# 0-5799-P1

# TxDOT Synthesis of the Construction Inspection Workload Reduction Strategies

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*Project 0-5799: Synthesis Study of Programs Used to Reduce the Need for Inspection Personnel*

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# Disclaimers

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# Chapter 1. Introduction

## 1.1. Background

An increase in transportation budgets the past two decades and a consequent movement toward more outsourcing of DOT activities can be significantly attributed to two historic events. The 1998 authorization of the Transportation Equity Act of the 21st Century (TEA-21), which resulted in an average increase in state funding of more than 44% in transportation programs. The subsequent authorization of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005, which extended and expanded the TEA-21 (Warne 2003). As a result, DOTs were able to complete projects that would have not been feasible without the additional funding. While these additional projects will decrease congestion and increase transportation safety, the DOTs have not seen a sufficient increase in personnel to manage the additional work. Consequently, TxDOT and other state DOTs are addressing their workforce challenges by outsourcing key project responsibilities that were previously performed by in-house DOT forces and adapting their practices to perform construction administration more efficiently.

TxDOT's Construction Division and the district construction departments have a shortage of skilled inspectors and that is impacting TxDOT's ability to efficiently manage its QC/QA workload, as suggested by anecdotal evidence. Several large highway projects, especially in the urban areas, where contractors are working six or seven days each week, result in construction inspectors working overtime in order to inspect the work as it is completed. Long-term overtime is a known cause of fatigue (Hanna 2005), and labor laws typically limit the number of consecutive days that a person can work. As a result, the district personnel have had considerable difficulty meeting the inspection needs and requirements, especially because state DOTs have difficulty recruiting and retaining experienced and well qualified inspection personnel. The situation is further complicated with the increase in complexity of transportation construction projects.

TxDOT faces significant workforce challenges, particularly in the districts, where the testing and inspection workload is increasing but the workforce is decreasing. As a result of these workforce challenges, TxDOT is looking for more effective ways to manage their testing, inspection, and measurement workload. They are looking to other DOTs from which they believe much can be learned. Other states are facing similar workforce challenges and have taken actions to implement procedures to reduce their construction inspection workload. Such procedures include increasing contractor testing and inspection responsibilities, outsourcing testing and inspection to third parties, creating extensive training and certification programs, and modifying their specifications to minimize time intensive testing and measurement. Accordingly, there is a need to summarize the best practices from those state DOTs that have already instituted successful programs to reduce the QC/QA workload that could potentially aid TxDOT in addressing their specific workload challenges. This project summarized TxDOT's current workload challenges, identified successful workload reduction strategies that have been implemented in other state DOTs, compared TxDOT's challenges and practices to the other states' challenges and practices, and lastly prioritized the workload reduction strategies implemented in other states that could be applied to manage TxDOT's workforce challenges.

## 1.2. Methodology

At the onset of this study, the researchers met with four high level inspectors that are part of a special program within TxDOT designed to train and mentor inspectors, identified as the Inspector Development Program (IDP). The IDP Team discussed testing, inspection, and measurement challenges faced by inspectors within TxDOT. An initial list of workload challenges was developed, and these challenges were used to structure subsequent interviews with personnel from TxDOT and other state DOTs. In-person and phone interviews were conducted with five TxDOT experts who had knowledge of concrete, hot mix asphalt, soils and bases, testing and materials, and striping. Directors of Construction from eight districts, both urban and rural, were also interviewed to identify challenges unique to various districts. The purpose of the interviews conducted with TxDOT officials was to investigate the impacts of the workload challenges identified by the IDP Team, identify additional workload challenges unique to various districts, and lastly gather suggestions for making changes within TxDOT to reduce the testing, inspection, and measurement workload.

Concurrently, telephone interviews were conducted with eight state DOTs who were selected randomly from regions across the U.S. These states interviewed include: Arizona, California, Florida, Indiana, South Carolina, Virginia, Washington, and Wisconsin. The purpose of these interviews was to identify potential workload reduction strategies that other states had successfully implemented to reduced their workload challenges and could potentially be of benefit to TxDOT as well. These states were questioned about their own workload challenges and innovative solutions they had developed. In addition, they were questioned about whether they were also experiencing challenges similar to TxDOT and if they had developed effective solutions. Documents, such as specifications, manuals, policies, checklists, flow charts, etc., were requested to allow the researchers to examine specific language, diagrams, and products that might provide a model for implementing other states' innovative workload reduction strategies within TxDOT.

After the interviews were completed, the researchers compiled the data and identified over 100 workload reduction strategies that were recommended by TxDOT and other states. Several strategies were consolidated, and a list of 60 strategies was presented to members of TxDOT's Project Monitoring Committee. The Project Monitoring Committee reduced the 60 strategies to 31. These strategies were used to conduct a ranking workshop during which 14 TxDOT subject-matter experts and district personnel reviewed each strategy and ranked it according to the eight criteria identified in Table 1.1. A list of the workshop participants is included in Appendix A1. The ranking workshop was conducted on June 12, 2008. The research team prepared a package of materials for the workshop. From those materials, a list of the preliminary workload reduction strategies is included in Appendix A2 and the information sheets developed for each strategy is included in Appendix A3.

The research team realized that not all the criteria were equally as important. As a result, members of TxDOT's Project Monitoring Committee and IDP Team performed a weighting exercise to assign relative importance to the eight criteria. The weightings were averaged based on the responses and then normalized. The final results were analyzed to determine which workload reduction strategies will likely provide the greatest benefit to TxDOT. For each of the workload reduction strategies, the workshop rankings and weightings were combined to give a ranking raw score. Using the raw scores, each strategy was rank ordered from 1-31. This paper presents the rank ordered list of workload reduction strategies that are being considered for implementation in order to ease TxDOT's workforce challenges in Section 2.2. The focal point of this document is on the guidelines developed by the research team that TxDOT can use to implement the top 5 ranked workload reduction strategies broadly throughout the districts,

which has been included in Section 2.3. The PMC group also identified two additional strategies that were not ranked in the top, but they wanted to be included in this implementation guide. They have been identified as workload reduction strategy specialty 1 and 2. The implementation guide is a summary for each strategy of the findings from the research group as well as valuable information that TxDOT needs to take into consideration upon implementation of the suggested strategy.

**Table 1.1: Criteria for Evaluating Workload Reduction Strategies in Response to the Question: How does implementing the workload reduction strategy impact each criterion?**

| Criteria | | Description |
|---|---|---|
| 1 | In-House Control Over Quality | The amount of TxDOT in-house control over quality. |
| 2 | Quality of Project or Product | The long-term performance of the highway component over its entire life cycle. |
| 3 | TxDOT Inspection Workload | The total current inspection work hours. |
| 4 | TxDOT Non-Inspection Workload (Administration and Oversight) | The implementation of the strategy may impact TxDOT personnel oversight and efforts in some other areas (or department/division, such as human resources). |
| 5 | Direct Project Cost | The bid or contract cost. |
| 6 | Indirect Cost (e.g. consultant contracts, training, certification) | The overhead cost incurred by TxDOT for providing in-house inspectors (for example, training and certifications). In addition, the cost incurred by TxDOT for outsourcing QC/QA services to third-party consultants (for example, rent-a-techs and professional service contracts). |
| 7 | Need for (or Development of) New Processes, Tools or Resources | New processes, tools or resources that will have to be created in order for the strategy to be implemented. |
| 8 | Ease of Implementation | How easy it will be to implement the strategy when considering economical, political, and legal or any other constraints. |
| NOTE: Criteria 1-6 are ranked from *Decrease* to *Increase*; Criteria 7-8 are ranked from *Low* to *High*. Each ranking has a *No Change* option. | | |

## 1.3. Organization of Synthesis

This guide book is divided into three chapters. Chapter 1 presents the project's background, purpose, methodology, and summary of findings. Chapter 2 presents the recommended guidelines for successful implementation of the workload reduction strategies throughout TxDOT. Each guideline developed in Section 2.3. includes the following sections: Description, Potential Benefits or Intent, Implementation Strategy, Conditions for Successful Implementation and Cautions, Anticipated Cost for Implementation, Examples, References and Attachments if needed. Finally, Chapter 3 provides conclusions.

## 1.4. Summary of Findings

As a result of interviews with TxDOT and other state DOTS and the analysis from a TxDOT ranking workshop, the suggested workload reduction strategies from the research group have been rank ordered from 1 to 31. The top 5 strategies and two additional strategies requested by the PMC are listed in Table 1.2. Implementation guidelines have been developed for these strategies and are included in Section 2.3.

**Table 1.2: Recommended Top 5 and Special Workload Reduction Strategies**

| Strategy Rank Order | Workload Reduction Strategy Description |
|---|---|
| 1 | Create checklists for selected pay items that help inspectors prioritize inspection elements and direct them to relevant inspection documents. |
| 2 | Use Lump Sum or Plan Quantity approach to payment where the contractor certifies compliance so that TxDOT does not have to measure: Bridge Projects, Fencing, Guardrail, Landscaping, Lighting, Seeding, Sidewalks, Signing, Signals, Traffic Stripes and Markings. |
| 3 | Make the contractor responsible for collecting quantity tickets and delivering them to TxDOT on a daily basis. |
| 4 | Reduce the number of specification items and combine items and quantities for payment: Landscaping, Signals, Traffic Stripes and Markings. |
| 5 | Use equipment technology for the measurement of temperature and segregation in HMA. |
| SP 1 | Completely outsource entire projects to consultants to manage and inspect all aspects of the project. |
| SP 2 | Require the contractor to provide independent consultant QA services: Seal Coat or Overlay, Embankment, Subgrade Compaction. |

# Chapter 2. Implementation Guide for Recommended Workload Reduction Strategies

## 2.1. Introduction to Recommended Workload Reduction Strategies

During the interviews with TxDOT and other state DOTs, over 100 workload reduction strategies were identified to address the 10 workforce challenges identified by the IDP Team. The researchers consolidated several strategies that were similar, reducing the number of viable techniques to 60. These 60 were reviewed by the TxDOT Project Monitoring Committee and reduced to 31 strategies. A workshop was held with TxDOT personnel that ranked the strategies based on eight criteria so the top methods for reducing inspection workload could be identified. After the workshop, members of TxDOT's Project Monitoring Committee and IDP Team performed a weighting exercise to assign relative importance to the eight criteria. For each of the workload reduction strategies, the workshop rankings and weightings were combined to yield a ranking raw score. The maximum raw score that a strategy could receive was 57.1 and the minimum was 11.2. Using the raw scores, the strategies were rank ordered from 1 to 31, which are identified in Table 2.1. The research team used the workshop to identify the workload reduction strategies with the potential to provide the most benefit to TxDOT. The research team has prepared guidelines that TxDOT can use to implement the top 5 ranked workload reduction strategies broadly throughout the districts in Section 2.3.

## 2.2. List of Recommended Workload Reduction Strategies

Table 2.1 is a list of the rank ordered workload reduction strategies from 1 to 31 based upon their ranking raw score.

**Table 2.1: Ranked Workload Reduction Strategies**

| Strategy Rank Order | Ranking Raw Score | Workload Reduction Strategy Description |
|---|---|---|
| 1 | 38.52 | Create checklists for selected pay items that help inspectors prioritize inspection elements and direct them to relevant inspection documents. |
| 2 | 38.27 | Use Lump Sum or Plan Quantity approach to payment where the contractor certifies compliance so that TxDOT does not have to measure: Bridge Projects, Fencing, Guardrail, Landscaping, Lighting, Seeding, Sidewalks, Signing, Signals, Traffic Stripes and Markings. |
| 3 | 38.22 | Make the contractor responsible for collecting quantity tickets and delivering them to TxDOT on a daily basis. |
| 4 | 38.10 | Reduce the number of specifications and combine items and quantities for payment: Landscaping, Signals, Traffic Stripes and Markings. |
| 5 | 36.75 | Use equipment technology for the measurement of temperature and segregation in HMA. |
| 6 | 35.46 | Increase or improve *Site Manager* system training to reduce double data entry and reduce time spent on paperwork. |
| 7 | 35.14 | Convert inspector training courses to Computer-Based Training Courses as much as possible to make training easier to obtain. |
| 8 | 35.07 | Standardize information provided to contractors for input into GPS controlled construction machinery. |
| 9 | 35.05 | Use off-the-shelf shared-access software system for contractors to submit required inspection data and reports. |

| | | |
|---|---|---|
| 10 | 34.16 | Modify specification to allow the replacement of density measurement with stiffness in order to encourage the use of high-tech "Intelligent Compactors". |
| 11 | 33.85 | Have consultants administer all or a portion of inspector training. |
| 12 | 33.82 | Outsource some specialty inspection items: Steel Painting and Welding. |
| 13 | 33.43 | Require compatible or equivalent certifications for in-house inspectors, consultants, and contractors for the area of work they will be inspecting. |
| 14 | 33.33 | Simplify TxDOT concrete certification process: Replace TxDOT concrete certification with ACI certification for as many pay items as feasible. |
| 15 | 33.20 | Use third-party consultant inspectors to perform inspection for SW3P. |
| 16 | 33.17 | Create construction training matrices that document training required of, and received by, inspectors on TxDOT projects (e.g. inspection, lab technician) (see info sheet for more). |
| 17 | 32.87 | Convert some specifications to performance-based or performance-related specifications: HMA, Landscaping, Seal Coats, Seeding, Traffic Stripes and Markings. |
| 18 | 32.75 | Replace some TxDOT QA testing and inspection with more extensive contractor QC testing and inspection. |
| 19 | 32.72 | Reduce the amount of time inspectors spend testing at the HMA plant: Replace an employee who works full-time at the plant with an employee who works part-time at the plant and only pulls samples twice a day. |
| 20 | 32.53 | Reduce the amount of time inspectors spend testing at the HMA plant: Take HMA samples at the site in lieu of taking samples at the plant. |
| 21 | 32.33 | Work with a third-party to develop and administer a more extensive QC/QA certification program. |
| 22 | 32.09 | Accept certain NICET and ASTM QC/QA testing certifications (to be selected by TxDOT experts). |
| 23 | 31.93 | Make the contractor responsible for on-site concrete testing (e.g. slump, air, temperature, making cylinders). |
| 24 | 31.85 | Outsource inspection and measurement of low-risk pay items to third-party consultants: Landscaping, Seeding, Traffic Stripes and Markings. |
| 25 | 31.56 | Require surety-issued warranty bonds on specific pay items: HMA, Landscaping, Seal Coats, Traffic Signals, Traffic Stripes and Markings. |
| 26 | 30.14 | Work with industry and contractors to establish contractor supplied long-term incentivized performance warranty (non-bond based) on specific pay items: Bridge Components, Highway Lighting System, HMA, Portland Cement Concrete Pavement, Signal Installation. |
| 27 | 29.76 | Use contractor QC results in lieu of TxDOT QA results for measurement and as a basis for payment. |
| 28 | 29.30 | Reduce the amount of time inspectors spend testing at the HMA plant: Use a certified QC/QA bond and weigh program where non-DOT plant employees are certified in an effort to reduce TxDOT inspectors at the plant. |
| 29 | 29.14 | Use more Design-Build project delivery systems, where the design-builder provides QC (and possibly QA). |
| 30 | 28.81 | Require the contractor to provide independent consultant QA services: Seal Coat or Overlay, Embankment, Subgrade Compaction. |
| 31 | 26.42 | Completely outsource entire projects to consultants to manage and inspect all aspects of the project. |

## 2.3. Implementation Guide for Recommended and Special Interest Workload Reduction Strategies

Implementation guides have been developed for the Top 5 workload reduction strategies in addition to two special interest strategies per the PMC's request. The guides are included in the following sections. It is important to note that these guides are a summary of the findings and for more detailed information please refer to the final project report that will be published October 31, 2008.

### 2.3.1. Implementation Guide for Recommended Workload Reduction Strategy 1

| Recommended Strategy | WLRS Implementation Strategy |
|---|---|
| 1 | **Create checklists for selected pay items that help inspectors prioritize inspection elements and direct them to relevant inspection documents.** |

**1. Description**

Checklists will be designed as an additional tool or resource to help inspectors more efficiently and effectively monitor the construction of TxDOT projects. The checklists will include a list of prioritized inspection elements so that inspectors can identify the most important items to inspect. The checklists will also reference the specifications and other relevant inspection documents. These checklists provide easily accessible documentation of quality requirements and allow inspectors to monitor construction processes to make sure that the project or product meets TxDOT's quality standards.

**2. Potential Benefits or Intent**

- Checklists will increase in-house control over quality because they will serve as a tool that is easily accessible to inspectors and will record and track the inspection documentation throughout a project. This documentation will be especially useful if inspection services are outsourced to third parties or as evidence if a project goes to litigation.
- An increase in quality of project or product because inspectors will be equipped with an additional tool to aid in the supervision of the quality of projects. Checklists will provide inspectors knowledge of what items are the most critical to inspect as well as the proper procedure for inspection.
- Anticipate no change in TxDOT inspection workload because inspectors are already inspecting items, but the checklists will serve as a way to help organize the inspection with a focus on highlighting the inspection of critical items.

**3. Implementation Strategy**

3.1 Form a committee to oversee the development of checklists
3.2 Identify specific pay items that are strong candidates for checklist development
3.3 Compile steps to be included in each checklist

- TxDOT will have the discretion to require checklist usage for projects or designate the checklists as guidelines for construction inspection.
- When possible, checklists should be compatible with Site Manager.
- It is recommended that these pay item checklists be integrated with checklists already developed in the TxDOT IDP Manual.

3.4 NOTE: As an alternative, this workload reduction strategy could be the subject of a future research project that would develop and lay out a framework for implementing a TxDOT checklists system.

**4. Conditions for Successful Implementation and Cautions**

- A passionate team committed to developing an effective checklist system for TxDOT will be essential to the success of this strategy.
- Checklists should be created to be compatible with TxDOT specifications. They need to reference item article numbers to point inspectors to TxDOT specifications and other relevant inspection documents.
- Checklists should be used as a complement to current inspector training and certification. The checklist should be used as one of many tools to aid an inspector. Checklists do not serve as a replacement for proper training or certification, but refer the inspector to the appropriate specifications and test methods.
- Checklists should not become a substitute for knowledge of the specification and good construction practice, which could lead to poor long-term inspector abilities.
- A significant amount of time will be spent on the development of the checklists. However, for the checklists to be effective there will need to be updates and revisions to stay up to date with the current specifications.
- It is anticipated that there will be a slight increase in TxDOT administration and oversight. By implementing checklists, a new program is being created that will require management, training and routine updates.

**5. Anticipated Cost for Implementation**

- There will be a slight increase to indirect project cost associated with the overhead cost to develop the checklists. In addition, there will be administrative costs to manage the new program and update the checklists.
- Anticipate no immediate impact on direct project cost. Potential cost benefits will be experienced in the long term as the checklists will enable inspectors to focus on inspection of important items more effectively and efficiently.

**6. Examples**

- Florida and Arizona have already developed comprehensive checklists that TxDOT could use as a model for adapting to their needs.
- Florida has developed checklists or what they refer to as “guidelists” that provide guidance for all major tasks that need to be completed relevant to construction inspection. The guidelists also highlight critical requirements, which are items that if not properly performed, have a high probability of causing problems during the construction phase. Some of the types of inspector guidelists developed in Florida include: Environmental Compliance, Earthwork, Drainage, Base, Asphalt, Concrete, Bridge Structures, Signalization, Lighting, Grassing, Landscaping (FDOT 2008).
- Arizona has created massive checklists or what they refer to as “quantlists” that cover every aspect of their work. The quantlists are described as allowing for an objective evaluation of construction processes. Their quantlists must be completed along with their diary and other documentation requirements.

- The Western Federal Lands Highway Division of the Federal Highway Administration (FHWA) has created inspection checklists for various construction items which can be accessed online (FHWA 2008). An example of the checklist they created for Structural Concrete is included in Appendix 1.

## 7. References


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## 8. Attachments for Recommended WLRS 1

- Attachment 1: FHWA Structural Concrete Inspection Checklist

## Attachment 1: FHWA Structural Concrete Inspection Checklist 1

US DEPARTMENT OF TRANSPORTATION – FEDERAL HIGHWAY ADMINISTRATION

*Construction Inspection Checklist*

**Section 552 Structural Concrete**

| | |
|---|---|
| Project Name: | Project No.: |
| Date: | Weather: |
| Contractor: | Subcontractor: |
| Inspector: | Location/Station: |
| Description of work being inspected: | |

| Conformance | | | CHECKS (characteristics) |
|---|---|---|---|
| Yes | No | N.A. | |
| | | | **Composition (Concrete Mix Design)** |
| ☐ | ☐ | ☐ | 1. Was a concrete mix design submitted in accordance with Subsection 552.03? (552.03) |
| ☐ | ☐ | ☐ | 2. Does the submitted concrete mix design meet the requirements of Subsection 552.03? (552.03) |
| | | | **Storage and Handling of Material** |
| ☐ | ☐ | ☐ | 3. Were all materials stored and handled in a manner that prevents segregation, contamination, or other harmful effects? (552.04) |
| ☐ | ☐ | ☐ | 4. Was cement and fly ash containing evidence of moisture contamination used? (552.04) |
| ☐ | ☐ | ☐ | 5. Was aggregate stored and handled in a manner that ensured uniform moisture content at the time of batching? (552.04) |
| | | | **Measuring Material** |
| ☐ | ☐ | ☐ | 6. Was the concrete batched according to the approved mix design and the following tolerances: Cement ± 1 percent, Water ± 1 percent, Aggregate ± 2 percent, and Additive ± 3 percent? (552.05) |
| | | | **Batching Plant, Mixers and Agitators** |
| ☐ | ☐ | ☐ | 7. If a batching plant, mixer and agitator was used did it conform to AASHTO M 157? (552.06) |
| ☐ | ☐ | ☐ | 8. Did the continuous volumetric mixing equipment conform to AASHTO M 241? (552.06) |
| | | | **Mixing** |
| ☐ | ☐ | ☐ | 9. Was all mixing equipment (mix plant or truck) operated within manufacturer's recommended capacity? (552.07) |
| ☐ | ☐ | ☐ | 10. Was the concrete produced, of a uniform consistency? (552.07) |
| ☐ | ☐ | ☐ | 11. If concrete was produced in a Central-mix plant was it according to Subsection 552.07(a)? (552.07a) |
| ☐ | ☐ | ☐ | 12. If concrete was mixed in a truck were any sections of the blades worn 1 inch or more below the original manufactured height? (552.07b) |

| Conformance | | | CHECKS (characteristics) |
|---|---|---|---|
| Yes | No | N.A. | |
| ☐ | ☐ | ☐ | 13. If concrete was mixed in a truck did the mixers and agitators in the mixing drum have accumulated hard concrete or mortar on them? (552.07b) |
| ☐ | ☐ | ☐ | 14. If concrete was mixed in a truck, were admixtures added to the mix water before or during mixing? (552.07b) |
| ☐ | ☐ | ☐ | 15. If concrete was mixed in a truck was the batch charged into the drum so a portion of the mixing water entered in advance of the cement? (552.07b) |
| ☐ | ☐ | ☐ | 16. If concrete was mixed in a truck was each batch mixed according to AASHTO M 157?<br>(552.07b) |
| | | | **Delivery** |
| ☐ | ☐ | ☐ | 17. Was concrete delivered according to Subsection 552.08 and Table 552-4? (552.08) |
| | | | **Quality Control of Mix** |
| ☐ | ☐ | ☐ | 18. Was the quality control of mix performed according to Subsection 552.09? (552.09) |
| | | | **Temperature and Weather Conditions** |
| ☐ | ☐ | ☐ | 19. Was the temperature of the concrete mixture just before placement between 50 and 90°F, except for bridge decks the mixture should be between 50 and 80°F? (552.10) |
| ☐ | ☐ | ☐ | 20. Was cold weather placement done according to Subsection 552.10(a) and for hot weather placement according to Subsection 552.10(b)? (552.10a,b) |
| ☐ | ☐ | ☐ | 21. When placing concrete in bridge decks or other exposed slabs, was the expected evaporation rate less than 0.1 pound per square foot per hour as determined by figure 552-1? (552.10) |
| ☐ | ☐ | ☐ | 22. If necessary was one or more of the following actions taken: (1) Construct windbreaks or enclosures to reduce wind velocity throughout the area of placement; (2) Use of fog sprayers upwind of placement to increase relative humidity; (3) Reduce the temperature of the concrete according to Subsection 552.10(b)? (552.10c) |
| ☐ | ☐ | ☐ | 23. Was the concrete protected from rain at all times during and immediately after placement? (552.10d) |
| | | | **Handling and Placing Concrete** |
| ☐ | ☐ | ☐ | 24. Was the handling and placing of the concrete done according Subsection 552.11? (552.11) |
| | | | **Construction Joints** |
| ☐ | ☐ | ☐ | 25. Were construction joints provided at locations shown on the plans? (552.12) |
| ☐ | ☐ | ☐ | 26. If additional construction joints were added was written approval provided? (552.12) |

| Conformance | | | CHECKS (characteristics) |
|---|---|---|---|
| Yes | No | N.A. | |
| ☐ | ☐ | ☐ | 27. Was reinforcing steel extended uninterrupted through construction joints? (552.12) |
| ☐ | ☐ | ☐ | 28. Were lap splices or mechanical splices embedded within the concrete and not in a construction joint? (552.12) |
| ☐ | ☐ | ☐ | 29. Dowels were not used? (552.12) |
| ☐ | ☐ | ☐ | 30. Were gauge strips placed at horizontal construction joints inside the forms along all exposed faces to produce straight joint lines? (552.12) |
| ☐ | ☐ | ☐ | 31. If a joint was between two fresh concrete placements, was the first placement rough floated to thoroughly consolidate the surface and leave the joint surface in a roughened condition? (552.12) |
| ☐ | ☐ | ☐ | 32. Was the joint surface kept saturated? (552.12) |
| ☐ | ☐ | ☐ | 33. Immediately before placing new concrete, were the forms drawn tightly against previously placed concrete and, where accessible, was the joint surface thoroughly coated with a very thin coating of cement mortar? (552.12) |
| ☐ | ☐ | ☐ | 34. If a joint was between existing concrete and a new placement, was the existing concrete cleaned by abrasive blasting or other approved method to remove all laitance and foreign material, to expose clean aggregate, and to roughen the joint surface? (552.12) |
| ☐ | ☐ | ☐ | 35. Before concrete was placed, was an approved bonding product applied to the joint surface according to the manufacture's recommendation? (552.12) |
| | | | **Expansion and Contraction Joints** |
| ☐ | ☐ | ☐ | 36. Were expansion and contraction joints formed according to Subsection 553.13? (552.13) |
| | | | **Finishing Plastic Concrete** |
| ☐ | ☐ | ☐ | 37. Was the finishing of plastic concrete performed according to Subsection 552.14? (552.14) |
| | | | **Curing Concrete** |
| ☐ | ☐ | ☐ | 38. Was curing begun immediately after the free surface water was evaporated and the finishing was completed? (552.15) |
| ☐ | ☐ | ☐ | 39. If the surface of the concrete began to dry before the selected cure method was implemented was the concrete surface kept moist using fog spray, without damaging the surface? (552.15) |
| ☐ | ☐ | ☐ | 40. Were surfaces to be rubbed kept moist after forms were removed and was the surface cured immediately following the first rub? (552.15) |
| Conformance | | | CHECKS (characteristics) |

| Yes | No | N.A. | |
|---|---|---|---|
| ☐ | ☐ | ☐ | 41. Were the top surfaces of bridge decks cured using the liquid membrane curing compound method combined with the water method and if so was the liquid membrane curing compound applied immediately after finishing and the water cure applied within 4 hours after finishing? (552.15) |
| ☐ | ☐ | ☐ | 42. Was all concrete cured uninterrupted for at least 7 days, unless pozzolans were used in excess of 10 percent by mass of the hydraulic cement and then cured uninterrupted for at least 10 days? (552.15) |
| ☐ | ☐ | ☐ | 43. If the following methods of curing were used were they used according to Subsection 552.15 (a) forms in place, (b) water method or (c) liquid membrane curing compound? (552.15) |
| ☐ | ☐ | ☐ | 44. If the steam-curing method was used, was it used according to Subsection 552.15(d)? (552.15) |
| | | | **Finishing Formed Concrete Surfaces** |
| ☐ | ☐ | ☐ | 45. Were all rock pockets or honeycombed concrete removed and replaced or repaired? (552.16) |
| ☐ | ☐ | ☐ | 46. Were all sound, formed concrete surfaces finished according to Subsections 552.16 (a), (b), (c), (d), (e), (f) or (g) depending of the finish required? (552.16) |
| | | | **Concrete Anchorage Devices** |
| ☐ | ☐ | ☐ | 47. Were concrete anchorage devices tested and installed according to Subsection 522.17? (552.17) |
| | | | **Loads on New Concrete Structures** |
| ☐ | ☐ | ☐ | 48. Was traffic kept off of concrete bridge decks until all deck concrete had attained the design compressive strength and had been in place for at least 14 days or longer? (552.18) |
| ☐ | ☐ | ☐ | 49. Construction loads of 4000 pounds or more were not placed on the deck until after the concrete had cured at least 7 days and the concrete in the entire span had attained a compressive strength of at least 70 percent of the specified design strength? (552.18) |
| ☐ | ☐ | ☐ | 50. For precast concrete multi-beam sections, vehicles were not allowed on any span before the grout attained strength of 3000 pounds per square inch and tie rods had been tightened? (552.18) |
| ☐ | ☐ | ☐ | 51. For post-tensioned concrete structures, vehicles were not allowed over 4500 pounds on any span before the prestressing steel for that span was tensioned, grouted, and cured, the grout obtained a strength of 3000 pounds per square inch, and the tie rods tightened? (552.18) |
| ☐ | ☐ | ☐ | 52. Were vehicles' weighing less than 4500 pounds permitted on a span provided the mass of the vehicle was included in the falsework design? (552.18) |

| | |
|---|---|
| Percent Conformance Calculations | $\frac{\text{Yes}}{\text{Yes + No}}(100) = \frac{\quad}{\quad}(100) = \quad$ % Conformance |

Comments:

_____

_____

_____

### 2.3.2. Implementation Guide for Recommended Workload Reduction Strategy 2

| Recommended Strategy | WLRS Implementation Strategy |
|---|---|
| 2 | **Use Lump Sum or Plans Quantity approach to payment where the contractor certifies compliance so that TxDOT does not have to measure.** |

**Lump Sum**

**1. Description**

- DOT inspection staffs are spending a large amount of time measuring and verifying pay items. Inspector efficiency would be increased if certain measurement-intensive pay items were changed to Lump Sum (LS).
- Lump Sum Contracting Technique as defined by FDOT requires the Contractor to submit a lump sum price to complete a project as opposed to bidding on individual pay items with quantities provided. The Contractor will be provided a set of bid documents (plans, specifications, etc.) and will develop a Lump Sum bid for all work specified in the contract drawings (2000).

**2. Potential Benefits or Intent**

- Using Lump Sum will reduce the time inspection staff spent on quantity verification and measurement in order to free-up inspector time for other duties.
- Lump Sum contracts streamline the payment process for the DOT because the contractor is responsible for estimating progress and invoicing (Scott and Mitchell 2007).
- Lump Sum reduces the administrative responsibility because several pay items are lumped together in one unit item (Scott and Mitchell 2007).

**3. Implementation Strategy**

3.1. Implementation is envisioned to require a considerable effort and commitment from a dedicated TxDOT team, but the potential benefits are significant. This method is fundamentally different than TxDOT's current unit price bidding and payment method.

3.2. Work with the Construction Division and TxDOT Specification Committee to form a sub-committee to oversee the development and administration of Lump Sum Contracting

3.3. Use a method to identify the most promising pay items to change measurement method to Lump Sum

3.4. Modify specifications for new Lump Sum pay items. It is recommended that this strategy be implemented with enough time to have the modifications incorporated into the next specification revision in 2014.

3.5. Use new Lump Sum guidelines on pilot projects and incorporate any necessary adjustments to guidelines

3.6. NOTE: As an alternative, this workload reduction strategy could be the subject of a future research project that would develop and lay out a framework for implementing a TxDOT Lump Sum bidding, payment, and measurement process.

## 4. Conditions for Successful Implementation and Cautions

- According to FDOT's Lump Sum Guidelines (2000), LS should be used on projects:
  - with a well-defined scope for all parties (Design and Construction)
  - with low risk of unforeseen conditions (i.e., projects that do not involve such things as significant underground utilities, earthwork variations, underground drainage pipes, bricks under pavement in urban areas, etc.)
  - with low possibility for change during all phases of work – Design and Construction (i.e., limited possibilities for added driveways, median modifications due to developments, changes due to political involvement, etc.)
- For Lump Sum items, require the contractor to provide a schedule of values to break out the quantities so TxDOT is able to quantify the cost of the changes, overruns and underruns.
- Lump Sum contracting places more risk on the contractor for quantity overruns, which could lead to higher bid prices. Also, the DOT runs the risk that they will pay a set amount even when quantities underrun the estimated amounts (Scott and Mitchell 2007).

## 5. Anticipated Cost for Implementation

- Lump Sum projects are anticipated to reduce the costs of design and inspection associated with quantity calculation, verification and measurement (FDOT 2000).
- There will be a slight increase to indirect project cost associated with the overhead cost to establish lump sum guidelines and modify the specifications for select pay items. In addition, there will be administrative costs associated with monitoring the effectiveness of lump sum items.

## 6. Examples

- From our interviews with TxDOT employees, it became overwhelmingly apparent that there was too much time being spent on measuring traffic stripes and markings. Therefore, it is highly recommended that the measurement of these pay items be changed to Lump Sum method.
- Florida recommends the following items as good Lump Sum candidates (FDOT 2000): Bridge Projects, Fencing, Guardrail, Landscaping, Lighting, Seeding, Sidewalks, Signing, Signals, Traffic Stripes and Markings.
- Florida gives examples of projects that may not be good Lump Sum candidates (FDOT 2000): Urban Construction/Reconstruction, Rehabilitation of Movable Bridges, Projects with Subsoil Earthwork, Concrete Pavement Rehabilitation Projects, and Major Bridge Rehabilitation/Repair Projects Where There Are Many Unknown Quantities.

## 7. References


- Blanchard, Brian. (2008). Director of Construction, Florida Department of Transportation. Phone: 850-414-4140. Email: brian.blanchard@dot.state.fl.us. Telephone conversation on March 20, 2008.
- Florida Department of Transportation (FDOT). (January 2000). *Plans Preparation Manual: Chapter 22 Lump Sum Project Guidelines*. Available at http://www.dot.state.fl.us/rddesign/PPMManual/2008/Volume1/zChap22.pdf.
- Scott, Sidney and Mitchell, Kathryn. (2007). *Alternative Payment and Progress Reporting Methods Task #2*. Trauner Consulting Services, Inc. Available at http://www.fhwa.dot.gov/programadmin/contracts/etgpayment.cfm.

**Plans Quantity**

1. **Description**
   - DOT inspection staffs are spending a large amount of time measuring and verifying pay items. Inspector efficiency would be increased if certain measurement-intensive pay items were changed to Lump Sum (LS) or Plan quantity (PQ).
   - According to TxDOT's 2004 Specifications, plans quantities may or may not represent the exact quantity of work performed or material moved, handled, or placed during the execution of the Contract. The estimated bid quantities are designated as final payment quantities, unless revised by the governing specifications.

2. **Potential Benefits or Intent**
   - The Wisconsin Department of Transportation lists the benefits of plan quantity items (2004), including:
     - Reduces time need for taking measurements
     - Eliminates resolving minor quantity variations
     - Provides for quicker payment to the contractor

3. **Implementation Strategy**
   3.1. Work with the Construction Division and TxDOT Specifications Committee and assign a sub-committee to oversee the modification of Plan Quantity Guidelines and Pay Items
   3.2. Identify additional specific pay items that can be changed to a Plans Quantity measurement method
   3.3. Modify specifications for new Plans Quantity pay items
   3.4. Monitor application of new Plans Quantity pay items and modify as necessary

4. **Conditions for Successful Implementation and Cautions**
   - TxDOT will not measure items that are designated as plans quantity items and will pay the quantity shown on the schedule of items, unless exceptions occur (WisDOT 2004).
   - During interviews with TxDOT employees, there seemed to be variation in the frequency of measuring of plans quantity items amongst the districts. In order for plans quantity items to be used as a successful workload reduction strategy, inspectors need to limit the amount of measuring they perform unless exceptions occur.
     - According to TxDOT Specifications (2004), exceptions occur if the quantity measured as outlined under "Measurement' varies by more than 5% (or as stipulated under "Measurement" for specific Items) from the total estimated quantity for an individual Item originally shown in the Contract, an adjustment may be made to the quantity of authorized work done for payment purposes. The party to the Contract requesting the adjustment will provide field measurements and calculations showing the revised quantity.
   - General guidance for selecting plans quantity pay items is summarized by WisDOT (2004).
     Select Pay items that:
     - Can be estimated accurately
     - Are not expected to vary beyond specification thresholds during construction
     - Are measured linearly or by area
     - Can be measured after the fact and can be measured later if needed
   - Do not select pay items that are (WisDOT 2004):
     - Measured by volume or weight, especially large quantities

- Shown on plans as undistributed quantities
- Traditionally have varied beyond the spec thresholds
- For repair or rehab work
- Pay items with small quantities

- The contractor should be required to certify the quantities to TxDOT for compliance to the Plans and Specifications.

**5. Anticipated Cost for Implementation**

- There will be a slight increase to indirect project cost associated with the overhead cost to establish plans quantity guidelines and modify the specifications for select pay items. In addition, there will be administrative costs associated with monitoring the effectiveness of plans quantity items.
- Anticipate no immediate impact on direct project cost. Inspectors should be able to spend less time measuring, but this likely will be offset with an increase time being now spent monitoring quality.

**6. Examples**

- WisDOT has prepared a list of guidance for selecting plan quantity items for various work types, including: concrete, asphalt, structural, traffic control, electrical and grading, landscaping and sewer. This presentation is included in Attachment 1 (WisDOT 2004).

**7. References**


- Scott, Sidney and Mitchell, Kathryn. (2007). *Alternative Payment and Progress Reporting Methods Task #2*. Trauner Consulting Services, Inc. Available at http://www.fhwa.dot.gov/programadmin/contracts/etgpayment.cfm.
- Texas Department of Transportation (TxDOT). (March 2005). *Plans Quantity Items.* Available at ftp://ftp.dot.state.tx.us/pub/txdot-info/des/specs/planquan.pdf.
- Texas Department of Transportation (TxDOT). (June 2004). *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges.* Available at ftp://ftp.dot.state.tx.us/pub/txdot-info/des/specs/specbook.pdf**.**
- Wisconsin Department of Transportation (WisDOT). (September 2004). *Pay Plan Quantity.* Available at https://trust.dot.state.wi.us/static/standards/fdm/19/PayPlanQuantityALL.pdf.
- Wisconsin Department of Transportation (WisDOT). (April 2008). *Construction and Materials Manual.* Available at http://roadwaystandards.dot.wi.gov/standards/cmm/index.htm.


**8. Attachments for Recommended WLRS 2**

- Attachment 1: WisDOT Pay Plan Quantity Presentation (September 2004)

# Pay Plan Quantity

Design Training - NetMeeting
Bureau of Highway Construction
September 2004

## Pay Plan Quantity

### Training Topics

- Objective
- Specification
- Selecting Bid Items
- Estimator & Trns•port Instructions
- Rollout - Implementation

## Pay Plan Quantity

### What is our objective?

- Pay Plan Quantity is one of several WisDOT initiatives to streamline contract administration.
- For selected bid items, Pay Plan Quantity will:
  - Eliminate field measuring
  - Eliminate time spent resolving minor quantity variations

## Pay Plan Quantity

### Standard Specifications

Section 109 - Measurement and Payment, establishes the general contractual requirement that WisDOT pays for all work acceptably completed, based on actual measured quantities.

# Pay Plan Quantity

## Standard Specifications

- 109.1 was revised in the 2004 Annual Supplement to add mechanism for Pay Plan Quantity
  (before letting decision to pay for work without measuring)
- 109.1 still includes mechanism for supplemental agreements
  (after construction decision to pay for work without measuring)

# Pay Plan Quantity

## Key specification elements:

- Pay Plan Quantity items are designated in the schedule of items with **P**
- Dept will not measure these designated items
- Dept will pay the quantity shown on the schedule of items, unless specified exceptions occur
- If specified exceptions do occur, Dept will make adjustments to the affected quantities

**109.1.1.2 Bid Items Designated as Pay Plan Quantity**

**109.1.1.2.1 General**

(1) If the schedule of items designates a bid item with a "P" in the item description, the department will not measure that bid item. The department will use the plan quantity, the approximate quantity shown on the schedule of items, for payment unless one or more of the following occurs:

1. A contract revision partially eliminates, completely eliminates, or affects the quantity for a designated bid item.
2. The quantity for a designated bid item varies by more than 5 percent from the plan quantity.
3. A quantity variation causes the value of the work under a designated bid item to vary by more than $5000 from the bid amount.

**109.1.1.2.2 Adjustments for Contract Revisions**

(1) The department will adjust the quantity for a designated bid item if the engineer revises the contract under 104.2 either with or without a change order. The engineer will either increase or decrease the affected quantity regardless of the magnitude of the revised work. The department will measure revised work as specified in 109.1.1.1. This adjustment has no impact on potential quantity changes the engineer might make under 109.1.1.2.3.

(2) If the department partially eliminates or completely eliminates a designated item, the department will pay for the designated item as specified in 109.5.

**109.1.1.2.3 Adjustments for Quantity Variations**

(1) If the actual work performed, excluding contract revisions, exceeds either the quantity threshold of item 2 of 109.1.1.2.1(1) or the value threshold of item 3 of 109.1.1.2.1(1), the engineer will adjust the affected quantity. Either the engineer or the contractor may identify an item for potential adjustment. If the contractor believes a quantity adjustment is necessary, notify the engineer as required under 104.3. Provide sufficient detail on the bid item in question to justify the engineer's review of that quantity.

(2) The engineer may adjust the quantity by re-computing or measuring all or only those portions of a bid item that vary from the plan quantity. The department will adjust the quantity to account for the entire variation from the plan quantity. If the engineer re-computes or measures only a portion of a bid item, the engineer will determine the quantity for the balance of that bid item based on the unaffected plan quantity.

# Pay Plan Quantity

## Selecting Bid Items

- General Guidance
- Guidance for Various Work Types
- Example Bid Items for Various Work Types

## Pay Plan Quantity

### General Guidance for Selecting Bid Items

Select Bid Items that:

- Can be estimated accurately
- Are not expected to vary beyond spec thresholds during construction
- Are measured linearly or by area
- Can be measured after the fact, i.e., have ability to measure later if needed

## Pay Plan Quantity

### General Guidance for Selecting Bid Items

Do not select Bid Items that are:

- Measured by volume or weight
  - Especially large quantities
  - Items with expansion factors

  (Note exception for structures, where volume and weight items are recommended)
- Shown on plans as undistributed quantities

## Pay Plan Quantity

### General Guidance for Selecting Bid Items

Do not select Bid Items that:

- Traditionally have varied beyond the spec thresholds
- Are for repair or rehab work

## Pay Plan Quantity

### General Guidance for Selecting Bid Items

There is not much value in selecting:

- Lump sum items
- Each items with small quantities

# Pay Plan Quantity

## Guidance for Various Work Types

- Concrete
- Asphalt
- Grading, Landscaping, and Sewer
- Structural
- Traffic Control
- Electrical

# Pay Plan Quantity

## Guidance for Concrete:

(See General Guidance)

Do not select:

- Concrete driveways
- Concrete pavement repair
- Spot replacements for curb & gutter and sidewalk

**Pay Plan Quantity**
**Example Bid Item List**

**Work Type:** Concrete Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 204.0100 | Removing Pavement | SY |
| 204.0130 | Removing Curb | LF |
| 204.0140 | Removing Gutter | LF |
| 204.0150 | Removing Curb & Gutter | LF |
| 204.0155 | Removing Concrete Sidewalk | SY |
| 211.0400 | Prepare Fundation for Asphaltic Shoulders | STA |
| 211.0500 | Prepare Foundation for Base Aggregate | STA |
| 320.0105 | Concrete Base 4 Inch | SY |
| 320.0110 | Concrete Base 4 1/2- Inch | SY |
| 320.0115 | Concrete Base 5 Inch | SY |
| 320.0120 | Concrete Base 5 1/2-Inch | SY |
| 320.0125 | Concrete Base 6 Inch | SY |
| 320.0130 | Concrete Base 6 1/2-Inch | SY |
| 320.0135 | Concrete Base 7 Inch | SY |
| 320.0140 | Concrete Base 7 1/2-Inch | SY |
| 320.0145 | Concrete Base 8 Inch | SY |
| 320.0150 | Concrete Base 8 1/2-Inch | SY |
| 320.0155 | Concrete Base 9 Inch | SY |
| 320.0160 | Concrete Base 9 1/2-Inch | SY |
| 320.0165 | Concrete Base 10 Inch | SY |
| 320.0170 | Concrete Base 10 1/2-Inch | SY |
| 320.0305 | Concrete Base HES 4 Inch | SY |
| 320.0310 | Concrete Base HES 4 1/2-Inch | SY |
| 320.0315 | Concrete Base HES 5 Inch | SY |
| 320.0320 | Concrete Base HES 5 1/2-Inch | SY |
| 320.0325 | Concrete Base HES 6 Inch | SY |
| 320.0330 | Concrete Base HES 6 1/2-Inch | SY |
| 320.0335 | Concrete Base HES 7 Inch | SY |
| 320.0340 | Concrete Base HES 7 1/2-Inch | SY |
| 320.0345 | Concrete Base HES 8 Inch | SY |
| 320.0350 | Concrete Base HES 8 1/2-Inch | SY |
| 320.0355 | Concrete Base HES 9 Inch | SY |
| 320.0360 | Concrete Base HES 9 1/2-Inch | SY |
| 320.0365 | Concrete Base HES 10 Inch | SY |
| 320.0370 | Concrete Base HES 10 1/2-Inch | SY |
| 320.0500 | Concrete Base Widening | SY |
| 415.0060 | Concrete Pavement 6 Inch | SY |



**Pay Plan Quantity**
**Example Bid Item List**

**Work Type:** Concrete Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 415.0065 | Concrete Pavement 6 1/2-Inch | SY |
| 415.0070 | Concrete Pavement 7 Inch | SY |
| 415.0075 | Concrete Pavement 7 1/2-Inch | SY |
| 415.0080 | Concrete Pavement 8 Inch | SY |
| 415.0085 | Concrete Pavement 8 1/2-Inch | SY |
| 415.0090 | Concrete Pavement 9 Inch | SY |
| 415.0095 | Concrete Pavement 9 1/2-Inch | SY |
| 415.0100 | Concrete Pavement 10 Inch | SY |
| 415.0105 | Concrete Pavement 10 1/2-Inch | SY |
| 415.0110 | Concrete Pavement 11 Inch | SY |
| 415.0115 | Concrete Pavement 11 1/2-Inch | SY |
| 415.0120 | Concrete Pavement 12 Inch | SY |
| 415.1080 | Concrete Pavement HES 8 Inch | SY |
| 415.1085 | Concrete Pavement HES 8 1/2 Inch | SY |
| 415.1090 | Concrete Pavement HES 9 Inch | SY |
| 415.1095 | Concrete Pavement HES 9 1/2 Inch | SY |
| 415.1100 | Concrete Pavement HES 10 Inch | SY |
| 415.1105 | Concrete Pavement HES 10 1/2 Inch | SY |
| 415.1110 | Concrete Pavement HES 11 Inch | SY |
| 415.1115 | Concrete Pavement HES 11 1/2 Inch | SY |
| 415.1120 | Concrete Pavement HES 12 Inch | SY |
| 416.0050 | Concrete Pavement Approach Slab | SY |
| 416.0055 | Concrete Pavement Approach Slab HES | SY |
| 416.0060 | Concrete Pavement Widening | SY |
| 416.0065 | Concrete Pavement Widening HES | SY |
| 416.0410 | Concrete Pavement Header | SY |
| 416.0415 | Concrete Pavement Header HES | SY |
| 416.0905 | Concrete Pavement Continuous Diamond Grinding | SY |
| 601.0105 | Concrete Curb Type A | LF |
| 601.0110 | Concrete Curb Type D | LF |
| 601.0115 | Concrete Curb Type G | LF |
| 601.0120 | Concrete Curb Type J | LF |
| 601.0150 | Concrete Curb Integral Type D | LF |
| 601.0155 | Concrete Curb Integral Type J | LF |
| 601.0205 | Concrete Gutter 24 Inch | LF |
| 601.0318 | Concrete Curb & Gutter 18 Inch | LF |
| 601.0322 | Concrete Curb & Gutter 22 Inch | LF |

**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Concrete Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 601.0331 | Concrete Curb & Gutter 31 Inch | LF |
| 601.0342 | Concrete Curb & Gutter Integral 18 Inch | LF |
| 601.0344 | Concrete Curb & Gutter Integral 36 Inch | LF |
| 601.0405 | Concrete Curb & Gutter 18 Inch Type A | LF |
| 601.0407 | Concrete Curb & Gutter 18 Inch Type D | LF |
| 601.0409 | Concrete Curb & Gutter 30 Inch Type A | LF |
| 601.0411 | Concrete Curb & Gutter 30 Inch Type D | LF |
| 601.0413 | Concrete Curb & Gutter 30 Inch Type G | LF |
| 601.0415 | Concrete Curb & Gutter 30 Inch Type J | LF |
| 601.0417 | Concrete Curb & Gutter 30 Inch Type K | LF |
| 601.0419 | Concrete Curb & Gutter 30 Inch Type L | LF |
| 601.0421 | Concrete Curb & Gutter 36 Inch Type A | LF |
| 601.0423 | Concrete Curb & Gutter 36 Inch Type D | LF |
| 601.0452 | Concrete Curb & Gutter Integral 30 Inch Type D | LF |
| 601.0454 | Concrete Curb & Gutter Integral 30 Inch Type J | LF |
| 601.0456 | Concrete Curb & Gutter Integral 30 Inch Type L | LF |
| 601.0502 | Concrete Curb & Gutter Integral 4 Inch Mountable 36 Inch | LF |
| 601.0512 | Concrete Curb & Gutter Integral 6 Inch Mountable 36 Inch | LF |
| 601.0552 | Concrete Curb & Gutter 4 Inch Mountable 36 Inch Type A | LF |
| 601.0554 | Concrete Curb & Gutter 4 Inch Mountable 36 Inch TypeD | LF |
| 601.0556 | Concrete Curb & Gutter 6 Inch Mountable 36 Inch Type A | LF |
| 601.0558 | Concrete Curb & Gutter 6 Inch Mountable 36 Inch Type D | LF |
| 602.0405 | Concrete Sidewalk 4 Inch | SF |
| 602.0410 | Concrete Sidewalk 5 Inch | SF |
| 602.0415 | Concrete Sidewalk 6 Inch | SF |
| 602.0420 | Concrete Sidewalk 7 Inch | SF |
| 603.0105 | Concrete Barrier Single-Faced 32 Inch | LF |
| 603.0110 | Concrete Barrier Single-Faced 42 Inch | LF |
| 603.0115 | Concrete Barrier Single-Faced 51 Inch | LF |
| 603.0205 | Concrete Barrier Double-Faced 32 Inch | LF |
| 603.0210 | Concrete Barrier Double-Faced 42 Inch | LF |
| 603.0215 | Concrete Barrier Double-Faced 51 Inch | LF |
| 603.0405 | Concrete Barrier Transition Section 32 Inch | LF |
| 603.0410 | Concrete Barrier Transition Section 42 Inch | LF |
| 603.0415 | Concrete Barrier Transition Section 51 Inch | LF |
| 603.0500 | Concrete Barrier Temporary Precast Contractor Furnished & Delivered | LF |
| 603.0600 | Concrete Barrier Temporary Precast State Owned Contractor Delivered | LF |



**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Concrete Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 603.0800 | Concrete Barrier Temporary Precast Contractor Furnished & Installed | LF |
| 603.0900 | Concrete Barrier Temporary Precast State Owned Contractor Installed | LF |
| 620.0100 | Concrete Corrugated Median | SF |
| 650.5000 | Construction Staking Base | LF |
| 650.5500 | Construction Staking Curb Gutter and Curb & Gutter | LF |
| 650.7000 | Construction Staking Concrete Pavement | LF |
| 650.7500 | Construction staking Concrete Barrier | LF |
| 690.0100 | Sawing Existing Pavement | LF |
| 690.0200 | Sawing Concrete Pavement Full Depth | LF |



# Pay Plan Quantity

## Guidance for Asphalt:

(See General Guidance)

Do not select:

- Patching items

**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Asphalt Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 211.0400 | Prepare Foundation for Asphaltic Shoulders | STA |
| 325.0100 | Pulverize and Relay | SY |
| 330.0100 | Mill and Relay | SY |
| 335.0100 | Rubblizing | SY |
| 340.0100 | Cracking and Seating | SY |
| 455.0600 | Tack Coat | TON |
| 455.0605 | Tack Coat | GAL |
| 465.0310 | Asphaltic Curb | LF |
| 465.0400 | Asphaltic Shoulder Rumble Strip | LF |
| 490.0100 | Salvaged Asphaltic Pavement | SY |
| 490.0200 | Salvaged Asphaltic Pavement Milling | SY |

# Pay Plan Quantity

## Guidance for Grading:

(See General Guidance)

Select:

- Common Exc.-rural, if quantity < 20,000 c.y.
- Common Exc.-urban, if typical section is relatively constant

NOTE:

- Plans must still include yardage information
- Can include EBS that is known
- Do not include EBS that is undistributed

# Pay Plan Quantity

## Guidance for Landscaping & Sewer:

(See General Guidance)

Select:

- Seed, sod, and mulch items on small projects only (i.e., small bridge projects)
- Storm sewer items

# Pay Plan Quantity

## Guidance for Landscaping & Sewer:

(See General Guidance)

Do not select:

- Rural drainage items

  (encourage use of supplemental agreement based on pipe list)
- Erosion Control Items

**Pay Plan Quantity**
**Example Bid Item List**

**Work Type:** Grading & Landscaping Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit | Small Quantity |
|---|---|---|---|
| 201.0105 | Clearing | STA | |
| 201.0110 | Clearing | SY | |
| 201.0205 | Grubbing | STA | |
| 201.0210 | Grubbing | SY | |
| 202.0105 | Roadside Clearing (station) | STA | |
| 202.0110 | Roadside Clearing | SY | |
| 204.0100 | Removing Pavement | SY | |
| 204.0105 | Removing Pavement Butt Joints | SY | |
| 204.0109.S | Removing Concrete Surface Partial Depth | SF | |
| 204.0110 | Removing Asphaltic Surface | SY | |
| 204.0115 | Removing Asphaltic Surface Butt Joints | SY | |
| 204.0120 | Removing Asphaltic Surface Milling | SY | |
| 204.0130 | Removing Curb | LF | |
| 204.0140 | Removing Gutter | LF | |
| 204.0150 | Removing Curb & Gutter | LF | |
| 204.0155 | Removing Concrete Sidewalk | SY | |
| 204.0160 | Removing Lip Curb | LF | |
| 204.0165 | Removing Guardrail | LF | |
| 204.0170 | Removing Fence | LF | |
| 204.0175 | Removing Concrete Slope Paving | SY | |
| 204.0200 | Removing Railroad Track | LF | |
| 204.0245 | Removing Storm Sewer (size) | LF | |
| 205.0100 | Excavation Common | CY | x |
| 208.0100 | Borrow | CY | x |
| 208.1100 | Select Borrow | CY | x |
| 209.0100 | Backfill Granular | CY | x |
| 210.0100 | Backfill Structure | CY | x |
| 211.0400 | Prepare Foundation for Asphaltic Shoulders | STA | |
| 211.0500 | Prepare Foundation for Base Aggregate | STA | |
| 214.0100 | Obliterating Old Road | STA | |
| 313.0115 | Rt Run | CY | x |
| 612.0104 | Pipe Underdrain 4-Inch | LF | |
| 612.0106 | Pipe Underdrain 6-Inch | LF | |
| 612.0108 | Pipe Underdrain 8-Inch | LF | |
| 612.0110 | Pipe Underdrain 10-Inch | LF | |
| 612.0112 | Pipe Underdrain 12-Inch | LF | |
| 612.0115 | Pipe Underdrain 15-Inch | LF | |

Page 1 of 3

**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Grading & Landscaping Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit | Small Quantity |
|---|---|---|---|
| 612.0118 | Pipe Underdrain 18-Inch | LF | |
| 612.0121 | Pipe Underdrain 21-Inch | LF | |
| 612.0204 | Pipe Underdrain Unperforated 4-Inch | LF | |
| 612.0206 | Pipe Underdrain Unperforated 6-Inch | LF | |
| 612.0208 | Pipe Underdrain Unperforated 8-Inch | LF | |
| 612.0210 | Pipe Underdrain Unperforated 10-Inch | LF | |
| 612.0212 | Pipe Underdrain Unperforated 12-Inch | LF | |
| 612.0215 | Pipe Underdrain Unperforated 15-Inch | LF | |
| 612.0218 | Pipe Underdrain Unperforated 18-Inch | LF | |
| 612.0221 | Pipe Underdrain Unperforated 21-Inch | LF | |
| 612.0404 | Pipe Underdrain Wrapped 4-Inch | LF | |
| 612.0406 | Pipe Underdrain Wrapped 6-Inch | LF | |
| 612.0408 | Pipe Underdrain Wrapped 8-Inch | LF | |
| 612.0410 | Pipe Underdrain Wrapped 10-Inch | LF | |
| 612.0412 | Pipe Underdrain Wrapped 12-Inch | LF | |
| 612.0415 | Pipe Underdrain Wrapped 15-Inch | LF | |
| 612.0504 | Pipe Underdrain Wrapped and Plowed 4-Inch | LF | |
| 612.0506 | Pipe Underdrain Wrapped and Plowed 6-Inch | LF | |
| 614.0100 | Cable Guard Fence | LF | |
| 614.0200 | Steel Thrie Beam Structure Approach | LF | |
| 614.0250 | Steel Thrie Beam Structure Approach Temporary | LF | |
| 614.0305 | Steel Plate Beam Guard Class A | LF | |
| 614.0310 | Steel Plate Beam Guard Class B | LF | |
| 614.0340 | Steel Plate Beam Guard Over Low-Fill Culverts Class A | LF | |
| 614.0355 | Steel Plate Beam Median Guard | LF | |
| 614.0360 | Steel Plate Beam Guard Temporary | LF | |
| 614.0400 | Adjusting Steel Plate Beam Guard | LF | |
| 614.0500 | Salvaged Guard Fence Cable | LF | |
| 614.0555 | Salvaged Guard Fence Steel Beam | LF | |
| 615.0100 | Guard Fence Timber Rail | LF | |
| 625.0100 | Topsoil | SY | x |
| 625.0500 | Salvaged Topsoil | SY | x |
| 627.0200 | Mulching | SY | x |
| 629.0205 | Fertilizer Type A | CWT | x |
| 629.0210 | Fertilizer Type B | CWT | x |
| 630.0110 | Seeding Mixture No. 10 | LB | x |
| 630.0120 | Seeding Mixture No. 20 | LB | x |



**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Grading & Landscaping Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit | Small Quantity |
|---|---|---|---|
| 630.0130 | Seeding Mixture No. 30 | LB | x |
| 630.0140 | Seeding Mixture No. 40 | LB | x |
| 630.0160 | Seeding Mixture No. 60 | LB | x |
| 631.1000 | Sod Lawn | SY | x |
| 645.0105 | Geotextile Fabric Type C | SY | |
| 645.0110 | Geotextile Fabric Type DF | SY | |
| 650.4500 | Construction Staking Subgrade | LF | |
| 650.5000 | Construction Staking Base | LF | |
| 650.5500 | Construction Staking Curb Gutter and Curb & Gutter | LF | |
| 650.7000 | Construction Staking Concrete Pavement | LF | |
| 650.7500 | Construction Staking Concrete Barrier | LF | |
| 650.8000 | Construction Staking Resurfacing Reference | LF | |
| 650.9900 | Construction Staking Initial Layout | LF | |



# Pay Plan Quantity

## Guidance for Structures:

(See General Guidance)

Select:

- Concrete masonry items measured by volume
- Bar steel reinforcement items measured by weight

Do not select:

- Piling Items
- Maintenance or repair items

**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Structural Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 502.0100 | Concrete Masonry Bridges | CY |
| 502.1100 | Concrete Masonry Seal | CY |
| 502.2000 | Compression Joint Sealer Preformed Elastomeric (width) | LF |
| 502.5002 | Masonry Anchors Type L No. 4 Bars | Each |
| 502.5005 | Masonry Anchors Type L No. 5 Bars | Each |
| 502.5010 | Masonry Anchors Type L No. 6 Bars | Each |
| 502.5015 | Masonry Anchors Type L No. 7 Bars | Each |
| 502.5020 | Masonry Anchors Type L No. 8 Bars | Each |
| 502.5025 | Masonry Anchors Type L No. 9 Bars | Each |
| 502.6102 | Masonry Anchors Type S 1/2 Inch | Each |
| 502.6105 | Masonry Anchors Type S 5/8 Inch | Each |
| 502.6110 | Masonry Anchors Type S 3/4 Inch | Each |
| 502.6115 | Masonry Anchors Type S 7/8 Inch | Each |
| 502.6120 | Masonry Anchors Type S 1 Inch | Each |
| 502.3200 | Protective Surface Treatment | SY |
| 503.0128 | Prestressed Girder Type I 28-Inch | LF |
| 503.0136 | Prestressed Girder Type I 36-Inch | LF |
| 503.0145 | Prestressed Girder Type I 45-Inch | LF |
| 503.0154 | Prestressed Girder Type I 54-Inch | LF |
| 503.0155 | Prestressed Girder Type I 54W-Inch | LF |
| 503.0170 | Prestressed Girder Type I 70-Inch | LF |
| 503.0172 | Prestressed Girder Type I 72W-Inch | LF |
| 504.0100 | Concrete Masonry Culverts | CY |
| 505.0405 | Bar Steel Reinforcement HS Bridges | LB |
| 505.0410 | Bar Steel Reinforcement HS Culverts | LB |
| 505.0605 | Bar Steel Reinforcement HS Coated Bridges | LB |
| 505.0610 | Bar Steel Reinforcement HS Coated Culverts | LB |
| 506.0105 | Structural Steel Carbon | LB |
| 506.0605 | Structural Steel HS | LB |
| 506.2605 | Bearing Pads Elastomeric Non-Laminated | Each |
| 506.2610 | Bearing Pads Elastomeric Laminated | Each |
| 506.3005 | Welded Stud Shear Connectors 7/8 x 4 Inch | Each |
| 506.3010 | Welded Stud Shear Connectors 7/8 x 5 Inch | Each |
| 506.3015 | Welded Stud Shear Connectors 7/8 x 6 Inch | Each |
| 506.3020 | Welded Stud Shear Connectors 7/8 x 7 Inch | Each |
| 506.3025 | Welded Stud Shear Connectors 7/8 x 8 Inch | Each |
| 506.4000 | Steel Diaphragms (structure) | Each |

**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Structural Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 506.5000 | Bearing Assemblies Fixed (structure) | Each |
| 506.6000 | Bearing Assemblies Expansion (structure) | Each |
| 511.3000 | Pile Points | Each |
| 514.0440 | Floor Drains Type G | Each |
| 514.0445 | Floor Drains Type GC | Each |
| 514.0460 | Floor Drains Type H | Each |
| 516.0100 | Dampproofing | SY |
| 516.0500 | Rubberized Membrane Waterproofing | SY |
| 604.0400 | Slope Paving Concrete | SY |
| 604.0500 | Slope Paving Crushed Aggregate | SY |
| 612.0106 | Pipe Underdrain 6-Inch | LF |
| 612.0206 | Pipe Underdrain Unperforated 6-Inch | LF |
| 612.0406 | Pipe Underdrain Wrapped 6-Inch | LF |
| 614.0150 | Anchor Assemblies for Steel Plate Beam Guard | Each |
| 616.0204 | Fence Chain Link 4-Ft. | LF |
| 616.0205 | Fence Chain Link 5-Ft. | LF |
| 616.0206 | Fence Chain Link 6-Ft. | LF |
| 616.0207 | Fence Chain Link 7-Ft. | LF |
| 616.0208 | Fence Chain Link 8-Ft. | LF |
| 645.0110 | Geotextile Fabric Type DF | SY |
| 645.0130 | Geotextile Fabric Type R | SY |
| 645.0120 | Geotextile Fabric Type HR | SY |
| 645.0105 | Geotextile Fabric Type C | SY |
| 502.0300.S | QMP Concrete Structures 5-Cylinder | SF |
| | | |
| SPV.0060 | Bar Couplers, 1/2 Inch | Each |
| SPV.0060 | Bar Couplers, 5/8 Inch | Each |
| SPV.0060 | Bar Couplers, 3/4 Inch | Each |
| SPV.0060 | Bar Couplers, 7/8 Inch | Each |
| SPV.0060 | Bar Couplers, 1 Inch | Each |
| SPV.0060 | Bar Couplers, 1 1/8 Inch | Each |



# Pay Plan Quantity

## Specific Guidance for Traffic Control:

(See General Guidance)

Select:

- Temporary pavement markings measured linearly

Do not select:

- Each items
- Day items

**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Traffic Control Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 643.1000 | Traffic Control Signs Fixed Message | SF |
| 646.0103 | Pavement Marking Paint 4-Inch | LF |
| 646.0106 | Pavement Marking Epoxy 4-Inch | LF |
| 646.0109 | Pavement Marking Preformed Plastic 4-Inch | LF |
| 646.0113 | Pavement Marking Paint 6-Inch | LF |
| 646.0116 | Pavement Marking Epoxy 6-Inch | LF |
| 646.0119 | Pavement Marking Preformed Plastic 6-Inch | LF |
| 646.0223 | Pavement Marking Channelizing Paint 8-Inch | LF |
| 646.0226 | Pavement Marking Channelizing Epoxy 8-Inch | LF |
| 646.0229 | Pavement Marking Channelizing Preformed Plastic 8-Inch | LF |
| 646.0403 | Pavement Marking Same Day Paint 4-Inch | LF |
| 646.0406 | Pavement Marking Same Day Epoxy 4-Inch | LF |
| 646.0413 | Pavement Marking Same Day Paint 6-Inch | LF |
| 646.0416 | Pavement Marking Same Day Epoxy 6-Inch | LF |
| 646.0600 | Removing Pavement Markings | LF |
| 647.0453 | Pavement Marking Curb Paint | LF |
| 647.0456 | Pavement Marking Curb Epoxy | LF |
| 647.0503 | Pavement Marking Curb Ramp Paint | LF |
| 647.0506 | Pavement Marking Curb Ramp Epoxy | LF |
| 647.0509 | Pavement Marking Curb Ramp Preformed Plastic | LF |
| 647.0553 | Pavement Marking Stop Line Paint 12-Inch | LF |
| 647.0556 | Pavement Marking Stop Line Epoxy 12-Inch | LF |
| 647.0559 | Pavement Marking Stop Line Preformed Plastic 12-Inch | LF |
| 647.0563 | Pavement Marking Stop Line Paint 18-Inch | LF |
| 647.0566 | Pavement Marking Stop Line Epoxy 18-Inch | LF |
| 647.0569 | Pavement Marking Stop Line Preformed Plastic 18-Inch | LF |
| 647.0573 | Pavement Marking Stop Line Paint 24-Inch | LF |
| 647.0576 | Pavement Marking Stop Line Epoxy 24-Inch | LF |
| 647.0579 | Pavement Marking Stop Line Preformed Plastic 24-Inch | LF |
| 647.0653 | Pavement Marking Parking Stall Paint | LF |
| 647.0656 | Pavement Marking Parking Stall Epoxy | LF |
| 647.0659 | Pavement Marking Parking Stall Preformed Plastic | LF |
| 647.0706 | Pavement Marking Diagonal Epoxy 6-Inch | LF |
| 647.0713 | Pavement Marking Diagonal Paint 8-Inch | LF |
| 647.0716 | Pavement Marking Diagonal Epoxy 8-Inch | LF |
| 647.0719 | Pavement Marking Diagonal Preformed Plastic 8-Inch | LF |
| 647.0723 | Pavement Marking Diagonal Paint 12-Inch | LF |



**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Traffic Control Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 647.0726 | Pavement Marking Diagonal Epoxy 12-Inch | LF |
| 647.0729 | Pavement Marking Diagonal Preformed Plastic 12-Inch | LF |
| 647.0736 | Pavement Marking Diagonal Epoxy 18-Inch | LF |
| 647.0743 | Pavement Marking Diagonal Paint 24-Inch | LF |
| 647.0746 | Pavement Marking Diagonal Epoxy 24-Inch | LF |
| 647.0749 | Pavement Marking Diagonal Preformed Plastic 24-Inch | LF |
| 647.0763 | Pavement Marking Crosswalk Paint 6-Inch | LF |
| 647.0766 | Pavement Marking Crosswalk Epoxy 6-Inch | LF |
| 647.0769 | Pavement Marking Crosswalk Preformed Plastic 6-Inch | LF |
| 647.0773 | Pavement Marking Crosswalk Paint 12-Inch | LF |
| 647.0776 | Pavement Marking Crosswalk Epoxy 12-Inch | LF |
| 647.0779 | Pavement Marking Crosswalk Preformed Plastic 12-Inch | LF |
| 647.0783 | Pavement Marking Crosswalk Paint 18-Inch | LF |
| 647.0786 | Pavement Marking Crosswalk Epoxy 18-Inch | LF |
| 647.0789 | Pavement Marking Crosswalk Preformed Plastic 18-Inch | LF |
| 647.0803 | Pavement Marking Aerial Enforcement Bars Epoxy 24-Inch | LF |
| 647.0806 | Pavement Marking Aerial Enforcement Bars Preformed Plastic 24-Inch | LF |
| 647.0830.S | Pavement Marking Raised Pattered Tape 4-Inch | LF |
| 647.0850.S | Pavement Marking High Performance Contrast Tape | LF |
| 647.0853 | Pavement Marking Concrete Corrugated Median Paint | SF |
| 647.0856 | Pavement Marking Concrete Corrugated Median Epoxy | SF |
| 648.0100 | Locating No-Passing Zones | MI |
| 649.0100 | Temporary Pavement Marking 4-Inch | LF |
| 649.0200 | Temporary Pavement Marking Reflective Paint 4-Inch | LF |
| 649.0300 | Temporary Pavement Marking Reflective Tape 4-Inch | LF |
| 649.0400 | Temporary Pavement Marking Removable Tape 4-Inch | LF |
| 649.0700 | Temporary Pavement Marking Channelizing 8-Inch | LF |
| 649.0800 | Temporary Pavement Marking Channelizing Removable Tape 8-Inch | LF |
| 649.0900 | Temporary Pavement Marking Stop Line 12-Inch | LF |
| 649.1000 | Temporary Pavement Marking Stop Line Removable Tape 12-Inch | LF |
| 649.1100 | Temporary Pavement Marking Stop Line 18-Inch | LF |
| 649.1200 | Temporary Pavement Marking Stop Line Removable Tape 18-Inch | LF |
| 649.1300 | Temporary Pavement Marking Stop Line 24-Inch | LF |
| 649.1400 | Temporary Pavement Marking Stop Line Removable Tape 24-Inch | LF |
| 649.1500 | Temporary Pavement Marking Diagonal 12-Inch | LF |
| 649.1600 | Temporary Pavement Marking Diagonal Removable Tape 12-Inch | LF |

# Pay Plan Quantity

## Specific Guidance for Electrical:

(See General Guidance)

Select:

- Linear items – wiring, conduit, etc

Do not select:

- Lump sum traffic signals or lighting
- Each items

**Pay Plan Quantity**
**Example Bid Item List**

**Work Type:** Electrical Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 652.0105 | Conduit Rigid Metallic 3/4-Inch | LF |
| 652.0110 | Conduit Rigid Metallic 1-Inch | LF |
| 652.0115 | Conduit Rigid Metallic 1 1/4-Inch | LF |
| 652.0120 | Conduit Rigid Metallic 1 1/2-Inch | LF |
| 652.0125 | Conduit Rigid Metallic 2-Inch | LF |
| 652.0130 | Conduit Rigid Metallic 2 1/2-Inch | LF |
| 652.0135 | Conduit Rigid Metallic 3-Inch | LF |
| 652.0140 | Conduit Rigid Metallic 3 1/2-Inch | LF |
| 652.0145 | Conduit Rigid Metallic 4-Inch | LF |
| 652.0205 | Conduit Rigid Nonmetallic Schedule 40 3/4-Inch | LF |
| 652.0210 | Conduit Rigid Nonmetallic Schedule 40 1-Inch | LF |
| 652.0215 | Conduit Rigid Nonmetallic Schedule 40 1 1/4-Inch | LF |
| 652.0220 | Conduit Rigid Nonmetallic Schedule 40 1 1/2-Inch | LF |
| 652.0225 | Conduit Rigid Nonmetallic Schedule 40 2-Inch | LF |
| 652.0230 | Conduit Rigid Nonmetallic Schedule 40 2 1/2-Inch | LF |
| 652.0235 | Conduit Rigid Nonmetallic Schedule 40 3-Inch | LF |
| 652.0240 | Conduit Rigid Nonmetallic Schedule 40 4-Inch | LF |
| 652.0305 | Conduit Rigid Nonmetallic Schedule 80 3/4-Inch | LF |
| 652.0310 | Conduit Rigid Nonmetallic Schedule 80 1-Inch | LF |
| 652.0315 | Conduit Rigid Nonmetallic Schedule 80 1 1/4-Inch | LF |
| 652.0320 | Conduit Rigid Nonmetallic Schedule 80 1 1/2-Inch | LF |
| 652.0325 | Conduit Rigid Nonmetallic Schedule 80 2-Inch | LF |
| 652.0330 | Conduit Rigid Nonmetallic Schedule 80 2 1/2-Inch | LF |
| 652.0335 | Conduit Rigid Nonmetallic Schedule 80 3-Inch | LF |
| 652.0340 | Conduit Rigid Nonmetallic Schedule 80 4-Inch | LF |
| 652.0405 | Conduit Reinforced Thermosetting Resin 2-Inch | LF |
| 652.0410 | Conduit Reinforced Thermosetting Resin 3-Inch | LF |
| 652.0415 | Conduit Reinforced Thermosetting Resin 4-Inch | LF |
| 652.0605 | Conduit Special 2-Inch | LF |
| 652.0610 | Conduit Special 2 1/2-Inch | LF |
| 652.0615 | Conduit Special 3-Inch | LF |
| 652.0620 | Conduit Special 3 1/2-Inch | LF |
| 652.0625 | Conduit Special 4-Inch | LF |
| 652.0690 | Conduit Special (Inch) | LF |
| 652.0705 | Drain Duct 2-Inch | LF |
| 652.0800 | Conduit Loop Detector | LF |
| 652.0900 | Loop Detector Slots | LF |



**Pay Plan Quantity**
**Example Bid Item List**

**Work Type:** Electrical Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 655.0102 | Cable In Duct 2-2 AWG | LF |
| 655.0104 | Cable In Duct 2-4 AWG | LF |
| 655.0106 | Cable In Duct 2-6 AWG | LF |
| 655.0108 | Cable In Duct 2-8 AWG | LF |
| 655.0110 | Cable In Duct 2-10 AWG | LF |
| 655.0122 | Cable In Duct 3-2 AWG | LF |
| 655.0124 | Cable In Duct 3-4 AWG | LF |
| 655.0126 | Cable In Duct 3-6 AWG | LF |
| 655.0128 | Cable In Duct 3-8 AWG | LF |
| 655.0130 | Cable In Duct 3-10 AWG | LF |
| 655.0144 | Cable In Duct 4-4 AWG | LF |
| 655.0146 | Cable In Duct 4-6 AWG | LF |
| 655.0148 | Cable In Duct 4-8 AWG | LF |
| 655.0150 | Cable In Duct 4-10 AWG | LF |
| 655.0205 | Cable Traffic Signal 3-12 AWG | LF |
| 655.0210 | Cable Traffic Signal 3-14 AWG | LF |
| 655.0215 | Cable Traffic Signal 4-12 AWG | LF |
| 655.0220 | Cable Traffic Signal 4-14 AWG | LF |
| 655.0223 | Cable Traffic Signal 5-10 AWG | LF |
| 655.0225 | Cable Traffic Signal 5-12 AWG | LF |
| 655.0230 | Cable Traffic Signal 5-14 AWG | LF |
| 655.0233 | Cable Traffic Signal 7-10 AWG | LF |
| 655.0235 | Cable Traffic Signal 7-12 AWG | LF |
| 655.0240 | Cable Traffic Signal 7-14 AWG | LF |
| 655.0243 | Cable Traffic Signal 9-10 AWG | LF |
| 655.0245 | Cable Traffic Signal 9-12 AWG | LF |
| 655.0250 | Cable Traffic Signal 9-14 AWG | LF |
| 655.0253 | Cable Traffic Signal 12-10 AWG | LF |
| 655.0255 | Cable Traffic Signal 12-12 AWG | LF |
| 655.0260 | Cable Traffic Signal 12-14 AWG | LF |
| 655.0263 | Cable Traffic Signal 15-10 AWG | LF |
| 655.0265 | Cable Traffic Signal 15-12 AWG | LF |
| 655.0270 | Cable Traffic Signal 15-14 AWG | LF |
| 655.0273 | Cable Traffic Signal 19-10 AWG | LF |
| 655.0275 | Cable Traffic Signal 19-12 AWG | LF |
| 655.0280 | Cable Traffic Signal 19-14 AWG | LF |
| 655.0285 | Cable Traffic Signal 21-12 AWG | LF |



**Pay Plan Quantity**
**Example Bid Item List**

**Work Type:** Electrical Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 655.0290 | Cable Traffic Signal 21-14 AWG | LF |
| 655.0305 | Cable Type UF 2-12 AWG Grounded | LF |
| 655.0310 | Cable Type UF 2-12 AWG | LF |
| 655.0315 | Cable Type UF 2-10 AWG | LF |
| 655.0400 | Communication Cable Plowed | LF |
| 655.0405 | Communication Cable Trenched | LF |
| 655.0410 | Communication Cable Installed in Conduit | LF |
| 655.0505 | Electrical Wire Traffic Signals 14 AWG | LF |
| 655.0510 | Electrical Wire Traffic Signals 12 AWG | LF |
| 655.0515 | Electrical Wire Traffic Signals 10 AWG | LF |
| 655.0520 | Electrical Wire Traffic Signals 8 AWG | LF |
| 655.0525 | Electrical Wire Traffic Signals 6 AWG | LF |
| 655.0530 | Electrical Wire Traffic Signals 4 AWG | LF |
| 655.0535 | Electrical Wire Traffic Signals 2 AWG | LF |
| 655.0610 | Electrical Wire Lighting 12 AWG | LF |
| 655.0615 | Electrical Wire Lighting 10 AWG | LF |
| 655.0620 | Electrical Wire Lighting 8 AWG | LF |
| 655.0625 | Electrical Wire Lighting 6 AWG | LF |
| 655.0630 | Electrical Wire Lighting 4 AWG | LF |
| 655.0635 | Electrical Wire Lighting 2 AWG | LF |
| 655.0640 | Electrical Wire Lighting 1 AWG | LF |
| 655.0645 | Electrical Wire Lighting 1/0 AWG | LF |
| 655.0700 | Loop Detector Lead In Cable | LF |
| 655.0800 | Loop Detector Wire | LF |
| 671.0100 | Conduit HDPE 4 Duct 1 1/4 Inch | LF |
| 671.0200 | Conduit HDPE Directional Bore 4-Duct 1 1/4-Inch | LF |
| 674.0106 | Cable ITS Communication 6 Pair | LF |
| 674.0112 | Cable ITS Communication 12 Pair | LF |
| 674.0125 | Cable ITS Communication 25 Pair | LF |
| 674.0200 | Cable Microwave Detector | LF |
| 674.0300 | Remove Cable | LF |
| 674.0400 | Reinstall Cable | LF |
| 678.0006 | Install Fiber Optic Cable Outdoor Plant 6-CT | LF |
| 678.0024 | Install Fiber Optic Cable Outdoor Plant 24-CT | LF |
| 678.0036 | Install Fiber Optic Cable Outdoor Plant 36-CT | LF |
| 678.0048 | Install Fiber Optic Cable Outdoor Plant 48-CT | LF |
| 678.0072 | Install Fiber Optic Cable Outdoor Plant 72-CT | LF |

**Pay Plan Quantity**
**Example Bid Item List**

Work Type: Electrical Bid Items

NOTE: Example Bid Item list provided for clarification of guidance only. Designers are not restricted to the bid items shown.

| Item Number | Description | Unit |
|---|---|---|
| 678.0096 | Install Fiber Optic Cable Outdoor Plant 96-CT | LF |
| 678.0144 | Install Fiber Optic Cable Outdoor Plant 144-CT | LF |

Page 4 of 4

# Pay Plan Quantity

## Example Bid Items for Various Work Types

- Lists of example Bid Items are provided for clarification of guidance only
- Designers aren't restricted to the Bid Items on the example lists
- Plan Examiners will not compare Bid Items selected by designers to the example lists

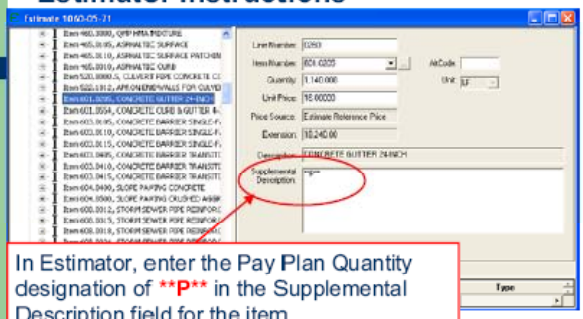
# Pay Plan Quantity

## Instructions for adding **P** to Schedule of Items for both:

- Estimator
- Trns•port

# Pay Plan Quantity

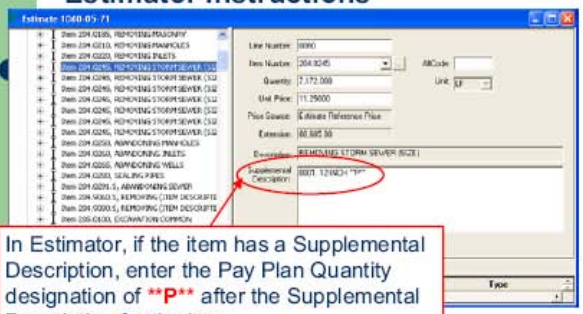
## Estimator Instructions




In Estimator, enter the Pay Plan Quantity designation of **P** in the Supplemental Description field for the item

## Pay Plan Quantity

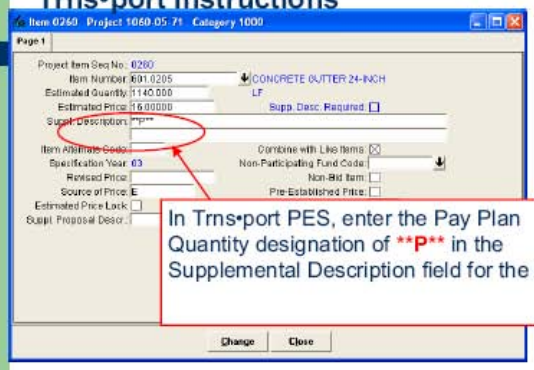
### Estimator Instructions



In Estimator, if the item has a Supplemental Description, enter the Pay Plan Quantity designation of **P** after the Supplemental Description for the item

## Pay Plan Quantity

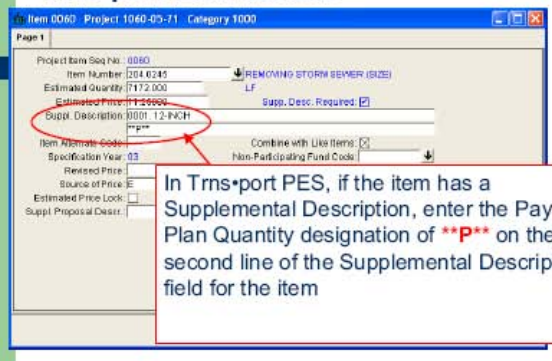
### Trns•port Instructions



In Trns•port PES, enter the Pay Plan Quantity designation of **P** in the Supplemental Description field for the item

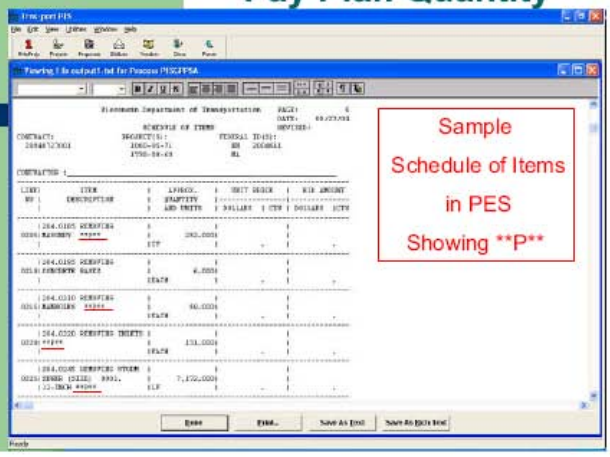
## Pay Plan Quantity

### Trns•port Instructions



In Trns•port PES, if the item has a Supplemental Description, enter the Pay Plan Quantity designation of **P** on the second line of the Supplemental Description field for the item

## Pay Plan Quantity



Sample Schedule of Items in PES Showing **P**

## Pay Plan Quantity

**Implementation**

- District's discretion as to when it can be worked into PSE's
- Everything is available for immediate implementation
- District's encouraged to implement as soon as they can

## Pay Plan Quantity

**Implementation**

- Districts should stop using the previous Bridge special provision that includes a list of pay plan quantity items and start using **P** mechanism
- Will look to expand Pay Plan Quantity to more items and possibly revise thresholds in the future

### 2.3.3. Implementation Guide for Recommended Workload Reduction Strategy 3

| Recommended Strategy | WLRS Implementation Strategy |
|---|---|
| 3 | **Make the contractor responsible for collecting quantity tickets and delivering them to TxDOT on a daily basis.** |

**1. Description**

- In several districts within TxDOT, inspectors are collecting tickets from trucks as they become available. Other districts are collecting tickets once or twice a day, while yet another district allows the contractors to collect tickets and drop them off with a TxDOT official. Collecting tickets is viewed as a very time consuming activity; consequently, a more efficient method for collecting tickets is to allow the contractors to collect their own tickets and give then to TxDOT at the end of the day.
- Currently, tickets are collected for two main reasons, to verify quantity for payment and to check the yield as construction is ongoing.

**2. Potential Benefits or Intent**

- By shifting responsibility to contractors for collecting tickets as they are delivered on-site and delivering them to TxDOT on a daily basis, this will free-up inspector time for other inspection obligations.
- This will allow the inspector to focus more on traffic control and on the lay down operations.

**3. Implementation Strategy**

3.1. In an effort to use in-house inspector time more efficiently, the contractor should be responsible for collecting the quantity tickets from trucks coming on-site instead of having TxDOT inspectors collecting them. The contractor should turn in these quantity tickets to TxDOT once a day.

3.2. The inspector should be present at the lay down operations and observe the collection of tickets

**4. Conditions for Successful Implementation and Cautions**

- This strategy is recommended for projects that:
  - Have seasoned inspectors that have a good working relationship with the contractor
  - On a uniform lay-down job
  - Have very small quantities or intermittent deliveries under conditions where the project engineer or inspector can visually determine the approximate quantity delivered (Iowa 2008).
- Even though the collection of the tickets will be the responsibility of the contractor, the inspector should be present at the lay operations and observe the collection of tickets (Iowa 2008).
- There is a risk that the contractor will send in faulty tickets, but precautions should be taken to prevent such actions.

**5. Anticipated Cost for Implementation**

- Anticipate no impact on indirect or direct project cost.

**6. Examples**

- Tickets need to be collected from truck deliveries including:

- HMA
- Lime and Cement Treated Bases
- Flexible Base

**7. References**

- Iowa Department of Transportation (Iowa DOT). (April 2008). *Iowa DOT Construction Manual.* Available at http://www.erl.dot.state.ia.us/APR_2008/CM/frames.htm.

### 2.3.4. Implementation Guide for Recommended Workload Reduction Strategy 4

| Recommended Strategy | WLRS Implementation Strategy |
|---|---|
| **4** | **Reduce the number of specification items and combine items and quantities for payment.** |

**1. Description**

- Several TxDOT officials highlighted the problem that many pay items have numerous sub-items that create confusion and make inspection, testing, and measurement very difficult and time consuming. One example is striping, which anecdotally is reported as having "hundreds" of separate but similar bid items. The overwhelming feeling is that similar bid items should be combined into a single item.
- This workload reduction strategy is closely related to strategy 2, "Use Lump Sum or Plans Quantity Approach to Payment." Specification items should be reviewed to determine which items could be combined into a single lump sum bid/pay item that will reduce the amount of measuring and tracking required.

**2. Potential Benefits or Intent**

- Reducing the number of bid items will decrease complexity and confusion.
- In addition, reducing the number of bid items will simplify the testing, measurement, and payment process.
- Because of the extensive number of bid items (i.e., 20,000+ according to TxDOT officials), this workload reduction strategy, along with strategy 2, has the potential to *significantly* reduce the amount of time spent on measuring and tracking pay items for payment. The PMC felt this strategy should be initiated immediately since it will likely take time to implement but the results would be tremendously beneficial and long-lasting.

**3. Implementation Strategy**

3.1. Work with the Construction Division and TxDOT Specification Committee to form a sub-committee to oversee the consolidation of the current specification items.
3.2. Identify time-consuming bid items that need to be reduced and can provide for the most time savings.
3.3. TxDOT's bid item structure needs to be modified and revised. Most other states have significantly fewer bid items than TxDOT.
3.4. Assign responsibility to experts to modify the current specifications by combining as many items as possible.

3.5. It is recommended that this strategy be implemented with enough time to have the modifications incorporated into the next specification revision in 2014.

3.6. NOTE: As an alternative, this workload reduction strategy could be the subject of a future research project that would analyze the current specifications and identify specific pay items that show the greatest potential for reducing time spent measuring. The research would include incorporating a framework for implementing a TxDOT Lump Sum bidding, payment, and measurement process the combines numerous pay items into one lump sum item.

**4. Conditions for Successful Implementation and Cautions**

- Reduce the number of pay items and sub-items in order to reduce confusion and inefficiency.
- Combine and reduce pay items in so far as it does not compromise quality.
- During the interviews with TxDOT employees, it was brought up that the time spent measuring these multiple bid items was usually disproportional to the cost of the items. It is recommended that items with multiple bid items that are low risk and low cost items be combined.

**5. Anticipated Cost for Implementation**

- Implementation will require a significant amount of time and money to go through and reduce the current specification items. However, this upfront cost will be offset by the future savings for measurement and inspection.

**6. Examples**

- Pay items that are strong candidates for consolidation include: Landscaping, Signals, Traffic Stripes and Markers
  - It was recommended in our interviews with TxDOT experts that traffic striping has hundreds of similar items that could be reduced down to prevent confusion.
- Currently TxDOT has approximately 21,000 pay items. The following state DOTs and the number of total bid items they have are significantly less than TxDOT.
  - Washington DOT approximately has 1,600 bid items in total
  - California DOT approximately has 4,600 bid items in total
  - Kansas DOT approximately has 3,400 bid items in total
- TxDOT has approximately 700 traffic stripes and marking pay items. Other states have significantly fewer bid items associated with traffic stripes and markings.
  - Washington DOT has approximately 57 traffic stripes and markings bid items
  - California DOT has approximately 71 traffic stripes and markings bid items
  - South Carolina DOT has approximately 116 traffic stripes and markings bid items
  - Kansas DOT has approximately 159 traffic stripes and markings bid items
- California is currently in the process of streamlining their specifications in order to make it easier for bookkeeping and to reduce complexity.

**7. References**


- Suszko, Chuck. Chief of the Office of Construction Engineering, California Department of Transportation. Telephone 916-227-7314. Email Chuck.Suszko@dot.ca.gov. Telephone conversation on March 5, 2008.


**8. Attachments for Recommended WLRS 1**

- Attachment 1: List of Washington DOT's traffic stripes and markings bid items

## Table 2.2: Washington DOT Traffic Stripes and Markings Standard Items (57)

http://www.wsdot.wa.gov/Design/ProjectDev/EngineeringApplications/StandardItems.htm

| Standard Item Number | Unit of Measure | Includes Obsolete (no longer used) Ibid Items<br>Standard Item description | Section |
|---|---|---|---|
| 6806 | L.F. | PAINT LINE | TRAFFIC |
| 6807 | L.F. | PLASTIC LINE | TRAFFIC |
| 6808 | L.F. | EMBOSSED PLASTIC LINE | TRAFFIC |
| 6809 | L.F. | PROFILED PLASTIC LINE | TRAFFIC |
| 6810 | L.F. | PROFILED EMBOSSED PLASTIC LINE | TRAFFIC |
| 6813 | L.F. | GROOVED PLASTIC LINE | TRAFFIC |
| 6817 | L.F. | PAINTED WIDE LINE | TRAFFIC |
| 6818 | L.F. | PLASTIC WIDE LINE | TRAFFIC |
| 6827 | L.F. | PAINTED WIDE LANE LINE | TRAFFIC |
| 6828 | L.F. | PLASTIC WIDE LANE LINE | TRAFFIC |
| 6833 | EACH | PLASTIC TRAFFIC ARROW | TRAFFIC |
| 6845 | L.F. | PROFILED PLASTIC WIDE LANE LINE | TRAFFIC |
| 6854 | L.F. | PAINTED BARRIER CENTER LINE | TRAFFIC |
| 6855 | L.F. | PLASTIC BARRIER CENTER LINE | TRAFFIC |
| 6856 | S.F. | PAINTED CROSSWALK LINE | TRAFFIC |
| 6857 | S.F. | PLASTIC CROSSWALK LINE | TRAFFIC |
| 6858 | L.F. | PAINTED STOP LINE | TRAFFIC |
| 6859 | L.F. | PLASTIC STOP LINE | TRAFFIC |
| 6860 | EACH | PAINTED TRAFFIC ARROW | TRAFFIC |
| 6862 | EACH | PAINTED ACCESS PARKING SPACE SYMBOL | TRAFFIC |
| 6863 | EACH | PLASTIC ACCESS PARKING SPACE SYMBOL | TRAFFIC |
| 6864 | EACH | PAINTED HOV LANE SYMBOL | TRAFFIC |
| 6865 | EACH | PLASTIC HOV LANE SYMBOL | TRAFFIC |
| 6866 | EACH | PAINTED BICYCLE LANE SYMBOL | TRAFFIC |
| 6867 | EACH | PLASTIC BICYCLE LANE SYMBOL | TRAFFIC |
| 6870 | EACH | PAINTED TRAFFIC LETTER | TRAFFIC |
| 6871 | EACH | PLASTIC TRAFFIC LETTER | TRAFFIC |
| 6878 | EACH | PAINTED RAILROAD CROSSING SYMBOL | TRAFFIC |
| 6879 | EACH | PLASTIC RAILROAD CROSSING SYMBOL | TRAFFIC |
| 6880 | EACH | PAINTED DRAINAGE MARKING | TRAFFIC |
| 6881 | EACH | PLASTIC DRAINAGE MARKING | TRAFFIC |
| 6882 | HUND | RAISED PAVEMENT MARKER TYPE 1 | TRAFFIC |
| 6884 | HUND | RAISED PAVEMENT MARKER TYPE 2 | TRAFFIC |
| 6886 | HUND | RAISED PAVEMENT MARKER TYPE 3 | TRAFFIC |
| 6887 | EACH | WHITE PLASTIC RUMBLE BAR | TRAFFIC |
| 6888 | L.F. | TEMPORARY PAVEMENT MARKING | TRAFFIC |
| 6889 | HUND | RECESSED PAVEMENT MARKER | TRAFFIC |
| 6892 | MI. | SHOULDER RUMBLE STRIP TYPE | TRAFFIC |
| 6893 | MI. | CENTERLINE RUMBLE STRIP | TRAFFIC |
| 9237 | EACH | PAINTED YIELD LINE SYMBOL | TRAFFIC |
| 9238 | EACH | PLASTIC YIELD LINE SYMBOL | TRAFFIC |
| 9239 | EACH | PAINTED YIELD AHEAD SYMBOL | TRAFFIC |
| 9240 | EACH | PLASTIC YIELD AHEAD SYMBOL | TRAFFIC |

| Standard Item Number | Unit of Measure | Includes Obsolete (no longer used) Ibid Items<br>Standard Item description | Section |
|---|---|---|---|
| 9241 | EACH | PAINTED SPEED BUMP SYMBOL | TRAFFIC |
| 9242 | EACH | PLASTIC SPEED BUMP SYMBOL | TRAFFIC |
| 9243 | EACH | PAINTED AERIAL SURVEILLANCE FULL MARKER | TRAFFIC |
| 9244 | EACH | PLASTIC AERIAL SURVEILLANCE FULL MARKER | TRAFFIC |
| 9245 | EACH | PAINTED AERIAL SURVEILLANCE 1/2 MARKER | TRAFFIC |
| 9246 | EACH | PLASTIC AERIAL SURVEILLANCE 1/2 MARKER | TRAFFIC |
| 9247 | EACH | PAINTED ACCESS PARKING SPACE SYMBOL WITH BACKGROUND | TRAFFIC |
| 9248 | EACH | PLASTIC ACCESS PARKING SPACE SYMBOL WITH BACKGROUND | TRAFFIC |
| 9362 | EACH | PAINTED ACCESS PARKING SPACE SYMBOL | TRAFFIC |
| 9363 | EACH | PLASTIC ACCESS PARKING SPACE SYMBOL | TRAFFIC |
| 9364 | EACH | PAINTED HOV LANE SYMBOL | TRAFFIC |
| 9365 | EACH | PLASTIC HOV LANE SYMBOL | TRAFFIC |
| 9370 | EACH | PAINTED DRAINAGE MARKING | TRAFFIC |
| 9371 | EACH | PLASTIC DRAINAGE MARKING | TRAFFIC |

### 2.3.5. Implementation Guide for Recommended Workload Reduction Strategy 5

| Recommended Strategy | WLRS Implementation Strategy |
|---|---|
| 5 | **Use equipment technology for the measurement of temperature and segregation in HMA.** |

**1. Description**

- Advances in technology have proven to increase productivity and efficiency among workers in all industries. Within DOTs around the country, machines such as Intelligent Compactors and pavers with thermal imaging bars are performing tasks that inspectors used to perform manually. This use of equipment technology can be very time-efficient and can provide computer printouts of stiffness, temperature, etc., that are recorded automatically rather than taken manually. Hence, there are a few technologies that are currently available (or will be soon) that can be used to reduce the inspection workload and increase inspection efficiency.
- TxDOT is currently using a system called Pave-IR, which uses thermal imaging to provide real-time measurements of material surface temperature. The Pave-IR test system continuously performs these profiles, providing more coverage and better documentation of thermal uniformity as compared to the existing test method (Sebesta 2007).

**2. Potential Benefits or Intent**

- By incorporating technology into projects, inspectors could spend time on other activities while the machines could be used to augment the inspector's activities. As new technologies become available, TxDOT should endeavor to be on the cutting edge – their road network is large, and consequently, the time-savings might be substantial.
- The thermal imaging system allows for the sample of all the material as it is being laid down, not just a random sample as in current practice. This helps both TxDOT and contractors ensure a good quality pavement (Sebesta 2007).

**3. Implementation Strategy**

3.1. Continue evaluation projects with TTI and contractors to encourage the use of thermal imaging technology.
3.2. Modify the specification to allow for the acceptance of thermal imaging data reports.
3.3. Provide an incentive structure for contractors who implement this new technology. For example, encourage bidders to submit two bids: one with and one without the use of thermal imaging.
3.4. In the future, it would be beneficial for TxDOT to work with contractors and paver manufacturers to make the thermal imaging technology part of their paver or as an option to retrofit existing equipment.

**4. Conditions for Successful Implementation and Cautions**

- The thermal imaging technology is not readily available yet for commercial use. However, TxDOT can work to expand the availability of Pave-IR to contractors on their projects.
- In addition, TxDOT can work with contractors and paver manufacturers to integrate the thermal imaging technology to make the technology readily available.

**5. Anticipated Cost for Implementation**

- There is the initial cost for contractors to upgrade their paving equipment and this cost will likely get passed along to TxDOT in their project cost. However, the slight increase in cost will be offset with the greater control over pavement quality.
- With the real time data that is produced, contractors can detect any problems in the pavement quickly. There is a significant cost savings here because it can prevent having to replace an entire section of pavement.

**6. Examples**

- Currently, TxDOT has partnered with Texas Transportation Institute and several paving contractors around the state to field test the Pave-IR system. TTI has used the new system on about 15 construction projects throughout its development and implementation. Currently, TTI is assisting with two TxDOT projects in the Odessa District and one in the Houston District. Currently, the Pave-IR system has to be attached to the back of the paver (Sebesta 2007).

**7. References**


- Sebesta, Stephen. (2007). "Partnership Tests Quality-Control Device for Asphalt Pavement". Texas Transportation Researcher, Volume 43, Number 2. Available at http://tti.tamu.edu/publications/researcher/newsletter.htm?vol=43&issue=2&article=10&year=2007.


### 2.3.6. Implementation Guide for Recommended Workload Reduction Strategy Specialty 1

| Recommended Strategy | WLRS Implementation Strategy |
|---|---|
| **SP 1** | **Completely outsource entire projects to consultants to manage and inspect all aspects of the project.** |

**1. Description**

In order to address the high number of projects but comparatively small in-house inspection force, state DOTs have begun to completely outsource entire projects to consultants to manage and inspect.

**2. Potential Benefits or Intent**

- Outsourcing part or all of infrastructure projects helps to (Moore, Segal, McCormally 2000):
  - Achieve improved quality
  - Accommodate peak demand
  - Speed project delivery and meet deadlines
  - Gain access to expertise
  - Improve efficiency
  - Cut or contain costs.
- By outsourcing entire projects, TxDOT would be able to better manage a high number of projects and make sure they are properly staffed with qualified inspectors without increasing the number of in-house inspectors. As a result, this will free-up in-house inspector time for other duties.

## 3. Implementation Strategy

3.1. Develop a Consultant Administration Manual that defines consultant contract and field administration procedure throughout TxDOT. Possible topics to be covered include: when to use consultant contracts, what monitoring is required by TxDOT, and define the role and responsibilities of each party.

3.2. NOTE: As an alternative, this workload reduction strategy could be the subject of a future research project that would evaluate similar programs in other states and public agencies and would develop a best practice third part consultant project management process.

## 4. Conditions for Successful Implementation and Cautions

- In Florida, the process is administered using a professional services contract. This is recommended so that FDOT can choose firms based on qualifications for the management of projects.
- It is important to get guidelines and procedures set up now for consultant administration so that TxDOT can be ready to implement this strategy when the construction budget rebounds.
- The third-party inspectors are expected to have the same qualifications as those required of DOT inspectors and will have the same responsibilities for verifying that the contractor is working in accordance with the project plans and specifications. The DOT will have full access to all of the third-party's inspection reports and testing results.
- The third-party consultant will be required to have a supervising engineer that will be responsible for reviewing all documents and test results before they are submitted to the DOT.

## 5. Anticipated Cost for Implementation

- There will be an increase in the indirect project cost associated with administering the third-party contracts.
- There will be an increase in direct project cost because third-party services are typically more expensive than in-house costs.

## 6. Examples

- In South Carolina, they completed an accelerated bonding program where they completed 27 years worth of work in 7 years, which was approximately 4 times their normal construction budget. During those seven years, they actually hired two experienced consulting firms to manage 100 projects. In the management of projects, it was anywhere from the complete development of the plan from proposals and field inspection to just doing the field inspection if they already had the plans developed. The accelerated bonding program in South Carolina went very well.
- In Florida and Virginia, they give entire projects to the consultant and only have one DOT employee who oversees them.

## 7. References


- Alvarado, Julio. State Engineer for Construction, Arizona Department of Transportation. Phone 602-712-7323. Email jalvarado@azdot.gov. Telephone conversation on April 1, 2008.
- Arizona Department of Transportation (ADOT). (January 2007). *Consultant Construction Administration Manual.* Available at http://www.azdot.gov/Highways/constgrp/PDF/CCAManual.pdf.

- Blanchard, Brian. (2008). Director of Construction, Florida Department of Transportation. Phone: 850-414-4140. Email: brian.blanchard@dot.state.fl.us. Telephone conversation on March 20, 2008.
- Adrian T. Moore, Geoffrey F. Segal, and John McCormally. (September 2000). "Infrastructure Outsourcing: Leveraging Concrete, Steel, and Asphalt with Public-Private Partnership". Policy Study No. 272. Available at http://www.reason.org/ps272.pdf.
- Shealy, Danny. Director of Construction, South Carolina Department of Transportation. Phone 803-737-1308. Email shealydr@dot.state.sc.us. Telephone conversation on March 7, 2008.

### 2.3.7. Implementation Guide for Recommended Workload Reduction Strategy Specialty 2

| Recommended Strategy | WLRS Implementation Strategy |
|---|---|
| **SP 2** | **Require the contractor to provide independent consultant QC/QA services.** |

**1. Description**

In order to augment limited in-house personnel, state DOTs have begun to use independent third parties that are retained by the contractor. The DOT is able to specify the required qualifications and responsibilities of the third-party inspectors, but the contractor will be responsible for administering the contract.

**2. Potential Benefits or Intent**

- Instead of TxDOT directly outsourcing inspection services to a third-party and alternatively requiring the contractor to be responsible, TxDOT would reduce the administrative burden of managing the consultant contract. This would reduce in-house inspection efforts, while ensuring unbiased results.

**3. Implementation Strategy**

3.1. Establish guidelines for the responsibilities of each party involved in the independent consultant QC/QA contract.

3.2. Establish a prequalification process for the contractor and TxDOT to both approve the consultant.

3.3. Test the strategy on a few pilot projects to measure the effectiveness.

3.4. NOTE: As an alternative, this workload reduction strategy could be the subject of a future research project that would evaluate similar programs in other states and public agencies and would develop guidelines for implementing a successful independent consultant QC/QA program in TxDOT.

**4. Conditions for Successful Implementation and Cautions**

- TxDOT would need to establish a prequalification process, where the consultant is approved by both the contractor and TxDOT.
- The third-party inspectors are expected to have the same qualifications as required of TxDOT inspectors and will have the same responsibilities for verifying that the contractor is working in accordance with the project plans and specifications. TxDOT will have full access to all of the third-party's inspection reports and testing results.

- The third-party consultant will be required to have a supervising engineer that will be responsible for reviewing all documents and test results before they are submitted to TxDOT. The engineer will be licensed and will sign all of the documents.
- By having the contractor responsible for administering the consultant contract, it will reduce the administrative burden for the DOT. If entrusting the contractor with this responsibility is viewed as a significant conflict of interest, the alternative would be to have TxDOT administer the consultant contract directly.

**5. Anticipated Cost for Implementation**

- This strategy would reduce the indirect project cost because TxDOT would not have to administer the consultant contract. However, it would increase the direct project cost because the contractor's bid would increase as a result of the new responsibility.

**6. Examples**

- Pay items that could be included in contractor provided independent consultant QC/QA services include: Seal Coat or Overlay, Embankment, Subgrade Compaction.
- In Virginia, they had a few pilot projects with contractor QC/QA. The contractor hired an independent inspection firm and provided that service through the contract, where VDOT did some limited oversight and sampling. In these cases, the contractor had to hire an inspection firm that reported to VDOT. There was a potential conflict of interest because the consultant was hired and paid by the contractor but technically working for the state. However, it was successful but some projects required more oversight than others. Virginia has not fully embraced this as a way of doing business yet.

**7. References**


- Liston, Dan. Director of Construction, Virginia Department of Transportation. Telephone 804-786-2847. Email daniel.liston@vdot.virginia.gov. Telephone conversation on March 13, 2008.

## Chapter 3. Conclusions and Recommendations

TxDOT and other state DOTs are experiencing inspection workforce shortages that can be specifically addressed by identifying workload challenges and implementing creative solutions. Overall, 31 workload reduction strategies were identified by TxDOT and other state DOTs to address 10 key workload challenges within TxDOT. These strategies show promise at increasing inspection and testing efficiency and decreasing unproductive time spent on activities that involve low risk pay items or particularly time consuming tasks. A workshop with TxDOT personnel was conducted and the 31 workload reduction strategies were ranked on eight criteria, with an emphasis on highlighting strategies with the greatest potential of decreasing inspection time without increasing construction project costs or reducing the overall quality of the end product. As a result of the workshop analysis, the top workload reduction techniques with the potential to provide the most benefit to TxDOT have been identified. Guidelines were developed for implementing the top 5 ranked and two special workload reduction strategies within TxDOT. More detailed information and guidelines for the Top 10 workload reduction strategies will be included in the final report that will be completed on October 31, 2008.

## References

Hanna, A.S., Taylor, C.S., and Sullivan, K.T. "Impact of extended overtime on construction labor productivity." *Journal of Construction Engineering and Management*, ASCE, Vol. 131, No. 6, 2005, pp. 734-739.

Warne, T.R. *NCHRP Synthesis 313: State DOT Outsourcing and Private-Sector Utilization.* Transportation Research Board of the National Academies, Washington, D.C., 2003.

# Appendix. Preliminary Workload Reduction Strategies

## A1. Workshop Participants

1. Karl Bednarz- San Angelo Director of Construction
2. David Belser- QA Program Manager
3. Thomas Bohuslav- Director of Construction Division
4. Glenn Eilert- Inspector Development Program (IDP)
5. Charles Gaskin- Houston Director of Construction
6. Darlene Goehl- Engineer
7. Caroline Herrera- Branch Manager Geotechnical, Soils and Aggregates
8. Paul Hoelscher- Abilene Director of Construction
9. Tom Hunter- Lufkin Director of Construction
10. Richard Izzo- Engineer
11. Lisa Lukefahr- Branch Manager Rigid Pavements and Concrete Materials
12. Johnnie Miller- Branch Manager Traffic Materials
13. Duane Schwarz- Waco Director of Construction
14. Steve Strmiska- Engineer

## A2. List of Preliminary Workload Reduction Strategies

| WLRS | |
|---|---|
| **Sub-Strategy Num.** | **Workload Reduction Sub-Strategy** |
| **A. Modify Inspector Training Methods** | |
| 1 | Create checklists for selected pay items that help inspectors prioritize inspection elements and direct them to relevant inspection documents. |
| 2 | Create construction training matrices that document training required of, and received by, inspectors on TxDOT projects (e.g. inspection, lab technician) (see info sheet for more). |
| 3 | Have consultants administer all or a portion of inspector training. |
| 4 | Convert inspector training courses to Computer-Based Training Courses as much as possible to make training easier to obtain. |
| 5 | Increase or improve Site Manager system training to reduce double data entry and reduce time spent on paperwork. |
| **B. Increase Inspector Effectiveness and Efficiency Through Certification** | |
| 6 | Work with a third-party to develop and administer a more extensive QC/QA certification program. |
| 7 | Require compatible or equivalent certifications for in-house inspectors, consultants, and contractors for the area of work they will be inspecting. |
| 8 | Accept certain NICET and ASTM QC/QA certifications (to be selected by TxDOT experts). |
| 9 | Simplify TxDOT concrete certification process |
| 9a | Require workers who will inspect concrete to have their ACI certification first before being eligible to complete the TxDOT concrete certification. |
| 9b | Replace TxDOT concrete certification with ACI certification for as many pay items as feasible. |
| **C. Outsource Testing and Inspection to a Third-Party** | |
| 10 | Outsource inspection and measurement of low-risk pay items to third-party consultants. |
| 10a | Landscaping |
| 10b | Seeding |
| 10c | Traffic Stripes and Markings |
| 11 | Outsource some specialty inspection items. |
| 11a | Steel Painting |
| 11b | Welding |
| 11c | Involving Hazardous Materials |
| 12 | Use third-party consultant inspectors to perform inspection for SW3P. |
| 13 | Completely outsource entire projects to consultants to manage and inspect all aspects of the project. |
| **D. Establish a More Extensive Contractor QC Program** | |
| 14 | Replace some TxDOT QC testing with more extensive contractor QC testing. |
| 15 | Use contractor QC/QA results in lieu of TxDOT QC/QA results for measurement and as a basis for payment. |
| **E. Share More Risk with the Contractor by Permitting Them to Have More Control** | |
| 16 | Require the contractor to provide independent consultant QC/QA services. |
| 16a | Seal Coat or Overlay |

| WLRS | |
|---|---|
| **Sub-Strategy Num.** | **Workload Reduction Sub-Strategy** |
| 16b | Embankment |
| 16c | Subgrade Compaction |
| 17 | Use Lump Sum or Plan Quantity approach to payment where the contractor certifies compliance so that TxDOT does not have to measure. |
| 17a | Bridge Projects |
| 17b | Fencing |
| 17c | Guardrail |
| 17d | Landscaping |
| 17e | Lighting |
| 17f | Seeding |
| 17g | Sidewalks |
| 17h | Signing |
| 17j | Signals |
| 17k | Traffic Stripes and Markings |
| 18 | Make the contractor responsible for collecting quantity tickets and delivering them to TxDOT on a daily basis. |
| 19 | Make the contractor responsible for on-site concrete testing (e.g. slump, air, temperature, making cylinders). |
| **F. Streamline Specifications to Simplify the Inspection Process** | |
| 20 | Convert some specifications to performance-based specifications. |
| 20a | HMA |
| 20b | Landscaping |
| 20c | Seal Coats |
| 20d | Seeding |
| 20e | Traffic Stripes and Markings |
| 21 | Reduce the number of specifications and combine items and quantities for payment. |
| **G. Use Alternative Delivery Methods** | |
| 22 | Use more Design-Build project delivery systems, where the design-builder provides QC (and possibly QA). |
| **H. Optimize the Use of Inspection Resources** | |
| 23 | Reduce the amount of time inspectors spend testing at the HMA plant. |
| 23a | Replace an employee who works full-time at the plant with an employee who works part-time at the plant and only pulls samples twice a day. |
| 23b | Take HMA samples at the site in lieu of taking samples at the plant. |
| 23c | Use a certified QC/QA bond and weigh program where non-DOT plant employees are certified in an effort to reduce TxDOT inspectors at the plant. |
| **I. Implement the Usage of Technology to Decrease Inspection Requirements** | |
| 24 | Use equipment technology for the measurement of temperature and segregation in HMA. |

| WLRS | |
|---|---|
| **Sub-Strategy Num.** | **Workload Reduction Sub-Strategy** |
| 25 | Modify specification to allow the replacement of density measurement with stiffness in order to encourage the use of high-tech "Intelligent Compactors". |
| 26 | Standardize information provided to contractors for input into GPS controlled construction machinery. |
| **J. Reduce Paperwork and Data Entry** | |
| 27 | Use off-the-shelf shared-access software system for contractors to submit required inspection data and reports. |
| **K. Implement Performance Warranties and Warranty Bonds** | |
| 28 | Work with industry and contractors to establish contractor supplied long-term incentivized performance warranty (non-bond based) on specific pay items. |
| 28a | Bridge Components |
| 28b | Highway Lighting System |
| 28c | HMA |
| 28d | Portland Cement Concrete Pavement |
| 28e | Signal Installation |
| 29 | Require surety-issued warranty bonds on specific pay items. |
| 29a | HMA |
| 29b | Landscaping |
| 29c | Seal Coats |
| 29d | Traffic Signals |
| 29e | Traffic Stripes and Markings |

## A3. Workload Reduction Strategies Information Sheets

# Workload Reduction Strategy Information Sheet 1

1. Workload Reduction Strategy (WLRS):
   **A. Modify Inspector Training Methods**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 1 | **Create checklists for selected pay items that help inspectors prioritize inspection elements and direct them to relevant inspection documents.** |

3. Background and Context:
   Florida has developed checklists or what they refer to as "guidelists" that provide guidance for all major tasks that need to be completed relevant to construction inspection. The guidelists also highlight critical requirements, which are items that if not properly performed, have a high probability of causing problems during the construction phase. In addition, Arizona has created massive checklists or what they refer to as "quantlists" that cover every aspect of their work. The quantlists are described as allowing for an objective evaluation of construction processes. The motivation behind the development of these checklists is for inspectors to know what the most important items to inspect are and reference where to find additional relevant inspection documents. These checklists document expected quality requirements and monitor construction processes to make sure that the end product meets established quality standards.

4. Specific Example or Application:
   Some of the types of inspector guidelists developed in Florida include:

   1. Environmental Compliance
   2. Earthwork
   3. Drainage
   4. Base
   5. Asphalt
   6. Concrete
   7. Bridge Structures
   8. Signalization
   9. Lighting
   10. Grassing
   11. Landscaping

http://www.dot.state.fl.us/construction/CONSTADM/guidelist/guideindex.htm

5. Reported or Expected Benefit:
   The reality is that departments of transportation are facing a shortage of inspection personnel. It is important that inspection is performed in the most efficient manner. Checklists will provide inspectors knowledge of what items are the most critical to inspect as well as the proper procedure for inspection. In addition, inspection checklists provide for good documentation of what has been inspected on projects. This documentation will be especially useful if inspection services are outsourced to third parties or as evidence if a project goes to litigation. Florida and Arizona have already developed comprehensive checklists that TxDOT could use as a model for adapting to their needs.

# Workload Reduction Strategy Information Sheet 2

1. Workload Reduction Strategy (WLRS):
   **A. Modify Inspector Training Methods**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 2 | **Create construction training matrices that document training required of, and received by, inspectors on TxDOT projects (e.g. inspection, lab technician).** |

3. Background and Context:
   Arizona has created training matrices to show what certifications are required for employees in their Construction Group. This was originally created for engineers-in-training to show what certifications they have currently completed and what additionally is needed in the future for permanent status or promotion.

4. Specific Example or Application:
   The types of inspector matrices developed in Arizona include:

   1. Construction Inspection Certification Matrix
   2. Construction Lab Technician Certification Matrix
   3. Landscape Inspection Certification Matrix
   4. Survey Technician Certification Matrix
   5. Traffic Signal and Lighting Certification Matrix
   6. Construction Office Certification Matrix
   7. Transportation Engineering Associate (TEA) Certification Matrix

   http://www.dot.state.az.us/Highways/ConstGrp/Training.asp

5. Reported or Expected Benefit:
   It would be useful to incorporate training matrices into the IDP program already developed in TxDOT. The matrices would categorize the various levels of construction inspectors depending upon training certifications and level of experience. Matrices will be beneficial for TxDOT to be able to easily identify how qualified their in-house staff is and identify what areas have a need for further training or certifications. An additional benefit would be that third parties would be able to easily identify what levels of inspectors they had on-staff according to TxDOT's classifications.

# Workload Reduction Strategy Information Sheet 3

1. Workload Reduction Strategy (WLRS):
   **A. Modify Inspector Training Methods**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| **3** | **Have consultants administer all or a portion of inspector training.** |

3. Background and Context:
   Florida and Arizona augment their training by in-house personnel with consultants. The reason behind this is there are not enough in-house personnel to handle all of their training.

4. Specific Example or Application:
   1. In Arizona and Florida, they have training classes that are prepared and/or administered by consultants.
   2. In Arizona, consultants are hired for training courses based on an individual basis depending on the particular skill set required for the training.

5. Reported or Expected Benefit:
   TxDOT could provide additional training to their in-house staff by using consultants to augment their training program. This would allow TxDOT to increase the skills of their personnel without an additional strain on their internal resources.

# Workload Reduction Strategy Information Sheet 4

1. Workload Reduction Strategy (WLRS):
   **A. Modify Inspector Training Methods**
2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| **4** | **Convert inspector training courses to Computer-Based Training Courses as much as possible to make training easier to obtain.** |

3. Background and Context:
   Florida is trying to convert their inspector training courses to Computer Based Training (CBT). This will allow Florida to train inspectors virtually anywhere at any time.

4. Specific Example or Application:
   The types of interactive inspector training courses that Florida is offering currently through CBT include:
   1. Asphalt Paving Level 1
   2. Drilled Shaft Tutorial
   3. Earthwork Inspection
   4. FDOT Concrete Field Inspector Course
   5. FDOT Concrete Laboratory Inspector Course
   6. Final Estimates Level 1
   7. Hot Mix Asphalt Plant Inspection
   8. Hot Mix Asphalt Testing
   9. Pile Driving Inspector's Tutorial

   http://ctt.ce.ufl.edu/courseMaterials.aspx

5. Reported or Expected Benefit:
   Florida has experienced a significant increase in the ability to train large numbers of inspectors. This has resulted in Florida increasing the skills of their new inspectors more rapidly while decreasing the overall cost of training.

# Workload Reduction Strategy Information Sheet 5

1. Workload Reduction Strategy (WLRS):
   **A. Modify Inspector Training Methods**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| **5** | **Increase or improve *Site Manager* system training to reduce double data entry and reduce time spent on paperwork.** |

3. Background and Context:
   TxDOT inspectors need more skills to navigate through *Site Manager,* especially the seasoned inspectors who are accustomed to the standard data entry. By providing inspectors training to improve their skills for using *Site Manager,* it will save time by reducing double-entry and the amount of paperwork.

4. Specific Example or Application:
   The type of inspector training courses that TxDOT can implement to improve inspector skills include:
   1. Develop an in-house training program that will help inspectors keep up with the most recent changes in the software and develop a certification process for *Site Manager* that has multiple levels.

5. Reported or Expected Benefit:
   Training for *Site Manager* will improve the navigation skills of inspectors and save time by reducing double-entry and paperwork. The inspectors may utilize for other inspection duties.

# Workload Reduction Strategy Information Sheet 6

1. Workload Reduction Strategy (WLRS):
   **B. Increase Inspector Effectiveness and Efficiency Through Certification**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 6 | **Work with a third-party to develop and administer a more extensive QC/QA certification program.** |

3. Background and Context:
   Several DOTs have begun to move towards certification programs to ensure that inspectors on their projects are properly trained. This has been beneficial to maintain consistency of inspection and testing in lieu of the growing trend toward increased contractor QC/QA and outsourcing to consultants. The certification programs allow for the DOTs to ensure that whoever is working on their projects has been certified for the area of work they are responsible for.

4. Specific Example or Application:
   1. South Carolina and Wisconsin have universities administer their certification programs and they are responsible for certifying and decertifying workers.
   2. Florida has a consultant administer their certification program.
   3. Florida is converting their certification exams and training to computer based as much as possible.
   4. Wisconsin negotiates a cost per person per course to be the same for in-house personnel, consultants or contractors.

5. Reported or Expected Benefit:
   The certification programs allow for the DOTs to ensure that whoever is working on their projects has been certified for the area of work they are responsible for. By having a third party responsible for administering the certification program, it reduces the stress on in-house resources. In addition, the third party can maintain a database documenting the certification records. This enables TxDOT to increase inspector skill level and qualifications, while decreasing the burden of administering an extensive certification program.

# Workload Reduction Strategy Information Sheet 7

1. Workload Reduction Strategy (WLRS):
   **B. Increase Inspector Effectiveness and Efficiency Through Certification**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 7 | **Require compatible or equivalent certifications for in-house inspectors, consultants, and contractors for the area of work they will be inspecting.** |

3. Background and Context:
   There is a growing trend toward increased contractor QC/QA and outsourcing to consultants. Several DOTs have begun to move towards certification programs to ensure that inspectors on their projects are properly trained. As a result, state DOTs require compatible or equivalent certifications for in-house inspectors, consultants and contractors for the area of work they will be inspecting. This has been beneficial to maintain consistency of inspection on DOT projects regardless of who is the responsible party.

4. Specific Example or Application:
   1. South Carolina requires that anyone doing inspections on their projects has to be certified in the area that they are doing inspection. This includes in-house, consultants and contractors.
   2. Florida does not require inspectors to sit through the certification training course and allows them to just take the certifying exam. This is a way for workers with years of experience to get certified while reducing the time and money spent on certification.
   3. Wisconsin requires all workers to sit through the certification training. They will not allow workers to "test-out" of certification training because they want everyone to be familiar with their state's specifications.

5. Reported or Expected Benefit:
   Requiring compatible or equivalent certifications for all parties working on TxDOT projects will improve consistency of inspection skills and qualifications. There are several options for how TxDOT will administer their particular certification program, but there needs to be emphasis put on consistency in an effort to maintain quality on their projects.

# Workload Reduction Strategy Information Sheet 8

1. Workload Reduction Strategy (WLRS):
   **B. Increase Inspector Effectiveness and Efficiency Through Certification**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 8 | **Accept certain NICET and ASTM QC/QA certifications (to be selected by TxDOT experts).** |

3. Background and Context:
   Accepting NICET & ASTM certifications will allow more consultants to work for TxDOT because many third-party consultants have these certifications already. Also allowing TxDOT inspectors to replace or augment TxDOT concrete certifications with NICET and ASTM might simplify TxDOT's concrete certification process. ASTM and NICET certifications are available for Asphalt, Soils, Concrete and Geotechnical.

4. Specific Example or Application:
   NICET & ASTM certifications are accepted by other public departments and many consultants are
   ACI & NICET certified, including Terracon (consulting firm), who is certified for NICET & ASTM and
   they are capable of doing more material testing.

5. Reported or Expected Benefit:
   TxDOT will be able to reduce their in-house certification programs that overlap with NICET and ASTM certifications. An increased number of consultants would be qualified to work for TxDOT because many consultants already have these certifications.

# Workload Reduction Strategy Information Sheet 9

1. Workload Reduction Strategy (WLRS):
   **B. Increase Inspector Effectiveness and Efficiency Through Certification**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 9 | **Simplify TxDOT concrete certification process.** |

3. Background and Context:
   TxDOT has its own concrete certification program. In some districts, ACI is also accepted for concrete but this is not standard throughout TxDOT and cannot replace TxDOT's certification. Many consultants are ACI certified for concrete because their other clients require such certification, especially clients that are private businesses.

4. Specific Example or Application:
   1. Require workers who will inspect concrete to have their ACI certification first before being eligible to complete the TxDOT concrete certification (including in-house personnel, third parties and contractors). The ACI certification will serve as a bare minimum of knowledge for concrete inspection. As a result, the TxDOT concrete certification will be able to be modified to reduce duplication of training and focus on concrete inspection requirements specific to TxDOT.
   2. Replace TxDOT concrete certification with ACI certification for as many pay items as feasible.

5. Reported or Expected Benefit:
   Adapting to ACI concrete certification will allow more consultants and contractors to be qualified to work for TxDOT that are already ACI certified. Accordingly, being able to reduce the TxDOT in-house certification for concrete will reduce in-house administration efforts.

# Workload Reduction Strategy Information Sheet 10

1. Workload Reduction Strategy (WLRS):
   **C. Outsource Testing and Inspection to a Third Party**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 10 | **Outsource inspection and measurement of low-risk pay items to third-party consultants.** |

3. Background and Context:
   Low-risk pay items can consume a significant amount of inspector time because inspectors test and measure these items to ensure compliance with specifications. Many districts reported that these items tend to receive less attention, which they feel is risky but necessary when inspectors are busy and must carefully allocate their time. A preferred method for dealing lot of time-intensive, low risk pay items is to outsource the testing and inspection to a third- consultant. This would free up TxDOT inspectors' time for monitoring high risk pay items.

4. Specific Example or Application:
   1. Outsource inspection and measurement of low-risk pay items including:
      a. Landscaping
      b. Seeding
      c. Traffic Stripes and Markers

5. Reported or Expected Benefit:
   Outsourcing low-risk items will free-up inspector time which can be better utilized on high-risk items. The low risk items would not be completely set aside, but would instead be inspected by a third-party, who may be inspecting numerous low risk items, resulting in a significant time-savings for TxDOT inspectors.

# Workload Reduction Strategy Information Sheet 11

1. Workload Reduction Strategy (WLRS):
   **C. Outsource Testing and Inspection to a Third Party**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 11 | **Outsource some specialty inspection items.** |

3. Background and Context:
   Items that require specialty inspection training (such as welding) can be outsourced to third-party consultants, who are better able to maintain the skills and certifications necessary to perform the inspections. Currently, TxDOT has their own specialty inspectors who drive around various districts to perform inspections. Perhaps a more efficient method for completing these inspections is to hire highly-qualified third-party inspectors who are likely to be very responsive while also providing a skill that TxDOT needs.
4. Specific Example or Application:
   Inspection specialty items that could be outsourced include:
   1. Steel Painting
   2. Involving Hazardous Materials

5. Reported or Expected Benefit:
   It may not be very cost effective to keep in-house personnel qualified to perform specialty inspections, whereas using a third-party who performs these types of inspections for many clients might be very efficient. Third-party consultants can readily fill the demand for inspection of these items when needed, reducing TxDOT's need to have in-house inspectors trained to perform specialty inspections.

# Workload Reduction Strategy Information Sheet 12

1. Workload Reduction Strategy (WLRS):
   **C. Outsource Testing and Inspection to a Third Party**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 12 | **Use third-party consultant inspectors to perform inspection for SW3P.** |

3. Background and Context:
   Currently, TxDOT performs inspections to ensure compliance with the SW3P (Storm Water Pollution Prevention Plan). These inspections are time consuming, and ensuring compliance requires multiple inspections throughout the project. Consequently, this activity might be outsourced to qualified third-party consultant inspectors using a professional service contract. These consultants would report the results (and potential violations) back to TxDOT so that TxDOT can ensure the contractor corrects any defects in the SW3P measures.

4. Specific Example or Application:
   One type of SW3P measure is silt fencing, which is used to prevent silt and debris from polluting nearby drainage culverts and ponds. A third-party consultant could be hired to check the silt fencing on a project weekly to ensure it is intact. Likewise, numerous other mitigation measures could be checked by the consultant on a routine basis. The consultant could verbally notify the contractor of the problem but inform TxDOT of the problem so TxDOT can officially notify the contractor to make a correction.

   Another alternative might include putting more responsibility or liability on the contractor by making them a co-permitee.

5. Reported or Expected Benefit:
   Because SW3P compliance inspections are so time consuming, outsourcing of SW3P can increase the amount of time available to TxDOT inspectors, which can be utilized for other duties. Likewise, the consultant can develop special expertise in these compliance inspections, which might result in noticing defects that might otherwise be missed by TxDOT inspectors (who must divide their time among many activities).

# Workload Reduction Strategy Information Sheet 13

1. Workload Reduction Strategy (WLRS):
   **C. Outsource Testing and Inspection to a Third Party**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 13 | **Completely outsource entire projects to consultants to manage and inspect all aspects of the project.** |

3. Background and Context:
   In order to address the high number of projects but comparatively small in-house inspection force, state DOTs have begun to completely outsource entire projects to consultants to manage and inspect.

4. Specific Example or Application:
   1. The third party inspectors are expected to have the same qualifications as required of DOT inspectors and will have the same responsibilities for verifying that the contractor is working in accordance with the project plans and specifications. The DOT will have full access to all of the third party's inspection reports and testing results.
   2. The third party consultant will be required to have a supervising engineer that will be responsible for reviewing all documents and test results before they are submitted to the DOT.
   3. In Florida and Virginia, they give entire projects to the consultant and only have one DOT employee who oversees them.
   4. In South Carolina, they completed an accelerated bonding program where they completed 27 years worth of work in 7 years, which was approximately 4 times their normal construction budget. During those seven years, they actually hired two experienced consulting firms to manage 100 projects. In the management of projects, it was anywhere from the complete development of the plan from proposals and field inspection to just doing the field inspection if they already had the plans developed.

5. Reported or Expected Benefit:
   The program in South Carolina went very well. Using third parties can assist in-house inspection forces because they lack the time, experience and/or training to effectively enforce quality control on their projects. By outsourcing entire projects, TxDOT would be able to better manage a high number of projects and make sure they are properly staffed with qualified inspectors without increasing the number of in-house inspectors. As a result, this will free-up in-house inspector time for other duties.

# Workload Reduction Strategy Information Sheet 14

1. Workload Reduction Strategy (WLRS):
   **D. Establish a More Extensive Contractor QC Program**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 14 | **Replace some TxDOT QC testing with more extensive contractor QC testing.** |

3. Background and Context:
   In order to reduce the in-house inspection workload, DOTs are shifting testing and inspection responsibilities over to contractors by requiring contractor QC. States DOTs interviewed that are currently requiring contractor QC include South Carolina, Florida, Arizona and Virginia.

4. Specific Example or Application:
   1. Require the contractor to have a separate, designated QC manager.
   2. In Virginia, the contractor is responsible for all the QC of the project, which covers several items, not just HMA. The contractor is responsible to build to a certain standard and the DOT oversees to verify if they met that standard.
   3. The DOT needs to review contractor QC results and their focus will be on verifying that the contractor's tests are accurate.

5. Reported or Expected Benefit:
   Overall, contractor QC programs reduces shift the responsibility for sampling and testing over to the contractor. This has been successful at reducing the in-house inspection workload in DOTs that have implemented contractor QC. This will allow TxDOT to focus more on QA testing and acceptance.

# Workload Reduction Strategy Information Sheet 15

1. Workload Reduction Strategy (WLRS):
   **D. Establish a More Extensive Contractor QC Program**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 15 | **Use contractor QC/QA results in lieu of TxDOT QC/QA results for measurement and as a basis for payment.** |

3. Background and Context:
   There has been a general trend toward shifting the responsibility for QC/QA to contractors. In order to reduce the amount of time that in-house inspectors spend testing and measuring, Florida and Wisconsin have begun accepting contractor testing for payment and acceptance.

4. Specific Example or Application:
   1. Florida uses contractor testing for payment and acceptance. FDOT does not view this as a conflict of interest because they are verifying the tests and then paying the contractor based on their tests. If there is a difference in the testing, they have a resolution testing process. They have not had a problem with this.
   2. In Wisconsin, contractors do the majority of all the testing, which is QC. QA testing is done in-house or by consultants. QA is usually one for every 10 QC tests. The contractor QC testing is used for payment.

5. Reported or Expected Benefit:
   TxDOT inspectors spend a significant amount of time measuring for payment. Using the contractor's QC and measurements will free-up in-house inspector time for other duties. If the contractor is already testing and measuring items, it will decrease the duplication of effort if TxDOT does not go out and test and measure also. In-house inspectors will still verify the contractor's testing and measurements, but overall this will significantly reduce the amount of time they spend measuring.

# Workload Reduction Strategy Information Sheet 16

1. Workload Reduction Strategy (WLRS):
   **E. Share More Risk with the Contractor by Permitting Them to Have More Control**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 16 | **Require the contractor to provide independent consultant QC/QA services.** |

3. Background and Context:
   In order to augment limited in-house personnel, state DOTs have begun to use independent third parties that are retained by the contractor. The DOT is able to specify what the qualifications and responsibilities of the third party inspectors, but the contractor will be responsible for administering the contract.

4. Specific Example or Application:
   1. Pay items that could be included in contractor provided independent consultant QC/QA services include:
      a. Seal Coat or Overlay
      b. Embankment
      c. Subgrade Compaction
   2. The third party inspectors are expected to have the same qualifications as required of DOT inspectors and will have the same responsibilities for verifying that the contractor is working in accordance with the project plans and specifications. The DOT will have full access to all of the third party's inspection reports and testing results.
   3. The third party consultant will be required to have a supervising engineer that will be responsible for reviewing all documents and test results before they are submitted to the DOT.
   4. In Virginia, they had a few pilot projects with contractor QC/QA. The contractor hired an independent inspection firm and provided that service through the contract, where VDOT did some limited oversight and sampling. In these cases, the contractor had to hire an inspection firm that reported to VDOT. There was a potential conflict of interest because the consultant was hired and paid by the contractor but technically working for the state. However, it was successful but some projects required more oversight than others. Virginia has not fully embraced this as a way of doing business yet.

5. Reported or Expected Benefit:
   Using third parties can assist in-house inspection forces because they lack the time, experience and/or training to effectively enforce quality control on their projects. Instead of TxDOT directly outsourcing inspection services to a third party and instead requiring the contractor to be responsible, they would reduce the administrative burden of managing the consultant contract. This would reduce in-house inspection efforts, while ensuring unbiased results.

# Workload Reduction Strategy Information Sheet 17

1. Workload Reduction Strategy (WLRS):
   **E. Share More Risk with the Contractor by Permitting Them to Have More Control**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 17 | **Use Lump Sum or Plan Quantity approach to payment where the contractor certifies compliance so that TxDOT does not have to measure.** |

3. Background and Context:
   DOT inspection staffs are spending a large amount of time measuring and verifying pay items. Inspector efficiency would be increased if certain measurement-intensive pay items were changed to Lump Sum or Plan Quantity.

4. Specific Example or Application:
   1. Florida recommends the following items as good Lump Sum candidates:
      a. Bridge Projects
      b. Fencing
      c. Guardrail
      d. Landscaping
      e. Lighting
      f. Seeding
      g. Sidewalks
      h. Signing
      i. Signals
      j. Traffic Stripes and Markings

      http://www.dot.state.fl.us/rddesign/PPMManual/2008/Volume1/zChap22.pdf
   2. Items listed in 4.1 above would also be beneficial as Plan Quantity to reduce the time spent measuring. The contractor would be required to certify the quantities to TxDOT for compliance to the Plans and Specifications.
   3. For Lump Sum items, require the contractor to provide a schedule of values to break out the quantities so TxDOT is able to quantify the cost of the changes, overruns and underruns.

5. Reported or Expected Benefit:
   Using Lump Sum and Plan Quantity will reduce the time inspection staff spends measuring in order to free-up inspector time for other duties.

# Workload Reduction Strategy Information Sheet 18

1. Workload Reduction Strategy (WLRS):
   **E. Shift More Risk to the Contractor by Delegating Control**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 18 | **Make the contractor responsible for collecting quantity tickets and delivering them to TxDOT on a daily basis.** |

3. Background and Context:
   In several districts within TxDOT, inspectors are collecting tickets from trucks as they become available. Other districts are collecting tickets once or twice a day, while yet another district allows the contractors to collect tickets and drop them off with a TxDOT official. Collecting tickets is viewed as a very time consuming activity; consequently, a more efficient method for collecting tickets is to allow the contractors to collect their own tickets and give them to TxDOT at the end of the day.

4. Specific Example or Application:
   In an effort to use in-house inspector time more efficiently, the contractor should be responsible for collecting the quantity tickets from trucks coming on-site instead of having TxDOT inspectors collecting them. The contractor should turn-in these quantity tickets to TxDOT once a day. Tickets collected from truck deliveries include:
   1. Treated Bases
   2. HMA

5. Reported or Expected Benefit:
   By shifting responsibility for collecting tickets from in-house inspectors to contractors, this will free-up inspector time for other inspection obligations.

# Workload Reduction Strategy Information Sheet 19

1. Workload Reduction Strategy (WLRS):
   **E. Shift More Risk to the Contractor by Permitting them to have More Control**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 19 | **Make the contractor responsible for on-site concrete testing (e.g. slump, air, temperature, making cylinders).** |

3. Background and Context:
   TxDOT inspectors spend substantial time performing on-site concrete testing. It was suggested during our interviews that this responsibility could be shifted to the contractors in order to free up time for other inspection obligations. The contractor would perform the concrete tests, and TxDOT would implement a QA process whereby they check the contractors' results to ensure they are achieving the quality required and perform fewer of their own tests to verify the contractors' results.

4. Specific Example or Application:
   1. TxDOT may shift more risk to the contractor by requiring them to perform the following concrete testing and responsibilities:
      a. Slump
      b. Air Entrainment
      c. Temperature
      d. Making Cylinders
   2. TxDOT personnel may witness contractor testing. TxDOT may use the contractor's test results for acceptance.

5. Reported or Expected Benefit:
   Require the contractor to be responsible for on-site concrete testing in order to free-up TxDOT inspector time, which can be utilized for other duties. The contractor will also be involved in a more central role for controlling quality.

# Workload Reduction Strategy Information Sheet 20

1. Workload Reduction Strategy (WLRS):
   **F. Streamline Specifications to Simplify the Inspection Process**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 20 | **Convert some specifications to performance-based specifications.** |

3. Background and Context:
   There is a general trend within state DOTs to modify their specifications from prescriptive specifications to performance-based specifications. This change is slowly being developed as the responsibilities of state DOTs and contractors are being modified and redefined. TxDOT has, likewise, modified some specifications from prescriptive to performance. However, there are many other opportunities to convert various specifications within TxDOT to performance specifications.

4. Specific Example or Application:
   1. Potential pay items that could be converted to performance-based specifications include:
      a. HMA
      b. Landscaping
      c. Seal Coats
      d. Seeding
      e. Traffic Stripes and Markings
   2. Florida is moving towards performance-based specifications. FDOT is trying to get away from telling the contractor what to use. They are concerned about the end result.

5. Reported or Expected Benefit:
   Prescriptive specifications are currently used most prevalently within state DOTs. The shift towards incorporating more performance-based specifications will simplify the measurement process to free-up inspector time for other duties. Likewise, performance specifications can be paired with warranties to allow the contractor to have more control over the quality of the product they provide while also providing some assurance to TxDOT that the product accepted will perform as expected. The best contractors will like this shift, but marginal contractors (or smaller contractors who are risk-averse) will resist implementation.

# Workload Reduction Strategy Information Sheet 21

1. Workload Reduction Strategy (WLRS):
   **F. Streamline Specifications to Simplify the Inspection Process**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 21 | **Reduce the number of specifications and combine items and quantities for payment.** |

3. Background and Context:
   It was brought to our attention that many pay items have numerous sub-items that create confusion and make inspection, testing, and measurement very difficult and time consuming. One example is striping, which anecdotally is reported as having "hundreds" of separate but similar items. The overwhelming feeling is that similar pay items should be combined into a single item.

4. Specific Example or Application:
   1. Pay items that need to be reduced include:
      a. Landscaping
      b. Signals
      c. Striping
   2. California is currently in the process of streamlining their specifications in order to make it easier for bookkeeping and to reduce complexity.

5. Reported or Expected Benefit:
   Reduce the number of pay items will decrease complexity and confusion. In addition, it will simplify the payment process.

# Workload Reduction Strategy Information Sheet 22

1. Workload Reduction Strategy (WLRS):
   **G. Use Alternative Delivery Methods**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 22 | **Use more Design-Build project delivery systems, where the design-builder provides QC (and possibly QA).** |

3. Background and Context:
   Design-Build is emerging as an alternative delivery method for DOTs in contrast to traditional Design-Bid-Build. Design-Build combines design, construction and inspection into a single contract. Design-Build projects allow the contractor to participate early in the design process and as a result have been found to reduce costs and accelerate construction. While there are many benefits to this delivery method, perhaps one of the most important is the ability to make the D-B contractor responsible for their own testing and inspection. TxDOT can define their role as simply QA or independent assurance.

4. Specific Example or Application:
   1. Design-Build alternative delivery contracts include:
      a. Design-Build
      b. Design-Build-Maintain
      c. Design-Build-Warranty
   2. Florida uses many design-build projects, which saves on inspection costs. It is a single point of responsibility where the Design-Build firm is responsible for design, construction and inspection services. Florida has created detailed Design-Build Guidelines. http://www.dot.state.fl.us/construction/DesignBuild/DB%20Rules/DesignBuildGuidelines.doc
   3. In Arizona, QC is the responsibility of the Design-Builder but QA sampling and testing is an option to be required by the Design-Builder. ADOT is always responsible for Quality Verification, Independent Assurance and final acceptance. Arizona has created a detailed Design-Build Manual. http://www.azdot.gov/Highways/ConstGrp/PDF/DesignBuildGuide.pdf

5. Reported or Expected Benefit:
   Design-Build projects have proven to reduce costs and accelerate the construction process. In addition, there is a significant reduction in inspection time required by the DOT because the design-builder assumes quality responsibilities and documentation. Incorporating a maintenance or warranty period into a design-build contract will also increase the contractor's focus on quality. In Arizona, the payment method is lump sum with an agreement as to monthly payments according to the contractor's schedule. This also reduces inspector time usually spent measuring.

# Workload Reduction Strategy Information Sheet 23

1. Workload Reduction Strategy (WLRS):
   **H. Optimize the Use of Inspection Resources**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 23 | **Reduce the amount of time inspectors spend testing at the HMA plant.** |

3. Background and Context:
   Inspectors are spending a significant amount of time testing at the HMA plant. In Virginia, inspectors have been removed from the HMA plant and have instead focused on field sampling. The responsibility of plant testing has been shifted to plant employees through a certified HMA QC/QA bond and weigh program.

4. Specific Example or Application:
   1. Replace an employee who works full-time at the HMA plant with an employee who works part-time at the plant and only pulls samples twice a day. This will allow the inspector to spend more time inspecting and testing at the site.
   2. Take HMA samples at the site in lieu of taking samples at the plant. Taking samples at the site instead of at the plant would reduce the need for TxDOT inspectors to be present at the plant all the time. The results from the on-site testing can be used and substituted for plant samplings.
   3. Virginia uses a certified HMA QC/QA bond and weigh program where non-DOT plant employees are certified in an effort to reduce TxDOT inspectors at the plant. They took their people out of the HMA plants several years ago and do QC/QA at the site now. The field inspectors will take the temperature, density testing, visual inspection (lay down, straight edging, roller patterns, etc.) to inspect and accept the product. The plant materials inspectors are asphalt plant employees who go through the VDOT certification program and then are bonded. The batch operator, the bond and weigh person, will send VDOT a form once a day that specifies how many tons of asphalt were sent to that project that day. If the tickets do not add up to that total, then they will deduct the difference from the tickets delivered on-site.

5. Reported or Expected Benefit:
   By reducing or eliminating the time inspectors spend at the plant, this will allow inspectors to work more efficiently by spending their time on other duties on-site.

# Workload Reduction Strategy Information Sheet 24

1. Workload Reduction Strategy (WLRS):
   **I. Implement the Usage of Technology to Decrease Inspection Requirements**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 24 | **Use equipment technology for the measurement of temperature and segregation in HMA.** |

3. Background and Context:
   Advances in technology have proven to increase productivity and efficiency among workers in all industries. Within DOTs around the country, machines such as Intelligent Compactors and pavers with thermal imaging bars are performing tasks that inspectors used to perform manually. This use of equipment technology can be very time-efficient, by providing computer printouts of stiffness, temperature, etc., that are recorded automatically rather than taken manually. Hence, there are a few technologies that are currently available (or will be soon) that can be used to reduce the inspection workload and increase inspection efficiency.

4. Specific Example or Application:
   Few applications in this context are as follows:
   1. Infrared bars for the temperature measurement of the running plant
   2. Radars for any segregated areas in HMA mat

5. Reported or Expected Benefit:
   By incorporating technology into projects, inspectors could spend time on other activities while the machines could be used to augment the inspectors' activities. As new technologies become available, TxDOT should endeavor to be on the cutting edge – their road network is large, and consequently, the time-savings might be substantial.

# Workload Reduction Strategy Information Sheet 25

1. Workload Reduction Strategy (WLRS):
   **I. Implement the Usage of Technology to Decrease Inspection Requirements**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| **25** | **Modify specification to allow the replacement of density measurement with stiffness in order to encourage the use of high-tech "Intelligent Compactors".** |

3. Background and Context:
   Intelligent Compaction (IC) is an evolving technology in the US but in Europe it has been widely used for several years. IC refers to vibratory rollers that are equipped with units that measure stiffness and temperature during compaction. This will control compaction to prevent under-compaction and over-compaction of materials. This technology can be applied with common highway materials, including soils, aggregate and HMA.

4. Specific Example or Application:
   1. The high-tech "Intelligent Compactors" measure stiffness. The current specification would have to be modified to allow for the replacement of density measurement with stiffness.
   2. IC provides precise and consistent compaction results and also provides detailed documentation of compaction quality and temperature. This could reduce the time that in-house staff spends taking density and temperature measurements. Instead they would simply have to review the documented results that the IC provides.
   3. The documentation results that the IC provides could also be used as contractor's proof of performance. This may be used as a basis for pay of bonus and penalties, as well as for performance related to warranties.
   4. In the future, the data and material properties collected from IC could be used to develop performance-based specifications that correlate long-term performance and properties produced during construction.

5. Reported or Expected Benefit:
   There are several benefits associated with integrating IC technology in TxDOT specifications. The inspector workload would be reduced significantly because of the reduction in density measurements. IC automatically adjusts compaction, which will allow for more consistent compaction and increased quality on projects. The IC documentation results could be used for several purposes including QC documentation, determination of bonus and penalty pay, performance-based specifications and warranties.

# Workload Reduction Strategy Information Sheet 26

1. Workload Reduction Strategy (WLRS):
   **I. Implement the Usage of Technology to Decrease Inspection Requirements**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 26 | **Standardize information provided to contractors for input into GPS controlled construction machinery.** |

3. Background and Context:
   Currently GPS controlled construction machinery is being used by many construction companies across the country. TxDOT needs to standardize information provided to contractors so that this technology can be implemented on TxDOT projects.

4. Specific Example or Application:
   1. Contractors should be encouraged to use GPS controlled construction machinery. As a result, TxDOT needs to provide digital files to the contractor for input into the GPS controlled construction machinery.
   2. In-house inspectors will not have to spend time verifying survey and instead can check that the GPS units are calibrated properly. This will reduce inspection time as a result.
   3. The GPS controlled construction machinery potentially could increase consistency and quality on the project with the use of automated construction.

5. Reported or Expected Benefit:
   Using GPS controlled construction machinery has the potential to save time and money on TxDOT projects. This will significantly reduce the time inspectors spend verifying survey and could increase quality on projects because of the accuracy the technology provides.

# Workload Reduction Strategy Information Sheet 27

1. Workload Reduction Strategy (WLRS):
   **J. Reduce Paperwork and Data Entry**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| **27** | **Use off-the-shelf shared-access software system for contractors to submit required inspection data and reports.** |

3. Background and Context:
   Inspectors spend a great deal of time on administrative duties. By using a shared-access software system, they will be able to better manage and track in-house and contractor inspection data and reports. In addition, there could be additional project documentation that could be controlled with this system.

4. Specific Example or Application:
   1. Use a web-based fully automated system like Constructware® so that contractors can upload electronic paperwork and efficiently communicate with TxDOT for items such as:
      a. RFIs
      b. Transmittals
      c. Submittals
      d. Meeting Minutes
      e. Change orders
      f. Reports
   2. Create a way for contractors to upload their QC/QA testing and inspection reports for review by TxDOT.

5. Reported or Expected Benefit:
   TxDOT inspectors could save a substantial amount of time by improved efficiency of data entry and management. In addition, using a software system like Constructware ® will allow for documents to easily be created, tracked and stored in the system.

   NOTE: We are not endorsing Constructware®, but we do think the concept of a web-based software system like Constructware® can be used efficiently within TxDOT.

# Workload Reduction Strategy Information Sheet 28

1. Workload Reduction Strategy (WLRS):
   **K. Implement Performance Warranties and Warranty Bonds**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| **28** | **Work with industry and contractors to establish contractor supplied long-term incentivized performance warranty (non-bond based) on specific pay items.** |

3. Background and Context:
   Florida requires contractors to provide a "Value-Added" warranty on select pay items, which are negotiated with industry that requires the contractor to meet certain criteria or threshold at the end of a specified number of years. There is no surety bond associated with this type of warranty. Instead, if the contractor fails to replace the pay items during the warranty period, FDOT will revoke the contractor's prequalification status or right to do work for FDOT for a minimum of 6 months. There is a general trend within state DOTs to modify their specifications from prescriptive specifications to warranties. This change is slowly being developed as the responsibilities of state DOTs and contractors are being modified and redefined.

4. Specific Example or Application:
   Pay items that are covered under Florida's "Value-Added" warranties include:
   1. Bridge Components: Performance Period of 5 years
   2. Highway Lighting System: Performance Period of 3 years
   3. HMA : Performance Period of 3 years
   4. Portland Cement Concrete Pavement: Performance Period of 5 years
   5. Signal Installation: Performance Period of 3 years

5. Reported or Expected Benefit:
   One main benefit of this type of warranty is that the risk is shifted to the contractor without requiring the contractor to take out a surety bond, which can sometimes prove to be difficult. In Florida, "Value-Added" warranties have been successful at reducing FDOT's inspection obligation. In addition, these performance warranties will reduce the amount of post-construction maintenance requirements for TxDOT.

# Workload Reduction Strategy Information Sheet 29

1. Workload Reduction Strategy (WLRS):
   **K. Implement Performance Warranties and Warranty Bonds**

2. WLRS Implementation Strategy:

| No. | Description |
|---|---|
| 29 | **Require surety-issued warranty bonds on specific pay items.** |

3. Background and Context:
   Florida requires surety-issued warranty bonds on select pay items in order to reduce the amount of in-house inspection that has to take place during construction. There is a general trend within state DOTs to modify their specifications from prescriptive specifications to warranties, which specify performance after a predetermined time in service. This change is slowly being developed as the responsibilities of state DOTs and contractors are being modified and redefined.

4. Specific Example or Application:
   1. Pay items that are covered under Florida's warranty bond requirement include:
      a. Landscaping: 1 year warranty bond for maintenance, survival and condition of all landscape items
      b. Traffic Signals: 90-day warranty bond for repair or replacement
      c. Traffic Stripes and Markings: 5 yr warranty bond for the total sum bid
   2. Additional pay items suggested to be covered under a warranty bond include:
      a. HMA
      b. Seal Coats (because they often experience failures)

5. Reported or Expected Benefit:
   In Florida, landscaping is not a problem anymore since they have required the warranty bond. If the contractor is responsible for maintenance and repair of select pay items, this will relax selected inspection obligations because the risk is now shifted over to the contractor.