



U.S. Department  
of Transportation

**Federal Highway  
Administration**

# Program Review

## National Review of State Cost Estimation Practice

**February 2015**



**Final REPORT**

### National Review Program

The National Review Program provides program evaluation at the corporate level for the Federal Highway Administration.

The program evaluations help to enhance program effectiveness, ensure more program consistency, and identify successful practices across the Nation.

## Table of Contents

Executive Summary .....	2
Background .....	4
Purpose and Objective .....	7
Scope and Methodology.....	8
Team Members .....	10
Observations and Recommendations .....	11
Successful Practices .....	21
Conclusion .....	26
Action Plan .....	27
Appendices .....	28
Appendix A - FHWA Division Office Cost Estimating Review Guide Questions .....	29
Appendix B – Review Guide Question Results .....	38

## Executive Summary

This national review of state cost estimation practice is a follow up activity to the U.S. Department of Transportation Office of Inspector General (OIG) Audit Report Number [MH-2013-012](#), “FHWA Has Opportunities to Improve Oversight of ARRA High Dollar Projects and the Federal-aid Highway Program” and the Government Accountability Office (GAO) Report No. [GAO-09-751](#), *Federal-aid Highways: FHWA has Improved Its Risk Management Approach, but needs to improve its Oversight of Project Costs*, July 2009.

The OIG review focused on the ARRA program which occurred during the economic downturn in 2008-2010. During this period a nationwide pattern of increased competition and lower bids was realized. Since State DOTs typically rely on historical bid data for use in preparing project cost estimates, the State’s engineer’s estimate (EE) lagged market conditions. The bids received during this time period were 10 to 30 percent below the EE. While low bids are typically considered beneficial from a funding standpoint, large variance from the EE may be more indicative of a cost estimating process that does not reflect market conditions. Overestimation of project costs causes inefficient use of public funds that could be used on other projects.

Maintaining and applying a standard documented process is essential to support the approving authority for estimates of project cost. The Divisions must approve estimates of project costs submitted by State DOTs. The State DOT’s estimate of project cost must be documented and provide the best estimate of costs. The State DOT is also required to maintain a process to adjust project cost estimates to reflect current costs and maintain a process to document a cost analysis of contract changes that is approved by the Division.

The review team conducted a nationwide survey of cost estimation practice and procedures used by State DOTs. The review focused on the documentation of the cost estimate development process, market conditions and risks, and the bid review and analysis process. The review identified ways to improve the consistency and accuracy of the cost estimation process through observations and recommendations.

### Key Recommendations:

- FHWA should work with AASHTO’s Technical Committee on Cost Estimation to develop national training consistent with AASHTO’s “Practical Guide to Cost Estimating”. The training should target competency level and be available in a variety of formats to maximize participation and access.
- As Divisions assess their State DOT’s documented process for cost estimation, they are encouraged to use AASHTO’s “Practical Guide to Cost Estimating” to

ensure the process adequately addresses all necessary components for reliable cost estimating practices.

- FHWA Headquarters should update its [Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation, January 2004](#) to include procedures to assess the competitive bidding environment during rapidly changing market conditions.
- Consistent with Risk-Based Stewardship and Oversight principles, FHWA Division Offices should conduct periodic reviews of State DOT's cost estimating procedures to verify the procedures address key recommendations from this report including that they adequately address the competitive bidding environment as a result of changed market conditions.
- Divisions should work with their State DOTs to maintain the confidentiality of the engineer's estimate up to award to ensure competition.
- Divisions should work with their State DOTs to establish methods to evaluate bids so that significant differences can be understood and provide a better comparison.

The survey results provide many insights into the current cost estimation practice of State DOTs. As many as 80% of State DOTs indicate they have documented cost estimation procedures. However, the review found the procedures often lack successful elements of recommended practice as contained in AASHTO's Practical Guide on Cost Estimation. Almost every State DOT uses historical bid-based data to prepare estimates. However, their cost estimating procedures may not capture rapidly changing market conditions. This is a continuing systemic weakness of many State DOTs cost estimation procedures. As many as 70% of State DOTs do not use a structured risk-based approach to develop cost estimates. As such, there are opportunities for process improvements particularly when considering high risk changing market conditions or complex projects. While the team found some areas in need of improvement, a number of successful practices were identified that have the potential to improve cost estimation practice.

## Background

The FHWA National Review Program (NRP) provides program evaluation at the corporate level to enhance program effectiveness, ensure greater program consistency, and identify successful practices across the Nation. The NRP is an annual program of reviews conducted by teams comprised of experienced FHWA personnel. Review topics are selected through an annual call, an analysis of risk statements developed by FHWA unit offices, and in consultation with FHWA Program Offices. State cost estimation practices was selected for review in 2013 and was sponsored by the Office of Infrastructure (HIF) and the Program Management Information Team (PMIT).

Between January 2010 and July 2012 the U.S. Department of Transportation Office of Inspector General (OIG) reviewed 32 projects in 21 States and Washington, DC, for compliance with value engineering requirements and to assess whether ARRA funds were obligated based on the State DOT's best estimate of cost. As part of the review, the OIG interviewed FHWA, State and local officials and consultants and contractors; reviewed relevant laws and FHWA regulations, policies, and guidance; and examined project documents.

The OIG review focused on the ARRA program during a recessionary period and found that State DOTs routinely received low bids ranging from 10 percent to 30 percent below the States' engineering estimates. While low bids are considered beneficial from a funding standpoint, large variance from the State DOT's estimate may be more indicative of a cost estimating process that does not reflect market conditions. On November 14, 2012, the OIG issued Audit Report Number [MH-2013-012](#), "FHWA Has Opportunities to Improve Oversight of ARRA High Dollar Projects and the Federal-aid Highway Program". One of the recommendations in the OIG report stated: FHWA should "verify that Division Offices review each State's procedures for estimating costs, including procedures to conduct periodic reviews and to address significant changes in market conditions". The FHWA concurred with this recommendation.

In addition to the OIG report, the Government Accountability Office (GAO) Report No. [GAO-09-751](#), *Federal-aid Highways: FHWA has Improved Its Risk Management Approach, but needs to improve its Oversight of Project Costs* published in July 2009. In the report the GAO made the following recommendation to FHWA: "to develop and implement a process to periodically evaluate the state's cost estimating practices". FHWA concurred and set-out action plan to address which include the CER program review contained herein. The FHWA concurred with the GAO recommendation and set-out an action plan which included this national cost estimate survey review.

On May 7, 2013 the FHWA provided an informational memorandum to the Division Administrators announcing a national review of project cost estimating procedures used by State Department of Transportation pending the completion of review guide questions. The review was to be completed by September 30, 2014. The memorandum also provided an enclosed copy of AASHTO report "Practical Guide to Cost Estimating" which was published in 2013.

On August 29, 2013 the FHWA provided a follow up informational memorandum to the Division Administrators announcing the availability of review guide questions, a SharePoint site to complete the review, as well as technical webinars to assist Divisions in the completion of the reviews.

### **Overview of Laws and Regulation Related to Cost Estimating**

23 USC 106(g)(1)(A) requires the Secretary to establish an oversight program to monitor the effective and efficient use of funds. Section (B) directs the Secretary to develop minimum standards for estimating project costs and to periodically evaluate the practices of States for estimating project costs, awarding contracts, and reducing project costs. For Major Projects where the estimated total cost is \$500,000,000 or more, section (h)(1) requires States to submit a project management plan and an annual financial plan which includes detailed estimates of cost and schedule to complete.

In accordance with 23 CFR 630.106 *Authorization to Proceed*, paragraph (a)(3) a State's request that Federal funds be obligated must be supported with a documented cost estimate that is based on the State's best estimate of costs. In addition paragraph (a)(4) of this section indicates the State must maintain a process to adjust project cost estimates. For example, the State is required to review inactive projects (i.e. those projects for which no federal funds have been expended) on a quarterly basis and revise the Federal funds obligated for a project within 90 days to reflect the current cost estimate.

CFR 630.205 *Preparation, submission and approval*, paragraph requires the State to submit to FHWA for approval a PS&E package that includes an estimate of construction costs of the project. The estimate must include sufficient detail to provide an initial prediction of the financial obligations to be incurred by the State and FHWA and to permit an effective review and comparison of bids received.

Paragraph (e) of CFR 635.120 *Changes and extra work*, requires the State to perform and document a cost analysis of each negotiated contract change or negotiated extra work order. The method and degree of the cost analysis is subject to the approval of the Division Administrator.

## Select Cost Estimating Guidance

There are many excellent resources available to State DOTs for use in developing cost estimates. A few of the more notable guides are highlighted below.

Much of the FHWA's non-regulatory guidance on cost estimation is contained in [Guidelines on Preparing Engineer's Estimate, Bid Reviews, and Evaluation](#) dated January 20, 2004. The guide provides an excellent overview of cost estimation and introduces numerous fundamental concepts including the accuracy of the engineer's estimate. While the need to account for market conditions is mentioned within the document specific guidance on how to account for changes in market conditions is not provided.

The FHWA also provides [Major Project Program Cost Estimating Guidance](#) – January 2007 that is an excellent resource including key concepts, cost elements and check lists that need to be considered in the estimate development process. However, this guidance is primarily targeted at Major Projects that exceed \$500 Million in cost.

More recently, AASHTO published [Practical Guide to Cost Estimating](#) in 2013 and is a highly recommended resource for use by FHWA and State DOT's. This document provides basic and essential information critical to the estimate development process. The guide overviews the different types of estimates including conceptual, bid-based, cost-based, and risk-based as well as the key elements to include in each. The guide provides consistency in terms of definitions and terms to be used. As noted earlier, the guide was provided to all Divisions in the May 7, 2013 FHWA informational memorandum to the Divisions.

## **Purpose and Objective**

The purpose of this national review was to document the cost estimation practices in use by State DOTs. The review focused on the documentation of the cost estimate process to include market conditions and risks, and the bid review and analysis process. The review identifies ways to improve the consistency and accuracy of the cost estimation process through observations and recommendations. The review also identifies successful practices that have potential to improve cost estimation practice if implemented. The results of the review will serve as a benchmark for the periodic evaluation of procedures in use by State DOTs.



## Scope and Methodology

This review was conducted through a national survey developed by FHWA staff including representatives from the Program Management Improvement team, Office of Infrastructure, Office of Innovative Program Delivery, Select Division Offices, and the Resource Center. A series of questions were developed by the team to form a review guide focusing on the following areas:

- Documentation of estimate development process
- Market conditions and risks
- Bid review and analysis

The intent was for the review guide questions to be completed by the Division offices following consultation with their State DOTs. The review guide questions were distributed to the Divisions in an August 29, 2013 memorandum. After the review guide questions were finalized the team developed an internal SharePoint site, see Figure 1, for Divisions to upload their responses. Using SharePoint simplified the data collection process from the Divisions and streamlined the data analysis.

In addition to the SharePoint site, a series of training sessions were presented to the Divisions to ensure a more consistent approach and interpretation of review guide questions. These training sessions included a kick-off webinar on October 1, 2013 announcing the review and the presentation of an overview to an internal SharePoint site used to collect review responses. A technical webinar was held on November 19, 2013 to answer Division questions about the review guide questions. On January 21, 2014 a peer exchange was held and two lead Divisions that had completed the review shared personal experiences on successes with completing the review guide questions. The Division Offices successfully completed their reviews on September 30, 2014. 51 Divisions submitted completed reviews.

The review team compiled the results of the review as shown in the Appendix. The results are presented in a format to maintain the privacy of the individual State DOT responses. In addition to providing a graphical summary of the response to each question, supplementary explanations were collected to clarify and provide a “window” into the basis for the responses. The supplementary explanations were analyzed and grouped within logical areas to better reflect the variety of responses. This allowed the team to better assess the response to each question and identify areas of needed improvement. As shown in the Appendix, the summary of explanations is presented in a table under each graphical response to the question.

Cost Estimate Review » Home

Cost Estimate Review

Review Guide Questions  
Resource Documents  
Discussion Board  
Submission Form

Recycle Bin  
All Site Content

**Your Cost Estimate Review Support Site**

Use this site complete the review, find help, and get your questions answered. Start with your check list.


**Check List**

1. Listen to October 1, 2013 Kick-off Meeting [Recording](#).
2. Listen to the November 19, 2013 Technical Webinar "partial" [Recording](#)
3. Listen to the January 21, 2014 Peer Exchange Webinar [Recording](#)
4. Send a copy of the Cost Estimating Review Guide questions to your State DOT contact in charge of cost estimating
5. Each Division received a copy of AASHTO's "Practical Guide to Cost Estimating 2013 First Edition". Read the book and familiarize yourself with the fundamental concepts.
6. Review you're State's cost estimating procedures.
7. Read the Cost Estimate Review Guide Questions and make note of any questions you may have.
8. Arrange a meeting with your State DOT and review the review guide questions together making note of any outstanding questions you may have.
9. Record any outstanding questions in the [Discussion Board](#) which is monitored by the review support team.
10. Participate in a webinar about the cost estimate review to be arranged by the technical review support team. **The technical webinar will be held November 19th 1-3 PM Eastern.**  
<https://connectdot.connectsolutions.com/divisioncer/> Conference Phone: 1-877-336-1839 Access Code: 2006524#
11. Ask your questions at the webinar. If you do not get your questions answered ask your questions on the [Discussion Board](#).
12. If you would rather contact the technical support team directly please feel free to do so. Contact information is shown on the right of this homepage.
13. After you have answered your questions fill out the review guide questions in the Microsoft Word file or on paper.
14. Click the link [Submission Form](#) to complete your review. Click **Add New** to initiate your review submission. Fill out the form online using your prepared responses. You can either copy and paste your response from the Word file into the online form or type your responses directly into the form. You do not have to fill out the form all at once. You can always return and complete the form later by selecting your entry and clicking the edit button in the toolbar. **Please do not create multiple form entries for your Division.** You should only have one entry for each Division. After you have completed your review change the last form entry to "Submit Completed Form". The form will perform conditional checks to evaluate your entries and ensure a complete response to required fields.

**Need Help?**  
[Scope and objectives of review](#)

Edwin Okonkwo  
HQ Contract Administration Team  
Ph: 202-366-1558  
[Edwin.Okonkwo@dot.gov](mailto:Edwin.Okonkwo@dot.gov)  
[Cost estimation questions or SharePoint site support](#)

Michael Smith  
Resource Center CPM TST  
Ph: 404-562-3694  
[michael.smith@dot.gov](mailto:michael.smith@dot.gov)



**Figure 1 FHWA Internal SharePoint site used to collect cost estimation response from FHWA Division Offices.**

## **Team Members**

The co-team leaders for this review were:

Michael Smith  
Project Management Engineer  
FHWA Resource Center

Edwin Okonkwo  
Contract Administration Engineer  
FHWA Office of Infrastructure

The team members for this review were:

Michael Kulbacki  
Area Engineer  
FHWA WY Division

Leslie Lahndt  
FHWA IN Division  
LPA Transportation Engineer

Craig Actis  
FHWA Resource Center  
Project Management Engineer

Michael Graf  
PMI Team Leader  
FHWA Program Management Improvement Team

James Sinnette  
Project Delivery Team Leader  
FHWA Office of Innovative Program Delivery

## Observations and Recommendations

Based on the Division Office response to the review guide questions presented in the appendix the following observations and recommendations are provided in the following areas:

- Documentation of estimate development process (see questions 1, 2, 3, 4 a-n, 5 and 6).
- Market conditions and risks (see questions 4h, 4i, 4j, and 4 k-m)
- Bid review and analysis (see questions 13 – 18, 24, and 25).

### Documentation of Estimate Development Process

#### **Observation # 1**

As shown in the response in the appendix to Question # 1 - 80% (41/51) of States, indicate they have a documented process for the preparation and management of cost estimates. Of the States that do, most use a standard process across all project types, size, and complexities except for alternate contracting methods. Those State DOTs that do not have a documented process indicated their system of estimating was informal (i.e. not written down) and based on institutional knowledge.

State DOTs are required to submit a documented cost estimate that is based on the State's best estimate of costs. The State DOT is also required to maintain a process to adjust project cost estimates. Having a documented process is a critical factor to achieving consistency in the estimation of project costs and review of bids received. A documented process increases the State's ability to provide accurate and timely updates that reflect current cost estimates.

#### **Recommendation # 1**

It is recommended that Divisions work with their State DOTs to establish a documented process to estimate project costs. Divisions are encouraged to share and promote the AASHTO "Practical Guide to Cost Estimating" that was provided in a May 7, 2013 FHWA informational memorandum to Division Administrators as a key resource to be used in the establishment of documented cost estimation procedures.

#### **Observation # 2**

As shown in the response to Question # 2 - 41% (21/51) of States indicated their cost estimating process is different based on project size, contracting type, etc. 76% (39/51) of States commented that their process was standard across all project types, size and complexities except for alternate bidding methods as applicable. Design-build, Best Value, Construction Manager / General Contractor and other alternative contracting methods used different cost estimating processes.

**Recommendation # 2**

Maintaining and applying a standard process in cost estimation is essential to producing consistent estimates. However, the standard process should be scalable to allow for flexibilities for smaller or less complex projects. As projects become larger and more complex the process should allow for increased control and greater consideration of project risks including a structured assessment of threats and opportunities to cost and schedule. Scalability lends toward greater efficiency and effectiveness in program delivery and is a desirable aspect of a quality process. It is recommended that Divisions work with their States to include project scalability as a factor in the estimate development process.

**Observation # 3**

As shown in the response to Question # 3 – 74% (37/50) of States responding indicated the primary estimating technique for the final estimate is based on historical bid-based estimates, 2%(1/50) on cost based estimates, and 24% (12/50) on both historical and cost-based estimates. Historical bid-based estimates use cost data from recent contracts as the basis for unit prices used in developing cost estimates.

The use of historical data is a widely accepted practice in developing cost estimates. Historical data are often stored for 3 to 5 years. However, price averaging typically limits the analysis to 1 to 2 years. The recession of 2009 revealed a systemic weakness in the State's ability to provide reliable cost estimates based on historical data that reflect changed market conditions.

**Recommendation # 3**

Following the completion of recommendation # 8, Divisions should work with their State to ensure that cost estimating procedures include a process to adjust the State's estimate to reflect changed market conditions as defined by the competitive bidding environment. FHWA Division Offices should conduct periodic reviews of State cost estimating procedures to verify the procedures adequately address the competitive bidding environment as a result of changed market conditions.

**Observation # 4**

As shown in Question #4 a – 78% (39 / 50) of States indicated their documented process includes regular review, update and approval of estimates. Regular estimate reviews and updates at certain milestones when significant changes occur, or at regular time intervals, are important to maintain an up to date cost estimate.

**Recommendation # 4**

It is recommended that all Divisions work with their State DOTs to incorporate reviews and updates as regular milestones in their documented cost estimating procedures.

**Observation # 5**

As shown in Question # 4 d - 78% (40 out of 51) of States indicated their documented process includes data source identification and update for bid-based estimates. Of the 40 States responding positively, 24 States indicated they use historical bid information, 17 indicated the use of Bid X, Bid Tab Pro, AASHTO BAMS-DSS Software, OMAN system or other internal developed software/database to maintain data and/or for comparison and statistical analysis purposes, and 7 indicated their state used established process and documentation requirements outlined within internal guidance.

**Recommendation # 5**

A State DOT's request to obligate Federal funds must be supported by a documented cost estimate. Additionally, the State DOT is required to maintain a process to adjust the estimate. It is recommended that State DOTs provide guidance to those preparing estimates on the appropriate documentation required to support the estimate of project cost.

**Observation # 6**

As shown in Question # 4 subparts a-n in the appendix, of the 85% of States that do have documented processes, the processes do not address one or more of the key elements of the AASHTO's "Practical Guide to Cost Estimating Chapter 3 Bid-Based Estimates.

AASHTO's "Practical Guide to Cost Estimating" has established guidelines of components of quality cost estimating processes. These components consist of such items as consideration of the entire scope of the project as well as geographical location, amount of other work of a similar type in the same time frame, market conditions, contingency, risk, and scalability as mentioned in the observation above. Refer to Question # 4 subparts a-n in the appendix for a more complete listing of these components.

**Recommendation # 6**

Divisions should assess their State DOT's documented process using AASHTO's "Practical Guide to Cost Estimating" to ensure that the process adequately addresses all necessary components for reliable cost estimating practices. To assist in this process it is recommended that FHWA work with AASHTO's Technical Committee on Cost Estimation to development national training in cost estimation that provides instruction on how to develop a cost estimating process consistent with AASHTO's "Practical Guide to Cost Estimating". The training should target competency level and be available in a variety of formats (on-site, on-line, instructor-led, self-paced, and blended) to maximize participation and access to the materials.

### **Observation # 7**

As shown in Question # 5 and 6, approximately 20% of States do not have a group or organization within their State that is responsible for the preparation, checking, review, updating, or approving of estimates.

### **Recommendation # 7**

It is recommended that all State DOT's establish contacts of responsibility for the development and approval of cost estimates in accordance with the State's documented process.

## **Market Conditions and Risks**

### **Observation # 8**

As shown in Question # 4 h - 67% (34 out of 51) of States indicated they include market conditions (i.e. competition) adjustments in the estimate. 16% (8 out of 51) indicate they do not include market conditions. 18% (9 out of 51) indicated the question was not applicable to their state. Of the 34 States responding positively, 25 indicated market conditions were factored into individual unit bid items (e.g., fuel costs, steel costs, etc.), 6 evaluation of trends by reviewing construction cost index data, 5 competition components factored in through use of AASHTOWare Project Estimator or historical competition levels through prior lettings, and 4 establish base variability or confidence interval for market conditions and/or cost escalation rates based on statistical modeling and adjusted based on similar projects.

As shown in the responses there are varying interpretations of market conditions and how it should be included into the cost estimation process. Incorporating the *competitive forces* that changing market conditions bring about is a critical element to the cost estimation process. State DOTs that rely on historical bid data (See observation # 3) may not adjust estimates in time to reflect changed market conditions causing the State to over or underestimate a project costs.

### **Recommendation # 8**

The available cost estimation guidance has advanced since the publication of FHWA Report: [Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation, January 2004](#). For example, the FHWA Major Projects team uses a probabilistic approach to assess market conditions. The current guidance should be revised to incorporate a more rigorous treatment of high risk market conditions (i.e. rapidly changing bidding environment) as well as other factors such as work season, contractor availability, multiple projects, etc. that reduce risk and enhance the competitive bidding environment.

**Observation # 9**

As shown in Question # 4 i - 49% (25 out of 51) of States indicate their State's documented process defines contingency and what it represents. 25% (13 out of 51) indicate their process does not and 25% indicate the question was not applicable. Of the 25 responding positively, 19 States indicated a specific definition for contingency was provided within internal guidance/manual, 5 States indicated a contingency percent was based on the project phase, historical values, a set percentage, and/or assumed level of overall uncertainty.

**Recommendation # 9**

From the response to this survey question, half of the States do not have a clear definition of contingency and what it represents. As a result State DOTs may be assuming unnecessary risk in the estimate development process. The topic of contingency is addressed within AASHTO's Practical Guide to Cost Estimation. It is recommended that all State DOT's procedures define contingency as part of their cost estimation process.

**Observation # 10**

As shown in Question 4 j - 63% (32 out of 51) of States indicate their documented process provides the appropriate contingency amounts in the estimate, while 12% (6 out of 51) indicate their process does not and 25% (13 out of 51) indicate the question was not applicable. Of the states responding positively, 17 indicated that ranges are provided to allow for risks and uncertainty, 8 indicated that a standard contingency was included within the estimate, and 7 indicated that the contingency percentage varies depending on the project development stage, type, and/or project cost with consideration for inflation.

**Recommendation #10**

All State DOTs need to incorporate contingency into cost estimates to compensate for potential project risks. The topic of contingency is addressed within AASHTO's Practical Guide to Cost Estimation. It is recommended that all State procedures define and use the appropriate amount of contingency to mitigate project risks.

**Observation # 11**

Approximately 70% of respondents to questions 4 k, 4l, and 4 m indicated the questions were not applicable. The questions: does the documented process provide: (4 k) a comparison of contingency amounts to historical contingency percentages, (4 l) the risk identification process, and (4m) peer review of estimates by an experienced and unbiased review team, all assume the use of risk-based estimates. The high number of not applicable responses are probably due to State DOT's not using a risk-based procedure.



### **Recommendation # 11**

The topic of risk-based estimates is addressed within AASHTO's Practical Guide to Cost Estimation. It is recommended that State DOT's use a risk-based cost estimating approach for high risk market conditions and complex projects.

### **Bidding Process**

#### **Observation # 12**

As shown in the appendix Question 13 - 65% (33 out of 51) of States indicated internal policy exists on award or rejection of bids at a set level above the Engineer's Estimate (EE), and of these states, Question 14 - 59% (30 out of 51) have specific award/rejection thresholds requires documentation of these decisions. Those states with conditions for award utilized established guidelines within their specifications and/or policies. Six (6) states indicated justification to higher approval authority was required when low bid exceeded specific acceptable levels. Seven (7) states without specific policy or guidance utilize a general percentage range for determining acceptable bid range(s). Specific internal guidance is used by 15 States in developing award justification documentation for award authority (i.e. Transportation Commission, Chief Engineer, etc.). When bid amounts are significantly higher, 1 State indicated information from contractor is utilized to support award recommendation presented to approval authority.

#### **Recommendation # 12**

- States should assess the distribution of bid results and use in selection process to determine if the EE contains errors. This assessment will provide a basis for acceptance of bids using current market condition factors and/or costs using median of bidder(s) unit prices.
- Documentation to justify award is necessary to provide approval authority basis for award decision.
- Utilize *FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation* (January 30, 2004) recommendations in developing acceptable condition criteria.

#### **Observation # 13**

As shown in the response to Question 15 – the data indicates a wide variance of how the EE is disseminated. Approximately 31% (16 of 51) of the States never disclose the EE, and those that disseminate, 29% (15 of 51) disclose data at bid opening. A group of States (14) indicated a range of estimated contract values is released and/or anticipated award amount specific to project published prior to bid letting based on project type and/or other criteria. The process by which this information is released varies by State, and as shown in the appendix Question 16 - 47% (23 of 49) release EE after receipt of bids, while the remaining states either never disclose data, during the

bidding process, or release upon request only. As shown in the appendix Question 17 – 37% (19 of 51) of States indicates interpretation of State Law dictates their EE confidentiality procedures related to public release. Nine (9) States utilize specific internal agency controls and policy regarding EE confidentiality.

#### **Recommendation # 13**

- Disadvantage of disclosing the EE cost during bidding process to public is contractors desiring to rig bids can use the EE as a basis for determining the low-bid amount to be submitted.
- Maintaining confidentiality of the EE up to award ensures market conditions are reflected within contractors submitting bids, and increases likelihood of better competition.
- Submitting range of costs provides a basis, and general guide to bidders in establishing a more accurate bid bond.
- Utilize *FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation* (January 30, 2004) recommendations in developing acceptable EE confidentiality criteria.

#### **Observation # 14**

As shown in the appendix Question 18 – 73% (37 of 51) of States contact lowest responsible bidder when excessive differences exist between the EE and lowest responsive bid. A group of States (9) indicated they contacted non-bidders if unit costs are inconsistent with the EE to gain a more complete assessment of market conditions and unit cost price trends.

#### **Recommendation # 14**

- During bid analysis process, contacting lowest responsible bidder and non-bidders provides a better comparison of bid prices and basis for understanding significant differences.
- Existing market conditions may not be reflected in historical unit bid database used in development of the EE; therefore, contacting lowest responsive bidder and non-bidders clarifies assumptions used by contractors.
- States use of Bid Analysis and Management System / Decision Support System, (BAMS/DSS), a module within the AASHTO Trns-port® software package, also provides an additional analysis method to justify differences between EE and lowest responsive bid.
- Utilize *FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation* (January 30, 2004) recommendations in developing acceptable EE confidentiality criteria.

### **Observation # 15**

FHWA Divisions assessed bidding data for 30 random projects selected under the Compliance Assessment Program (CAP) for 2012 and 2013 project data. As shown in the appendix Question 24 – 39% (20 of 51) of States indicates the highest concentrations of bidders are between 3 and 4, 27% (14 of 51) between 4 and 5, and 18% (9 of 51) between 2 and 3. The data indicates adequate level of competition as compared to national trends and correlates with final report (3.36 average number of bidders) - [AASHTO/FHWA Survey on Construction Cost Increases and Competition, April 2006](#). As shown in the appendix Question 24c specific trends were identified. Six (6) States indicated that percentage of incidences when lowest responsive bid was below the EE increases with number of bidders. In addition, 6 States indicated 50% of their projects were below the EE and within 10%.

The review team conducted additional analysis of the CAP project data used by Divisions to respond to Question 24. The team analyzed data for engineer's estimate (EE), the Low Bid (LB), and the # of bidders. Based on a review of 1611 project the team found the following:

Average EE = \$4,401,147  
Average LB = \$4,113,588  
Average # Bidders = 4.5  
# Projects within 10% of EE = 774

As shown the percentage of project on a national basis that are within 10% of the EE nationally is 774, or 48%, which is slightly under FHWA's non-regulatory guidance [Guidelines on Preparing Engineer's Estimate, Bid Reviews, and Evaluation](#) dated January 20, 2004 which states "the engineer's estimate should be within 10 percent of the low bid for at least 50 percent of the projects."

The team also analyzed the CAP project data by project size as shown in Table 1. The largest number of projects are between \$1 million and \$10 million with the average number of bids = 4.6. Projects between \$10 million and \$50 million had a slightly higher average number of bids at 4.7. While the data may suggest the larger the project size the greater the number of bids. For projects exceeding \$50 million there is insufficient data to draw significant conclusions.

**Table 1. Analysis of State Engineers Estimate, Low Bid, and # of Bidders for Compliance Assessment Program Project Data for years 2012 and 2013.**

Project Size			
Min	Max	# Projects	Avg # Bid
-	100,000	56	3.8
100,000	1,000,000	628	4.5
1,000,000	10,000,000	767	4.6
10,000,000	50,000,000	134	4.7
50,000,000	75,000,000	5	6.0
75,000,000	100,000,000	5	6.0
100,000,000	150,000,000	4	6.3

**Recommendation # 15**

- To increase and/or maintain number of bidders recommend conducting cost-estimating training to ensure risk considerations are adequately considered in the EE.
- Consider bundling, tying, or grouping projects to ensure size and overall construction cost estimates are within range that generates interest within potential contractor marketplace.
- Develop risk-based cost estimation process to better manage and identify potential known risks through risk register and ensure reflection within the EE.
- Balance size and work type within lettings to maximize participation based on contractor capacity.
- Reject non-competitive bids and re-advertise to increase potential responsible bidders.

**Observation # 16**

As shown in the appendix Question 25 – 80% (41 of 51) of States indicates based on results of this review, follow-up program review is not necessary. Six (6) States indicated a review was in progress to evaluate and improve current cost estimate preparation procedures. States indicating a need for follow-up review identified the following as the critical areas: (3 States) – Establish more uniform cost estimate policies and procedures throughout project development continuum; (3 States) –

Evaluate cost estimating documentation and management of total project costs through construction; and, (3 States) – Conduct process/program review on cost estimating and bid analysis. More recent follow-up communications with Divisions indicate that only 2 or 3 reviews will be needed to support Division initiatives.

**Recommendation # 16**

- Coordinate with FHWA Division Office to solicit input and technical assistance on evaluation of cost estimating procedures.
- Utilize *FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation* (January 30, 2004) recommendations in developing a formal cost estimating and bid analysis process.

## Successful Practices

The following successful practices were identified as through this cost estimation survey. As can be seen about 25 states indicated they have developed their own internal guidance and manuals outlining cost estimation procedures, 10 States incorporate internal reviews to improve their cost estimating procedures, 8 States have established teams or units to develop cost estimates, 7 States have developed their own models and software and models, while 3 States use standard off the shelf software. A few States identified highly advanced systems that include access to extensive resources to prepare cost estimates.

AK: Developed own internal cost estimating guidance/manual; utilizes customized parametric based estimating BIDTAB program; internal memo outlining obligation activities at various project stages,

AL: Developed own internal cost estimating guidance/manual; formalized process (memo) to meet with low bidder,

AR: Developed own internal cost estimating guidance/manual; formalized process (memo) to meet with low bidder; programs and contracts division provides third level of check on cost estimates; established AHTD Review Committee approves projects; Construction Division has a Subcontract Administrator that reviews and acknowledges that the proposed subcontract is accurate and meeting the requirements of the contract according to Sec. 108.01 of the AHTD Standard Specifications.

AZ: Utilizes own in-house software called FAST for collecting and storing historic bid price data; Developed own internal cost estimating guidance documents,

CA: Developed own internal cost estimating guidance/manual; utilizes customized parametric based estimating models; extensive resource documentation on cost estimation process; certification process for costs estimates with EE >\$1M; internal process for conducting independent analysis of change orders,

CO: Developed internal CDOT engineering and market analysis manual; designated unit within CDOT - Engineering Estimate and Market Analysis (EEMA) unit,

CT: Developed own internal cost estimating guidance/manual,

DE: Process review completed on preparation of engineering estimates and determining initial contract time,

FL: Developed own internal cost estimating guidance/manual; Long Range Estimating System for managing estimates; annual studies of market areas performed with areas of concern identified. If trends and unusual bidding patterns are detected they are then forwarded to IG for further investigation.

GA: Developed own internal cost estimating guidance/manual; under development - GDOT estimating procedures manual

IA: Developed own internal cost estimating guidance/manual; Division monitors DOT cost estimating accuracy and developed report based on review

ID: Developed own internal cost estimating program for use in basis in developing EE; Ongoing joint team ITD/FHWA evaluating improvements to costs estimates

IL: Developed own internal cost estimating guidance/manual; ProEst contains functionality to automatically download and maintain databases for prevailing wage rates and equipment costs and also allows for custom material databases, labor force projections, and other potential contract costs; engineering estimate is maintained as confidential with assistance by district

IN: Developed own internal cost estimating guidance/manual; Construction staff coordinates with project manager to run OMAN on determining historical costs for unit items within change order; Internal guidance/manual/procedures on determining collusion and/or assessing market conditions

KS: has written procedures that discuss the types of reports and analysis to run to detect evidence of collusion and antitrust issues

KY: Mobilization excluded from cost estimate on projects <\$2M

LA: Developed own internal cost estimating guidance/manual; during the plan development process, each section (bridge, roadway, ITS, geotechnical, etc.) will develop cost estimates for their section. In each section, two engineers will development a separate cost estimate for each project and then compare estimates. The two engineers will reconcile any different in unit cost in the estimate. The section will then send the revised estimate to the project manager.

MA: Developed own internal cost estimating guidance/manual; web based bid analysis and posting of historical bid values; After a comprehensive evaluation of the factors influencing the construction sector, statistical modeling techniques are applied using these data series to project future market conditions; The Comptroller of the Commonwealth of Massachusetts has issued A Toolkit for Departments to Combat

Fraud, Waste and Abuse dated November 2009 (see attached). Training is provided by MassDOT in Fraud Awareness and Prevention.

MD: Developed own internal cost estimating guidance/manual; Manual provides comparison of various items depending on the cost estimates used (cost per mile estimate, major quantities estimate, or detailed estimates) with unit price bid analysis or with recently bid similar projects or price index (page F9 and F13); SHA's Office of Finance is looking/working into running new reports to document when projects are at 90% or better of their approved budget (for State and Federal funds). These reports will be provided to the fund managers who then would communicate the information to the project managers to aid in managing their funds and/or projects.

MI: Developed own internal cost estimating guidance/manual; Verify change order estimates using WIRS (Work Item Reporting System) which utilizes bid-based prices; Utilize Road Cost Estimating Checklist for developing project conditions; MDOT sends the Division Office a month report on number of projects bid and a trend of bid prices

MO: Bid analysis information is captured in the Project of Interest document and distributed to the Division staff for review and members of MoDOT management.

MS: Developed own internal cost estimating guidance/manual; Planning Office will review past lettings to evaluate prices with respect to the number of bidders and pay item quantities; estimator develops independent cost estimates for change orders based on average pricing generated with the use of AASHTO Trns-port® software

MT: Developed in-house cost estimation procedures and risk management guideline; nomination estimate developer involved throughout cost estimation process; extensive bid analysis and award justification procedures; defines contingency in risk management guidelines

NE: Engineering estimate review currently underway

NH: NHDOT Highway Design Manual contains section on cost estimating; specific guidance on change order estimate development and analysis

NJ: Specific cost estimating group used to prepare and update cost estimates - Construction Management Group; conducting process review on cost estimating and bid analysis

NM: In the process of developing SOP for cost estimating procedures on projects with defined scope of work



NV: Documented internal cost estimating guidance; risk-based cost estimating used; dedicated unit to track and monitor cost estimates throughout project development

NY: Documented internal cost estimating guidance; risk-based cost estimating used; dedicated unit to track and monitor cost estimates throughout project development; use competition based adjustments within estimate process; separate unit established to perform updates to cost estimates

OH: Ad hoc internal team comprised of OHDOT, attorney general, inspector general, etc. to review bidding and other irregularities

OK: Procedure issued by memorandum for project cost estimating with plan on refining within new version of roadway design manual

OR: Documented internal cost estimating guidance; ODOT independent review is performed by OPL staff - separate from project development by regional technical centers,

PA: Extensive policy on cost estimating which includes factors and methods; estimating software linked to historical unit bid cost database; maintains internal system to track ineligible contractors (ECMS)

SC: Use AASHTO/Project BAMS/DSS to perform Market Analysis and Competition Analysis within defined Market Types and Areas

SD: Completed review of following program areas: Construction Contractor Payments 2006, Estimating Projects Costs 2008, and Bid Analysis and Concurrence in Award 2012,

TX: Documented internal cost estimating guidance,

UT: Utilize cost-based estimate team and procedure; utilize OMAN software for bid item database analysis

VA: Developed own internal cost estimating guidance/manual based on FHWA - revised Oct 2012

VT: Provides internal cost estimator guidance - AASHTOWare Project Estimator

WA: Developed own internal cost estimating guidance/manual; utilizes customized parametric based estimating models; unique formalized cost estimating peer review process; extensive resource documentation on cost estimation process

WI: Developed own internal cost estimating guidance/manual; extensive risk-based procedure for major projects; construction project delivery team prepares and submits a cost-to-complete projection,

WY: Maintain flowchart within design manual that identifies cost estimate milestones

## **Conclusion**

As many as 80% of State DOTs indicate they have documented cost estimation procedures the review found the procedures often lack successful elements of recommended practice as contained in AASHTO's "Practical Guide on Cost Estimation". Almost every State DOT uses historical bid-based data to prepare estimates. However, their cost estimating procedures may not capture rapidly changing market conditions. This is a continuing systemic weakness of many State DOTs' cost estimation procedures. As many as 70% of State DOTs do not use a structured risk-based approach to develop cost estimates. As such, there are opportunities for process improvements particularly when considering high risk market conditions or complex projects. While the team found some areas in need of improvement, a number of successful practices were identified having potential to improve cost estimation practices. A review of Compliance Assessment Program data by Division office staff found adequate levels of competition given the current market conditions.

## **Action Plan**

- FHWA Division Offices should conduct periodic evaluations of their State's practice for estimating project costs and awarding contracts.
- FHWA Headquarters will coordinate the update of the appropriate cost estimating guidance and in particular, "*Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation*", January 2004.

## **Appendices**

Appendix A - FHWA Division Office Cost Estimating Review Guide

Appendix B - Review Guide Question Results

## Appendix A - FHWA Division Office Cost Estimating Review Guide Questions

**Division Contact**

(First, Last): \_\_\_\_\_ Phone: \_\_\_\_\_ Email: \_\_\_\_\_

**State Contact**

(First, Last): \_\_\_\_\_ Phone: \_\_\_\_\_ Email: \_\_\_\_\_

**Attachments (Optional):**

**Resource Links (Optional):**

	Title	url
1		
2		
3		

1. Does the State DOT have a documented process for the preparation and management of cost estimates? Yes \_\_\_ No \_\_\_ NA\_\_\_

Explain:

2. Is the process different based on project size, contracting type, etc.? Yes \_\_\_ No \_\_\_ NA\_\_\_

Explain:

3. What is the primary estimating technique for establishing the State’s final estimate?

\_\_\_ Historical bid-based estimates

\_\_\_ Cost-based estimates

Explain:

4. Does the documented process address the following?

- a. Regular review, update and approval of estimates.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

- b. Comparison of estimate with estimates from similar projects.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

- c. Inclusion of entire scope of project in the estimate.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

- d. Data source identification and update for bid-based estimates.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

- e. Consideration of labor, equipment, material, production, cash flow, overhead, and profit for cost-based estimates.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

- f. Documentation for basis of estimate for major cost items.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

g. Independent (i.e. not the estimator) review for complex projects.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

h. Market condition (i.e. competition) adjustments in the estimate.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

i. Definition of what contingency represents.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain

j. Appropriate contingency amounts in the estimate.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

k. Comparison of contingency amounts to historical contingency percentages for risk-based estimates.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

l. The risk identification process for risk-based estimates.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:



m. Peer review of estimates by an experienced and unbiased review team for risk-based estimates.

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

n. Independent cost estimates for change orders (i.e. independent of contractor estimate)

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

5. Is there an organization or unit within the State DOT structure identified as being responsible for the preparation and update of cost estimates?

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

6. Are other parts of the agency involved in preparing, checking, or approving the estimate?

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

7. Does your cost estimate target a "fair and reasonable price" such as an average of historical low bids, a quartile of bids received, or some other definition of fair and reasonable?

Yes \_\_\_ No \_\_\_ NA \_\_\_

Explain:

8. Are estimates managed from one project phase to the next (i.e. planning through final estimate)?

Yes \_\_\_ No \_\_\_ NA\_\_\_

Explain:

9. Does the State have a policy for adjusting estimates after receipt of bids?

Yes \_\_\_ No \_\_\_ NA\_\_\_

Explain:

10. Does the State make ongoing adjustments to the Federal-aid project agreement to reflect cost over-runs and under-runs? If so, what are typical triggers (such as dollar threshold of cost over-runs or under- runs) that would cause adjustments?

Yes\_\_\_ No\_\_\_ NA\_\_\_

Explain:

11. Are methods used to identify and incorporate anticipated changes in cost of labor, equipment, and material?

Yes \_\_\_ No \_\_\_ NA\_\_\_

Explain:

12. Are adjustments made for individual project conditions?

Yes \_\_\_ No \_\_\_ NA\_\_\_

Explain:

13. Does the State have a policy for award or rejection of bids at a set level above the engineer's estimate (i.e. engineer's estimates should be within -10% to +10% percent of the low bid for at least 50 percent of the projects)?

Yes \_\_\_ No \_\_\_ NA\_\_\_

Explain:

14. For projects with bids that fall outside of the established award/rejection threshold, does the state have a policy requiring the documentation of award /rejection decisions (e.g. a decision to award for a high priority safety projects)?

Yes \_\_\_ No \_\_\_ NA\_\_\_

Explain:

15. Which of the following best describes your state's policy for the disclosure of the engineer's estimate?

A range of the estimated contract value is published

The engineer's estimate is disclosed at advertisement

The engineer's estimate is disclosed at bid opening

The engineer's estimate is disclosed upon award

The engineer's estimate is never disclosed

Other (please explain)

If Other Explain:

16. If the engineer's estimate is disclosed, how is the information released?

During the bidding process

After receipt of bids

NA

Explain:

17. If the engineer's estimate is disclosed, is this required by state law or an interpretation of state law?

State law

Interpretation of State Law

NA

Explain:

18. Does the State contact bidders and non-bidders who checked out proposal forms in the case of excessive difference between the estimate and the low bid?

Yes  No  NA

Explain:

19. Does your state have written procedures to perform market assessments or program-wide assessments to detect evidence of collusion or antitrust issues?

Yes  No  NA

Explain:

20. If your answer is "Yes", what approach is used, what were the results of the assessments, and what steps were taken to improve competition?

- Market assessments
- Program-wide assessments

Explain:

21. Does your Division Office stewardship policy provide for review/approval of changes in your states procurement procedures (e.g. 23 CFR 635.110(b))?

Yes  No  NA

Explain:

22. 2 CFR 180.300 provides three methods to ensure that ineligible, suspended or debarred persons/firms are not participating in Federal-aid projects. What method does your state use to verify the eligibility of prime contractors?

- Checking the Excluded Parties List System,
- Collecting a certification from that person; or
- Adding a clause or condition to the covered transaction with that person

Explain:

23. What method does your state use to verify the eligibility of subcontractors?

- Checking the Excluded Parties List System,
- Collecting a certification from that person; or
- Adding a clause or condition to the covered transaction with that person

Explain:

24. Review the bid results for 30 projects from your CAP random project list and conduct the following analysis.

- a. Determine the percentage of projects sampled where the low bid fell within -10% to +10% of the estimate.

Explain

- b. Determine the percentage of projects with 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, etc. bids.

Explain

- c. Are any trends noted?

Yes \_\_\_ No \_\_\_ NA\_\_\_

Explain

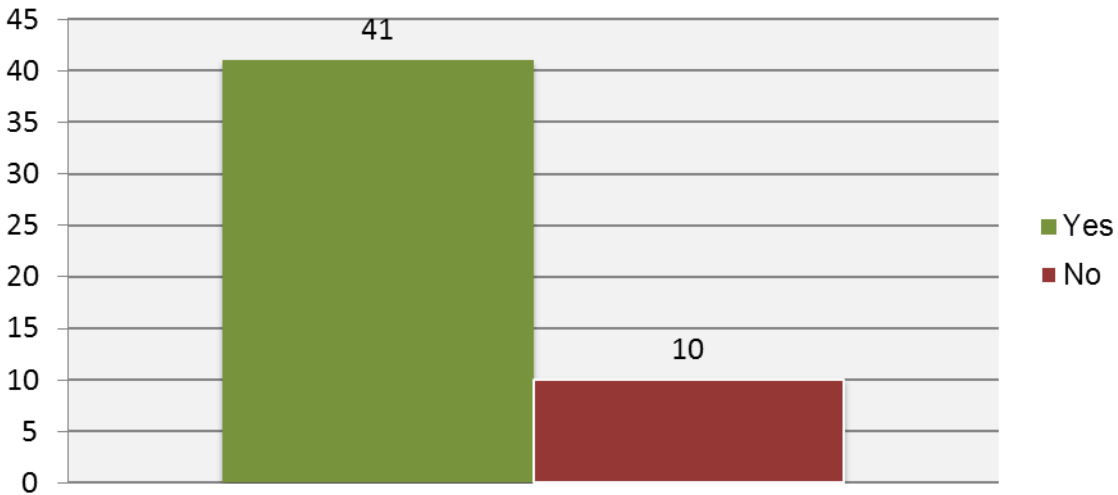
25. Based on the results of this review does the Division recommend a follow-up program review for this State?

Yes \_\_\_ No \_\_\_ NA\_\_\_

- a. If yes, what is the scope of the recommended review? Explain

## **Appendix B – Review Guide Question Results**

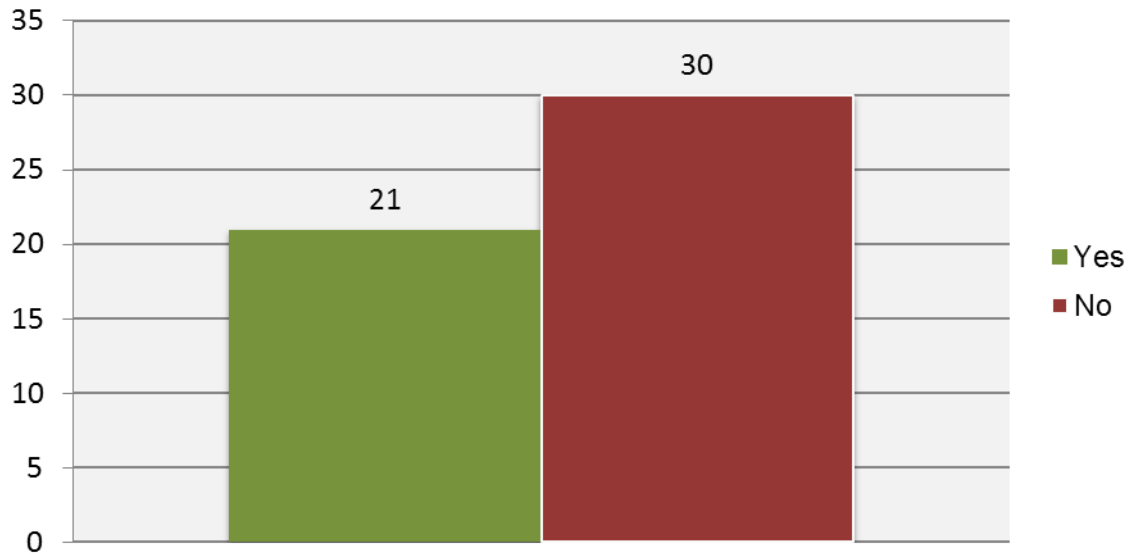
**1) Does the State DOT have a documented process for the preparation and management of cost estimates?**



Yes	No	Summary Comments
37	0	Use standard process and methodology across all project types, size, and complexities except for alternate bidding methods as applicable
2	10	Estimating system has separate categories based on project cost and type (e.g., parametric, historical bid-based, cost-based and risk-based)
2	0	Developed risk register and apply risk-based approach on selected projects
1	0	Unit price adjustments for project size, cost, geographic location, etc.

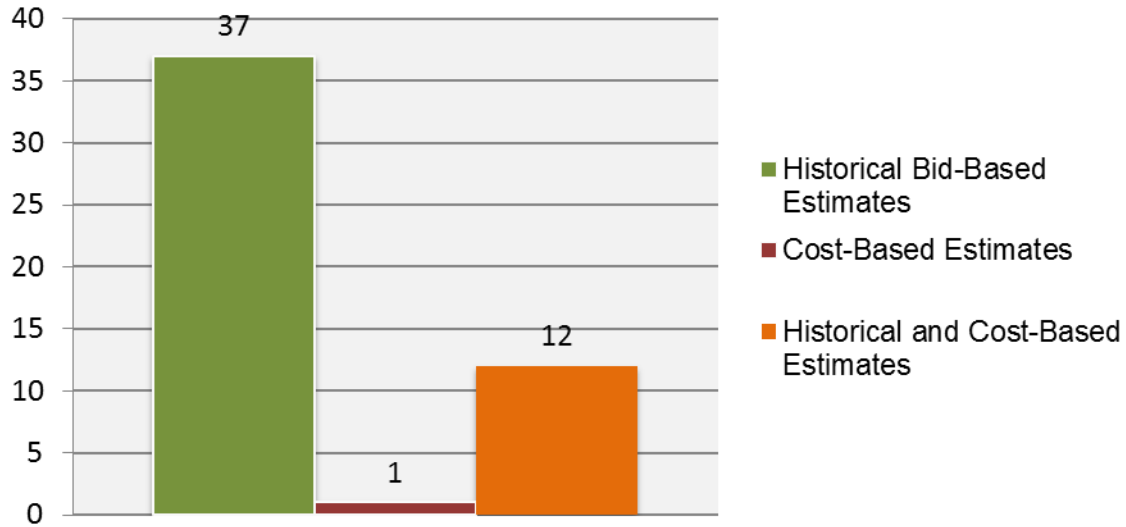


**2) Is the process different based on project size, contracting type, etc.?**



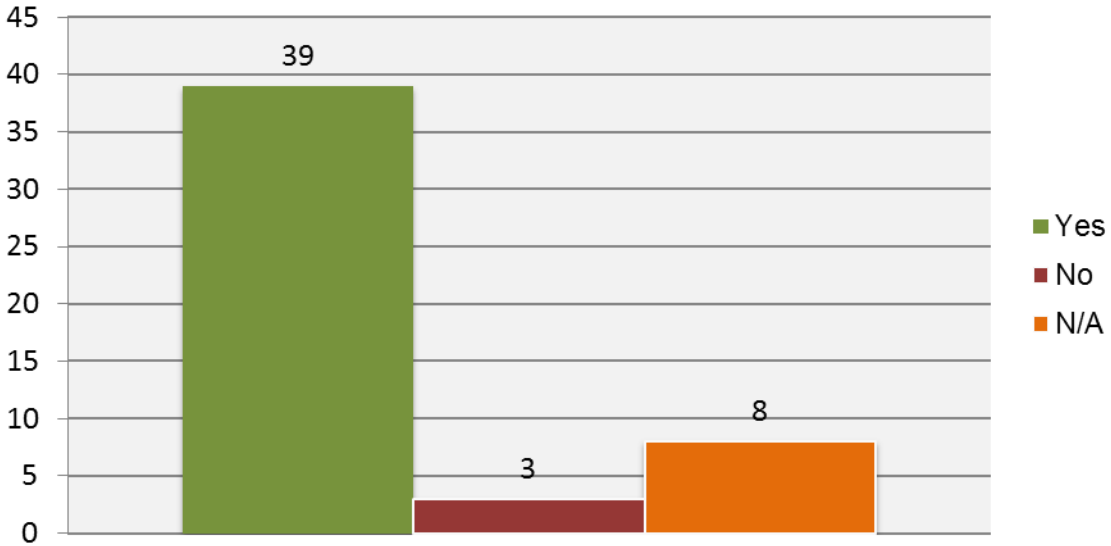
Yes	No	Summary Comments
10	29	Use standard process and methodology across all project types, size, and complexities except for alternate bidding methods as applicable
5	1	Estimating system has separate categories based on project cost and type (e.g., parametric, historical bid-based, cost-based and risk-based)
2	0	Developed risk register and apply risk-based approach on selected projects
3	0	Unit price adjustments for project size, cost, geographic location, etc.
1	1	Mega projects utilize specific set of guidelines for cost estimating
10	0	Design-Build, Best Value, Construction Manager / General Contractor and other alternative contract methods use different process
3	1	Internal guidance/manual defines process for different project size, contracting type, etc.
1	0	Cost-based used for major items and historical-based used for remaining items

**3) What is the primary estimating technique for establishing the State's final estimate?**



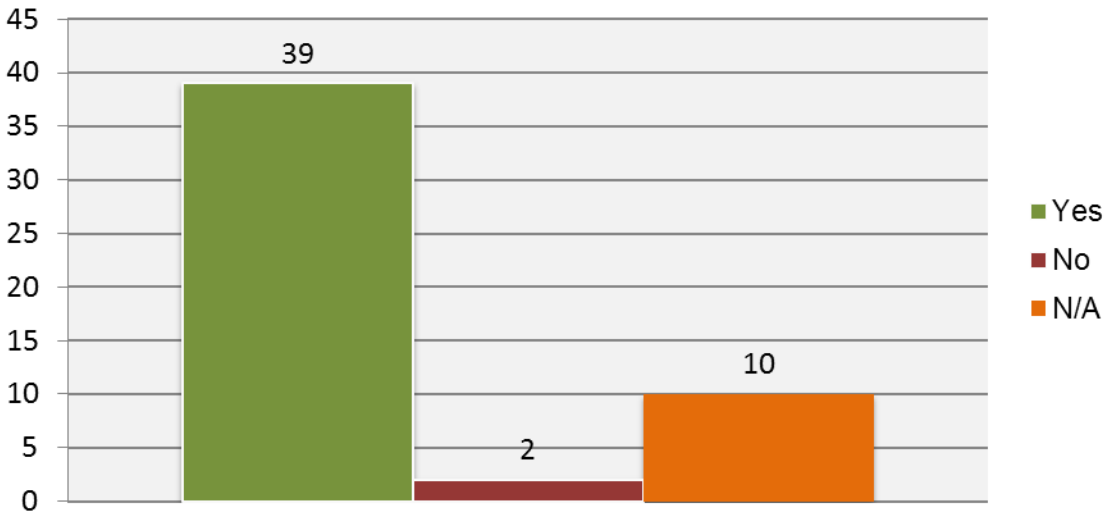
Historical Bid-Based Estimates	Cost-Based Estimates	Historical and Cost-based Estimates	Summary Comments
6	0	0	>5+ year bid history comparison using weighted average unit prices
1	0	0	Utilizes data from all bidder submissions
7	0	0	5+ year bid history comparison using weighted average unit prices
0	1	0	Utilizes Cost Based Estimating Team approach utilizing historical information
2	0	12	Cost estimate includes combination of historical based and cost-based estimates
7	0	0	Utilize AASHTOWare Project Estimator software, or other software package, to assist in development and/or management of cost estimate and make adjustments based on various criteria
1	0	0	Utilize cost-based approach used when limited historical unit prices available

**4a) Does the documented process address the following:  
Regular review, update and approval of estimates?**



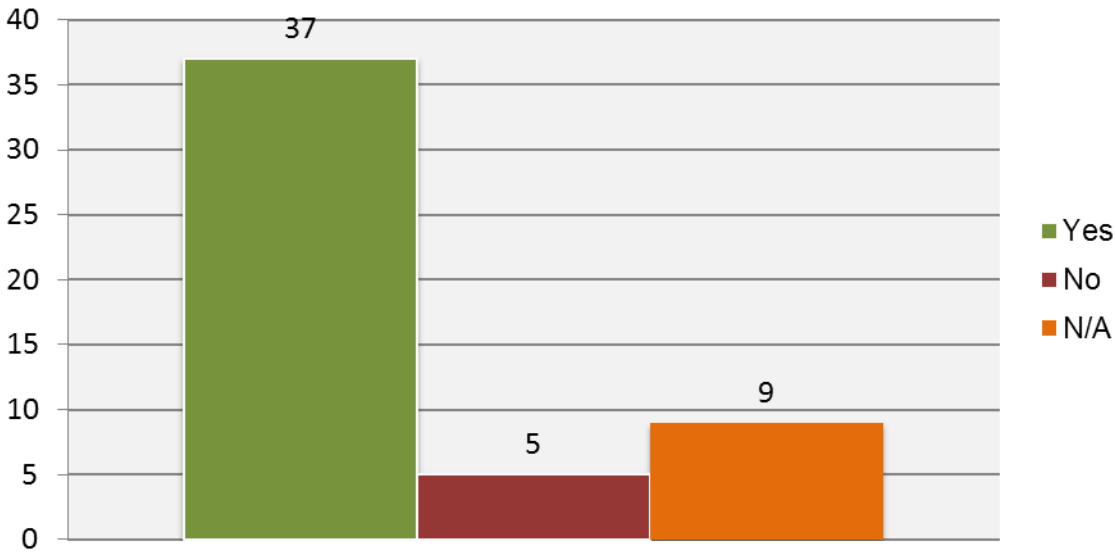
Yes	No	N/A	Summary Comments
33	0	0	Established approval milestones within guidance/manual/flowchart
1	2	3	Review cycle performed at set intervals but process not documented
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
0	1	0	Common Practice - no documented process

**4b) Does the documented process address the following:  
Comparison of estimate with estimates from similar projects?**



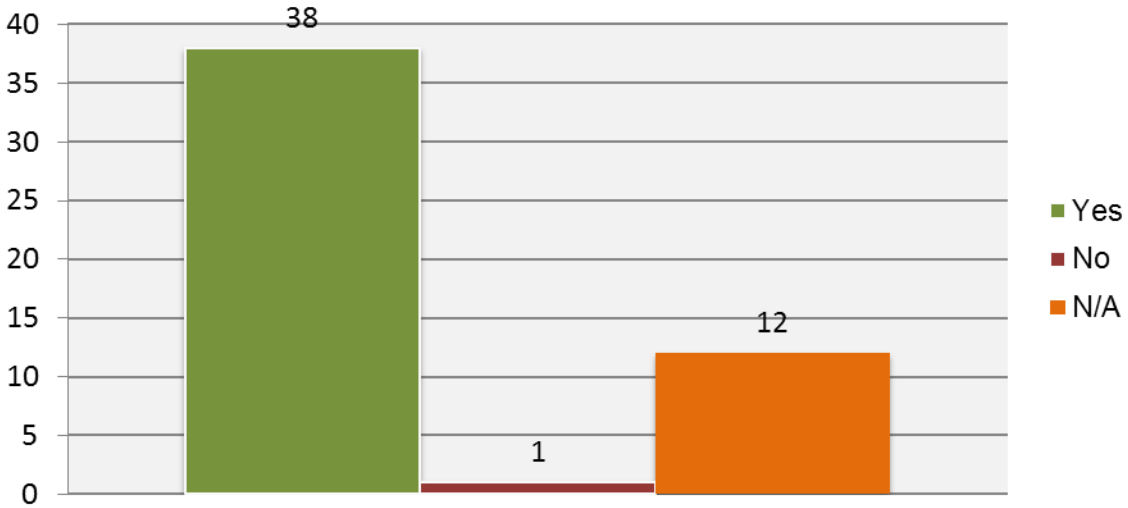
Yes	No	N/A	Summary Comments
37	0	6	Use similar projects (i.e., quantity, geographical location, size, complexity, etc.) as basis for unit items within cost estimate
1	0	0	Cost-based estimates use fair market value determination
6	0	1	Utilize parametric estimating software and/or OMAN software/Bid Analysis and Management System/Decision Support System (BAMS/DSS) to perform comparative analysis
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
4	0	0	Utilize AASHTOWare Letting and Award and/or Estimator software (DSS) to automate process and perform analysis
0	1	0	Estimates compared to similar project but process not documented
0	1	0	Common Practice - no documented process

**4c) Does the documented process address the following:  
Inclusion of entire scope of project in the estimate.**



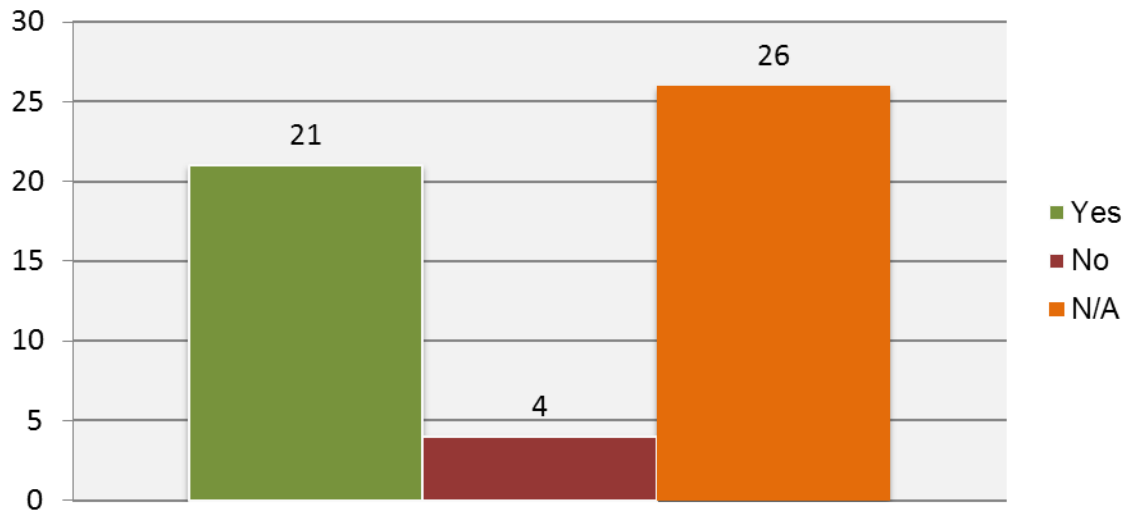
Yes	No	N/A	Summary Comments
4	0	0	Complete estimate addressing full project scope identified in project management system and/or in FMIS by phase
26	1	7	Designers, and other organizational units, develop estimate(s) by phase that include entire project scope during development and/or at final estimate stage
1	0	0	Refine estimate through project development to reduce, or eliminate, need for contingencies
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
1	2	0	Excludes one or more of the following ROW, Utility Relocation, Design, CE, and PE
2	0	0	Internal guidance/manual identifies factors for preparation of cost estimate may include contingency elements to address scope refinements
0	1	0	Estimates performed independent then rolled into one single estimate - full scope not included in single estimate

**4d) Does the documented process address the following:  
Data source identification and update for bid-based estimates?**



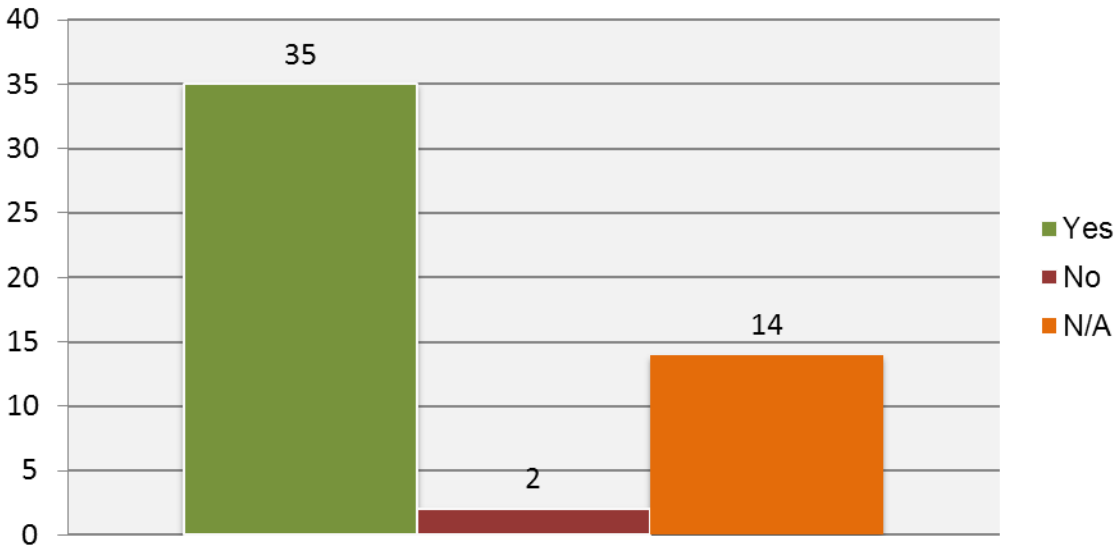
Yes	No	N/A	Summary Comments
7	0	0	Established process and documentation requirements outlined within internal guidance/manual
23	0	7	Use historical bid information
8	0	1	Utilize AASHTOWare Project Estimator (DSS) to assist in statistical analysis of bid price history
16	0	3	Use Bid X, Bid Tab Pro, AASHTO BAMS-DSS Software, OMAN system or other internal developed software/database to maintain data and/or for comparison and statistical analysis purposes
0	1	0	No data source recordation in documented process
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
1	0	0	Systematic updates performed on regular cycle

**4e) Does the documented process address the following:  
Consideration of labor, equipment, material, production,  
cash flow, overhead, and profit for cost-based estimates?**



Yes	No	N/A	Summary Comments
0	4	19	Cost-based type estimating not used during project development phase
2	0	0	Section included within design guidance/manual references cost-based estimate development for use on change orders
7	0	2	Used on projects/pay items of critical importance, significant quantities, complexity, alternative contracting methods, or those lacking adequate historical data
7	0	0	Cost-based estimate guidance/manual outlines process for creating fair market price
2	0	0	Utilizes AASHTOWare Project Estimator software, or other software program, that incorporates these areas and other potential contract costs
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
3	0	2	Informal cost-based estimate process used

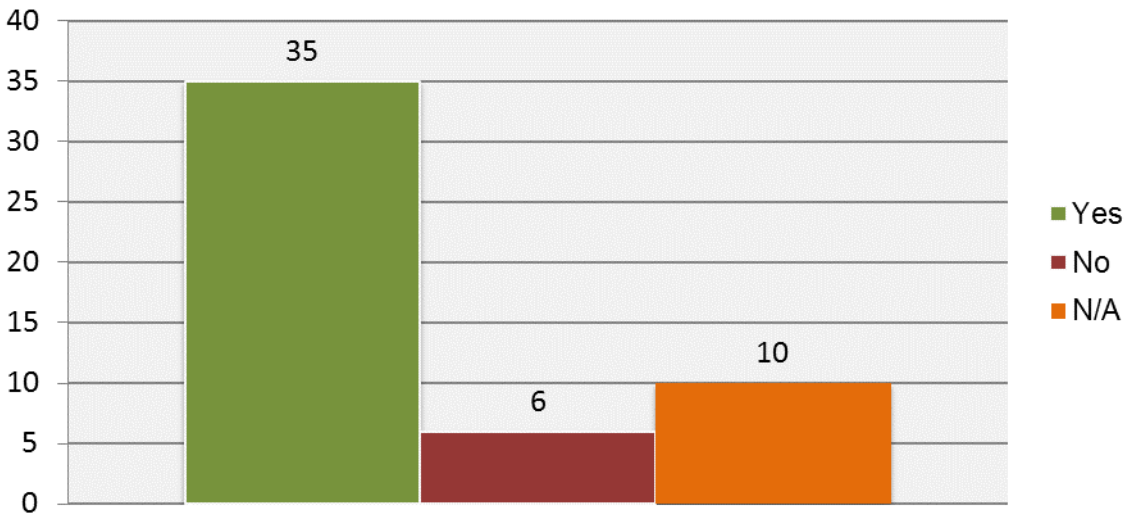
**4f) Does the documented process address the following:  
Documentation for basis of estimate for major cost items?**



Yes	No	N/A	Summary Comments
15	0	0	Required documentation outlined within internal guidance/manual document
0	0	1	Cost per mile basis
4	0	2	Extra consideration given on analyzing major items during cost estimate process
12	0	6	Historical data analysis and/or cost estimating techniques (i.e., cost-based) used for major cost items and include documentation for basis of unit price
6	0	1	Utilize OMAN software, AASHTO BAMS/DSS and/or other software package, to document basis of estimate(s)
1	0	0	Quotes are acquired directly from manufacturers
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
3	2	0	Not within official internal guidance/manual; however, common practice to document basis of estimate for major cost items

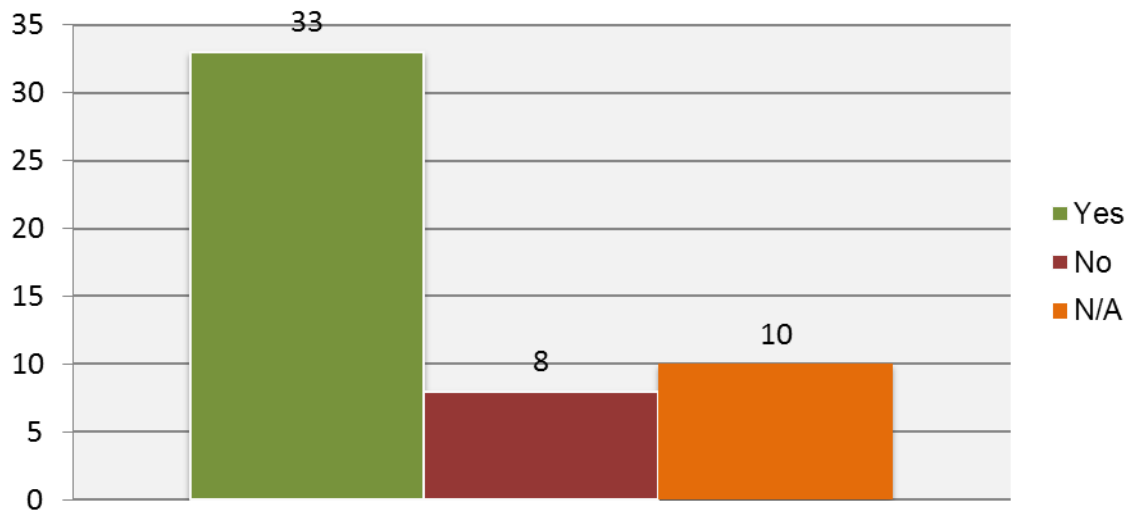


**4g) Does the documented process address the following:  
Independent (i.e. not the estimator) review for complex  
projects?**



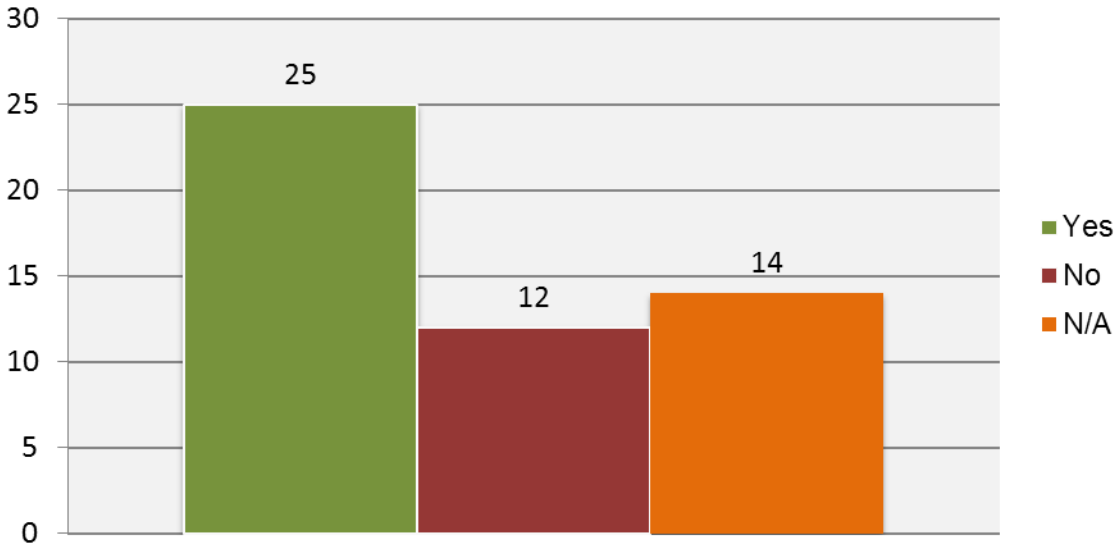
Yes	No	N/A	Summary Comments
0	1	0	Project size and types does not warrant independent review
18	2	3	Internal independent committee/design squad/central office unit type review approach
13	0	1	Internal independent estimating manager/estimator review and/or process
2	0	0	Internal review performed by individual organizational units responsible for their specific project elements
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
1	2	2	Internal independent estimating manager/estimator review performed on alternative procurement or other unique type projects
1	1	1	Common Practice - Internal review performed by individual organizational units responsible for their specific project elements

**4h) Does the documented process address the following:  
Market condition (i.e. competition) adjustments in the  
estimate?**



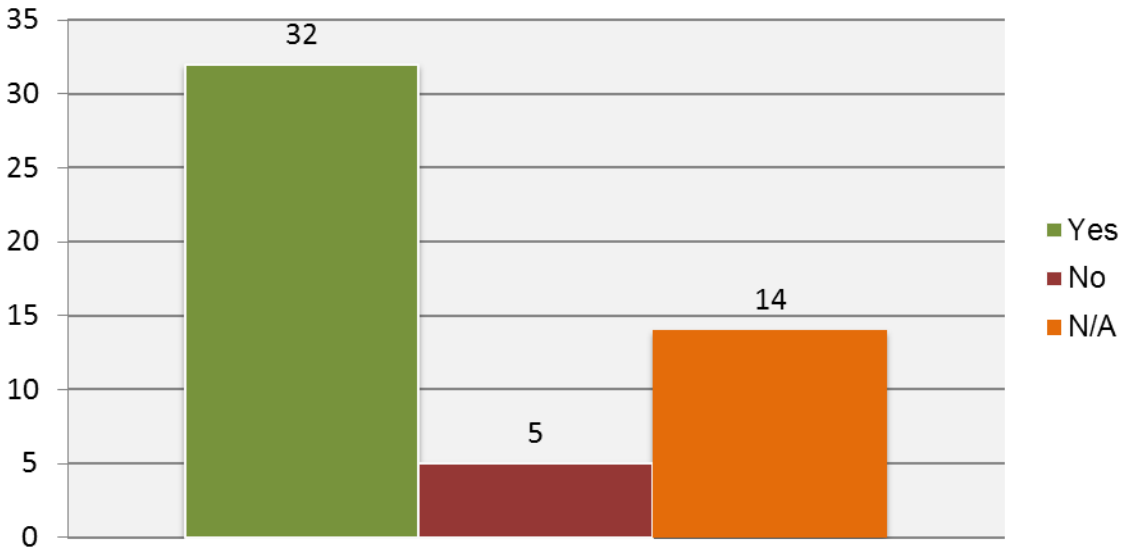
Yes	No	N/A	Summary Comments
25	1	5	Specific market conditions factored in to individual unit bid items (e.g., fuel costs, steel costs, etc.)
2	0	2	Inflation adjustments
6	0	1	Evaluate trends by reviewing construction cost index data
2	0	0	Market analysis performed on major items
0	4	2	No market condition considerations
4	0	0	Establish base variability and/or confidence interval for market conditions and/or cost escalation rates based on statistical modeling and adjusted based on similar awarded projects
0	0	2	External influences from other industries and markets (labor) - oil production
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
5	0	1	Competition components factored into adjustments through AASHTOWare Project Estimator and/or historical competition levels from prior lettings
4	0	0	Project database, industry quarterly cost reference, and/or software reflects real market conditions that are used for adjustments in the estimate
0	2	0	Not within official internal guidance/manual; however, common practice to account for market condition adjustments and/or regional differences that impact unit costs

**4i) Does the documented process address the following:  
Definition of what contingency represents?**



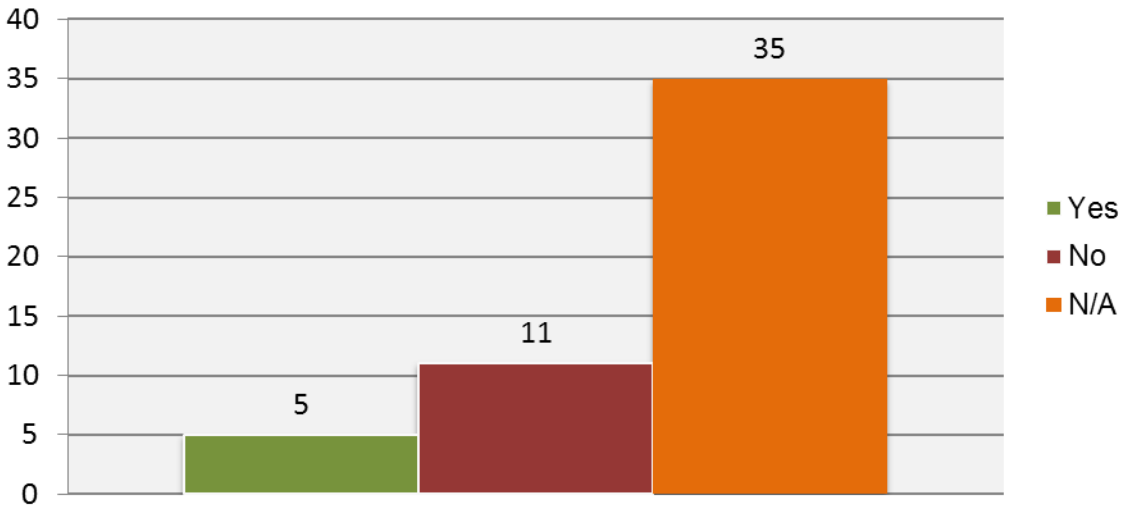
Yes	No	N/A	Summary Comments
19	0	0	Specific definition provided within internal guidance/manual
5	2	4	Contingency percentage based on phase, historical values, set percentage, and/or assumed level of overall uncertainty
0	2	1	Contingency factors not used in cost estimating procedures
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
0	1	7	Not Applicable
1	4	0	Common practice - account for uncertainty during estimating process on bid-based and/or projects using alternate bidding as applicable

**4j) Does the documented process address the following:  
Appropriate contingency amounts in the estimate?**



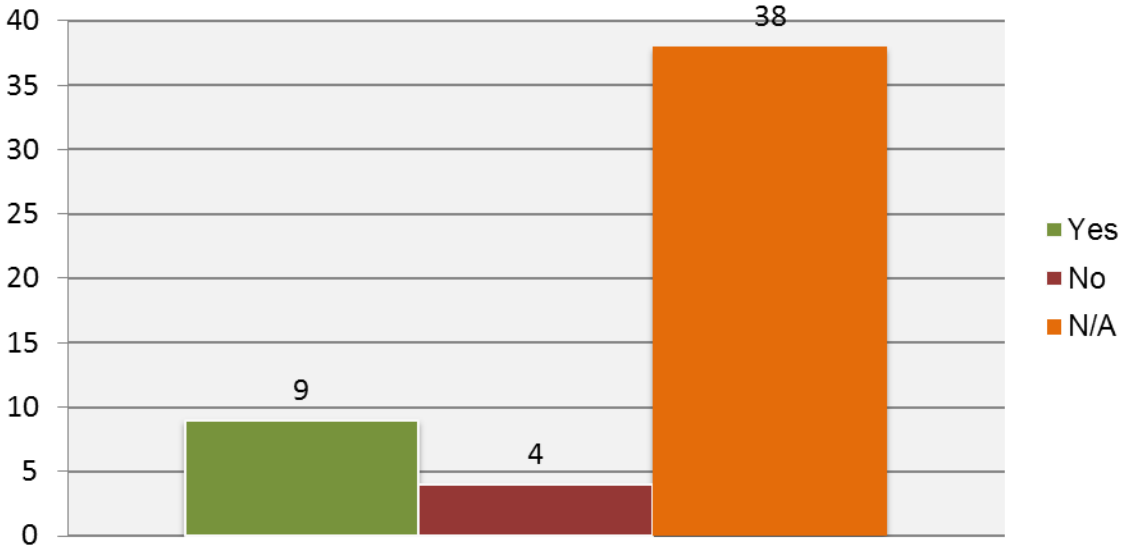
Yes	No	N/A	Summary Comments
17	0	0	Ranges to allow for risks and uncertainty is defined within internal guidance/manual
6	0	1	Reasonable ranges established and applied across individual unit items within cost estimate and/or to cover unknown construction-related costs
0	2	7	Not Applicable
8	1	0	Standard set contingency included within cost estimate based on anticipated construction costs
7	3	4	Common Practice - contingency percentage varies depending on project development stage, type, and/or project cost with standard considerations such as inflation
1	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation

**4k) Does the documented process address the following:  
Comparison of contingency amounts to historical  
contingency percentages for risk-based estimates?**



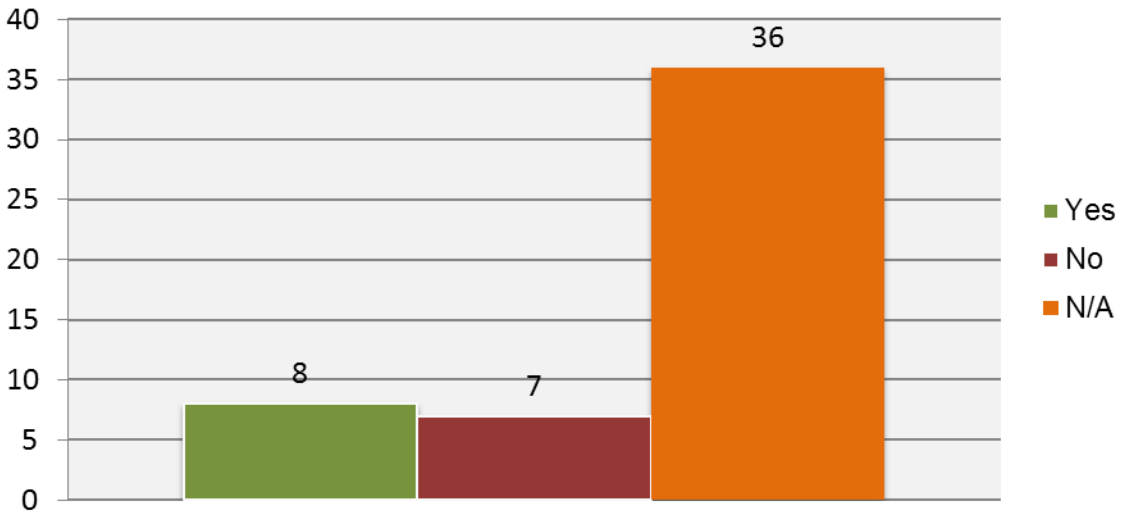
Yes	No	N/A	Summary Comments
0	6	2	Not performed
0	3	31	Not Applicable
4	1	1	Performed on all risk-based estimates
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
1	0	0	Develops probability range for cost estimate and uses analysis of cost growth to set contingency percentage

**4l) Does the documented process address the following:  
The risk identification process for risk-based estimates?**



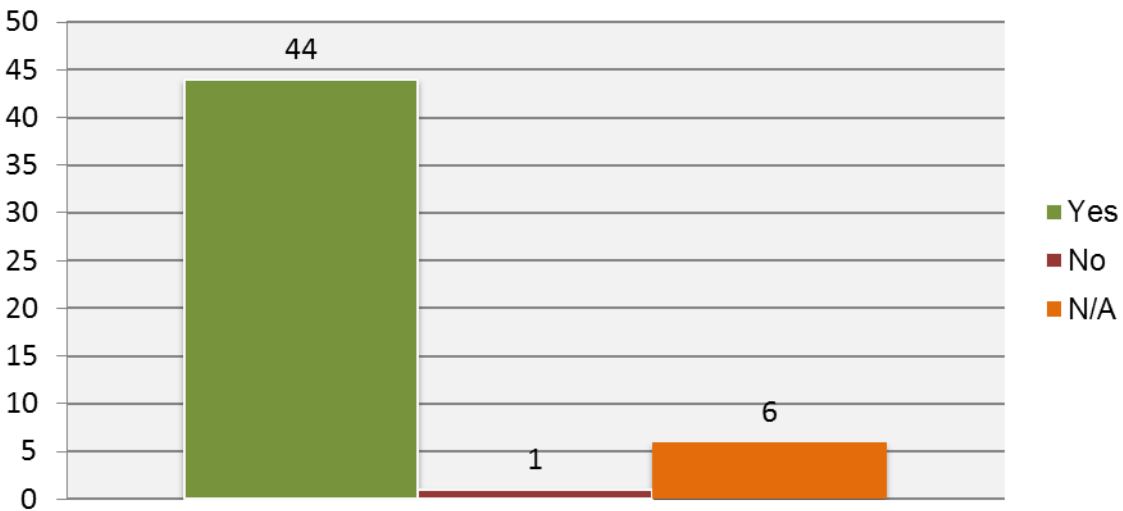
Yes	No	N/A	Summary Comments
6	3	0	Risk-based estimate process described within internal guidance/manual to include procedure for assigning risk values
0	3	31	Not Applicable
3	0	0	Risk register established within risk-based estimate guidance/manual
1	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation, and/or risk assessment and cost estimate review (CER) if required
0	1	2	Performed on all risk-based estimates
2	1	1	Internal guidance/manual does not detail process for conducting risk-based estimates; however risk considerations applied during development of cost estimate
0	0	1	Evaluate major pay items on projects with respect to quantities and price ranges to determine reasonable average pricing for major pay items

**4m) Does the documented process address the following:  
Peer review of estimates by an experienced and unbiased  
review team for risk-based estimates?**



Yes	No	N/A	Summary Comments
0	1	0	Project and program size does not warrant
5	0	2	Designated internal committee/group/individual review process
0	1	31	Not Applicable
1	1	0	Internal guidance/manual detailing cost estimate peer review process
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
2	2	0	Performed on major projects as defined by FHWA or other high cost complex type projects

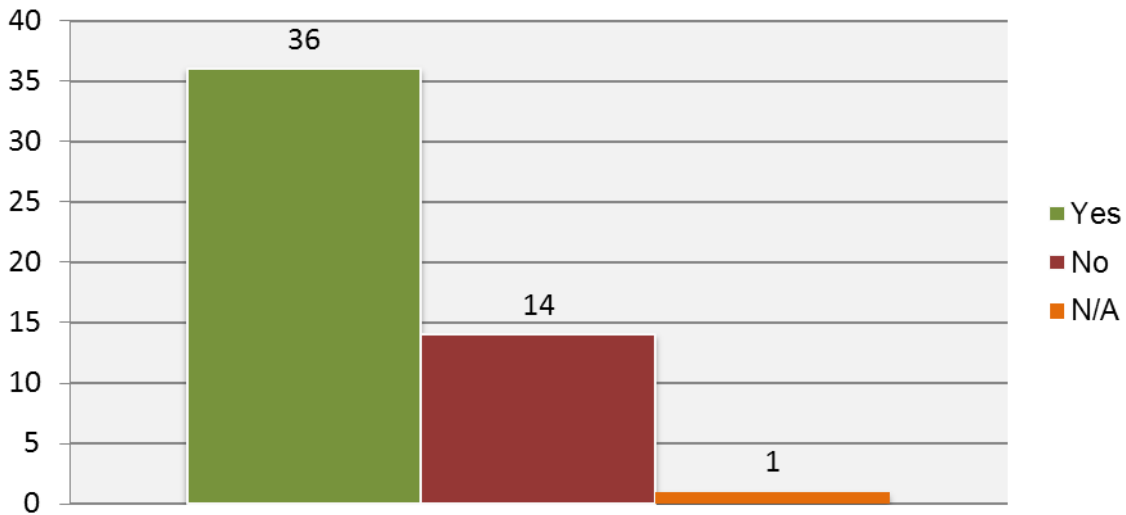
**4n) Does the documented process address the following:  
Independent cost estimates for change orders (i.e.  
independent of contractor estimate)**



Yes	No	N/A	Summary Comments
37	1	3	Construction staff/group independently reviews bid history for estimate items during change order negotiations (i.e., Internal Databases, AASHTOWare Site Manager, etc.)
18	0	0	Internal guidance/manual describes requirements for cost estimate analysis on change orders
1	0	0	Performed in accordance with CFR
2	0	0	Contract unit prices used for developing independent estimates
0	0	1	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
4	0	0	Construction staff coordinates with project manager, construction division, and/or independent estimator to run OMAN and/or review independently to determine historical costs for unit items within change order
1	0	0	Internal estimator develops independent cost estimate based on average pricing from AASHTOWare Estimator and provides to construction staff

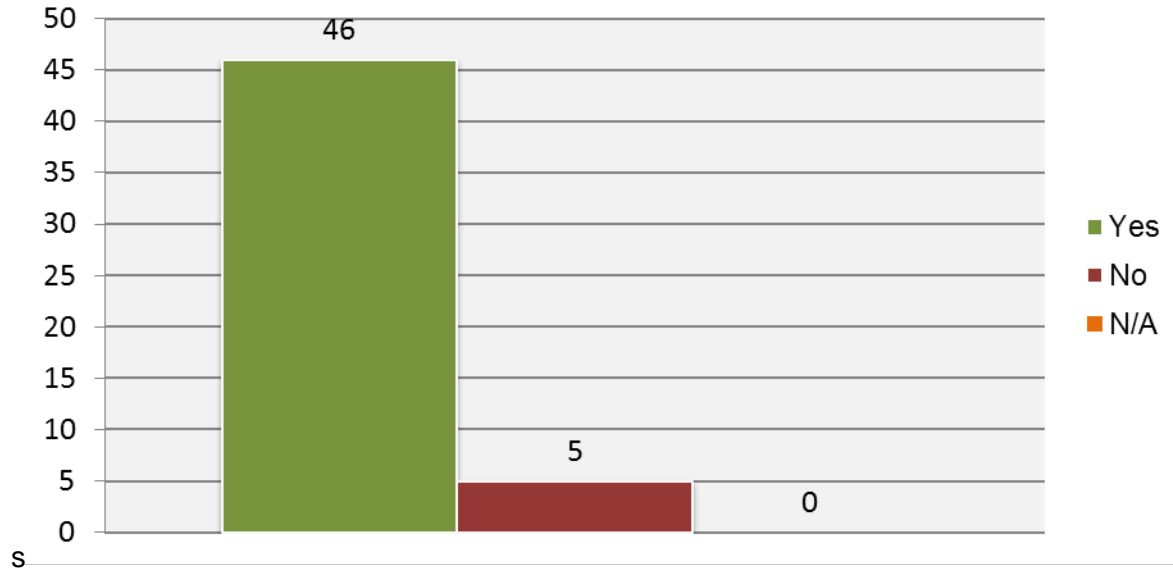


**5) Is there an organization or unit within the State DOT structure identified as being responsible for the preparation and update of cost estimates?**



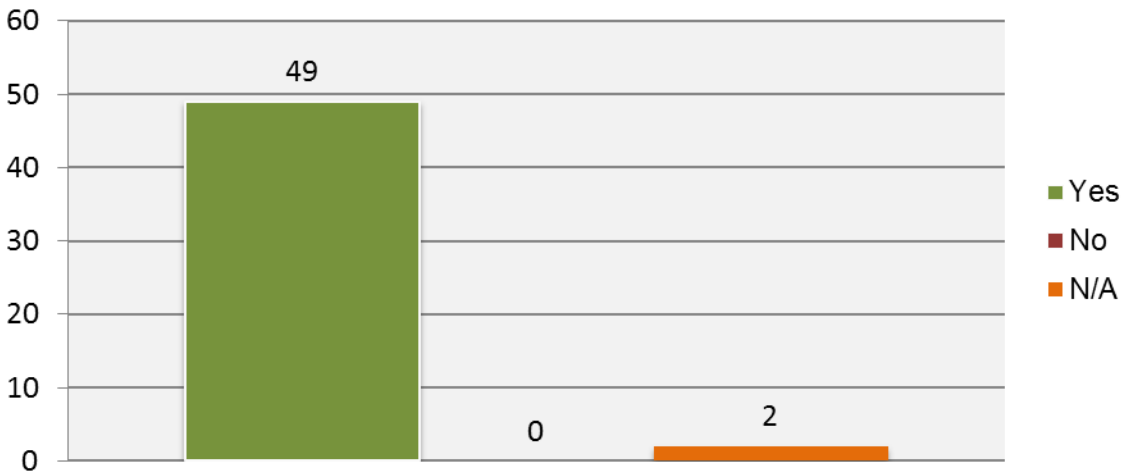
Yes	No	N/A	Summary Comments
4	2	0	Final Estimates completed by specific group within organization
0	14	0	No specific office responsible for updating design-level estimates
12	9	1	Cost estimates maintained by project designers/managers up to preconstruction phase at which time a separate organizational unit finalizes cost estimate and contract documents for advertisement
21	0	0	Specific estimating unit within agency dedicated to maintaining cost estimates which or/may not be within Engineering division
3	0	0	Internal agency estimate section maintains information within OMAN software database and/or other system and ensures cost estimate updated

**6) Are other parts of the agency involved in preparing, checking, or approving the estimate?**



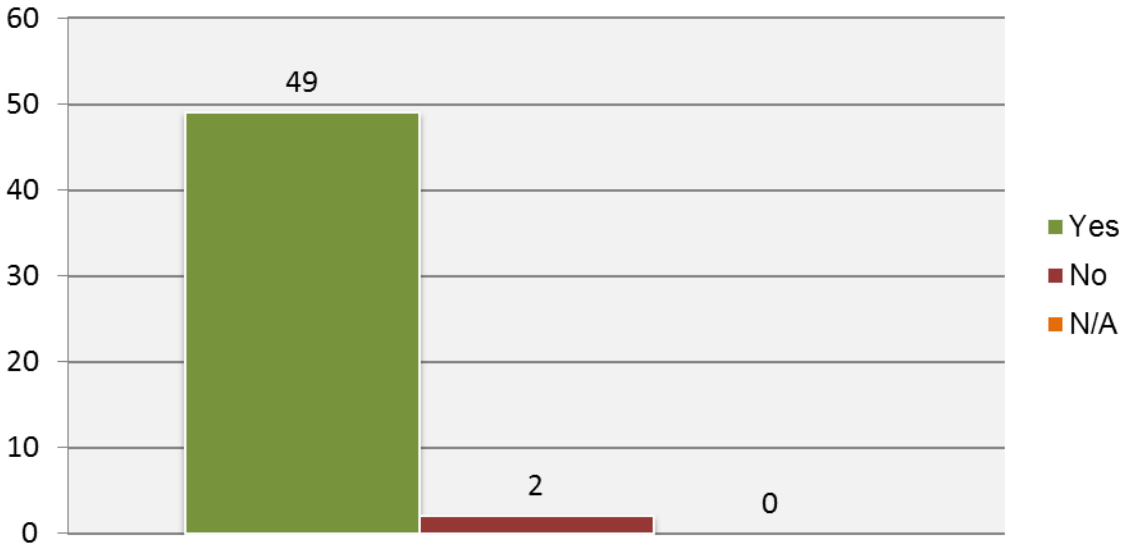
Yes	No	N/A	Summary Comments
37	1	0	Checking and preparing estimate(s) performed by respective organizational units during process (Planning, Project Development, Design, Construction)
13	0	0	Internal agency committee/team/section/project manager conducts review of cost estimate
7	1	0	Consultation occurs across organizational unit disciplines to improve accuracy of the cost estimate
1	0	0	Function performed by fiscal/and or financial section
1	0	0	In-house consultant designer

**7) Does your cost estimate target a "fair and reasonable price" such as an average of historical low bids, a quartile of bids receive, or some other definition of fair and reasonable?**



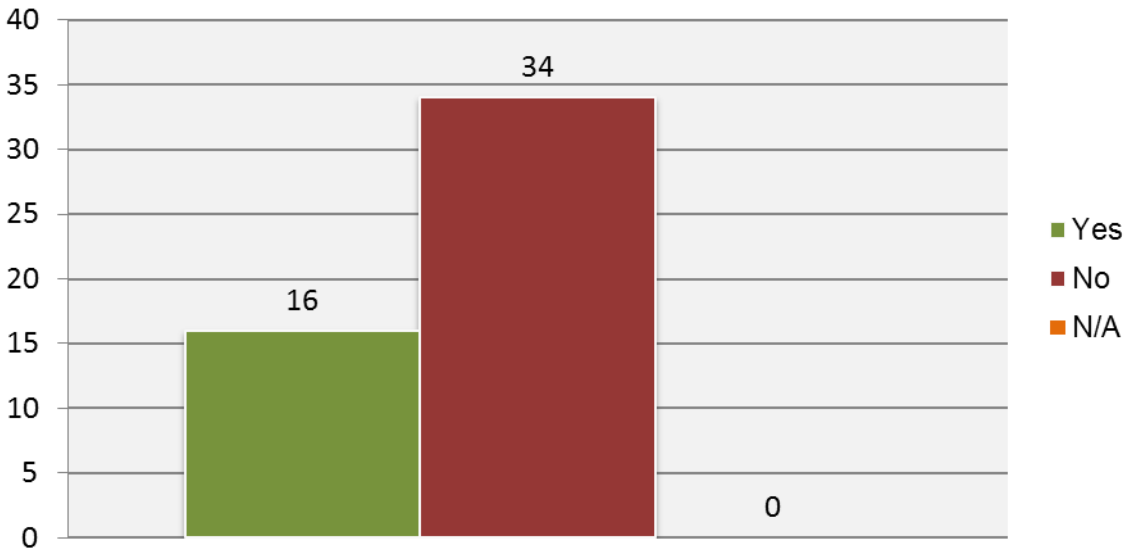
Yes	No	N/A	Summary Comments
45	0	1	Historical database specific to certain criteria used to justify engineer's estimate unit prices and establish fair price
1	0	0	Utilize cost-based estimating on all projects
3	0	0	Evaluate cost estimates using bid profile analysis

**8) Are estimates managed from one project phase to the next (i.e. planning through final estimate)?**



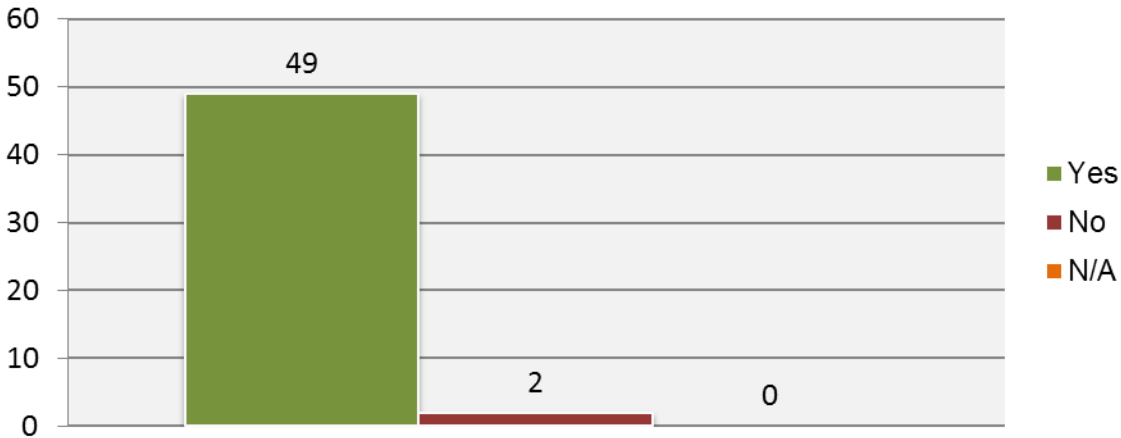
Yes	No	N/A	Summary Comments
1	0	0	Developer of planning level estimate remains involved throughout each phase
41	0	0	Cost estimates updated as necessary through-out project life cycle at specific milestones by respective organizational unit and coordinated as appropriate up to final estimate stage
8	0	0	Continuously manage estimates within project management/accounting system
0	1	0	Each organizational unit maintains estimate independent of other prior phase-
1	1	0	Final estimate developed independent of preliminary estimate
5	1	0	Internal unit/group/team manages cost estimate process
2	0	0	Internal project manager manages cost estimate
3	0	0	Cost estimate management defined within internal guidance/manual/flowchart
2	0	0	AASHTOware Estimator software used to manage official estimate up to 90% plans development

**9) Does the State have a policy for adjusting estimates after receipt of bids?**



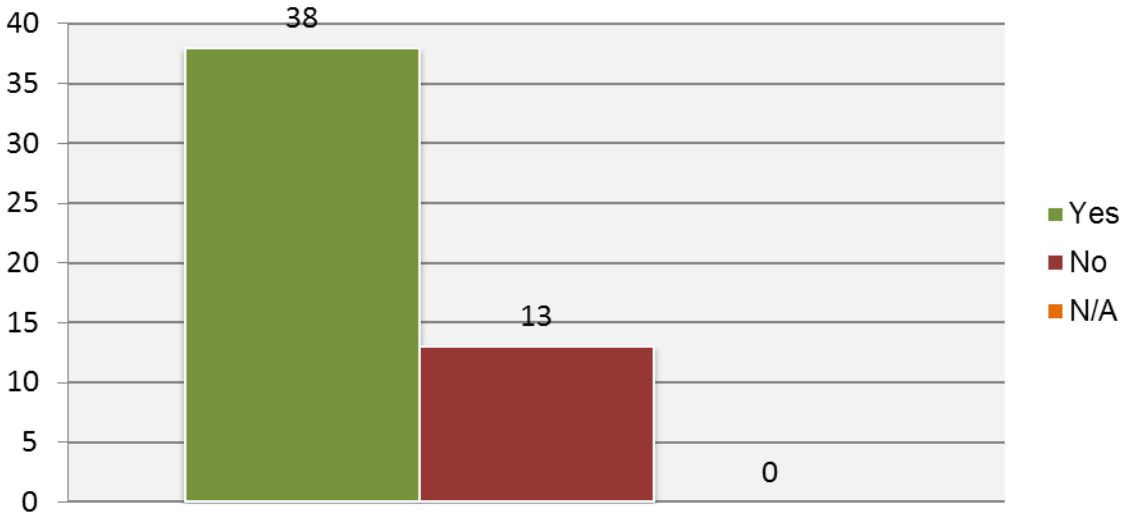
Yes	No	N/A	Summary Comments
3	0	0	Adjusts EE bid amounts to justify award
2	31	0	No adjustments to engineering estimate before and/or after bid letting
7	2	0	Adjustments performed only if error detected and/or omission from plans
2	0	0	Adjustments performed only if bids appear nonresponsive and project rejected
2	3	0	Adjustments to EE performed to conduct comparative analysis of differences in unit prices and support award and contract bid amount

**10) Does the State make ongoing adjustments to the Federal-aid project agreement to reflect cost over-runs and under-runs? If so, what are typical triggers (such as dollar threshold of cost over-runs or under-runs) that would cause adjustments?**



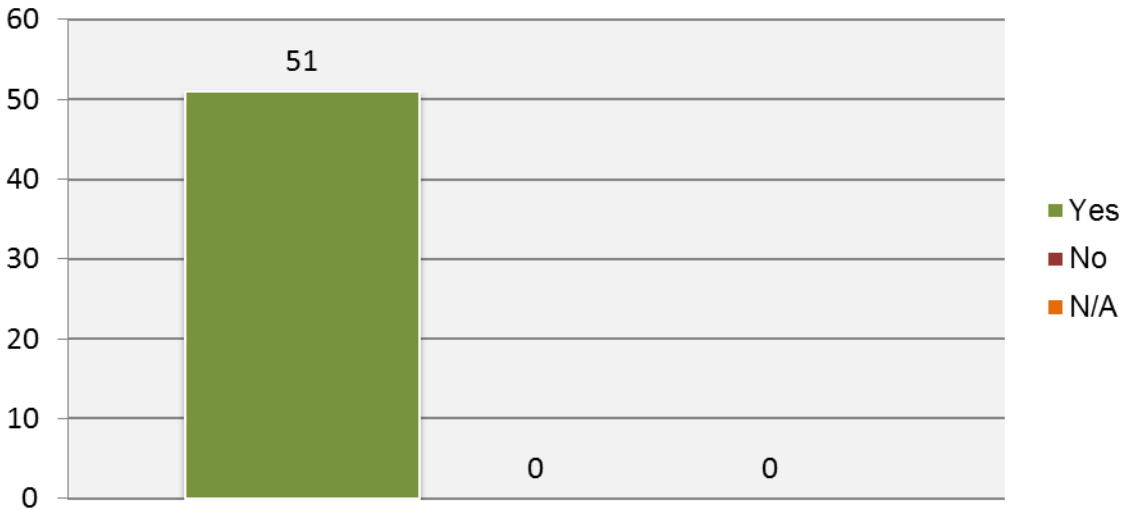
Yes	No	N/A	Summary Comments
3	0	0	Preliminary Engineering (PE) modifications are requested when remaining design work exceeds current obligated amount
20	2	0	Project agreement modified after award to ensure bid amount matches FMIS obligation
32	1	0	Project agreement adjustments performed for cost over runs, and/or under runs, due to contract amendments or overall budget modifications
8	2	0	Separate triggers established between Financial Division of DOT and FHWA Financial Manager (i.e., final voucher)
1	1	0	Contingencies established to prevent need for ongoing adjustments
4	0	0	Specific percentage adjustments and/or amount used as triggers
1	0	0	Adjustments initiated per regulation - 23 CFR 630.106(4)
1	0	0	Construction develops cost estimate on cost-to-complete projection
1	0	0	Use Advance Construction (AC) as primary funding source
3	0	0	Internal guidance/manual/memo describes timeline for adjustments relative to specific stages during project life cycle

**11) Are methods used to identify and incorporate anticipated changes in cost of labor, equipment, and material?**



Yes	No	N/A	Summary Comments
2	0	0	State contacts local suppliers on market conditions
2	0	0	Involve field construction staff perspective within estimate development and identify variables
26	2	0	Fuel cost and material adjustments (liquid asphalt, concrete, steel, etc.) are monitored on regular/annual basis for trends and cost estimate and unit prices adjusted accordingly
4	0	0	Evaluate historical project bid history for similar projects
2	0	0	Internal guidance/manual addresses methods
3	0	0	Cost escalation factors considered due to inflation
2	0	0	Internal guidance/manual outlines specific factors to consider during cost estimate development
1	0	0	Document and identify conditions within project file
3	0	0	Utilize external resources and industry resource references (i.e., blue book, business quarterly, etc.) to remain informed of market condition changes and to ensure identified in estimates

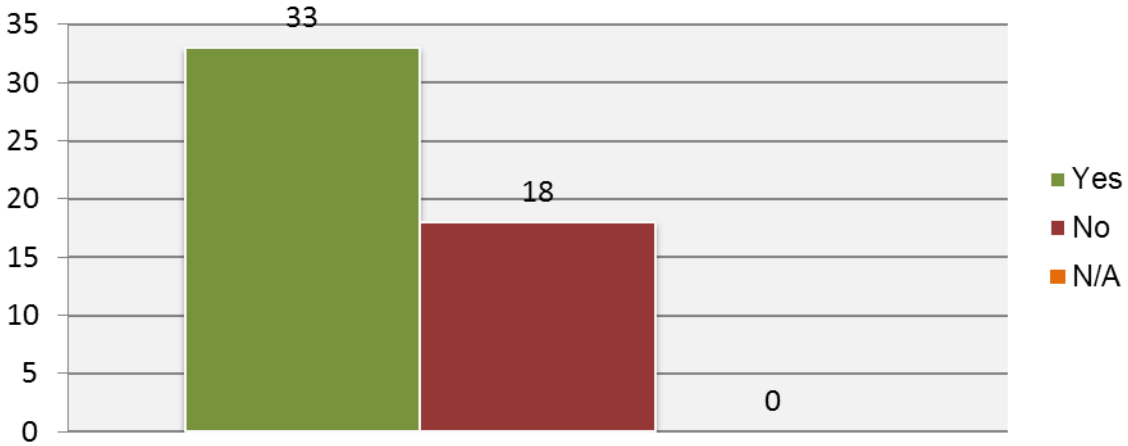
**12) Are adjustments made for individual project conditions?**



Yes	No	N/A	Summary Comments
21	0	0	Material availability and supply impacts on cost
3	0	0	External influences from other industries and markets (labor) - oil production
23	0	0	Long haul distances/site constraints
31	0	0	Geographic locations and areas of State
5	0	0	Utility risk
12	0	0	Market conditions (i.e., competition)
9	0	0	Time of year
5	0	0	Internal guidance/manual outlines project conditions to be considered in developing cost estimate
3	0	0	Project staging, phasing restrictions, and other contract administration operational constraints
1	0	0	Political factors
1	0	0	Restrictive work hours
6	0	0	Work Type , complexity and/or large/small quantities

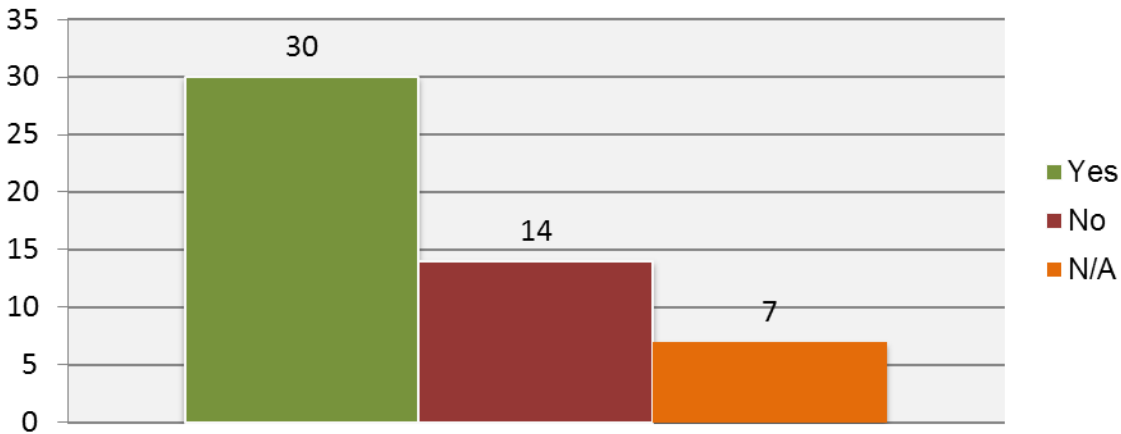


**13) Does the State have a policy for award or rejection of bids at a set level above the engineer's estimate (i.e. engineer's estimates should be within -10% to +10% percent of the low bid for at least 50 percent of the projects)?**



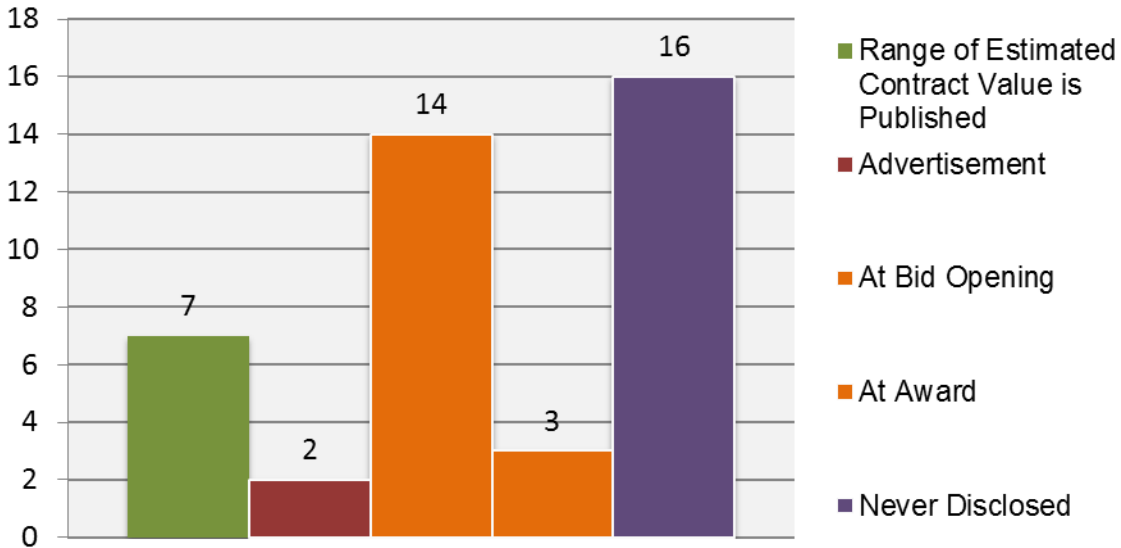
Yes	No	N/A	Summary Comments
28	0	0	Guidelines/standards/rules for award established within specifications and/or internal guidance/policy
1	0	0	Separate guideline for design-build projects
1	6	0	General rule and/or guidelines not documented and may/may not include established percentage range for acceptance
1	1	0	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
6	0	0	Justification to award required when low bid exceeds specific level
1	0	0	Rejection based on number of competitive bids and threshold of +/-10% of low bid

**14) For projects with bids that fall outside of the established award/rejection threshold, does the state have a policy requiring the documentation of award/rejection decisions (e.g. a decision to award for a high priority safety projects)?**



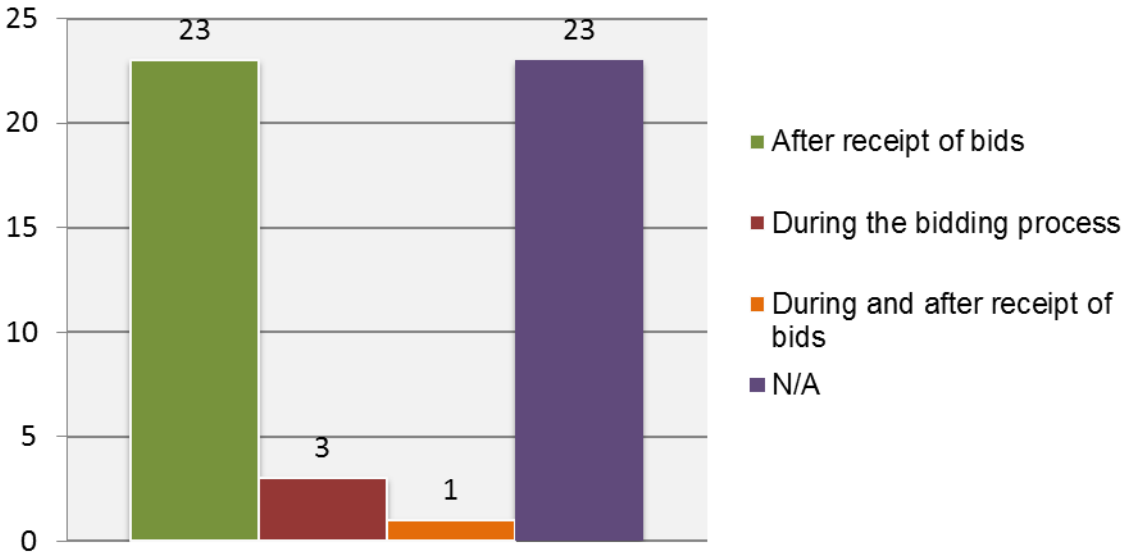
Yes	No	N/A	Summary Comments
0	1	0	Information from contractor required to support award with bid containing significantly higher cost on item(s)
1	1	0	Transportation Commission awards or rejects bid
23	7	0	Projects outside guidelines are analyzed internally by DOT and findings documented for review by award authority (i.e., Transportation Commission, Awards Committee, Chief Engineer, etc.)
15	0	0	Internal guidance/policy on award justification requirements and documentation
1	0	0	If outside guidelines project is re-advertised with adjustments
0	1	0	Utilize meeting minutes/information from internal bid review committee
1	0	0	Utilize FHWA regulation (23 CFR) and Contract Administration Manual guidance on basis and documentation for rejection

**15 Which of the following best describes your state's policy for the disclosure of the engineer's estimate?**



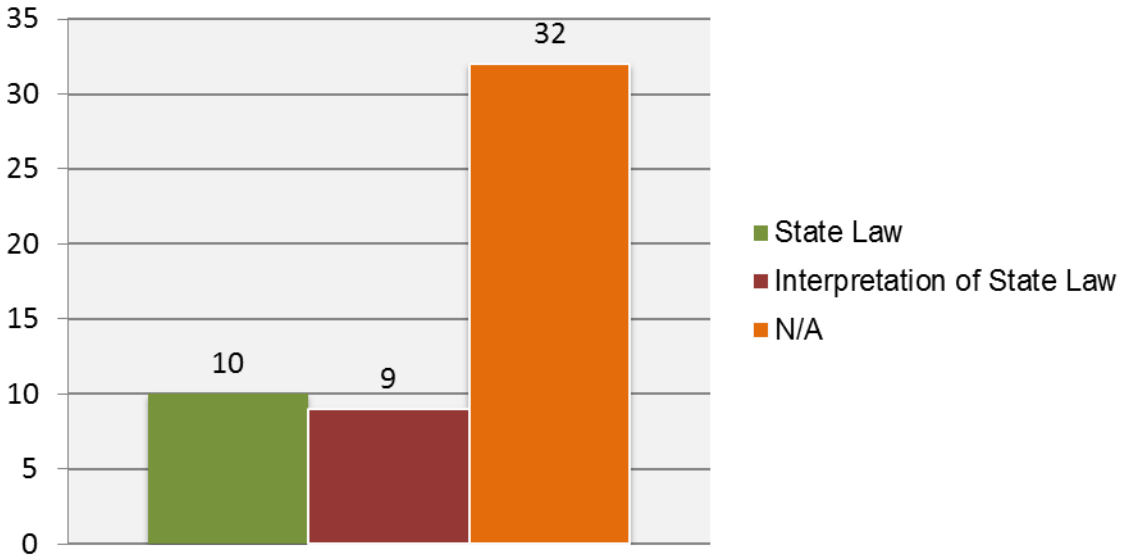
Range of Estimated Contract Value is Published	Advertisement	At Bid Opening	At Award	Never Disclosed	Summary Comments
0	0	12	0	0	Disclosed at bid opening
0	0	1	0	0	Design-build identifies range of estimated contract value
7	0	1	0	2	Range of estimated contract value and/or anticipated award amount specific to project published prior to bid letting based on project type and/or other criteria
0	2	0	0	0	EE released at advertisement
0	0	0	0	1	Upon request only
0	0	0	0	15	EE never disclosed
0	0	0	0	0	Disclosed upon award
0	0	1	0	1	Total EE released without unit price costs

**16) If the engineer's estimate is disclosed, how is the information released?**



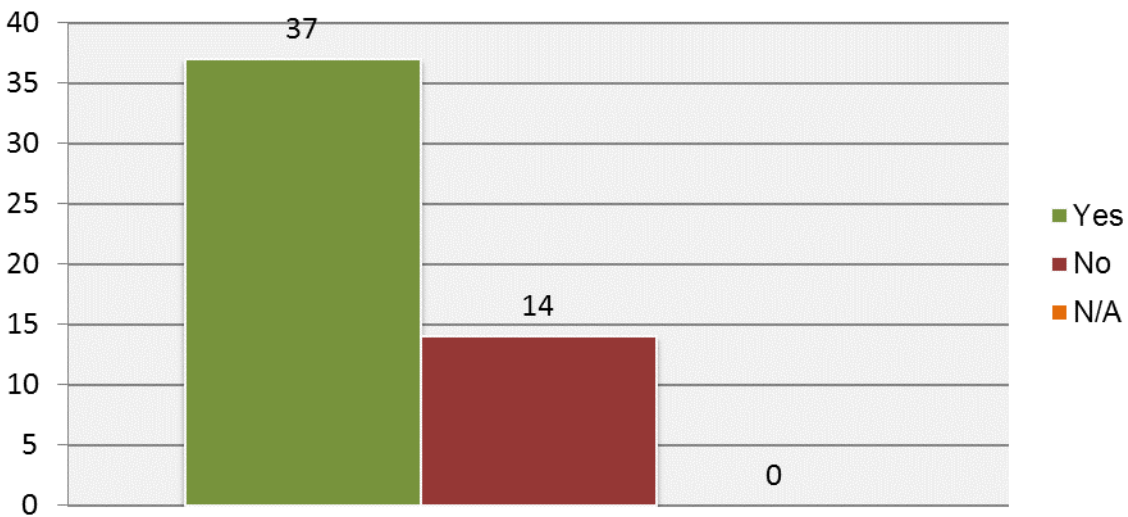
After receipt of bids	During the bidding process	During and after receipt of bids	N/A	Summary Comments
17	0	0	0	EE disclosed at bid opening
6	0	0	0	EE bid tabulation released after award
0	0	0	19	EE not disclosed
6	1	1	0	EE bid tabulation released after receipt of bids
1	1	0	5	Upon request only
1	0	0	0	Disclosed upon award
0	1	0	0	EE disclosed at advertisement
1	0	0	0	Lump sum final cost disclosed

**17) If the engineer's estimate is disclosed, is this required by state law or an interpretation of state law?**



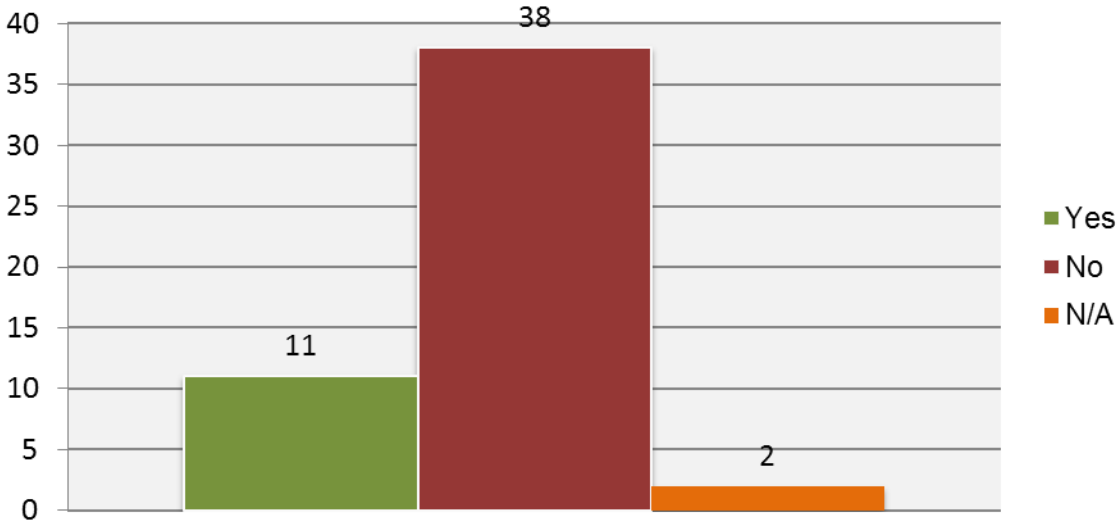
State Law	Interpretation of State Law	N/A	Summary Comments
8	8	1	Disclosure of EE covered by public information state statute/legislation
0	0	29	Not Applicable
0	0	9	Internal agency policy to maintain confidentiality/and or option to release EE (i.e., range of estimated contract value)
0	1	0	Internal agency interpretation of state law

**18) Does the State contact bidders and non-bidders who checked out proposal forms in the case of excessive difference between the estimate and the low bid?**



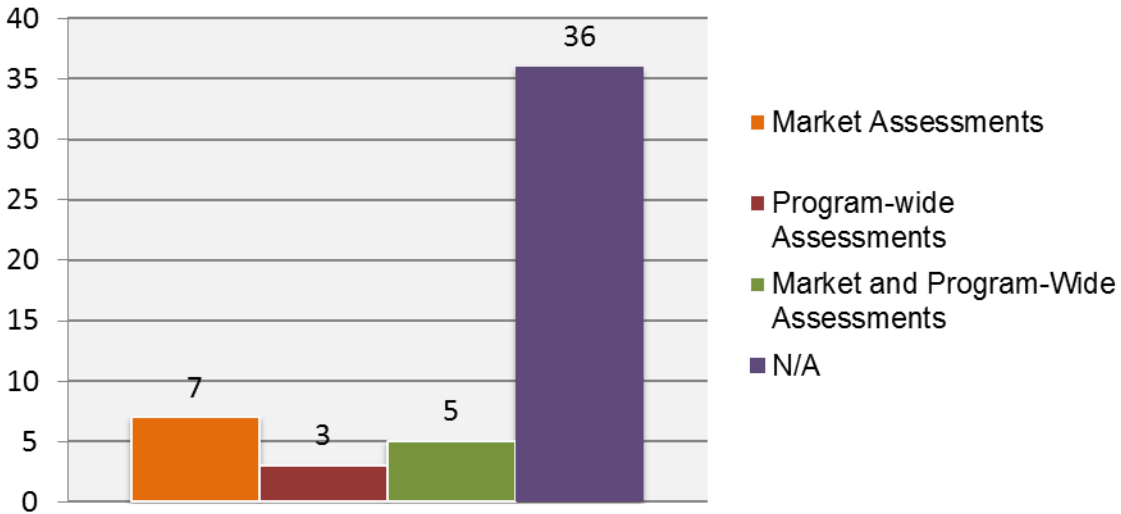
Yes	No	N/A	Summary Comments
29	1	0	Contacts lowest responsible bidder on items with large differences from EE prior to award
2	0	0	Only contact bidders after rejection based on excessive cost
0	2	0	Internal discussion (i.e. construction, cost estimate section, etc.) on potential price adjustments and rationale for higher bid amounts
7	0	0	Case-by-case basis (i.e., lack of bidders, unbalanced bid analysis)
9	0	0	Contact bidders (and non-bidders) if unit costs are significantly higher than engineer's estimate, to determine reason for non-submission of bids, and/or prior to re-advertising if applicable

**19) Does your state have written procedures to perform market assessments or program-wide assessments to detect evidence of collusion or antitrust issues?**



Yes	No	N/A	Summary Comments
2	3	0	Regularly reviews bid history and trends to determine if any unusual patterns exist
0	1	0	Market assessment performed
6	2	0	Utilize AASHTO/Project BAMS/DSS, or other software, to conduct competition analysis of defined market types and areas
0	3	0	Internal ad hoc team performs analysis and bid monitoring of defined markets and other bidding trend irregularities as needed
1	0	0	Utilizes FHWA Guidelines on Preparing Engineer's Estimate, Bid Reviews and Evaluation
3	1	0	Internal guidance/manual/procedures on determining collusion and/or assessing market conditions

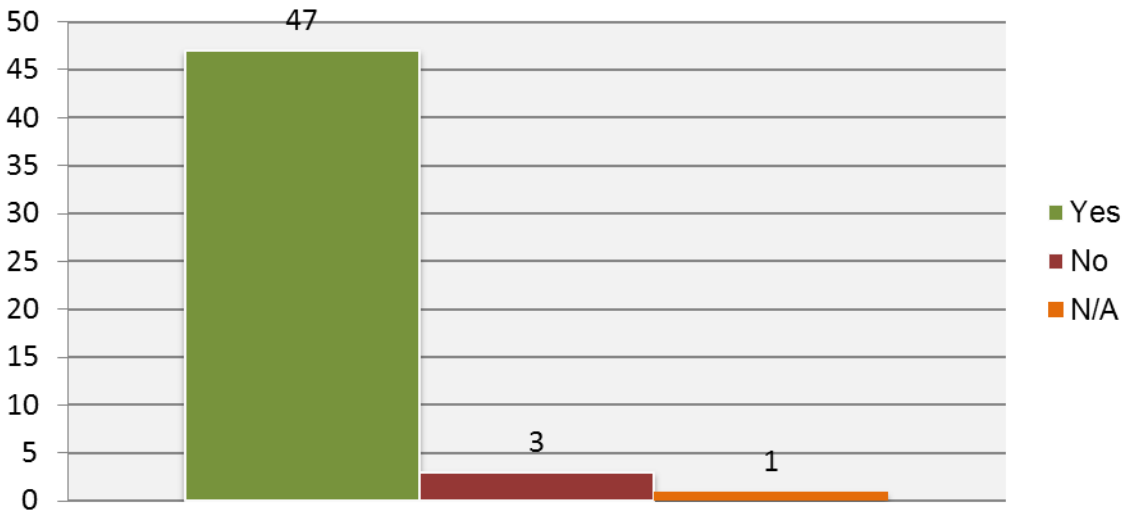
**20) If your answer is "Yes", what approach is used, what were the results of the assessments, and what steps were taken to improve competition?**



Market Assessments	Program-wide Assessments	Market and Program-Wide Assessments	N/A	Summary Comments
0	0	0	1	Let projects in Fall and Spring
2	0	0	2	Tie projects
0	0	0	1	Extend advertising period
0	0	0	1	State optioned material sources
0	0	0	0	Separate unique project elements into stand-alone contract
0	0	0	0	Flexible starting dates and extend advertising periods
0	0	0	0	Increase outreach to contractors
1	0	0	34	Not Applicable
1	0	0	0	Minimize monopoly type conditions of material sources and asphalt plants
0	0	3	0	Approach outlined within internal guidance/manual/procedures using AASHTO BAMS/DSS and/or other software to perform statistical analysis
1	0	0	0	Change size and type between lettings
2	0	0	0	Electronic bidding system

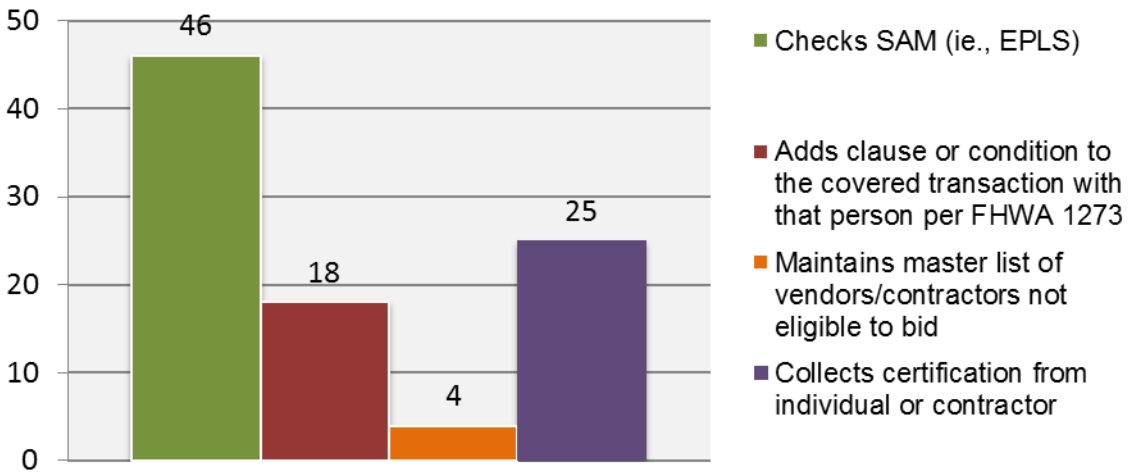


**21) Does your Division Office stewardship policy provide for review/approval of changes in your states procurement procedures (e.g. 23 CFR 635.110(b))?**

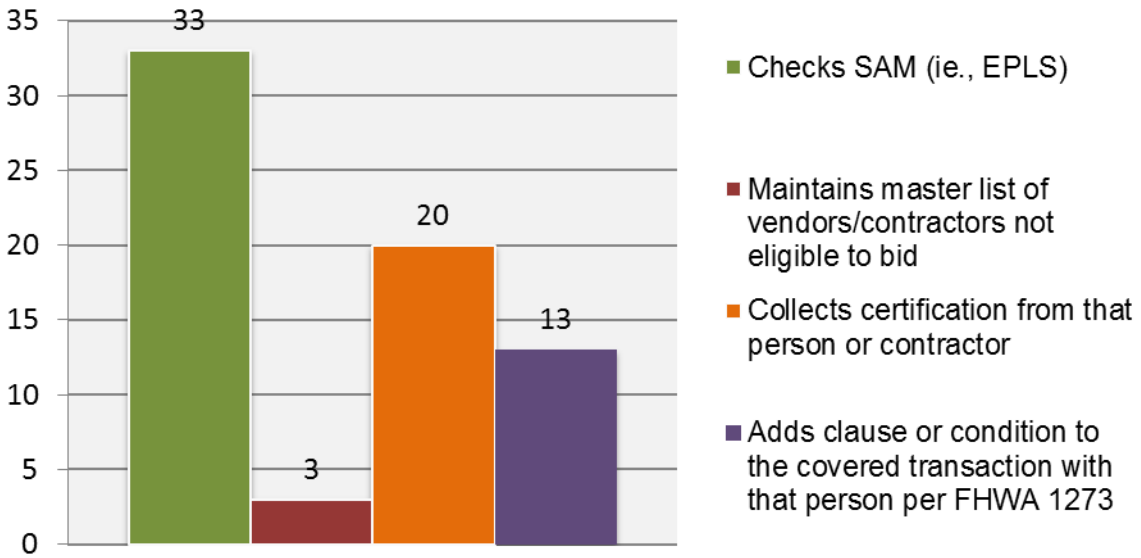


Yes	No	N/A	Summary Comments
27	0	1	Approval process for changes to state's procurement procedures specifically cited in stewardship and oversight agreement
14	0	0	By reference to federal regulations
5	2	0	Common Practice - any changes to procurement procedures impacting competition require FHWA review and approval
1	0	0	By reference related to Division Office approval of internal manual

**22) 2 CFR 180.300 provides three methods to ensure that ineligible, suspended or debarred persons/firms are not participating in Federal-aid projects. What method does your state use to verify the eligibility of prime contractors?**



**23) What method does your state use to verify the eligibility of subcontractors?**



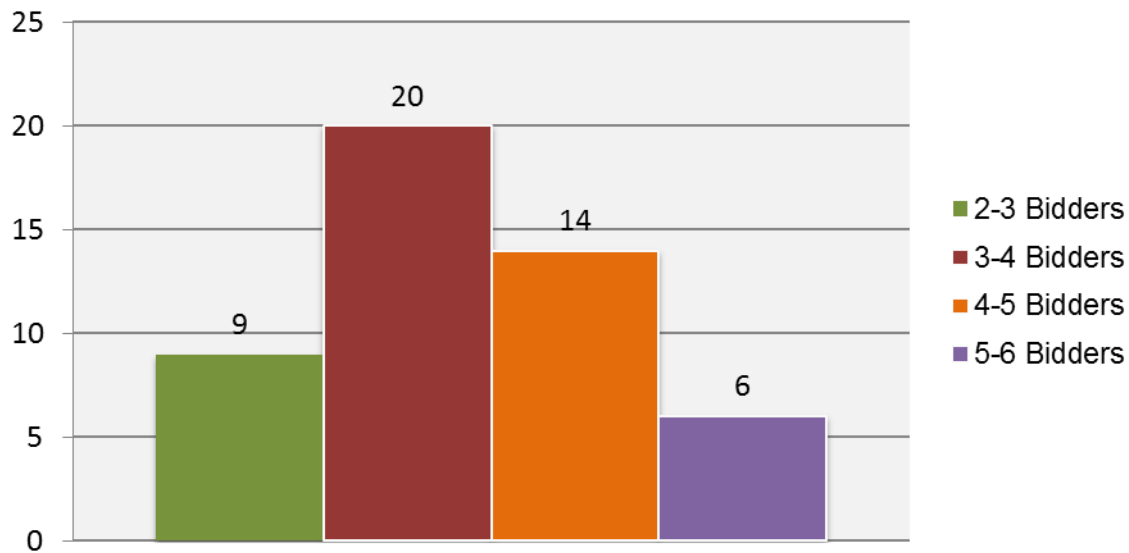
**24) Review the bid results for 30 projects from your CAP random project list and conduct the following analysis.**

Count	Response
1611	Total Number of Projects Reviewed

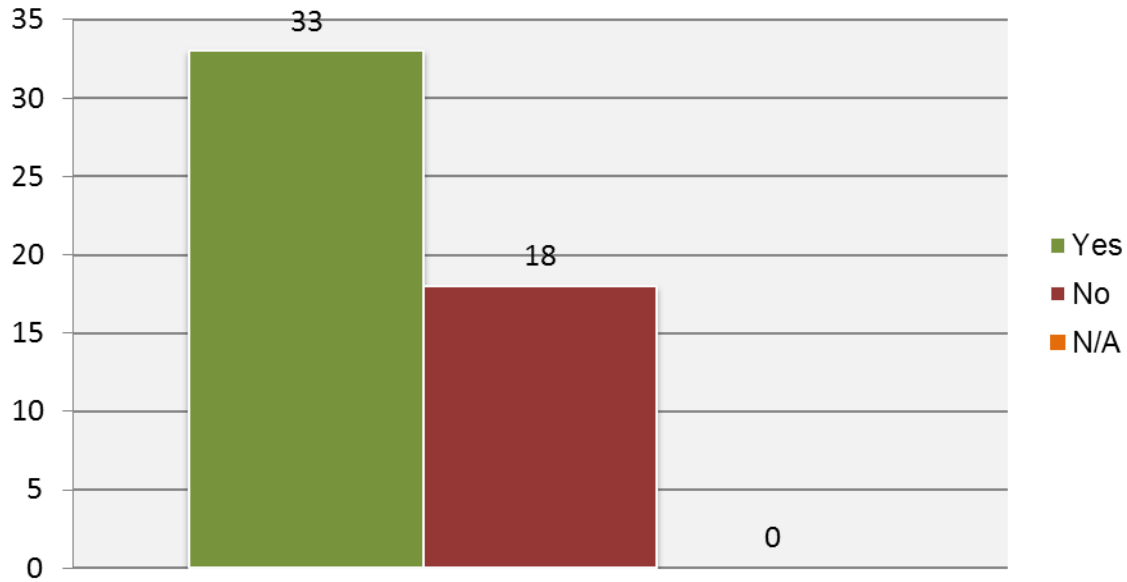
**24a) Determine the percentage of projects sampled where the low bid fell within -10% to +10% of the estimate.**

Percent	Response
47%	Median Percent of projects samples falling between +/- 10% of estimate
48%	Average Percent of projects samples falling between +/- 10% of estimate
13%	Standard Deviation Percent of projects samples falling between +/- 10% of estimate

**24b) Determine the percentage of projects with 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 19, etc. Bids.**

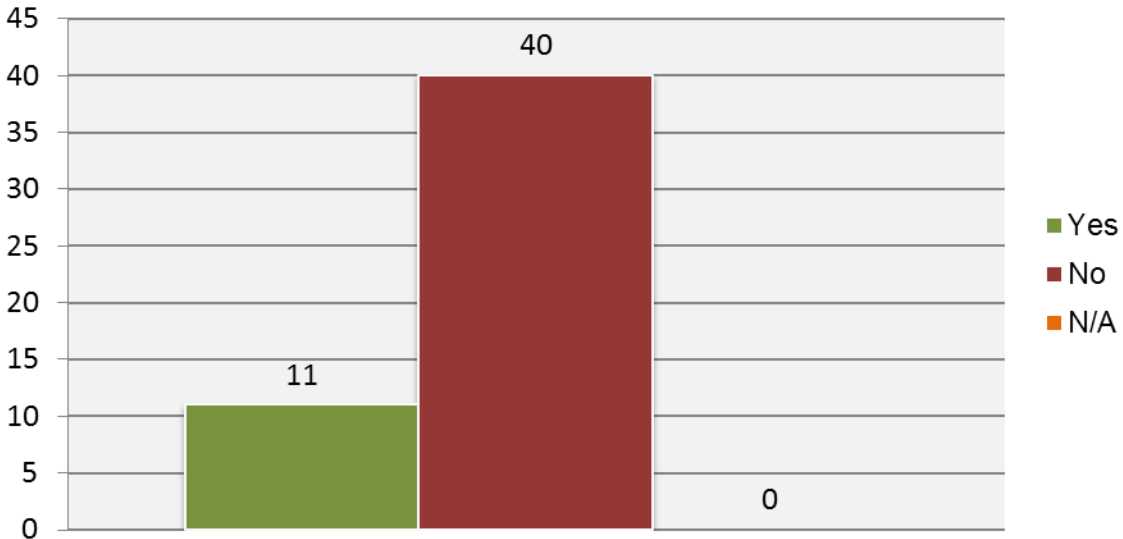


### 24c) Are any trends noted?



Yes	No	N/A	Summary Comments
4	0	0	Percentage below EE decreases with number of bidders per proposal
6	0	0	Percentage below EE increases with number of bidders per proposal
2	0	0	>50% of projects exceeded EE by >10%
3	0	0	Accuracy of estimates vary significantly between EE and bid amount(s)
6	0	0	>50% of projects below EE (within 10%)
1	0	0	Pavement preservation (maintenance) projects consistently outside guidelines for award
2	0	0	Bid distribution consistent with prior analysis
1	0	0	No projects below 3 bidders
1	0	0	No project in data set with low bid greater than 10% of EE
1	0	0	<\$1M projects have highest percentage difference between engineer's estimate

**25) Based on the results of this review does the Division recommend a follow-up program review for this State?**



**25a) If yes, what is the scope of the recommended review?**

Count	Summary Comments
33	Not Applicable
3	Establish more uniform cost estimate policies and procedures throughout project development continuum
6	Review underway on cost estimate preparation and improvements to process
1	Developing SOP on estimating procedures with projects having defined scope of work
2	Plan to develop internal cost estimating manual/policy/guidance document
3	Evaluate cost estimating documentation and management of total project costs through construction
3	Conducting process/program review on cost estimating and bid analysis
1	Establish performance goals for cost estimating to ensure quality estimates and budgets are met
1	Review procedures and accuracy of cost estimates developed for construction change orders
1	Process review completed on engineering estimates and determining initial contract time



*Report prepared by:*

*FHWA Resource Center  
Construction & Project Management  
Technical Service Team  
61 Forsyth Street SW, STE 17T26  
Atlanta, GA 30303  
Phone: (404) 562-3570  
Fax: (404) 562-3700*

*For additional copies of this report, contact us.*