing operational processes that were not fully documented. Figure 7 presents the results for State DOTs that met these criteria for the various material categories.

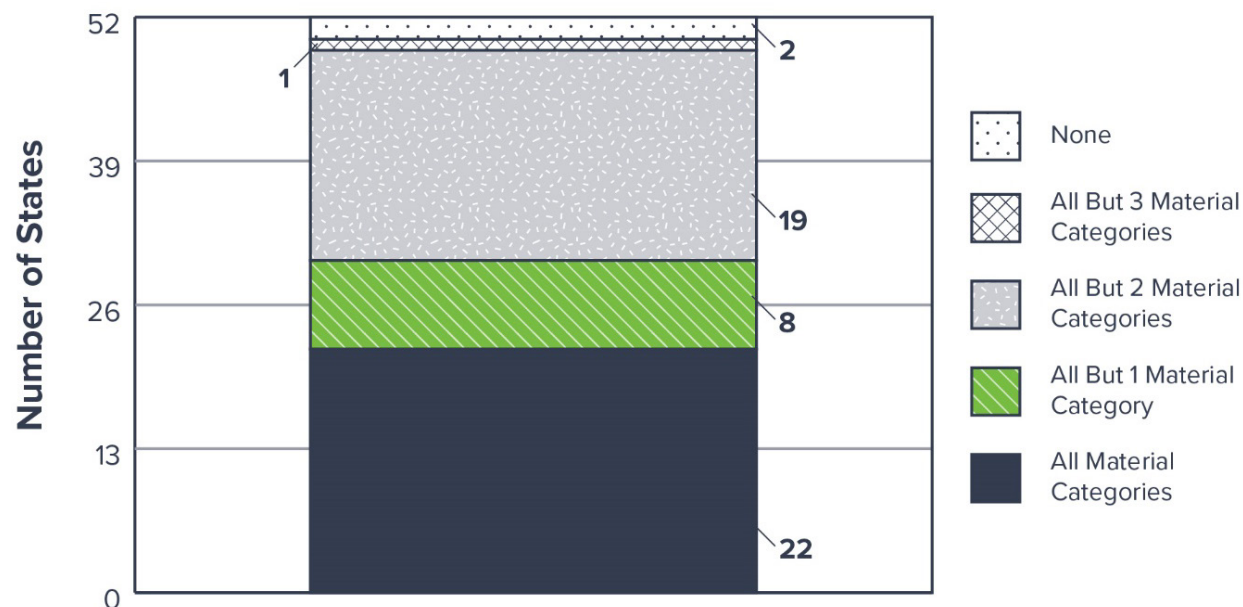


Figure 7. Number of State DOT QA programs with a documented process to ensure sample security for agency acceptance samples for the four listed material categories (asphalt pavement mixture, asphalt pavement density, PCC pavement, and PCC structural).

Question 5. Does the State DOT predominantly sample material at the closest point prior to the incorporation into the project?

Sampling material at the closest point prior to incorporation into the project provided the most direct representation of the properties of the final in-place materials. Figures 8 through 10 present maps of the State DOT QA programs that require sampling of:

- Asphalt paving mixture after discharge from the hauling vehicle (before or after the paver).
- A portion of the PCC from the end of the pump line (for structural concrete).
- A portion of the PCC from ahead of the paver on the grade (for concrete pavement).

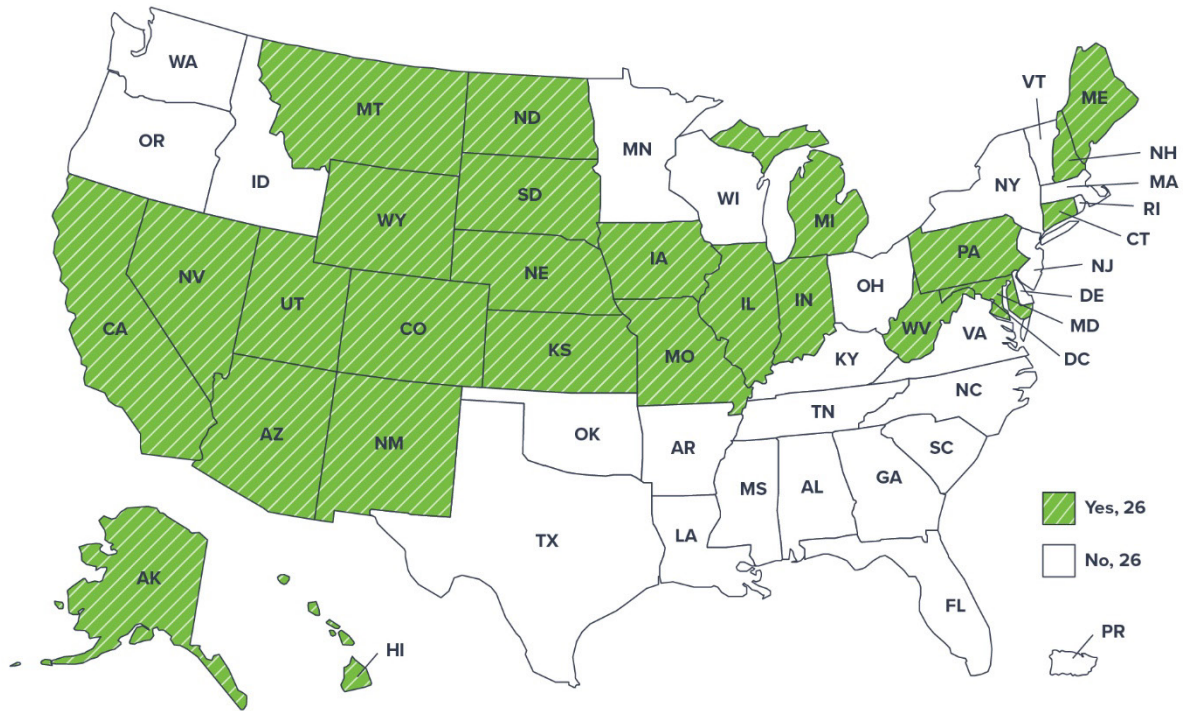


Figure 8. State DOTs that predominantly sampled asphalt paving mixture after discharge from the hauling vehicle (before or after the paver).

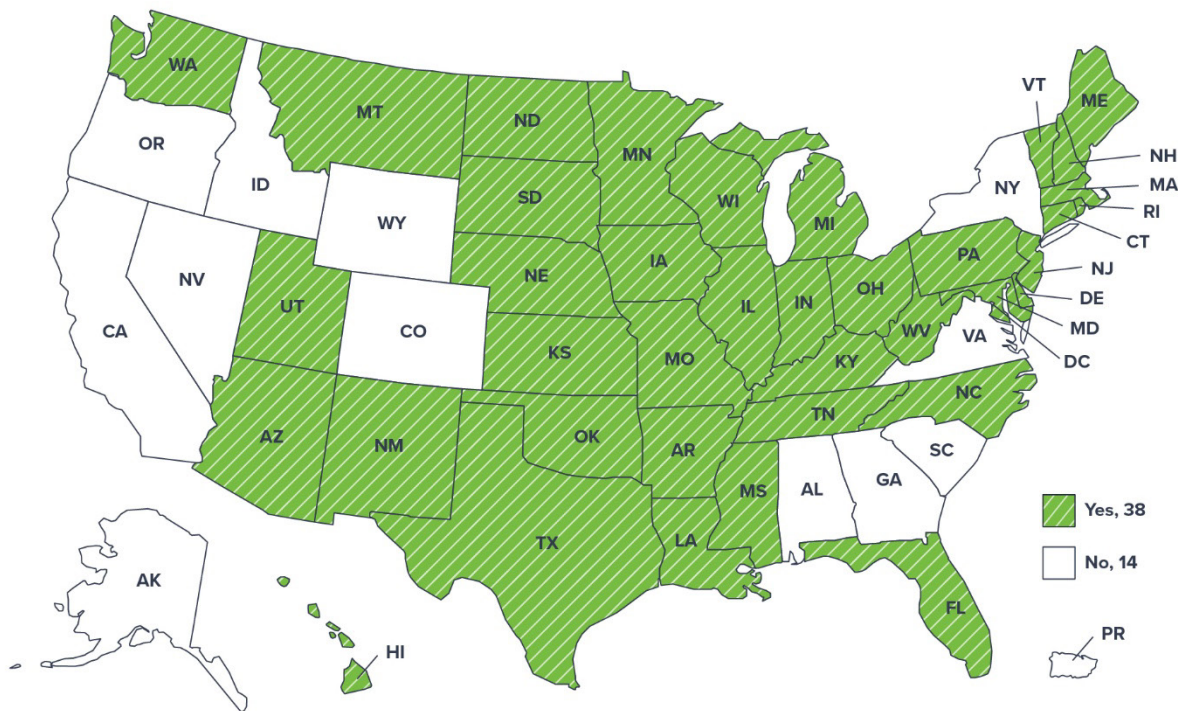


Figure 9. State DOTs that required a portion of the structural PCC to be sampled from the end of the pump line.

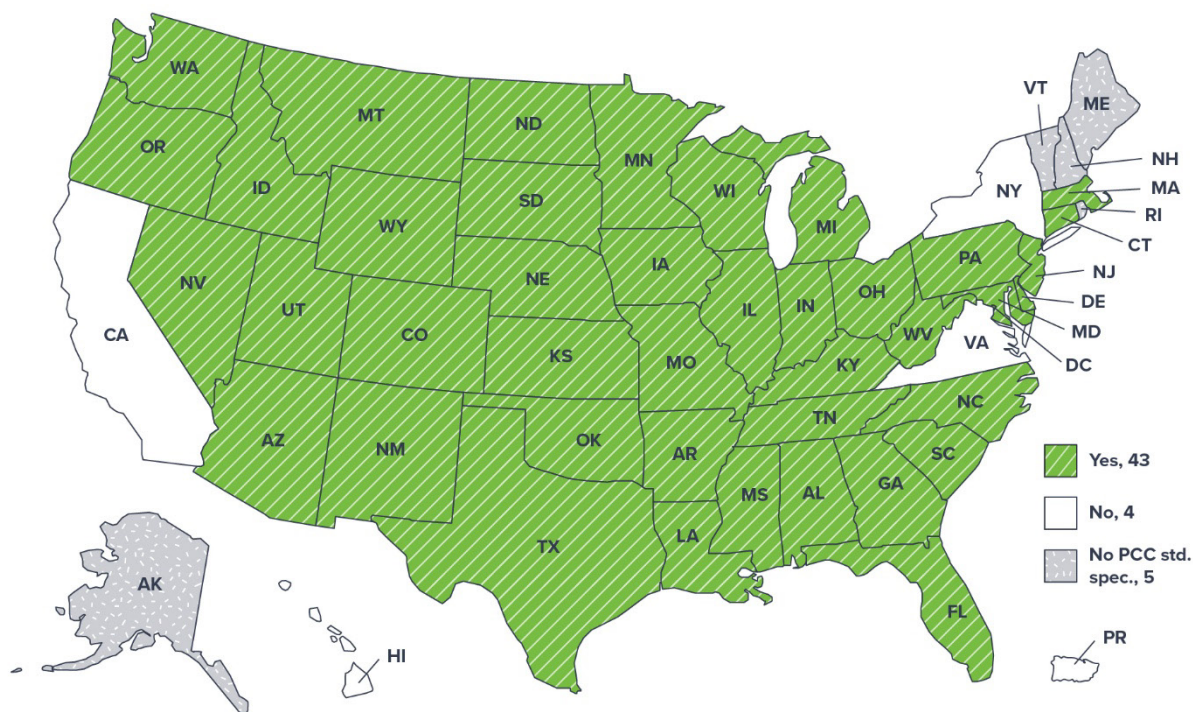


Figure 10. State DOTs that required a portion of the pavement PCC to be sampled from ahead of the paver on the grade.

Question 6. Which quality characteristics does the State DOT use for asphalt pavement acceptance?

Quality characteristics for asphalt pavement included in the 2022 QA Assessment were:

- Air voids in the total mix (V_a) or asphalt binder content (P_b).
- In-place density.
- Smoothness measured either with the International Roughness Index (IRI) or Profile Index (PI).
- Voids in mineral aggregate (VMA).
- Mixture performance test with examples listed in *Index-Based Tests for Performance Engineered Mixture Designs for Asphalt Pavements* (Hajj et al. 2019). Typical tests used by the State DOTs included Asphalt Pavement Analyzer (APA), Hamburg Wheel-Tracking Test (HWTT), Indirect Tensile Cracking, and Indirect Tensile Strength Ratio.

Figure 11 shows the use of these quality characteristics as either a pay factor or production control (i.e., go/no-go) criteria in the State DOT's QA program. V_a or P_b , in-place density, and smoothness were the most common pay factors.

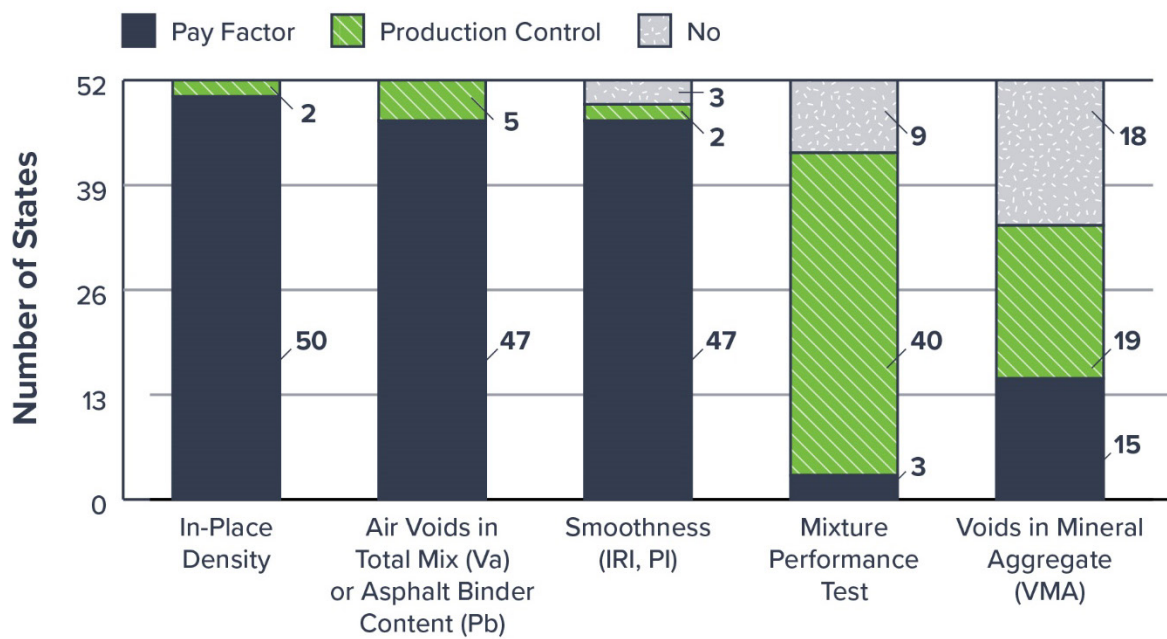


Figure 11. Quality characteristics used by the State DOTs for asphalt pavement acceptance.

Question 7. Which quality characteristics does the State DOT use for PCC pavement acceptance?

Quality characteristics for PCC pavement included in the rating were:

- Thickness as measured with cores or magnetic image tomography (MIT-Scan-T2/T3).
- Entrained air.
- Smoothness as measured either with IRI or PI.
- Optimized gradation using the tarantula curve, combined percent retained chart (8-18 band), or Shilstone coarseness/workability factor chart.
- Dowel bar alignment after placement of the concrete as measured by either the MIT-Scan 2 or probing.
- Permeability, including measurement by resistivity.
- Strength, either compressive or flexural.

Figure 12 shows the use of these quality characteristics as either a pay factor or production control (i.e., go/no-go) criteria in the State DOT's QA program. Pavement thickness, smoothness, and strength were the most common pay factors. Most of the State DOTs used the entrained air content as a production control. State DOTs that were not using entrained air content as a quality characteristic had climates with limited freeze-thaw exposure for the concrete. The five State DOTs without a PCC standard specification are accounted for at the top of each bar.

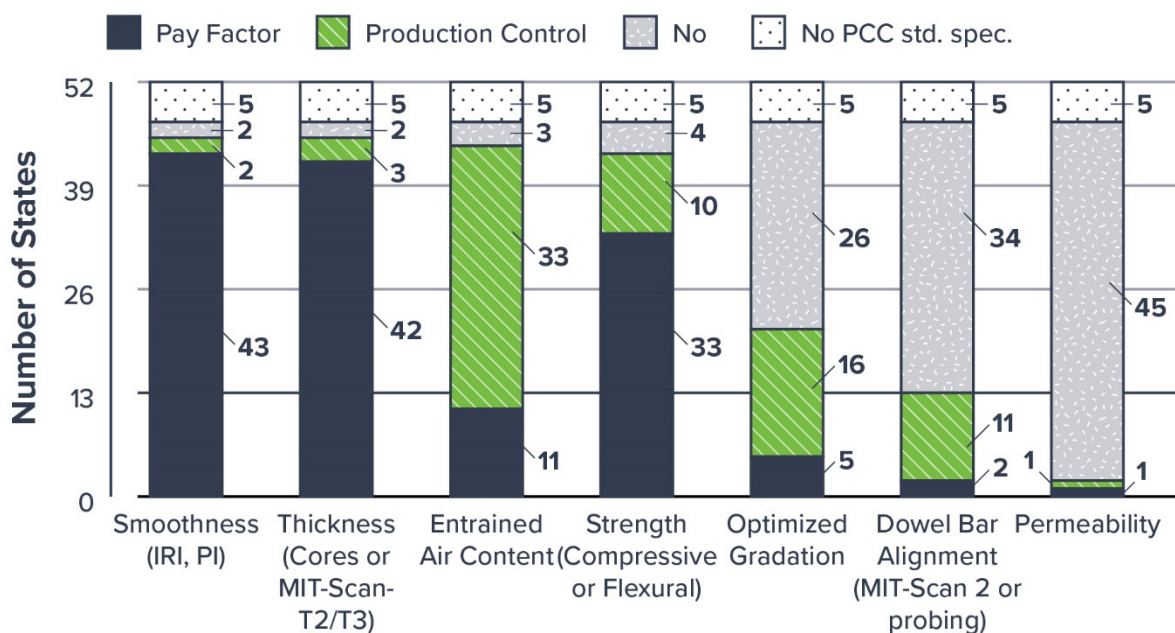


Figure 12. Quality characteristics used by the State DOTs for PCC pavement acceptance.

Question 8. Which quality characteristics does the State DOT use for structural concrete acceptance?

Quality characteristics for structural PCC included in the rating were:

- Strength (compressive or flexural).
- Entrained air content.
- Permeability (including resistivity).
- Smoothness (IRI, PI).
- Depth of concrete cover over the reinforcing steel, before or after the PCC is placed.

Figure 13 shows the use of these quality characteristics used as either a pay factor or production control (i.e., go/no-go) criteria in the State DOT’s QA program. Strength was the most common pay factor, but most State DOTs used the entrained air content and depth of concrete cover over the reinforcing steel as production control criteria. State DOTs that were not using entrained air content as a quality characteristic had climates with limited freeze-thaw exposure for the concrete.

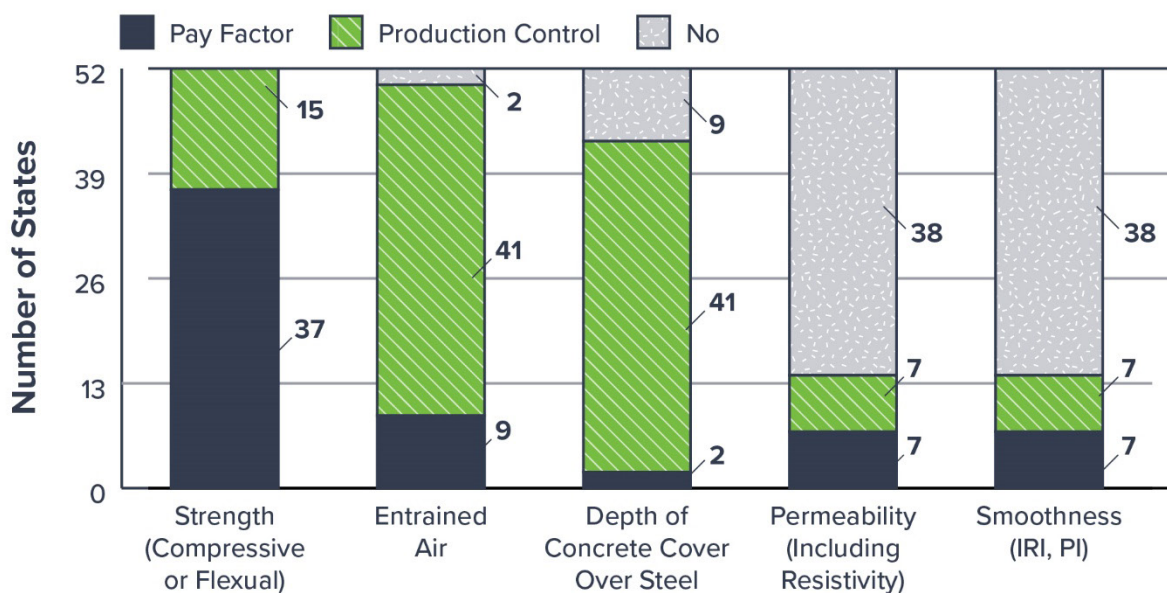


Figure 13. Quality characteristics used by the State DOTs for structural PCC acceptance.

Question 10. Does the State DOT use Percent Within Limits (PWL)/Percent Defective (PD) specifications for payment?

The use of a PWL or PD specification for payment allows the State DOT to determine the acceptability of the material and construction activities using statistical specifications that control both the average and variability of the material properties. To receive a YES response, the State DOT used PWL or PD for at least one quality characteristic for a material type.

Figure 14 shows the 28 State DOTs that used a PWL or PD specification in the payment determination for the asphalt mixture quality characteristics (e.g., V_a , P_b , VMA). Figure 15 shows the 28 State DOTs that used a PWL or PD specification in the payment determination for the density of asphalt pavements. Although both maps show 28 State DOTs that were rated YES, Delaware and Maryland used PWL or PD only for asphalt mixture and New Jersey and New York used it only for asphalt pavement density.

For PCC pavement quality characteristics (e.g., thickness, air content, strength), 14 of the 47 State DOTs with a PCC pavement standard specification used PWL or PD in their payment determination as shown in figure 16. Figure 17 shows the 8 State DOTs that used PWL or PD for the payment determination of structural PCC quality characteristics (e.g., strength, air content, permeability).

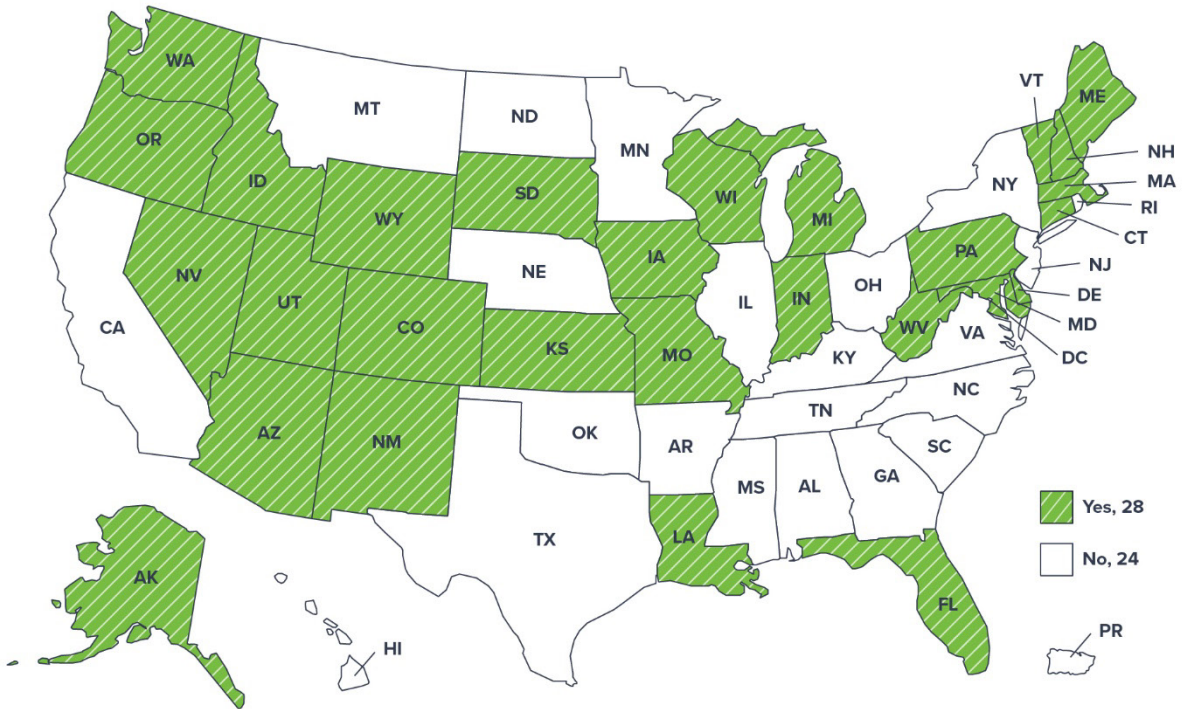


Figure 14. State DOTs that used PWL or PD to determine payment for the asphalt mixture.

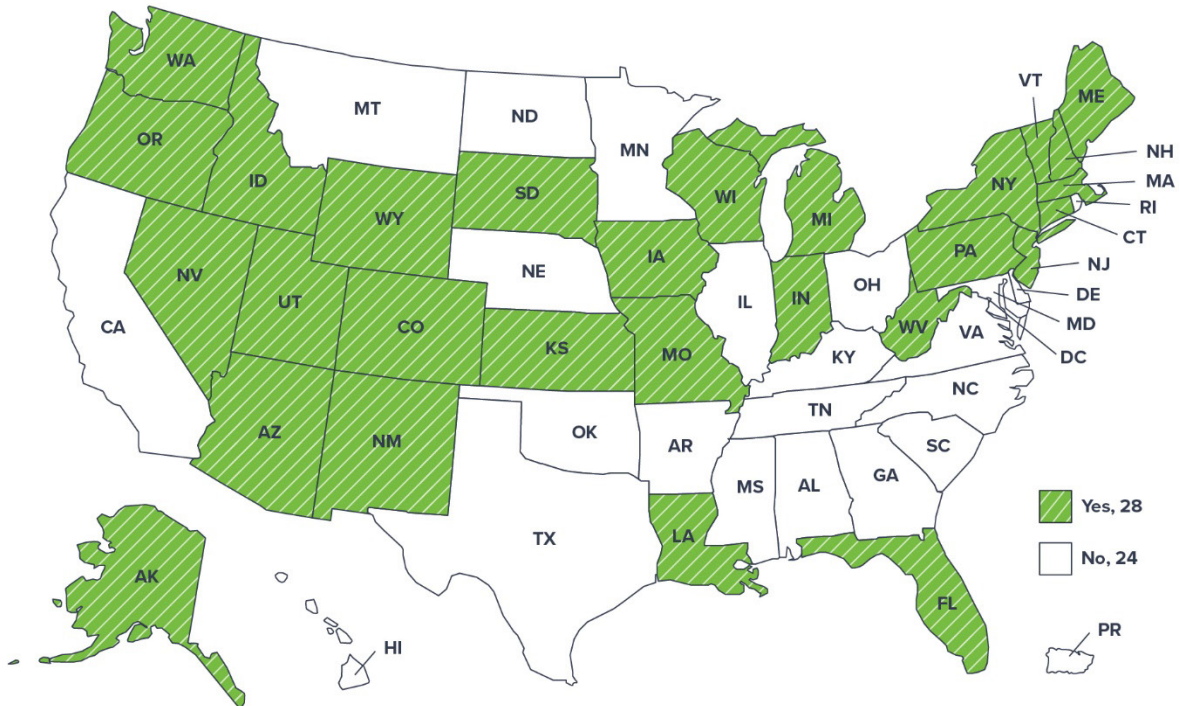


Figure 15. State DOTs that used PWL or PD to determine payment for asphalt pavement density.

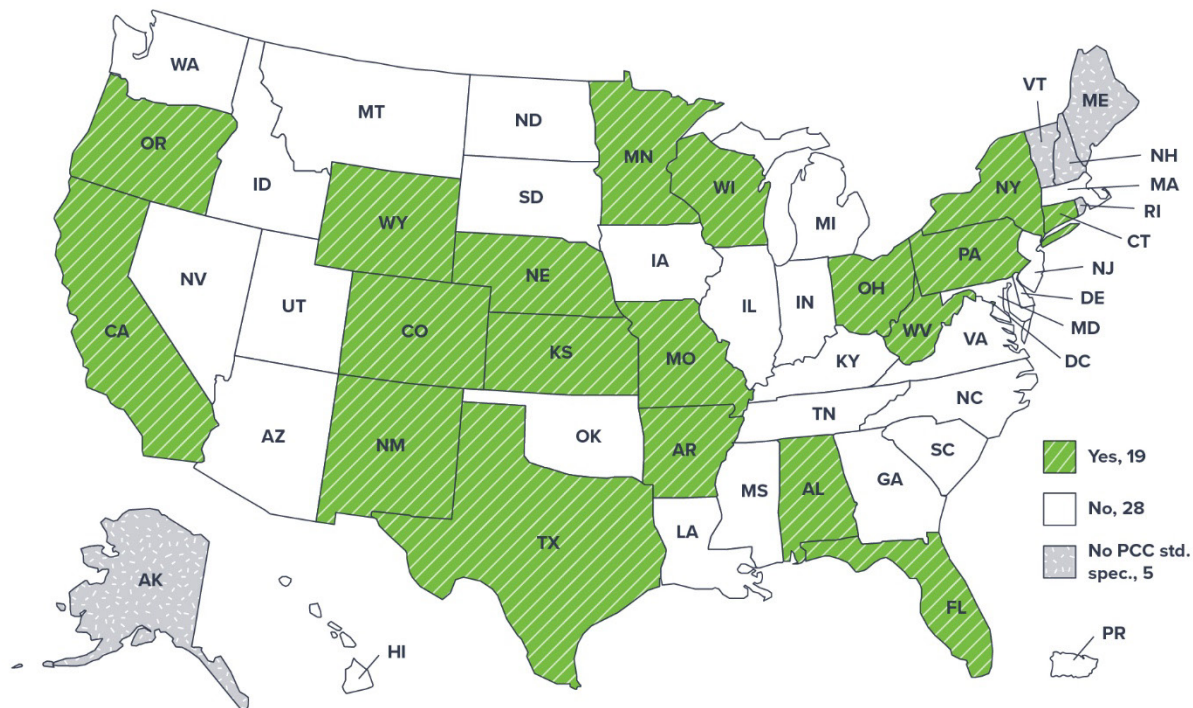


Figure 19. State DOTs that used contractor test results in the acceptance decision for PCC pavements.

Question 11. If the State DOT uses contractor tests in the acceptance decision for asphalt pavement, does the State DOT verify the contractor test results with F- & t-tests for asphalt pavement using a minimum of 5 State results and a maximum of 50 contractor results? And if the State DOT uses contractor tests in the acceptance decision for PCC pavement, does the State DOT verify the contractor test results with F- & t-tests for PCC using a minimum of 5 State results and a maximum of 50 contractor results?

For State DOTs using contractor's tests in the acceptance decision, data validation using statistical tests allowed the State DOT to determine if both the contractor's test results and the State's verification test results were from the same population. Using a minimum of 5 State DOT tests to compare to a maximum of 50 contractor tests ensured at least a 50 percent chance of detecting if a difference existed. If more than 50 contractor tests were used in the validation process, it allowed for process changes that would not be detected by the statistical comparison.

Figure 20 shows that for the 27 State DOTs that used contractor testing as part of their acceptance decision for asphalt pavements; only 7 of those State DOTs used F- and t-tests to validate the quality of the material using the sample sizes discussed in Question 11. Likewise, for PCC pavements, only 3 of the 19 State DOTs that used contractor test results as part of their acceptance decision used F- and t-tests in the manner described.

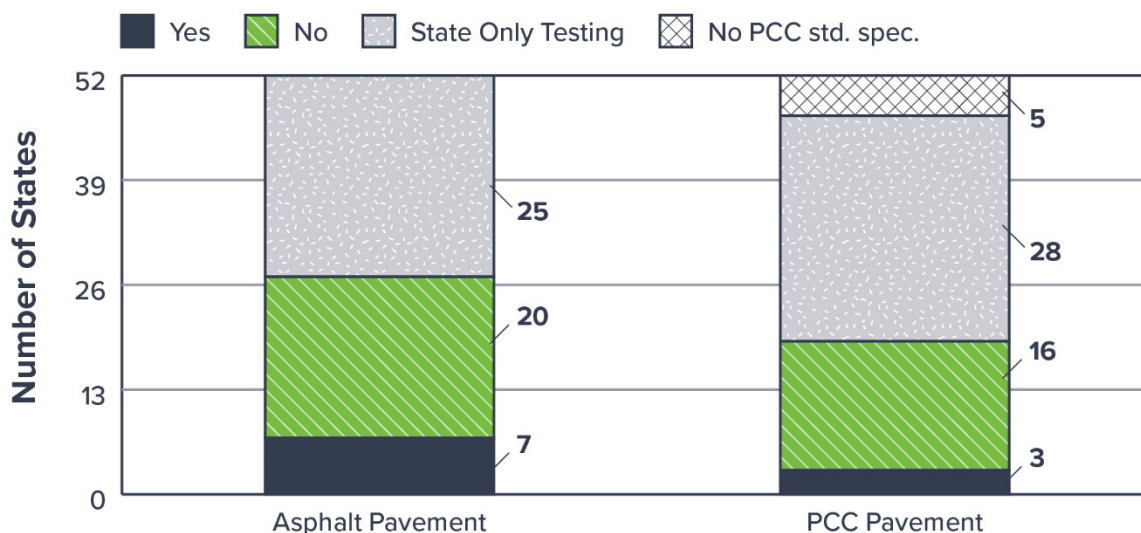


Figure 20. Number of State DOTs that used F- and t-tests with the recommended sample sizes to statistically verify the contractor’s test results for acceptance.

Question 12. Does the State DOT use equations for payment adjustments for asphalt pavement? And does the State DOT use equations for payment adjustments for PCC pavement?

Payment decisions determined using equations reduce the potential for fraud and abuse, especially when the contractor’s tests are being used in the acceptance decision because incremental changes in test results correspond to incremental changes in pay. State DOTs that were using pay equations (or tables with minimal increment size) for at least one quality characteristic were noted with a YES for Question 12.

Figure 21 shows that 40 State DOTs used pay equations for at least one quality characteristic for asphalt pavements and that 32 State DOTs used them for PCC pavements.

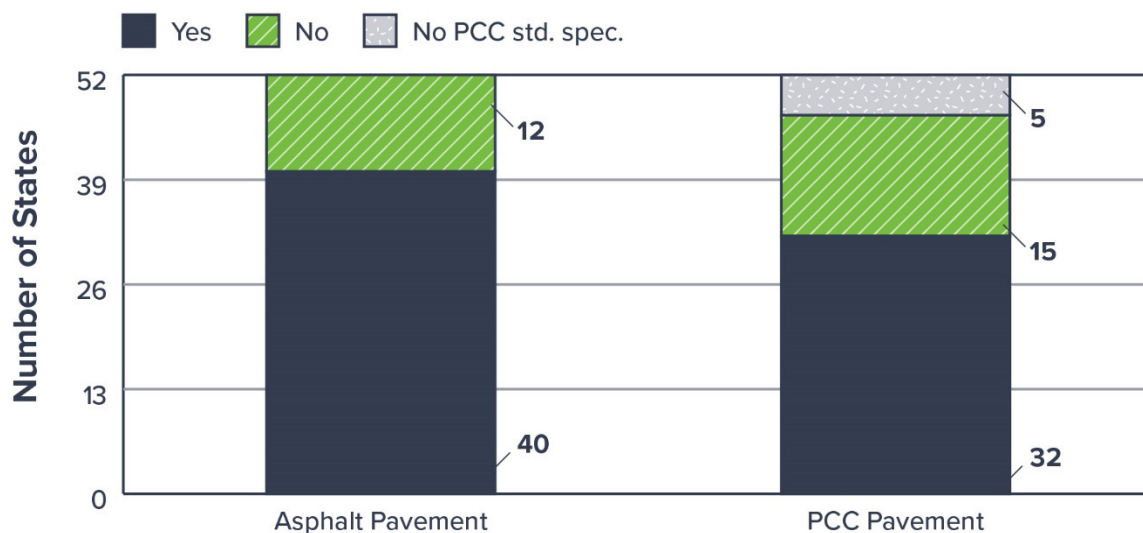


Figure 21. Number of State DOTs that used pay equations for at least one quality characteristic.

Question 13. Has the State DOT evaluated specification limits for asphalt mixture paving, PCC paving, or PCC structural applications along with independent assurance (IA) comparison tolerances within the past 5 years?

The practice of routinely reevaluating specification limits (including PWL/PD criteria if applicable) and IA tolerances can ensure those limits are appropriate for current practices considering recent project results. This question shows an application of the electronic materials management system that was raised in Question 2. Figure 22 presents the results of Question 13 where in the past 5 years, 42 State DOTs had reevaluated some aspects of their asphalt pavement specification limits, 34 had reevaluated some aspects of their PCC pavement or structural PCC specification limits, and 19 had reevaluated their IA tolerances.

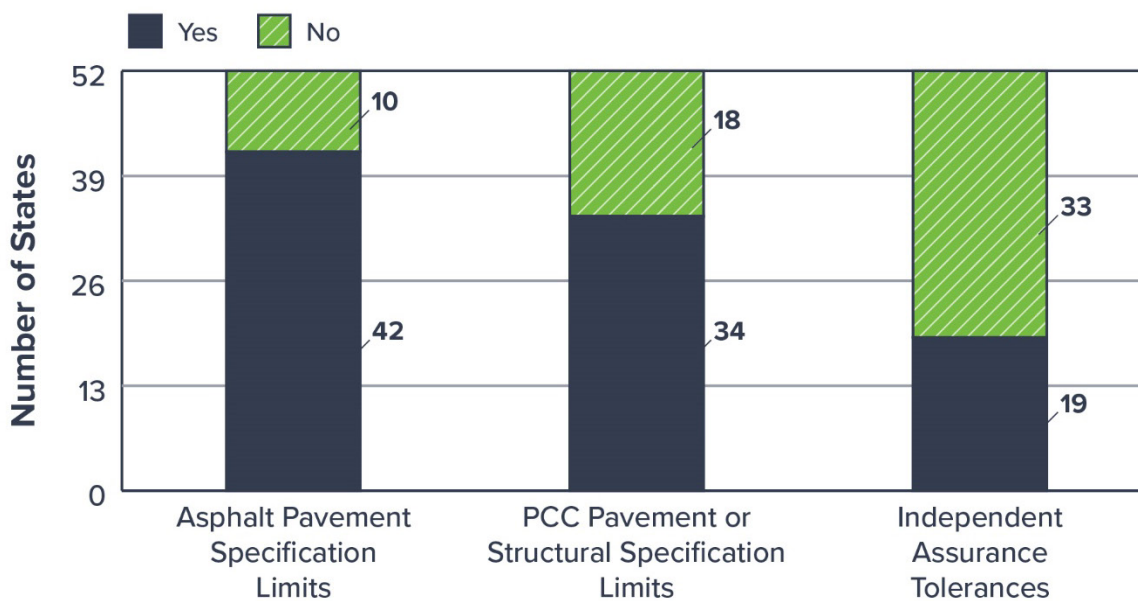


Figure 22. Number of State DOTs that had reevaluated specification limits and IA tolerances in the past 5 years.

Question 15. Does the State DOT use information from the National Transportation Product Evaluation Program (NTPEP) when developing qualified product lists?

As part of agency acceptance, the information from the NTPEP can be utilized in the evaluation process for approving manufactured materials, allowing for a more effective use of State DOT’s testing resources. Figure 23 shows that 50 of the State DOTs used NTPEP information as part of the process for developing their qualified product lists.

State DOTs Approach to Independent Assurance

State DOTs conducted their IA programs on a project basis, system basis, or some combination of the two, which was referred to as the hybrid basis. Figure 24 shows the 9 State DOTs that used the project basis, the 29 State DOTs that used the system basis, and the 14 State DOTs that operated under a hybrid approach.

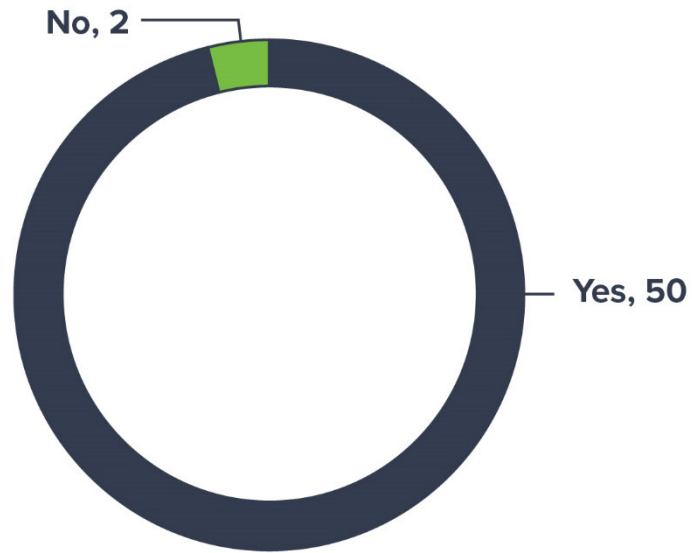


Figure 23. Number of State DOTs that used information from the NTPEP when developing qualified product lists.

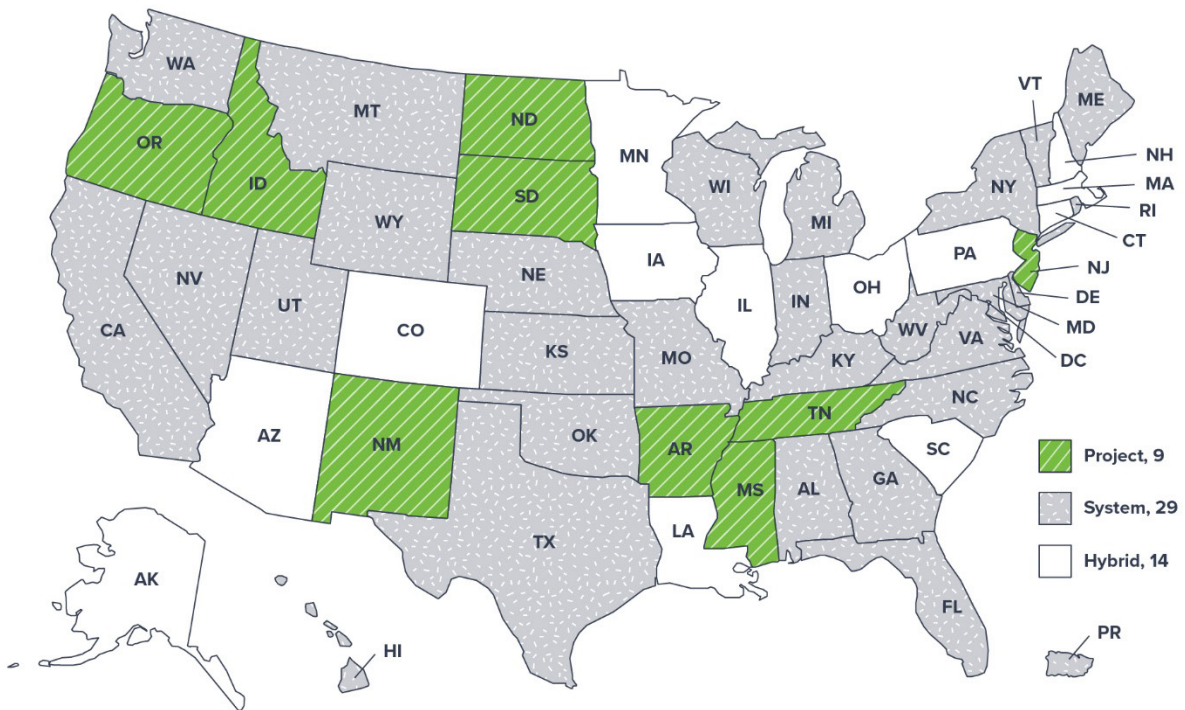


Figure 24. State DOT's approach to independent assurance.

Question 16. Does the State DOT use a system approach or a project approach with a system-based analysis that results in an annual report that shows that the IA program covered at least 90 percent of the technicians once a year? Or does the State DOT use a system approach or a project approach with a system-based analysis that results in an annual report that shows that the IA program covered at least 75 percent of the technicians once a year?

An annual report summarizing the results of a State DOT's IA program was required by 23 CFR 637.207(a)(2)(iv) if a State used the system approach or for the system portion of their hybrid approach. Many of those reports included a system-based analysis of the coverage of the IA program. Figure 25 presents the results for Question 16. Twenty-nine State DOTs were listed with a NO response since they either had not conducted the system-based analysis or their results showed less than 75 percent of the technicians were reviewed in the previous year. This included 8 State DOTs that used the project approach. Four State DOTs reported coverage between 75 percent and 90 percent and 19 State DOTs reported at least 90 percent coverage of technicians in their annual report. This latter group included a State DOT that operated under the project approach.

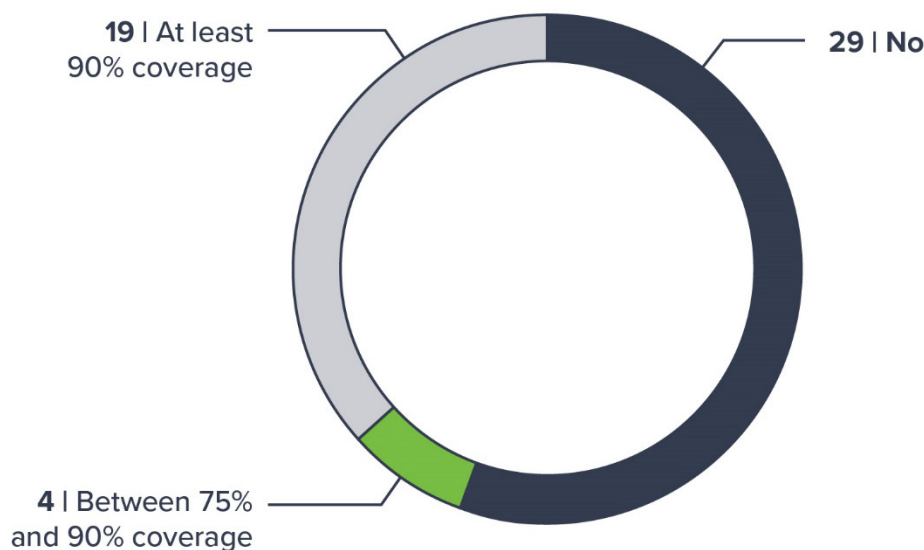


Figure 25. Number of State DOTs that had a system-based IA analysis of program coverage for its testing technicians during the previous year. The NO response was indicative of either no system-based analysis or less than 75 percent coverage.

Question 17. Does the State DOT have a formal material testing dispute resolution process that includes samples that are in the custody of the State and are analyzed in an unbiased manner?

A material testing dispute resolution process can reduce the risk related to inaccurate test results and was especially important when contractor's tests were being used in the acceptance decision. A YES response for Question 17 meant that the dispute resolution process was written and included in the State DOT's QA program documents and that the process included:

- State DOT custody of samples
- Testing by alternative laboratories.

Figure 26 shows that 35 State DOTs had a formal dispute resolution process that met these criteria. The YES and NO answers are differentiated depending upon whether the State DOT used contractor test results in the acceptance decision.

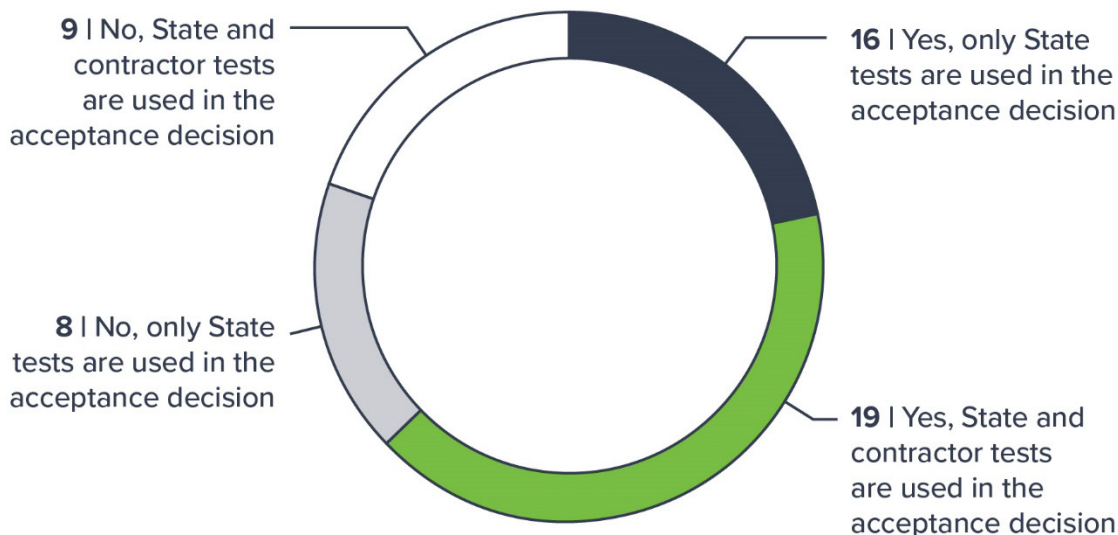


Figure 26. Number of State DOTs that had a formal dispute resolution process that ensured sample security and unbiased testing.

Question 18. Are non-project personnel from a higher organizational level (that is covered by an accreditation or qualification program) responsible for the review and approval of the State DOT and contractor field laboratories used for acceptance?

Checks and balances for laboratory approvals including qualified non-project personnel approving field laboratories can reduce the potential that the laboratories do not meet the minimum standards established by the State DOT. Typically, State DOTs use qualified non-project personnel to review and approve (qualify) a field laboratory used for acceptance testing by either the contractor or the State DOT. The non-project personnel could include qualified individuals from an:

- Accredited State DOT Central laboratory.
- Accredited or Qualified District laboratory.
- Accredited or Qualified Region laboratory.
- AASHTO Accreditation Program or a comparable laboratory accreditation program approved by the FHWA.

Fifty-one of the State DOTs had this process in place as part of its Materials QA program as shown in figure 27.

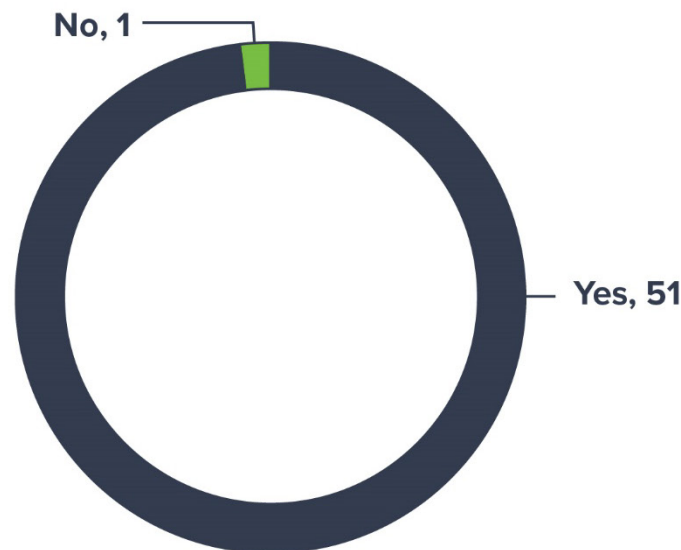


Figure 27. Number of State DOTs that used qualified non-project personnel to review and approve field laboratories used for acceptance testing by the contractor or State DOT.

Question 19. Does the State DOT qualify sampling and testing personnel through a program that includes: 1) formal classroom training of sampling and testing procedures, 2) a written examination, 3) testing to demonstrate proficiency, 4) requalification procedures with some proficiency and/or knowledge demonstration, and 5) documented process for retraining or removing personnel?

Sampling and testing personnel qualification programs reduced the potential risk of inaccurate test results. Question 19 focused on three material types: asphalt pavement, PCC, and soils and aggregates. For a State DOT to receive a YES in each material type, its program for qualifying sampling and testing personnel had to include all the listed characteristics including a:

- Formal classroom training on sampling and testing procedures.
- Written examination.
- Demonstration of testing proficiency.
- Requalification process with some proficiency and/or knowledge demonstration.
- Documented process for retraining or removing personnel that performed the sampling and testing procedures incorrectly.

Figure 28 presents the number of State DOTs that satisfied the five characteristics for the three principal material types.

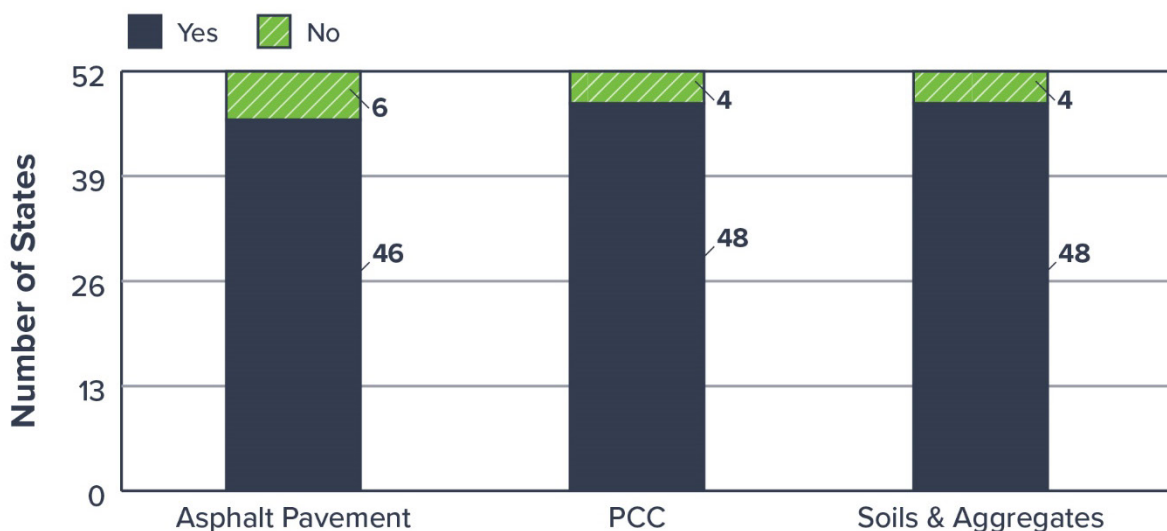


Figure 28. Number of State DOTs with a technician qualification procedure that included the characteristics listed in Question 19 for the three primary material types.

Question 20. Does the State DOT have a standardized QA program for alternate project delivery (e.g., Design-Build) projects?

As part of agency acceptance for alternate project delivery, the development and use of a standardized QA program when such projects are commonly used will improve the efficiency and consistency of implementation. Alternate project delivery types considered in Question 20 included:

- D-B.
- Construction Manager/General Contractor (CM/GC).
- Construction Manager at Risk (CMAR).
- Alternate pavement type bidding.
- Project bundling.

Figure 29 shows the State DOTs with a standardized QA program for alternate project delivery projects. The figure also shows those State DOTs that had advertised less than five alternate delivery projects in the past 3 years and did not have the question rated.

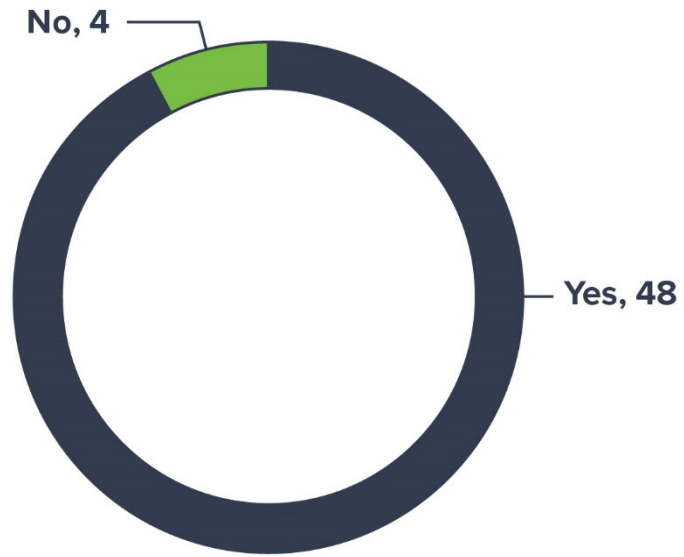


Figure 30. Number of State DOTs with a standardized QA program for Federal-aid LPA projects.

CHAPTER 5. TIME SERIES QA ASSESSMENT RESULTS

Introduction

This chapter provides the temporal trends for the QA Assessment data going back to the 2008 QA Assessment results if available. The graphs in Chapter 5 show how the QA programs of the 52 State DOTs have changed over the past 14 years. The results are presented in the 40 stacked bar graphs in the Temporal Trends section of this chapter.

Crosswalk

In the six QA Assessments performed over the past 14 years, questions have been added, deleted, modified, and clarified as discussed in Chapter 3 of this report. To create the temporal graphs a crosswalk was created between the six QA Assessments from 2008 through 2022. The crosswalk was a matrix that showed the equivalent questions from each of the six QA Assessments. For most of the questions, there were identical or very similar questions that were used for all six QA Assessments (e.g., Question 15 in the 2018 and 2022 QA Assessment aligned with Question 12 in the previous four QA Assessments). In the other cases, some new questions were added in 2018 or there was significant rewording. For example, for the questions on materials quality characteristics (Questions 6, 7, and 8) the YES answer was changed to either be PAY FACTOR or PRODUCTION CONTROL starting in 2018.

Temporal Trends

Question 1. Has your Division Office formally approved revisions to the State DOT's QA program within the past 3 years?

Question 1 was added to the QA Assessment in 2018. Figure 31 presents the trend for 2018 and 2022 responses. There was a noticeable increase in the formal approval activities that FHWA Division Offices took in the past 4 years.

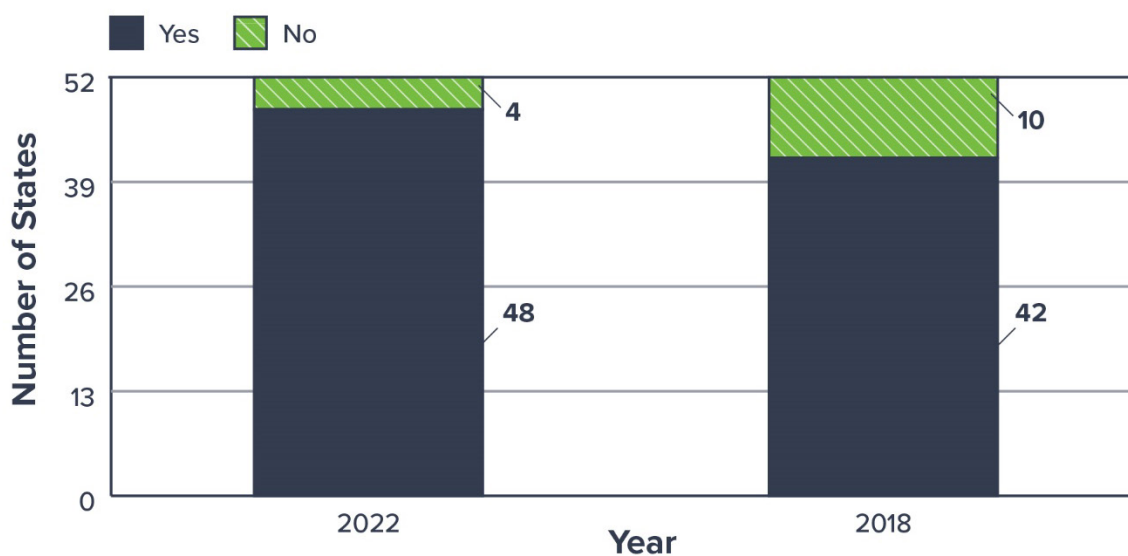


Figure 31. Changes in the number of FHWA Division Offices that had formally approved revisions to the State DOT's QA program within the past 3 years.

Question 2. Does the State DOT use an electronic materials management system that includes all test results (State and contractor) that are used in the acceptance decision?

Question 2 has been included in all the QA Assessments. Figure 32 shows a noticeable increase in State DOTs with electronic materials management systems in the early reviews that had plateaued over the past 10 years.

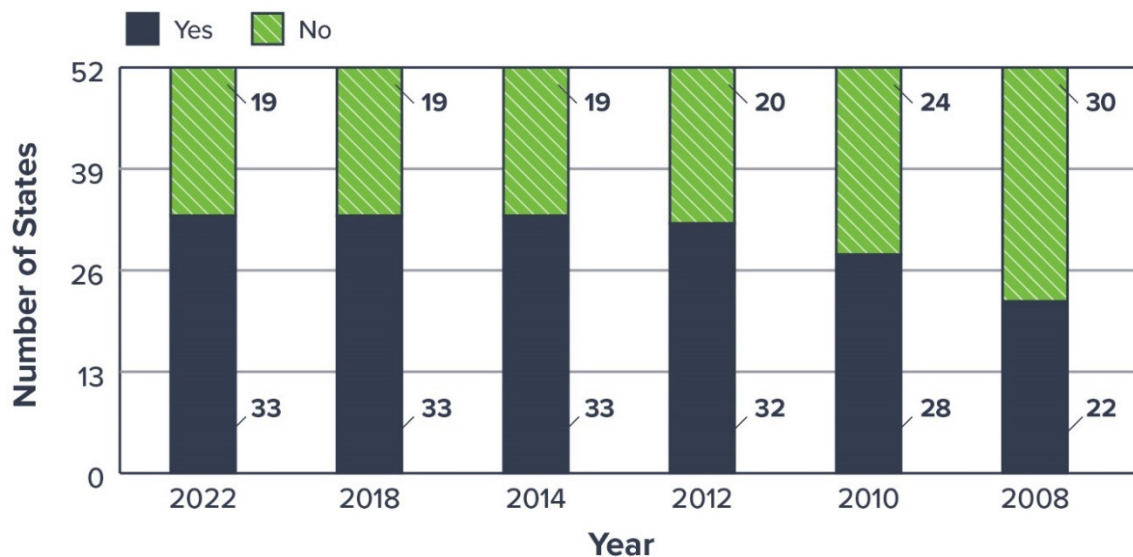


Figure 32. Changes in the number of State DOT QA programs that used an electronic materials management system that included all test results (State and contractor) used in the acceptance decision.

Question 3. Does the State DOT have a documented process for controlling the location of random verification (agency acceptance) sampling?

Figure 33 presents the trend since 2008 for the State DOTs having a documented process for controlling the location of random verification sampling.

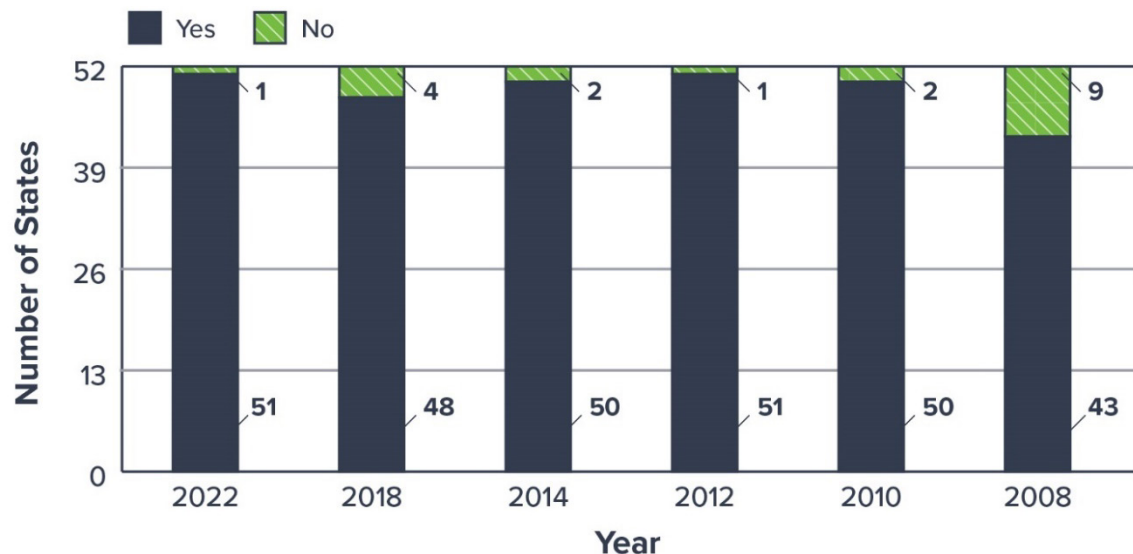


Figure 33. Changes in the number of State DOT QA programs that have a documented process for controlling the location of random verification (agency acceptance) sampling.

Question 5. Does the State DOT predominantly sample material at the closest point prior to the incorporation into the project?

Question 5 originated in the 2010 QA Assessment. Figure 34 presents the trend for sampling asphalt mixture after discharge from the hauling vehicle. This sampling procedure remained constant over the past 12 years.

Figure 35 presents the trend for sampling a portion of the structural PCC from the end of the pump line. In the past 4 years, there was a decline in State DOTs that were sampling from the end of the pump line. This may be due to ongoing research on the change in the quantity and quality of the entrained air in the plastic and hardened concrete after it is pumped (Becker and Ley 2019).

There is no trend graph for the sampling location of PCC pavements since that part of Question 5 was just added in 2022.

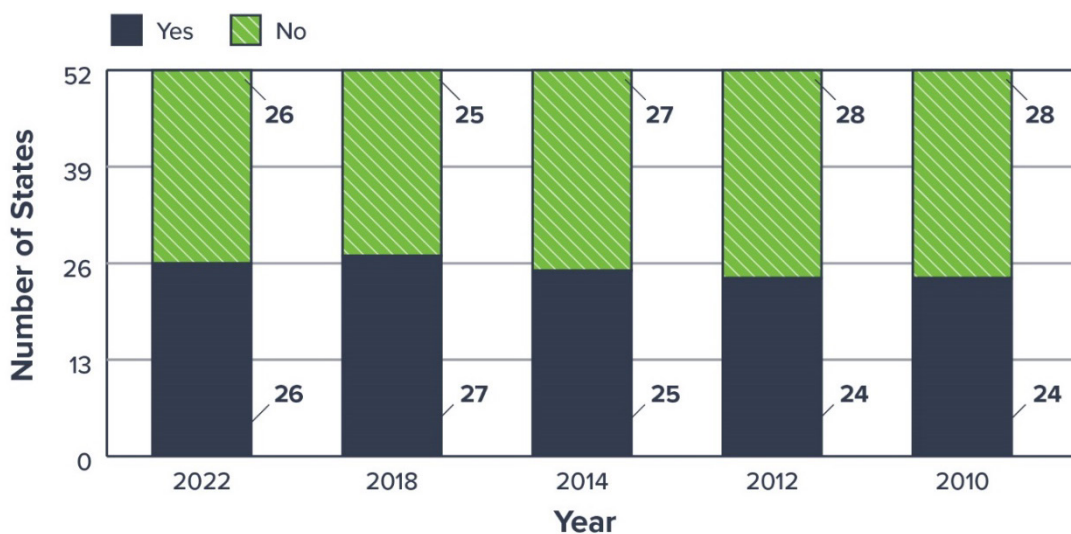


Figure 34. Changes in the number of State DOTs that predominantly sampled asphalt paving mixture after discharge from the hauling vehicle (before or after the paver).

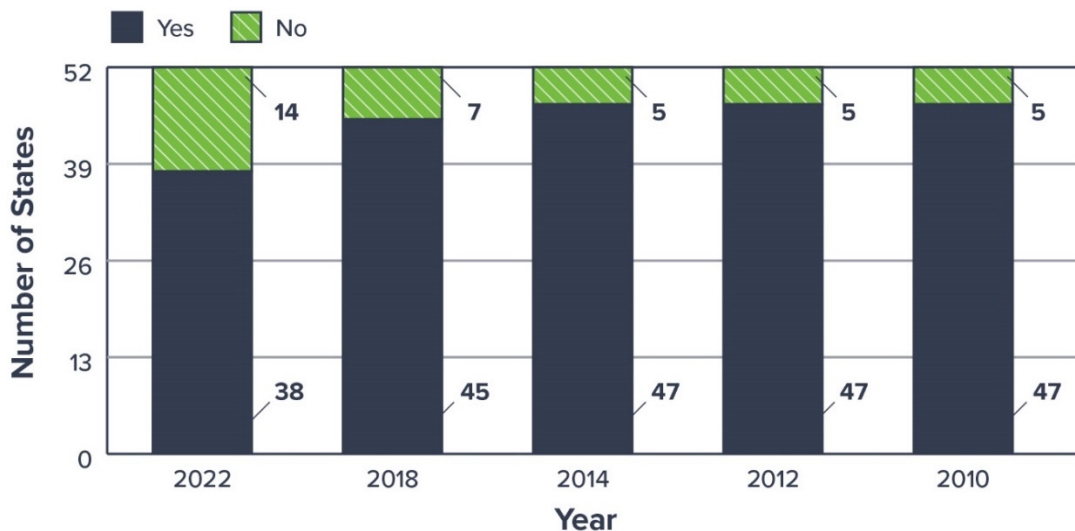


Figure 35. Changes in the number of State DOTs that required a portion of the structural PCC to be sampled from the end of the pump line.

Question 6. Which of the following does the State DOT use for asphalt pavement acceptance?

Quality characteristics were part of the QA Assessment since 2008, although there have been some modifications to the questions. Starting in 2018, PAY FACTOR and PRODUCTION CONTROL were provided as separate answers, replacing the YES. Furthermore, air voids in the total mix (V_a) and asphalt binder content (P_b) were separate characteristics until 2022 when they were combined in a single response. Asphalt pavement quality characteristic trends included:

- Figure 36 shows the trend for the V_a or P_b quality characteristic for the asphalt mixture.
- Figure 37 provides the trend information for State DOTs that used asphalt pavement density as a quality characteristic.
- Figure 38 shows that State DOTs using pavement smoothness (measured by either IRI or PI) as a quality characteristic had been consistent since 2010.
- Figure 39 presents a steady increase in the State DOTs that used VMA as a quality characteristic for the asphalt mixture.
- Figure 40 presents the trend in the number of State DOTs that used performance tests as a quality characteristic for asphalt pavements. Performance test as a quality characteristic was first added in the 2018 QA Assessment.

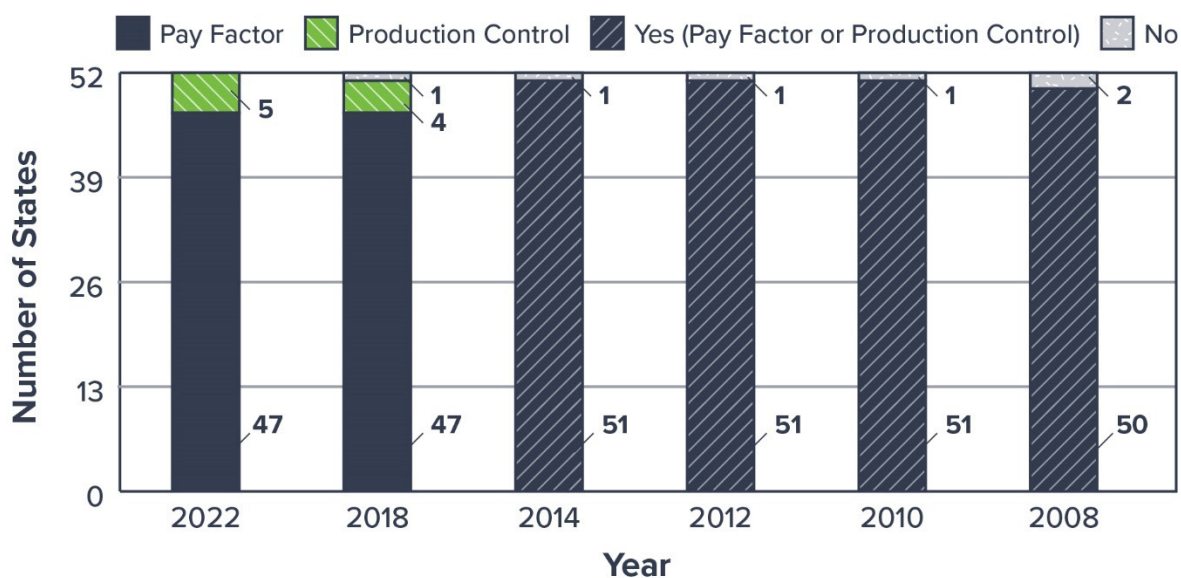


Figure 36. Changes in the number of State DOTs that use V_a or P_b as an asphalt mixture quality characteristic. The YES answer was separated into PAY FACTOR and PRODUCTION CONTROL in 2018.

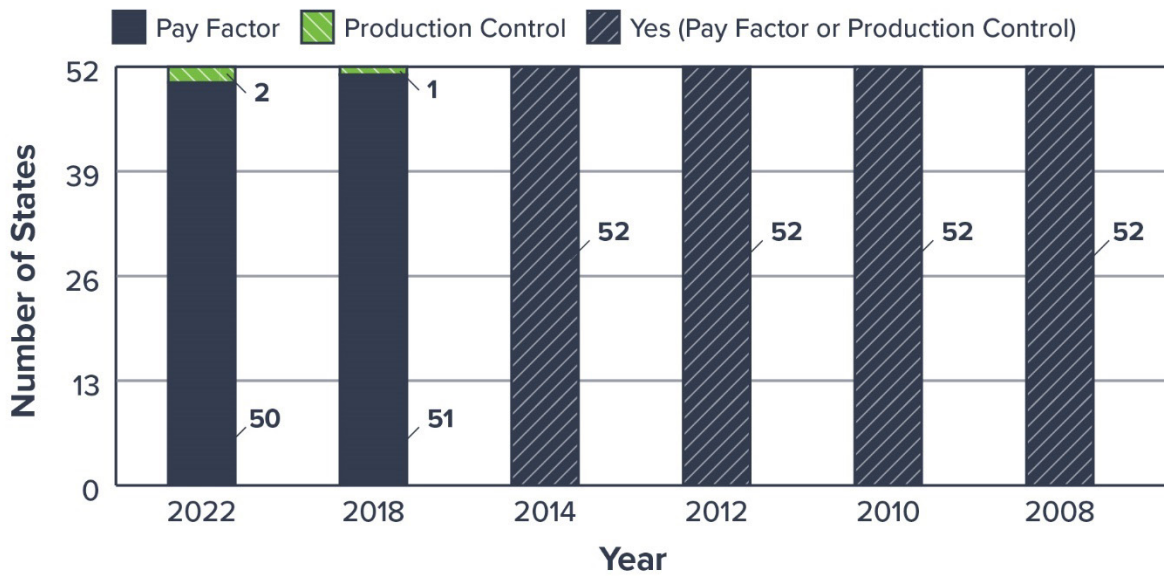


Figure 37. Changes in the number of State DOTs that used density as an asphalt pavement quality characteristic. The YES answer was separated into PAY FACTOR and PRODUCTION CONTROL in 2018.

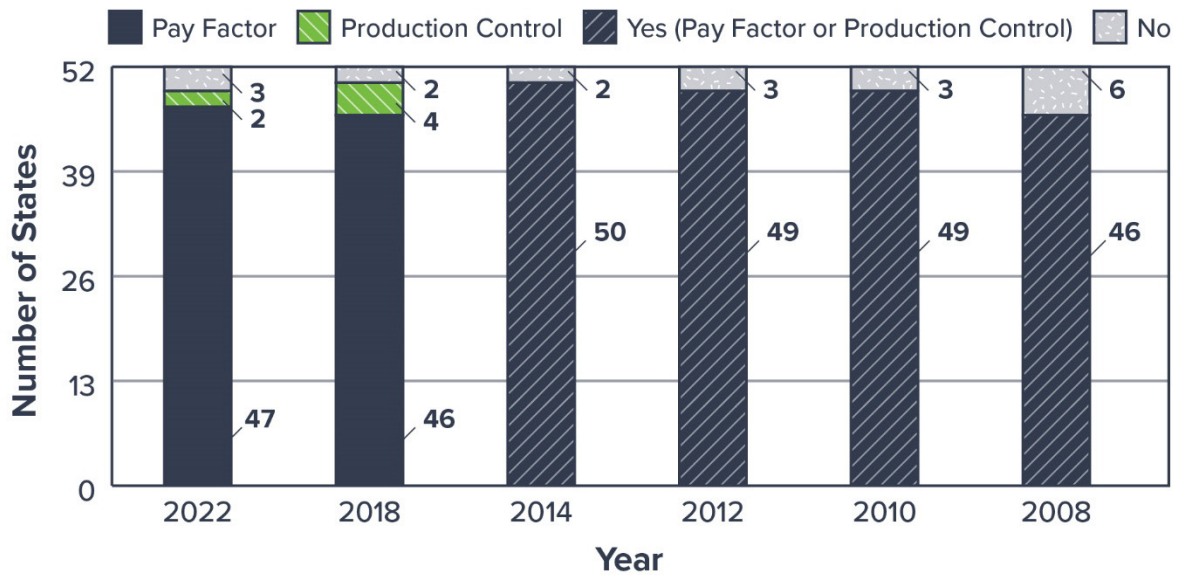


Figure 38. Changes in the number of State DOTs that used pavement smoothness measured by IRI or PI as an asphalt pavement quality characteristic. The YES answer was separated into PAY FACTOR and PRODUCTION CONTROL in 2018.

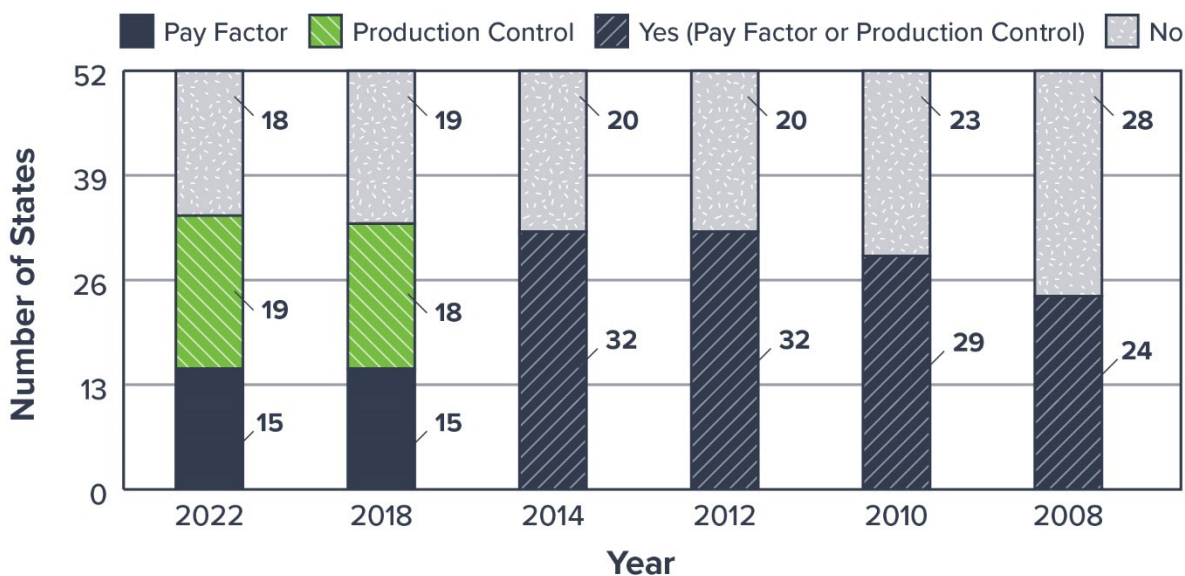


Figure 39. Changes in the number of State DOTs that used VMA as an asphalt mixture quality characteristic. The YES answer was separated into PAY FACTOR and PRODUCTION CONTROL in 2018.

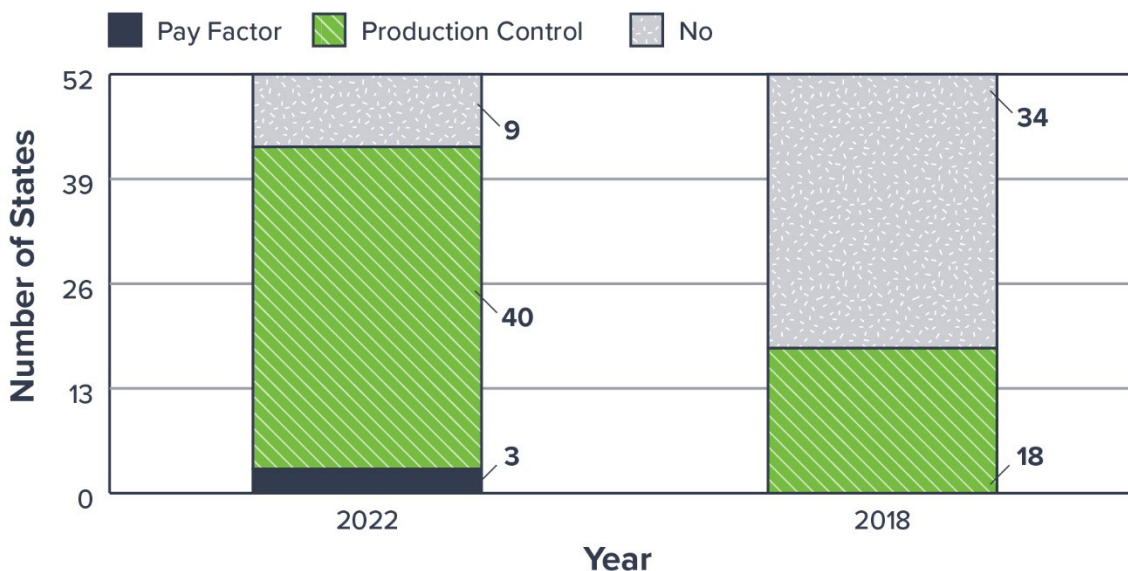


Figure 40. Changes in the number of State DOTs that used a mixture performance test as an asphalt pavement quality characteristic.

Question 7. Which of the following does the State DOT use for PCC pavement acceptance?

Like asphalt pavements, PCC pavement quality characteristics were part of the QA Assessment since 2008 with some modifications. Starting in 2018, PAY FACTOR and PRODUCTION CONTROL were provided as separate answers, replacing the YES. The overall trends are presented in figures 41 through 47. One item noted in these figures is that the top segment of

each of the stacked bars denotes the number of State DOTs that do not have a standard specification for the construction of PCC pavement. Overall, PCC pavement quality characteristic trends included:

- Figure 41 shows the trend for the number of State DOTs that measured the as-constructed thickness of the PCC pavement as a quality characteristic by either coring or using an MIT-Scan-T2/T3.
- Figure 42 provides the trend information for the number of State DOTs that used entrained air content as a PCC pavement quality characteristic.
- Figure 43 shows the number of State DOTs using pavement smoothness (measured by either IRI or PI) as a quality characteristic, had been consistent since 2010.
- Figure 44 presents the trend in the use of optimized gradation as a quality characteristic for PCC pavements since 2018. In the past 4 years, there has been an increase in the number of State DOTs using optimized gradation as a pay factor or production control.
- Figure 45 shows the trend for the number of State DOTs that measured dowel bar alignment, either by probing or using an MIT-Scan 2, as a quality characteristic for PCC pavements. Many State DOTs checked the dowel bar alignment before the concrete was placed, but for a QA program to be marked YES for this question there had to be a check of the alignment after the concrete was placed and consolidated, which captured the risk of dowel bar translation and rotation during concrete placement.
- Figure 46 presents the trend for the number of State DOTs that used permeability as a quality characteristic for PCC pavements. Very few State DOTs have adopted this characteristic over the years.
- Figure 47 provides the trend for the number of State DOTs that used either compressive or flexural strength as a quality characteristic for PCC pavements. The use of strength by State DOTs has been consistent over the 14 years.

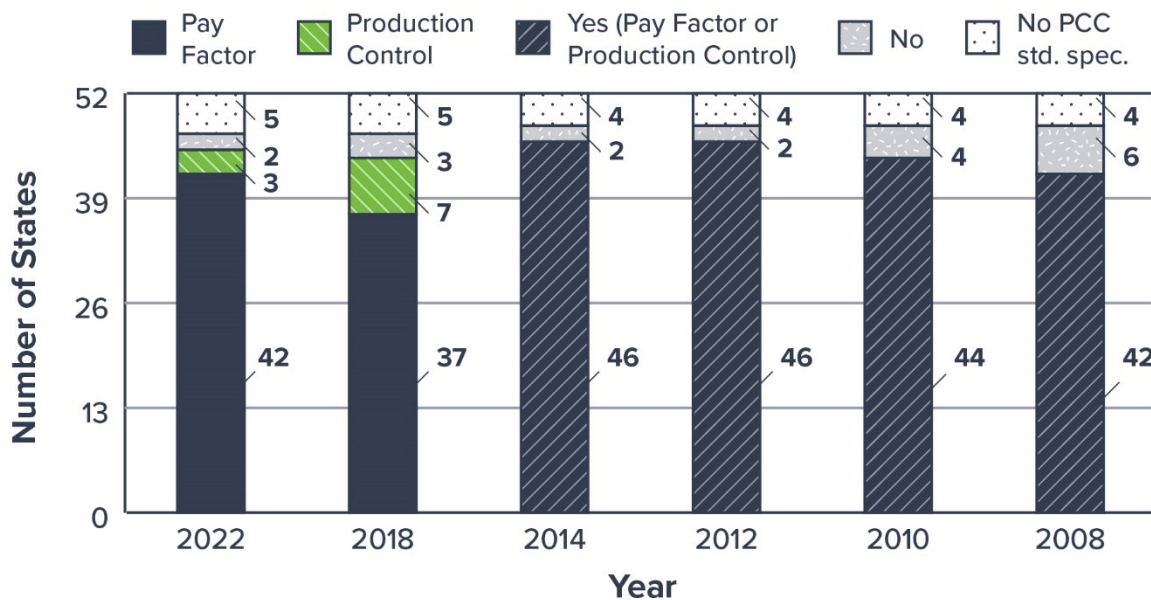


Figure 41. Changes in the number of State DOTs that measured as-constructed pavement thickness as a quality characteristic by either coring or using an MIT-Scan-T2/T3 for PCC pavement.

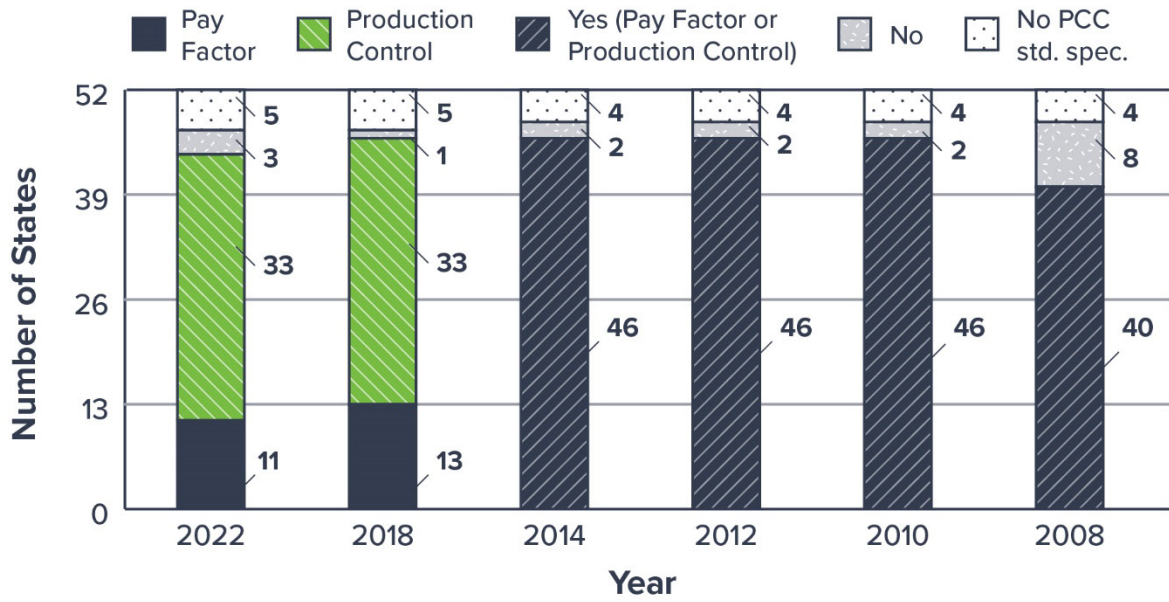


Figure 42. Changes in the number of State DOTs that used the entrained air content as a quality characteristic for PCC pavements.

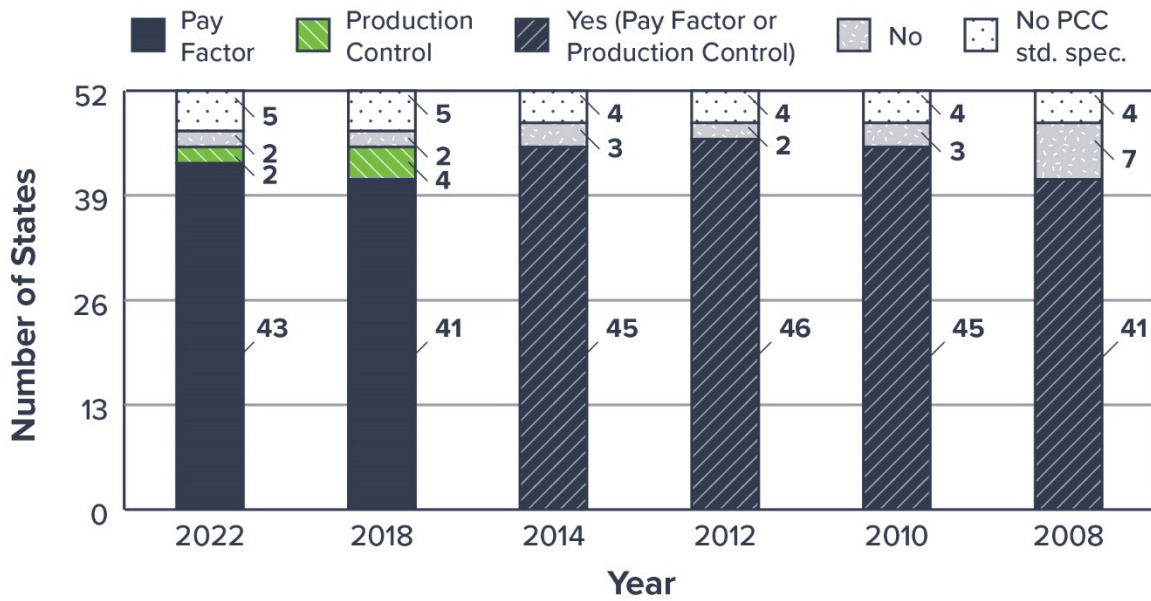


Figure 43. Changes in the number of State DOTs that used smoothness measured with either IRI or PI as a quality characteristic for PCC pavements.

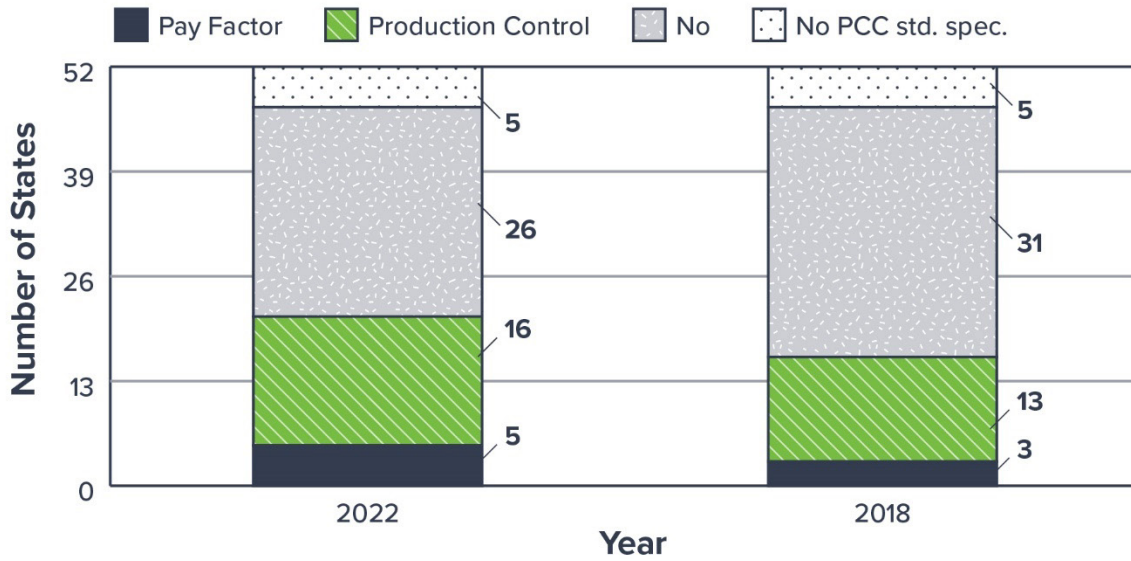


Figure 44. Changes in the number of State DOTs that used optimized gradation as a quality characteristic for PCC pavements.

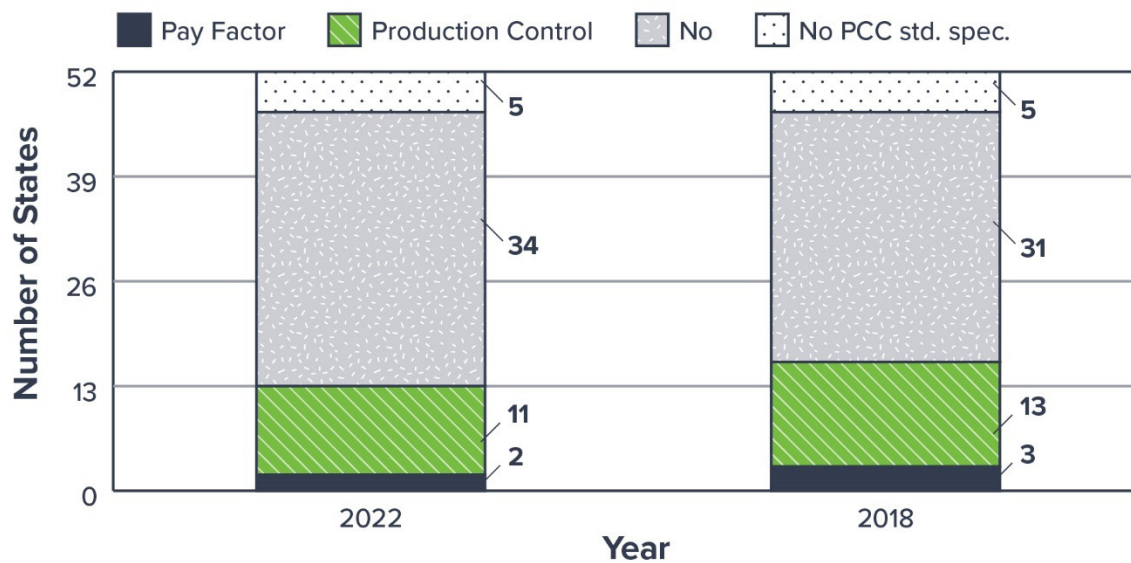


Figure 45. Changes in the number of State DOTs that measured the dowel bar alignment after the concrete was placed as a quality characteristic for PCC pavements.

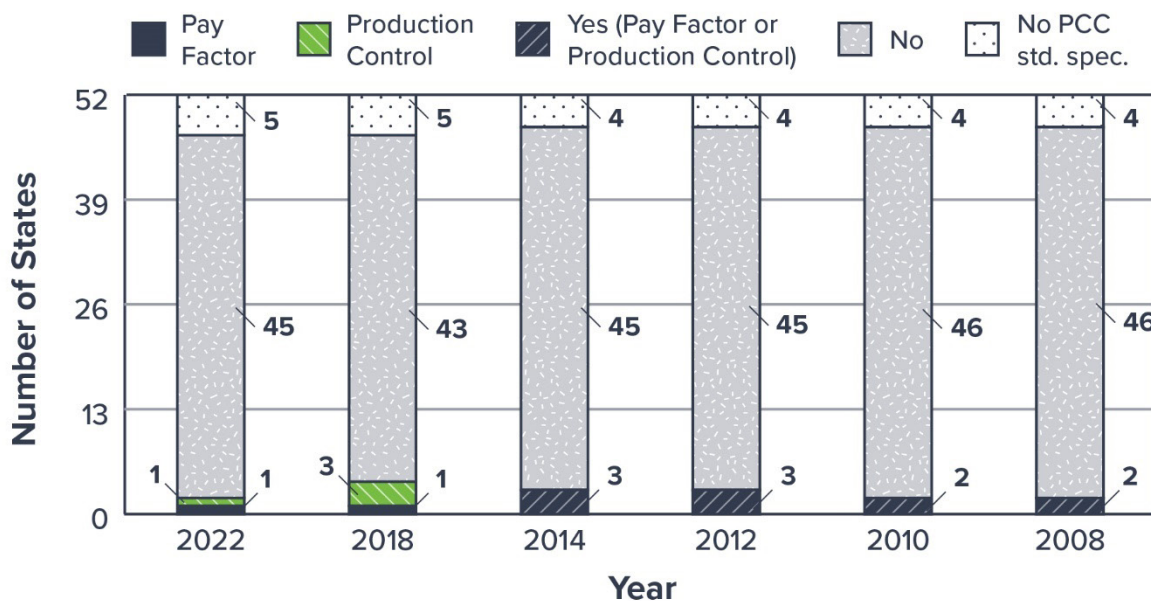


Figure 46. Changes in the number of State DOTs that used permeability as a quality characteristic for PCC pavements.

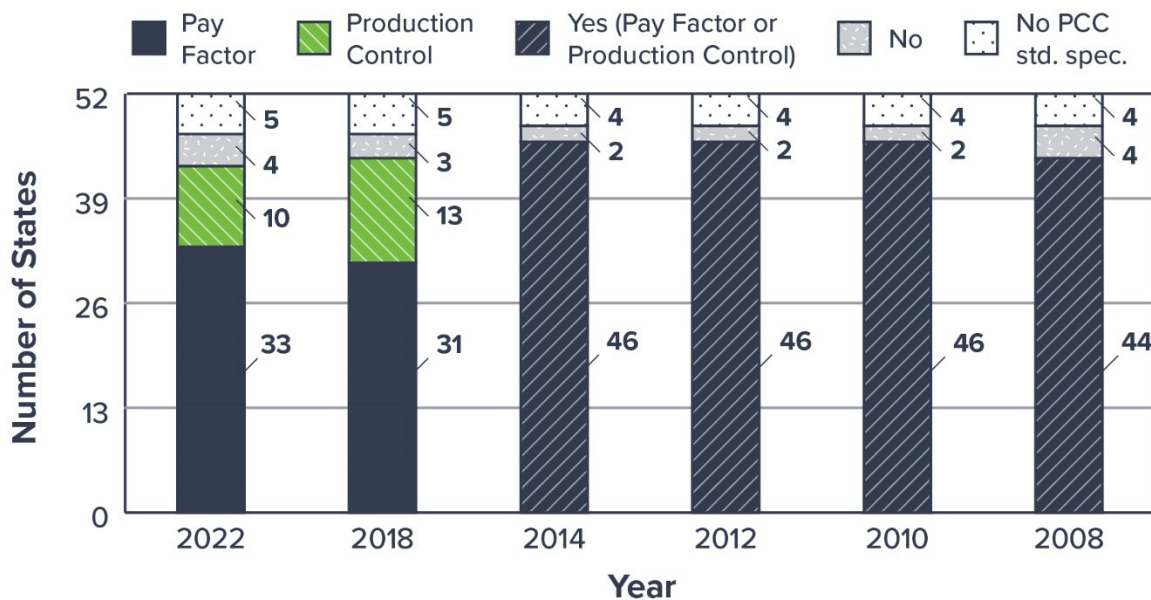


Figure 47. Changes in the number of State DOTs that used compressive or flexural strength as a quality characteristic for PCC pavements.

Question 8. Which of the following does the State DOT use for structural concrete acceptance?

Structural PCC quality characteristics were part of the QA Assessment since 2008 with some modifications. Structural PCC quality characteristic trends included:

- Figure 48 provides the trend for the number of State DOTs that used either compressive or flexural strength as a quality characteristic for structural PCC. The use of strength by State DOTs has been consistent over the 14-year period.
- Figure 49 provides the trend information for State DOTs that used the entrained air content as a structural PCC quality characteristic.
- Figure 50 presents the trend for the number of State DOTs that used permeability as a quality characteristic for structural PCC. Multiple State DOTs included permeability in their Standard Specifications for one or more mix types or with limited testing, but whether that mix was determined to be the predominant practice likely accounts for some of the variability in the graph. For example, some State DOTs only required permeability testing during mix design or only for bridge decks.
- Figure 51 shows the trend for the number of State DOTs that were using smoothness measured with either IRI or PI as a quality characteristic for bridge decks. For most of the State DOTs, the predominant practice was to measure bridge deck smoothness with a straightedge.
- Figure 52 presents the trend for the number of State DOTs that measured the depth of cover over the reinforcing steel (before or after the concrete was placed) as a quality characteristic for bridge decks. This quality characteristic had been included in the QA Assessment since 2018.

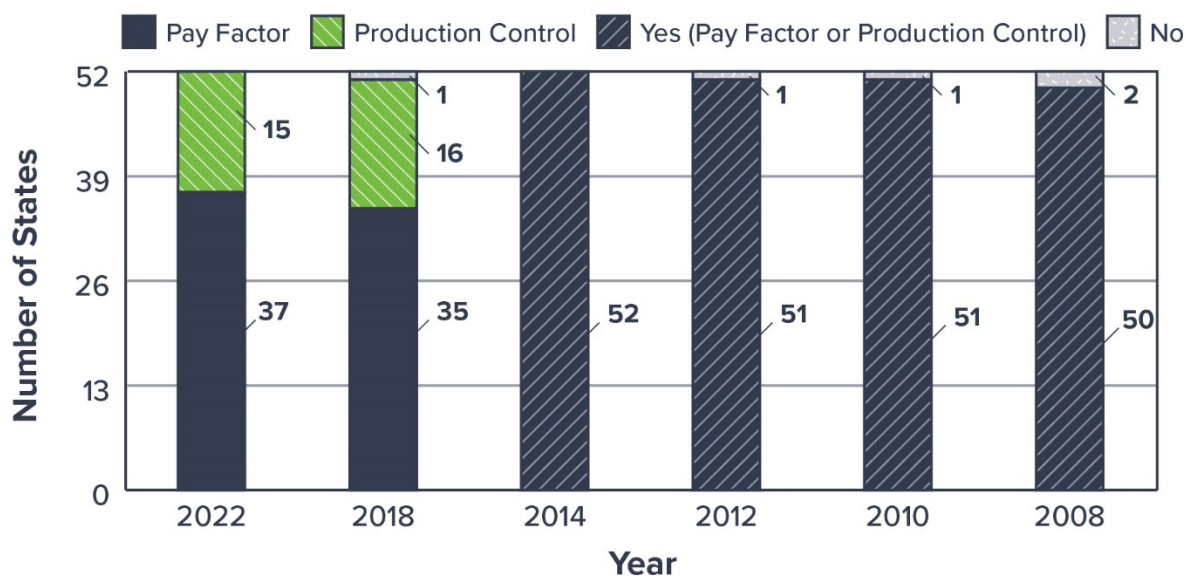


Figure 48. Changes in the number of State DOTs that used compressive or flexural strength as a quality characteristic for structural PCC.

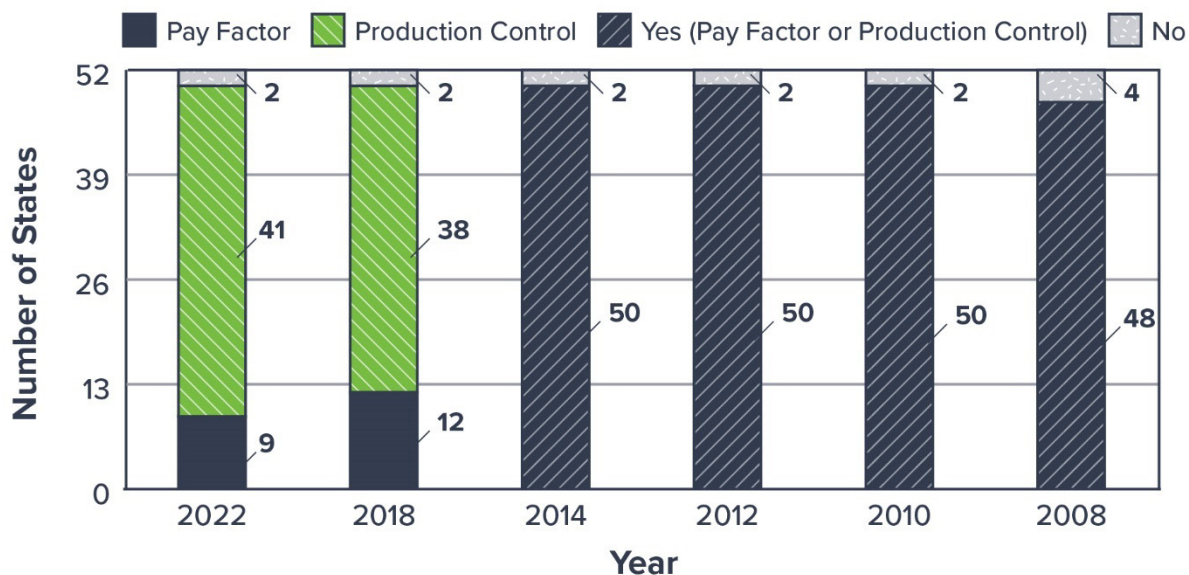


Figure 49. Changes in the number of State DOTs that used the entrained air content as a quality characteristic for structural PCC.

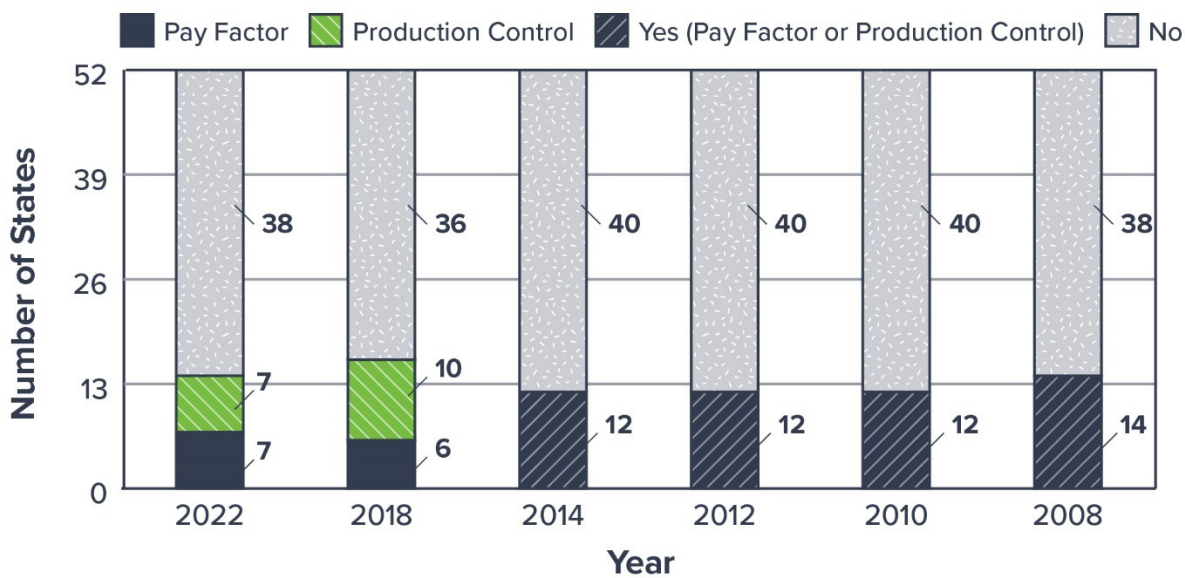


Figure 50. Changes in the number of State DOTs that used permeability (including resistivity) as a quality characteristic for structural PCC.

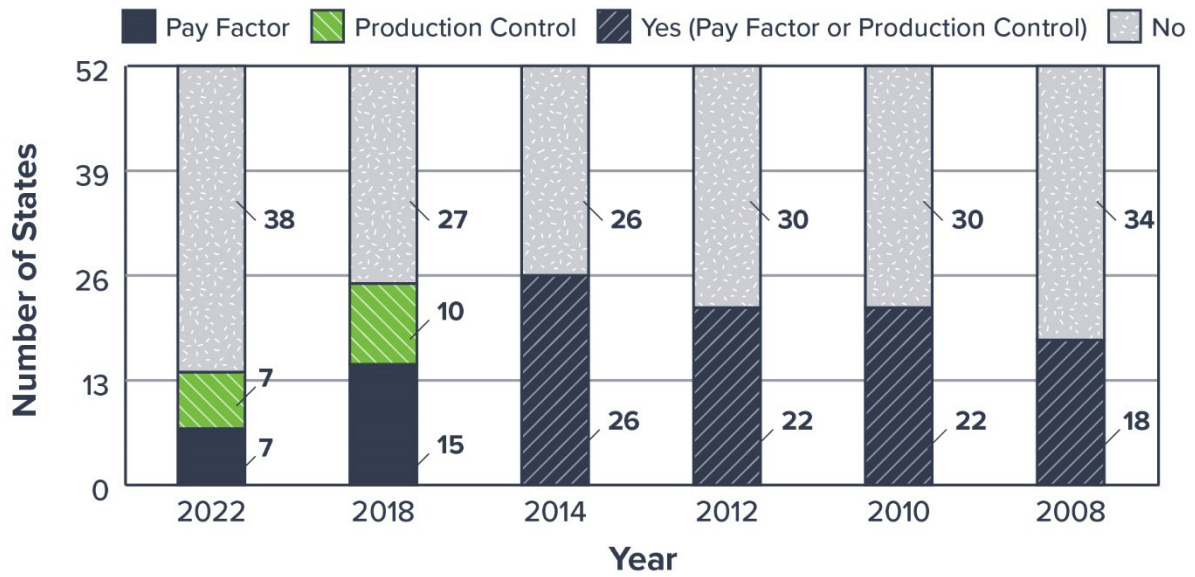


Figure 51. Changes in the number of State DOTs that used smoothness measured with either IRI or PI as a quality characteristic for bridge decks.

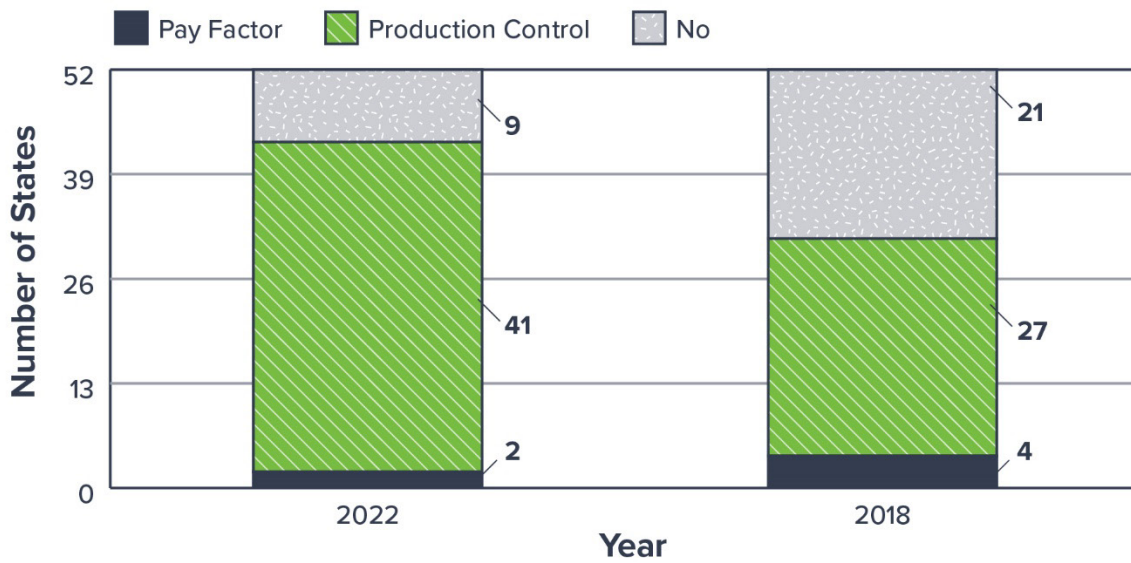


Figure 52. Changes in the number of State DOTs that used the depth of concrete cover over the reinforcing steel as a quality characteristic for bridge decks.

Question 10. Does the State DOT use Percent Within Limits (PWL)/Percent Defective (PD) specifications for payment?

Since 2010, the QA Assessment has tracked the use of PWL/PD specifications for payment for asphalt and PCC pavements. The use of PWL/PD for structural PCC was added to the 2018 assessment.

Figure 53 shows the trend for the number of State DOTs that used PWL/PD for determining the payment for asphalt pavements. In the 2018 and 2022 QA Assessments, the PWL/PD for asphalt mixture and asphalt pavement density were addressed separately, but they were combined in figure 53. Figures 54 and 55 show the trends in the number of State DOTs that used PWL/PD for determining the payments for PCC pavements and structural PCC, respectively.

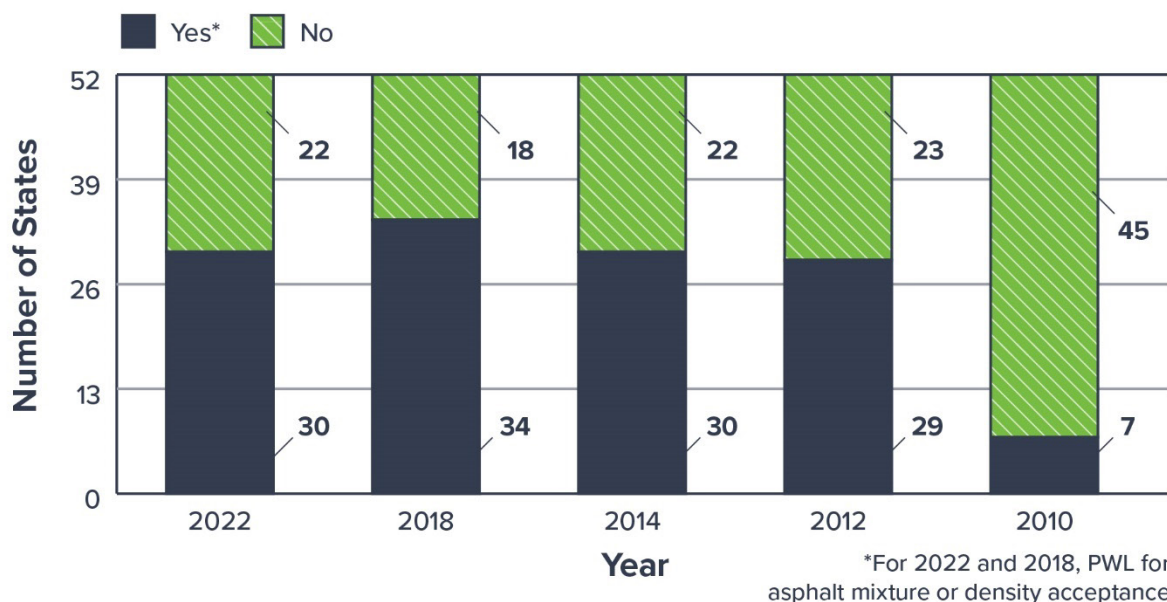


Figure 53. Changes in the number of State DOTs that used PWL/PD specifications for determining the payment for asphalt pavements.

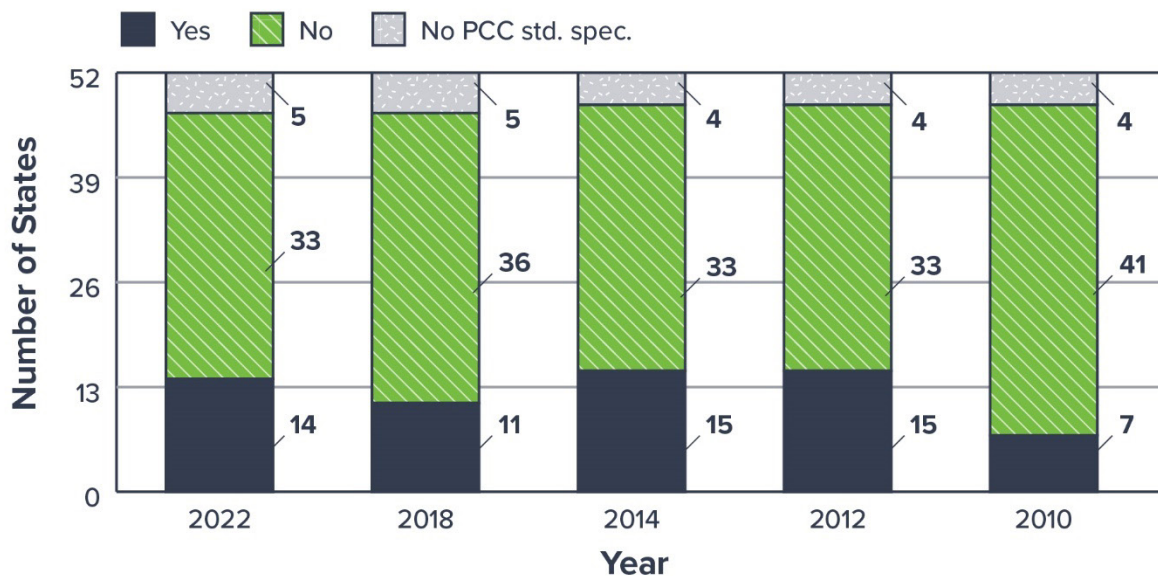


Figure 54. Changes in the number of State DOTs that used PWL/PD specifications for determining the payment for PCC pavements.

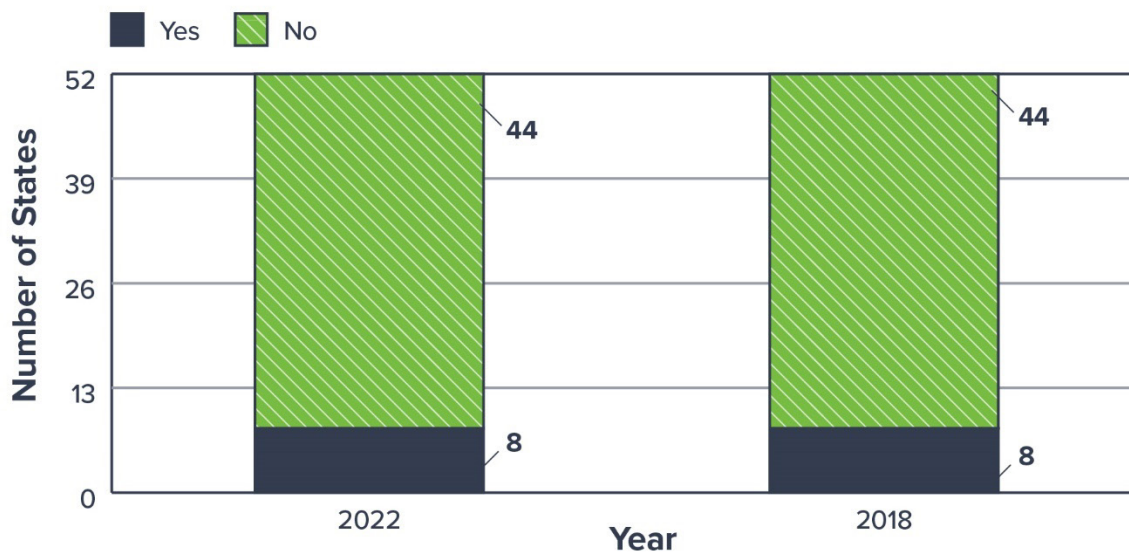


Figure 55. Changes in the number of State DOTs that used PWL/PD specifications for determining the payment for structural PCC.

Question 11. If the State DOT uses contractor tests in the acceptance decision for asphalt pavement, does the State DOT verify the contractor test results with F- & t-tests for asphalt pavement using a minimum of 5 State results and a maximum of 50 contractor results? If the State DOT uses contractor tests in the acceptance decision for PCC pavement, does the State DOT verify the contractor test results with F- & t-tests for PCC using a minimum of 5 State results and a maximum of 50 contractor results?

Figures 56 and 57 provide the trends for the number of State DOTs that used F- and t-tests to verify the contractor’s test results that were used in the acceptance decision with the

recommended sample sizes for asphalt pavement and PCC pavement, respectively. Before 2018, the question was based on a minimum of 5 State DOT results compared to between 7 and 29 contractor test results.

The top series in the stacked bars also provides the trends for the number of State DOTs that are relying on State DOT testing only in their acceptance decision for the respective pavement types.

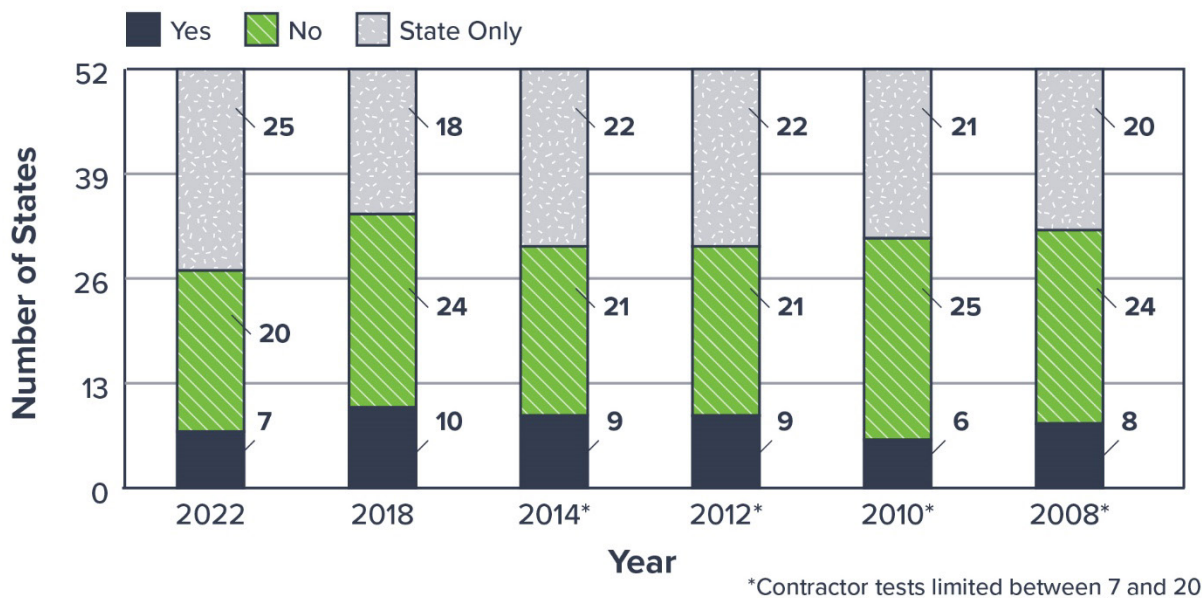


Figure 56. Changes in the number of State DOTs that used F- and t-tests to verify the contractor’s test results with the recommended sample sizes for asphalt pavements.

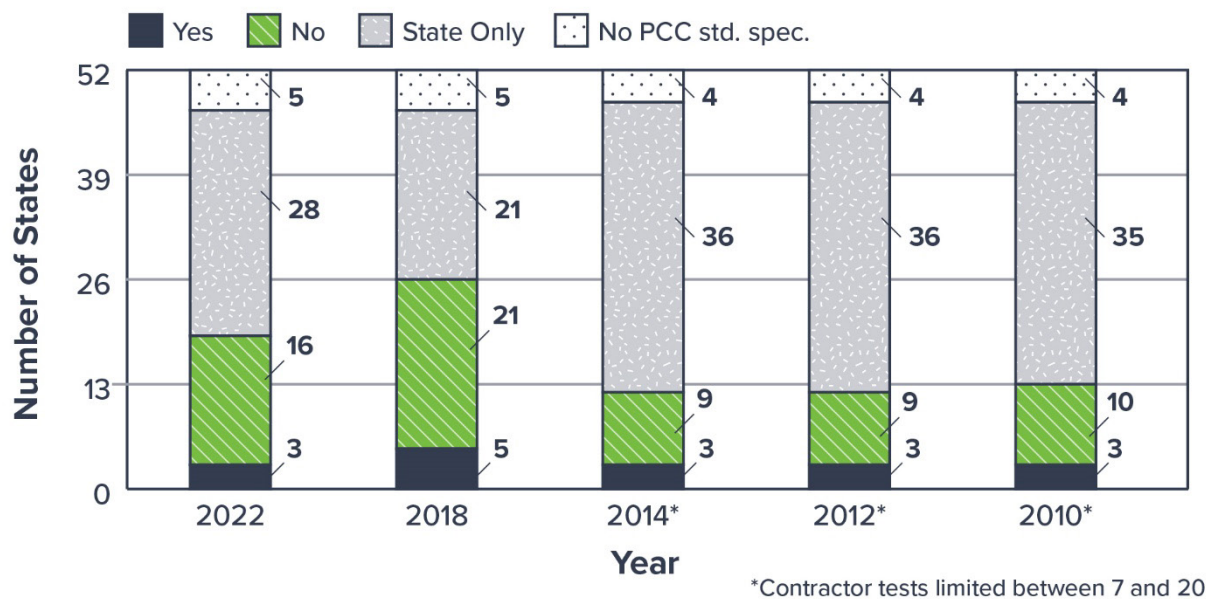


Figure 57. Changes in the number of State DOTs that used F- and t-tests to verify the contractor’s test results with the recommended sample sizes for PCC pavements.

Question 12. Does the State DOT use equations for payment adjustments for asphalt pavement? Does the State DOT use equations for payment adjustments for PCC pavement?

Figures 58 and 59 present the trends for the number of State DOTs that used equations (or tables with small, incremental steps) for the payment adjustments for asphalt pavement and PCC pavement, respectively. The use of equations for payment adjustments has seen an increase over the 14 years of the QA Assessment for both pavement types.

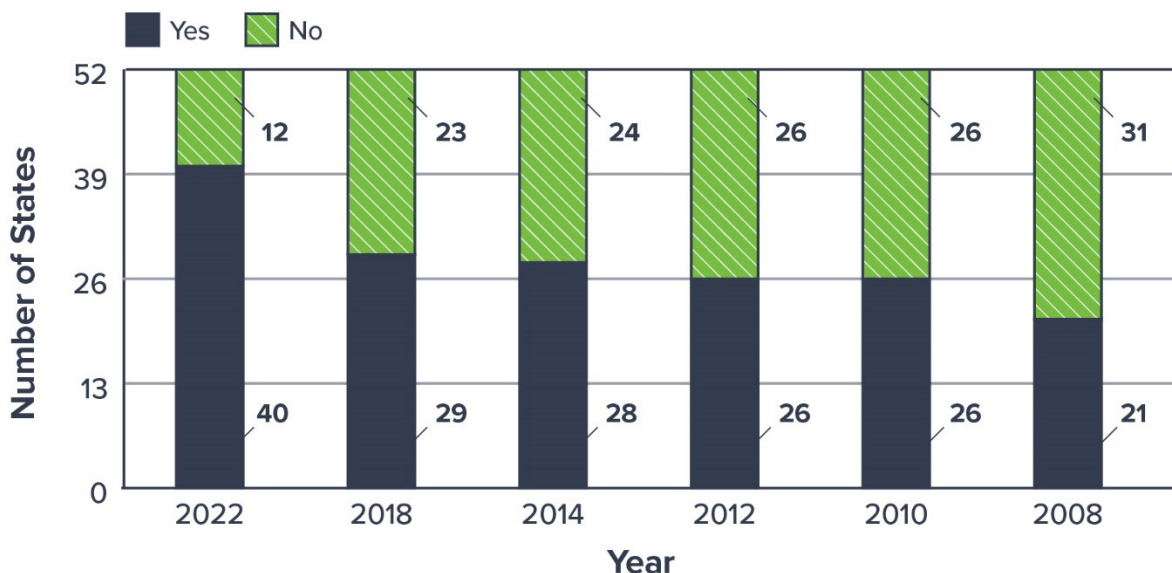


Figure 58. Changes in the number of State DOTs that used equations for payment adjustments on asphalt pavements.

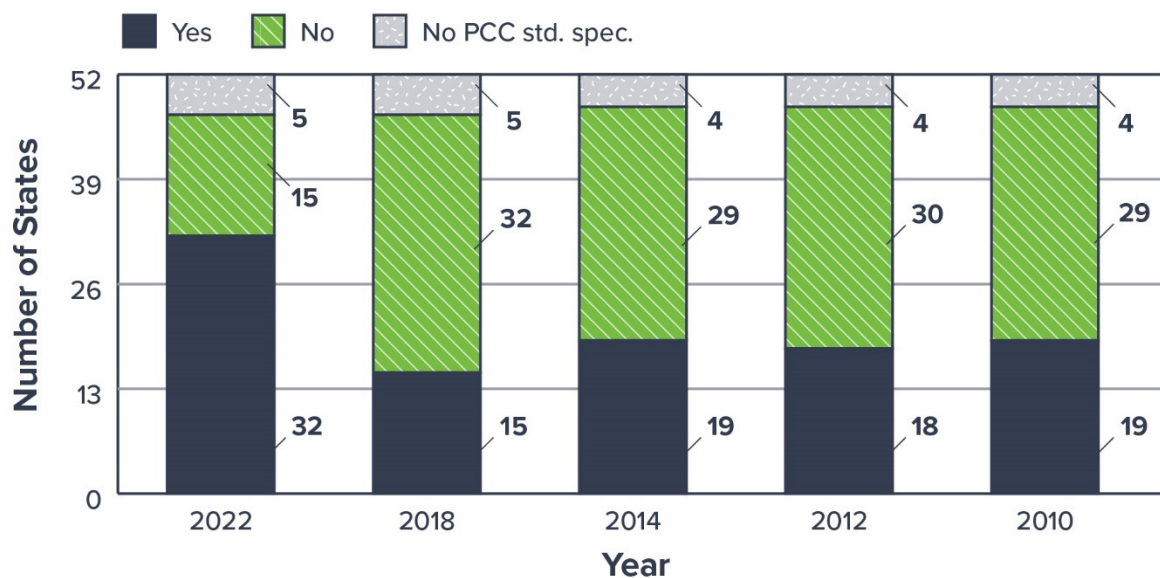


Figure 59. Changes in the number of State DOTs that used equations for payment adjustments on PCC pavements.

Question 13. Has the State DOT evaluated specification limits for asphalt mixture paving, PCC paving, or PCC structural applications along with independent assurance (IA) comparison tolerances within the past 5 years?

Question 13 was added to the QA Assessment in 2018. Figure 60 shows the trend for the number of State DOTs that had evaluated their specification limits in the previous 5 years for asphalt pavements. Figure 61 shows the trend for the number of State DOTs that had evaluated their specification limits in the previous 5 years for PCC pavements or structural PCC. Figure 62 shows the trend for the number of State DOTs that had evaluated their IA tolerance in the previous 5 years. While there has been an upward trend in the past 4 years for State DOTs that evaluated specification limits for both asphalt pavement and PCC applications, there was a downward trend for evaluating IA tolerances.

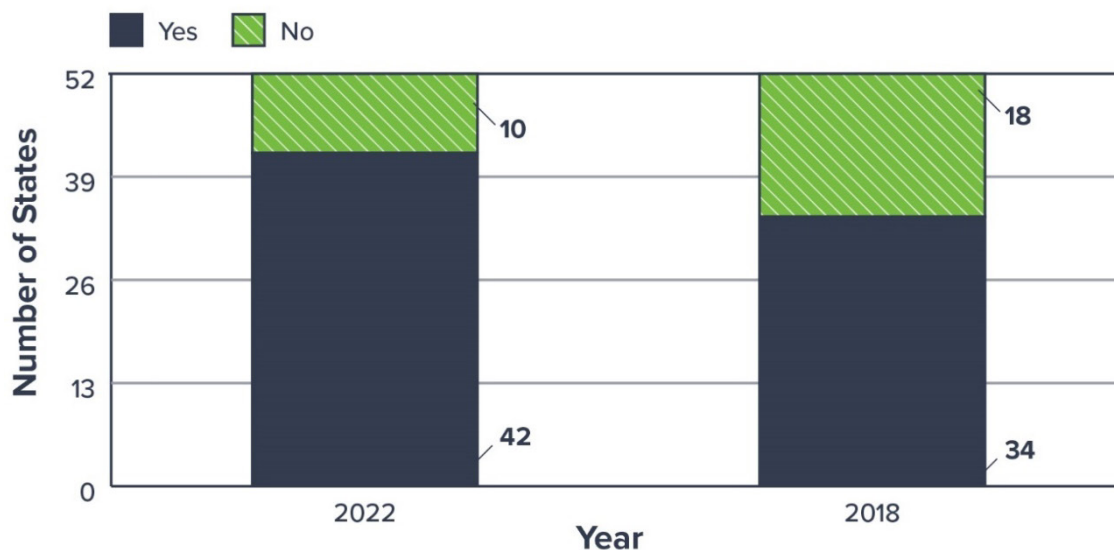


Figure 60. Changes in the number of State DOTs that had evaluated their asphalt pavement specification limits in the past 5 years.

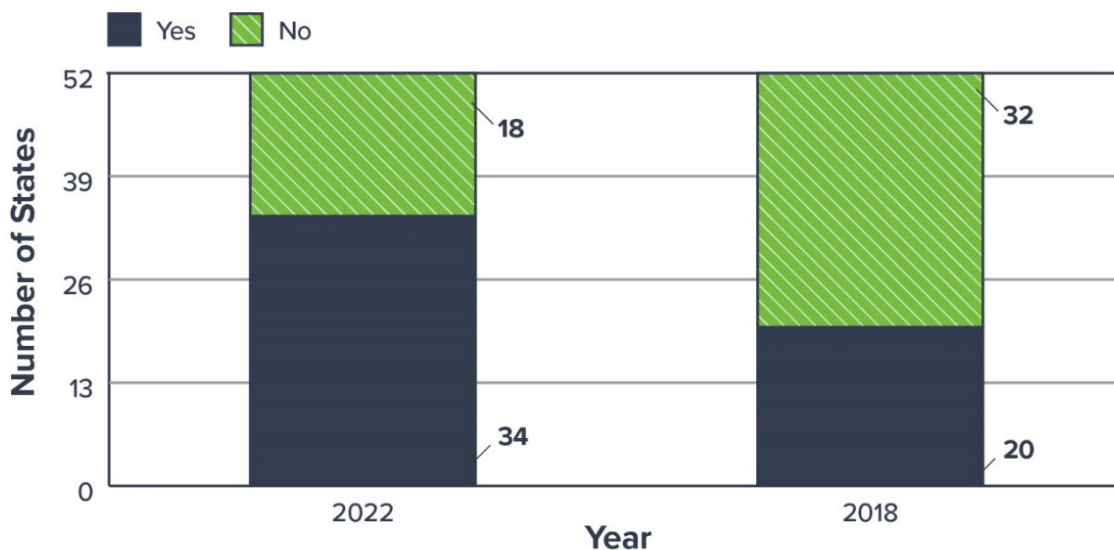


Figure 61. Changes in the number of State DOTs that had evaluated their PCC pavement or structural PCC specification limits.

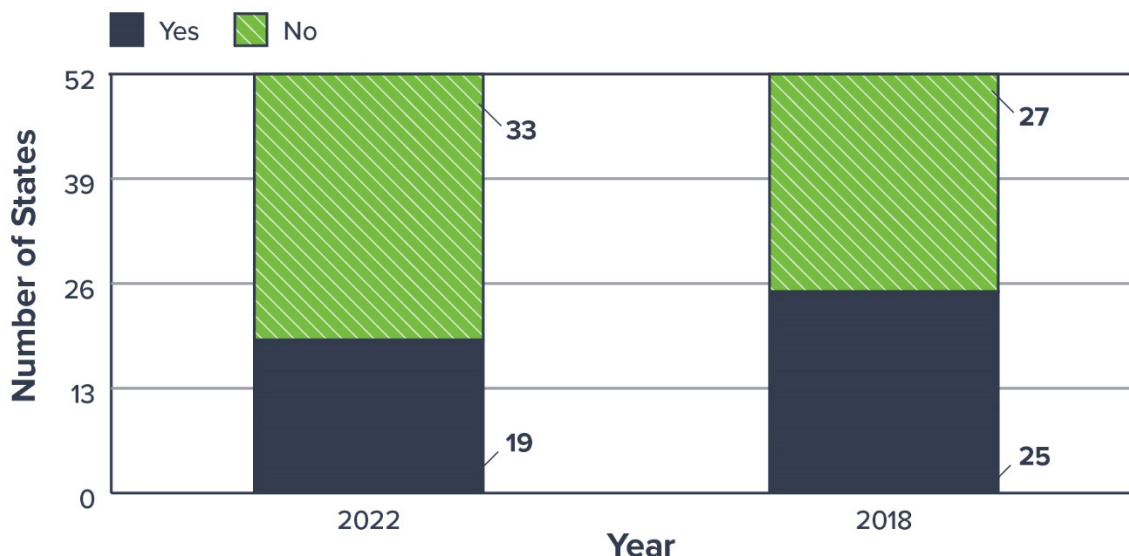


Figure 62. Changes in the number of State DOTs that had evaluated their IA tolerances.

Question 15. Does the State DOT use information from the National Transportation Product Evaluation Program (NTPEP) when developing qualified product lists?

Figure 63 presents the trend for State DOTs that had used the information from the NTPEP when developing qualified product lists over the last 14 years.

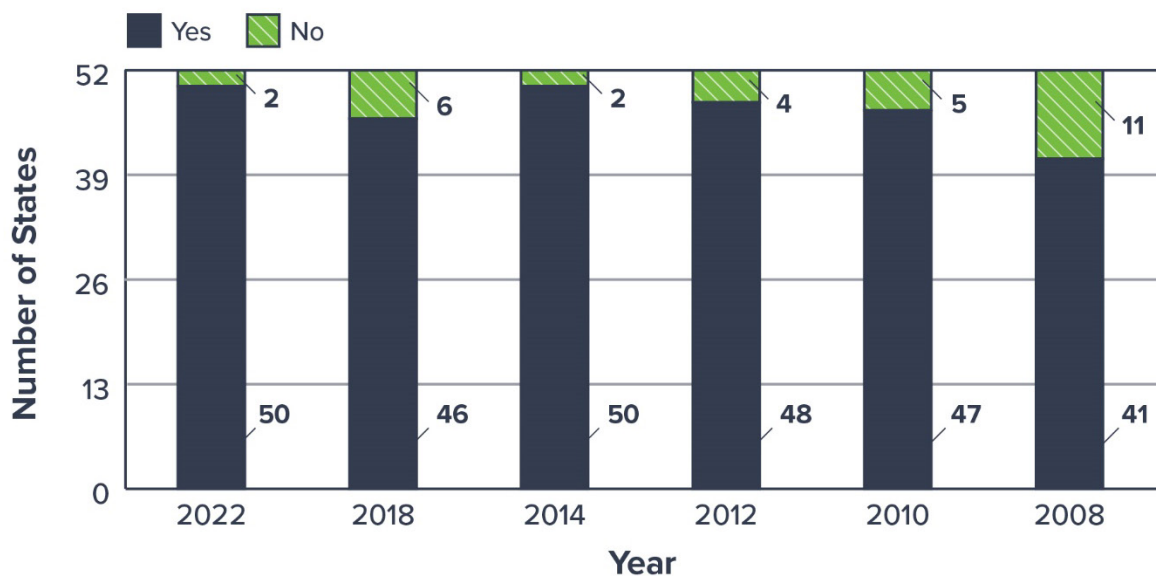


Figure 63. Changes in the number of State DOTs that had used the NTPEP when developing qualified product lists.

What type of Approach is used by your State for Independent Assurance?

State DOTs conducted their IA programs on a project basis, system basis, or some combination of the two, which was referred to as the hybrid basis. Figure 64 presents the trend for the approach that State DOTs used for their IA program. The hybrid approach had increased in

popularity in the past few years while the pure project approach had declined. For the QA Assessments conducted in 2008, 2010, and 2012, the answers for the IA approach were limited to project or system based.

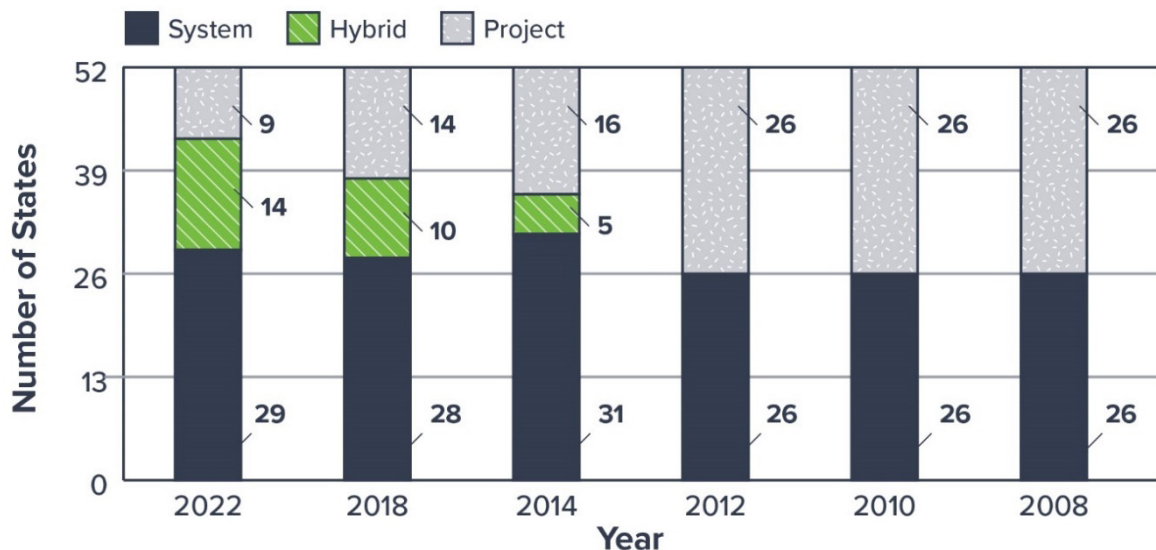


Figure 64. Changes for the IA approach used by State DOTs since 2008.

Question 16. Does the State DOT use a system approach or a project approach with a system-based analysis that results in an annual report that shows that the IA program covered at least 90 percent of the technicians once a year? Or does the State DOT use a system approach or a project approach with a system-based analysis that results in an annual report that shows that the IA program covered at least 75 percent of the technicians once a year?

Figure 65 provides the trend for the second part of Question 16 on the coverage if a system-based analysis was conducted by State DOTs. While the coverage trend had increased since 2008, there was a decrease in the system-based analysis, reporting, and coverage in 2022. The 2008 QA Assessment did not include the 75 percent coverage option.

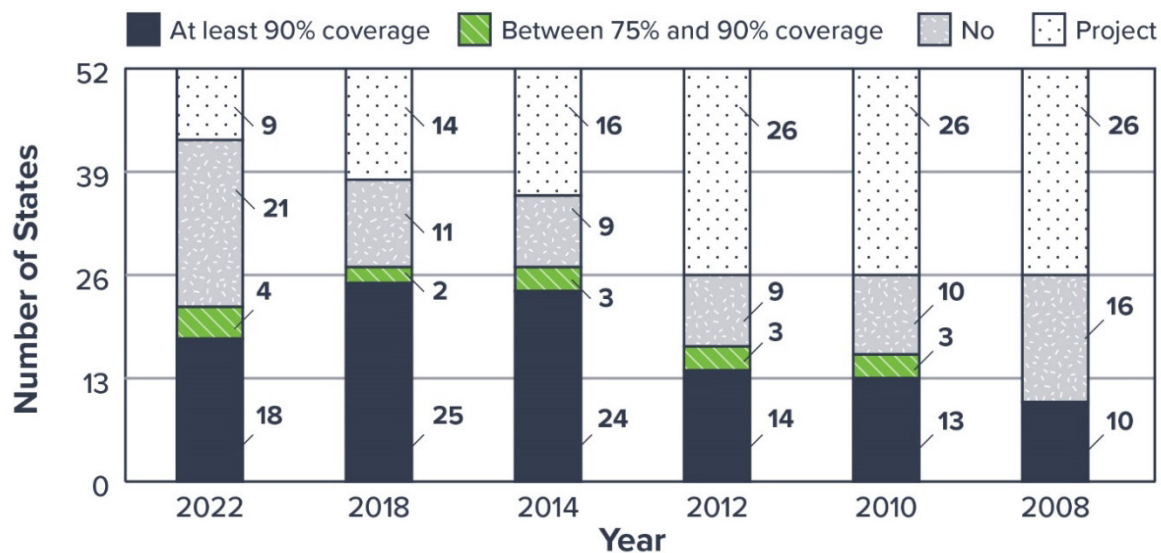


Figure 65. Changes for the system-based analysis of IA coverage of State DOTs since 2008.

Question 17. Does the State DOT have a formal material testing dispute resolution process that includes samples that are in the custody of the State and are analyzed in an unbiased manner?

Figure 66 presents the trend for the number of State DOTs that had a formal, written materials dispute resolution process that included custody of the samples by the State DOT and the test results were analyzed in an unbiased manner, including testing by alternative laboratories. In 2022, additional detail was added to this question to differentiate whether the contractor’s QC results were used in the acceptance decision.

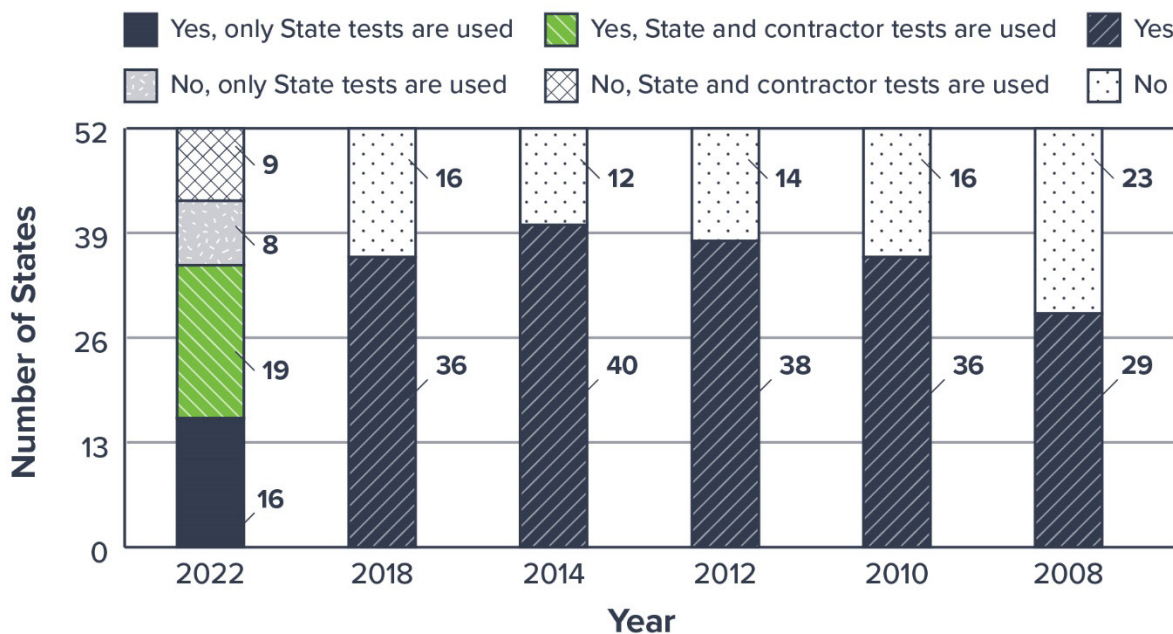


Figure 66. Changes in the number of State DOTs that had a formal dispute resolution process that included custody of the samples by the State DOT and test results analyzed in an unbiased manner.

Question 18. Are non-project personnel from a higher organizational level (that is covered by an accreditation or qualification program) responsible for the review and approval of the State DOT and contractor field laboratories used for acceptance?

Figure 67 provides the trend for the number of State DOTs that used non-project, accredited or qualified personnel from a higher organization level that were responsible for the review and approval of the field laboratories used by the State DOT and contractors.

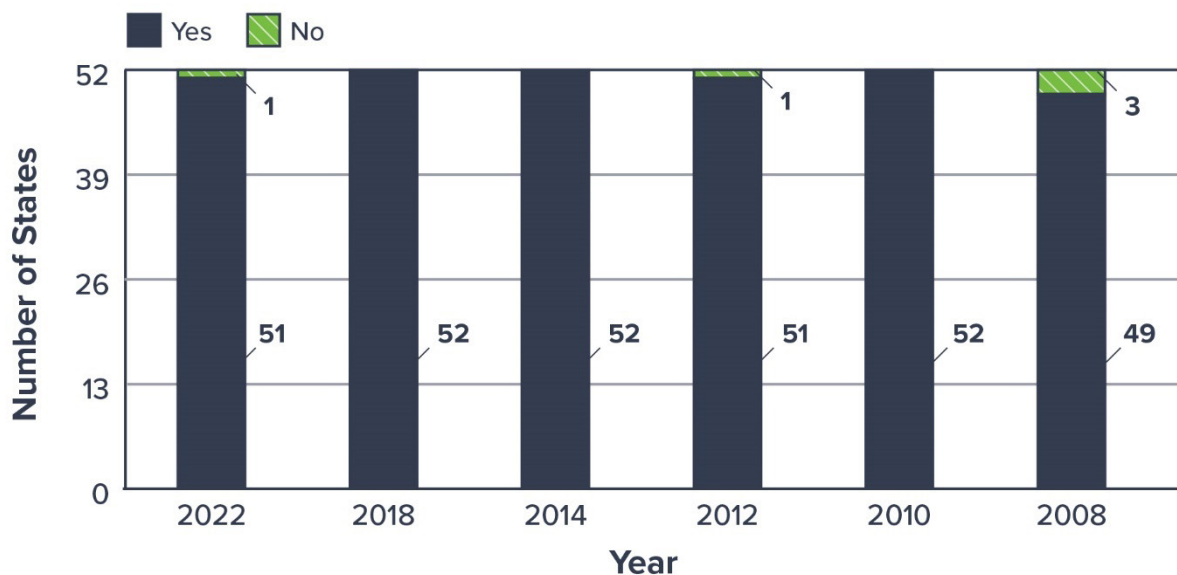


Figure 67. Changes in the number of State DOTs that used non-project personnel from a higher organization level that was responsible for the review and approval of the field laboratories used by the State DOT and contractors.

Question 19. Does the State DOT qualify sampling and testing personnel through a program that includes: 1) formal classroom training of sampling and testing procedures, 2) a written examination, 3) testing to demonstrate proficiency, 4) requalification procedures with some proficiency and/or knowledge demonstration, and 5) documented process for retraining or removing personnel?

Figures 68 through 70 provide the trends, by material type, for the number of State DOTs that qualified sampling and testing personnel through a program that included:

- Formal classroom training of sampling and testing procedures.
- A written examination.
- Testing to demonstrate proficiency.
- Requalification procedures with some proficiency and/or knowledge demonstration.
- A documented process for retraining or removing personnel.

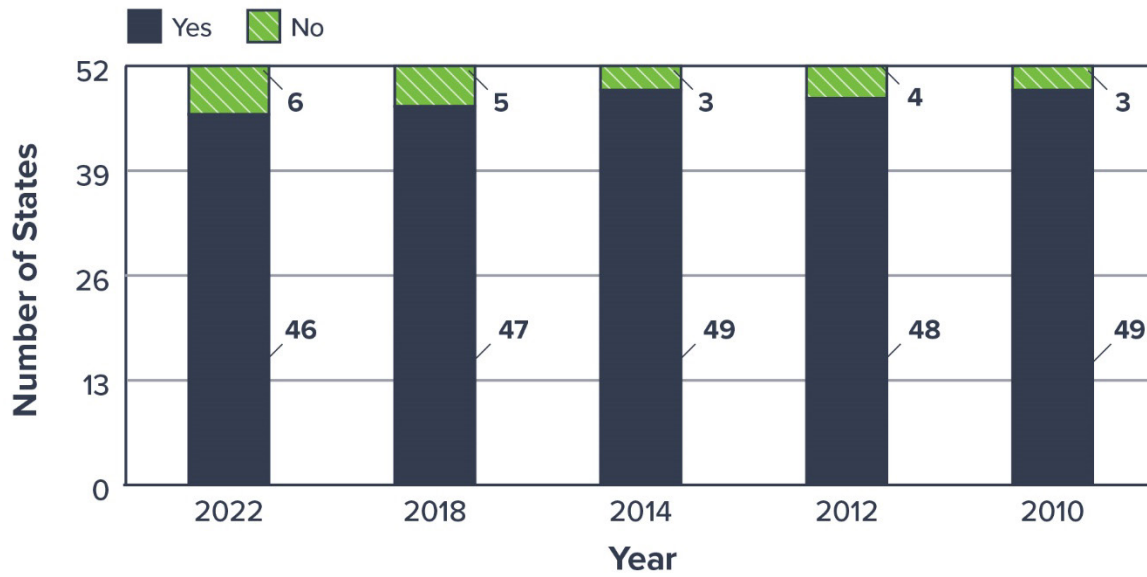


Figure 68. Changes in the number of State DOTs that qualified sampling and testing personnel for asphalt pavement using the characteristics listed in Question 19.

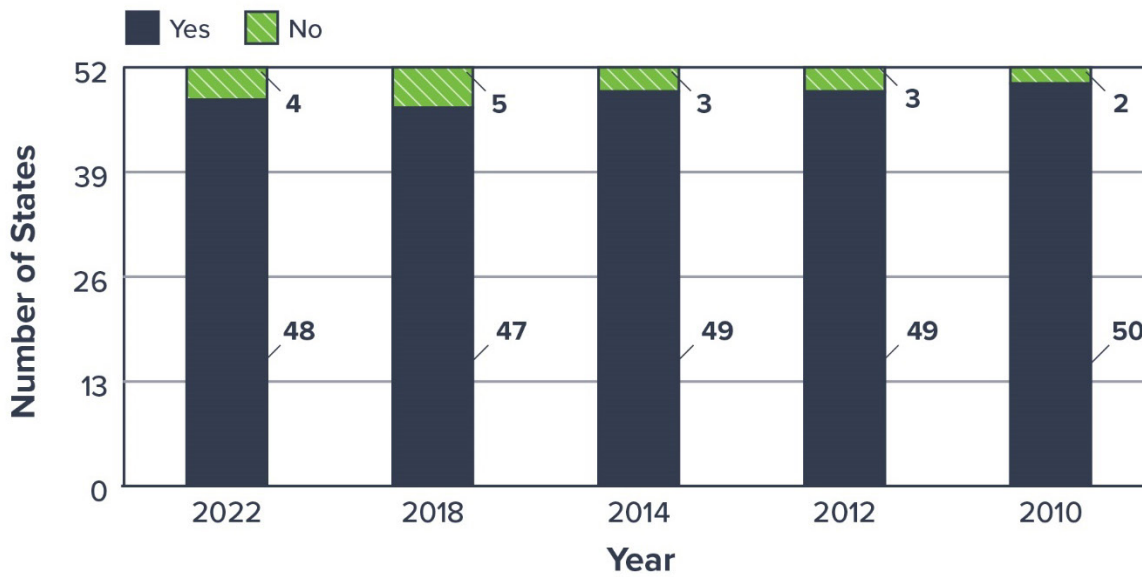


Figure 69. Changes in the number of State DOTs that qualified sampling and testing personnel for PCC using the characteristics listed in Question 19.

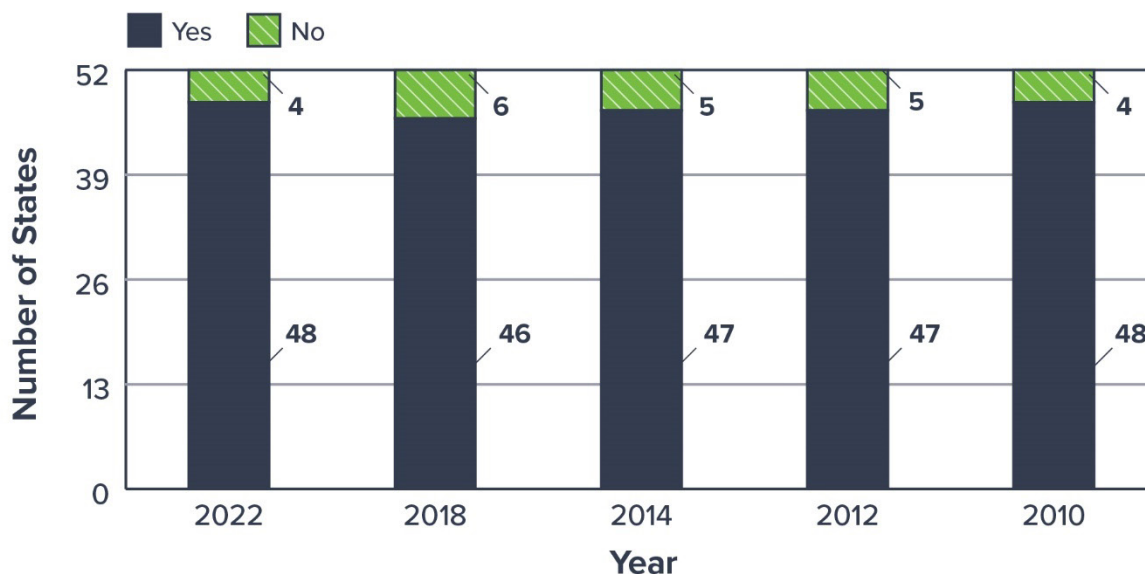


Figure 70. Changes in the number of State DOTs that qualified sampling and testing personnel for soils and aggregates using the characteristics listed in Question 19.

Question 20. Does the State DOT have a standardized QA program for alternate project delivery (e.g., Design-Build) projects?

A question on State DOTs having a standardized QA program for alternate project delivery projects had been included in the QA Assessment since 2018. The trend for the number of State DOTs that had a standardized QA program for alternate project delivery projects is shown in figure 71. As discussed in Chapter 4, State DOTs that had advertised less than 5 alternate delivery projects in the past 3 years did not have this question evaluated in the QA assessments.

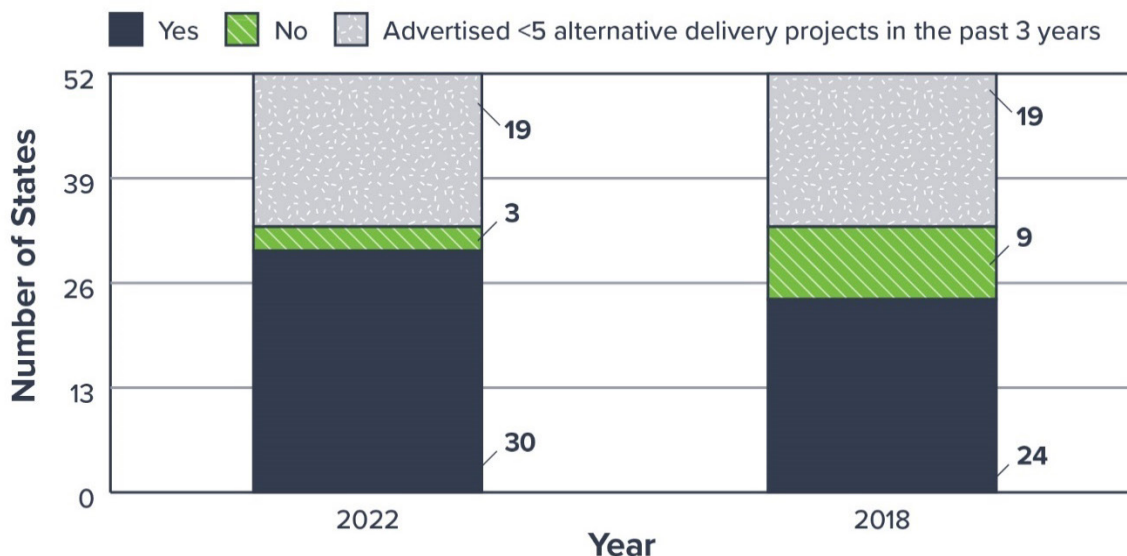


Figure 71. Changes in the number of State DOTs that have a standardized QA program for alternate project delivery projects.

Question 21. Does the State DOT have a standardized QA program for all Federal-aid projects administered by local public agencies (LPA)?

A question on how State DOTs address the need for a QA program for Federal-aid LPA projects was added to the QA Assessment in 2014. The potential responses were simplified in 2018 and again in 2022. Figure 72 provides the trend for how State DOTs address the need for a QA program for Federal-aid projects that were administered by an LPA.

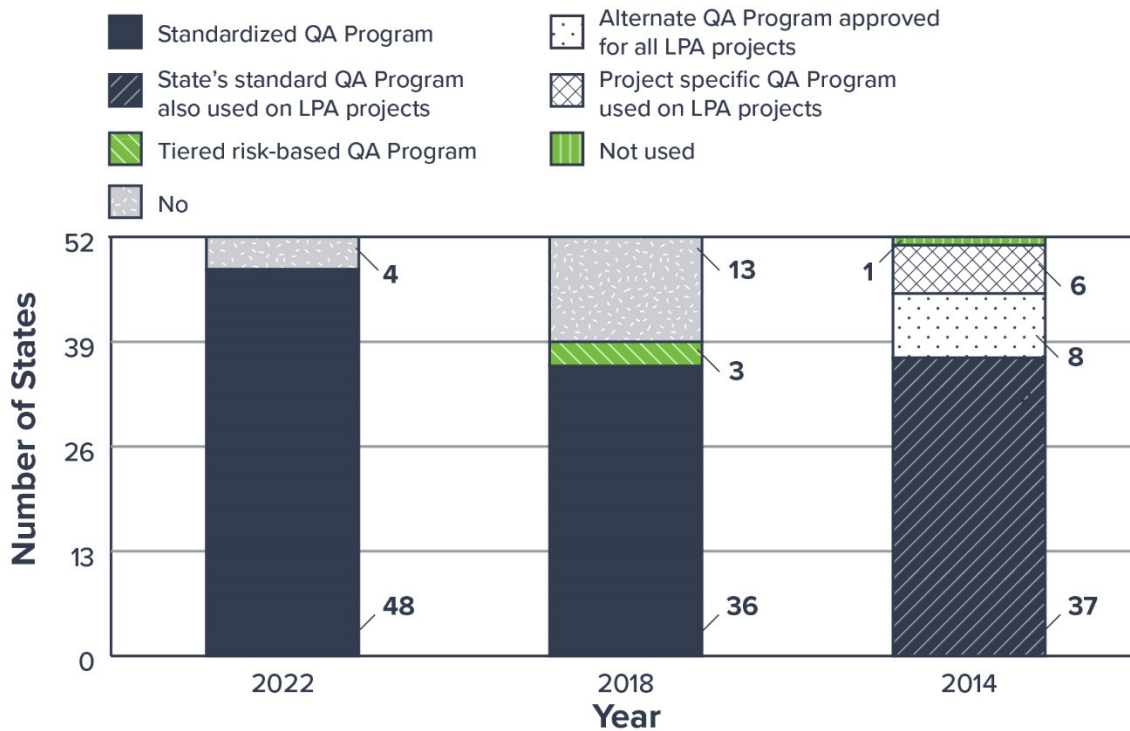


Figure 72. The trend in the number of State DOTs that have a standardized QA program for Federal-aid projects administered by LPAs.

CHAPTER 6. LESSONS LEARNED

Introduction

This chapter outlines lessons learned in preparing and conducting the 2022 QA Assessment regarding potential clarification of the criteria and other issues to review in any future assessments.

Clarifications for Future QA Assessments

During the conduct of the QA Assessment, several items generated discussion on the intent of the question and how it was answered on previous QA Assessments. The potential clarifications include:

- Question 7—clarify that the dowel bar alignment is checked after the concrete is placed.
- Question 8—clarify that there is a documented process to require the check for the depth of cover over steel for bridge decks that can be verified before or after concrete placement.
- Question 21—modify to include a not applicable option for agencies such as the District of Columbia and Puerto Rico that do not have LPA recipients of Federal-aid funding.

Outstanding Issues

While completing this assessment some topics were identified that could benefit from review and potential updates before the next QA Assessment is conducted. These topics for consideration include:

- Predominant practice—As discussed in Chapter 3, the 2022 QA Assessment defined predominant practice as greater than 50 percent of the quantity (tons, square yards, cubic yards, etc.) for a given material let by the State DOT for the previous calendar year. Many States used multiple specifications for the construction of asphalt pavements. For one QA program, 48 percent of their asphalt pavements were constructed with a specification that would have resulted in a higher rating for several of the questions, but it was not considered the predominant practice. This led to a discussion of whether the criteria of 50 percent should be lowered. This change could also affect items like bridge deck smoothness where some States only applied this characteristic to longer bridge decks.
- Questions 6, 7, and 8 discussed quality characteristics used for the acceptance of asphalt pavement, PCC pavement, and structural PCC. For asphalt pavement, the use of mixture performance testing could be rated as a YES if it used for mix design approval or materials acceptance. This same provision for mix design approval did not apply to an item like permeability for PCC pavement or structural PCC.
- There were multiple questions where the Total Potential Rating was reduced from its full value, sometimes to 0, if a State's QA program did not use contractor test results in the acceptance decision, did not have a standard specification for PCC pavement, or had advertised fewer than 5 alternate project delivery projects in the past 3 years (Questions 4, 5, 7, 10, 11, 12, 17, and 20). There were comments that QA programs that did not contain these features had an overall lower Total Potential Rating that could impact the Normalized rating when the percentage was calculated.

- In the 2022 QA Assessment there were 5 State DOTs that did not have a standard specification for the construction of PCC pavements. This reduced the Total Potential Rating for Questions 4, 5, 7, 10, 11, and 12. There were also multiple States that had not constructed PCC pavements in the past several years but still had a standard specification, although it had likely not been updated recently. The weighting of this question could be adjusted similar to Question 20 where the number of PCC paving projects constructed by a State in the past 3 or 5 years would be used to determine if those questions would be evaluated for that State.
- Recent legislation (Bipartisan Infrastructure Law—enacted as the Infrastructure Investment and Jobs Act (Pub. L. No.117-58, Nov. 15, 2021)) has added programs with more types of transportation entities eligible for Federal-aid highway funds compared to prior Federal-aid highway authorizations. This change may impact Question 21 regarding Federal-aid projects administered by LPAs through a State DOT and LPAs that are direct recipients of Federal-aid.

CHAPTER 7. CONCLUSIONS

An analysis of the temporal graphs in Chapter 5 indicated that most of the responses had remained consistent over the past 8 years. Observed changes in the responses included:

- Formal approval of the State DOT's QA program by the FHWA Division Office had increased in the past 4 years.
- The sampling of the PCC for structural applications after pumping had decreased, potentially due to ongoing research on the effect on the quantity and quality of the entrained air content in PCC after pumping.
- The use of VMA as a quality characteristic for asphalt mixture had increased over the past 14 years.
- There had been an increase in the number of State DOTs that were using optimized gradation as a quality characteristic for PCC pavements.
- The use of equations for pay adjustments for both asphalt and PCC pavements had increased.
- The number of State DOTs using contractor test results in the acceptance decision was declining for asphalt and PCC pavements.
- The number of State DOTs that had evaluated their asphalt pavement specification limits and PCC pavement and structural PCC specification limits had increased, but there was a decrease in the number of State DOTs that had evaluated their IA tolerances.
- There was an increase in the number of State DOTs that were using a hybrid approach to IA while the project approach was declining.

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McLaury, K., M. Grogg, M. Praul, B. Neitzke, K. Jacoby, P. Kulyk, and T. Brim-Burnell. 2007. [*Quality Assurance in Materials and Construction*](#). Final Report. Federal Highway Administration, Washington, DC.

APPENDIX A

QUALITY ASSURANCE ASSESSMENT 2022

As part of the efforts to improve FHWA Materials Quality Assurance (QA) initiatives, the QA Assessment will provide information on current trends in national QA practices and the progress of ongoing QA program efforts. The QA Assessment is an evaluation of the effectiveness of materials QA programs and the degree to which they minimize the potential for waste, fraud, and abuse. The QA Assessment is not an evaluation of the Division Office or State DOT compliance with Federal laws and regulations nor is it a direct indication of material quality. The initial QA Assessment was completed in 2008 with updates occurring in 2010, 2012, 2014, and 2018. Minor revisions have been made to the QA Assessment for 2022 to address current QA program risk areas.

QA Program

The responses to the QA Assessment will be based on the standard practices used by the State DOT on a majority of work on Federal-aid projects that are let by the State DOT. The QA Assessment questions, criteria, and rating are shown in table 1. Questions are assigned different weights based on their assigned risk value and not all questions apply to all States.

Normalized Rating

The QA Assessment ratings are summed for the applicable questions and a percentage (numerator over denominator) is calculated for each State DOT producing the Normalized Rating. The numerator is assigned based on a review of the State's DOT QA documentation and the rating defined for each question. The denominator will vary from State to State based on items included in the State DOT's QA program as discussed in the table 1 footnote. The weight column of table 1 provides the potential rating for the denominator. If a question or part of a question doesn't apply to the State DOT's QA program, the appropriate lower values in the weight column will be used for the denominator.

Table 1. 2022 QA Assessment questions and ratings.

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
1.	<p>Has your Division Office formally approved revisions to the State DOT's QA program within the past 3 years?</p> <p>As part of proper QA program oversight, the Division Office should routinely review and approve changes to the State DOT's documented QA program.</p> <p>Rating:</p> <ul style="list-style-type: none"> • 7 if Division Office has formally approved revisions to the State DOT's QA program within the last 3 years. • 0 if Division Office has not formally approved revisions to the State DOT's QA program within the last 3 years. 	QA Program	7	—
2.	<p>Does the State DOT use an electronic materials management system that includes all test results (State and contractor) that are used in the acceptance decision?</p> <p>An effective tool to evaluate the risks in a QA program is to develop an electronic materials management system to store and analyze data to develop and modify specification limits. All project test results used in the acceptance decision are important to provide data when evaluating specification limits.</p> <p>Criteria for electronic materials management system:</p> <ul style="list-style-type: none"> • Contains all project test results used in the acceptance decision (contractor and State). • Data for multiple materials may be combined in the same database or a separate database may be used for each material. • Data for the same material is not split among multiple project-specific spreadsheets. <p>Rating:</p> <ul style="list-style-type: none"> • 3 if all criteria are included in the QA Program. • 0 if all criteria have not been met. 	QA Program	3	—

Table 1. 2022 QA Assessment questions and ratings (continued).

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
3.	<p>Does the State DOT have a documented process for controlling the location of random verification (agency acceptance) sampling?</p> <p>Documented procedures to obtain random locations for sampling materials support consistent State DOT implementation. State DOT procedures that control the locations for verification testing and do not let the Contractor know of the sampling locations until the actual sampling or testing is to be conducted minimize the risk of biased production operations.</p> <p>Criteria for random verification sampling:</p> <ul style="list-style-type: none"> • Random numbers for field verification sampling and testing are generated. • Locations for sampling are controlled by State personnel. • Random locations are not provided to the Contractor until the actual verification sampling is to be conducted. <p>Rating:</p> <ul style="list-style-type: none"> • 7 if all criteria are included in the QA program. • 0 if all criteria have not been met. 	Agency Acceptance and Contractor Quality Control	7	—
4.	<p>Does the State DOT have a documented process to take immediate possession of verification (agency acceptance) samples or to maintain the security of the samples for asphalt pavement mixture, asphalt pavement density, PCC pavement, and PCC structural applications?</p> <p>Maintaining the security of the verification samples is critical to ensure the integrity of those samples for State DOT acceptance.</p> <p>Criterion for verification sample security:</p> <ul style="list-style-type: none"> • The State DOT must take immediate possession of the samples or have a documented process to maintain the security of the samples. <p>Rating based on four material categories (asphalt pavement mixture, asphalt pavement density, PCC pavement, and PCC for structures):</p> <ul style="list-style-type: none"> • 7 if the criterion is met for all four material categories. • 5 if the criterion is met for three material categories. • 3 if the criterion is met for two material categories. • 1 if the criterion is met for one material category. • 0 if the criterion is not met for any material category. 	Agency Acceptance and Contractor Quality Control	5/7	Question weight is reduced to 5 if the State DOT does not have a standard specification for PCC pavement.

Table 1. 2022 QA Assessment questions and ratings (continued).

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
5.	<p>Does the State DOT predominantly sample material at the closest point prior to the incorporation into the project?</p> <p>Sampling material at the closest point prior to incorporation into the project provides the most direct representation of the final in-place materials.</p> <p>Cumulative rating:</p> <ul style="list-style-type: none"> • 1 if asphalt paving mixture is sampled after discharge from the hauling vehicle (before or after the paver). • 1 if a portion of the PCC is sampled from the end of the pump line for structural concrete. • 1 if a portion of the PCC is sampled from ahead of the paver on the grade for concrete pavement. • 0 if the criteria are not met. 	Agency Acceptance and Contractor Quality Control	2/3	Question weight is reduced to 2 if the State DOT does not have a standard specification for PCC pavement.
6.	<p>Which of the following does the State DOT use for asphalt pavement acceptance?</p> <ul style="list-style-type: none"> • Air voids in total mix (V_a) or asphalt binder content (P_b). • In-place density. • Smoothness (IRI, PI). • Voids in mineral aggregate (VMA). • Mixture performance test (see examples listed in Index-Based Tests for Performance Engineered Mixture Designs for Asphalt Pavements). <p>In the response, indicate which quality characteristics are used in a pay factor and which characteristics are used as production control (i.e., go/no-go) criteria.</p> <p>Partial credit will be provided for each of the recommended quality characteristics for use in asphalt pavement acceptance with the following breakdown.</p> <p>Cumulative rating:</p> <ul style="list-style-type: none"> • 1 if V_a or P_b are used. • 1 if in-place density is used. • 1 if smoothness is used. • 1 if VMA is used. • 1 if mixture performance testing is used for mix design approval or materials acceptance. 	Agency Acceptance and Contractor Quality Control	5	—

Table 1. 2022 QA Assessment questions and ratings (continued).

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
7.	<p>Which of the following does the State DOT use for PCC pavement acceptance?</p> <ul style="list-style-type: none"> • Thickness (cores or MIT-Scan-T2/T3). • Entrained air. • Smoothness (IRI, PI). • <i>Optimized gradation</i> (tarantula curve, combined percent retained chart [8-18 band], or Shilstone coarseness/workability factor chart). • Dowel bar alignment (MIT-Scan 2 or probing). • Permeability (including resistivity). • Strength (compressive or flexural). <p>In the response, indicate which quality characteristics are used in a pay factor and which characteristics are used as production control (i.e., go/no-go) criteria.</p> <p>Partial credit will be provided for each of the recommended quality characteristics for use in PCC pavement acceptance with the following breakdown.</p> <p>Cumulative rating:</p> <ul style="list-style-type: none"> • 1.0 if thickness is used. • 1.0 if entrained air is used. • 1.0 if smoothness is used. • 0.5 if optimized gradation is used. • 0.5 if dowel bar alignment is used. • 0.5 if permeability (including resistivity) is used. • 0.5 if strength is used. <p>For those State DOTs that do not have a PCC pavement standard specification, this question is not included in the overall rating.</p>	Agency Acceptance and Contractor Quality Control	0/5	Question is not rated if the State DOT does not have a standard specification for PCC pavement.
8.	<p>Which of the following does the State DOT use for structural concrete acceptance?</p> <ul style="list-style-type: none"> • Strength (compressive or flexural). • Entrained air. • Permeability (including resistivity). • Smoothness (IRI, PI). • Depth of concrete cover over steel. <p>In the response, indicate which quality characteristics are used in a pay factor and which characteristics are used as production control (i.e., go/no-go) criteria.</p> <p>Partial credit will be provided for each of the recommended quality characteristics for use in structural concrete with the following breakdown.</p> <p>Cumulative rating:</p> <ul style="list-style-type: none"> • 1 if strength is used. • 1 if entrained air is used. • 1 if permeability (including resistivity) is used. • 1 if smoothness is used. • 1 if concrete cover is used. 	Agency Acceptance and Contractor Quality Control	5	—

Table 1. 2022 QA Assessment questions and ratings (continued).

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
9.	Reserved for future use.	—	—	—
10.	<p>Does the State DOT use Percent Within Limits (PWL)/Percent Defective (PD) specifications for payment?</p> <p>Determining the acceptability of materials and construction activities using statistical specifications allows the State DOT to control both average and variability of the material properties.</p> <p>Criteria:</p> <ul style="list-style-type: none"> • PWL/PD specifications used for asphalt mixture acceptance. • PWL/PD specifications used for asphalt pavement density acceptance. • PWL/PD specifications used for PCC pavement acceptance. • PWL/PD specifications used for structural PCC acceptance. <p>Rating:</p> <ul style="list-style-type: none"> • 3 if three or more of the criteria are met. • 2 if two of the criteria are met. • 1 if one of the criteria is met. • 0 if PWL/PD specifications are not used. <p>Credit will be given if at least one quality characteristic under each criterion uses PWL/PD specifications. Other quality characteristics can use go/no-go criteria.</p>	Agency Acceptance and Contractor Quality Control	2/3	Question weight is reduced to 2 if the State DOT does not have a standard specification for PCC pavement.

Table 1. 2022 QA Assessment questions and ratings (continued).

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
11.	<p>If the State DOT uses contractor tests in the acceptance decision for asphalt pavement, does the State DOT verify the contractor test results with F- & t-tests for asphalt pavement using a minimum of 5 State results and a maximum of 50 contractor results? And if the State DOT uses contractor tests in the acceptance decision for PCC pavement, does the State DOT verify the contractor test results with F- & t-tests for PCC using a minimum of 5 State results and a maximum of 50 contractor results?</p> <p>For State DOTs using contractor’s tests in the acceptance decision, data validation using statistical tests allows the State DOT to determine if both the contractor’s test results and the State’s verification test results are from the same population. Using a minimum of 5 State tests to compare to a maximum of 50 contractor tests ensures at least a 50 percent chance of detecting a difference that exists. If more than 50 contractor’s tests are used in the validation process, the contractor can change their process without being detected by the statistical comparison.</p> <p>Criteria: F & t comparisons contain at least the minimum number of State tests and no more than the maximum number of contractor tests.</p> <p>Rating:</p> <ul style="list-style-type: none"> • 7 if F & t criteria are met for both asphalt pavement and PCC pavement acceptance. • 5 if F & t criteria are met for either asphalt pavement or PCC pavement acceptance. • 0 if F & t criteria are not met for asphalt pavement and PCC pavement acceptance. <p>For those State DOTs that do not utilize contractor’s tests in the acceptance decision for asphalt pavement and PCC pavement this question is not included in the overall rating. For those State DOTs that only use contractor tests in the acceptance decision for either asphalt pavement or PCC pavement, this question will be based only on that material and the rating will be either 5 or 0 out of 5.</p>	Agency Acceptance and Contractor Quality Control	0/5/7	<p>Question weight reduced to 5 if:</p> <ul style="list-style-type: none"> • The State DOT does not have a standard specification for PCC pavement, or • The State DOT only uses contractor test results in the acceptance decision for asphalt pavement or PCC pavement. <p>Question is not rated if contractor test results are not used in the acceptance decision for asphalt pavement and PCC pavement.</p>

Table 1. 2022 QA Assessment questions and ratings (continued).

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
12.	<p>Does the State DOT use equations for payment adjustments for asphalt pavement? And does the State DOT use equations for payment adjustments for PCC pavement?</p> <p>Payment decisions determined using equations reduce the potential for fraud and abuse, especially when Contractor's tests are being used in the acceptance decision because incremental changes in test results correspond to incremental changes in pay.</p> <p>Rating:</p> <ul style="list-style-type: none"> • 3 if equations are used for both asphalt pavement and PCC pavement pay adjustments. • 2 if equations are used for either asphalt pavement or PCC pavement pay adjustments. • 0 if equations are not used for asphalt pavement and PCC pavement pay adjustments. <p>Credit will be given if at least one quality characteristic under each criterion uses equations.</p>	Agency Acceptance and Contractor Quality Control	2/3	Question weight is reduced to 2 if the State DOT does not have a standard specification for PCC pavement.
13.	<p>Has the State DOT evaluated specification limits for asphalt mixture paving, PCC paving, or PCC structural applications along with independent assurance (IA) comparison tolerances within the past 5 years?</p> <p>When State DOTs routinely reevaluate specification limits (including PWL/PD criteria if applicable) and IA tolerances they can ensure those limits are appropriate for current practices considering recent project results.</p> <p>Cumulative rating:</p> <ul style="list-style-type: none"> • 1 if asphalt pavement specification limits were evaluated. • 1 if PCC pavement or structural specification limits were evaluated. • 1 if IA tolerances were evaluated. 	Agency Acceptance and Contractor Quality Control Independent Assurance	3	—
14.	Reserved for future use.	—	—	—
15.	<p>Does the State DOT use information from the National Transportation Product Evaluation Program (NTPEP) when developing qualified product lists?</p> <p>As part of agency acceptance, the information from the NTPEP can be utilized in the evaluation process for approving manufactured materials. The utilization of the NTPEP allows for more effective use of State DOT testing resources.</p> <p>Rating:</p> <ul style="list-style-type: none"> • 1 if the NTPEP is being utilized for one or more materials. • 0 if the NTPEP is not being utilized. 	Agency Acceptance and Contractor Quality Control	1	—

Table 1. 2022 QA Assessment questions and ratings (continued).

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
16.	<p>Does the State DOT use a system approach or a project approach with a system-based analysis that results in an annual report that shows that the IA program covered at least 90 percent of the technicians once a year? Or does the State DOT use a system approach or a project approach with a system-based analysis that results in an annual report that shows that the IA program covered at least 75 percent of the technicians once a year?</p> <p>IA is an important element of a QA program to ensure the sampling and testing personnel can perform the tests accurately. The system-based approach is an efficient way to cover most technicians.</p> <p>Rating:</p> <ul style="list-style-type: none"> • 5 if 90 percent of the technicians were reviewed once a year as documented in an annual report. • 3 if 75 percent of the technicians were reviewed once a year as documented in an annual report. • 0 if the criteria were not met. 	Independent Assurance	5	—
17.	<p>Does the State DOT have a formal material testing dispute resolution process that includes samples that are in the custody of the State and are analyzed in an unbiased manner?</p> <p>A material testing dispute resolution process can reduce the risk related to inaccurate test results and is especially important when contractor’s tests are being used in the acceptance decision.</p> <p>Criteria for dispute resolution process:</p> <ul style="list-style-type: none"> • The State has custody of samples. • The dispute resolution process is written and is included in the State DOT’s QA program documents. • The dispute resolution process includes testing by alternative laboratories. <p>Note: Different weights are assigned depending on whether the contractor’s tests are used in the acceptance decision.</p> <p>Rating when only State tests are used in the acceptance decision:</p> <ul style="list-style-type: none"> • 3 if all three criteria are included in the QA Program. • 0 if all criteria have not been met. <p>Rating when State and contractor tests are used in the acceptance decision:</p> <ul style="list-style-type: none"> • 7 if all three criteria are included in the QA Program. • 0 if all criteria have not been met. 	Dispute Resolution Process:	3/7	Question weight is reduced to 3 if contractor test results are not used in the acceptance decision.

Table 1. 2022 QA Assessment questions and ratings (continued).

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
18.	<p>Are non-project personnel from a higher organizational level (that is covered by an accreditation or qualification program) responsible for the review and approval of the State DOT and contractor field laboratories used for acceptance?</p> <p>Checks and balances for laboratory approvals including qualified non-project personnel approving field laboratories can reduce the potential that the laboratories don't meet minimum standards.</p> <p>Examples of qualified non-project personnel include:</p> <ul style="list-style-type: none"> • Accredited State DOT Central laboratory. • Accredited or Qualified District laboratory. • Accredited or Qualified Region laboratory. • AASHTO Accreditation Program or a comparable laboratory accreditation program approved by the FHWA. <p>Rating:</p> <ul style="list-style-type: none"> • 3 if qualified, non-project personnel are used. • 0 if project personnel or non-qualified personnel are used. 	Laboratory Qualification	3	—
19.	<p>Does the State DOT qualify sampling and testing personnel through a program that includes: 1) formal classroom training of sampling and testing procedures, 2) a written examination, 3) testing to demonstrate proficiency, 4) requalification procedures with some proficiency and/or knowledge demonstration, and 5) documented process for retraining or removing personnel? Consider programs for the following material types:</p> <ul style="list-style-type: none"> • Asphalt pavement. • PCC. • Soils & aggregates. <p>Robust personnel qualification programs for sampling and testing reduce the potential risk of inaccurate testing.</p> <p>Criteria for qualification programs:</p> <ul style="list-style-type: none"> • Formal classroom training on sampling and testing procedures. • Written examination. • Demonstration of testing proficiency. • Requalification procedures with some proficiency and/or knowledge demonstration. • Documented process for retraining or removing personnel that perform the sampling and testing procedures incorrectly. <p>Rating:</p> <ul style="list-style-type: none"> • 7 if all five criteria are met for all three material types. • 5 if all five criteria are met for two of the material types. • 3 if all five criteria are met for one of the material types. • 0 if all five criteria are not met for at least one material type. 	Personnel Qualification/Certification:	7	—

Table 1. 2022 QA Assessment questions and ratings (continued).

Number	Question, Criteria, and Rating	Area	Weight	Weight Standard
20.	<p>Does the State DOT have a standardized QA program for alternate project delivery (e.g., Design-Build) projects?</p> <p>As part of agency acceptance for alternate project delivery, development and use of a standardized QA program when such projects are commonly used will improve efficiency and consistency of implementation.</p> <p>Rating:</p> <ul style="list-style-type: none"> • 3 if the State DOT has a standardized QA program for alternate project delivery projects. • 0 if the State DOT does not have a standardized QA program for alternate project delivery projects. <p>For those State DOTs that have advertised fewer than five alternate project delivery projects in the past 3 years this question is not included in the overall rating.</p>	Alternate QA Programs	0/3	Question is not rated if the State DOT has advertised fewer than five alternate project delivery projects in the past 3 years.
21.	<p>Does the State DOT have a standardized QA program for all Federal-aid projects administered by local public agencies (LPA)?</p> <p>As part of agency acceptance for LPA projects, the development and use of a standardized QA program for all Federal-aid projects administered by an LPA will improve efficiency and consistency of implementation.</p> <p>Rating:</p> <ul style="list-style-type: none"> • 5 if the State DOT has a standardized QA program for all Federal-aid LPA projects including if the State DOT’s standard QA program for State DOT administered projects is also used on all LPA projects. • 0 if the State DOT does not have a standardized QA program for all LPA projects. <p>In the case of large local agencies with an agency-specific QA program that has been reviewed and approved by the Division Office or State DOT for use with Federal-aid highway funds, those LPA programs will be considered to meet the standardized QA program criteria.</p>	Alternate QA Programs	5	—

Note: Question weight may vary based on whether a State DOT’s program includes certain items (e.g., use of contractor test results in the acceptance decision, PCC pavement standard specification, alternative contracting methods).